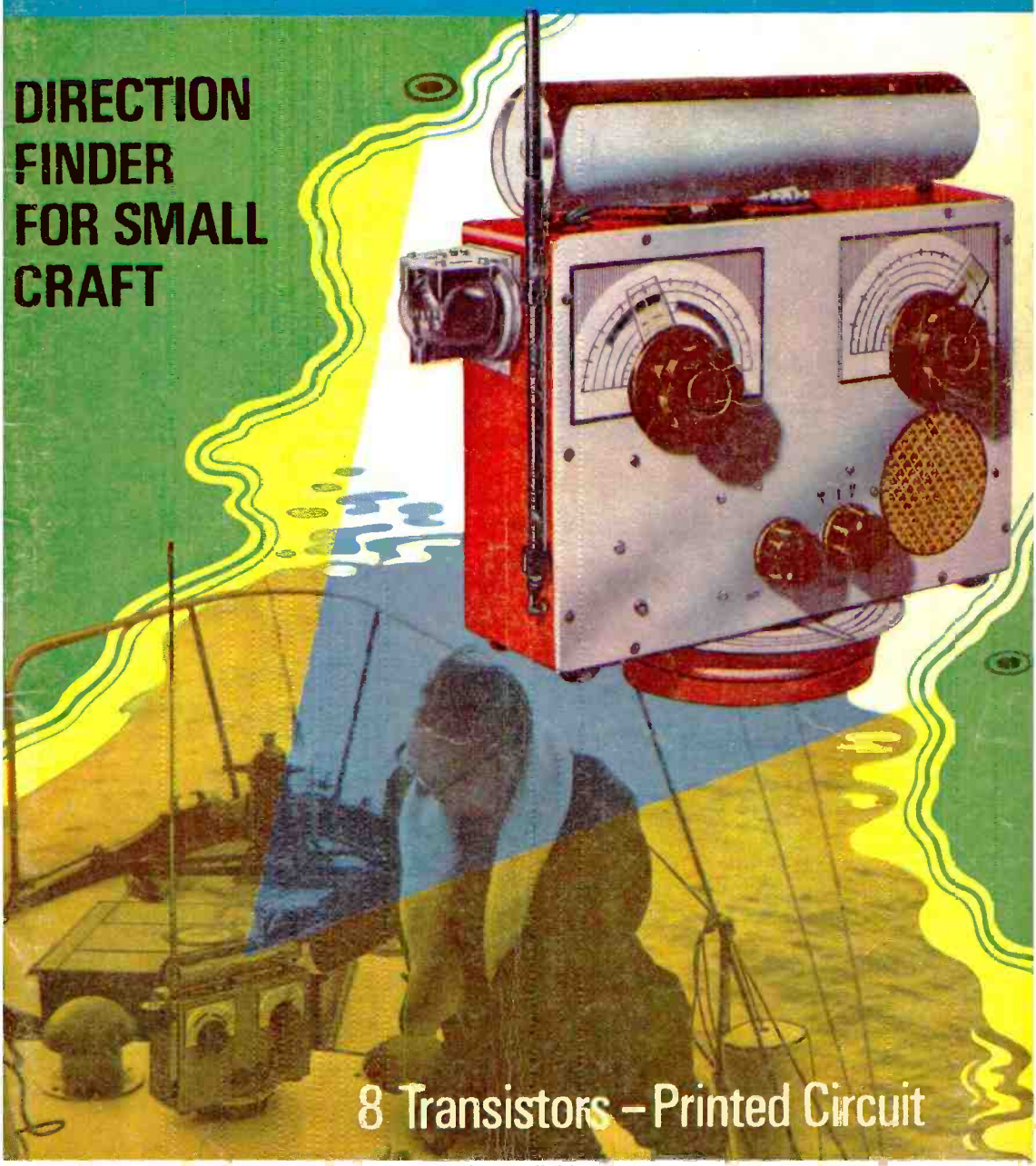
PRACTICAL WIRELESS

JULY 1965

2/-



DIRECTION FINDER FOR SMALL CRAFT

8 Transistors – Printed Circuit

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

Interleaved and impregnated. Primaries 200-230-250 v. 50 c/s. Screened.

TOP SHROUDED DROP THROUGH

250-0-250v. 70mA. 6.3v. 2a, 0-5-6.3v. 2a	17/9
350-0-350v. 80mA, 6.3v. 2a, 0-5-6.3v. 2a	21/9
250-0-250v. 100mA, 6.3v. 2a, 6.3v. 1a ..	21/9
250-0-250v. 100mA, 6.3v. 3.5a, C.T. ..	19/9
250-0-250v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a	28/9
300-0-300v. 150mA, 6.3v. 4a, 6.3v. 1a, for Mullard 510 Amplifier	35/9
300-0-300v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a	28/9
350-0-350v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a	28/9
350-0-350v. 150mA, 6.3v. 4a, 0-5-6.3v. 3a	37/9

FULLY SHROUDED UPRIGHT

250-0-250v. 60mA, 6.3v. 2a, 0-5-6.3v. 2a Midget type 2½ x 3 x 3in. ..	18/9
250-0-250v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a	29/9
300-0-300v. 100mA, 6.3v. 4a, 5v. 3a ..	29/9
300-0-300v. 130mA, 6.3v. 4a, C.T. 6.3v. 1a, for Mullard Amplifier	36/9
350-0-350v. 10mA, 6.3v. 4a, 0-5-6.3v. 3a	29/9
350-0-350v. 150mA, 6.3v. 4a, 0-5-6.3v. 3a	38/9
425-0-425v. 200mA, 6.3v. 4a, C.T. 6v. 3a	57/9
425-0-425v. 200mA, (6.3v. 4a Twice), 5v. 3a	59/9
450-0-450v. 250mA, 6.3v. 4a, C.T. 5v. 3a	69/9

FILAMENT TRANSFORMERS

200-250v. 50 c/s primaries 6.3v. 1.5a, **5/9**; 6.3v. 2a, **7/6**; 12v. 1a, **7/11**; 6.3v. 3a, **8/11**; 6.3v. 6a, **17/6**; 12v. 1.5a, twice, **17/6**.

OUTPUT TRANSFORMERS

Standard Pentode 5,000 Ω to 3 Ω ..	5/9
Standard Pentode 7,000 Ω to 3 Ω	5/9
Push-Pull 8 watts, EL84, or 6V6 to 3 Ω or matched to 15 Ω	9/9
Push-Pull 10-12 watts to match 6V6 or EL84 to 3-5-8 to 15 Ω	19/9

Following types for 3 and 15 Ω speakers

Push-Pull 10-12 watts, 6V6 or EL84 ..	18/9
Push-Pull 15-18 watts, 6L6, KT66 ..	22/9
Push-Pull Mullard 510 Ultra Linear ..	29/9
Push-Pull 20 watts, sectionally wound 6L, KT66, EL34, etc.	49/9

SMOOTHING CHOKES

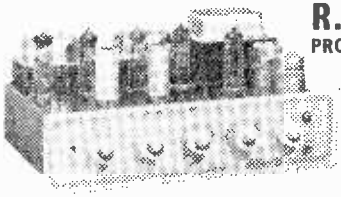
15mA, 7-10 H, 250 ohms	11/9
100mA, 10 H, 200 ohms	8/9
80mA, 10 H, 350 ohms	5/9
60mA, 10 H, 400 ohms	4/11

CHARGER TRANSFORMERS

All with 200-230-250v. 50 c/s Primaries; 0-9-15v. 1a, **12/9**; 0-9-15v. 2a, **14/9**; 0-9-15v. 3a, **16/9**; 0-9-15v. 5a, **19/9**; 0-9-15v. 6a, **23/9**; 0-9-15v. 8a, **28/9**.

AUTO Step up/Step down TRANS. 0-110/120-230/250v. 50-80 watts, **13/9**; 150 watts, **27/9**; 250 watts, **49/9**; 500 watts **99/9**.

MICROPHONE TRANSFORMERS 120:1 high grade, clamped, **8/9**.



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

PROVIDING 10/14 WATTS ULTRA LINEAR PUSH-PULL OUTPUT ON EACH CHANNEL

SUITABLE for "MIKE", GRAM., RADIO OR TAPE. **INTENDED FOR THE HOME OR STUDIO BUT SUITABLE FOR LARGE HALLS OR CLUBS**

FREQUENCY RESPONSE ±2dB. 30-20,000 c.p.s.
HUM LEVEL 65dB down.
SENSITIVITY: 5 millivolts maximum.
HARMONIC DISTORTION (each channel) 0.2%.

★ **Four-position tone compensation and Input Selector switch.**
★ **Will amplify direct from Tape Heads.**
★ **Stereo/Mono switch so that peak monaural output of 28 watts can be obtained.**
★ **Separate Bass "Lift" and "Cut" and treble "Lift" and "Cut" controls.**
★ **Neon panel indicator.**
★ **Handsome Perspex Frontplate.**

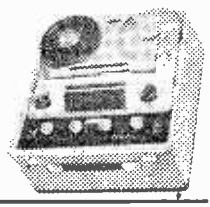
Send S.A.E. for illustrated leaflet.

Based on a current Mullard design and employing valves ECC83, ECC83, ECL86, ECL86, ECL86, ECL86, EZ81. Output transformers are high quality sectionally wound to required specification. Output matchings for 3 and 15 ohm speakers on each channel. Complete set of parts with point-to-point wiring diagrams and instructns. Carr. 10/-. or Factory assembled, tested and supplied with our usual 12 months' guarantee for 18 gns. or DEPOSIT 2 gns. and 9 monthly payments of 41/6 (total £20.15.6)

13 Gns.

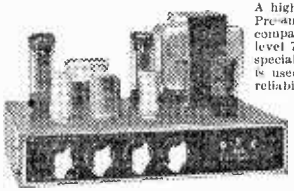
AUDIOTRINE HI-FI TAPE RECORDER KIT 25½ GNS. Carr. 17/6.

REALISM AT INCREDIBLY LOW COST, CAN BE ASSEMBLED IN AN HOUR
Incorporating the latest Collaro Studio Tape Transcriptor. The Audiotrine High Quality Tape Amplifier with negative feedback equalisation for each of 3 speeds. High Flux P.M. Speaker. empty Tape Spool. a Reel of Best Quality Tape and a Handsome Portable Carrying Cabinet tastefully covered in two contrasting shades of Rexine and Vynair. Size 14½ x 15 x 8½in. high and circuit. Total cost if purchased individually approximately £40. Performance equal to units in the £60-£80 class. S.A.E. for leaflets. **TERMS. Deposit £3** and 12 monthly payments of 44/- (Total 28 Gns).



ONLY 3 PAIRS OF SOLDERED JOINTS PLUS MAINS

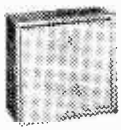
R.S.C. A10 30 WATT ULTRA LINEAR HIGH FIDELITY AMPLIFIER



A highly sensitive Push-Pull high output unit with self-contained Pre-amp. Tone Control Stages. Certified performance figures compare equally with most expensive amplifiers available. Hum level 70 dB down. Frequency response ±3 dB, 30-20,000 c/s. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All components are chosen for reliability. Six valves are used EF86, EF86, ECC83, 807, 807. GZ34. Separate Bass and Treble Controls are provided. Minimum input required for full output is only 12 millivolts so that **ANY KIND OF MICROPHONE OR PICK-UP IS SUITABLE.** The unit is designed for **CLUBS, SCHOOLS, THEATRES, DANCE HALLS or OUTDOOR FUNCTIONS,** etc. For use with Electronic **ORGAN; BASS, LEAD OR RHYTHM GUITAR, STRING BASS,** etc. For standard or long-playing records. **OUTPUT SOCKET PROVIDES** L.T. and H.T. for **RADIO FEEDER UNIT.** An extra input with associated vol. control is provided so that two separate inputs such as Gram and "Mike" can be mixed. 200-250 v. 50 c/s. A.C. Mains output for 3 and 15 ohm speakers. Complete Kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. Supplied factory built with EL34 output valves and 12 months' guarantee for 14 Gns. If required perforated cover with carrying handles can be supplied for 19/9. Carr. 10/-. Send S.A.E. for leaflet, also speaker. **TERMS: DEPOSIT 34/6** and 9 mthly. payments of 33/6 (Total 16gns).

11 Gns.

12in. 10 WATT HIGH QUALITY LOUDSPEAKER



In walnut veneered cabinet. Gauss 12,000 lines. Speech coil 3 ohms or 15 ohms. Only Carr. 5/6 **£4.19.6**
Terms: Deposit 11/3 and 9 monthly payments of 11/3 (Total £5.12.6). **12in. 20 WATT HI-FI LOUDSPEAKERS IN CABINETS.** Size 18 x 18 x 10in. Finish as above. Only **£7.19.6.** Terms: Deposit 17/9 and 9 monthly payments of 17/9 (Total £8-17.6). Carr. 8/6.

INTEREST CHARGES REFUNDED

on H.P. and CREDIT SALE Accounts settled in 6 months.

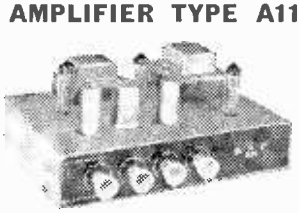
LINEAR TAPE PRE-AMPLIFIER. Type LP/1. Switched Equalisation. Positions for Recording at 1in., 3¾in., 7½in. per sec., and Playback. EMM4 Recording Level Indicator. Designed primarily as the link between a Collaro Tape Deck and Hi-Fi amplifier, suitable almost any Tape Deck. Only 9½ Gns. S.A.E. for leaflet.

W.B. "STENTORIAN" HIGH FIDELITY P.M. SPEAKERS HF1012.

10 watts rating. Where a really good quality speaker at a low price is required, we highly recommend this unit with an amazing performance. £4.12.0. Please state whether 3 ohm or 15 ohm required.

HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11

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



Two input sockets with associated controls allow mixing of "mike" and gram., as in A10. High sensitivity. Includes 5 valves, ECC83, ECC83, EL84, EL84, EZ81. High Quality sectionally wound output transformer specially designed for Ultra Linear operation and reliable small condensers of current manufacture. **INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut".** Frequency response ± 3 dB 30-20,000 c/s. Six negative feedback loops. Hum level 60 dB down. ONLY 23 millivolts input required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and microphones. Comparable with the very best designs for **STANDARD or LONG PLAYING RECORDS.** For **MUSICAL INSTRUMENTS** such as **STRING BASS, LEAD or RHYTHM GUITARS, etc. OUTPUT SOCKET** with plug provides 300v. 30mA. and 6.3v. 1.5a. for supply of a **RADIO FEEDER UNIT.** Size approx. 12 x 9 x 7in. For A.C. mains 200-250v. 50 c.p.s. Output for 3 and 15 ohms speaker. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied Only **8 Gns.** Carr. 10/- (Or factory built 51/- extra).
If required louvred metal cover with 2 carrying handles can be supplied for **18/9. TERMS ON ASSEMBLED UNITS. DEPOSIT 25/-** and 9 monthly payments of 25/- (Total £12.10.0). Send S.A.E. for illustrated leaflet detailing Cabinets, Speakers, Mikes, etc.

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

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

8 Gns.

R.S.C. JUNIOR BASS REFLEX CABINET.

Designed for above speaker, but suitable for any good quality 8in. or 10in. speaker. Acoustically lined and ported. Polished walnut veneer finish. Size 18x12x 10in. Strongly made. Handsome appearance. Ensures superb reproduction for only £4.7.6.

R.S.C. STANDARD BASS REFLEX CABINET.

For 12in. loudspeakers, acoustically lined and ported. Size 20 x 14 x 13in. Beautiful walnut veneer finish. Recommended for use with Audiotrine Speaker System. **£5.19.6.**

AUDIOTRINE CORNER CONSOLE CABINETS. Strongly made. Beautiful polished walnut veneered finish. Pleasing design. **JUNIOR MODEL.** For up to 8in. speaker. Approx. 20x11x8in. **49/9 STANDARD MODEL.** To take up to 10in. speaker. Size 27 x 18 x 18in. **5 Gns.** Carr. 7/6.

SENIOR MODEL. To take up to 12in. speaker and with Tweeter cut-out. Size approx. 30 x 30 x 15in. (Recommended for use with Audiotrine speaker system). **8 gns.** Carr. 8/6. Terms available.

S4/4 STEREO AMPLIFIER

A complete set of parts to construct a good quality Stereo amplifier with an undistorted output total 8 watts. For A.C. mains input of 200-250 v. Sensitivity 180 m.v. Ganged Volume and Tone Controls. Preset balance control. Full instructions and wiring diagrams supplied **5 Gns.**

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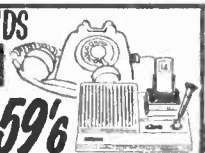


59'6

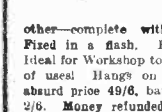
Original Price 6 gns. Now offered at this ridiculously low price because we have bought a large batch by a reputable manufacturer. Speak and listen up to 6ft away from telephone, leaves hands free. **Fixed in a flash.** No plugging in. Just clip to any telephone! With own volume control and on and off switch. Control gives enough volume to fill a room—or turns down to a whisper. Used in most American homes, offices, etc. Attractive. **Brand New and Guaranteed. You have 30 days to judge its value. Money back if not delighted. 59/6** plus 2/6 P. & P. (batt. 2/6 extra).

AMAZING CIGARETTE RADIO

ONLY 18'6

Yes, a perfectly ordinary packet of cigarettes! but watch your friends' astonishment on hearing it fetch in station after station, loud and clear! Still holds 10 Cigarettes—yet cleverly conceals highly sensitive, fully transistorised circuit **(including tiny battery).** Even a young boy can assemble it in under 2 hours. **No soldering. No experience necessary. Only 16 connections to make.** Ideal for taking to work with you. From our bulging testimonial file: **Mr. D. B. of Huddersfield writes:**—"*. . . I have fitted the parts in and it is working wonderfully.*" ALL PARTS including Semi-Conductors, A.B.C. Plans, etc. **ONLY 18/6,** plus 1/6 post, etc. (Parts available separately).

HAVE 5 DIFFERENT TRANSISTOR RADIOS FOR 35/-



NO EXPERIENCE NECESSARY. No Soldering. Only 8 connections for first radio to work. Just look, you get Giant 4 colour box, 1ft. 2in. x 10½in. x 2½in. containing Radio Book, A.B.C. Plans, Cabinet, Carrying Case, 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 Authorities, H.M. Forces, etc. TESTIMONIALS GALORE. **Mr. R. O'D. of Londonderry, writes:** "*. . . I received your components and I must say that I am very satisfied with them. I have it already set up!. . .*" **COMPLETE HOME RADIO COURSE. Originally £6. SEND ONLY 35/-. plus 2/6 post, etc.**

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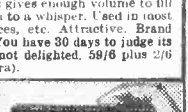

ANYONE CAN BUILD IN 2-3 HOURS

EVEN THE OLDER CHILDREN BUILD THEM! 19'6

No soldering—only 16 connections! then hear it reach out bringing in station after station, loud and clear. Palm-of-hand size 4¼ x 2¾ x 1¼in. Many Testimonials: **M.H. of Bradford, writes:** "*. . . I have just completed one of your sets successfully, it is the first time I have ever tackled anything like a radio, and I must state here and now, I am amazed how easy it is to a layman like me. Your instructions and plans have obviously been very carefully thought out so that even the most dim can follow them. . . .*" **Direct from Manufacturers to You. SEND 19/8 plus 1/6 post, etc.**

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SAVE £3 TRANSISTOR RADIO KITS

SOLD IN DEPARTMENT STORES AT £5.8.0.

P. & P. 2/6 extra.

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Fantastic purchase makes this ridiculously low price possible. **Well-known brand Transistor Radio Kits** complete in large box. As sold in leading Department stores at £5.8.0. **BRAND NEW—YOU SAVE £3.0.6.** Covering all medium and long wave with parts including Mullard Semi-Conductor. **48 page instruction manual.** Absolutely safe—works on torch battery. Wonderfully entertaining and educational. No soldering parts, just plug in, making many different Radios in a few minutes. **Money back if not delighted. Send 37/6 plus 2/6 P. & P.**

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B.M. of HARROGATE writes: "*. . . I would like to thank you . . . It is a real bargain.*"

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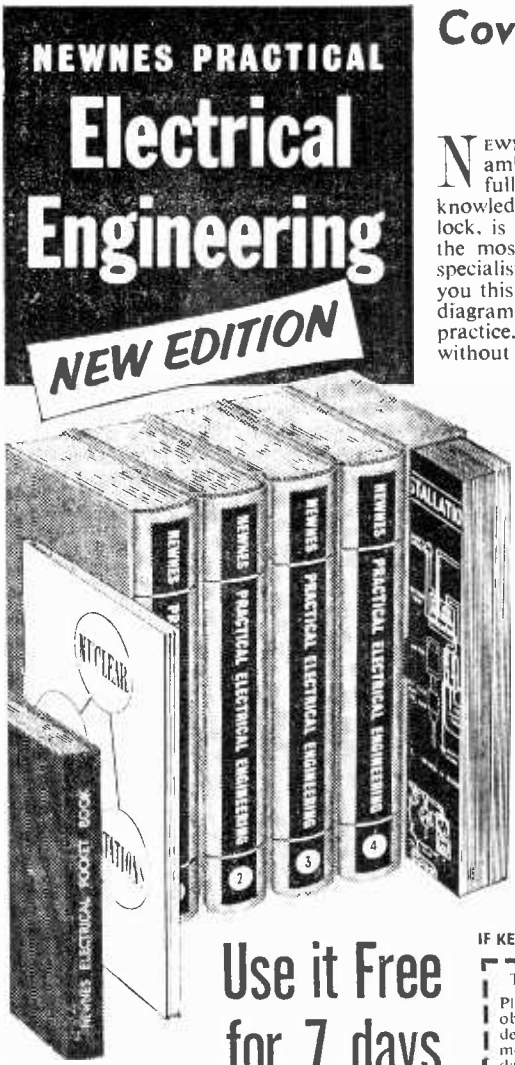

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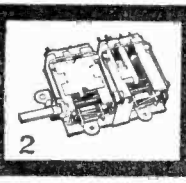

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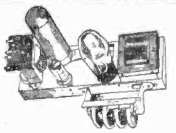
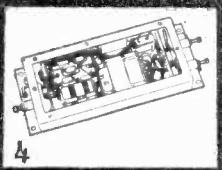


Comprising chassis 8¾ x 2¾ x 1in. Double wound mains transformer, output transformer, volume and tone controls, resistors, condensers etc. Valves 6V6, ECC81 and metal rectifier. Circuit 1/6 free with kit. 29/6 plus 4/- P & P

3



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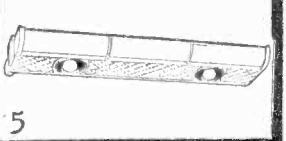

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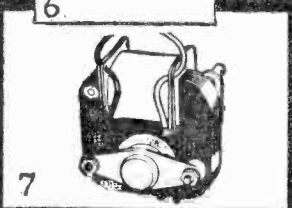

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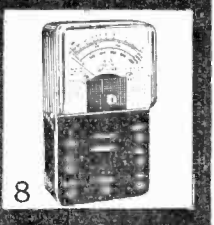

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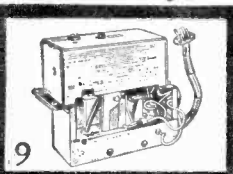

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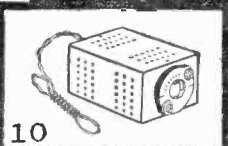

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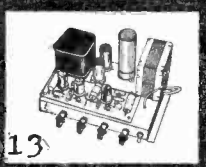

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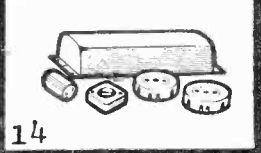

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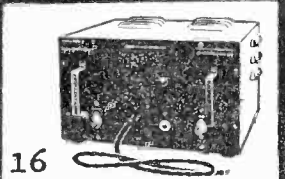

16

1. **6 VALVE 15 WATT PUSH-PULL AMPLIFIER,** 15 x 7 x 1¼in. A.C. Mains 200-250 volts. 4 inputs with controls for same and bass and treble lift controls. Tapped for 3 and 15 ohm speakers. Extra H.T. and L.T. for F.M. Tuner supplies etc. Built and tested. **7 gns.** P. & P 15/6.

2. **CYLDON A.M. F.M. PERMEABILITY TUNERS FOR ALL TRANSISTOR OPERATION.** Size 2¼ x 2¼in. approx. By famous manufacturer. A.M. I.F. 470 Kc/s. F.M. I.F. 10.7 Mc/s. A.M. coverage from 1620 Kc/s-525 Kc/s. F.M. coverage 108 Mc/s-88 Mc/s. Circuit diagrams 2/6. **FREE** with Tuner, 1st, 2nd and 3rd A.M. I.F.'s, 1st, 2nd, 3rd and 4th F.M. I.F.'s V.H.F. Osc. choke, A.M. I.F. trap. All the above are the R.F. end of an A.M./F.M. receiver car radio etc. The above items, **£2.10.0.**

3. **AMPLIFIER KIT.** 3 to 4 watt Amplifier Kit.

4. **TRANSISTOR INVERTOR.** 50 v. D.C. Input. Output 240 v. A.C. 40 watts incorporating transformers, choke, condensers and 2 GET573. In solid 16 gauge aluminium case, size 15 x 6 x 2¼in. by famous manufacturer, **19/6,** plus 7/- P. & P.

5. **FLUORESCENT LIGHT FITTING.** Twin **40 watt** 200/250 v. less tubes, **39/6.** P. & P. 7/-.

6. **SIGNAL GENERATORS:** Cash **£7.5.0,** & P. P. **7/6.** Coverage 100 Kc/s. to 100 Mc/s on fundamentals and 100 Mc/s to 200 Mc/s on harmonics. Case 10 x 6¼ x 5¼in. Three miniature valves and Metal Rectifier. A.C. mains 200/250v. Internal modulation of 400 c.p.s. to a depth of 30 per cent. Modulated or unmodulated R.F. output continuously variable 100 multivolts, C.W. and mod. switch, variable A.F. output. Magic eye as output indicator. Accuracy 2 per cent.

7. **A.C. MAINS MOTOR.** Can be used for a variety of purposes, silent running, satisfactory in every way. 230/250v. **A.C., 9/6.** P. & P. 2/-.

8. **POCKET MULTI-METER.** Size 3¾ x 2¾ x 1¼in. Meter size 2¼ x 1¼in. Sensitivity 1,000 O.P.V. on both A.C. and D.C. A.C. and D.C. volts. 0-15, 0-150, 0-1,000. D.C. current 0-150 mA. Resistance 0-100K Ω. Complete with test prods, battery and full instructions, **39/6.** P. & P. 2/6. **FREE GIFT** for limited period only. 30 watt Electric Soldering Iron value **15/-** to every purchaser of the Pocket Multi-Meter.

9. **CHANNEL TUNER I.F.** 16-19 Mc/s. Continuously tunable from 174-216 Mc/s. Valves required—PCF80 and PCC84 (in series). Cover BBC and ITA ranges. Also Police, Fire and Taxis, etc. Brand new by famous maker, **10/-.** P. & P. 3/-.

10. **POWER SUPPLY KIT** in metal case, size 3¾ x 2¼ x 2in. incorporating mains transformer, rectifier and condensers. 230/250 A.C. mains. Output: 9v., 100mA. **10/6** plus 2/6 P. & P.

11. **B.S.R. MONARCH UA14 WITH FULL FI HEAD,** 4-speed, plays 10 records, 12in., 10in., or 7in. at 16, 33, 45 or 78 r.p.m. Intermixes 7in., 10in. and 12in. records of the same speed. Has manual play position: colour brown. Dimensions: 12¼ x 10¼in. Space required above baseboard 4¾in., below baseboard 2¾in. Fitted with Full Fi turnover crystal head. **£5.19.6.** P. & P. 7/6.

12. **50 MICRO-AMP METER** movement by world famous manufacturer. Size 3 x 2¾in., **25/-,** plus 1/6 P. & P.

13. **8-WATT 5-VALVE PUSH-PULL AMPLIFIER & METAL RECTIFIER.** Size: 9 x 6 x 1¼in. A.C. Mains, 200-250v. 5 valves. For use with Std. or L.P. records, musical instruments, all makes of pick-ups and mikes. Output 8 watts at 5 per cent total distortion. Separate bass and treble lift controls. Two inputs, with controls for gram. and mike. Output transformer tapped for 3 and 15 ohm speech coils. Built and tested. **£3.19.6.** P. & P. 8/-.

14. **40W. FLUORESCENT LIGHT KIT** incorporating GEC Choke size 8¼ x 1¾ x 1¼in. 2 bi-pin holders, starter and starter holder, **11/6.** P. & P. 4/6.
Similar to above: **80W** Fluorescent Light Kit incorporating GEC choke size 14¾ x 1¾ x 1¾in. 2 bi-pin holders, starter and starter holder **17/6.** P. & P. 5/6.

15. **FIRST QUALITY PVC TAPE.**

5¼in. Std. 850ft. ..	9/-	5in. D.P. 850ft.	10/6
7in. Std. 1200ft. ..	11/6	3in. T.P. 600ft.	8/-
3in. L.P. 240ft.	4/-	5in. T.P. 1800ft. ..	20/6
5¼in. L.P. 1200ft. ..	11/6	5¼in. T.P. 2400ft. ..	27/6
7in. L.P. 1800ft. ..	18/6	7in. T.P. 3600 ft. ..	37/6

P. & P. on each 1/6. 4 or more Post Free.

16. **FIXED FREQUENCY SIGNAL GENERATOR.** Crystal controls in metal case, size 10 x 6 x 6in. Incorporating two FC13 valves, mains transformer, metal rectifier, choke, indicator, lamp, crystal and numerous components. Modulated and unmodulated output socket. Originally used for I.T.V. frequencies. Brand new, **39/6,** plus 7/- P. & P. A.C. mains 200-250 volts.

SILICON RECTIFIERS. 250v. P.I.V. 750 mA. Six for **7/6** post paid.

RADIO & T.V. COMPONENTS (ACTON) LTD.

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PRACTICAL WIRELESS

JULY 1965
VOL 41 NO 701

CASTING OFF THE SHACKLES

Even before recorded history, man has always been seeking better and more efficient means to communicate over longer distances. Primitive methods of communication, such as smoke signals, were restricted to "line of sight" until the telegraph semaphone systems of the early 19th century achieved quite remarkable results through being linked together like a modern microwave chain.

Then came the transatlantic telegraph cables in the mid-19th century. But even at that time, men were probing deeper and the discovery of the electromagnetic nature of light was the turning point which lead through other discoveries to electromagnetic signalling over land, between ships and culminating in the historic Cornwall-Newfoundland transmission at the turn of the century. The embryo modern communications system had been freed from the need for wires between terminal stations.

When it was understood that the radio crossing of the Atlantic was made possible by conducting layers above the earth, the way lay open ultimately for another stride forward—the development of short wave radio for world-wide communication.

But the conducting layers which had liberated radio communication at the same time bound it hand and foot. For its density, position and behaviour varied with natural phenomena such as solar activity. And so, to combat this situation, modern technology has produced the communications satellite. Another shackle is cast aside.

A passing thought—the story of communications rings with names like Maxwell, Lodge, Hertz, Marconi, Fleming, Appleton, Edison and many others, all linked with their great individual triumphs. Today, great technical developments are more the result of collective effort, which produces faster and more spectacular strides but is coldly impersonal. A second thought—after Early Bird, what?

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All correspondence intended for the Editor should be addressed to: The Editor, "Practical Wireless", George Newnes Ltd., Tower House, Southampton Street, London, W.C.2. Phone: TEMple Bar 4363. Telegrams: Newnes Rand London. Subscription rates, include postage: 29s. per year to any part of the world.

THE AUGUST ISSUE WILL BE PUBLISHED ON JULY 8TH

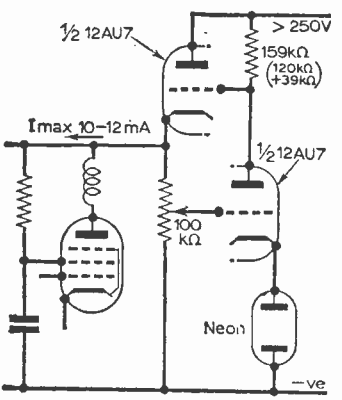
Alternative Valve for V.F.O.

READERS unwilling to buy a special valve (stabiliser VR150) for F. G. Rayer's "Stabilised V.F.O." in the March issue of P.W. can make use of a 12AU7 valve, which is more likely to be in the junk box. The advantages are that no heat-producing dropper resistor is required, the regulation is as good as, if not better than, that given by the average regulator valve, and the current requirements are less.

No originality is claimed for this well-known circuit; it, or one using a pentode-triode which gives somewhat better regulation (in fact too good for the average circuit, but of course excellent for a v.f.o. provided the rest of the circuit comes up to the requisite excellence), has been used almost as a routine in the oscillator sections of s.w. receivers and b.f.o.'s, which I have found are far more reliable for s.s.b. reception when regulated. Q-multipliers even benefit! The current drain is so low that the inclusion of one such valve and a few components neither takes up much room nor overloads the power supply.

Dr. H. Wagner.

Kuala Lumpur,
Malaya.



Dr. Wagner's alternative stabiliser circuit for F. G. Rayer's "Stabilised V.F.O." article in the March issue. Apart from saving the expense of a special valve, this circuit has other advantages over the original.

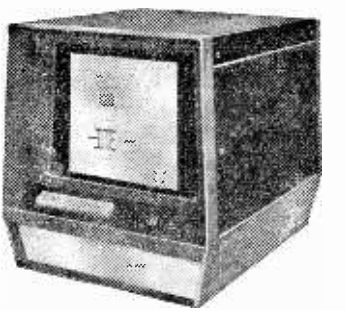
NEWS AND...

THE TEACHING MACHINE

The device shown right is a fully transistorised teaching machine in which movements and thinking, irrelevant to the learning process, have been eliminated.

Illustrated instructions are projected on to the screen and the student either presses a button marked "yes" to indicate he agrees or understands, or presses another marked "no" for a negative answer or misunderstanding.

The machine is made under licence for Educational Systems Limited.



A SEAFARER'S RECEIVER

Designed specially for seafarers and developed after consultation with the National Union of Seamen (British), the Ekco Mariner receiver incorporates a number of features regarded as essential for the use of seamen. It covers all wavebands from 13 to 1930 metres, including the trawler band.

The receiver operates from almost any a.c. or d.c. mains supply and is fully "tropicalised" for use in all climates. A special rubberised non-slip base helps keep the receiver in place aboard ship. Ekco Export Ltd., Southend-on-Sea, Essex.

FROM EUROPE TO JAPAN VIA RUSSIA

A new Europe-Japan communications link will result from an agreement reached between the Soviet Union and the Northern Telegraph Society of Denmark recently.

Under the agreement, Northern Telegraph will lay a submarine coaxial cable between Japan and Russia. The cable will cross the Sea of Japan from Naoetsu (Honshu Island) to the Soviet port of Nakhodka.

This cable will be 490 nautical miles long, about a third shorter than a cable laid nearly a hundred years ago from Vladivostock to Nagasaki and which at present is the only one in operation.

When the cable is opened in 1967 it will establish for European countries, a new telephone and telegraph link with Japan via Soviet cable and radio relay lines.

MORE RADAR TRAPS

The Home Office has ordered fifty radar speed measuring equipments from the Marconi Company. These will be used to augment equipment already in use by police authorities throughout the country to monitor traffic speeds, especially on busy roads.

The Marconi PETA (Portable Electronic Traffic Analyser) works on the same principle as an aircraft Doppler Navigator and its basic accuracy is better than 2 m.p.h.

..COMMENT

COMMONWEALTH COMMUNICATIONS CONFERENCE

Satellite communications was one of the subjects discussed at a recent Commonwealth telecommunications conference. Twenty Commonwealth countries were represented at the conference whose purpose was to consider the whole pattern of Commonwealth co-operation in telecommunications and prepare a report for the various governments.

The conference was opened at Marlborough House, London, by Mr. Cledwyn Hughes, Minister of State for Commonwealth Relations. Sir Ronald German, Director General of the British Post Office was Chairman.

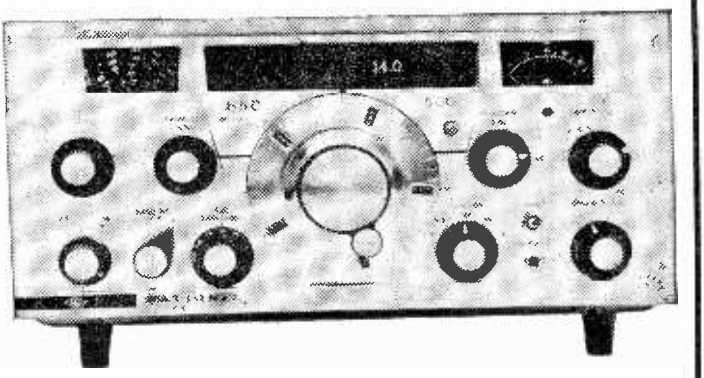
WASHING MACHINES AND THYRISTORS

When it comes to improving the lot of its customers by technical advancement, Mullard Ltd. is not a firm to forget the man—or woman—in the street. This was demonstrated recently at the Radio and Electronic Component Show where hearing aids and washing machines were unusual features of the Mullard stand.

The hearing aid device was a microminiature integrated circuit amplifier, so small that it actually fits into the ear. A complete three-stage d.c.-coupled amplifier, it measures only 2mm x 2·5mm x 1mm—little bigger than a matchhead.

The display also showed that simpler and more reliable washing machines for the housewife result when thyristors (power-controlling rectifiers) are used to eliminate gearing in single-motor systems and to obtain optimum ratios between washing and spinning speeds.

THE NEWEST HRO



This good-looking communications receiver is the latest addition to the National Radio Company's HRO-family, the HRO-500.

The newcomer is transistorised throughout and boasts frequency coverage of the entire v.l.f. through h.f. spectrums, from 5kc/s to 30Mc/s, in sixty 500kc/s bands. The HRO-500 operates from 12V d.c. or 115/230V a.c., 50/60c/s, and provides s.s.b., c.w. or f.s.k. reception and many other first-class features.

No price was given with the announcement of the new receiver, but a technical bulletin can be obtained from Ad. Auriema Ltd., 125 Gunnersbury Lane, London, W.3.

more News and Comment on page 232

Fidelity F.M. Tuner

I HAVE a few comments to make on the Fidelity F.M. Tuner which I think will be of assistance to your readers.

This tuner is unsuitable for reception at a distance of 30—40 miles from the transmitter. The coil formers are 0·3in. diameter Alladin types with square cans and v.h.f. cores, and the diodes used are OA5 and OA81.

The setting of VR1 is best done by trial after a station has been located.

There is a transposition of R17 and R20 in the layout drawing. Fig. 4.

W. Groome.

Blackheath,
Birmingham.

Praise Indeed

EVERY day it seems, more and more new magazines appear on the book-stalls covering a wide range of technical subjects from semiconductors to space flight, all aimed at the man-in-the-street who may have no specific knowledge of the subject and yet is keen to keep abreast, on a layman's plane, of latest developments. Many of the new journals seem only to last a very short time while their subject is in vogue, and yet magazines of long standing like P.W. go on for ever. For my money, give me a magazine that has an air of permanence—like PRACTICAL WIRELESS.

Colin Rich.

Woodford,
London, E.18.

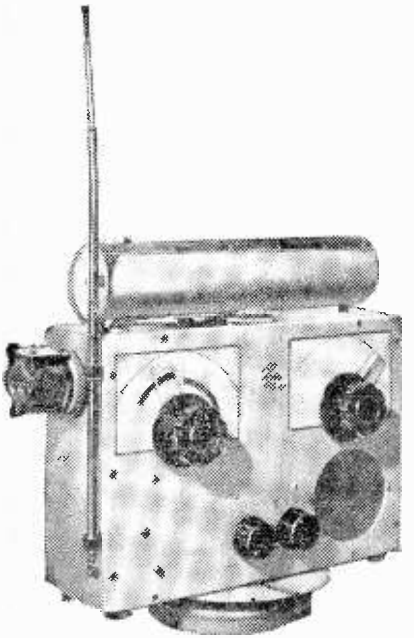
Octal Valves out of Date

I READ with interest R. A. Packer's comments about out-of-date circuits and valves (May issue). However, I do object to him implying that constructors who use octal valves are incompetent. I have built circuits using 6V6's and have the highest regard for this remarkable beam tetrode.

Maybe in future years constructors will want to build valve circuits purely as a novelty. But surely this does not imply incompetence?

L/Cpl. A. Dyson.

Catterick Camp,
Yorkshire.



A DIRECTION FINDER for Small Craft

by F. C. Judd

COVER SUBJECT

THE longwave marine radiobeacons which are located all round the coast of the U.K. and other countries are used to a great extent by small coastal vessels such as private yachts, motor cruisers, fishing vessels and small cargo vessels which normally carry no other radio navigation aid. The marine radiobeacons operate between 287·3kc/s and approximately 315kc/s and day and night send out their callsigns in morse code followed by a long dash. The operational sequences of the radiobeacons are in themselves interesting and will be dealt with later in greater detail.

Briefly however, the beacons work in groups, each group being assigned to cover a specific area. The group frequencies are quite close together, in fact the channel separation is only 2·3kc/s, for example the North Hinder Light Vessel group operate on 287·3kc/s whilst the Ile de Batz lighthouse and Pte. St. Mathieu lighthouse operate on 289·6kc/s.

Each group operates in a sequence and taking the North Hinder light vessel group on 287·3kc/s they transmit in order and at the times given in the table following:

Order in Group	Name	Mins. past the hr.	Callsign
1	Smiths Knoll Lt. V	00	SK
2	Goeree Lt. V	01	GR
3	Dudgeon Lt. V	02	LV
4	Outer Gabbard Lt. V	03	GA
5	Cromer Lt. Ho.	04	CM
6	Noord Hinder Lt. V	05	NR

Each beacon in turn transmits its callsign followed by a long dash on which the d.f. can be carried out. The characteristic sequence period of the above group is 6 minutes, i.e. the sequence is repeated every 6 minutes day and night. It is interesting to note that these beacons are controlled by accurate clocks and rarely get out of sequence by more than a few seconds. This is

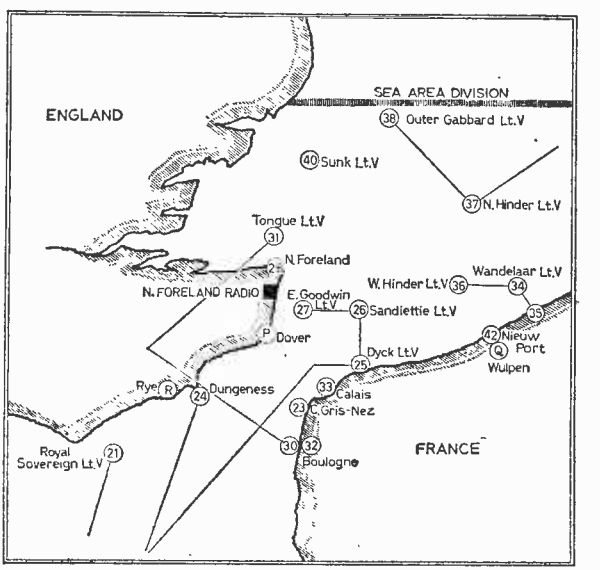


Fig. 1: This map (taken from R.I.C. 5022) indicates some of the marine radio beacons in the Thames sea area.

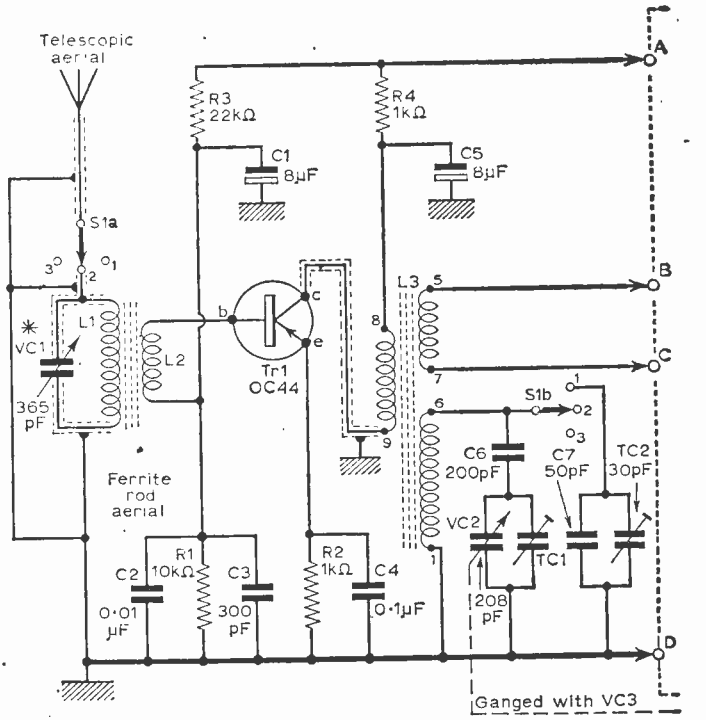


*Fig. 2: The aerial and r.f. stage of the circuit which is built on a separate paxolin chassis. *VC1 is insulated from chassis; see text and Fig. 7.*

allowed for in the timing of all the groups so it is extremely rare for different groups or any two beacons in a group to overlap

It should be remembered, however, that some groups share a common frequency but the distance separating these groups is large enough to prevent interference. However, when propagation conditions are good, radiobeacons from as far away as Denmark and Sweden can be received quite clearly in London.

Radio Information Charts

Before going on to describe the marine d.f. receiver it would be as well to mention the four marine radiobeacon charts that are necessary and which give precise details about the beacons, their exact location, frequencies, groups and sequences, useful day and night range, callsigns etc. (Fig. 1). These charts are numbered 5022, 5023, 5024 and 5025 and cover the whole of the British Isles including the Faeroes and sea districts, Forties, Fisher, German Bight, and Viking. The charts are called "Yachtsmans, Fishermans and Small Craft Radio Information Chart", (Radiobeacons and Radio-Telephone Services) (quote chart numbers as above) and cost 4s. each from J. D. Potter Ltd., 145, Minories, London, E.C.3. Aside from being essential when using any radiobeacon receiver, these charts may also be of interest to radio enthusiasts generally. Further information on radio beacons and radiotelephone services etc., can be found in The Admiralty List of Radio Signals and R. D. F. Stations and Beacons Vol. 2, also available price 27s. 6d. from the address above. It took

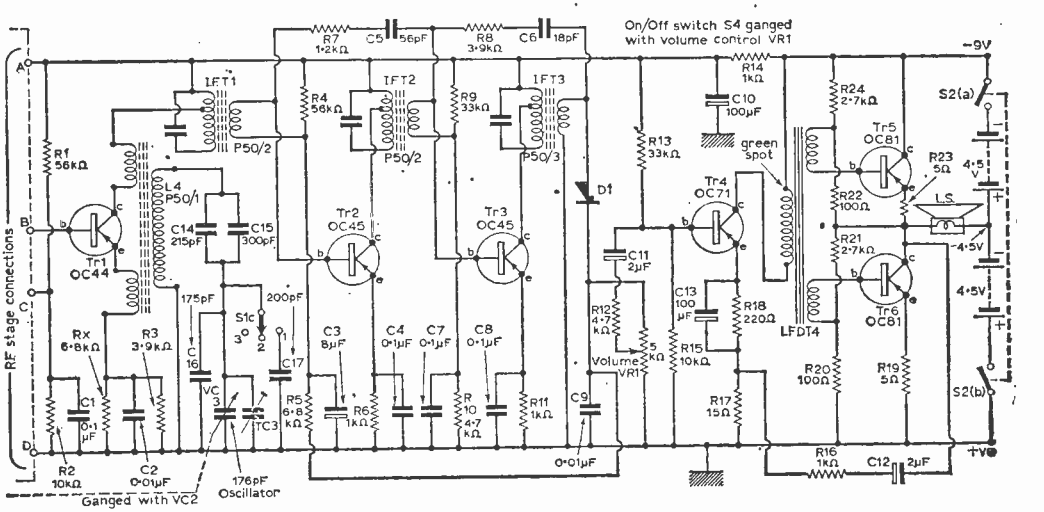


Fig. 3: The mixer, i.f. and audio stages which are built on a commercially available printed circuit board.

COMPONENTS LISTS

MIXER, I.F. AND AUDIO CIRCUITS

Resistors:

R1	56kΩ	R13	33kΩ
R2	10kΩ	R14	1kΩ
R3	3·9kΩ	R15	10kΩ
R4	56kΩ	R16	1kΩ
R5	6·8kΩ	R17	15Ω
R6	1kΩ	R18	220Ω
R7	1·2kΩ	R19	5Ω
R8	3·9kΩ	R20	100Ω, 5%
R9	33kΩ	R21	2·7kΩ, 5%
R10	4·7kΩ	R22	100Ω, 5%
R11	1kΩ	R23	5Ω
R12	4·7kΩ	R24	2·7kΩ, 5%
Rx	6·8kΩ		

All 10% ½W carbon unless otherwise stated
VR1 5kΩ w.w. potentiometer, with d.p. switch, S2

Semiconductors:

Tr1	OC44	Tr3	OC45
Tr2	OC45	Tr4	OC71
Tr5	OC81 } Matched		
Tr6	OC81 } pair		
D1	OA70 or GEX34		

Inductors:

IFT1, 2 I.F. transformers type P50/2 by Weyrad
IFT3 I.F. transformer type P50/3 by Weyrad
L4 Oscillator coil type P50/1 by Weyrad

Capacitors:

C1 0·1μF paper
C2 0·01μF paper
C3 8μF electrolytic
C4 0·1μF paper
C5 56pF silver mica
C6 18pF silver mica
C7 0·1μF paper
C8 0·1μF paper
C9 0·01μF paper
C10 100μF electrolytic
C11 2μF electrolytic
C12 2μF electrolytic
C13 100μF electrolytic
C14 215pF silver mica
C15 300pF silver mica
C16 175pF silver mica
C17 200pF silver mica
VC2, 3 208-176pF tuning gang (Jackson '00') with trimmers, TC1, 3

Miscellaneous:

S1a, b, c, 3-pole, 3-way rotary switch
S2 D.P. on/off switch on VR1
Driver transformer (Weyrad LFDT4). Transistor superhet receiver printed circuit board by Weyrad. 3 in. diameter 30Ω loudspeaker. 4·5 + 4·5V battery (Vidor T6011 or equivalent).

AERIAL AND R.F. CIRCUITS

Resistors:

R1	10kΩ	R3	22kΩ
R2	1kΩ	R4	1kΩ

All 10% ½W carbon

Capacitors:

C1 8μF electrolytic
C2 0·01μF paper
C3 300pF silver mica
C4 0·1μF paper
C5 8μF electrolytic
C6 200pF silver mica
C7 50pF silver mica
VC1 365pF max. tuning capacitor (Jackson 'O')
TC2 30pF ceramic trimmer

Miscellaneous:

Tr1 OC44
L1, 2 Ferrite rod aerial (see text)
L3 R.F. interstage transistor transformer (Denco Range I Yellow)
10 in. x ⅜ in. diameter ferrite rod. Brass telescopic aerial. Paxolin. Two slow-motion ball drives (Jackson 6-1 epicyclic). 28 s.w.g. enamelled copper wire.

no less than a dozen telephone calls to as many different Naval establishments to acquire the above information in the first place.

Sea Trials

The prototype receiver shown on page 212 has been very thoroughly tested for its accuracy in direction finding with the marine radio beacons. Initial tests with the aerial and r.f. stage only (using a separate receiver) were carried out on a motor cruiser on the Norfolk Broads and the results compared with those made initially in London. The complete receiver as described in this article was then constructed and calibrated for all the radiobeacon frequencies listed in the R.I. charts. *Then followed actual trials at sea on a 30ft. motor cruiser in the Thames sea area off the Essex coast.*

These trials showed the receiver to have quite satisfactory d.f. properties and sufficient sensitivity to work with beacons more than 50 miles away. *It is important, however, that d.f. checks are made on as many different frequencies and on as many different bearings as possible on the vessel on which the set is to be used. Careful attention must be given to the compass as well.*

The Circuit

The receiver circuit is split into two parts, Figs. 2 and 3. The major part of the receiver consists of the mixer, i.f. and l.f. stages which are a printed circuit arrangement by Weyrad Limited. The d.f. aerial and its associated r.f. stage shown in Fig. 2 is quite straightforward but requires careful attention as to layout, especially the aerial, its tuning capacitor VC1 and aerial coupling coil. The tuning range of the receiver covers approximately 400 to

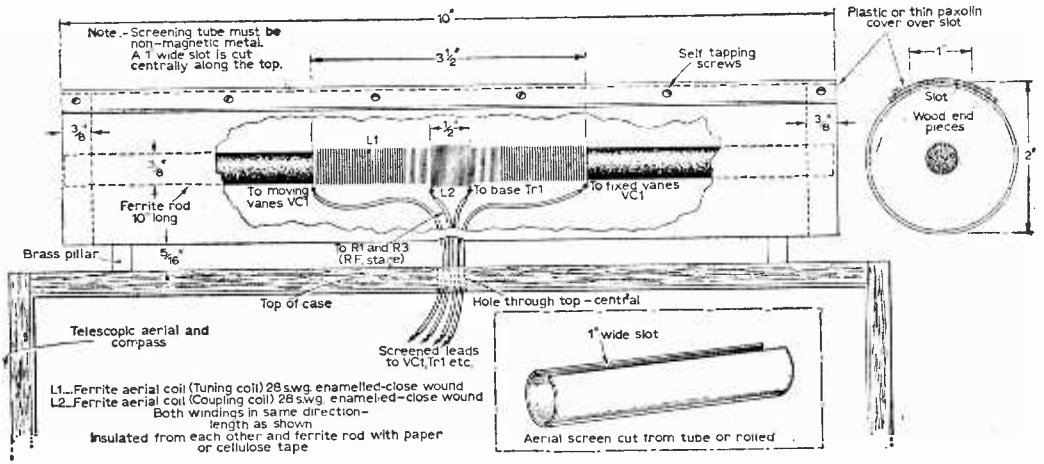


Fig. 4: Construction details of the d.f. aerial housing and winding details of L1 and L2.

220kc/s, thus including the long wave BBC station at Droitwich which is listed in the Radio Information charts as a reliable weather forecast station, receivable over most of the British Isles and immediate sea areas.

The aerial tuning capacitor (VC1) must be insulated from the chassis and the leads to aerial tuning coil and coupling coil must also be screened. A separate constructional diagram (Fig. 4) is given for the ferrite aerial, its windings and screen.

Although the aerial coil will tune over the entire band the h.f. and oscillator tuning (VC2 and VC3) have to be switched padded to cover the band in two parts. This was done so that the standard Weyrad printed circuit receiver, its components and coils could be used with as little modification as possible. These modifications include the addition of Rx (6·8kΩ) in parallel with R3 (printed circuit board 3·9kΩ) and C15 which is in parallel with the original padding capacitor C14 (printed circuit

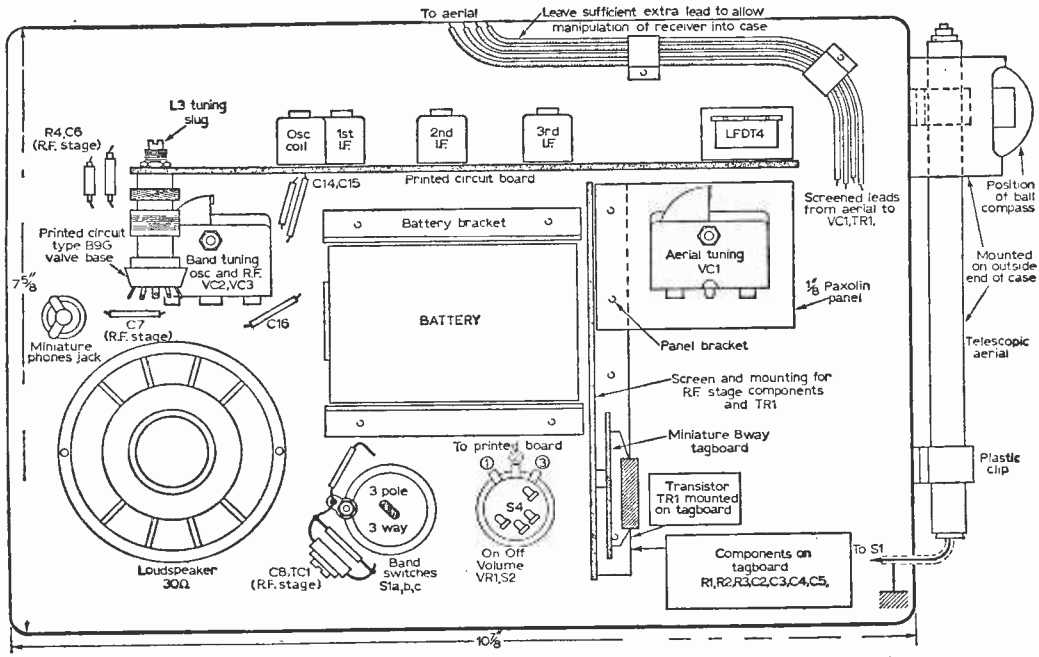


Fig. 5: Layout inside the cabinet, viewed from the rear. Only the larger components are shown.

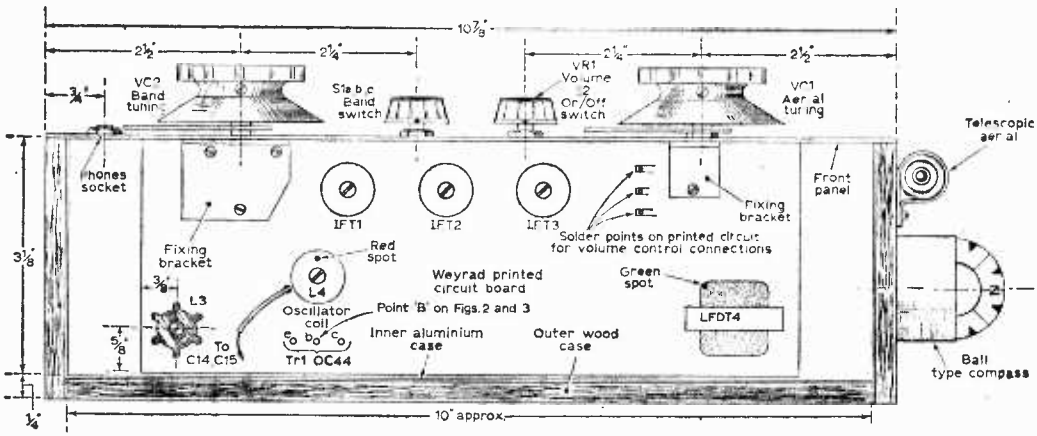


Fig. 6: Looking down on top of the cabinet, this view indicates the positioning of the printed circuit board.

CABINET COMPONENTS LIST

Two small knobs. Two 100° tuning dials. Miniature jack socket. Ball type compass. Non-magnetic metal for aerial screening tube. Aluminium and wood for cabinet. Nuts, bolts, wire, etc.

board 215pF). Note that all the padding capacitors —C8 in Fig. 2, C14, C15, C16, and C17 in Fig. 3—must be close tolerance silver mica types.

The switched padding and tuning capacitors allow the h.f. and aerial tuning to track with the oscillator over the whole band so that the intermediate frequency stages can remain at the working frequency of 470kc/s. The tuning is therefore as follows: Osc. and h.f. (VC2 and VC3) ganged to cover approximately 220kc/s to 260kc/s (switch position 1). With the i.f. tuned to 470kc/s—set osc. coil (L4) slug so that Droitwich comes in at about 90° on h.f./osc. tuning dial. Now trim the r.f. stage with TC2. The ferrite aerial circuit will require no trimming but should tune to Droitwich at the high end of scale—80 to 90°.

The radiobeacon range is covered when the band switch is in position 2 or 3. The h.f./osc. section then covers approximately 270 to 350kc/s whilst the aerial tuning covers the same band but over the lower half of the tuning dial.

In the South of England the North Foreland radiobeacon on 301·1kc/s can be received quite well and should come in on the r.f./oscillator dial at about 75 to 76° (aerial tuning approximately 38°). If not, carefully tune the oscillator coil slug to move the station to this approximate reading. Droitwich will also be moved slightly but this is not important.

The following beacon band calibration was obtained for the r.f./oscillator tuning using the small Data panel 100° receiver dials:

Dial	kc/s		Dial	kc/s	
100	—270		72	—305·7	Aerial
93	—280		70	—308	tuning
86·5	—287·3		68·5	—310·3	covers
85	—289·6		67·5	—312·6	these
83	—291·9		66·5	—313·5	frequen-
81	—294·2		65	—315	cies
79	—296·5		57	—328	between
76·5	—301·1	(N. Foreland)	49	—340	approxi-
74	—303·4		41	—352	mately
			34	—362	20° to
			31	—370	45°.

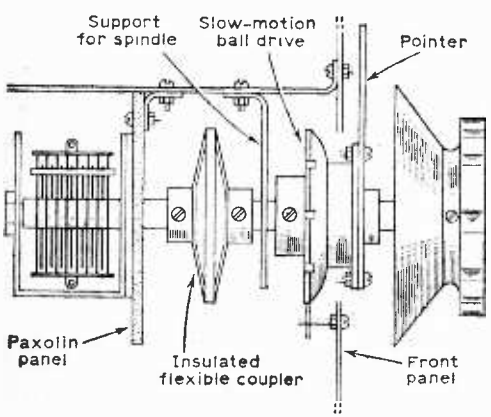


Fig. 7: Dial drive assembly for VC1, viewed from the top of the front panel.

North Foreland is one of the more sophisticated radiobeacons, for it has the frequency 301·1kc/s all to itself and its own modulation frequency of 354c/s. It therefore becomes a useful marker station when calibrating the receiver.

Accurate calibration of the receiver dials is very important because of the narrow channel separation of 2·3kc/s. It is important, too, that the i.f. stages are tuned to peak so as to maintain the narrowest possible bandwidth.

—continued on page 265

Regulated Power for Transistor Receivers

by G. J. King

MAINS OPERATED VARIABLE POWER SUPPLIES

WHILE transistor sets do not generally put very big demands upon the power supply and an ordinary 9V dry battery will normally supply the power for several months' of hard listening there are, nevertheless, times when a mains power supply is advantageous. If the set is to be used as the household model, for example, there is little point in burning up batteries unnecessarily, even though the process may be relatively slow. A variable voltage supply can also be useful during the development of a transistorised radio or some other device and to avoid relying upon the set's battery when servicing becomes necessary. A regulated low-voltage supply from the mains could also be built into all but the smallest models, thereby permitting the set to be operated either from batteries or the mains supply, in line with some of the latest models.

Requirements

To start. let us see what is required of the power supply. It must give up to, say, 9V of d.c. adequately smoothed to avoid mains ripple. The output voltage must also remain reasonably constant despite large changes of receiver current. Most transistor sets have a push-pull class B output stage which is virtually biased to collector current cut-off in the absence of a signal. The output stage current then rises from a few milli-amperes to 30 or 40mA at full output, the actual current. of course. being dependent upon the loudness of the sound.

Over this range of current (say from zero to 40mA) the voltage across the terminals of the power supply must not vary too much otherwise distortion would be troublesome, the voltage falling as the volume rises. This sort of thing happens when the battery gets towards the end of its useful life, and is one of the largest causes of distortion in transistor sets.

Simple Power Supply

The simplest of mains power supplies for transistor receivers is shown in Fig. 1. This uses a mains transformer with a fully isolated secondary. a half-wave silicon rectifier and a very large value electrolytic reservoir capacitor. The reservoir charges to the peak of the a.c. voltage across the secondary of the transformer off load while the d.c. voltage across the output terminals is about equal to the r.m.s. value of the a.c. when the unit is supplying current. depending upon the type of components employed, and the amount of current supplied.

The output impedance of the unit is very low, of cuurse, but there is, nevertheless, quite a swing in output voltage as the current requirements of the receiver change with varying volume, as discussed in the foregoing.

Bridge Circuit

Slightly improved "regulation" is possible by using a bridge full-wave rectifier instead of a simple half-wave diode, as shown in Fig. 2. The better regulation arises mainly from the fact that the reservoir capacitor is recharged on both the

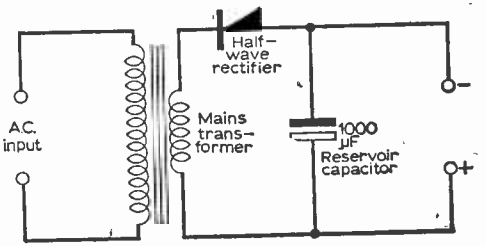


Fig. 1: This simple mains power supply for transistor sets has very poor voltage regulation and is not recommended for use with receivers in which the current varies with volume of sound.

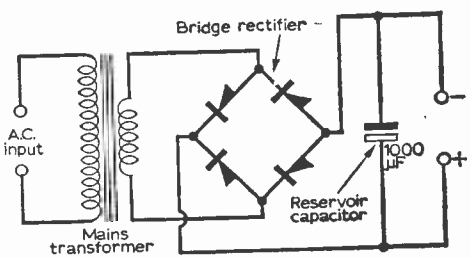


Fig. 2: The use of a bridge rectifier improves on the voltage regulation of the Fig. 1 circuit but even so, a fully regulated supply is desirable for the best results for sets with a Class B output stage.

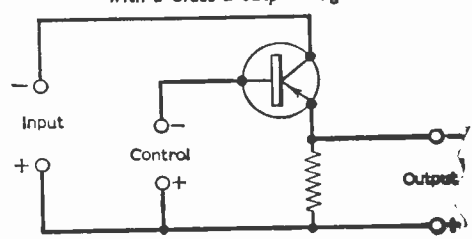


Fig. 3: The basic transistor "regulator".

positive and negative peaks of the a.c. input waveform, instead of only on the negative peaks, as in Fig. 1. The more efficient basic operation of the bridge rectifier also helps matters. While this kind of circuit would work a transistor receiver the results would not be fully up to standard, particularly on very loud passages of music. What is required is some form of automatic regulation which, in effect, adjusts the impedance of the power supply to match the instantaneous current requirements of the load (e.g. receiver). It is also desirable for the regulation device to maintain a constant output voltage under conditions of varying a.c. input voltage.

Transistor Regulator

A simple transistor circuit can be evolved to perform these tasks, and that most suitable is the common collector (sometimes called the "emitter-follower") arrangement shown Fig. 3. This is analogous to the cathode-follower valve circuit and like this, the transistor circuit has 100 per cent feedback and is therefore extremely stable under temperature variations.

The voltage across the output terminals depends upon the forward current in the base/emitter junction, but at "full base/emitter conduction" the voltage from the emitter to the positive line is almost equal to the voltage between the collector and the positive line.

The output voltage can thus be controlled by varying the base bias, and in practice, a potentiometer is used to set the output voltage to suit the circuit the unit is to power.

The circuit is arranged so that any variation of load across the emitter resistor is reflected into the base circuit as a change of voltage here, thereby correcting the output voltage to suit the load conditions, and in that way regulating the voltage.

Commercial Circuit

This may be better understood by considering the practical circuit in Fig. 4. This circuit is, in fact, used in the Ekco range of mains/battery transistor sets.

The power supply uses a small mains transformer with two secondary windings, one to supply the receiver power and the other for supplying a control voltage, marked "A" and "B" respectively in Fig. 4. The main supply is rectified by a bridge circuit, the same as that in Fig. 2, with C1 as the reservoir capacitor.

The control supply is rectified by a simple half-wave diode with C2 as the reservoir electrolytic.

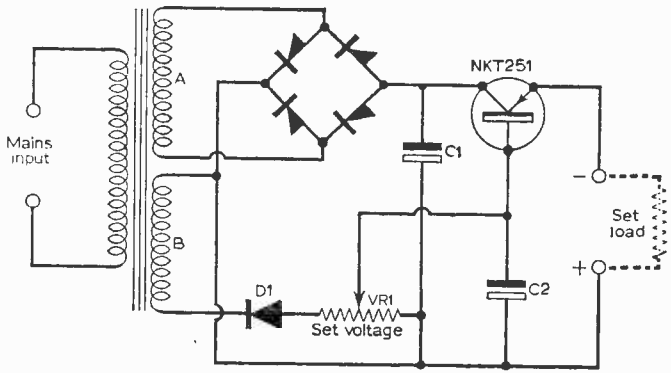


Fig. 4: A simple stabilised power supply used commercially.

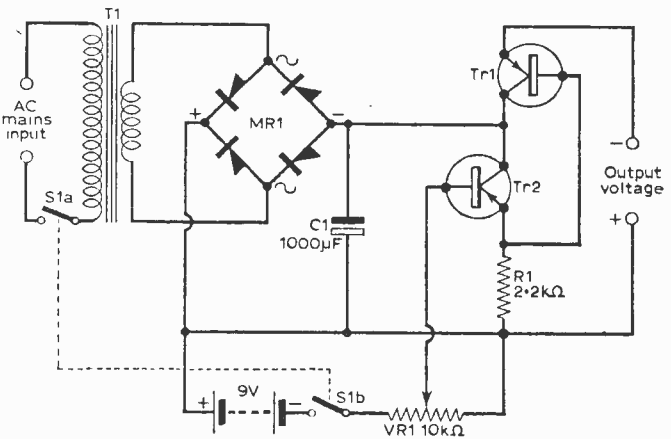


Fig. 5: A fully variable and regulated power supply.

The voltage across the reservoir capacitor is adjustable by the preset potentiometer VR1. Although there is no actual emitter resistor as such, the load of the receiver itself is reflected across the emitter circuit, which is the same as the emitter resistor in Fig. 3.

Operation

Now, although the receiver load varies with output due to class B operation of the output stage, voltage regulation is derived from the fact that a fall in the negative emitter voltage automatically produces an increase in forward current in the base/emitter junction. This results in a corresponding increase of emitter current, thereby making the supply current a function of receiver output and ensuring adequate voltage regulation.

It will, of course, now be understood that the output voltage is adjustable by the VR1 preset, and in practice this is set for 9V output.

Instead of the complication of a secondary circuit for producing a control or reference potential, a battery can be used for this operation, and this is not costly since the very low current

—continued on page 224

A "valve-base coil" short wave set

by K. F. Perry

AN AMATEUR BANDS REGENERATIVE RECEIVER USING COILS WOUND ON HOME-MADE FORMERS

CONSTRUCTORS who have been keeping up to date with their radio hobby will, no doubt, have discovered that their spares and junk boxes now contain many of the older fashioned octal based valves. Since the tendency is always towards smaller and smaller items the all-glass noval types have generally taken over from their larger predecessors and these in turn are gradually being supplanted by transistors.

One is apt to feel nostalgia when inspecting "has beens" but as there is usually a limit to the amount of idle gear that can be retained it is sometimes necessary to prune out surplus items, particularly if these have passed the useful period of life.

Fortunately, some retired or faulty valves can be made most useful by smashing them!

Uses for Old Valves

Valves of the 6H6 metal type, etc., can provide extremely useful octal plugs with which to pick up supplies from power packs, etc., whilst 6K7, 6SK7, 6K8, etc., glass (G or GT) specimens, which have a deeper base can be used as coil formers for plug-in applications. Suitable "formers" of this kind are by no means inexpensive to purchase and are in frequent demand by the fraternity, the advantage being that they can be wound to suit the purpose or waveband required. In the early days of radio as a hobby and as many readers will remember, home-made constructors coils were widely used.

Although slight variations occur, international octal (I.O.) bases measure approximately 1¼in. diameter by 13/16in. deep and will therefore easily accommodate sufficient turns, even if comparatively thick wire is used, to tune "top band". Valves from the Mazda octal (M.O.) range such as the very common VR65A may also be utilised, but the resulting "former" is somewhat smaller and of course must be used with a Mazda octal holder which immediately adds a restriction; because of this the exclusive use of I.O. types may be preferred.

Obtaining a "Former"

To obtain a "former" from an unwanted valve specimen, place the old valve in a strong brown paper bag—to prevent flying glass splinters—and holding the bakelite base through the paper for protection strike the glass bulb smartly with a hammer. A loud "pop" should result; and then judicious minor taps will dislodge unwanted glass fragments remaining and the "centre" can be pulled out leaving the wires.

With all the refuse snipped away the base is turned pins upward and a hot soldering iron applied to each pin in turn from which wires erupt. Immediately the solder melts the whole base is tapped down smartly on the bench when the unwanted sliver of wire will fall out cleanly.

If a number of formers are required it will be necessary to select unwanted valves with similar basing, although pins 1, 2, 7 and 8 normally exist in all the types.

Winding a Coil

The next problem lies in securing the turns of wire to the slippery, unretentive surface; this is most satisfactorily accomplished by first winding on a layer of Sellotape *inside out* viz., with the sticky side outermost. This is fairly easy to do if an overlap is allowed at the start as shown in Fig. 1, but it is preferable not to touch the

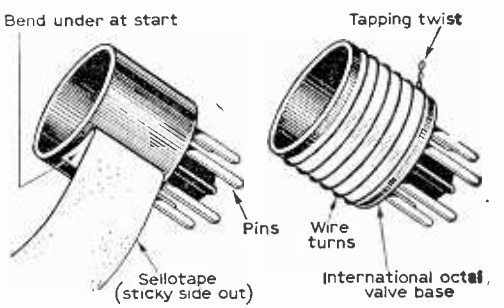


Fig. 1: Preparing a valve-base "former" and winding a typical coil.

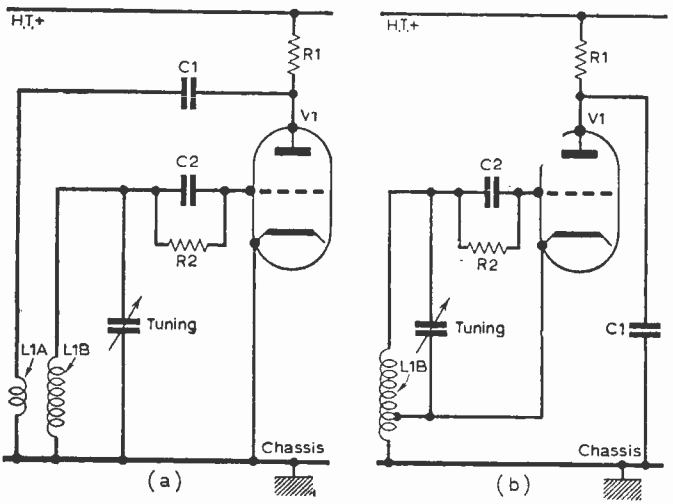


Fig. 2(a) and (b): Typical feedback circuits.

adhesive more than is necessary or it will not hold the wire.

Another layer of Sellotape wound on later over the wire will make a secure and damp-proof construction—this layer should of course be put on the correct way round. The ends (or tappings)—may be soldered to the pins outside or inside the former as is most convenient.

Coils may consist of a single winding or may be double or even treble wound and will be chosen to suit a particular design.

The simplest coil to wind is obviously the single layer, single winding type as is used in many simple regenerative receivers—whereupon someone is certain to query the location of the reaction coil. Such a coil is shown theoretically in Fig. 2(a). Energy is fed back from V1 anode to the reaction coil L1A. The coupling capacitor is often made variable in order to provide a means of controlling the amount of r.f. energy fed back—and hence the sensitivity of the stage. This basic arrangement is frequently encountered and apparently requires two windings. However, if we redraw the circuit as Fig. 2(b) the result is a single coil winding, the valve cathode being "tapped in" whilst the "outers" are connected to grid and anode of the valve (the anode being effectively at "earth" as far as r.f. signals are concerned).

A Reliable Circuit for use with the Home-made Coils

The circuit of a suitable and easily made amateur bands regenerative receiver is shown in Fig. 3 and a test model worked well. Details of

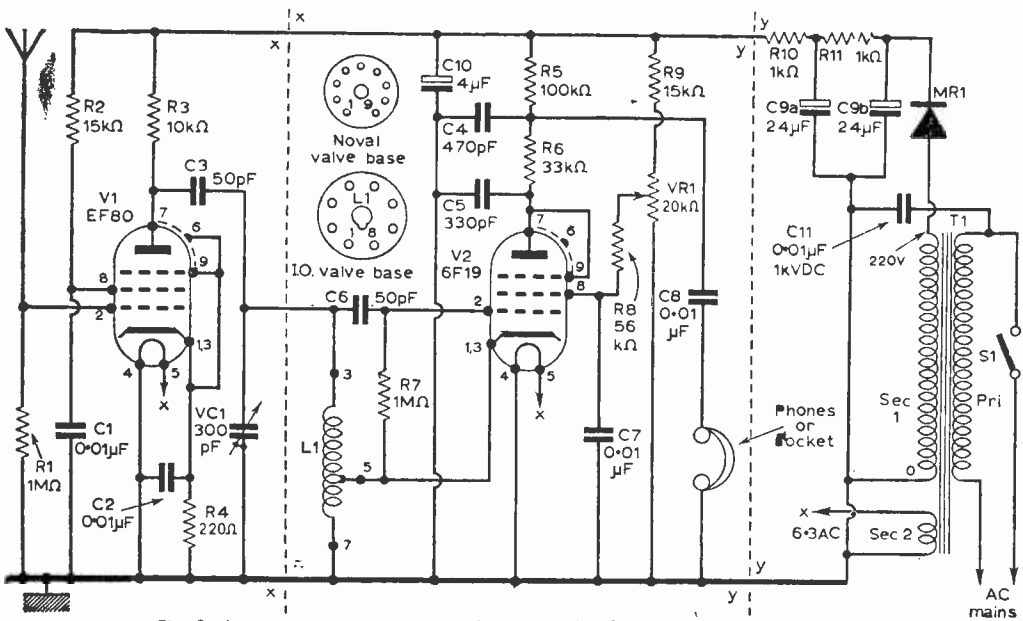


Fig. 3: A regenerative s.w. receiver design suitable for use with valve-base coils.

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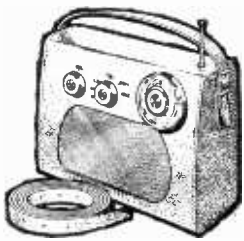

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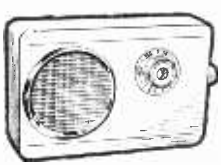

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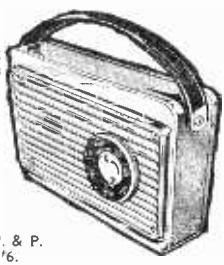

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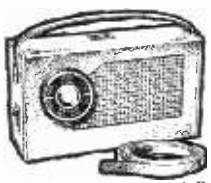

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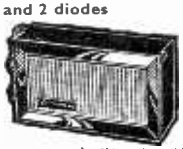

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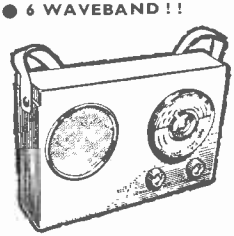

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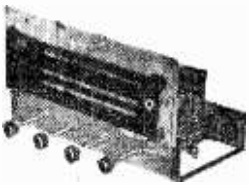

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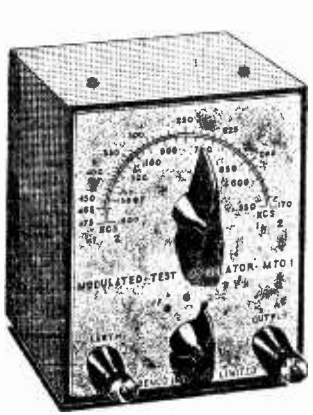

- ★ Provides modulated signal suitable I.F. alignment, also trimming and tracking R.F. circuits.
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COMPONENTS LIST

Resistors:

R1	1MΩ	R7	1MΩ
R2	15kΩ	R8	56kΩ
R3	10kΩ	R9	15kΩ 1W
R4	220Ω	R10	1kΩ 1W
R5	100kΩ	R11	1kΩ 1W
R6	33kΩ		

All ± 10%, ½W carbon unless otherwise stated.

VR1 20kΩ wirewound potentiometer.

Valves:

V1 EF80 V2 6F19 or EF85

Miscellaneous:

MR1 Contact cooled rectifiers 250V 50mA
S1 Toggle or rotary on/off switch
T1 Mains transformer. Secondaries 220V 25mA; 6·3V 1A

Chassis 8in. x 4in. x 1¾in. Dial and drive (Jackson, etc).

Valveholders: Noval (2) with cans; I.O. (1). Control knobs. Aerial and earth sockets. Output socket.

Capacitors:

C1 0·01μF ceramic or paper
C2 0·01μF ceramic or paper
C3 50pF silver mica
C4 470pF ceramic or mica
C5 330pF ceramic or mica
C6 50pF silver mica
C7 0·01μF ceramic or paper
C8 0·01μF ceramic or paper
C9a/b 24+24μF, 350V electrolytic
C10 4μF, 300V electrolytic
C11 0·01μF, paper 1000V
VC1 300pF nominal air spaced variable

ADDITIONAL PARTS FOR FIG. 4

Resistors:

R12 470kΩ
R13 100kΩ
R14 2·2kΩ

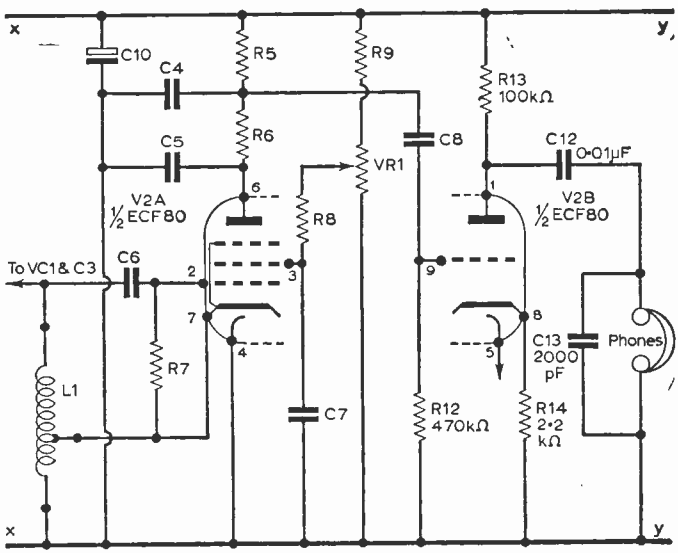
Capacitors:

C12 0·01μF paper
C13 2,000pF ceramic

Valve:

V2 ECF80

Fig. 4: Modifications to the circuit of Fig. 3 for a higher output.



suitable coils are given in Table 1 and when winding remember that it is easier to take off turns than to add them. Slight changes might be necessitated by different layouts, component tolerances and so on and will mainly affect Ranges 4 and 5.

Basically the receiver consists of a regenerative detector circuit around V2 where the valve functions on similar lines to Fig. 2(b). In essence V2 is an e.c.o. (electron coupled oscillator) but actual oscillations are not allowed due to the critical setting of VR1. The valve anode plays no part in the detector function, serving only as an audio take-off point. The cathode plus the control grid (g1) and the screen grid (g2) perform together as a triode oscillator, whilst the cathode and g1 act also as a diode for demodulation purposes.

It is found in practice that if VR1 is advanced too far oscillations result but when set slightly below the critical point very sensitive detection occurs. A point in favour of this circuit is that tuning is little affected by different settings of VR1. The valve also does service as an audio amplifier and good "phone" signals may be extracted as shown—and quite safely for they are isolated from the voltage supplies.

A radio frequency filter is essential in the output circuit and comprises of C4, C5, R6. Some benefit might result from exchanging R6 for a good quality r.f. choke.

TABLE I

Range	Turns	Tap from earthy end	Band Mc/s
1	38 closewound	7 turns	1·8
2	20 spaced wire thickness	4 ,,	3·5
3	12 ,, ,, ,,	3 ,,	7·0
4	6 ,, ,, ,,	1½ ,,	14·0
5	2½ spaced twice wire thickness	1 ,,	28·0

All coils are wound with 28s.w.g. enamelled wire.

If V2 is used alone and is allowed to oscillate interference is likely to be radiated. To minimise this a buffer stage must be used. This buffer stage consists of V1 and the associated circuitry and effectively isolates the aerial from the detector. Only small gain results due to V1, for it is an untuned stage, but gain is not an important factor here.

Another desirable feature is bestowed by the buffer stage, for a moment's reflection will show that the input to L1 via C3 is likely to remain more constant than if the aerial was connected direct, also no tuning "dead spots" are likely to occur. Experimenters who have tried simple feedback detectors without a buffer stage will know only too well how troublesome "dead spots" on the dial can be.

Power Requirements

The power consumption of this receiver is so modest that a small "converter" type mains transformer may be used. However, on no account should such a receiver be connected to rectifying equipment that does not employ a "double-wound" mains transformer with an isolated h.t. winding.

Increasing Output Power

Where the receiver output is considered low a further stage of audio amplification can be incorporated while still keeping within the compass of two valves by making use of a ECF80 in the V2 position. This has been tried and provides really "fat" phone signals. It must be realised, however, that this modification in no way improves the input sensitivity.

The revised circuitry is shown in Fig. 4 and as the component designations are identical with those in the earlier circuit the extra items can be readily identified.

The circuitry to left and right of the broken lines in Fig. 3 should be used but that given in Fig. 4 inserted in the V2 location and connected at points "x" and "y" as appropriate.

A suitable layout for the receiver is given in Fig. 5, this agreeing with the test model. If a reduction mechanism is not used to control VC1 a bandspread capacitor can easily be wired across it. Component values for the set are given in the Components List and the only ones likely to require adjusting are C6 and R7. ■

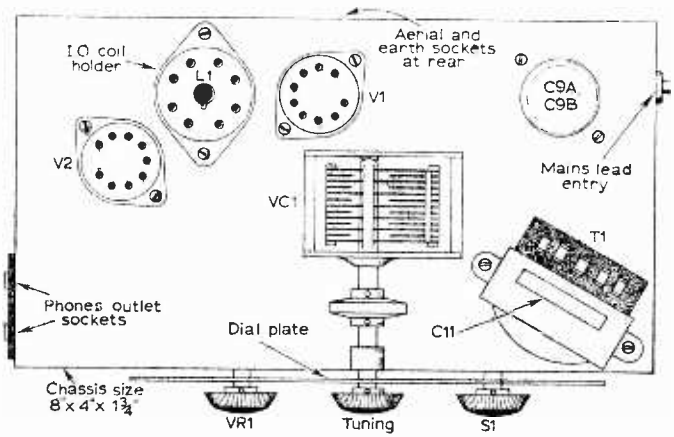


Fig. 5: A suggested chassis layout for the receiver.

REGULATED POWER FOR TRANSISTOR RECEIVERS

—continued from page 218

in the base circuit endows the battery with almost shelf life.

Experimental Circuit

An experimental circuit supplying up to 1A d.c. at 12V using this arrangement is shown in Fig. 5. This uses two transistors, Tr1 being the emitter-follower and Tr2 an amplifier giving d.c. feedback.

The transformer needs a primary winding to match the local a.c. mains voltage and a secondary winding of 12·6 or 13 volts rated at 1A. The choice of bridge rectifier will depend upon the total current requirements of the unit, being also a function of the transistors (see under components).

Base current for Tr2 is supplied by a 9V miniature layer type battery and the voltage is controllable from zero up to a maximum of 9V by the "variable voltage" control VR1, thereby giving a control of output voltage. A double-pole on/off switch is desirable as the second pole can be used to switch the battery out of circuit. The value of Tr2 emitter resistor may require adjustment to suit the type of transistors employed and for optimum regulation.

Components

A 13V transformer is available from Radiospares Limited, and although this is rated only for 0·5A it is adequately suitable for most applications. Alternatively, the "Hygrade" type of transformer can be used. This has two 6·3V windings, each rated at 1·8A, which may be connected in series to give the required voltage.

The bridge rectifier MR1 should be capable of providing the maximum current required by the set, and can be a 0·5 or 1A bridge rectifier as used in many battery chargers. 1,000μF electrolytics at 15V working are also readily available and any "standard" type of control may be used for VR1.

Suitable transistors are the NKT251 for Tr2 and the V15/30P for Tr1. ■

PREPARING FOR THE R.A.E

BRIAN ROBINSON.

9. THE SUPERHETERODYNE CONTINUED

9.1 Image Ratio

WHEN a frequency changer—mixer and oscillator—is in operation, the oscillator can cause a response in the INTERMEDIATE FREQUENCY circuits at two different input signal frequencies. For example—an oscillator operates at 3,000kc/s and the intermediate frequency is 465kc/s. Input frequency signals of—3,000 + 465 = 3,465kc/s and 3,000 − 465 = 2,535kc/s will both cause a response in the i.f. circuit. If the signal required were that of 2,535kc/s the signal on 3,465kc/s would be called the IMAGE. The ratio of the output of the required signal to that of the image in a receiver is called the IMAGE RATIO. Obviously if the image ratio is to be kept high the selectivity in the early stages of a receiver must be high (i.e. in any stage preceding the mixer or in the mixer itself).

Other false signals which may occur in a receiver are those which may be caused to HARMONICS of the oscillator which BEAT with other signals to produce the correct i.f. response. If in a receiver the oscillator frequency is 3,000kc/s and the i.f. is 465kc/s, the normal frequency of the input to the mixer would be either 2,535kc/s or 3,465kc/s, as shown previously. If, however, a harmonic of the oscillator at 6,000kc/s is present, responses in the i.f. can also occur for inputs to the mixer of 5,535kc/s and 6,465kc/s.

Methods of climinating such spurious responses include—

1 Shielding the oscillator circuit;
2 Decoupling the oscillator power supply;
3 Keeping the power of the oscillator at a low level.

9.2 Choosing the I.F. Frequency

When an i.f. of a low frequency is chosen the gain of the i.f. amplifier can be high and the selectivity good. A low frequency i.f. will however result in the image frequency being brought near to the desired input frequency and therefore the image ratio will be decreased. Also the nearer the oscillator frequency to the input frequency (hence a low i.f.), the greater will be the "pulling" effect on the oscillator (i.e., the changing of the frequency of the oscillator due to the adjacency of the input signal).

A high i.f. will greatly improve the image ratio and reduce the effect of pulling. Less gain will be obtained in a single i.f. amplifier stage when a high i.f. is used.

Up to input frequencies of about 8Mc/s an i.f. of 465kc/s will be satisfactory, but to say 28Mc/s the i.f. should be increased to 1,600kc/s or more. For frequencies above about 28Mc/s the DOUBLE CONVERSION SUPERHET is generally employed. In a double superhet receiver the input signal is first converted to an i.f. of say 5Mc/s (or higher), and usually one stage of i.f. amplification follows. This 5Mc/s i.f. signal is then mixed with a signal from a second oscillator and a second i.f. of say 100kc/s is produced. At this second i.f. high amplification can be obtained as can high selectivity. It must also be remembered that the image ratio of the receiver will be high too, due to the first i.f. being high.

9.3 A Simple I.F. Amplifier

The circuit for a simple i.f. amplifier is shown in Fig. 80. This amplifier does not use AUTOMATIC GAIN CONTROL (which is dealt with in 9.4) but is a straight high gain amplifier. Pentodes with high mutual conductances are suitable for an amplifier of this type.

The i.f. transformers are generally iron-dust-cored and contained in screening cans to prevent signals at the i.f. frequency being picked up directly, amplified, and passed to the detector. The capacitances connected in parallel with the i.f. transformer windings are also enclosed in the metal can and may be either fixed or semi-variable.

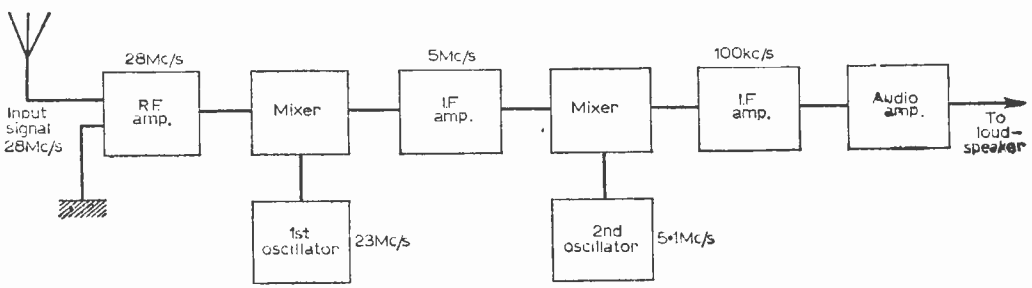


Fig. 79: A block diagram showing the stages of a double conversion superhet receiver.

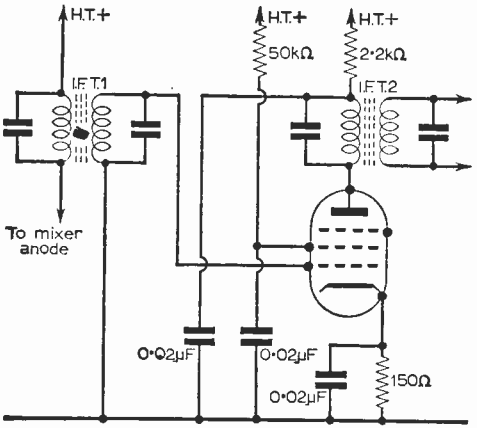


Fig. 80: The circuit of a simple i.f. amplifier.

9.4 Automatic Gain Control—A.G.C.

In most superhet receivers Automatic Gain Control (a.g.c.) is applied to the i.f. amplifier stages and also to the r.f. amplifier stages. Part of the signal from the i.f. amplifier is passed to an a.g.c. rectifier which produces a rectified d.c. voltage across a resistance. The higher the signal level the greater the rectified voltage. This rectified voltage is used to vary the grid bias on the i.f. and r.f. amplifiers. As the signal becomes stronger the gain of the r.f. and i.f. amplifiers is decreased —due to increased negative bias—and as the signal becomes weaker the gain of the amplifiers will be increased. Remember that a certain value of fixed bias is applied to the amplifiers by means of a resistance in the cathode circuit.

Therefore the function of a.g.c. is to maintain the output level of the receiver at a fairly constant level. The more stages the a.g.c. is applied to the more efficient is its operation.

A.G.C. is particularly useful in the reception of modulated signals. A simple a.g.c. rectifier is shown in Fig. 81.

The rectified a.g.c. voltage is developed across the 1·5MΩ resistance and the a.g.c. is applied to the controlled stages through the 100kΩ resistance connected to the anode.

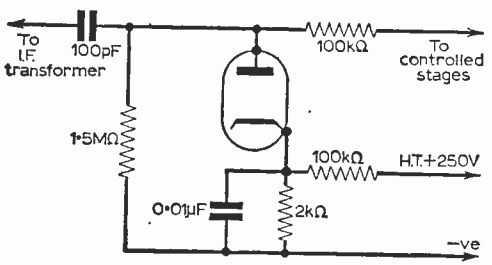


Fig. 81: A simple a.g.c. rectifier.

The method of applying the a.g.c. voltage to the controlled stages is shown in Fig. 82. Only the tuned circuits of the various stages are shown, for simplicity. Notice that to change from a.g.c. to manual gain control the a.g.c. line is simply shorted to earth through the switch shown.

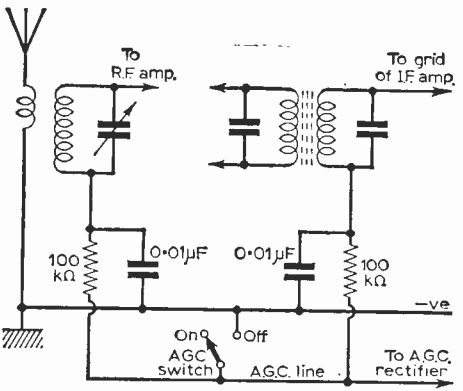


Fig. 82: How a.g.c. is applied to the controlled stages.

In i.f. or r.f. amplifiers which use a.g.c. VARIABLE μ PENTODES are used. These have a remote cut-off value and are able to accept the widely varying bias which results when a.g.c. is used.

In general the gain of an amplifier using a variable μ valve is not as great as that using a high slope sharp cut-off type.

9.5 The Detector an Audio Frequency Amplifier

The principle of the detector and various detector circuits were dealt with in Part 8, but the audio frequency (a.f.) amplifier has only been dealt with in theory. Therefore simple circuits for a triode Class A amplifier and a tetrode output stage are shown in Figs. 83 and 84.

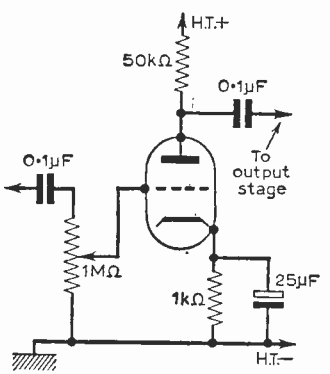


Fig. 83: A simple Class A triode a.f. amplifier.

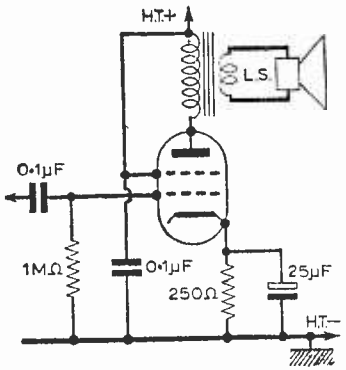


Fig. 84: A simple tetrode output stage.

The type of coupling employed between the stages is called resistance capacity coupling (r.c.c.) which is cheaper and more compact than the transformer coupling which used to be generally used.

9.6 The Reception of C.W. Signals

Carrier wave, or c.w., signals are not modulated signals but signals produced by interrupting the carrier wave generated by the transmitter. Morse code is used for the transmission of c.w. signals. These signals would not normally be heard on a receiver, as to be heard they would have to BEAT with a second signal to produce an audible note.

If the i.f. of the receiver is 465kc/s the output from the beat frequency oscillator (b.f.o.), which can be varied between say 460kc/s and 470kc/s, is fed to the input circuit of the detector. This will then give an audible beat note of from 0—5kc/s and will enable the c.w. signal to be heard. If the b.f.o. were tuned exactly to 460kc/s no signal would be heard of course.

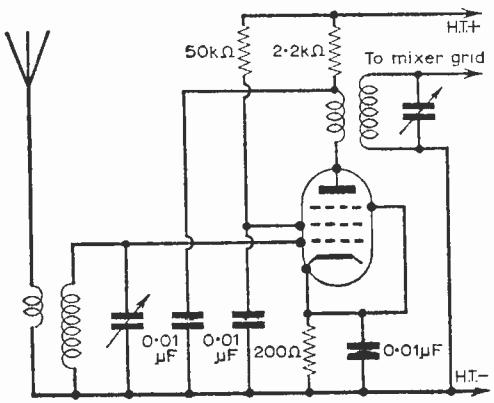


Fig. 85: Circuit of an r.f. amplifier.

9.7 The Radio Frequency Amplifier

The function of the radio frequency (r.f.) amplifier is to amplify the incoming signal before it is passed to the control grid of the mixer valve.

The r.f. amplification will result in a higher image ratio (as the image has to pass through more tuned circuits before reaching the mixer valve) and will also give a lower noise level.

It is almost essential for good receivers to have at least one stage of r.f. amplification when operating at frequencies above about 8Mc/s.

A simple r.f. amplifier circuit is shown in Fig. 85. This uses a high slope pentode valve. If a.g.c. is applied to the r.f. amplifier valve the method used is the same as that shown in Fig. 82, the valve naturally being changed to a variable μ type.

9.8 A Simple Receiver Power Supply

A power supply suitable for operating a five or six valve receiver is shown in Fig. 86. This uses the basic principles outlined in Part 5 and is of the full wave type (or more correctly bi-phase half wave). Notice that a separate heater supply is used for the rectifier heater as the cathode of the rectifier is at full h.t. potential.

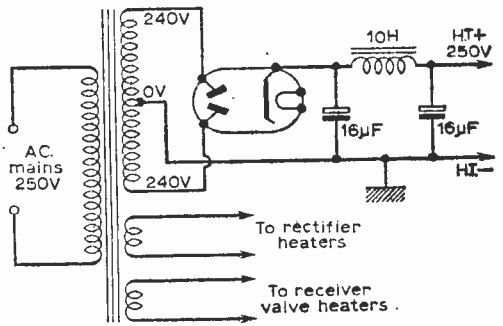


Fig. 86: This power supply would be suitable for a five or six valve receiver.

9.9 Tuned Radio Frequency Receivers

In a tuned radio frequency (t.r.f.) or straight receiver, the signal is detected at its input frequency—e.g. a signal on 7Mc/s is fed to a tuned circuit in the detector which is resonant at 7Mc/s. The main advantage of the t.r.f. receiver is its simplicity allied with a fairly satisfactory performance. Generally the detector stage in a t.r.f. is made regenerative so as to increase the sensitivity. If the detector is made regenerative an r.f. stage should be used, otherwise if oscillation occurs the set will radiate signals in the same way as a transmitter.

9.10 The Noise Limiter

Much interference to radio reception is caused by domestic electrical apparatus, motor car ignition systems, and other such sources.

To the serious listener this type of interference can be particularly annoying and in many communications type receivers a single diode is used as a NOISE LIMITER. A circuit for a simple shunt noise limiter is given in Fig. 87.

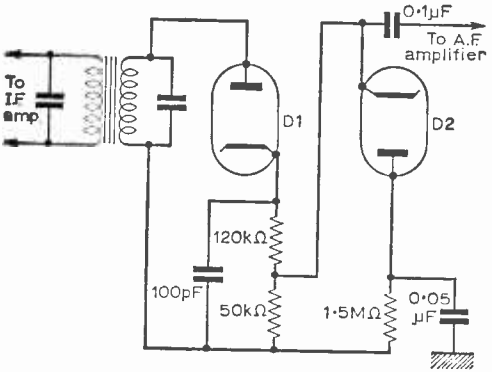


Fig. 87: A shunt noise limiter circuit.

In the circuit shown D1 is the normal diode detector. The second diode D2 does not operate until a sudden noise pulse appears. When this occurs D2 short circuits the output of D1 during this period. Normal a.f. variations are not affected due to the time constant of the circuit. This type of noise limiter therefore eliminates sudden surges of signal, such as those from a motor car ignition system.

Question

Using information and diagrams from this article and Part 8 draw a full circuit diagram of a superhet receiver which has the following features—

1	R.F. stage	—(Pentode—no a.g.c.)
2	Mixer	—(Pentode—leaky grid)
3	Oscillator	—(Triode)
4	I.F. amp	—(Pentode—no a.g.c.)
5	Detector	—(Diode)
6	A.F. amp	—(Triode—Class A)
7	Output stage	—(Tetrode)
8	Power supply	—(Double Diode)

Answer to Last Month's Question

a —3V
b 1V
c 40V
d 20
e Class A

PART 10 NEXT MONTH

A STEREO EXPERIMENT

by Peter J. Harvey

THE BBC's decision not to develop stereophonic broadcasting for the time being has disappointed many people. Nevertheless it is possible to simulate some of the effects of stereophony during the monophonic transmission of large-scale orchestral concerts. Furthermore it is possible to achieve this without the need for two sets of bulky full-range speaker assemblies which, as many wives will tell you, do not fit well into all living-rooms.

An experimental hook-up can probably be made at no cost, since suitable equipment will, in most cases, already be in the experimenter's possession. Most of the work, too, can be carried out by a younger member of the family.

A symphony orchestra disposes its bass strings to the right of the platform, its violins to the left and, broadly speaking, violas, woodwind and keyboard instruments to the centre. Allow your cymbals to be to the left and your drums to the right and it is clear that the feeding of left- and right-hand speakers with selected frequencies will go part of the way towards stereophonic effect.

In my own hook-up I have used the tuner section of a really good v.h.f. radio (a.c. only), tapped at the top and bottom of the volume control to feed a preamplifier and push-pull amplifier (triode output) into a sand-filled corner baffle equipped with a 10in. Wharfedale Golden FSB.

Almost any amplifier of good response would serve but the speaker should be able to reproduce low frequencies without undue resonance. The preamplifier should be able to cut treble response very drastically and be capable of substantial bass boost.

In connecting to the tuner ensure that matching is carried out other than by resistors wired across the load, otherwise the signal to the second channel might be dramatically reduced.

To serve the second channel the writer has made up a separate high-pass amplifier, cutting off below 200c/s, but to simplify the experiment the a.f. amplifier of the v.h.f. set would most probably prove satisfactory, although it is desirable that there should be a really flexible treble control and a bass cut control.

Make up a middle-range speaker (an old 10in. unit salvaged from a television console would be ideal) by building up a small box round the speaker chassis. Line the inside of the box with expanded polystyrene, which must be stuck to the wood really well to avoid "tizz". Offcuts from polystyrene ceiling tiles are suitable. Do not make the box too large, since good bass response is to be avoided.

Before screwing the back on to the box test the speaker. It will be found that when the back is held against the box without any venting the sound is "boxy". Slide the back panel to one side until the sound is acceptable and measure the vent space. A hole of similar area can then be cut in the panel and the box screwed up.

The treble unit should be 6½in. or less and must be of reasonably good quality (I have used the 6½in. Celestion speaker salvaged from an old Deccalian gramophone with quite good results, although a more expensive Wharfedale unit is worth the extra cost).

This can, for purposes of experiment, be stood cone upwards on its magnet on top of the middle-range box and should be connected to the second channel output with a suitable capacitor set in one of the leads (an 8μF electrolytic works quite effectively here).

The bass unit should be in the right-hand corner of the room. Stand the middle unit in the left-

—continued on page 265

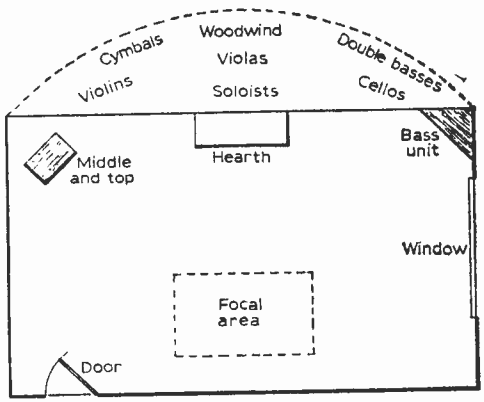


Fig. 1: The author's arrangement for his loudspeakers, indicating the area of "stereo" effect (Focal area) and the apparent displacement of the instruments of the orchestra.

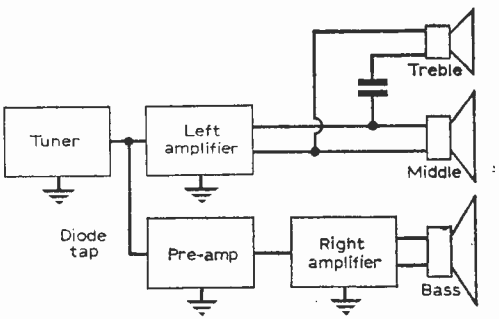


Fig. 2: A block diagram representation of the author's equipment set-up.

HAM FEATURE

A Valve Keying Circuit

By A. D. Taylor GW8PG

A VALVE keyer unit provides the most elegant means of keying an amateur c.w. transmitter. The unit described in this article is designed to key the cathode of the untuned buffer stage which normally follows the v.f.o.; it may also be used to key a crystal oscillator (Figs. 1 and 2). In most circuits of this type the resistive elements in the delay network connected to the control grid of the keying valve are made large and the capacitive elements relatively small. This means that it is only possible to vary the keying characteristic by a few steps, normally controlled from a switch. In the present design the capacitive element is made large and the main resistive element is a 0·5MΩ variable resistor. This circuit configuration allows the transmitter keying characteristic to be varied over wide limits by means of a continuously variable front panel control. Apart from allowing the operator to obtain the exact keying characteristic which he requires, this system has the additional advantage that if several transmitters are in use the keyer can be adjusted to meet the individual electrical characteristics of any one of them in a few seconds.

Circuit Description

The power supply is required to provide 150 to 200V at a few mAs and 6·3V at 0·6A. The simple half-wave circuit shown in Fig. 3 was used because the components were available but a full-wave or bridge arrangement such as would be provided by the transformer and rectifier from a discarded ITV converter are equally suitable. The reservoir capacitor C1 has R1 connected across it as a safety bleeder. The grid bias delay network for V1 consists of R2, VR1 and C2, the delay time being controlled by VR1. The 120Ω resistor is provided to prevent a direct short-circuit being applied

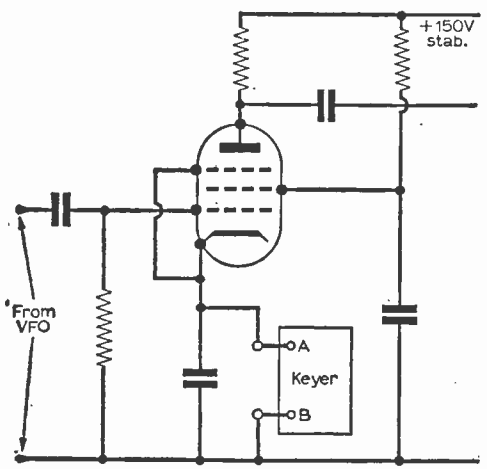


Fig. 1: A typical untuned buffer stage where keying is incorporated in the cathode circuit.

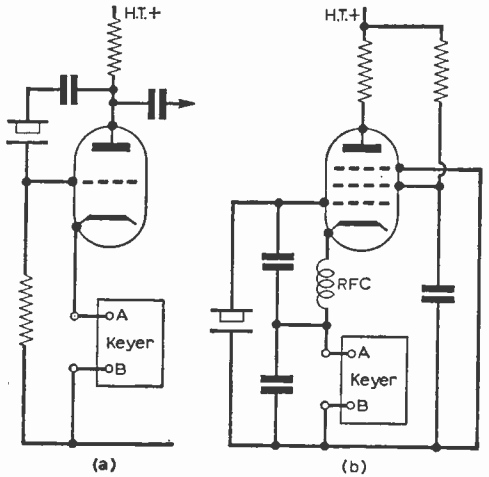


Fig. 2(a): The Pierce crystal oscillator and (b): the circuit modified somewhat.

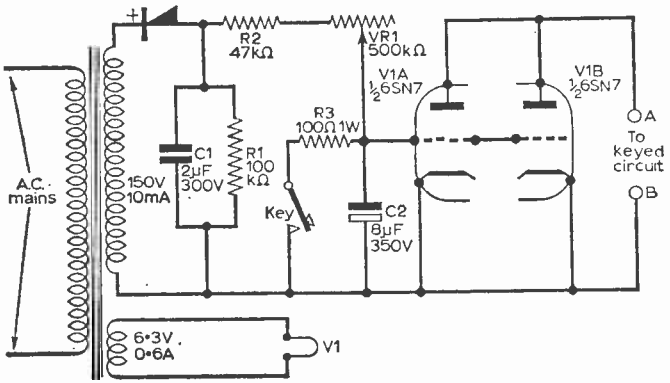


Fig. 3: The relatively simple valve keying circuit. This particular power supply arrangement was adopted as a matter of convenience, and a full-wave circuit could easily be used instead. The double-triode 6SN7 may be replaced by two 6J5's if desired.

across C2 when the key is closed. It also eliminates sparking at the key contacts.

The operation of the circuit is simple. V1 is connected in series with the cathode of the stage to be keyed. With the key up cut-off bias is applied to the grid of V1, the valve does not conduct and the keyed stage is inoperative. When the key is pressed the bias on the grid of V1 decays and the valve begins to conduct, switching on the keyed stage. As the rate of decay of the bias is controlled, shaping is introduced and the transmitter carrier comes on smoothly and without a click. When the key is raised the bias on the grid of V1 rises, again at a controlled rate, thus smoothly cutting off V1 and the stage which it is keying.

Construction

Even with standard sized components the whole unit can easily be accommodated on a 6 x 6 x 2in. chassis. There are no special layout arrangements and the components can be arranged in the configuration most suitable to the individual constructor. The only point to note is that the negative terminal is "live" and the positive terminal earthy. If an electrolytic capacitor of the "can negative" type is used for C2 it must therefore be carefully wrapped with insulation tape to ensure that the can does not short-circuit to the chassis. It is also recommended that VR1 be provided with a pointer knob and scale so that the resistor can be quickly reset to any predetermined value. The external connection to the key and keyed stage can be via suitable plugs and sockets.

Operation

After the normal wiring check and a voltmeter check to ensure that the power supply is functioning correctly the unit should be connected in series with the cathode of the keyed stage as shown in Fig. 1. Monitoring on a receiver it will be found that when VR1 is at minimum value the keying is fairly "hard" but completely free from clicks. As the resistance of VR1 is increased the keying will become progressively softer and exhibit a pleasant "ringing" characteristic. Near the maximum value of VR1 keying "tails" will become apparent and this part of the range should not be used. Over the remainder of the range it should be easy to find a keying characteristic to suit any individual preference.

It should be noted that under "key up" conditions there will be about 150V across the key, so normal safety precautions should be taken if a keying relay is not employed. In low-level keying of this type it is also essential that the succeeding stages of the transmitter be designed to accept the removal of the r.f. drive without sustaining damage. Most modern transmitters are designed in this way.

As it stands the unit will key most low-power stages without noticeably reducing anode current or r.f. output. If it is found that the output is reduced with the keyer in circuit, however, this can be corrected by connecting one or more 6J5 triode valves in parallel with V1 and thus reducing the "insertion resistance" of the keyer. ■

Correspondents

I AM 15 years old and would like to correspond with someone of roughly my age and who is interested in radio.

Robert Girdo.

111 Cooper Road,
Birrong, N.S.W.,
Australia.

I WOULD like to correspond with other P.W. readers of any age and country, particularly radio service men. I have already modified a PCR-3 into a console-type with a built-in aerial and it is working very well.

D. Arthur Samuel.

Arunuganeri.
Tirunelvelly,
South India.

The Old Times

I wish I still had all the various publications I have purchased relating to radio since the 1920's. Everything relating to the earlier days of radio is of interest, and those earlier days had something which is lacking today in this age of the transistor.

Some years ago, during my travels in the Western Highlands and Skye, I gathered a number of ancient battery receivers from attic and byre. In this way, I accumulated quite an assortment of valves and components; and how well were sets made in those days!

My teenage son and I get a great deal of fun out of baseboard hook-ups with these old components. At the moment he has a short wave superhet with an ancient Ever-Ready frequency changer, two VP2's, a 220 Pen and a double triode output valve and home-wound coils, which really wheels them in.

We dabble in modern transistor circuits from time to time but these somehow do not seem to give the scope hobbywise that was possible in those earlier days of radio.

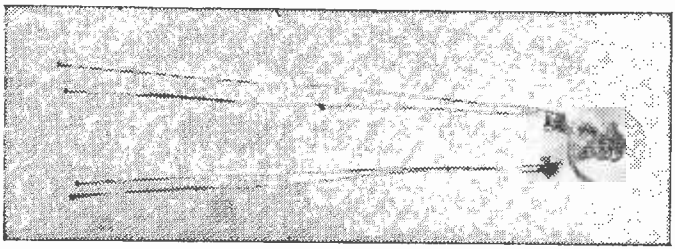
R. A. Ball.

Ross-shire,
Scotland.

NEWS AND ...

MINIATURE VARIABLE CAPACITORS

The photograph below shows over twice full size, a new miniature ceramic variable capacitor made by the JFD Electronics Corporation of the USA. This is one of a new series with standard dimensions of 0·208in. x 0·280in. x 0·120in. In spite of their size, the capacitors feature high stability in all the value ranges from 1·6 to 50pF.

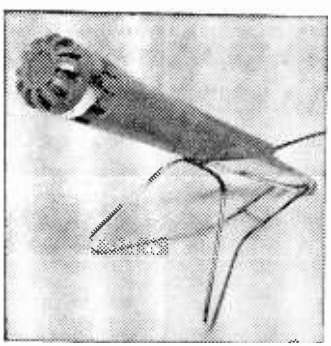


NORTHERN AMATEURS' CONVENTION

Manchester readers will be interested to hear that the newly formed Northern Radio Societies' Association is to hold a convention at Belle View, Manchester, on 10th October.

There will be lectures, talks and demonstrations on amateur television and radio, and exhibitions of amateur mobile transmitting and radio control models.

VERSATILE MIC



New from the Communications Division of S. G. Brown Limited comes the "Dual Function" microphone which, by operation of a simple shutter mechanism, is transformed from a conventional pressure-operated configuration to differential operation. In the latter operating mode the microphone is sensitive only to sound originating in close proximity to it.

SEACOM LINK OPENED

The Hong Kong-Malaysia link of the South East Asia Commonwealth Telephone Cable (SEACOM) was opened recently by the Governor of Hong Kong, Sir David Trench. At the ceremony in Hong Kong, Sir David made inaugural calls to Jesselton (Sabah) and Kuala Lumpur.

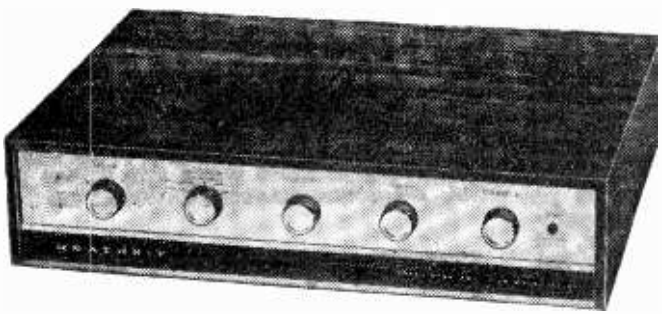
For this new link, Cable and Wireless Ltd. layed two thousand miles of deep sea cable between Hong Kong, Sabah and Singapore. The SEACOM project should be complete by the end of 1966 when it will connect Hong Kong with Australia and into the Commonwealth telephone cable system across the Pacific and North Atlantic.

..COMMENT

NEW SIGNAL GENERATOR

The G.30 r.f. signal generator from K.L.B. covers the frequencies from 120kc/s to 240Mc/s in seven switched bands. The r.f. output which is in excess of 100mV can be internally or externally modulated. The depth of modulation is adjustable from 0–50% by a control knob. The 400c/s modulating frequency is also available at two sockets on the front panel. The G.30 signal generator is priced at £24 15s. K.L.B. Electric Ltd., 335 Whitehorse Road, Croydon, Surrey.

STEREO AMPLIFIER KIT



From Daystrom Ltd., Gloucester, comes the Heathkit model AA-22U, 20+20W r.m.s. stereo amplifier. Frequency response of the amplifier is 15–30,000c/s ±1dB and input sensitivity for magnetic or ceramic pick-ups is 6mV. Twenty transistors and ten diodes are employed in the circuit and power requirements are 100/250V 50/60c/s a.c.

The cabinet is finished in oiled walnut and has a brushed gold anodised panel with matching knobs. The amplifier assembled, costs £68 16s. while in kit form the price is £43 18s.

RSGB SHOW DATES

This year's RSGB Show (full title the International Radio Communications Exhibition) will once again be held at Seymour Hall, London, W.1, from 27th to 30th October.

The Show will feature "design and construction" and ten awards will be made for the most outstanding home-constructed equipment, components, and miniature transistor working equipment.

PULSE COUNT BY REMOTE CONTROL

It is now possible to measure the pulse and breathing rate of an astronaut in space or a hospital bed patient without any instruments connected to the subject's body.

This has been made possible by equipment developed at the Convair Division of General Dynamics Corp. of the USA. With the new method the subject is placed between two sensing antennae so that the subject's body is in an electromagnetic field. By the filtering processes of a preamplifier, the equipment monitors the very low range frequency changes caused by movement of the body in this field. These very low frequencies are then amplified and recorded.

BECAUSE OF THE LARGE NUMBER OF OUTSTANDING "SELL OR LOAN" REQUESTS NOW HELD BY US, WE REGRET THAT FOR THE NEXT FEW MONTHS WE WILL NOT BE ABLE TO ACCEPT ANY LETTERS FOR THIS COLUMN.

Sir, I would be grateful if any reader could sell or loan me . . .

. . . any details on the R1466 receiver and/or the 19 set Mk. 3/T "B" set and i.c. amplifier and/or infra-red image-converter tube type CV147.—A. Hansen, 99 Stretton Road, E. Croydon, Surrey.

. . . the circuit diagram or any data on the Verdik S.1 tape recorder.—R. Bruce, 123 East Parade, York.

. . . any information on the R107 receiver, serial No. 52.—W. Badz, 15 Somerset Crescent, Melksham, Wilts.

. . . circuit diagram and/or circuit details of the Cossor CR1601 four track tape recorder.—J. Phillips, 2 Brinkburn Street, Chester Road, Sunderland, Co. Durham.

. . . information or a circuit diagram for the 3½in. oscilloscope described in July 1956 P.W.—P. Leveridge, 46 Third Avenue, Chelmsford, Essex.

. . . the service manual and/or circuit of the Hallicrafters S.38 receiver.—2449053 SAC Armstrong, J. F., 14 A.M.Q., R.A.F., Bishops Court, Downpatrick, Co. Down, N. Ireland.

. . . instructions on converting R1392 from crystal to manual tuning.—G. Muscroft, 43 Central Avenue, Baildon, Yorkshire.

. . any information on the Smith's Radiomobile Model 4220.—I. H. Wand, 49 Derwent Road, Scunthorpe, Lincs.

. . . modification details of the 19 Set Mk. 3 and supply unit Mk. 2.—J. Peirson, 11 Cavendish Place, Newcastle upon Tyne 2.

. . . any information on a valve bearing the markings: E^. V1105. 10E/230. It is a large glass type on a Mazda Octal base.—T. L. Kirk, 29 The Ridgeway, Fetcham, Leatherhead, Surrey.

. . . any information on the Taylor valve tester Model 45A.—W. Fraser, 69 Tone Hill, Wellington, Somerset.

. . any information, circuit diagram, etc., on Indicator Type 62A Ref. No. 10Q/37.—J. Ballantyne, 18 Clouden Road, Cumbernauld, Scotland.

. . . information regarding the Marconi CR150/4 receiver B. e.g. power supplies and valve line-up.—C. R. Smallwood, 35 Dakin Avenue, Fairfield, Buxton, Derbys.

. . . plans and data on the Bush TV 53. 62 series television sets.—J. M. Cushen, 51 Crawford Street, Invercargill, New Zealand.

. . . any information concerning the improvement of selectivity of the "A" sets of the 19 Set Mk. 2 and 3/T, also details on the v.h.f. receiver P104 (R1392, 62H).—M. Franklin, 17 Hitherwood Drive, London, S.E.19.

. . . the circuit diagram or any other information regarding the PCR3 receiver.—L. D. Proverbs, 33 Park Road North, Acton, London, W.3.

. . . the circuit diagram and information on the Type 62 Indicator Unit Ref. 10Q/1300.—A. Smith, "Chaery Vale", Ballykeep, Lurgan, Co. Armagh.

. . . the manual, circuit diagram, or service sheet for the K.B. television model FV30L.—Y. A. Georgi, 14 Park Avenue, London, N.22.

. . . information on the Indicator Unit, 166A.—K. Holmes, 2 Keswick Close, Plas Newton, Chester.

. . . literature on the R.A.F. receiver R1392D Ref. 10D 17745. I use one of these but it appears to be getting less sensitive.—L. Adlard, 24 St. Clements Avenue, Leigh-on-Sea, Essex.

A Ferrite Aerial 'Q' Multiplier

by D. Bollen

SMALL superhet transistor portables sometimes fail to give satisfactory results when, say, they are used on holiday in poor reception areas, after dark. Strong Continental stations tend to "blot out" low-power local transmissions making listening unpleasant or impossible. Also, these receivers are often used in cars, where a strong signal is necessary to overcome ignition interference, and engine noise. It is no simple matter to add a tuned r.f. stage to an existing receiver because an extra gang would be needed on the tuning capacitor. An untuned r.f. stage certainly increases signal strength, but it amplifies unwanted interference too. If one is prepared to chip away at an unaccommodating printed circuit board, a Q multiplier could be added to the i.f. stages of the receiver, to enhance selectivity and sensitivity, but this requires a certain amount of courage born of desperation when the set is brand new.

The unit described here considerably improves both signal strength and selectivity. It can be fitted without major alteration of the receiver, the only wired connections being to the battery, and has no effect on performance when switched off. The prototype multiplier has been used for a lengthy period in a hilly district in Devonshire, where medium wave reception is notoriously poor.

Circuit

It will be seen in Fig. 1 that Tr1 operates in the common base mode, where its cut-off frequency is much higher than in other configurations, and performance is less likely to be affected by substituting slightly substandard transistors. R5 controls positive feedback between emitter and collector, due to inductive coupling between L1, L2 and the ferrite rod aerial coil. The effect of applying positive feedback to the coil, thus increasing its "Q" magnification factor, can be seen in Fig. 2. A steep-sided response curve is produced, with high voltage gain at the selected frequency, and a narrow bandwidth. The normal working Q of such a coil might be around 100. Carefully controlled feedback can push this to beyond 1,000. A practical limitation is imposed by bandwidth. If the curve is too narrow and steep the higher audio frequencies will be rejected. In fact, if R5 is carefully set to just below the point where uncontrolled regeneration takes place, the sound becomes very muffled, indicating a marked lack of top response.

Construction

Gummed economy label 2in. wide is used to roll a paper tube on a former $\frac{1}{16}$in. bigger than the outside diameter of the aerial coil (see Fig. 3). L1 and L2, each consisting of ten turns 32s.w.g. enamelled copper wire close wound on the paper tube, are given a generous coating of polystyrene cement which is then allowed to dry thoroughly. A piece of paxolin $\frac{1}{4}$in. wide and $1\frac{1}{4}$in. long is cut and drilled with eight $\frac{1}{16}$in. holes and is then cemented to the tube as in Fig. 3. A strip sawn from Vero plain board would save drilling the holes. All components except R4 and R5 can then

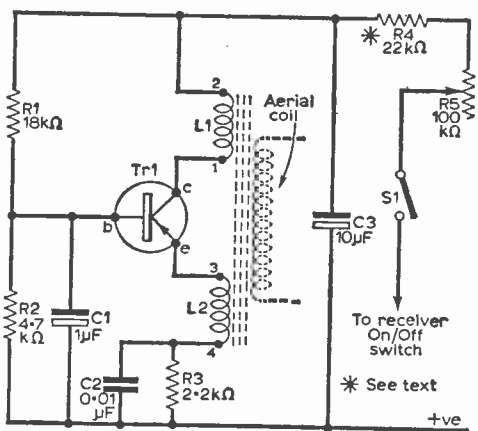


Fig. 1: The simple circuit of the device.

COMPONENTS LIST

R1	18kΩ
R2	4·7kΩ
R3	2·2kΩ
R4	22kΩ (see text)
R5	100kΩ pot. combined on/off switch S1
C1	1μF electrolytic 15V
C2	0·01μF
C3	10μF 15V
Tr1	OC44 or equivalent

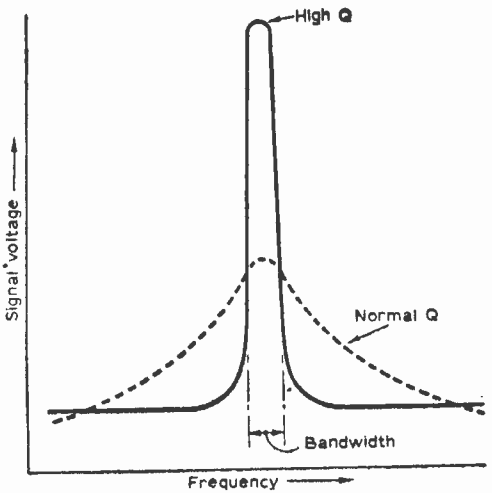


Fig. 2: These two response curves illustrate the effect of the multiplier—the original curve shown in broken line.

midway along the aerial coil, and connect to battery +ve and the receiver on/off switch. R4 is selected to suit the battery voltage. The value given in Fig. 1 is for 12V, the highest likely to be encountered. The correct value is that which just causes oscillation at the minimum resistance setting or R5. If oscillation cannot be obtained try removing the tube and reversing it, also move it fractionally along the aerial coil to the place where maximum regeneration occurs. The tube can be fixed in position with a sliver of matchstick wedged between it and the aerial coil. With Q multiplier switched off ensure that the receiver's alignment has not been upset and correct if necessary. The chassis can now be replaced in its case. If desired S1 may be omitted and a preset pot used for R5, mounted inside the case, so that the multiplier is always in use when the set is switched on. This is quite practicable as the total consumption of the unit is not more than 100μA and the level of regeneration is reasonably constant throughout the band. However, the writer chose to mount R5 on a bracket inside the case and drilled a hole in the removable back panel of his receiver to accommodate the spindle, thus allowing critical adjustment to be made when very weak signals were being received.

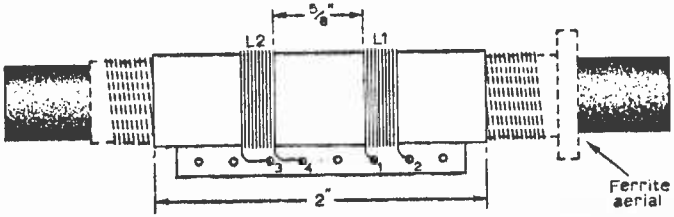
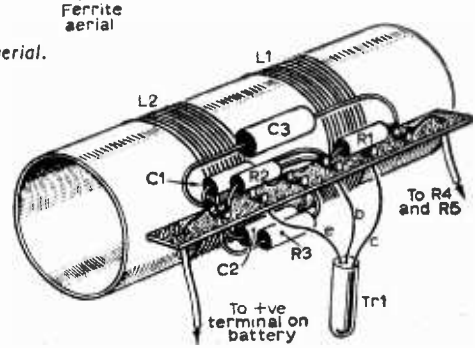


Fig. 3: Showing how L1 and L2 are wound over the receiver aerial.

Fig. 4: Here the rest of the components are mounted on the paxolin strip.



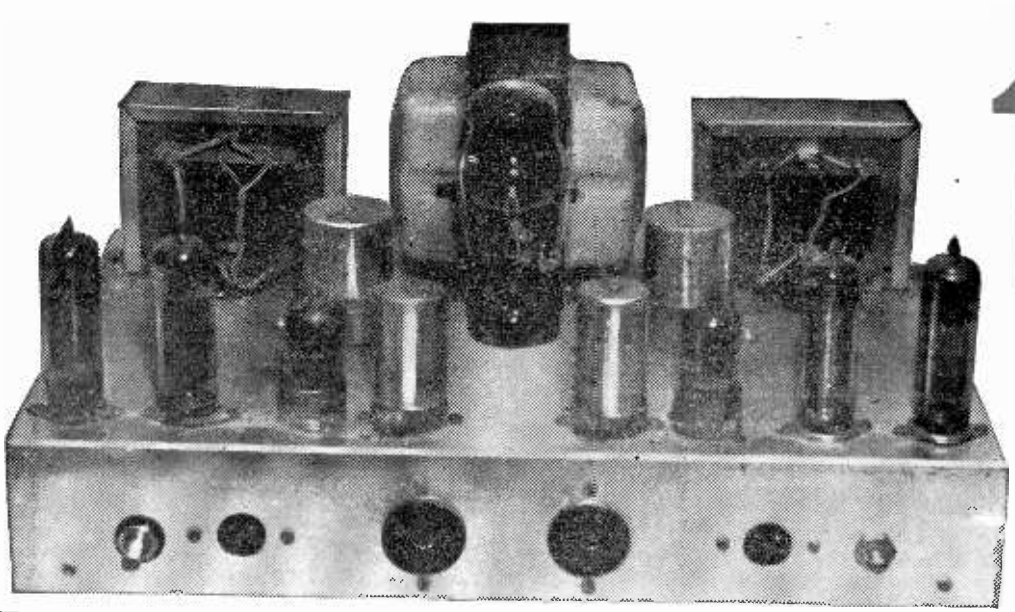
be mounted on the strip, close to the tube, making a compact assembly.

Setting Up and Use

Remove receiver chassis from its case and reconnect battery. It is important to check that the oscillator and aerial sections are tracking correctly. No amount of increased selectivity will be of any use if the tuned circuits are not in correct alignment. The simplest method of checking this is to inject a signal from a free-running multivibrator. This gives a virtually continuous rasping note all around the band and any reduction in volume at a particular dial setting is immediately apparent. If careful trimming does not produce good tracking the simplest solution is to add a small trimmer of around 10pF in parallel with the aerial trimmer in the receiver. This should be accessible from outside the case so that small variations in alignment, as one tunes around the band, can be corrected. With "difficult" receivers this modification alone can provide better reception of the weaker signals.

The next step is to slide the Q multiplier tube assembly on to the ferrite rod, positioning it

Select a station and increase R5, at the same time rock the tuning knob slightly. It will be found that the tuning becomes progressively sharper and more critical until, near the maximum setting of R5, there is a noticeable reduction of treble response. Back off R5 to the setting which gives the best all-round results while ensuring that the station is correctly tuned to the mid-point of its bandwidth. The signal strength should have increased so that with a reduction of audio gain there will be an improvement in the signal-to-noise ratio. It is better to use a receiver which has some form of slow-motion dial or tuning will be more than delicate with the Q multiplier in operation. ■



FOR the realistic reproduction of speech and music there are certain minimum requirements that the reproducing system must fulfil. Although each part of that system is of importance it is proposed in this article to discuss only one part in the shape of the power output amplifier.

Stereo has in the past, and is even now, viewed by many members of the general public with some cynicism and a great deal of suspicion and one doesn't have to search very hard or very far to find the reason for this deplorable state of affairs. Many manufacturers have jumped on the stereo band wagon and have turned out cheap and nasty and sometimes not so cheap but still nasty "stereograms" which, in spite of glowing and most imaginative advertising, cannot produce stereo except under very limited conditions, since the speakers are no more than 2ft or 3ft apart. The musical reproduction, too, leaves much, very much, to be desired and, for the benefit of younger listeners, this applies as much to the wildest "pop" record as to the most sedate chamber music.

One can, on the other hand, by the expenditure of much coin of the realm buy equipment by Quad Garrard and Decca, or for that matter by many other reputable manufacturers (these names come most readily to mind, since they, in fact, form part of the author's own equipment), and enjoy the most perfect mono or stereo as human beings can devise. The world being what it is, most of us have to compromise in one way or another, so here for the benefit of readers in a like situation is how the author resolved his own stereo problem.

Having bought a Garrard transcription table and Decca pick-up. together with a Quad stereo control unit and Quad f.m. tuner, the author found he lacked the courage to tell his long-suffering wife that he wanted a pair of Quad power amplifiers—for a mere £45. At which point the decision was taken to build a suitable stereo amplifier which had to cost substantially less than a pair of Quads but had at the same time to do reasonable justice to the Quad "front ends", which, of course, takes us back to the beginning!

The output from the Quad preamplifier is 1·4V r.m.s. into a load of 1·5MΩ, which proved a suitable starting point, the present amplifiers putting out some 10W (intermittent peak) for this input with approximately 18dB feedback (negative, of course). At this point it would be advisable to draw readers' attention to the o/p stages of the present design which are operated in the low-loading configuration developed by Mullard some years ago. Readers requiring further details are advised to study the appropriate Mullard literature, though it must be emphasised that sine or square wave testing must not be carried out at anything near the rated output. Readers possessing the requisite test equipment must limit the output to 2W or less. If full-power tests are desired these can be performed by temporarily replacing the present cathode bias resistors with 270Ω components, in which case, to save overloading the mains rectifier and transformer, the valves of the other channel must be withdrawn. The h.t. line must be checked before and after withdrawal so that any rise in voltage can be countered by a suitable resistor. Similarly with the other channel..

CIRCUIT AND COMPONENTS

The components, as with many designs, are something of a compromise, mainly between cost and efficiency. The output transformers, for instance, are Elstone type OTML's which, in the author's opinion, are good transformers—for the money! An alternative to the above is the Electrovoice D68A. One could use much dearer transformers which might make a measurable

H. T. KITCHEN

STEREO AMPLIFIER

difference though, the author would venture to state, not an audible difference unless one were gifted enough to hear 20kc/s and differentiate between distortion levels of 0·1 and 0·5%!

The personal opinion (for which no doubt I will be taken to task) having been stated, the final choice is left to the individual constructor. Similarly every milliamp is squeezed out of the power unit and constructors wanting to use ancilliary equipment are advised to use more generously rated components. In all fairness, however, it must be stated that the amplifier is used every day, sometimes all day, and in two and a half years it has had only one component change, the 5Z4 rectifier. Good ventilation is absolutely essential and has undoubtedly played a large part in the long and trouble-free service the author has had from his own amplifiers.

In actual fact though the mains transformer could supply the mere 5mA required by the Quad it could not supply the 1·5A required by the heaters, so T3 was added. Since the Quad required a centre-tapped heater supply, resistors R21 and R22 were added to provide this. Whether or not T3 is required by individual constructors will depend on the ancillary equipment and the simplest course would be to make T2 large enough, not forgetting the rectifier, to cater for all possible needs. A more generously rated transformer will be physically larger, so a certain amount of component reshuffling may be required to accommodate it.

After receiving a hefty shock from the still-charged electrolytics several minutes after the amplifier was disconnected, the bleeder resistor was added, this having a value of 100kΩ.

Referring to Fig. 1 it will be seen that the circuit is quite simple, though nothing has been sacrificed that would in any way improve the circuit's performance. V1 A, B are the two halves of a high-gain 12AX7 double triode, the first half being used as a voltage amplifier and the second

SPECIFICATION FOR BOTH CHANNELS

Input	1·4V r.m.s. across 1·5MΩ 30 pF
Output	2W max. sine or square wave 10W intermittent peak
Frequency Response	40 c/s—25 kc/s ±1dB, 25 c/s—40 kc/s ±2dB } at 1·5W r.m.s.
Cross Talk	26dB
Hum & Noise	—65dB at 10W
N.F.B.	18dB

COMPONENTS LIST

Resistors:

R1	1·5M Ω	R14	8·2k Ω
R2	470 Ω	*R15	3·3k Ω
R3	100 Ω	*R16	2·2k Ω
R4	680k Ω	*R17	82 Ω 3W
R5	1M Ω	*R18	47 Ω 1W
R6	820 Ω	*R19	47 Ω 1W
R7	22k Ω 5%	*R20	470 Ω
R8	22k Ω 5%	*R21	100 Ω
R9	270k Ω	*R22	100 Ω
R10	270k Ω	R23	10k Ω
R11	439 Ω see	R24	10k Ω
R12	439 Ω text	*R25	100k Ω
R13	8·2k Ω		

All 10% ½W carbon except where stated

VR1 1k Ω lin. potentiometer

Capacitors:

C1	100μF electrolytic 25V
C2	0·05μF paper tubular 350V
C3	25μF electrolytic 25V
C4	0·05μF paper tubular 350V
C5	0·05μF paper tubular 350V
C6	100μF electrolytic 25V
C7	100μF electrolytic 25V
C8	3,000pF silver mica 350V
C9, 10	16+16μF double can electrolytic 350V
*C11	50μF electrolytic 350V
*C12	50μF electrolytic 350V
*C13	50μF electrolytic 350V, rated for 200mA ripple current

Transformers:

T1	Output transformer (Elstone OTML or Electrovoice D68A)
*T2	Mains transformer. Secondaries: 300-0-300V, 125mA; 6·3V, 4A with c.t.; 5V, 2A
*T3	Mains transformer. Secondary: 6·3V, 2A

Valves:

V1	12AX7	V3	EL84 or N709
V2	EL84 or N709	*V4	5Z4

*Two off of all the above components are required except those marked with an asterisk.

Miscellaneous:

Length of tag board. Aluminium for 13½in. x 9in. x 2½in. chassis. Various tag strips. Six B9A and three Int. octal valveholders (two for sockets). Loudspeaker plug and sockets. Grommets, solder tags, etc.

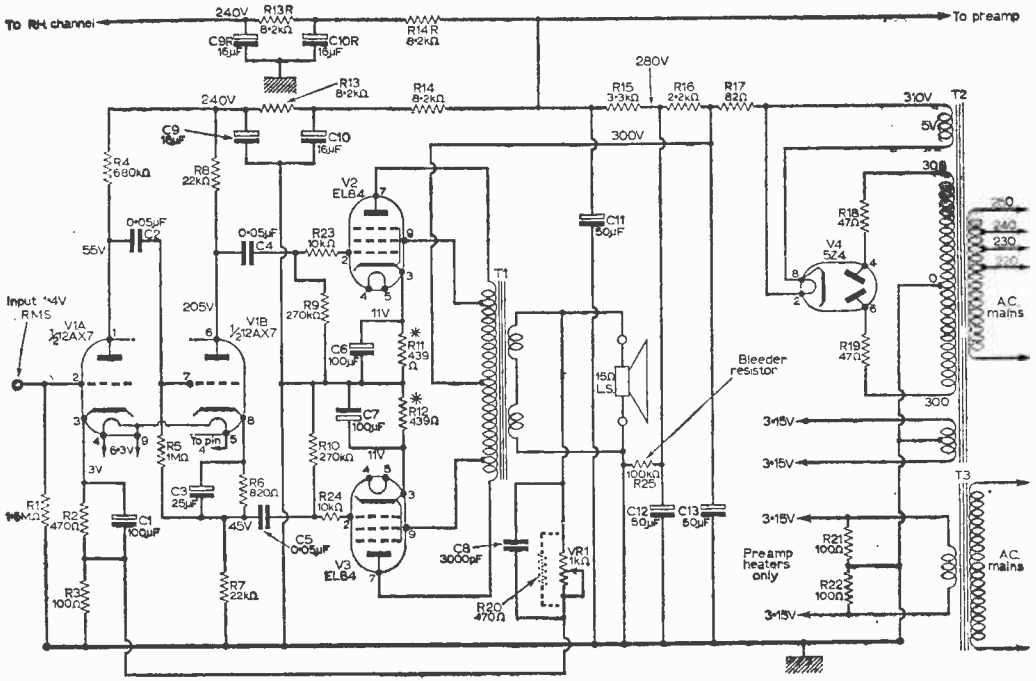


*Fig. 1: The circuit of the left-hand channel of the amplifier. The right-hand channel is identical except for the common power supply (V4, T2, T3, etc.—see Components List) which provides h.t. and l.t. for both channels. *See text*

as a concertina phase splitter. R2 and R3 form the cathode bias components for V1A, the n.f.b. being developed across R3. R4, the anode load for V1A, has been given a high value in an attempt to provide the maximum possible gain from this stage. C2 couples the signal from V1A anode to V2B grid, R5 being the grid leak for this stage. V2B is the concertina phase splitter, a type much favoured by the author primarily on the point of balanced outputs. This type, unlike the paraphase, depends only on the anode (R8) and cathode (R7) loads for balanced outputs, these being unaffected by changing valve characteristics due to ageing. The output valves are operated in the ultra-linear fashion, which bestows several advantages upon them, namely the ability to operate with the efficiency of pentodes though with the low distortion of triodes. Negative feedback is from the transformer secondary to the cathode of V1A by means of VR1 and R20, C8 forming the h.f. feedback component. The reason for using a fixed resistor in one channel and a variable one in the other channel is somewhat as follows: The value for R20 was found experimentally and was found to be 470Ω, which allowed approximately 18dB of n.f.b. to take place. The other channel was therefore provided with a 1kΩ potentiometer so that it could function as a balance control, being set up with the Quad balance control at mid-position, which meant that the full range of the latter control was available should it be needed. Purely as a matter of interest the resistance of the potentiometer when set was found to be 420Ω, which brought it almost within the 10% tolerance of the 470Ω fixed resistor. The value of the 470Ω feedback resistor is correct when

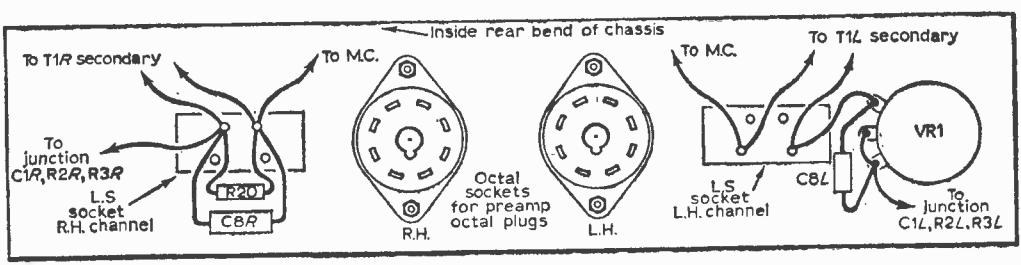


Fig. 2: The arrangement of loudspeaker and input sockets and feedback control VR1 on the rear panel of the chassis.

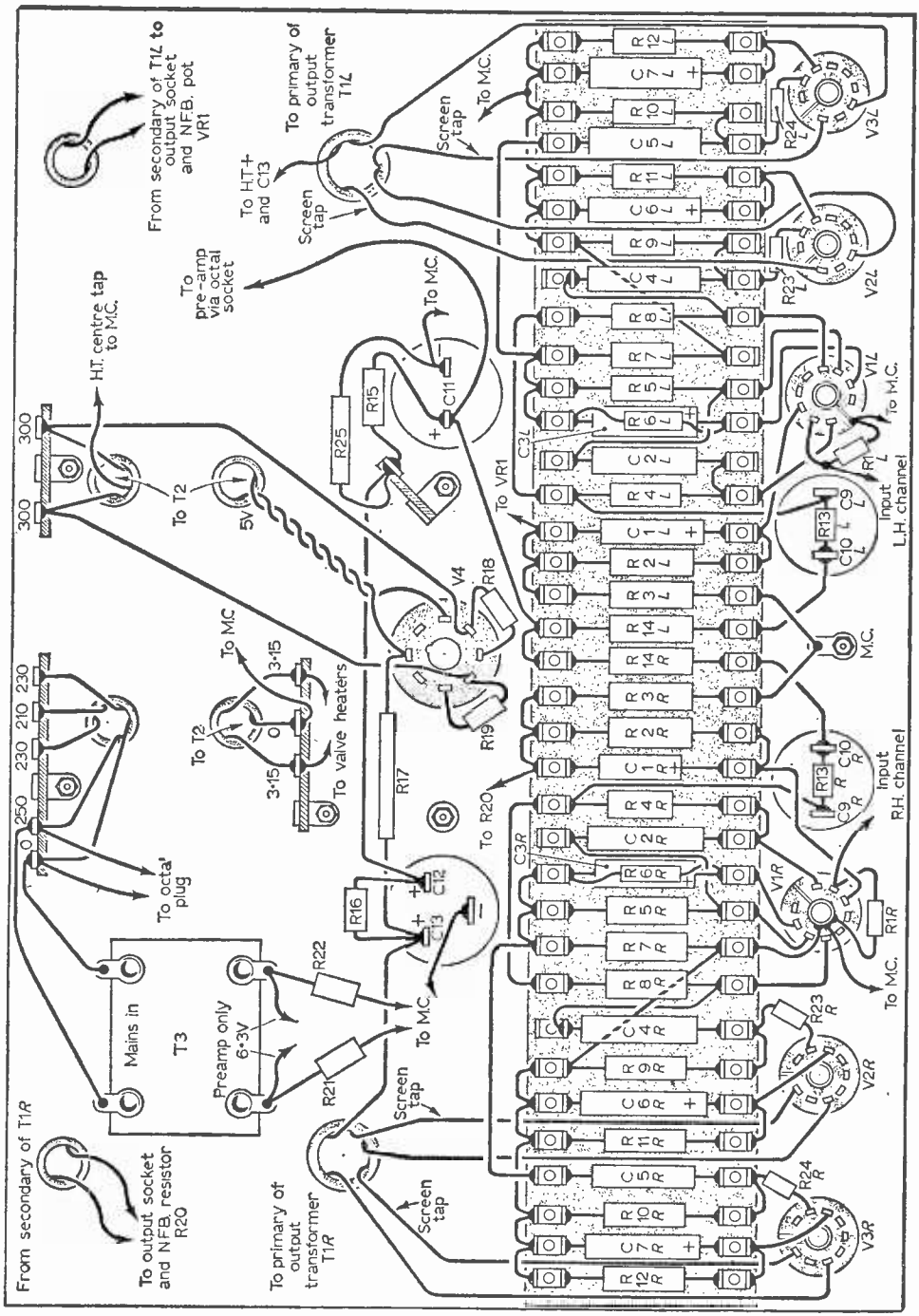


Fig. 3: The underchassis wiring diagram. This indicates the positions of valves, electrolytic cans and transformers above chassis, and shows complete wiring of the tag board. If the cans of the electrolytic capacitors C11, C12 and C13 are negative, they should be isolated from the chassis.

the 15Ω output is in use and will have to be reduced to about 220Ω for the 3Ω output.

In order to use the low-loading configuration the cathode bias resistors for the o/p valves have been increased to 439Ω, which is a non-standard value amongst some resistor manufacturers. If this value is unobtainable two resistors of 390 and 47Ω could be used in series. 11V cathode bias across a resistor of 439Ω means a cathode current of 25mA, which in turn implies a long valve life, good for the amateur but pity the valve manufacturer. The OTML output transformers have two output windings which are used in series for 15Ω and in parallel for 3Ω, but whether the two windings could be used to run two 7·5Ω speakers is open to debate —and experiment.

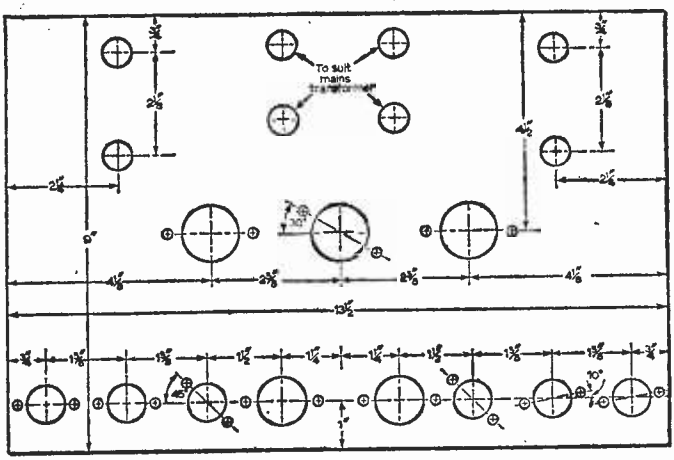


Fig. 4: Drilling details of the chassis.

CONSTRUCTION

The chassis is made of aluminium and has an overall size of 13¼in. x 9in. x 2¼in. and is drilled according to Fig. 4 It is about as small as possible without overcrowding and wiring difficulty.

Wiring is much eased if the tag panels are wired first, leaving sufficient wire to reach from the various tags to the respective pins on the valveholders and decoupling capacitors, these wires being appropriately sleeved, red for h.t.+, yellow for anodes, blue for grids, etc. It will be noted that components used in the left and right hand channels are coded L and R respectively.

As with any other electrical equipment the components used influence the performance to a greater or lesser degree, so that if the amplifiers are to give of their best the components used must be of good quality. It is hard to single out any components as being worthy of particular comment but it has been the author's experience that coupling capacitors can cause much trouble if they leak, so they should be new and not salvaged. C12 and C13 have a hard life and a busy one, so here again are two components deserving some comment. Apart from a suitable working voltage C13 should possess an adequate a.c. ripple current rating; since the total d.c. current is 120mA a ripple rating of at least 200mA is desirable.

The Quad control unit used Painton plugs and sockets for connection to the Quad power amplifiers, but when the author inquired locally about purchasing the requisite sockets for use on his own amplifiers he was told that they were only obtainable in minimum quantities of one gross! It was considered cheaper to substitute the Painton plugs and sockets with octal ones and these can be seen in the photographs. Two small four or five pin non-reversible plugs and sockets should be used for the speaker outputs and these are suggested because they can be wired up so that the speakers can't be wrongly connected. This is done quite simply by wiring the output of one speaker to the two pins spaced closely together and the other speaker to the two pins further apart, thus the speakers will work when plugged into the right socket but not if plugged into the wrong one. Also the feedback capacitor C8 in both channels and R20 in one channel can be wired across the two unused pins. Whilst on the subject of wiring it would be as well to mention earth wiring. All the earth points in each channel should be connected together and earthed at one point, near the input as shown, minimising the signals flowing through the chassis and hence any possibility of instability or mutual interference. The centre spigots of all valveholders should be earthed and should not, as is sometimes done, be used as a tie point for different components.

Having carefully earthed all components that require earthing we still have to dispose of the a.c. carrying wires and in order to reduce hum radiation to the minimum all wires carrying a.c. must be tightly twisted together and pushed well away from all high-impedance points. Where valve heaters are wired from valve to valve it is possible, due to voltage drop, for the last valve to be undernourished, particularly if light-gauge wire is used. It is therefore advisable to wire each amplifier separately from the transformer output using fairly heavy gauge wire.

The author would like to, if he may, recap on one or two points that were only briefly mentioned earlier on. Output transformers, for instance. It is quite true that the output transformer is literally the heart of an amplifier and more so when large amounts of n.f.b. are used, since this can lead to instability with a poor component. Where only moderate degrees of feedback are used, as in the present design, one can get away with a cheaper transformer. This doesn't mean to say a dearer transformer should not be used. On the contrary, for it will improve amongst other things transient response and

—continued on page 265

FOR THE BEGINNER

AMPLIFYING the "Junior" Crystal Set+2

A 2-transistor amplifier for this P.W. beginner's receiver

by E. V. King

MANY readers have written asking for details of a suitable amplifier to use with the Junior Crystal Set +2 (P.W. May, June and July, 1964). It was pointed out that most amplifiers described in this journal and sold by radio dealers would probably suit, but would doubtless overload on the output from this small receiver. This article is written to help those beginners who would like to build a home-made amplifier and use it in conjunction with this receiver.

In view of the fact that transformers usually introduce some distortion it is best to keep their number to a minimum, and in the design to be described no output transformer is required. The amplifier is preferably used in a separate cabinet with a jack that plugs into the receiver in place of phones when loudspeaker reception is required. The output will be equal in volume to most transistor receivers, but since no feedback is applied and the first stages are reflexed and regenerated, Hi-Fi quality is not to be expected. However, the quality is as good as many commercial receivers, and except for the enthusiast (audio!) will satisfy most constructors and their families.

Construction

The method is similar to that used for the receiver. Since some readers might like to use this amplifier with other two or three transistor straight receivers full constructional details are given.

A sheet of formica or paxolin is cut and drilled as shown in Fig. 1, and fitted with 6BA bolts, nuts and solder tags, to form anchor points for the components. All solder tags should then be adequately tinned.

The driver transformer has small tags forming part of the mounting clamp, and these are passed through the chassis and simply bent over.

Wiring

Thin pvc tinned copper wire is used. Make sure that all wire and component ends are tinned properly before attempting to fit them.

First of all sort out the resistors and solder them in position, following the arrangement shown in Fig. 2.

The capacitors are fitted next. Observe the polarity of the electrolytic capacitors, these must be fitted as indicated. Finish off the remaining connecting wires, including speaker, battery and input leads from the receiver.

The transistors are wired in last of all. You may fit sleeving over the leads, but this is not necessary if you take care that they do not touch. The lead connections, Emitter, Base and Collector are indicated in the inset to Fig. 4. Do not shorten the leads, and gently bend the transistors down so as not to take up too much space.

Testing

The unit is plugged into a 9V transistor battery (VT9 or equivalent). The speaker is connected and the input leads are connected to the phone terminals of the receiver. The receiver has previously been tested on the phones before disconnecting them. Receiver and amplifier are then switched on, and the signal from the receiver should be heard at good strength from the speaker. There should be no sign of feedback (howling etc.) and the quality should be quite good. Remember to keep the speaker face downwards on the table during this test. If you have a test meter, you can check that the centre voltage at the bottom of R6 is 4·5 as in Fig. 4. It is, in fact, 4·5V from either side of the battery. The no signal current taken by each collector will be between 3 and 10mA, and should be the same in each transistor. The current (total) from the battery on full volume may be up to about 80mA. The unit is most economical when run at moderate volume levels.

The Cabinet

The prototype units were fitted in various plastic sandwich boxes obtained from a walk-round store. The following points might help readers in their choice.

Some boxes are made of very brittle plastic

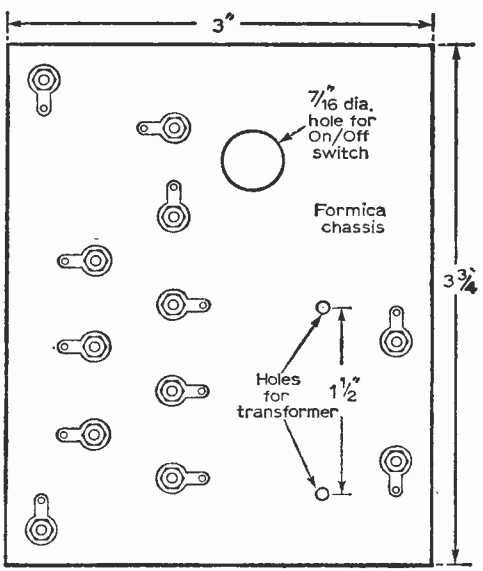
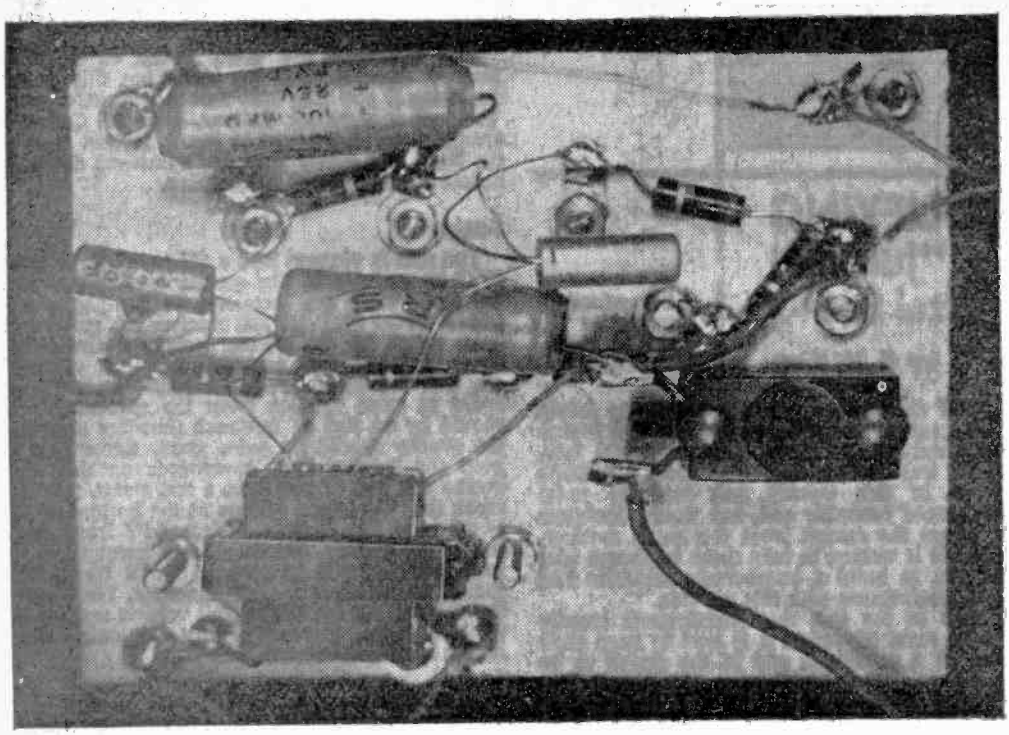


Fig. 1: Details of the paxolin or Formica base, indicating positions of the solder tags.



The author's original amplifier chassis fully wired up and ready for mounting in its cabinet.

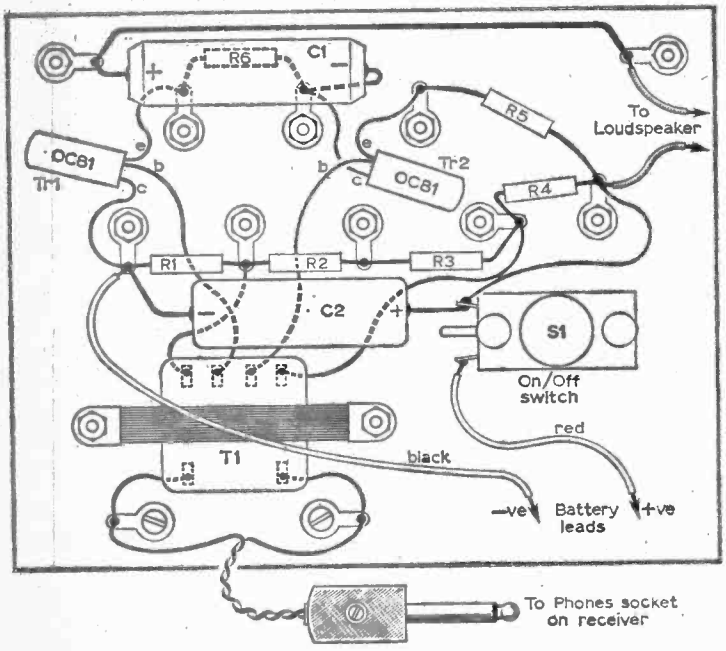


Fig. 2 (left): The complete wiring diagram of the amplifier.

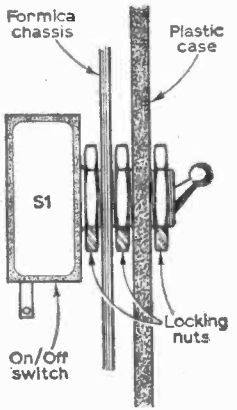


Fig. 3: The mounting of S1 which serves to clamp the chassis to the case.

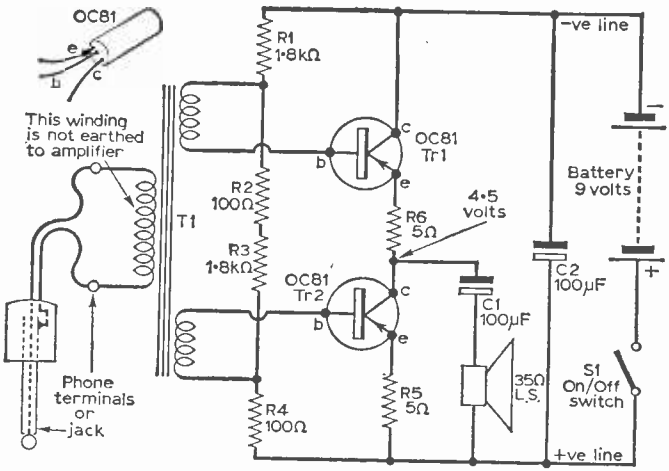
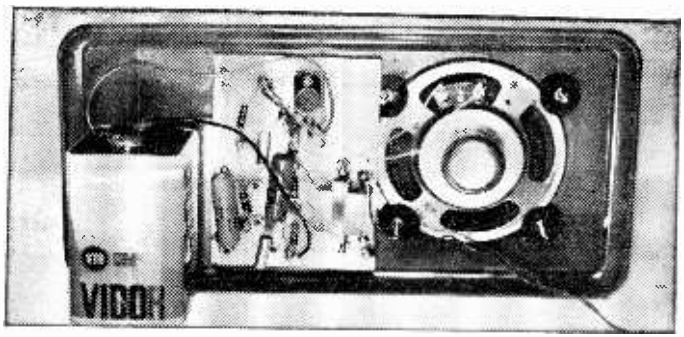


Fig. 4: The simple two-transistor circuit.



The amplifier chassis mounted on the front of the case, with loudspeaker and battery also in place.

COMPONENTS LIST

Resistors:

R1	1·8k Ω	R4	100 Ω
R2	100 Ω	R5	5 Ω
R3	1·8k Ω	R6	5 Ω

All 10% ½W carbon

Two 10 Ω resistors in parallel can be used to provide 5Ω for R5 and R6 if the single component for each cannot be obtained.

Other Components:

C1, C2 100μF electrolytic capacitors 25V working.

Tr1, Tr2 OC81 transistors (Mullard) preferably matched.

T1 3·6 : 1+1 ratio input transformer (Radio spares T/T3).

S1 On/off toggle switch.

9V battery. 35 Ω permanent magnet loudspeaker any diameter. One miniature jack plug to match socket on Junior receiver. One pair of battery clips. Piece of Formica, Plastic case. Solder tags, nuts and bolts, wire, sleeving, etc.

which makes it difficult to cut the speaker hole out without causing cracks. The softer grade of plastic seems better, and incidentally gives a more mellow note to the receiver. The best way to cut the speaker hole was to drill a hole and use a fretsaw. Final rounding being done with sandpaper so that the speaker itself is about ¼in. larger than the diameter of the hole.

Another way to cut the hole is to roughly burn out a circle of plastic with a hot soldering iron, preferably near an open window. When the plastic is *cold* it may be gently filed or sandpapered to the correct size and shape. Speaker, or any open grained cloth, may be stuck to the inside of the cabinet with Unibond or other adhesive. The speaker may be similarly stuck on top making sure no adhesive touches the "cone". If the speaker has fixing holes it may, of course, be mounted with nuts and bolts.

The chassis itself is fitted into the plastic box by drilling a hole to take the toggle switch barrel and then fitting an extra nut on the outside. The battery will fit in the bottom of the case or stand at one end, preferably near the amplifier chassis.

Using the Amplifier

As so far explained the Junior Crystal Set remains as it was and phones may be plugged into it at any time. If loudspeaker reception is required the amplifier is plugged-in in lieu of the phones and both units are switched on. No volume control is necessary as the reaction control on the receiver suffices.

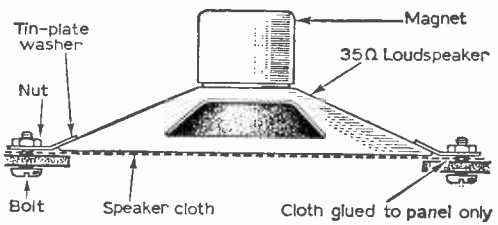


Fig. 5: How the loudspeaker is mounted to the case. Four washers (two only shown here) hold it in place.

With this amplifier there should be *no* troubles with whistles and howls . . . this is the usual trouble which occurs when a reflexed regenerated circuit is amplified. ■

on the Short Waves

MONTHLY NEWS FOR DX LISTENERS

All times are in G.M.T. All frequencies are in kc/s.

The Broadcast Bands—by John Guttridge

FIRST call this week is in the Far East, E Conduit (Wolverhampton) reporting the European English Service of *Radio Japan*, Tokyo, just readable at 0800 on 15,135, at which time the General Service on 15,310 comes through well. A QSL from this station like one from Radio Peking had no details. English to Europe from Peking, he says, is now from 2030—2125 and 2130—2225, probable frequencies being 7,080/9,457.

Both J. Mills (Billericay) and D. Owens (Ipswich) report good reception of *Radio Pyongyang*, North Korea, with English between 1800—2000 on 6,520, although s.s.b. and c.w. interference sometimes spoil the signal. Fair reception is also possible on 7,390.

The only South American information this month comes from E Conduit who reports that the QSL from *Radiodifusora Argentina al Exterior* (Sarmiento 151, Buenos Aires) gives details of the frequency only.

New frequencies for *Voice of America*. English to Europe (transmitter locations in brackets where known) are: 3.980 (Munich) 0300—0730, 1400—2315; 5,995 (Greenville), 6.080 (Tangier), 6,095, 7,205, 9,540 0300—0730; 5,995 (Tangier) 1630—2245; 7,205 (Thessaloniki) 1500—2245; 9,760 0300—0730, 1830—2245; 11,790 (Tangier), 15,295 0500—0730; 15,205 (Greenville), 17.780 (Greenville) 1400—2215; 15,290 (Tangier) 1400—2245; 1,196 (Munich) 0400—0430, 0500—0600, 1630—1830, 2200—2345. Full details are available in a schedule available either direct from the Voice of America, Washington, D.C., 20547, U.S.A., or from the U.S. Information Agency, American Embassy, P.O. Box 444, Grosvenor Square, London, W.1.

According to E. Conduit, date and frequency only are being given on V.O.A. QSL cards at present. A full QSL he says will be given by *United Nations Radio*, United Nations, New York, which uses V.O.A. transmitters. The 1800—1830 European Arabic, English and French transmission is once again on Fridays only he says, frequencies being 17.800 Greenville/15.250 Greenville/21,485 Bethany/15.180 Tangier. Another United Nations transmission is reported from 0630—0700 on 7,250 Tangier by M. J. Smith, of Heylor in the Shetlands.

J. W. Smith (Anstruther) and R. Selby (Cheltenham) have both supplied information about the Sunday "Happy Station" programmes from *Radio Nederland*, International Service, (P.O. Box 222, Hilversum). Details are 0600—0720, 0730—0850 on 9,715/6,025; 1030—1150 on 9.715/6.020/5,980; 1400—1520 on 17,830/15,425/6,020; 1530—1650 on 15,425/11,950; 1900—2020 on 11,950/11,730/15,425; 2200—2320 on 11,800/9,715/6,020.

Radio Nederland has also changed its schedule again. English transmissions (not Sundays) are 0400—0450 49m.b. (Bonaire relay); 0700—0750 31—49m.b. 1400—1450 16m.b./15.425/6.020; 2000—2050 11,960/9,590/6.020 plus 25m.b. relay from Bonaire; 2100—2150 19m.b./11,730. Once again frequency details would be appreciated.

Slight changes have been made by *Radio Warsaw* to its English transmissions for the summer. The 2230—2300 transmission is now on 7,270/5,995/1,502. The musical concert programmes at 1900—2030 and 2330—0100 are now on 5,995/1,502 and 7,270/7,125/1,502, respectively.

Letters from A. J. Dunning (Wellington, Som.) and P Yates (Worcester) tell of "communications satellites" operating around the 16 and 19 metre bands. It seems likely that the signals are emanating from practical joking pirates. Has anyone any further information? Another oddity is the Rhode Island Radio and Television Service reported in the evenings on 20 metres by R. J. Boorman of Newton Abbot. Is this another pirate?

Returning to more normal things, E. Conduit gives details of this year's test transmissions by the International Committee of the Red Cross, *Radio Geneva* (66 Boulevard, Carl Vogt), using the S.B.C. transmitter on 7,210. Transmissions are from 0600—0700, 1130—1230, 1500—1600, 2100—2200 on July 5th, 7th and 9th; September 21st, 23rd and 25th; and November 22nd, 24th and 26th. The programmes are comprised of ten minute French, German, Italian, English, Spanish and Arabic segments. Reception reports are verified by a QSL card giving no details.

European QSL's mentioned by E. Conduit are Radio Sweden (Box 955, Stockholm 1) with all details; Oy Yleisradio Ab, (Radio Finland), Unioninkata 16, Finland—date and frequency only; and R.A.I. (Casella Postale 320, Rome)—no details.

Detailed information has been received from A. N. Speight (Blackpool) about *Radio Portugal's* DX club. Membership of the club entails sending in five correct reports on the station's International Service (not Portugese language) transmissions, plus a fortnightly log to maintain standing. Reception reports must state: 1 Date and time of reception indicating frequency; 2 At least five

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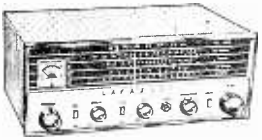


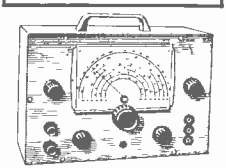
STAR SR 40 COMMUNICATION RECEIVER

4 Bands 550 Kc/s—30 Mc/s. 'S' Meter-BFO-ANL-Bandspread Tuning-Built in speaker. 200/250v A.C. Brand New. 18½ Gns. Carriage 10/-.

STAR SR.600 AMATEUR COMMUNICATION RECEIVER

New crystal controlled triple conversion de-Luxe 80-10 Metre band receiver. Employs up-to-date design and techniques. 95 Gns. S.A.E. for full details.

S.A.E. FOR DETAILS OF ALL EQUIPMENT



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120 Kc/s—390 Mc/s on 6 ranges Variable R.F. and A.F. outputs. Large clear scale. Size 7½ x 10½ x 4½in. 200/250v. A.C. operation. Brand New £12.19.6. Carr. 5/-.

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High quality Portable American Oscilloscope. 3in. c.r.t. TYB 3c/s-50 kc/s X Amp: 0-500 kc/s Y Amp: 0-2 Mc/s. Power requirements 105-125v. A.C. Supplied in "as new" condition, fully tested. £25. Carr. 10/-. Suitable 230/115v. Transformer. 15/6.

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

2mA	22/6	10V. DC	22/6
5mA	22/6	20V. DC	22/6
10mA	22/6	50V. DC	22/6
50mA	22/6	100V. DC	22/6
100mA	22/6	150V. DC	22/6
150mA	22/6	300V. DC	22/6
200mA	22/6	500V. DC	22/6
300mA	22/6	750V. DC	22/6
500mA	22/6	15V. AC	22/6
750mA	22/6	50V. AC	22/6
1-0-1mA	22/6	150V. AC	22/6
1A. DC	22/6	300V. AC	22/6
2A. DC	22/6	500V. AC	22/6
5A. DC	22/6	"8" Meter 1mA	29/6
3V. DC	22/6		

50µA	32/6
100µA	29/6
200µA	27/6
500µA	25/-
50-0-50µA	29/6
100-0-100µA	27/6
500-0-500µA	22/6
1mA	22/6

POST EXTRA. Larger sizes available—send for lists.
ILLUMINATED "S" METER. 1 21/32in. square front. Cal. in S units. 6V. lamp. 29/6. P.P. 1/-. Ditto 2 5/16in. square 39/6. P.P. 1/-.

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2 pF, 2,000 mFd, 2 ohms, 200 megohms. Also, checks impedance. Turns ratio. Insulation 200/250v. A.C. Brand New. £15. carr. 7/6.

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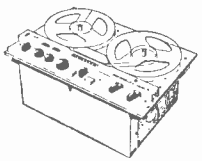

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4 Transistors, 4 Valves. Will record or playback ½ Track Stereo or Mono at 7½ or 3¾ IPS. 7in. spool size. Twin meter level indicators. 4 inputs. Output 500 MW. 40-18,000 CPS response. Size 15 x 10 x 6½in. 200/250 volt A.C. operation Brand New 42 Gns. P.P. 15/-.

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Brand New Guaranteed. Fully Shrouded. input 230v. 50/60 c/s output 0-23v.

1 Amp £4.10.0.	8 Amp £14.10.0.
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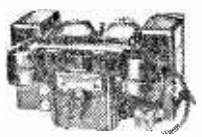

ARMY FIELD TELEPHONES TYPE F

Generator Bell Ringing, 2 Line Connection. With Wood Carrying Case. Fitted Batteries. Supplied Fully Tested £4.19.6. Pair Carr. 5/-.

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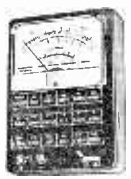
16Ω—25-15,000 Cycles. Air Cushioned Headband with cable and overload Junction Box. Brand New Guaranteed. 82/6. P. & P. 2/6.



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

Large clear plastic scale, simple operation. D.C. volts up to 1,000v. A.C. volts up to 1,000v. Resistance up to 10 megohm. Current up to 250mA. Decibels. 20 to +36dB. Size 6in. x 4 3/16in. x 2½in. Complete with leads, batteries and instructions. ONLY £5.5.0. P. & P. 2/-.

TYPE 13 DOUBLE BEAM OSCILLOSCOPES

Perfect order. £27.10.0. Carr. 20/-.

AVOMETERS

Supplied reconditioned, guaranteed perfect.

MODEL D. £8.19.6

MODEL 7. £12.10.0

Post & Ins. 5/-

AMERICAN TAPE

First grade quality American tapes. Brand new and guaranteed. Discounts for quantities.

3in.	225ft. L.P.	4/-
3½in.	600ft. acetate mylar	10/-
5in.	600ft. std. plastic	8/6
5in.	900ft. L.P. acetate	10/-
5in.	1200ft. D.P. mylar	15/-
5½in.	1200ft. L.P. acetate	12/6
5½in.	1800ft. D.P. mylar	22/6
7in.	1200ft. std. mylar	12/6
7in.	1800ft. L.P. acetate	15/-
7in.	1800ft. L.P. mylar	20/-
7in.	2400ft. D.P. mylar	25/-

Postage 2/-. Over £3 post paid.

COSSOR 1035 DOUBLE BEAM OSCILLOSCOPES

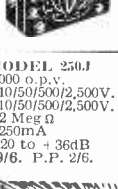
Guaranteed perfect order. £35. Carr. 20/-.

SINCLAIR X10 AMPLIFIER IN STOCK.

X10 Kit £5.19.6. Ready Built £6.19.6. P.S.U. £2.14.0.

MULTIMETERS

Brand New—Fully Guaranteed. Lowest ever prices. Supplied with leads, batteries and instructions.



MODEL 250J
2,000 o.p.v.
0/10/50/500/2,500V. AC
0/10/50/500/2,500V. DC
0/2 Meg Ω
0/250mA
—20 to +36dB
49/6. P.P. 2/6.

MODEL IT1-2
20,000 o.p.v.
0/5/25/250/500/2,500V. DC
0/10/50/500/1,000V. AC
0/50µA/25/250mA DC
0/60K/6 Meg Ω
.01—.3mFd
78/6. P.P. 2/6.

MODEL AR-620
20,000 o.p.v.
0/10/50/250/500/1,000V. A.C. and D.C.
0/500µA10/250mA
0/10K/100K/1 Meg Ω
250pF—.02mFd
0-500 Henrys
92/6. P.P. 2/6.

MODEL NH-201
30,000 o.p.v.
0/.25/1/10/50/250/500/1,000V. D.C.
0/10/50/250/500V. A.C.
0/50µA/10/250mA
0/5K/500K/5 Meg Ω
99/6. P.P. 2/6.

MARCONI TF144G, 4 STD SIGNAL GENERATORS

85 Kc/s-25 Mc/s. Perfect order. £25. Carr. 30/-.

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200 P.I.V	200mA	2/6
200 P.I.V.	6 amp	5/6
1,000 P.I.V.	650mA	7/6
800 P.I.V.	500mA	5/6
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400 P.I.V.	500mA	3/6
150 P.I.V.	165mA	1/-
70 P.I.V.	1 amp	3/6
95 P.I.V.	3 amp	5/6

Post extra.

MINE DETECTOR No. 4A

Will detect all types of metals. Fully portable. Complete with instructions. 39/6 each. Carr. 10/-. Battery 8/6 extra.

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Open 9 a.m. to 6 p.m. **Every day. Monday to Saturday.** Trade supplied.

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minutes of a spoken programme with details of items heard; 3 SINPO rating; 4 SINPO ratings of stations on adjacent frequencies; 5 Details of receiver and antenna and prevailing weather; 6 They must cover transmissions beamed to the listener's area; and 7 they must be mailed within 48 hours of the date in question. Reports should be sent to the International Service, Portuguese National Radio, Rua Sao Marcal, 1-A, Lisbon, Portugal. Reports on Portuguese transmissions should be sent to Servicos Technicos, Emissora Nacional de Radiofusao, Rua do Quelhas, 2, Lisbon, Portugal.

Some of the information demanded by this station is surely irrelevant and the conditions too stringent. DX'ers like to listen to the station as well as make lots of copious notes. Of course, a number of details must be sent to establish the authenticity of the report but this goes too far.

Finally, *Radio Iran*. R Howard (Stockport), J. Worley and E. Conduit say that English goes out at 2000 on announced frequencies of 11,730/7,135, although E. Conduit does not think these are the frequencies actually used. A schedule forwarded by R. Firth gives these frequencies also. D. Owens (Ipswich) says the 25m.b. outlet is 11,715. So there you are, checking of this station still seems to be required

The Amateur Bands—by David Gibson G3JDG

QUITE a good month with a good sprinkling of DX. The bands are improving, especially the h.f. bands, and even 10m opened up now and again. Reports indicate that people find it easier to listen on the h.f. bands.

Top band—mostly Gs, Europeans and Ws for the vigilant around 1,800kc/s usually from 0300 GMT on. Although the 160m trans-Atlantics are considered by many to be over, there are still a number of American amateurs trying their luck (and skill) on 160. Reports from listeners would be welcomed by these stations.

Eighty metres has produced mostly Europeans but also a few Ws. Not many logs for this band and only the stalwarts keep at it. Times to listen for DX are from 2400 on.

Forty metres, Sgt. Bob Garvey (Singapore) sums it up: "Still the playground of the Continental stations with occasional DX coming through". The DX *is* there and through chinks in the noise will waft a VK or W or even a JA. Try around 2200. A good antenna is needed for this band.

Twenty is going like a bomb! Times for DX depend on the particular continent but almost any hour of the day finds something of interest.

Fifteen has been spasmodic but when it does open (which is quite often) almost anything can arrive. Times to listen are difficult to predict with certainty but around 1600—1800 should prove fruitful.

Ten metres is on the move. Occasional semi-local G stations are giving way to G nets (instead of 160?) and Europeans with the odd rare one popping up. Africa is getting quite common—ZE/ZS, etc. Just for the record 5A1TK (Libya) was heard to say that Central and East African amateurs were giving R5 S9 plus to VK stations. Times to listen are afternoons and weekends, particularly Sundays from 1400. Now for some listeners' reports.

Twenty Metres

Stephen Shaw (HE30, 150ft longwire): a.m.—6W8AG, OX3LP, VE7BFN, CX2CO, OD5AX, KP4BL, 6Y5RD, YV5AL, W5HWR/P/VP9, PJ2AA, VP2GTA, YV1LA, ZC4CZ, KP4CL.

P. Collins, Leeds (Cossor AC464, 90ft longwire): 0810—2214 on a.m.—VK3MR, KL7DLF, VP5PR, OD5BU, FM7WN, F9YP/FC, VP3DU, W6HLH, W7RSP, 5Z4HT, COZAB, FO8GO, PJ3AJ.

Nick Roberts (G3UDE), on holiday in Cambridge, using two b.c. receivers, one to listen on and the other tuned to produce a beat note in the first. This gave him a b.f.o. and the following c.w. stations were raised on a 30ft wire thrown out on the roof between 2145—2215: W3AQT, 4OBM, 8N1B, 2LSW, 1EVT, 3GJY, 9AW, 9BPW, K4OBM, 3MTW, VE1RB, YV2AH and KV4CI.

D. Owens, Ipswich (BC342-N, 150ft longwire): VK4FJ, 4XK, 2ACD, CR4AJ, K1PJC/KP4, 9M2SR, 5A1TT, KP6UL, KC4BL, MP4TBN, ZC4CZ, YV5AST, PY2PE, 5Z4AA, ET3DR, 4X4DK, 9K2BY, 9Q5DO, ZM6AJ, VP4VP, KG4AM, KC4TL, KH6ADT, SVØWG. All s.s.b.

A4552 (Surrey) using a CR100 and a joystick antenna with a 100ft feeder: VE3CVL, PY2CK, VO1DC, UO5AW, TN8BK, FM7WN, YV4BC, HI4XAB, PY6MW, WA0IYW, VK3MO, VE8SK, SV1BT, HP1AE, UD6KAK, UV3TP, 5H3BX, VF8ZZ, nearly all a.m.

Alan Dailey, Leeds (R107 and a coat hanger!): K1IXG, UB5KFB, W2MG, 7Q7PBD, WA8DAZ. Inserting an ATU between the two brought in the following from 1810—1820: K1DPR, IEUR, IS1RUA, WB2PPP, I1KMZ, VE3CT, ET3USA. Alan says this was a real eye-opener and suggests that we run a "coat hanger" competition, no lead or feeder of any kind between coat hanger and the input socket. Any offers? Using a crystal controlled converter and a proper antenna, Alan raised JA8HK, VU2NR, MP4MAH, FG7XR (Guadeloupe), PZ1AX, KC4USB (Antarctica), KB6EPN (Canton Island), KC4USN, XE1YO, HK7AKV, ZP5CF, KH6BVS, VQ9HB (Seychelles), ZD5R, VK6XX, VP2GTA, HC8FN (Galapagos), KR6CA, EP2RW, TN8TD, TU2AW, MP4TBM.

J. Ingliss (Alloa), with his faithful R1155 and 66ft wire, 22ft high, reports on a.m.: W3HQY, 2MM, 1CTI, KG4AN and VE8ML (who is 700 miles from the North Pole and runs 750W to a dipole).

K. W. Chattenton, Middlesbrough (HE40, 14Mc/s dipole), on a.m. between 0030—0630: DL4TX, OK2KBR, PAØJGA, DJ9RQ, ØJGA, 8R1, 9KH, GB3RAF, OK2KBR, M1ZG (San Marino), F7DO, SM7CRW.

J. Fletcher (Pontefract) sends in a huge log of over 100 G stations, all on phone.

"Forty" is another forgotten 100kc/s where only the keen and determined SWLs can make the,

grade. If you can pull it in on 7Mc/s you can do it on any band.

John Fitzgerald, Great Missenden (Hitachi WH837 eight-transistor portable, 20m doublet E/W 18ft high). During the CQ SSB contest—VK2UH, VK3AS, VK3ATN, DJ6EP/LX, HB9AFIØP, all around breakfast-time. Also ZS1XR.

J. Ingliss logged on a.m. VK3ATN, YA4A, TF3AP, VP2GTA, VP2SM, UA4KED, GW3A.

R. Garvey (Cheltenham) heard on c.w.: VP9FT, W3MFW, W3KT, WA4TRS, W1EVT, WB2NYN, WA2GTL, K2UCE, K8NVC, K3UKZ, VE1ZZ, VO1AW, LX1PH, SV1YY.

Fifteen

P. Collins (Leeds) on a.m. between 0930—2120: 6Y5XX, XE3AF, EL2I, TU2RB, ZP3AL, PY7VKN/P, 5X5JK, PZ1BE, W6FXZ, LU4FX, KØLTL, CXZCN, YV5EG, PH3FL, MP4TBM, UA9VB.

A. Trickey, Bristol (R208, 75ft longwire, 50ft high) on a.m. between 1340—1940: HI8JBA, HI8JSM, ZS1AB, PY1BYS, SV1DL, 5A5TE, HK4AVL, EL8C, ZC4MO, 9Q5RB, 5A1TK, K9QCB, W4NZS, YV5APW, VE3FBP, CN8BS, ZB1RM, OD5BU, ZE2KA.

Alan Jones (Chertsey): 6W8AJ, ZP3AL, FM7WN, PY5EG, WA9GBB, CR5AS, KZ5MK, TR8AFF, CR7FR, ZS1AB, 9L1WN, SV1DL, 5N2AAC, VW9CR, 4X4QE, YA1AW, 9X5AV, 9K2AD, FG7XL, all a.m.

BRS26813, Gloucester (S640, 90ft longwire), on c.w.: KR6MB, 5A3TX, PY2AHM, 9Q5QR, EP2RC, VO1AW, W5FGO/MM, W6HFB, 5H3JJ, ZE4JS, UJ8KAA, 9KZAN, ZC4JU, OD5AX, W4KXV.

Ten

L. Cox, Pevensey (Heathkit Mohican and Hy-Gain 14AVS vertical antenna mounted at ground level), Sunday, 1100—1215, all a.m.: HB9EF, GJ, MP, DJ9BF, 6EK, 2FL, 11BAE, LCF, BAD, FKF, AYE, APQ, CID, RTF, FGW, CT1ML, DL9SL, 6GC.

Alan Jones (CR100, 100ft longwire) on a.m.: ZE2JA, CR7CZ, ZS6AMO, 9J2DT, DJ9BF, I1PES, Z1N, PLJ, BVP, BBR, ZSF, JY. How about a line from someone with a beam?

News in General

Twenty is good for the Far East in the afternoons—JA8HK, MP4MAM, VU2NR, heard 1240—1435. 5Z4FB used to collect bus tickets! Specials to listen for—KB6EPN (Canton Island), KC4USN and KC4USB in Antarctica, M1ZG (San Marino), UAØs on Sakhalin Island, PY7BAL/Ø Fernando de Novonha (mainly 7Mc/s), HKØQA (San Andres), KH6EDY (Kure Island).

ZC4MO is 6,000ft a.s.l. on Mount Olympus. ZD5 and ZF1 are the new prefixes for Swaziland and Cayman Island respectively. VQ9HB is reported off on an expedition to Agalega, callsign VQ8BFA. Sao Thome will soon be active under CR5SP and VU2NRL is reported on Laccadive Island. San Felix CEØXA and CEØAG are now both believed QRT. VR2EK is on Fiji and known to be active—s.s.b. on twenty.

A number of readers complain about the number of bad c.w. signals heard. The two main moans are people who use bug keys badly and the chirpy T6 notes. Wonder if it's not partly the fault of the other stations who always send a T9 report regardless?

Contests this month include—4th-7th: CHC/FHC/HTH QSO party. 6th: R.S.G.B. National Mobile Rally at Wethersfield. 7th: Saltash and District A.R.C. Mobile Rally. 12th-13th: National Field Day. 20th: Hunstanton Bucket and Spade Party, listen for the talk-in station around 1,980kc/s and the call to listen for is G3AMN/A. 27th: D.F. Qualifying Event. 27th: Longleat Mobile Rally. July 4th: Fourth 2m Portable Contest. Deadline for next month is July 1st. **Please note that all logs must be listed alphabetically.**

PCR MODS

Mr. W. V. Woods article under this title, which appeared in last month's *Practical Wireless*, aroused considerable interest. Many readers already own these ex-government communications receivers and in response to numerous requests for alignment details we publish the accompanying table of frequencies and admustments.

Model	Band	Generator setting	Receiver Dial setting	Tune
PCR PCR2 PCR3	 M.W. M.W.	 600 kc/s 1,500 kc/s	 600 kc/s (500 m) 1,500 kc/s (200 m)	 M.W. padder M.W. osc. and r.f. trimmers
PCR PCR2	L.W. L.W.	171·4 kc/s 300 kc/s	171·4 kc/s (1750 m) 300 kc/s (1000 m)	L.W. padder L.W. osc. and r.f. trimmers
PCR PCR2	S.W.	15 Mc/s	15 Mc/s (20 m)	S.W. osc. and r.f. trimmers. Fixed padder
PCR3	S.W. 1 (120/43 m)	2 Mc/s 6 Mc/s	2 Mc/s (100 m) 6 Mc/s (50 m)	S.W.1 padder S.W.1 osc. and r.f. trimmers
PCR3	S.W.2 (43/13 m)	15 Mc/s	15 Mc/s (20 m)	S.W.2 osc. and r.f. trimmers. Fixed padder

THIS MONTH'S COMPONENT BARGAINS

465 Kc/s IF Transformers. Standard type in aluminium can with trimmers, size 1¾in. square, 1/6 each, 12/- doz.

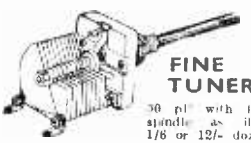
46 Receiver/Transmitter. Complete except for crystals packed with valves and components, easily buildable into other gear. 19/6, plus 6/6 carriage and insurance.

Output Transformer. Standard pentode type 2/6, 24/- doz.

Mullard 510. Amplifier chassis complete with inner screening section, stove enamelled. 7/6, plus 2/9 postage.

Precision Wheatstone Bridge. Opportunity to build 100K wire wound pot. 1a watt rating, 5/- only. Also 100K 100 watt. American made, 15/-, post 2/9.

10KV Mains Transformer. American make, 110v. primary, £7.10.0.



FINE TUNERS

50 pF with long spindle as illus. 1/6 or 12/- dozen.

MAKING AN FM TUNER

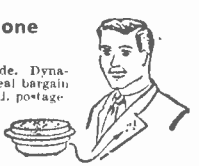
Available at present is a very nice cadmium-plated F.M. Tuner chassis with holes punched for coils and other components, also a nicely printed perspex front, calibrated usual F.M. frequencies. Real bargain 6/8 + 2/- or with two-gang tuning condenser 10/- + 2/- postage

SELF ENERGISED TELEPHONES

These require no batteries; in fact they have only to be connected by a pair of wires. They can thus be fitted into existing bell circuits. Results are extremely good and maintenance costs are nothing.

Handsets only 15/- each, post etc. 2/6. Two post free.

Microphone Inserts

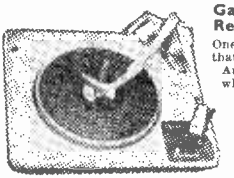


American made. Dynamic type. Real bargain at 2/6, plus 6d. postage

Morganite Potentiometer

Single and 2-gang types available, standard size with good lengths spindle all new. Single type, 1/- each values available 1K, 5K, 10K, 25K, 50K, 100K, 250K, 1 meg., 2 meg. Ganz type 3/- each — values available 5K ± 5K, 100K ± 100K, 1 meg. ± 1 meg., ½ meg. ± ½ meg.

AUTOCHANGER BARGAIN



Garrard Auto-Slim Record Changer

One of the nicest record changers that this famous company make—Automatic selection of records which may be mixed—may also be played manually. Finger tip adjustment of stylus pressure. Fitted with monohead—but pick-up wired for stereo—suitable 200/250 A.C. mains. Cabinet space required 14¼ x 12¼in. with 4¾in. above and 2¼in. below. DON'T MISS THIS SPECIAL SNIP only £5.15.0 (post and insurance, 6/6).

MULTI-METER BARGAIN

Model number EP10K. Extra wide scale fitted corner wise for compactness, extra accurate as it uses 1% components. Sensitivity 10,000 ohms per volt A.C. and D.C. ranges. D.C. voltage up to 1.2KV in 5 ranges. A.C. voltage up to 1.2KV 5 ranges. D.C. current up to 500mA 3 ranges. Resistance up to 2 meg. Capacities .005 to .15 mfd and decibels. Complete with full instructions and test prods and battery for ohms range. A real bargain not repeatable once stocks cleared. Price 69/6. Carriage and insurance 5/-.

THIS MONTH'S SNIP

All the components for the short wave receiver as described in May **PRACTICAL ELECTRONICS.** Only 35/- post free, includes free earphone with headband.

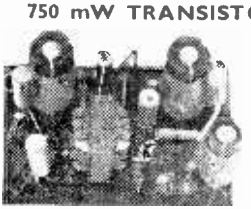
MAINS POWER PACK

Designed to operate transistor sets and amplifiers. Adjustable output 6v—9 to 12 volts for up to 500mA (class B working). Takes the place of any of the following batteries: PP1-PP3-PP4-PP6-PP7-PP9 and others. Kit comprises: mains transformer-rectifier, smoothing and load resistor 5000 and 500 mfd condensers, zener diode and instructions. Real snip at only 14/6 plus 2/6 post.

INSTANT STAKT FLUORESCENT GEAR

Best make, ideal for home or business—no flicker—on immediately—choke/transformer and power factor condenser—40 watt 19/6, post 2/9, 80 watts 27/6, post 3/6. Normally £4 and £6 respectively.

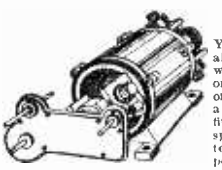
750 mW TRANSISTOR AMPLIFIER



4 transistors including two in push-pull input for crystal or magnetic microphone or pick-up—feed back loops—sensitivity 5 m/v.

Price 19/6

Post and insurance 2/6.
35 ohm Speaker, 12/6 extra.



Multi-Speed Motors

You can adjust this motor to almost any speed you want. It will work directly off A.C. mains or if you require greater power or greater speed, work it through a metal rectifier. This motor is fitted with a gear box enabling speeds down as low as 1 r.p.m. to be obtained. Price 19/6, postage and packing 4/6 extra.

FLOODLAMP CONTROL

Dim and full switch for controlling photo floodlamps. Gives two lamps in series, two lamps full brilliance and lamps off. Similar control of other appliances. With cut-out 3/6, plus 9d. postage.

Timer Kit

Special offer of all components except metal box to make mains operated interval timer for photography etc. 12/6 plus 2/6 post.

Speaker Bargain

12in. High-fidelity loud-speaker. High flux permanent magnet type with either 3 ohm or 15 ohm speech coil. Will handle up to 10 watts. Brand new by famous maker. Price 27/6 + 3/6 post and insurance.

Hi-Fi Speakers

Hi-Fi Speakers—E.M.I. Ceramic magnet 12,000 lines, size: 13 x 8in. (roughly equivalent to 12in. round speaker). Bass frequency 40-50 c/s. Handles up to 10 watts. Price 33/6 plus 5/- carriage and ins. State whether 15 ohm or 3 ohm.

Brayhead Turret Tuner

Complete with Band 1 and Band 3 coils. Less valves 10/- each or with valves 17/6 each. Post 2/6. Knobs 3/6 extra.

Waterproof Heater Wire

16 yds. length, 70 watts, self regulating temperature control. 10/-, post free.

Cabinet Snip

This fine cabinet as illustrated but less control knobs is available this month at a special snip price of 12/6 plus 3/6 post and insurance. Size is 13¼in. x 9in. x 4in. and it is nicely covered in two tone L.C.I. fabric.

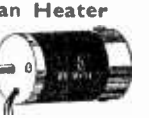
Siemens High Speed Relay

Twin 250 ohm coils adjustable tension change over contact—plat points 7/6. Post 1/-.

Five Core Cable

Ideal for switching circuits, intercoms. P.A. runs etc. each core flex copper with rubber insulation, cores covered overall in tough rubber or P.V.C. 9d. per yd. or 30 yds. length 15/- plus 5/- post.

Making a Fan Heater

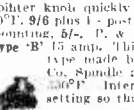


Miniature motor laminated poles. Operates off 20-30v. D.C. Original cost at least £3 each, 8/6 plus 1/6 postage and insurance. Mains model 9/6 plus 2/9 postage and insurance.

THERMOSTATS

Type 'A' 15 amp. for controlling room heaters, greenhouse airing cupboard. Has spindle for pointer knob quickly adjustable from 30/-80°F. 9/6 plus 1/- post. Suitable box for wall mounting, 5/-. P. & P. 1/-.

Type 'B' 15 amp. This is a 17 in. long rod type made by the famous Sunvic Co. Spindle adjusts this from 50-300°F. Internal screw alters the setting so this could be adjustable



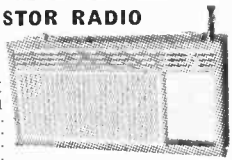
over 50° to 1,000 F. Suitable for controlling furnace, over kiln, immersion heater or to make flamestat or fire alarm. 8/6 plus 2/9 post and insurance.

Where postage is not definitely stated add 2/- all orders under £3.

WIRECOMP ELECTRONICS

WIRECOMP'S BARGAIN STORE
48 Tottenham Court Road, London, W.1
Thousands of bargains: Transistor Radios—Record Players —Tape Recorders—Radiograms—Rock Bottom Prices

FAMOUS MAKE TRANSISTOR RADIO THE "STELLA"



7 transistor portable radio. Long Med. and Short wavebands. Fitted tone switch and sockets for personal earphone and external aerial; chrome telescopic aerial. Uses four 1.5 v. torch batts. Plastic cabinet in beige and red. size 4 x 7 x 1¼in. Excellent tone. 3in. p.m. speaker. Comp with shoulder strap and external aerial. Full guarantee. List price 17 gns.
WIRECOMP'S PRICE **£9.19.6** P. & P. 5/-

NEW SUPER MINIATURE POCKET RADIOS

THE SINCLAIR MICRO-6. Self-contained pocket radio. Size only 1⅞ x 1⅜ x ½in. Complete with earphone and detailed construction data. **Can be built for only** Mercury cell 1/11 extra (2 required). **59/6**

THE SINCLAIR SLIMLINE. The new 2-transistor pocket radio size only 2½ x 1⅝ x 1¼in. Micro alloy transistorised and printed circuit. All components available separately. Easy to assemble. **Can be built for** **49/6**

INTERNATIONAL BRAND TAPE—Fully Guaranteed

MYLAR BASE		ACETATE BASE	
3½in. Triple play, 600ft.	15/-	3in.—150ft.	3/6
4in. Triple play, 900ft.	17/6	3in.—225ft.	4/11
5in. Double play, 1,200ft.	15/-	3in.—300ft.	7/6
5in. Triple play, 1,800ft.	35/-	5in. Long play, 900ft.	10/-
5½in. Double play, 1,800ft.	22/6	5½in. Long play, 1,200ft.	12/6
5½in. Triple play, 2,400ft.	45/-	7in. Stand. play, 1,200ft.	10/-
7in. Stand play, 1,200ft.	12/6	7in. Long play, 1,800ft.	15/-
7in. Long play, 1,800ft.	19/6	P.V.C. BASE	
7in. Double play, 2,400ft.	25/-	5in. Stand. play, 600ft.	8/6
7in. Triple play, 3,600ft.	58/6	5½in. Stand. play, 840ft.	11/6

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

STEREO TAPE RECORDER SCOOP!

ELIZABETHAN TYPE LZ 511

A fully professional 4-track, 3 speed Stereophonic Tape Recorder—at almost half price! 4 track record and replay—Mono or Stereo. 3 speeds—7½, 3¾, 1⅞ i.p.s.—fast forward and rewind. Frequency response 40/16 000 c.p.s. at 7½ i.p.s. Output 3 watts per channel to two 8in. × 5in. speakers in detachable enclosures. 2 Vu record level meters; tape position indicator and auto. tape stop; inputs for 2 microphones and 2 radio/pick ups. Controls include: volume, treble/monitor, bass etc.—duplicated for each channel. Takes 7in. spools. For 200/250 v. 50 c.p.s. Mains operation. Overall size (including speakers) 25 × 13 × 8in. Brand new and guaranteed. **List Price 65 Gns.**
WIRECOMP'S PRICE **39Gns.** Incl. 2 crystal mics, tape & spool. Carriage & Ins. 15/- extra.

ELIZABETHAN TYPE LZ 507

High quality 4-track Stereophonic Tape Recorder with unique "solid state" transistor circuit. Brief spec.: 4-track recording, mono or stereo, 4 or 2 track replay; 3 speeds—7½, 3¾, 1⅞ i.p.s.; fast forward and rewind; auto tape stop; output 2 watts per channel to two 7in. × 4in. speakers in detachable enclosures; frequency response 60/14,000 c.p.s. at 7½ i.p.s. Tape position indicator; 2 Vu record level meters; volume and tone controls for each channel; input for 2 mikes and 2 radio/pick-ups. Takes 7in. spools. For 200/250 v. mains use. Overall size 22 × 15 × 7½in. Brand new and guaranteed. **List Price 49 Gns.**
WIRECOMP'S PRICE **33 Gns.** Incl. 2 crystal mics., tape and spool. Carriage & Packing 15/- extra.

PAMPHONIC HI-FI EQUIPMENT

TYPE 3001 Integrated Stereo Amp. List price £38/10/0. WIRECOMP'S PRICE 23 Gns. C. & P. 10/6.
TYPE 1002A Control Unit. WIRECOMP'S PRICE £4/19/6. C. & P. 2/6.
TYPE 1002B Control Unit/Pre-Amp. List Price £25/4/0. WIRECOMP'S PRICE £6/19/6. C. & P. 2/6.
TYPE 2001A Pre-Amplifier. WIRECOMP'S PRICE £5/19/6. C. & P. 3/6.
TYPE 732A Switched Radio Tuner. WIRECOMP'S PRICE £5/19/6. C. & P. 7/6
All fully described in our advertisement in "P.W." April 1965.

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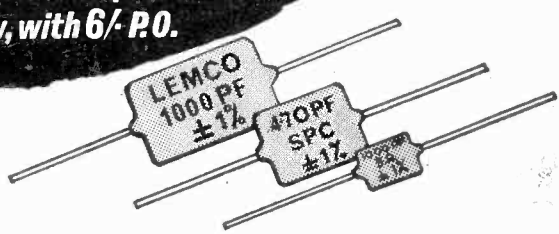
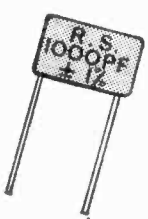
HOME RADIO (MITCHAM) LTD.

NON-ELECTROLYTIC CONDENSERS—*Continued*





...tolerance is 1 pF or 5%

Condensers: Silver Mica (*value given in picofarads*)
Voltage 350; tolerance 1% above 50 pF (except where ot...

Cat. No. C81.

Value	Price	Value	Price	Value	Price	Value
4·7	9d.	39	9d.	150	9d.	400
8·2		45		175		470
10		47		180		500
12		50		200		560
15		56		220		660
18		65		250		680
20		68		270		800
		75		300		820
				330		1000
						1200

Please write your name and address in block capitals

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ADDRESS _____

_____

HOME RADIO LTD., DEPT. PW. 187 LONDON ROAD, MITCHAM.

A COMMENTARY BY HENRY

PRACTICALLY WIRELESS

No. 11 Fun Finding Out

NO, don't look! Where is that circuit of the transistorised amplifier you meant to build? Or the table of wire gauges and turns ratios? Or even the list of station frequencies?

To be sure, you will find them, or more accurately, fail to find them until you are searching for something else, at the back of the deepest bookshelf. This is the "H" Factor at work.

That wise old saw: "Seek and ye shall find", lacks one qualifying word . . . *eventually*. We could even add a corollary . . . "*when the data is no longer wanted.*"

The thought is inspired by a recent search through the archives to find a drawing which one reader required and which he *thought* appeared some time in '57. The fact that the diagram, when located, was totally unsuitable for his purpose has nothing to do with the case.

But it illustrates the point that has exercised Henry (and Mrs. Henry) for ages. How do you find vital references at the drop of a telephone pad?

Do you rely on mad thumbing through one of the tomes which have become classics of the radio bookshelf? Or keep a neat folder of lettered indices that lead you straight to the correct bound volume?

Either way, sooner or later the mass of accumulating information is going to overwhelm both you and the system. And then you are going to have the task of sorting the superfluous from the absolutely ineradicable —or, as Mrs. Henry would put it, "*That* pile of junk from *this*."

Sorting out that pile of junk from this.

There was the classic occasion when Henry just managed to save a priceless list of the first names, nicknames and hobbies (for casual reference) of most of the Technical Editors in West Central. The fact that it was scribbled on the back of an old menu, and included such cryptic lines as:

"*Sam. S.S. Rad. Tech. Rev. (chrysanthemums)*" and "*Joe, Big-ead, Sparks Agency, (dames),*" may have helped deceive modom about its priceless value.

Some sense of value is imparted by the publishers of this magazine, who supply neat binders and an index of many back numbers. But although the sort of index that says: "3-Valve Super by F. G. Rayer, Page 956, Vol. 7," and goes on to cross-reference: "Authors —F.G. . . . etc." confirms what we already know, that F. G. R. is an industrious father-figure to we constructors, it does not tell us whether the interesting reflex circuit came in that particular article or the one about the earlier Super-Three.

This is not to deprecate the publishers' aid.* But it does spotlight the vexing business of looking up reference you want when you want it, and quickly.

One of our diligent contributors, who shall be nameless (for once), has a filing system which makes me squirm with envy. No pile of dusty back numbers in the corner of the second-best bedroom for him! He had a specially built annexe to the house, containing rows of formidable steel filing cabinets. One felt that any part of any set,

* Henry knows which side his bread is buttered!

The nonchalant gent at the other end.

back to when Marconi was a boy, could have been looked up between the cries of the nearby seagulls.

At the other extreme is the nonchalant, not to say blasé, gent at the other end of the telephone when we asked a manufacturer for information. We feel that he has answered what we thought our unique query so many times that repetition quite audibly palls. He has no need to look anything up: his greatest trouble is keeping awake. We can almost hear him thinking disdainfully: "*these amateurs* . . . " If it was not that the call was costing us another half-dollar with every sentence we would be inclined to tell him we were in the trade before he was dry behind the ears.

And, in fact, it is here that the practising radio engineer scores. Working daily with the equipment, he tends to absorb a great quantity of data, almost without effort, and can tell you in the wink of a neon how many puffs make five. His index is in the mind. He is probably one of that panel of experts our Editor keeps on the end of his strings.

But even his mental index is not going to help him when some reader wants to know the value of C77 in that circuit of an electronic egg-timer that came out in—in—oh, dear, when was it?

BOOKS REVIEWED

The following books are all published by the Radio Society of Great Britain, New Ruskin House, 28 Little Russell Street, London, W.C.1. All have the same format (9¾in. x 7¼in.), the number of pages and the prices being given individually below.

A GUIDE TO AMATEUR RADIO by Pat Hawker, G3VA.
80 pages. Price 4s. post paid.

WHEN your reviewer first started to get interested in amateur radio, a great number of questions came readily to mind. In fact, fresh ones arrived daily—in batches! The answers lay in a man who had the great misfortune to work in the same building, one "Bill".

A man of great knowledge (and suffering) he answered my daily barrage of queries straight off the cuff. However, he was human and humans have a limit. One day he threw in a few extra answers, too. The only printable portion of these extra pearls of wisdom was "*and buy a good book*". This offering is not only passed on but underlined. A simple book not too expensive and covering the basic fundamentals is, of course, the ideal.

A Guide to Amateur Radio is just such a book, and the price brings it within the reach of every pocket. It contains a gentle introduction to transmitters, receivers, aerials, and includes much very useful information on the R.A.E., and gives a typical exam paper.

Many of the circuits appear to be purloined from other R.S.G.B. sources but the only item which did give rise to disappointment was a two valve battery circuit which I saw in a book on receivers some ten years ago, and this did rather suggest a book which had been made up of things gleaned from here and there, rather than a modern book written especially for the beginner.

However, it does offer excellent value for money, and for those who like bargains it is definitely a desirable item.—*D.L.G.*

THE RADIO AMATEUR EXAMINATION MANUAL by B. W. F. Mainprise, B.Sc. (Eng.), G5MP.
60 pages. Price 5s. 6d. post paid.

IN the pages of this magazine views are sometimes expressed as to the desirability of the examination in order to obtain a transmitting licence. For those who would like to know more about this examination then the book under review is a very interesting and well written volume containing dozens of questions likely to be encountered in the exam, followed by clear and concise answers.

It was particularly pleasing to see that the thorny subject of interference had a whole chapter to itself. The last chapter consists of questions and specimen answers which should prove extremely useful. Other chapters take in receivers, semiconductors, aerials and propagation and calculations.

For people who would like to become a radio amateur, and who need a book devoted to the examination and nothing else, then this R.S.G.B. publication is undoubtedly a must, and at 5s. 6d. is an extremely good buy.—*L.S.A.*

COMMUNICATION RECEIVERS by G. R. B. Thornley, G2DAF.
36 pages. Price 3s. post paid.

READERS who listen on the short wave amateur bands are essentially interested in receivers, and here is a book written especially for them costing only 3s.

Each stage is considered separately and the stages are then assembled into a full circuit diagram of a complete modern receiver. Photographs of the completed project are also included, and these are a decent size, and so enable the various components to be clearly seen. There is also an alternative circuit using one of the Japanese mechanical filters currently available.

In case you should find the finished receiver too advanced, or you perhaps already have a receiver which could do with "hotting up", then you are catered for in a three valve crystal controlled front end. This book is worth every penny, and it is thoroughly recommended. Even if there is no intention to build, it is well worth having for the interest value alone.—*C.F.B.*

S.S.B. EQUIPMENT by G. R. B. Thornley, G2DAF.
24 pages. Price 3s. post paid.

THERE are many different forms of modulation used by amateurs in their transmission. Amplitude modulation is by far the best and most common. This last sentence could have been written with confidence some years back, but today it would be a very silly statement to make.

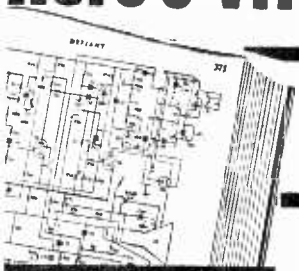
Listen on any of the amateur bands today and you will find that more and more are using single side band (s.s.b.). This type of transmission offers considerable advantages at a cost of slightly more complex circuitry. It follows, therefore, that a really good design is essential, and this is provided in *S.S.B. Equipment*.

It consists of reprints from the R.S.G.B. Bulletins on an s.s.b. transmitter and a linear amplifier. There are full circuit diagrams together with details of alignment and setting up, and the design considerations for the various stages are explained.

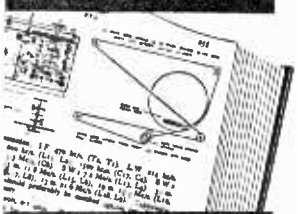
Also provided are photographs of the equipment, and the whole book is well sprinkled with diagrams. If you are interested in s.s.b. then this one is a must—*C.R.*

Here's vital time-saving data

to earn money for you!



NEARLY 1,200 CIRCUITS



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DATA FOR OVER 90 MAKES 1964 BACK TO 1958

Ace, Aerodyne, Ajax, Alba, Argosy, Baird, Beethoven, Berec, B.R.C., B.S.R., Bush, Capitol, Champion, Channel, Collaro, Cossor, Cyldon, Dansette, Decca, Defiant, Doric, Dynatron, E.A.R., Eddystone, Ekco, Elizabethan, Elpico, E.M.I., Emerson, Emisonic, Eumig, Ever Ready, Ferguson, Ferranti, Fidelity, Ford Motor Co., Garrard, G.B.C., G.E.C., Gramdeck, Grundig, H.M.V., Invicta, K-B., Magnavox, Marconiphone, Masteradio, McMichael, Motorola, Murphy, National, Newmatic, Pageant, Pam, Perdio, Peto Scott, Philco, Philips, Pilot, Playmate, Portadyne, Portogram, Pye, Pye Telecommunications, Radiomobile, Raymond, Recording Devices, Rediffusion, Regentone, Retra, Revelation, R.G.D., Roberts' Radio, Sobell, Sonolor, Sony, Sound, Spencer-West, Standard, Stella, Stereosound, Stuzzi, Thorn, Trans Arena, U.K.W., Ultra, Vidor, Volmar, Walter, Waltham-Standard, Zenith.

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- RADIO
- RADIOGRAMS
- TAPE RECORDERS
- RECORD REPRODUCERS
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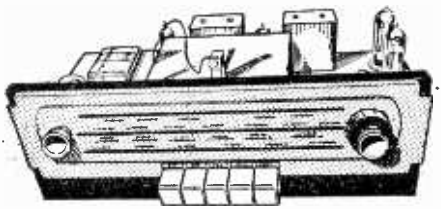
BRAND NEW AM/FM (V.H.F.) RADIO GRAM CHASSIS AT £13.13.0 (Carriage Paid)



Chassis size 15 x 6½ x 5¾in high. New manufacture. Dial 14½ x 4in. in 2 colours, predominantly cream. 200-250v. A.C. only. Pick-up. Ext. Speaker. Ae., E., and Dipole Sockets. Five pushbuttons—OFF L.W., M.W., F.M., and Gram. Aligned and tested O.P. Transformer. Tone control. 1000-1900 M.: 200-550 M.: 88-98 Mc/s. Valves EZ80 rect.; ECH81 EF89, EABC80, EL84, ECC85, 3-ohm speaker required. 10 x 6in. ELLIPTICAL SPEAKER 25/- to purchasers of this chassis. **TERMS:** (Chassis) £3.10.0 down and 5 monthly payments of £2.4.0. Cheap Room Dipole for V.H.F., 12/6. Feeder 6d. per yard. **ALTERNATIVE DESIGN.** L.W. 1000-1900 M.: S.W. (9-15 Mc/s); M.W. 190-475 M.: V.H.F. 87-100 Mc/s.; Gram position. Otherwise similar to above chassis. Price £15.15.0 (carr. paid). **TERMS:** £3.10.0 down and 6 monthly payments of £2.4.0. Total H.P. price £16.14.0. Circuit diagram 2/6.

AMERICAN BRAND TAPE

FULLY GUARANTEED AT RECORD LOW PRICES

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7in. Long play, 1,800ft.	19/6
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7in. Double play, 2,400ft.	25/-
3in. Triple play, 450ft. (Plain white boxes)	12/6
3¾in. Triple play, 600ft. (Plain white boxes)	14/-
4in. Triple play, 900ft. (Plain white boxes)	22/6
5in. Triple play, 1,800ft. (Plain white boxes)	42/6
7in. Triple play, 3,600ft. (Unboxed)	75/-
ACETATE BASE	
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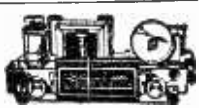

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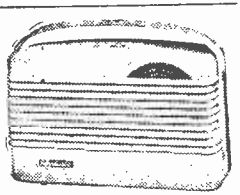

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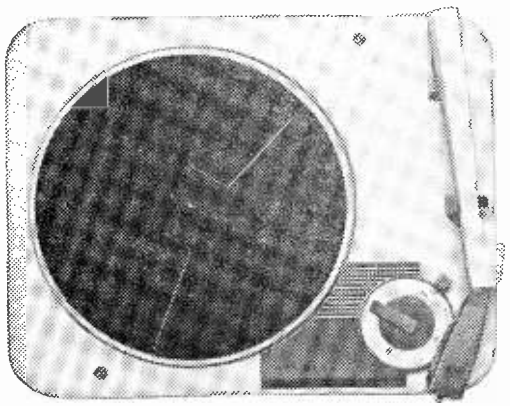

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Goldring Manufacturing Co. (GB) Ltd.,
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Telephone: Leytonstone 8343

GETTING STARTED WITH TRANSISTORS

By Louis E. Garner, Jnr.
Published by the Gernsback Library, New York, N.Y.
Gernsback Library No. 116.
160 pages. 7 Chapters. Size 8¼ x 5½ in.
Price $3.95. (U.K. Agents: Modern Book Co. Price 28s.)

THE other day a friend of mine went into a store to buy some metal rectifiers for a battery charger he was building. He had allowed plenty of room in the case for their large plates to fit in easily. He gazed in amazement when the assistant placed on the counter four tiny cylinders of metal with a thin wire sticking out of each end. My friend said credulously: "But they've got to take six amps!" The assistant smiled and said: "It's all right, sir, these will take up to 20 amps."

That semiconductors are replacing valves and more conventional components in certain circuits is a fact and it is also certain that transistors with their family of brothers and sisters are coming more and more into the foreground each day. Many, like my friend mentioned earlier, are beginning to realise this and would very much like to know more about these fascinating devices but, after opening the odd book and finding themselves besieged with pages of higher maths, decide to stick to other things for as long as possible.

If you are such a person then, alas, your last excuse for avoiding semiconductors is gone. It has been stolen by Louis E. Garner Jnr. and in its place he offers *Getting Started with Transistors*. I thoroughly recommend this book to anyone who has an elementary knowledge of basic radio and wishes to know all about transistors. So well does Mr. Garner write that at the end of the book one says to oneself: "So that's all there is to them" and a great feeling of shame descends for avoiding the transistor for so long.

Everything is covered, from the way the different types are made to their function and circuit values, and not once does the author try to confuse or impress with mathematics. Also included is the "lowdown" on such frightening names as Four-layer Diode, Unijunction Transistor, Tunnel Diode and Silicon Controlled Rectifier.

When I review a book I ask myself at the end: "Is this a book I can honestly recommend? Has it achieved what it set out to do, is it technically accurate and is it well written?" In this case the answer is "Yes" to all questions and a unanimous vote in favour for Louis E. Garner, Jnr.—*A.E.B.*

HOW TO BUILD TINY ELECTRONIC CIRCUITS

By Morris Moses.
Published by Gernsback Library, New York. N.Y.
Gernsback Library No. 117.
7 Chapters. 190 pages. 8¼ x 5½ in.
Price $4.15. (U.K. Agents: Modern Book Co., Price 30s.)

MINIATURISATION is a word which seems to be creeping more and more into electronics and radio every day both in commercial and amateur equipment.

With the coming of rockets and space travel the business of making smaller equipment has produced in its wake some fascinating techniques, and as a result a sort of wonderland in miniaturisation has grown up. A peep into this wonderland is offered to anyone who cares to secure for himself a copy of the above book.

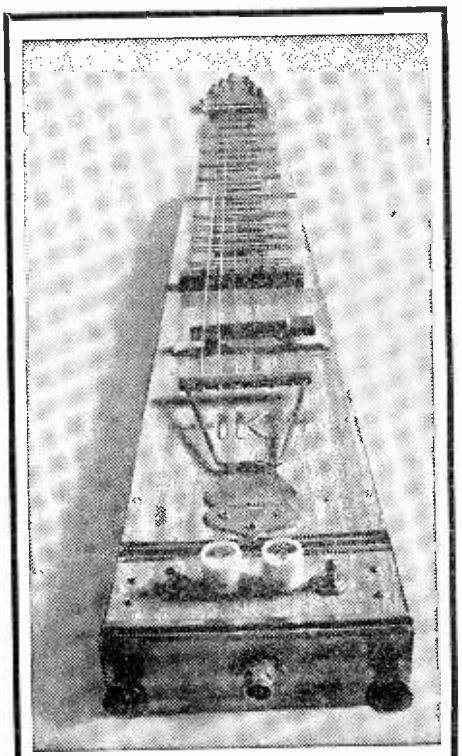
You won't find any white rabbit or a caterpillar smoking a hookah but you will find that after reading it a pin will look more like a telegraph pole! Not convinced? Let's get aboard the magic carpet and travel to page 43 in our new-found Lilliputian world.

Here is a picture of a small plastic tube container; by the side is a match. There's a tiny speck of dirt on the photograph but don't try to wipe it off because it is, in fact, not a speck of dirt at all but a transistor. For those who would like the vital statistics they are as follows: Length $\frac{1}{16}$in., width $\frac{1}{32}$in., depth $\frac{1}{32}$in. The three leads are flat 1/100in. wide, $\frac{1}{4}$in. long and ·003in. thick. The diodes aren't much bigger either, $\frac{1}{16}$in. long and $\frac{1}{16}$in. diameter. It works out to around 1,400 to the ounce.

Page 48 depicts an indicator lamp. Nothing special really except that it is in the process of being threaded through the eye of a needle! There are numerous circuit diagrams, an electronic wrist watch, a radio pill, in fact there are two complete chapters devoted entirely to practical projects.

There is, however, one drawback which it is only fair to mention. This is an American publication and therefore all transistors and components are of American origin. For those with an equivalents list or sufficient knowledge then no great problems are likely to be encountered.

For others it might be mentioned that it is possible to send to America direct for components. If this is done then the necessary forms may be obtained from the post office. *How to Build Tiny Electronic Circuits* is well worth reading and will certainly stir the imagination of prospective constructors.—*A.E.B.*



AN ELECTRONIC Hawaiian Guitar

by I. J. Kampel

CONTINUED FROM PAGE 124 OF THE JUNE ISSUE

THIS month a simpler head, using a single bar magnet as opposed to six individual vertical magnets, is described. The previous head is preferable for tone quality, though impressive quality will be obtained with the simpler head to be described.

In the case of difficulty in obtaining six small magnets for the other type of head this is an easy alternative as bar magnets are comparatively easy to obtain. Dimensions are not given as you may have to make these fit the particular magnet you obtain. The distance from the top of the bar magnet to the strings should be about the same as recommended for the other head, however, the magnet extending at minimum ¼in. outside the two outer strings. See Fig. 13.

The magnet itself is attached to the body of the instrument by means of a shaped piece of phosphor bronze or similar material, screwed either side. A cardboard frame is made to fit snugly around the magnet and on this 100 turns of 36s.w.g. enamelled copper wire are wound. The ends are taken through to the slot as before. only here a cross-slot only is necessary if the magnet is large enough to require countersinking. (Should it be countersunk, screw retaining clip to top face as before.)

A rectangular block of wood is hollowed out at the middle to take magnet plus former and winding. Formica sections are cut to line the sides of this and also a piece for the top but cutting in it a true rectangle the size of the magnet. Before sticking into place the top section of Formica place beneath this either a suitable piece of loudspeaker fabric, stretched taut to cover the rectangle exposing the magnet, or a very thin piece of fine loudspeaker cover-gauze countersunk into wooden frame. Types used on small transistor portables would be ideal for this. If fabric is used be sure that it is taut and that the adhesive does not get on to portion that will be exposed. Stick this down taut and wait until stuck before sticking top Formica. The wooden frame itself may be stuck to the Formica instrument base.

The Final Touch

The final touch can make or break a good piece of craftsmanship. Bad lettering of the controls, for instance, sadly a point which often lets down the amateur. Letraset is the preferred method and a box of electronic lettering legends can be purchased from many drawing offices and is a sound investment. Pressure on one side of a lettered sheet transfers letters to the article to be labelled, it only being necessary to then fix them with a supplied lacquer (which is, incidentally, also ideal to paint the head with). With one player controls might be left unlabelled, but then there is always the danger of the battery being left on.

A small rectangle of paper with the legend required carefully printed on, stuck down with a slightly larger rectangle of Sellotape, can look far better than a shaky paint job.

The Hawaiian guitar is generally laid across the knees of its seated player and it is usual for this reason for them to have a foam underside. (Guitars!) The author purchased for half a crown a ½in. thick foam bathmat which, cut up, served well. The outline may be marked with a ballpoint pen and can be cut quite easily with scissors. Be sure, however. to make the first cut of the scissors the last all the way round for a smooth edge. Stick this to the wooden underside of the instrument with Evo-Stik, remembering that a rectangle has to be cut out and stuck separately to the battery compartment cover. Holes should be made through this piece neatly to leave exposed the screw heads for battery renewal.

Finally select two suitable matching control knobs to complete a professional appearance as a couple of dull black knobs will completely spoil the overall effect. The ones chosen for the prototype were slim, tubular type with cream walls and a countersunk golden centre matching the edging; for the matching appearance well worth 2s.

Final Notes

If the amplifier used has a pronounced hum caused by mains a small value capacitor between the chassis of the guitar circuit and the strings themselves will reduce this hum in most cases but only when the player touches the wires, actually or through the "steel" earthing it. This may be done with a 0·5μF capacitor linked from chassis to the tailpiece securing screw which projects through into the channel.

If the channel is widened a little where this screw comes, enough to allow power and head leads to pass at either side, a longer screw could screw right through to the wood below the channel, a better solution than a false screw into a wooden block.

This method of reducing mains hum is not encouraged and it is advisable to cure this in the amplifier itself rather than by the above method.

The output socket of the guitar should be connected by light, but not too small, microphone coaxial to the amplifier input. No intermediate matching transformer is involved.

The pick-up head need not be in the position described, though this position gives a mellow tone suited to the instrument. As the head is moved up from the end of the fingerboard (24th fret) towards the bridge the tone becomes much sharper, reaching a final twangy quality. Where two, three or even four pick-up heads are to be seen on an ordinary guitar to make use of this quality, only one head is to be found on normal Hawaiian guitars. Of late, however, it has become common to have Hawaiian guitars with two fingerboards, the whole unit duplicated and linked, here, of course, using two heads, one per unit. Heads may be placed at an angle to the strings but here, of course, magnet centres have to be adjusted to match.

Some players prefer the strings as close to the edge as possible and one method of doing this is to place all six winding keys on one side, though making the instrument longer, allowing it to be tapered more. Certainly the end strings should not be any further in from the edge than as described in the article. The author preferred the more pleasing appearance as described, giving a very playable instrument, but for those that would prefer it some Hawaiian guitars are box shaped at the bottom end with, as in a guitar, a narrow fingerboard running up to a head holding the winding keys. If making the instrument for a musician rather than oneself it is advisable to check which form he would prefer. Some musicians would prefer the frets to stretch the full width of the fingerboard. If edging is used to

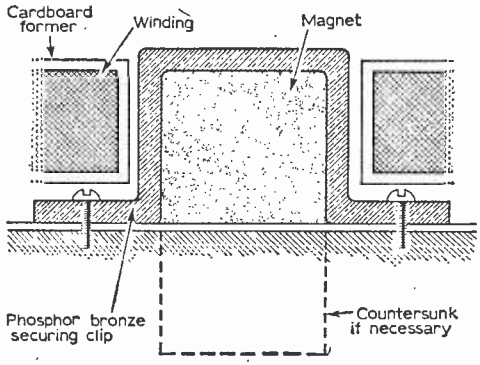


Fig. 11: How the bar magnet is mounted and clamped down.

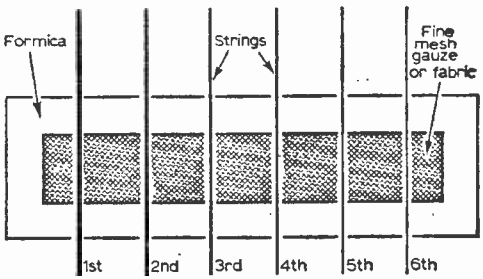


Fig. 12: The appearance of the new finished pickup looking straight down on to the strings of the instrument.

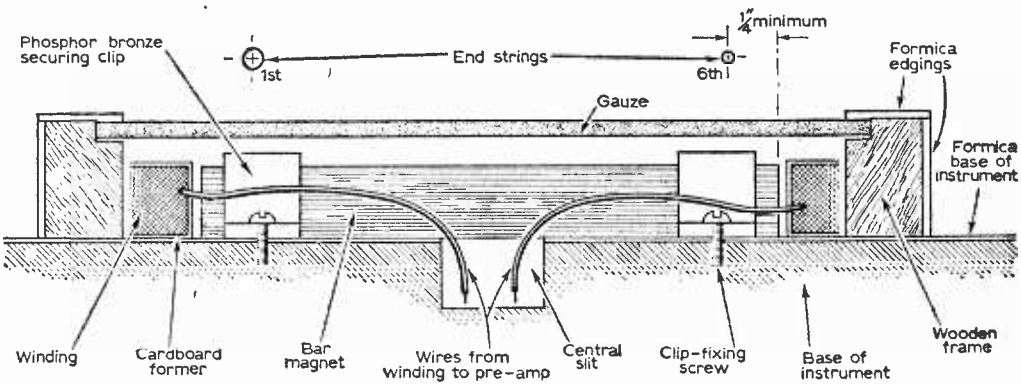
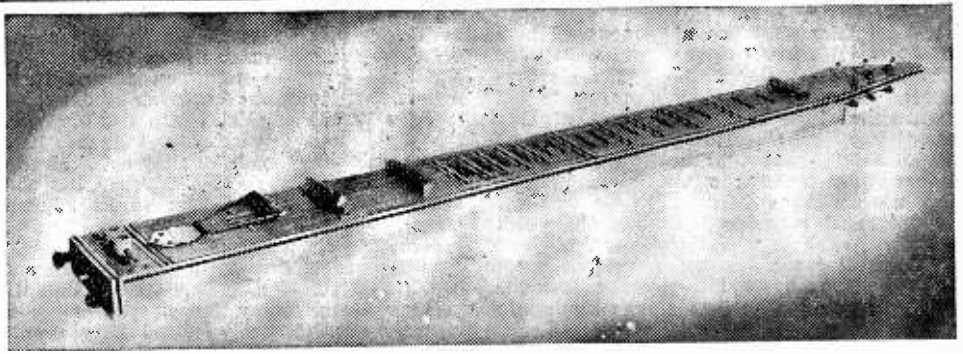


Fig. 13: A cross-sectional view of the complete pickup assembly.



The author's original instrument.

mark the frets as described in this article, and if they were stretched the whole width, this would cause a ribbed edge. Sometimes the steel is, when playing the end strings, actually tilted over and slid along the edge of the instrument. It will readily be seen what a hamper a ribbed edge would be and hence frets in this case have either to be countersunk or painted. Coloured tape is perhaps one easy solution.

The output from the internal preamplifier gives a reasonably high impedance output at around 600mV and is suitable for feeding either a valve or transistor amplifier.

The Strings

Steel Hawaiian guitar strings *must* be used for this instrument. There is a different set of strings for the Hawaiian guitar to the ordinary electric guitar, so make sure that you get the right ones. The reason for this is that on a Hawaiian guitar the strings are tuned differently to those on an ordinary guitar, those on a Hawaiian guitar being so tuned that a chord is obtained when the steel is straight across the strings. Suitable strings are: Cathedral Hawaiian guitar strings and will be obtainable through any music shop or, failing this, the British Music and Tennis Strings Ltd., London. Prices vary for different strings, ranging from 11d. for the first (treble) string to the sixth (bass) string at 2s. 4d. The most common tuning for the guitar from sixth string to first is:

E A E A C# E

and certainly the strings for this tuning are the easiest to come by.

Tuning

If a piano is available then this may be used to tune each string to its correct pitch. See that the strings go in in their right places. The largest, the sixth, a large wire-wound string, is closest to you, and they decrease in size, two more wire wound then three wires to the first. The usual tuning method with an ordinary guitar is with a pitch pipe, which consists of a metal tube which when blown emits the required note. A tuning fork is, of course, an alternative. A pitch pipe or fork for E, A and C# willl enable each string to be tuned, remembering that the different E's and A's are in different octaves. Three pitch pipes will serve for this or another alternative, though expensive (14s. 6d.), a chromatic pitch pipe, which is variable over all notes.

Tuning may be accomplished, however, with only one pitch pipe, tuning one string to this and the others to it. Here is how it is done and this tuning is in many ways preferable to other methods.

Start at either end, we shall start at the first string, which should be tuned to E, and adjust tension on its key until this string is tuned to E. A pitch pipe or tuning fork will give you this. The steel is not yet on the strings. When the first string has been tuned forget about pitch pipes, etc., and pick up the steel. Place the steel directly over the third fret so that it covers all the strings *except* the first and then tune the second string to the same note as that of the first. Hence the steel over the third fret on the C# string gives E. When the second string has been tuned place the steel over the fourth fret, covering all strings except the two previously tuned (cover sixth, fifth, fourth, third) and tune this string, the third, to the open second. Next place steel over the fifth fret, covering only untuned strings, and tune the fourth string to the open third. Then cover sixth and fifth strings with steel over seventh fret and tune fifth string to open fourth. Finally, steel just on sixth string above fifth fret, tune sixth string to open fifth. Fig. 9 on the Blueprint of last month summarises this.

Playing the Instrument

This is your problem! This article only intends to tell you how to make the instrument, not to play it. It is best to obtain a book if no tutor is available. Basically, however, the steel is slid up and down the strings, the fingers of the left hand trailing on the string *behind* it. Oscillating movements about one point cause a tremolo effect and striking a chord across whilst bringing the steel up towards the bridge causes the rising crescendo associated with this particular instrument. Unless the proper device, a plectrum, is used for plucking the strings, inferior results will be obtained. As mentioned before, it is common to use three of the type that push on two fingers and the thumb of the right hand, the thumb chiefly managing the

—continued on page 266

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DOUBLES, 42/6, PP1+PP1, PP9+PP9, PP11 (4+12). Same size as batteries.

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NEW MULLARD TRANSISTORS
Holders 1/3; OC71, 6/-; OC72, 7/6; OA210, 9/6; OC81, 7/6; AF115, 10/6; AF114, 11/-; OC44, 8/-; OC45, 8/-; OC171, 9/-; OC170, 8/6; AF117 9/6; OA81, 3/-; OC26, 12/6; BY100, 10/-. Min. Condensers 0.1 mFd., 30 v. 1/3; 1, 2, 4, 5, 8, 16, 25, 30, 50, 100, 500, 1,000 mFd., 15 volt, 2/6.

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Linear or Log Tracks Long spindles, Midget 5 K ohms to 2 Meg. L.S., 3/-. D.P. 4/6.
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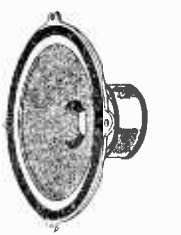

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WAVE-CHANGE SWITCHES. 2 p. 2-way or 2 p. 6-way; 3 p. 4-way or 1 p. 12-way; 4 p. 2-way or 4 p. 3-way, 3/6 ea., 8 p. 4-way, 2 wafer, 6/6.
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RESISTORS. Preferred values. 10 ohms to 10 meg. ¼ w., ½ w., 1 w., 20% 4d.; 1½ w., 8d.; 2 w., 1/-.
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MAINS DROPPERS Midget. With sliders. 0.3a 1 K., 0.2a., 1.2 K., 0.15 a., 1.5 K., 0.1a., 2 K., 6/- each. Line Cord 100 ohms ft. 3-way. 1/- ft.
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D3025 7.3 CT.1 Push-pull to 3 ohms output	11/-
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B.T.H. TAPE MOTORS 115 v. A.C. 28 w. 12/6 pair, for 200/250 v. (in series).

Blank Aluminium Chassis, 18 s.w.g. 4 sides, riveted corners, lattice fixing holes, 2½in. sides, 7 x 4in., 5/6; 9 x 7in. 6/6; 11 x 7in., 7/6; 13 x 9in., 9/6; 14 x 11in. 12/6; 15 x 14in., 15/-; 11 x 3in. 6/6.

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DIRECTION FINDER

—continued from page 216

Construction

The entire receiver must be completely screened and the original was built into a wood case lined with thin aluminium sheet. An aluminium front panel completes the screening but note that *magnetic metal of any kind must not be used for screening and this includes internal mounting screens and brackets, etc.*

The layout of the receiver is shown in Figs. 5 and 6 and calls for little explanation except that it should be followed as closely as possible. The assembly of the aerial tuning capacitor mounting and coupling is shown in Fig. 7. Note that the r.f./oscillator and aerial tuning capacitors have slow-motion ball drives.

The connections to the printed circuit board (PCB) C14 and C15 and point B are shown in Fig. 6. The remaining connections are (C) the junction of R1 (PCB) and R2 (PCB), (A) h.t. rail (negative) (PCB) and (D) h.t. positive rail (PCB).

The Telescopic Aerial and Compass

The telescopic aerial mounted at one end of the case is an optional fitting and is brought into circuit when the band switch is in position 2. The aerial is then connected to the ferrite aerial coil and can be used to increase the overall sensitivity, thus making it easier to find and tune a particular beacon. Once this is done the band switch must be set to position 3 (DF) and the telescopic aerial closed up. The ferrite aerial will then require slight retuning before taking a fix.

The position and mounting of the compass requires careful attention and must be at the end of the case opposite the loudspeaker. The position shown in the diagram was found satisfactory but it may be necessary to apply compass correction or to make a graph showing any errors introduced by the presence of the ferrite aerial rod and the loudspeaker magnet.

Next Month

The concluding part of this article deals with the operation of the receiver and includes further notes on calibration, etc.

A STEREO EXPERIMENT

—continued from page 229

hand corner with the cone facing into the corner and set the box so that the speaker is at the same height from the floor as the bass speaker. The treble unit stands on top of the middle unit facing the ceiling. The internal speakers of the v.h.f. set must, of course, be muted.

For purposes of setting up choose a concert of music with plenty of range—a Berlioz or Mahler symphony could hardly be bettered. By carefully adjusting your tone controls you can put your 'cellos and double basses to the right and the violins out on the left, and when solo voices or the piano join the concert they tend to be in the centre. I do emphasise the word " tend " because sopranos in particular sometimes give the impression of walking up and down whilst performing. In the event of disappointing results check your speaker impedances and phasing.

This is not, of course, stereophony, but until stereophonic broadcasts are with us it is a great improvement on simple monophony and will certainly stimulate the desire for the real thing. It is also not to be confused with high fidelity, a quality which is not obtainable as cheaply as this.

But in some applications, particularly in small rooms, it might be considered more practicable than high fidelity, since the problem of standing waves is less acute due, no doubt, to the wider distribution of sound. ■

10 + 10 STEREO AMPLIFIER

—continued from page 240

increase the margin of stability. The o/p transformer will therefore depend upon the critical and financial status of the individual constructor.

The other point the author would like to expand upon concerns the input sensitivity which, at 1·4V r.m.s., is not unduly high. The sensitivity can be increased to 700mV r.m.s. by decreasing the feedback by 6dB from the original 18dB, at which level the amplifiers are still singularly free from hum and noise, though it is inadvisable to decrease the feedback any further, since the hum and noise level rapidly deteriorates. Similarly the input level can be raised to 2·8V r.m.s. by increasing the feedback by 6dB to 24dB, though again it is inadvisable to alter the feedback any more, since one then runs the risk of instability.

THE RESULTS

It was Mrs. Beeton, I believe, who once said that the proof of the pudding was in the eating thereof. So with these amplifiers. In the author's living-room, which measures 26ft x 11ft 6in. x 8ft, it produces noises of a most pleasing nature. One has to be definitely anti-social before any traces of roughness can be detected and then only on sustained peaks. This is due to the regulation of the power supply allowing the h.t. voltage to drop and the author can, regretfully, suggest no simple cure for this short of stabilising the h.t. line, though this should not deter constructors who like their music at a more reasonable level, for the sound output will then depend on the ancillary equipment. If this is of a reasonably high quality satisfaction, in the words of the advertising fraternity, is assured. ■

CLUB NEWS

ACTON, BRENTFORD AND CHISWICK RADIO CLUB
Hon. Sec.: W. G. Dyer, G3GEH, 188 Gunnersbury Avenue, Acton, London, W.3.

At the meeting on 15th June, there will be a discussion on QSO's and QSL cards opened by G5ZA. This should be of interest to all those hoping to obtain an amateur licence.

Meetings are held at 66 High Road, Chiswick, London, W.4.

AMATEUR RADIO MOBILE SOCIETY
Hon. Editors: Maurice (G3NMR) and Sylvia Margolis, 95 Collinwood Gardens, Ilford, Essex.

On Saturday/Sunday, 22nd/23rd May, the Society held its 6th International Mobile Meeting at the US Air Force Base, Barford St. John, Oxon.

One of the main features of the event was the Trade Show, which is now the largest exhibition of amateur communications equipment outside London.

BASILDON AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: C. Robertson, G8AAO, Milestone Cottage, London Road, Wickford, Essex.

Members were entertained to a film show by courtesy of AEI Ltd., on 27th April, and a discussion was held on 17th May on the Club arrangements for the R.S.G.B. N.F.D.

The next meeting will be at the Van Gough on 15th June when a Ragchew will endeavour to answer members' queries.

The Club is trying to arrange for RAE classes to be held this winter and anyone interested should contact the Hon. Sec. at the above address.

COVENTRY AMATEUR RADIO SOCIETY
Hon. Sec.: A. J. Wilkes, G3PQQ, 141 Overslade Crescent, Coundon, Coventry.

At the meeting on 3rd May. Alan Wilkes, G3PQQ, gave a lecture entitled "Communications Receivers", and on the 10th May, G2ASF (Club callsign) had a night on the air.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: F. C. Ward, G2CVV, 5 Uplands Avenue, Littleover, Derby.

On 19th May there was a d.f. practice night with a social evening and ragchew for non-participants. The following week, J. Anthony, G3KQF, gave a talk on the Basic Principles of Television. On 2nd June there was a surplus sale and on 9th June, there will be a discussion on the preparations for National Field Day.

Meetings are held in Room No. 4, 119 Green Lane, Derby, and start at 7.30 p.m.

GUILDFORD AND DISTRICT RADIO CLUB
Hon. Sec.: N. Birch, G3KMO "Sorrento", White Lane, Ash Green, near Aldershot, Hants.

Recent meetings have included lectures on Aerial Systems by G2FXO and Early Radio Equipment by M. Child. Some Mullard films were also shown.

Meetings are held on the 2nd and 4th Friday of each month at the Model Engineering Club, Stoke Park, Guildford.

HALIFAX AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: J. Ingham, G3RMQ, Lambert House, Greetland, Halifax, Yorkshire

On 29th June, there will be a visit to the Royal Naval Volunteer Reserve Communications Centre, Manor Buildings, Manor Row, Bradford. Meet at the Beehive and Cross Keys Hotel at 7.30 p.m.

MID-WARWICKSHIRE AMATEUR RADIO SOCIETY
Hon. Sec.: H. C. Loxley, 51 Guy Street, Warwick.

At the meeting on 3rd May, the chairman announced that the new premises, 7 Regent Grove, Leamington Spa, would be officially opened by the Mayor of Leamington on Monday, 10th May.

The Club now has its own callsign and the official licence holder is "George" G3EHA.

NORTHERN HEIGHTS AMATEUR RADIO SOCIETY
Hon. Sec.: A. Robinson, G3MDW, Candy Cabin, Ogden, Halifax, Yorkshire.

On 26th May, the late G2SU's tape recording on Microphones was heard. On 9th June there will be a return visit to Manchester and District Radio Society.

OTLEY RADIO SOCIETY
Hon. Sec.: J. Millward, 15 Queens Place, Otley, Yorkshire.

This new Society holds weekly meetings on Tuesday evenings at 7.30 p.m. Morse classes are held during the evening and visits and lectures are still to be arranged.

READING AMATEUR RADIO CLUB
Hon. Sec.: N. C. Taylor, G3TOQ, 83 Stoneham Close, Tilehurst, Reading, Berkshire.

The next meeting will be held on 26th June when the evening will be devoted to the design and construction of v.h.f. and u.h.f. equipment. The first Mobile Picnic of the season will be held at the Childe Beale Trust Pavilion at Lower Basildon, near Pangbourne, Berkshire, on 20th June.

SLADE RADIO SOCIETY
Publicity Officer, R. L. Jenkins, 42 Warwick Road, Warley, Birmingham 32.

On 8th May, R. H. Edmuns gave a talk and demonstration on Designing an Electronic Organ, and members were invited to try their hand at being an organist.

At the meeting on 11th June, there will be a replay of the tapes sent by the Catalpa Amateur Radio Society of Birmingham, Michigan, U.S.A.

SOUTH BIRMINGHAM RADIO SOCIETY
Hon. Sec.: J. Rowley, G3TQO, 195 Castle Lane, Solihull.

The half-yearly Junk and Surplus Sale took place on 20th May. At the meeting on 17th June, there will be a demonstration and display of "Heathkit Products", including amateur transmitters, receivers and test gear.

AN ELECTRONIC HAWAIIAN GUITAR

—continued from page 262

sixth, fifth, fourth and third, leaving the second and first for the other two fingers.

Some Further Notes

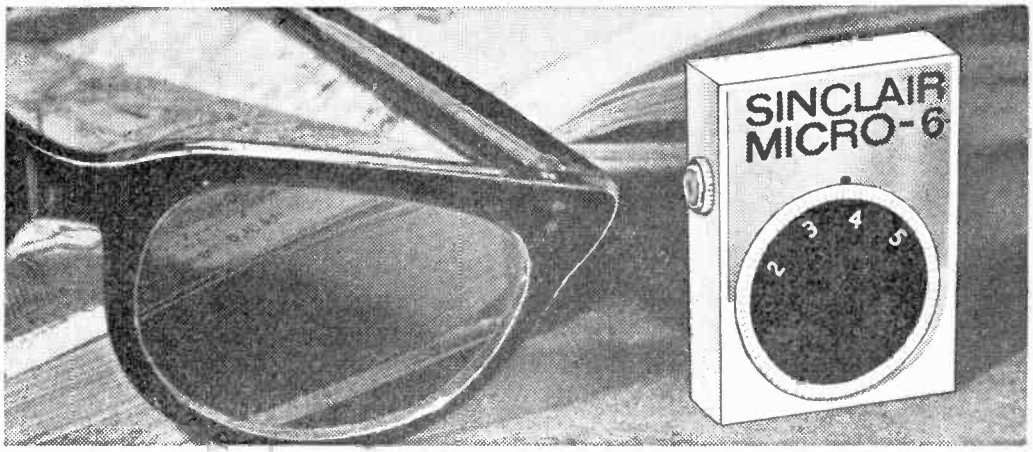
During the preparation of the Blueprint presented free with the June issue, on which the theoretical and physical details of the guitar were given, a few errors escaped notice and were unfortunately carried into print.

The transistor base diagram beneath Fig. 1 shows the leads labelled, left to right, c (collector), e (emitter), b (base), when for an OC71 the second two should be reversed (i.e. c, b, e).

On the other side Fig. 6 shows the "cut-out" to house the lower portion of the pick-up magnets in line with the bridge of Fig. 7 (point "B"). This is wrong. The 2½in. x ⅜in. cut-out should, of course, be in line with the pick-up (point "P.U."), 4¼in. up the body of the guitar. Naturally the channel which carries the leads from the pick-up to the preamplifier has to be extended by the same amount. The rectangular compartment for the preamplifier measures 3½in. x 2½in. (references in the text and on the drawing contradict these measurements slightly).

In the Components List the length of soft wood required is, of course, 4ft and not 4in. as stated, and likewise the amount of Formica should have been 4ft x 1ft and not as given. One item omitted from the Components List was "foam rubber" which is suitable for covering the base of the instrument to protect it and the player's knees. This may conveniently be stuck with Bostik, remembering to leave a rectangular gap for the battery compartment. ■

PERFECT FOR OUTDOOR DAYS



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- **SIZE $1^4/_5$ x $1^3/_{10}$ x $\frac{1}{2}$in.**
- **WEIGHT Less than 1 oz.**
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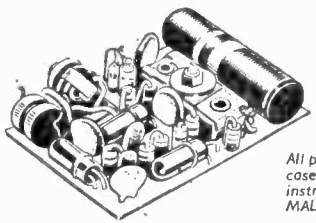

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"The Micro-6 is tremendous and all 7 local stations here in Melbourne are easy to tune. During daylight hours I also listen to 3GL (45 miles away). In the evening I have listened to 3BO (90 miles away) and best of all 2QN in N.S.W. (160 miles away). All these stations transmit on 2 kW. So naturally I wish to congratulate you on your excellent design."
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All parts inc. transistors, case, earpiece and instructions come to **59/6**
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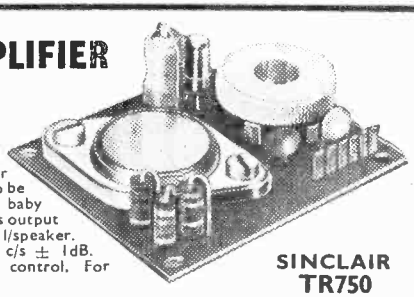

This highly original amplifier intended to make a powerful car, portable or domestic loudspeaker radio used with the Micro-6, can also be used for record reproduction, as a baby alarm, intercom, etc., 750 milliwatts output for feeding into a standard 2S-30Ω l/speaker. Input, 10mV. Response, 30-20,000 c/s ± 1dB. With built in switch and volume control. For 9V d.c. operation.

Parts and instructions **39/6** *Ready built and tested* **45/-**

SINCLAIR TR750 POWER AMPLIFIER

X-20

See next page

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New Principles New Power

The Sinclair X-20 uses a pulse repetition frequency between 65 to 75 kc/s., and has perfect square wave formation with constant amplitude at all times irrespective of the A.F. modulation. Special silicon epitaxial planar transistors with 60 Mc/s cut-off are used in the output stage. These have rise and fall times of less than 0.2 micro-seconds and ensure a fantastically high energy conversion factor of at least 95%. Barely a watt is dissipated in the output transistors with a 20 watt R.M.S. output. The complete linearity of the integrator together with the careful design of the modulator ensure absolutely negligible distortion right up to maximum output. Two negative feed back loops in the pre-amp define gain and maintain a completely flat response from 20 to 20,000 c/s. The amplifier is widely tolerant of the type of load to which it is connected. The manual supplied with every X-20 details a variety of tone, volume and equalisation circuits for adding to one X-20 in mono or two X-20's in stereo.

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"It is everything you claim it to be. It is so good that I can hardly believe it is true. Now I would like to order another one."
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"I must say that the amplifier certainly delighted myself and others with its beautiful crisp quality."
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"I congratulate you upon the remarkable standards achieved by your product the X-10 and also the clearness of the instructions upon how to construct this amazingly small amplifier."
P.E.T., Winsford, Cheshire.

All parts with X-20 manual come to **£7.19.6**

Ready built and tested **£9.19.6**

P.X-2 Power Supply Unit to drive one or two X-20's **£4.19.6**

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COMBINED P.W.M. AMPLIFIER & PRE-AMP

This superb P.W.M. assembly is ideal for more restricted listening conditions. The X-10 offers the same advantages and facilities as the X-20, but with 10 watts peak output, operating from 12 to 15V d.c. supply. It measures only 6 x 3in. complete. Tone and volume controls (mono or stereo) are added to choice. Thousands of X-10's have been built and are in regular use. Construction and installation could not be simpler.

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UNSURPASSED QUALITY

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$8\frac{1}{4}$" x $3\frac{1}{4}$" x 1"
WEIGHT
$4\frac{1}{2}$ ozs.

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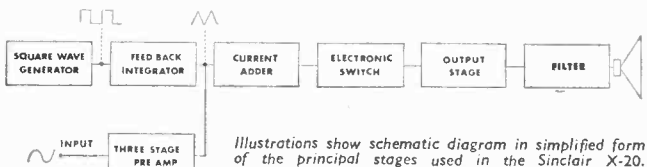
NEW PRINCIPLES—NEW POWER!



Illustrations show schematic diagram in simplified form of the principal stages used in the Sinclair X-20. It embodies the very latest in transistors and quality components.

BRIEF SPECIFICATION

- ★ Very easy to build and install
- ★ No. of transistors—12
- ★ Output transistors—Silicon epitaxial planars
- ★ Pulse repetition frequency—65 to 75 kc/s
- ★ Energy conversion factor at output—better than 95%
- ★ Frequency response—20 to 20,000 c/s ± 1 dB
- ★ Total harmonic distortion at 10 watts R.M.S.—0.1%
- ★ Input sensitivity—1 mV into 5-K ohms
- ★ Signal-to-noise ratio—better than 70dB
- ★ 20 watts R.M.S. music power or 15 watts R.M.S. continuous power into 7.5 ohms
- ★ 15 watts R.M.S. music power or 12 watts R.M.S. continuous power into 15 ohms
- ★ The pre-amp is designed for using with any type of pick-up, microphone, radio tuner, tape pre-amp, etc.
- ★ Built-in low pass filter cutting off above 20 Kc/s
- ★ Ideal for stereo and P.A.
- ★ Makes a superb guitar amplifier
- ★ Power required—36Vdc at 700mA

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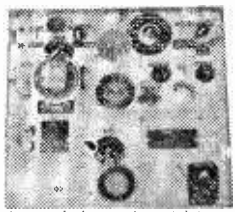

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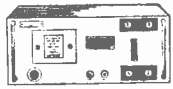

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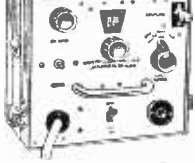

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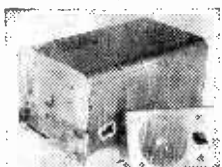

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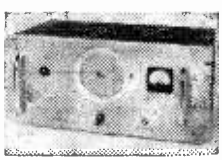

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DF33	7/6	EL41	7/-	UBF89	6/6
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DL33	6/9	KT41	6/6	UCL83	8/9
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DL92	4/3	PCC89	8/6	UF89	5/9
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EABC80	5/9	PCL83	8/11	X79	20/6

Postage on 1 valve 9d. extra. On 2 valves or more, postage 6d. per valve extra. Any parcel insured against damage in transit 6d. extra.
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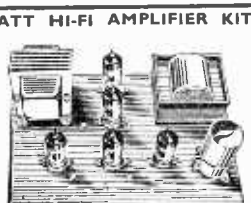
10/14 WATT HI-FI AMPLIFIER KIT



A stylish finished monaural amplifier with an output of 14 watts from 2 EL84's in push-pull Super reproduction of both music and speech with negligible hum. Separate inputs for mike and gram. allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3-15Ω speaker and independent volume controls and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84's ECC83 EF86 and EZ80 rectifier. Simple instruction booklet 1/6. (Free with parts).

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Also available ready built and tested complete with standard input sockets. **£8.15.0.** P. & P. 8/6.

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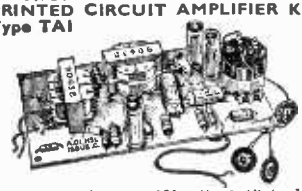

● Peak output in excess of 1½ watts. ● All standard British components. ● Built on printed circuit panel size 6 x 3in. ● Generous size Driver and Output Transformers. ● Output transformer tapped for 3 ohm and 15 ohm speakers. ● Transistors (GET114) or S1 Mullard OC81D and matched pair of OC81 o/p ● 9 volt operation. ● Everything supplied wire battery clips solder etc. ● Comprehensive easy to follow instruction and circuit diagram 1/6. (Free with Kit). All parts sold separately.

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B.S.R UA15 £6.19.6; B.S.R. UA16 £6.19.6

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SPECIAL OFFER !

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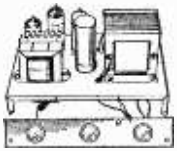
THE NEW HARVERSON KIT FOR THE HOME CONSTRUCTOR



A really excellent all purpose A.C. mains 200/240v. **AMPLIFIER KIT TYPE HSL 'FOUR' 3 VALVE. 4 WATT USING ECC83, EL84, EZ80, VALVES**

Special features include:

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ALSO AVAILABLE. Mounted on board with output transformer and 6in. speaker ready to fit into cabinet below. PRICE **89/6.** P. & P. 5/9

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Uncut motor board. Will take above amplifier and B.S.R. or GARRARD Autochanger or single Record Player Unit. Size 18 x 14 x 8¾in.

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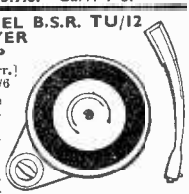
LATEST MODEL B.S.R. TU/12 4-SPEED PLAYER AND PICK-UP

ONLY **69/6** Carr. 5/6



7in. metal turntable Low flutter performance, 200/250 v. shaded pole motor with 90 v. tap for valve beaters. High gain crystal pick-up with turnover LP/78 head complete with sapphire stylii.

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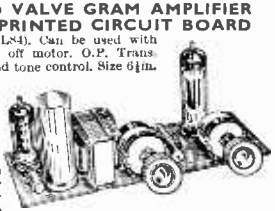

(UY85, UL84). Can be used with 80 v. tap off motor. O.P. Trans. volume and tone control. Size 6¼in. wide x 2in. deep x 3¼in. high overall. ONLY **39/6.** P. & P. 2/6. Mains dropper res. for filaments if required. **2/6** extra.

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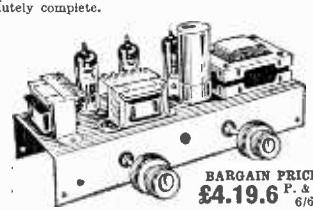

BARGAIN PRICE £4.19.6 P. & P. 6/6

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PRACTICAL WIRELESS, JULY, 1965

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