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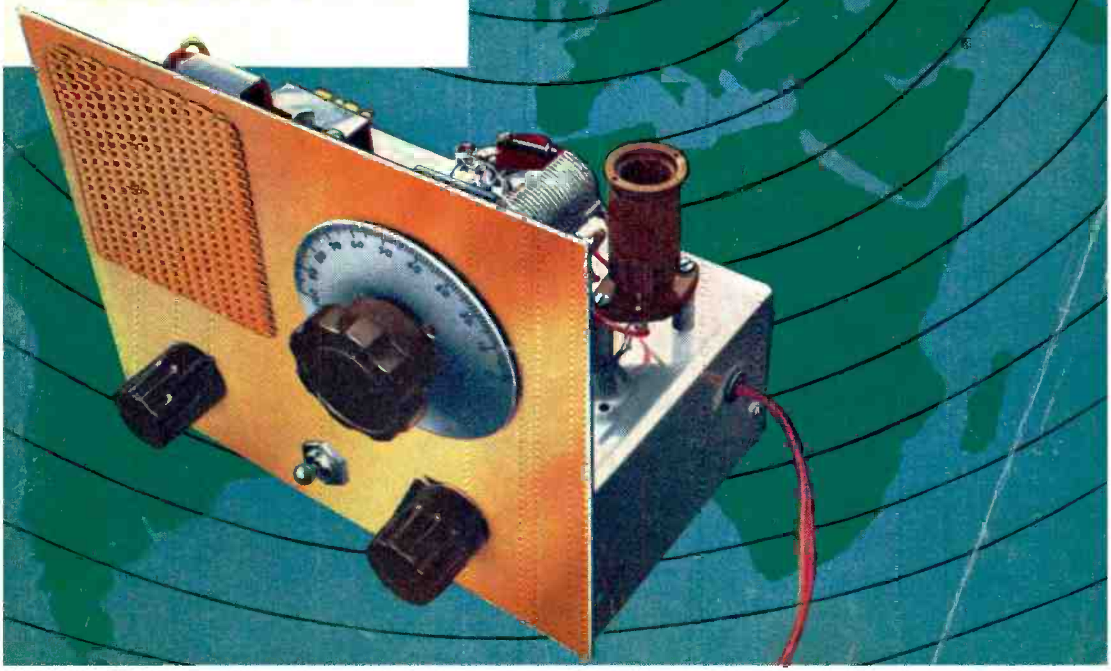

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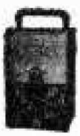

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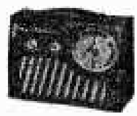

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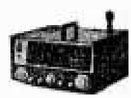

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The HA34 has been specially designed for us and our quantity order enables us to offer them complete with knobs, valves etc. wired and tested for only **£4.5.0** P. & P. 4/-.

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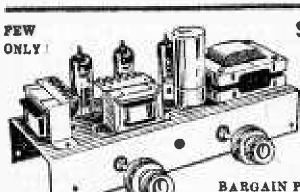

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Incorporating 2 ECL82s and 1 EZ80, heavy duty double wound mains transformer. Output 4 watts per channel. Full tone and volume controls. Absolutely complete.

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

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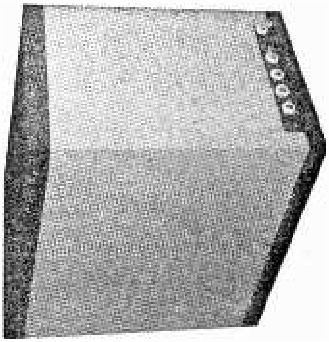
THE R.S.C. BASS-MAJOR 30 WATT GUITAR AMPLIFIER



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R.S.C. JUNIOR GUITAR AMPLIFIER 5-watt high quality output. Separate bass and treble "cut" and "boost" controls. Sensitivity 15 m.v. Two high impedance inputs. 10in. loudspeaker. Handsome, strongly made cabinet (size 14 x 14 x 7in. approx.) finished in attractive and durable polychrome. 200-250 A.C. mains operation. **£8.19.6** Or DEPOSIT £1 and 9 monthly payments of £1. Carr. 7/6.

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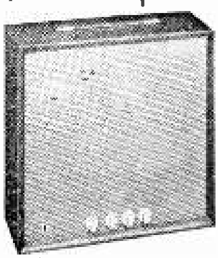

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A highly efficient unit incorporating a massive 15in. high flux loudspeaker specially constructed to withstand heaviest load conditions. Rating 25 watts. Individual bass and treble controls give ample "boost" and "cut". Two high impedance jack socket inputs are separately controlled. All controls are conveniently positioned in a recess on top of the cabinet. Cabinet is of substantial construction and attractively finished in two contrasting tones of Rexine and Vynair. Size approx. 24 x 21 x 13in. Operation from 200-250 v. 50 c.p.s. A.C. mains.
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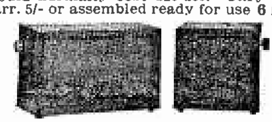

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R.S.C. (Manchester) Ltd. *MAIL ORDERS to 5 County Arcade, Leeds 1. Terms: C.W.O. or C.O.D. No C.O.D. under £1 Postage 2/9 extra under £2. 4/6 extra under £5. Trade Supplied. S.A.E. with all enquiries please*

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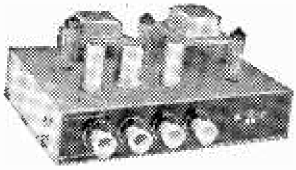
Incorporating the latest Collaro Studio Tape Transcriptor. The audiotrine High Quality Tape Amplifier with negative feedback equalisation for each of 3 speeds. High Flux P.M. Speaker, empty Tape Spool, a Reel of Best Quality Tape and a Handsome Portable carrying Cabinet with latest attractive two-tone polychrome finish, size 14¼ 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 £2.13.9** and 12 monthly payments of **44/-**. Cash price if settled in 3 months.

ONLY 3 PAIRS OF SOLDERED JOINTS PLUS MAINS

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., a in A.10 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 d.b. 30-30,000 c/s. Six negative feedback loops. Hum level 60 d.b. 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 300 v. 30 mA. and 6.3 v. 1.5 a. For supply of a **RADIO FEEDER UNIT.** Size approx. 12×9×7in. For A.C. mains 200-250v. 50 c.p.s. Output for 3 and 15 ohms speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Only **8 Gns.** Carr. 10/-
(Or factory built **51/-** extra.)
If required louvred metal cover with 2 carrying handles can be supplied for **18/9. TERMS ON ASSEMBLED UNITS. DEPOSIT 24/9** and 9 monthly payments of **24/9.** Send S.A.E. for illustrated leaflet detailing Cabinets, Speakers, Microphones, etc., with cash and credit terms.

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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 of "lift" and "cut". Provision is made for use as straight (monaural) 10-watt amplifier. Valve line-up ECC83, ECC83, EL84, EL84, EZ81. Outputs for 2-3 ohm speakers. Point-to-Point wiring diagrams and instructions supplied. Send S.A.E. for leaflet. **8 Gns.**
Full constructional details and price list 2/6. Carr. 10/-.
Kit can be supplied assembled ready to use for **59/6** extra.

HI-FI CRYSTAL PICK-UP HEADS. (Cartridges.) Acos Standard replacement for Garrard, B.S.R. and Collaro. **16/9.** Acos Stereo-Monaural **29/9.** Ronette Stereo-Monaural **59/6.** B.S.R. Stereo **39/9.**

BRADMATIC RECORDING HEADS. High Impedance Record/Playback **22/-.** Low Impedance Erase, **12/6.**

MARRIOTT RECORDING HEADS. High Impedance, Record/Playback **15/-.** Low Impedance, Erase, **10/-.**

PICK-UP ARMS. Complete and with latest Acos/hi-fi Turnover Cartridge **29/11.**

CRYSTAL MICROPHONES. Hand type NP110 **14/9**, R.T.C. **19/9**, Acos Mic 40 **25/9**, Acos Mic 45 **29/9**. Stick type Acos 39-1 **39/9**, BM3 with neck band and heavy table stand **59/9**. Lapel type **35/9.**

COLLARO JUNIOR 4-speed Single Player Unit and Crystal Pick-up with hi-fi Turnover head. Only **£3.19.6.**

B.S.R. UA14 4-sp'd AUTO-CHANGERS with hi-fi turnover head. **£6.19.6.** Carr. 4/6

GARRARD AUTO-SLIM 4-SPEED AUTO-CHANGER with high fidelity pick-up. Latest model. For 200-250 v. A.C. mains, **£7.19.6.** Carr. 4/6.

GARRARD AT6 AUTO-SLIM DE-LUXE 4-SPEED AUTOCHANGERS. Turnover GC8 head. for 200-250 v. A.C. mains, **£11.9.0.**

GL3A MINIATURE 2-3 WATT GRAM AMPLIFIER. For use with any single or auto-change unit. Output for 2-3 ohm speaker. For 200-250 v. A.C. mains. Size 11¾ x 2¾ x 2¾in. Controls: Vol. and Tone with Switch. Only **59/6.**

B.S.R. MONARDECK TAPEDECKS. Speed 3¾in. per sec. With high quality recording heads, **£6.19.6.** Carr. 5/-. Cabinets to take Deck and amplifier **39/6.**

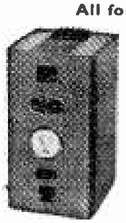
SENSATIONAL STEREO OFFER

A complete set of parts to construct of a good **(4 Gns.)** quality Stereo amplifier with an undistorted output total 6 watts. For A.C. mains input of 200-250 v. Sensitivity 130 m.v. Ganged Vol. and Tone Controls. Preset balance control. Full instructions and wiring diagrams supplied. Stereo Pick-up Head **19/9** extra with above only.

SOLDERING IRONS. 230-250 v. 30 watts. First quality. For Radio work. **18/9.** Spare elements and bits available.

R.S.C. BATTERY CHARGING EQUIPMENT

All for A.C. Mains 200-250v., 50 c/s. Guaranteed 12 months.



Assembled 4-5amps 6/12 v.
Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvred steel case with stoved blue hammer finished. Fused and ready for use with mains and output leads. **69/9** Carr. 5/-. Terms: Deposit **13/3** and 5 monthly payments **13/3**
6/12 v. 3a., all facilities as above. Only **59/9**, carr. 3/9.

ASSEMBLED
6/12 v. 2 amps. Fitted Ammeter and selector plug for 6 v. or 12 v. Louvred metal case finished attractive hammer blue. Fused, ready for use with mains and output leads.
49/9 Carr. 3/9
6/12v. 1 amp. 27/9 Less meter.

BATTERY CHARGER KITS
Consisting of Mains Transformer, F.W. Bridge, Metal Rectifier, well ventilated steel case. Fuses. Fuse-holders. Grommets, panels, Heavy Duty Clips, circuit. Carr. 3/6 extra.
6 v. or 12 v. 1 amp. 22/9
As above, with Ammeter 28/9
6 v. 2 amps. 19/9
6 v. or 12 v. 2 amps 25/9
6 v. or 12 v. 2 amps, inclusive of Ammeter 35/9
6 v. or 12 v. 4 amps......... 45/9
6 v. or 12 v. 4 amps. with Ammeter and variable charge rate selector 52/9

HEAVY DUTY CHARGER KIT. 6/12 v. 6 amps. variable output. Consisting of Mains Transformer 0-200-230-250 v.: F.W. (Bridge) Selenium Rectifier: Ammeter, Variable Charge Rate Selector Panels, Plugs, Fuses, Fuseholder and circuit, **59/9.** Carr. 4/6.

CHARGER AMMETERS
0-1.5 a., 0-3 a., 0-4 a., 0-7 a., 0-60 a., **8/11.**

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. 5v. 2a .. 18/9
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 25/9
300-0-300v. 130mA. 6.3v. 4a. 6.3v. 1a. for Mullard 510 Amplifier.. .. .. .. 29/9
300-0-300v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a 26/9
350-0-350v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a 26/9
350-0-350v. 150mA. 6.3v. 4a. 0-5-6.3v. 3a 29/9
425-0-425v. 200mA. 6.3v. 4a. 5v. 3a .. 49/9

FULLY SHROUDED UPRIGHT
250-0-250v. 60mA. 6.3v. 2a. 0-5-6.3 v. 2a. Midget type 2½ x 3 x 3in. 17/11
250-0-250v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a 27/9
300-0-300v. 100mA. 6.3v. 4 a. 5v. 3a 27/11
300-0-300v. 130mA. 6.3v. 4a. C.T. 6.3v. 1a. for Mullard Amplifier 33/9
350-0-350v. 100mA. 6.3v. 4a. 5v. 3a 27/11
350-0-350v. 150mA. 6.3v. 4a. 5v. 3a .. 35/9

FULLY SHROUDED (continued)—
425-0-425v. 200mA. 6.3v. 4a. C.T. 5v. 3a 55/-
425-0-425v. 200mA. 6.3v. 4a. C.T.. 6.3v. 4a. C.T.. 5v. 3a. 59/9
450-0-450v. 250mA. 6.3v. 4a. C.T. 5v. 3a 69/9

OUTPUT TRANSFORMERS
Midget Battery Pentode 66 : 1 for 3S4, etc. 4/6
Small Pentode, 5,000Ω to 3Ω 4/6
Small Pentode 7/8,000Ω to 3Ω .. 4/6
Standard Pentode 5,000Ω to 3Ω .. 5/9
Standard Pentode 7,000Ω to 3Ω .. 5/9
10,000Ω to 3Ω 5/9
Push-Pull 8 watts, EL84, or 6V6 to 3Ω or matched to 15Ω 9/9
Push-Pull 10-12 watts to match 6V6 or EL84 to 3-5-8 to 15Ω 19/9
Following types for 3 and 15Ω speakers:
Push-Pull 10-12 watts 6V6 or EL84 .. 18/9
Push-Pull 15-18 watts, 6L6, KT66 .. 22/9
Push-Pull Mullard 510 Ultra Linear .. 29/9
Push-Pull 20 watts, sectionally wound, 6L6, KT66, EL34, etc. .. 49/9

MIDGET MAINS Primaries 200-250 v.
50 c/s. 250 v. 60 mA. 6.3 v. 2a. 11/9
250-0-250 v. 60 mA. 6.3 v. 2a. .. 12/11
Both above size 2¾ x 2¾ x 2¼ins.

FILAMENT TRANSFORMERS
All with 200-250 v. 50 c/s. primaries 6.3 v. 1.5a, 5/9; 6.3 v. 2 a, 7/6; 0-4-6.3 v. 2a. 7/9; 12 v. 1 a, 7/11; 6.3 v. 3 a, 8/11; 6.3 v. 6 a, 17/6; 12 v. 1.5 a, twice, 17/6.

SMOOTHING CHOKES
150 mA. 7-10 H 250 ohms.. .. .. 11/9
100 mA. 10 H 200 ohms 8/9
80 mA. 10 H 350 ohms 5/9
60 mA. 10 H 400 ohms 4/11

CHARGER TRANSFORMERS
All with 200-230-250 v. c/s Primaries; 0-9-15 v. 1½ a, 12/9; 0-9-15 v. 2a. 14/9; 0-9-15v. 3 a., 16/9; 0-9-15 v. 5a., 19/9; 0-9-15 v. 6 a. 23/9; 0-9-15 v. 8 a. 28/9.

AUTO (Step up/Step down) TRANS. 0-110/120-230/250 v. 50-80 watts. 13/9; 250 watts, 39/9; 150 watts, 27/9.

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

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SETS OF VALVES

1R5, 1S5, 1T4, 3S4, 3V4... ... Set of 4, 19/-
DAF91, DF91, DK91, DL92, DL94 Set of 4, 19/-
DAF96, DF96, DK96, DL96 ... Set of 4, 26/6

SILICON RECTIFIERS

400 volts 350 mA ... ... 7/6 each

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MITCHAM · SURREY
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EABC80	5/6	PCC89	8/6	6K8	9/6
EAC91	4/-	PCF80	9/-	6L6	10/-
EB91	4/-	PCL82	9/-	6Q7	9/6
EBC33	4/6	PL84	8/6	6SL7	6/-
EBF89	8/-	UABC80	7/-	6SN7	5/6
ECC81	5/-	UBF89	7/6	6V6	8/6
ECC85	7/6	UF41	7/6	6X5	6/-
ECC91	3/-	UF89	6/6	8D3	4/-
ECH81	8/-	UL41	8/-	12AT7	5/-
EF39	4/-	UL84	7/-	12AH8	9/-
EF50	3/-	UY85	7/-	12BA6	7/6
EF80	5/-	W81	6/-	12BE6	7/6
EF85	5/-	5U4	4/-	12K7	5/-
EF91	4/-	6AQ5	6/6	12Q7	6/6
EL84	6/9	6BA6	6/-	807	6/-
EY86	7/-	6BE6	6/-		
OZ4	5/6	6D2	4/-		

Obsolete Valves a Speciality—Quotations by Return

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UF85	7/6	Y61	10/-	6AK5	5/-	6F26	13/6	6V6GT	8/-	12BA6	7/6	30C15	12/6
UF86	12/6	Y63	10/-	6AK8	7/6	6F33	5/6	6X4	4/6	12BE6	7/6	30F5	10/-
UF89	6/6	Z63	7/6	6AL5	4/-	6H6	2/-	6X5G	6/-	12BH7	10/-	30FL1	10/6
UL41	8/-	Z66	10/-	6AM5	5/-	6J5	5/6	6X5GT	8/6	12C8	8/6	30L1	8/6
UL44	20/-	Z77	4/-	6AM6	4/-	6J5G	4/6	6/30L2	10/-	12J5GT	4/-	30L15	11/6
UL46	14/6	Z152	5/-	6AQ5	6/6	6J5GT	5/-	7B5	12/6	12J7GT	8/6	(30P4)	18/-
UL84	6/6	ZD152	8/6	6AQ8	9/3	6J7	7/6	7B6	10/-	12K7GT	5/-	(30P19)	21/-
UL85	7/6	OZ4	5/-	6AT6	6/-	6J7G	5/-	7B7	8/6	12K8GT	10/-	30P12	10/-
UM80	10/6	1A7	11/-	6AU6	9/-	6J5GT	7/6	7C5	8/-	12Q7GT	6/6	30P16	9/-
URIC	15/-	1C5	10/-	6B7	8/6	6K7	7/6	7C6	8/6	12H6	5/-	30P19	17/6
UU5	10/-	1D5	8/6	6B8G	3/-	6K7G	2/-	7C7	8/-	12SA7	8/6	30PL1	15/-
UU6	17/6	1D6	10/-	6BA6	6/-	6K7GT	7/6	7D3	15/-	12SC7	8/6	30PL13	12/6
UU8	15/-	1H5	9/6	6BE6	6/-	6K8	9/6	7D5	15/-	12SG7	7/-	30PL14	16/6
UU9	7/6	1L4	5/-	6BG6G	15/-	6K8G	5/-	7D6	15/-	12SH7	8/-	35A5	15/-
UYIN	12/6	1LN5	4/6	6BH6	8/-	6K8GT	9/6	7D8	15/-	12SJ7	8/-	35L6GT	8/6
UY21	15/6	1N5	9/6	6BJ6	6/-	6K25	17/6	7H7	6/-	12SK7	6/-	35W4	7/6
UY41	7/6	1R5	6/-	6BQ7A	12/6	6L1	10/-	7K7	8/6	12SL7	8/-	35Z3	15/-
UY85	6/6	1S4	8/-	6BR7	10/6	6L6	7/6	7Q7	10/-	12SQ7	12/-	35Z4	7/6
VMS4B	12/6	1S5	5/6	6BS7	12/6	6L7	10/-	7R7	15/-	12SN7	10/-	35Z5	8/6
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VP4	15/-	1U5	5/9	6BW7	8/-	6L19	15/-	7Y4	6/6	12Z3	10/-	41STH.	22/6
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VP4B	15/-	2A3	10/-	6C4	3/6	6N7GT	9/6	9BW6	12/6	14H7	10/-	50C5	10/-
VP41	7/6	3A4	5/-	6C5G	6/6	6P25	10/6	10C1	12/6	14R7	10/-	50CD6G	27/6
VR105/30	7/-	3A5	10/6	6C5GT	8/-	6P28	12/6	10C2	17/6	14S7	16/-	50L6	8/6
VR150/30	7/-	3D6	10/-	6C6	6/6	6Q7	9/6	10C14	13/6	19AQ5	8/-	53KU	12/6
VU39	9/-	3Q4	8/-	6C9	12/6	6Q7G	6/6	10F1	10/-	19BG6G	15/-	75	8/-
VU111	2/6	3Q5	9/-	6CD6G	27/6	6Q7GT	8/6	10F3	12/6	20D1	10/-	78	7/6
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W76	5/-	5U4	4/-	6D2	4/-	6SF5	10/-	10LD11	15/-	20L1	22/6	85A2	12/6
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W81	6/-	5Y3	6/6	6E5	10/-	6SH7	6/-	10P13	15/-	20P3	24/-	305	13/-
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W107	11/-	5Y3GT	6/6	6F6	6/9	6SK7	5/6	10P18	15/-	20P5	20/-	807A	9/6
X41	22/6	5Z3	10/-	6F7	10/-	6SL7GT	6/-	11D3	23/6	25A6	8/-	7475	5/
X61M	10/-	5Z4	10/-	6F11	10/-	6SN7GT	5/6	11D5	23/6	25L6	8/-		
X65	12/6	5Z4G	9/6	6F12	4/-	6SQ7	8/6	12A6	6/6	25Y5	8/-		
X76	12/6	5Z4GT	12/6	6F13	10/-	6SR7	10/-	12AH8	9/-	25Y5G	8/-		

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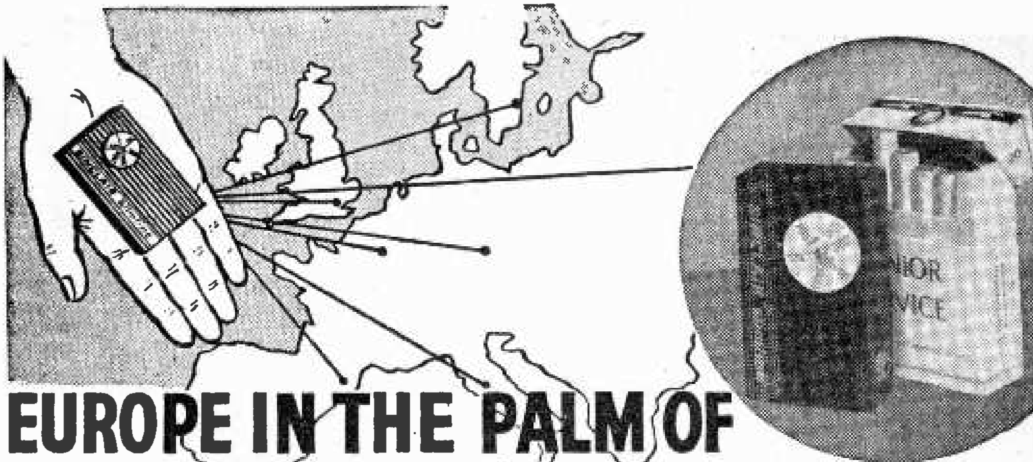

EUROPE IN THE PALM OF YOUR HAND with the wonderful *Sinclair Slimline*

MICRO-RADIO RECEIVER

and still they write!

With each post we get more and more constructors writing to us about the "Slimline". Here's a user who took his to Europe.

HOMER GREEN
BUCKS
6.9.63

Dear Sirs,
I took the "Slimline" to Paris and to Fuentarrabia near Irun in Northern Spain.
In Paris we received three French Stations and Radio Luxembourg at excellent strength.
In Fuenterrabia we could get a Spanish station, two or three French stations—and on one evening the LIGHT PROGRAMME nearly 900 miles away.
In San Sebastian which we visited one day, the local station was booming in. We are delighted with the present performance of the set. I would like a Sinclair Micro Amplifier and enclose cheque for 28/6.
With thanks,
Yours sincerely,
F.H.R. Aldred.

TAPE RECORDER USERS NOTE

The "Slimline" is unequalled as a radio jack and can be plugged into ANY tape recorder by substituting a plug and lead for the earpiece. Its power and sensitivity are ideal for this purpose.

NOW IS THE TIME TO BUILD YOUR SINCLAIR SLIMLINE.

Small enough to conceal in one hand, it gives choice of British and European programmes with staggeringly good quality and selectivity. Building is easy and interesting, and as well as providing superb listening through the earpiece, the "Slimline" makes a wonderful radio jack too.

- ★ **NEW** improved solid dielectric tuning capacitor
- ★ **FULL** coverage of medium waveband
- ★ **USES** Micro-Alloy Transistors throughout (MATs)
- ★ **EXTREMELY** robust construction
- ★ **TRUE** high-fidelity performance with quite incredible volume and quality of reproduction
- ★ **EXTREMELY SENSITIVE**—pulls in literally dozens of continental stations right across the band
- ★ **IDEAL** for use in car or train where tremendous volume is really valuable
- ★ **IDEAL** as a radio jack for tape recorders, etc.
- ★ **COMPLETELY** self contained; uses internal ferrite rod aerial and a PP5 battery
- ★ **ELEGANT** royal blue case with gold trim and calibrated dial

Size $2\frac{11}{16} \times 1\frac{11}{16} \times \frac{3}{8}$ in.
Comprises brand new sub-miniature components, printed circuit board, genuine MAT transistors, case, featherweight quality earpiece and well illustrated easily followed instructions.

TOTAL COST 49/6

FULL SERVICE FACILITIES ALWAYS AVAILABLE

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PM24A 5/-
PT15 10/-
PT25H 7/6
PX4 14/-
PX25 9/-
PY32 9/6
PY80 6/6
PY81 6/6
PY82 6/-
PY83 7/-
PY800 10/-
PZ1-35 9/-
PZ1-75 12/-
QP21 6/-
QP25 5/-
QS95/10 5/6
QS1202 8/-
QV04/7 7/-
R3 8/-
R3/10 2/-
REL21 25/-
RX235 10/-
SP2 3/6
SP41 2/-
SP61 2/-
SP210 3/6
STV280/40 12/6
STV280/80 50/-
SU2150A 4/9

T41 6/6
TP22 5/-
TP25 15/-
TT11 3/-
TT15 30/-
TTR31 60/-
TZ20 16/-
TZ05-20 4/-
U12/14 8/-
U17 5/-
U18 6/6
U25 10/-
U26 11/-
U27 8/-
U52 5/-
U801 20/-
YABC80 7/-
UBC41 7/-
UBF80 8/-
UBF89 7/6
UCH42 7/6
UCH81 8/-
UCL82 9/-
UCL83 11/-
UL41 7/-
UL84 7/-
UU9 5/6
UY41 6/-
UY85 6/-
V1507 5/-
V1924 18/-
V2023 13/6
VMP4G 12/-
VP23 3/-
VP133 10/-
VR99 8/-
VR105/30 5/6
VR150/30 5/-
VT4C 20/-
VU39 6/-
VX3256 4/-
W21 5/-
X66 7/6
Y63 5/-
Y65 4/-
Y66 8/-
Z800U 20/-
ZA1 8/-
1A3 3/-
1A5GT 5/-
1C5GT 7/-
1D8GT 6/-
1E7G 7/6
1F2 3/-
1G6GT 6/-
1L4 3/-
1LA6 6/-
1LC6 7/-
1LH4 4/-
1N43 4/-
1N70 4/-
1R4 5/6

1R5 6/-
1S4 5/-
1S5 5/6
1T4 3/-
2A3 5/-
2A5 6/-
2A6 7/-
2C26 3/-
2C26A 3/-
2C34 2/6
2C43 42/6
2C46 30/-
2C51 12/-
2D21 5/-
2D21W 8/6
2X2 3/-
3A4 4/-
3A/167/M 25/-
3B7 5/-
3B24 5/-
3B28 15/-
3E29 50/-
3Q4 6/-
3S4 5/-
3V4 6/-
5A173G 5/-
5A174G 5/-
5B/257M 19/-
5R4GY 9/-
5T4 8/-
5U4G 5/-
5X4G 8/6
5V4G 8/-
5Y3G 3/-
5Y3GT 6/-
5Y3WGTB 9/-
5Z4 8/6
5Z4G 7/-
6AB7 4/-
6AC7 3/-
6AG5 3/-
6AG7 6/-
6AH6 10/-
6AJ5 8/6
6AJ7 3/-
6AK5 5/-
6AK6 6/-
6AK7 6/-
6AL5W 7/-
6AM5 2/6
6AM6 4/-
6AQ5 7/-
6AQ5W 9/-
6AS6 4/-
6AS6W 9/-
6AT6 5/-
6AU6 7/-
6AX4 8/-
6B4G 8/-
6B7 5/-
6B8G 2/6

6BA6 5/6
6BE6 5/3
6BR7 12/-
6BW6 9/-
6C4 2/6
6C5G 4/-
6C6G 3/-
6C8G 3/-
6CH6 5/-
6D6 3/-
6E5 6/-
6F5G 5/3
6F5GT 5/9
6F6G 4/-
6F7 5/-
6F8G 5/-
6F12 4/6
6F13 5/-
6F32 4/-
6F33 3/6
6G6G 2/6
6H1 6/-
6H6M 1/6
6J4 9/-
6J4WA 10/-
6J5 3/6
6J5G 3/-
6J6 3/6
6J6W 6/-
6J7G 5/-
6K6GT 6/-
6K7G 2/-
6K7GT 4/9
6K8G 5/-
6K8GT 8/3
6K8M 8/6
6K25 12/-
6L5G 6/-
6L6 9/-
6L6GA 7/6
6L6G 6/-
6L7G 4/6
6L34 4/6
6LD20 5/9
6N7G 5/9
6N7 6/-
6Q7G 6/-
6R7 6/-
6SC7 5/6
6SC7GT 5/-
6SG7 5/-
6SH7 3/-
6SJ7 5/-
6SJ7GT 5/6
6SJ7Y 6/6
6SK7 4/6
6SL7GT 6/6
6SF5GT 5/6
6SN7 4/6
6SQ7 6/-
6SS7 2/-
6U4GT 9/6
6V6G 4/-
6V6GT 6/-

6VuM 8/-
6X4 5/-
6X5G 5/-
6X5GT 6/6
6Y6G 6/-
6-30L2 10/-
6Z4 5/-
7B7 7/6
7C5 7/-
7C6 7/-
7C7 5/-
7H7 7/3
7Q7 7/-
7V7 5/-
7Z4 4/6
8D2 2/6
9D2 3/-
11E3 17/6
12A6 2/6
12AH7 5/-
12AH8 11/-
12AT7 4/6
12AU6 9/-
12AU7 5/-
12AX7 5/6
12AY7 10/-
12BH7 7/6
12C8 3/-
12E1 17/-
12H6 2/-
12J5GT 2/6
12K7GT 4/6
12K8M 7/6
12Q7GT 4/6
12SA7 7/-
12SC7 4/-
12SG7 3/-
12SH7 3/-
12SJ7 5/-
12SK7GT 3/-
12SL7GT 5/9
12SN7GT 5/9
12SR7 5/-
12Y4 2/-
14L7 7/-
15D2 6/-
19G3 10/-
19G6 9/-
19H1 6/-
20A2 17/6
20P4 17/6
21B6 9/-
25L6GT 7/9
25Y5 8/-
30 5/-
30C15 10/-
30F5 8/6
30FL1 9/6
30P19 11/-
30PL1 10/6
30PL13 10/6
35L6GT 8/-
35T 17/6

35Z3 8/-
35Z4GT 6/-
37 4/-
38 4/-
41MP 4/-
53A 7/6
58 6/-
59 6/-
75 5/6
76 5/-
77 6/-
78 5/-
80 5/6
81 9/-
82 8/-
84 8/-
85A2 7/6
89 6/-
90C1 8/-
210VPT 7 pin 2/6
220PA 7/-
220TH 4/-
225DD 9/-
307A 5/6
350B 8/-
357A 70/-
368A 5/-
393A 15/-
446A 8/-
705A 15/-
715B 60/-
801 6/-
803 22/6
805 30/-
807BR 6/-
808 8/-
813 55/-
815 40/-
829A 30/-
829B 50/-
830B 4/-
832 15/-
837 9/-
843 5/-
866A 14/-
954 3/6
955 2/6
956 2/-
957 5/-
958A 4/-
1612 5/-
1616 3/-
1619 5/-
1625 6/-
1626 3/-
1629 4/6
2051 5/-
4043C 13/6
4063 8/-
5654 9/-
5663 9/-
5670 9/-
5704 9/-

5726 6/6
6058 7/-
6064 7/-
6065 6/-
6073 7/-
6120 4/-
6516 8/-
7193 1/9
7475 3/-
8013A 25/-
9001 3/-
9002 4/6
9003 6/-
9004 2/6
9006 2/6

C.R. Tubes

ACR8 20/-
CV955 15/-
CV1530 60/-
CV1596 (09J) 55/-
E4103/B/4 25/-
E4504/B/16 30/-
VCR97 28/-
VCR138 30/-
VCR139A 35/-
3FP7 25/-
5CP1 25/-
5FP7 45/-
5FP7A 25/-
7BP7 30/-
12DP7A 80/-

Photo Tubes

CMG8 9/-
GS16 12/6
931A 55/-
6097C 35/-

Special Valves

ACT6 £8
ACT25 £25
CV52 70/-
CV125 35/-
CV193 30/-
CV980 1/6
ESU77 £10
KR6/3 70/-
U15 25/-
1B24 25/-
3J/92/E £37/10/-
723A/B 50/-
725A 30/-
726A 27/6
4033L 20/-

***MANY OTHERS IN STOCK** include Cathode Ray Tubes and Special Valves.* U.K. orders below £1 P. & P. 1/-; over £1, 2/-; over £3, P. & P free C.O.D. 2/6 extra. Overseas Postage extra at cost.

MARCONI COMMUNICATION RECEIVERS. CR.150. Frequency coverage 2-60 Mc/s in 5 bands. Two IFs. 1st 1,600 kc/s, 2nd 463 kc/s. Image signal protecting over 40 dB up to 30 Mc/s and 20-40dB from 30-60 Mc/s. Self checking calibration (built in calibrator). Stabilisation of supply and temperature compensation. Electrical and mechanical bandspread. Metering and visual tuning indicator. Bandpass from 100 c/s to 10 kc/s in 5 stages. Acoustic filter associated with 100 c/s. Bandpass position for CW reception. Facilities for diversity reception. In as new guaranteed condition with original mains power supply unit **£70** or without power supply unit **£60.** Carriage 30/-.

P.C. RADIO's mains power supply unit for above, **90/-.**

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

P.C. RADIO'S mains power supply unit for above, **90/-.**

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

Individual frequency coils for above **£1** each set or set of 9 **£8.** Either model, carriage £1.10.0.

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

CHR HIGH RESISTANCE HEAD-PHONES. New, 16/-. P. & P. 1/6.

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

TWO IMPORTED RX's HIGH QUALITY COMMUNICATION RECEIVER, Type JR 101. 540 kc/s–30 Mc/s in 4 bands with bandspreads for 3.5, 7, 14, 21 and 29 Mc bands. A built-in "Q Multiplier" permits the selectivity to be raised to a very high value. Vertical "S" meter. Automatic interference suppressor. 220v A.C. Valves: 6BA6 (3); 6BE6 (2); 6AV6 (2); 6AQ5; 5Y3. Weight approx. 20 lbs. Meas.: 15 x 10 x 7in. Price **£60,** carriage free U.K.

COMMUNICATION RECEIVER Type SR 40. 540 Kc/s–31 Mc/s in 4 bands. Built-in 5in. loudspeaker, telescopic aerial for SW reception. Calibrated "S" meter, automatic interference limiter. BFO circuit. 220v A.C. Weight approx. 15 lbs. **£34,** carriage free U.K.

P. C. RADIO LTD

170 GOLDHAWK ROAD, W.12

Shepherd's Bush 4946

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

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

PANEL METERS

0-500μA 2½in. round D.C. ...	... 30/-
0-25mA 2½in. round D.C. ...	... 12/-
0-30mA 2½in. round D.C. ...	... 12/-
0-100mA 2in. square D.C. ...	... 9/-
0-100mA 2½in. round D.C....	... 10/-
0-150mA 2½in. round D.C....	... 10/-
0-200mA 2½in. round D.C....	... 10/-
0-250mA 2½in. round D.C....	... 10/-
0-300mA 2½in. round D.C....	... 10/-
0-500mA 2½in. round D.C....	... 10/-
150-0-1500mA 3½in. round ...	... 29/-
0-4amps Thermo 2½in. round	... 8/-
0-6amps Thermo 2½in. round	... 8/-
0-20amps Thermo 2½in. round	... 8/-
0-15 v. 2½in. round A.C. ...	... 17/6
0-20 v. 2½in. round A.C. ...	... 17/6
0-500 v. (Shunt) 2½in. round D.C....	20/-
0-600 v. 2½in. round D.C. ...	... 15/-
0-5KV electrostatic 3½in. round	... 85/-

Postage 2/- extra.

UNIVERSAL AVOMETERS

Guaranteed perfect working order. Supplied complete with leads, batteries and instructions.
Model "D" 34 range £8.19.6
Model "7" 50 range £11.0.0
Registered Post 5/- extra.

COSSOR 1035 DOUBLE OSCILLOSCOPES

Available in excellent condition, fully checked, £45 each. Carr. 30/-.

MICROAMMETERS

0–500 microamps. 2½in. circular flush panel mounting. Dials engraved 0-15, 0-600 volts. BRAND NEW. BOXED. 15/-. P. & P. 1/6.

230/250 VOLT A.C. MOTORS

4½ x 3in. dia. 90 watts, 5,000 r.p.m. ¼in. spindle. Brand New, 22/6 each. P. & P. 2/-.

FIELD STRENGTH METERS

Frequency coverage 1 to 250 Mc/s. Fitted with 200 microamp meter. Supplied with telescopic aerial, earpiece and instructions. 69/6 post paid.

FIELD TELEPHONES TYPE "F"

Suitable for many applications. Generator bell ringing. 2 line connection. With batteries and wooden carrying case, fully tested. £4.19.6 per pair. Carr. 5/-.

HEAVY DUTY AUTO TRANSFORMERS

0-115-230 volt step up or step down. Brand New. boxed. Ex U.S.A. 3,000 watt, £7.10.0, carr. 10/-. 7,500 watt, £15, carr. £1.

MINIFLUX TAPE HEADS

Set of three, record, playback, erase. Only 29/6 set. P. & P. 9d.

PANEL METERS

100µA	2½"	F.M.	D.C.	42/6
100µA	3½"	F.M.		62/6
1 mA	2½"	F.M.	D.C.	25/-
30 mA	2½"	F.M.	D.C.	12/6
30/0/30 mA	2½"	F.M.	D.C.	9/6
350 mA	2½"	F.M.	D.C.	10/6
15 amp.	3½"	F.M.	D.C.	39/6
5/0/5 amp.	3½"	F.M.	D.C.	25/-
300 v.	2½"	Proj.	A.C.	19/6
300 v.	2½"	F.M.	A.C.	25/-
500 v.	2½"	F.M.	A.C.	25/-
120 v.	3½"	F.M.	D.C.	32/6

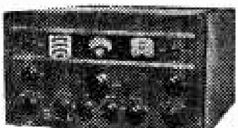
Postage extra.

SILICON RECTIFIERS

400V. p.i.v. 4.7 amp	7/6
200V. p.i.v. 6 amp	5/6
800V. p.i.v. 500 mA	5/6
400V. p.i.v. 500 mA	3/6
70V p.i.v. 1 amp.	3/6

OA 202 miniature silicon rectifiers 1/- each.
Discount for quantities.
Please add postage.

R.C.A. AR.88 D. RECEIVERS



New release, limited number available. Frequency coverage 550 Kc/s to 32 Mc/s on 6 bands. Operation 110/230 volts A.C. Offered in excellent used condition, fully checked and guaranteed perfect order. £45 each. Carr. £2.

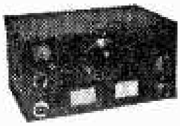
P.C.R.2 COMMUNICATION RECEIVERS

Excellent performance for modest outlay. Frequency coverage on three bands 800–2,000 metres, 190–550 metres, 6–22 Mc/s. Output for phone or speaker. Supplied in perfect condition £5.19.6 each. Carr. 10/-. The receiver can be supplied with an internal power supply to operate on 200/250 volt A.C. at 39/6 extra or plug in external power supplies are 35/- extra. Full circuit supplied.

AVO WIDE RANGE SIGNAL GENERATORS

Frequency coverage 50 Kc/s to 80 Mc/s in six turret operated ranges. For use on standard A.C. mains. Packed in original transit cases with accessories. Supplied in as new condition, fully checked before despatch. £15. Carriage 10/-.

NATIONAL H.R.O. RECEIVERS



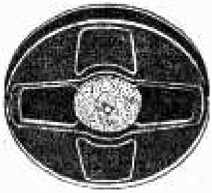
SENIOR MODEL. Supplied complete with full set of 9 coils covering 50 Kc/s. to 30 Mc/s. Each receiver thoroughly checked and available as follows:—
TABLE MODEL. As new condition £25.
TABLE MODEL. Good used condition £19.19.0
RACK MODEL. As new condition £22.10.0
RACK MODEL. Good used condition £18.18.0

NB—Rack model is identical to table model with extended front panel to fit a 19in. rack. Carriage £1 extra.
200/250 volt A.C. power supplies for all above receivers, also sold separately. 59/6, carr. 5/-.

HALLICRAFTER S-36 V.H.F. RECEIVERS

F.M./A.M. 27-143 Mc/s. 110 volt A.C. (transformer supplied for 230 v. A.C.) Improved version of S-27. Tested before despatch. Brand new boxed with instruction manual. **£40** each Carr. £2

LAFAYETTE BRAND TAPES



First grade quality, brand new guaranteed. Discounts for bulk purchases.

5in.	600ft.	std.	8/6
5in.	900ft.	L.P.	10/-
5in.	900ft.	L.P. 'Super Mylar'	12/6
5in.	1200ft.	D.P.	15/-
7in.	1200ft.	std.	12/6
7in.	1800ft.	L.P.	15/-
7in.	1800ft.	L.P. 'Super Mylar'	20/-
7in.	2400ft.	D.P.	25/-

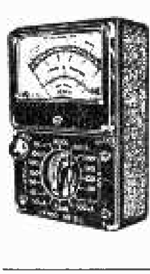
Post 2/-. Over £3 post paid.

MULTIMETERS BRAND NEW—FULLY GUARANTEED LOWEST EVER PRICES

Supplied with Leads, Batteries and Instructions.

1,000 Ω/VOLT
0/15/150/1,000 v. A.C. and D.C.
0/150 mA. D.C.
0/100 K Ω etc.
39/6. P. & P. 1/6.

20,000 Ω/VOLT
0/10/50/250/500/1,000 v. A.C. and D.C.
0/50µA/0/25/500 mA. D.C.
0/50K/500K/5 meg., etc. 97/6. P. & P. 2/6.



30,000 Ω/VOLT
0/½/1/10/50/250/500/1,000 v. D.C.
0/10/50/250/500 v. A.C.
0/50µA/0/10/250 mA. D.C.
0/10K/1 meg./10 meg., etc. £5.10.0. P.P. 2/6.

30,000 Ω/VOLT
0/½/1/2½/10/25/100/250/500/1,000 v. D.C. and A.C.
0/50µA/5/50/500 mA/0/12/ amp. D.C.
0/60K/6 meg./60 meg., etc. £8.17.6. Post paid.

50,000 Ω/VOLT
0/10/50/250/500/1 000 v. D.C. and A.C.
0/25µA/2.5/25/250mA. D.C.
0/10K/100K/1 meg./10 meg., etc. £7.10.0. P.P. 2/6.

100,000 Ω/VOLT
.5/2.5/10/50/250/500/1,000 v. D.C.
2.5/10/50/250/1,000 v. A.C.
10/25µA/2.5/25/250 mA/10 amp. D.C.
20K/200K/2 meg./20 meg. ohm, etc.
£6.19.6. Post paid.

MARCONI

CR 100/8 RECEIVERS BRAND NEW

Packed in original transit cases and complete with handbook/manual. 60 Kc/s to 30 Mc/s. 200/250 volt A.C. operation. Tested before despatch.

£35 Carriage £2.

A few CR.100 receivers available in good used condition, £21. Carr. 5/-.

COLLARO/MAGNAVOX STUDIO TAPE DECKS

Latest 1963 model. Fitted with latest bradmatic heads and interlock button. Brand new, guaranteed, with instructions and fixings, £10.10.0. Carr. 5/-.

MINE DETECTOR No. 4A

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

MODEL RX60 AMATEUR COMMUNICATION RECEIVER

Four bands, 550 Kc/s-30 Mc/s. Special features, S meter-anl-dfo-electrical band spread—internal 5 in. speaker—head set socket—cone control—standby switch—3 aerials, loop, wire, telescopic—200-250 volt. A.C. Brand new, guaranteed with manual £24.15.0 each. Post paid.

L.T. METAL RECTIFIERS

All full wave, bridge connected. Brand new.

12/18v. 1.5A.	3/9	24/36v. 6A.	27/6
12/18v. 2.5A.	6/3	24/36v. 15A.	45/-
12/18v. 4A.	8/6	36/48v. 2A.	19/6
12/18v. 6A.	12/3	36/48v. 4A.	29/6
12/18v. 10A.	22/6	36/48v. 6A.	32/6
12/18v. 15A.	37/6	48/60v. 2A.	21/-
24/36v. 1A.	7/3	48/60v. 10A.	82/6
24/36v. 2A.	13/6		

Please add postage.

L.T. TRANSFORMERS

All primaries tapped 200/250 volts
1 Battery Charging. 3.5, 9 or 17 volt, 1 amp., 9/9. Ditto 2 amp., 14/3. Ditto 4 amp., 16/6. 9 or 17 volt, 6 amp., 26/-.
2 Model Type 3, 4, 5, 6, 8, 10, 12, 15, 18, 20, 24 or 30 volt, 2 amp., 18/6. Ditto 4 amp., 30/-. Ditto 5 amp., 37/6. Add Postage.

FIELD TELEPHONES TYPE "L"

Generator bell ringing, two line connection. Supplied complete with batteries, ready for use, 69/6 per pair. Carriage 5/-.

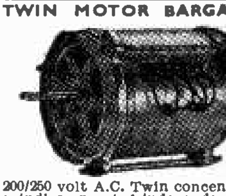
MINIATURE PANEL METERS

For 1½in. dia. panel hole.

0–50µA	39/6	0–1 mA	27/6
0–500µA	32/6	0–5 mA	27/6

0–300 v. D.C. 27/6
"S" meter 35/-

TWIN MOTOR BARGAIN



200/250 volt A.C. Twin concentric spindles operated independently. Either motor reversible, 1440 r.p.m. Brand New, Boxed. Only 12/6 each. P. & P. 2/6.

Hours of Business: **3 LISLE STREET, 9 a.m.—6 p.m. Half Day Saturday**
34 LISLE STREET, 9 a.m.—6 p.m. Half Day Thursday

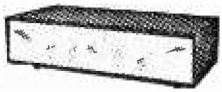
G.W. SMITH & CO (RADIO) LIMITED

Phone: GERRARD 8204/9155
Cables: SMITHEX LESQUARE
3-34 LISLE STREET, LONDON, W.C.2

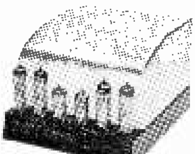
STERN-CLYNE

INTRODUCTION OFFER ! ! Available Shortly

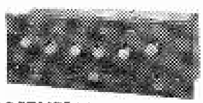
FOR ONLY **48 gns** Plus 15/- Pkg. & Carr.



THE TUDOR STEREO HI-FI SYSTEM, comprising a Self Powered AM/FM Tuner, Stereo Pre-amplifier, 12 watt per channel Stereo Power Amplifier. The Tuner and Pre-amplifier are housed in matching black crackle finish metal cabinets for shelf mounting, with silver metal dials and matching knobs. Specifications: **Tuner**—Outstanding quality providing full VHF/FM long and medium waveband coverage, frequency range FM 87.5-108.5 Mc/s, AM/MW 522-1630 Kc/s, LW 145-270 Kc/s, 100mV output, mains supply 105/240 AC. Valve line-up: ECC85, ECH81, EBF89, EF80, EB91, EM84, ECC83. Multiplex outlet provided. **Pre-Amplifier**—Designed for use with the Tudor Stereo Power Amplifier with inputs for most types of Pickups, direct play from Tape-Heads and ample sensitivity for either Crystal or Moving Coil Microphone. Distortion 0.1%, tape outputs 100mV from 90 K.ohm source, inputs—Microphone 5 mV, Tape 5.3 mV, R.I.A.A. 4.3 mV, flat 250 mV, Tuner 100 mV. Valve line-up: 2—EF86, 4—ECC83. **Power Amplifier**—14 watts per Channel, sensitivity 1 volt r.m.s. for 14 watts output, frequency response ± 0.5db 20 c/s.—20 Kc/s. Speaker impedance 4, 8 or 16 ohms, surplus power available for Tape Pre-Amp, mains supply 105/240 v. A.C. valve line-up, 2-ECC83, 4-EL84, 1-GZ34.



MULLARD 3-VALVE PRE-AMPLIFIER TONE CONTROL UNIT

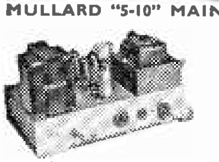


Designed mainly for Mullard Range of Amplifiers, also suitable for any Amplifiers requiring input up to 250mV. Incorporates 5 input Channels, including for Tape and Magnetic Pickups. Separate Bass and Treble controls. High pass filter 20 to 160 c/s. low pass filter 5-9 Kc/s. Totally enclosed in case size 11½" x 4½" x 4".

KIT OF PARTS **£10.0.0** (Carr. & Ins. 5/-). ASSEMBLED & TESTED **£13.13.0**

Instruction book and detailed price list available separately at 3/6 Post Free

MULLARD "5-10" MAIN AMPLIFIER



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

COMPLETE KIT (Parmeko Output Trans). **£10.0.0**

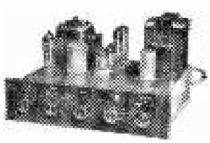
(Carr. & Ins. 6/6). ASSEMBLED AND TESTED **£13.10.0**

ABOVE incorporating PARTRIDGE OUTPUT TRANS. £1.6.0 **extra.**

Instruction book and detailed price list available separately at 2/- Post Free.

THE MULLARD 5-10RC AMPLIFIER

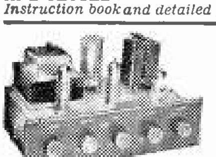
The popular complete "5-10" incorporating Passive Control Unit providing up to 10 watts high quality reproduction with input of 600 mV. Specified components and new MULLARD VALVES. Includes PARTRIDGE MAINS TRANSFORMERS and choice of PARMEKO or PARTRIDGE Output Transformers. Surplus Power available for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



COMPLETE KIT **£12.0.0**

ASSEMBLED AND TESTED **£16.0.0** (Carr. & Ins. 7/6). With PARTRIDGE OUTPUT TRANS. £1.6.0 ex.

Instruction book and detailed price list available separately at 2/- Post Free.



THE MULLARD 3-3RC

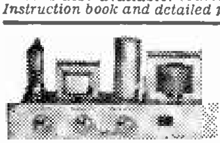
A HIGH QUALITY AMPLIFIER DEVELOPED FROM THE VERY POPULAR 3-WATT MULLARD "3-3" DESIGN.

KIT OF PARTS **£8.8.0**

ASSEMBLED AND TESTED **£11.10.0**

Complete to the MULLARD specification including PARMEKO OUTPUT TRANSFORMER. Switched inputs for 78 and L.P. records plus a Radio position. Extra power to drive a Radio Tuning Unit is also available. (Carr. & Ins. 6/6). Please state L.S. impedance.

Instruction book and detailed price list available separately at 2/- Post Free.



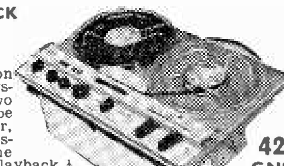
THE "MONO-GRAM"

A small Amplifier of genuine high quality performance. Incorporates MULLARD ECL86 Valve, separate BASS and TREBLE controls, PARTRIDGE output Transformer producing up to 3 watts undistorted output. (Carr. & Ins. 3/6).

Kit of Parts **£4.10.0** Assembled and Tested **£6.0.0**

Instruction book and detailed price list available separately at 2/6 Post Free.

STEREO TAPE DECK WITH BUILT IN PRE-AMPLIFIER



42 GNS. Carr. & Pkg. 15/-

A professional addition to your Hi-Hi Stereo System consisting of two basic Units, the Tape Deck and Pre-amplifier, which employs 4 Transistors and 4 Valves. The Unit will record and playback ¼ track stereo or ¼ track mono at either 7½ i.p.s. or 3¾ i.p.s. both speeds being fully equalised. Features: Track System: ¼ track 2 channel stereo or monaural record and playback. Independent single channel recording on either channel while playback on other channel. Head Type: ¼ track 2 channel in-line stereo and associated erase heads. Low loss laminated pole pieces. Level Indicators: 2 Meters, 1 per channel. Digital Counter: 3 digit tape position indicator. Automatic Stop: When tape runs out or breaks. Inputs: Microphone 1mV (50K. ohms impedance) Gram/Tuner 50mV (high impedance). Output: (cathode follower). Monitor Sockets: 2 x 5K. ohms impedance. Audio Output: 500mV. Oscillator: Pushpull 80kc. S/N Ratio: —45db or better at 7½" tape speed. Separation: 45db or more between stereo channels. Frequency Response: 40 to 15,000 cycles per sec. at 7½ i.p.s., 40 to 9,000 cycles per sec. at 3¾ i.p.s. Single Motor: 4 pole heavy duty induction type. Power Supply: 240v A.C. 50 cycles. Size: 6¼" x 10½" x 15". Tape Size: Up to 7". Line Up: 4-2SB173 Transistors, 2-12AT7, 1-12AU7, 1-12BH7 Valves.

MULLARD 2-VALVE PRE-AMPLIFIER TONE CONTROL UNIT

Employing two EF86 valves and design to operate with the Mullard AMPLIFIERS but also perfectly suitable for other makes with input up to 250 m/V.

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

KIT OF PARTS **£6.6.0** ASSEMBLED AND TESTED **£9.10.0** (Carr. & Ins. 5/-).

Instruction book and detailed price list available separately at 2/- post free.

PRICE REDUCTIONS

(a) THE KIT OF PARTS to build both the "5-10" **Amplifier** and the **2-Valve Pre-Amplifier**.... (Carr. & Ins. 8/6).	**£15.15.0**
(a) Assembled and Tested........................	**£21.10.0**
(b) THE KIT OF PARTS to build both the "5-10" **Amplifier** and the **3-Valve Pre-Amplifier**.... (Carr. & Ins. 10/-).	**£19.10.0**
(b) Assembled and Tested......................	**£25.10.0**
With PARTRIDGE OUTPUT TRANSFORMER	**£1.6.0 extra.**

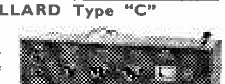
STEREO TAPE PRE-AMPLIFIER

MODEL STP-1. For use with current TRUVOX BRENELL, or COLLARO "STUDIO" ½ and ¼ track Stereo Decks. Incorporates Ferrox-cube Oscillator, 4 speed Equalisation Signal Level Meter and separate Gain Controls. Includes separate Power Unit.

KIT OF PARTS **£22.0.0** (Carr. & Ins. 8/6). ASSEMBLED **£28.0.0**

Instruction book and detailed price list available separately at 5/- Post Free.

TAPE PRE-AMPLIFIER MULLARD Type "C"



Suitable for most ¼ track, Mono Tape Decks. Incorporates Ferrox-cube Push-Pull Oscillator. Treble Inductor and 3-sp. Equalisation. Includes Separate Power Unit.

KIT OF PARTS **£14.0.0** (Carr. & Ins. 7/6). ASSEMBLED **£19.10.0**

Instruction book and detailed price list available separately at 3/6 Post Free.

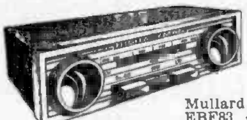
MULLARD TAPE AMPLIFIER

MODEL HF/TR3/MK. II Based on Mullard's Type "A" design and suitable for most ¼ track Mono Tape Decks. Incorporates Ferrox-cube Treble Inductor. Gilson Output Transformer, and 3-speed Equalisation. Includes separate Power Unit. using PARTRIDGE Mains Transformer.

KIT OF PARTS **£13.13.0** (Carr. & Ins. 7/6). ASSEMBLED **£19.0.0**

Instruction book and detailed price list available separately at 3/- Post Free.

NEW LOW PRICES — NOW YOU CAN AFFORD A CAR RADIO



THE "HIGHWAYMAN"

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

Look at these features: ★ Attractive styling. ★ Push-pull output. ★ Three latest Mullard transistors plus valves types EBF83 and ECH83. ★ No Buzz, high output and sensitivity. ★ Printed circuit (latest type). ★ 7 x 4 in. high flux p.m. speaker and baffle. ★ Medium and Long Waves. ★ Push button for fingertip control. ★ Extremely low battery consumption (less than ¼ amp). ★ Easy to fit any make car. (Positive earth only.) ★ 12-volt operation. ★ Compact size, measures only 7 x 7 x 2 in. deep. ★ Easy assembly, supplied with dial and drive already mounted.

Special inclusive price of ONLY **£7.19.6** Plus 4/- P. & P.

All parts available separately. Individually priced parts list and comprehensive instruction booklet 2/6 post free. (Deducted from cost if complete parcel purchased later.)

THE "TRAVLER" MkII

Introducing our new ready built transistorised car radio for ONLY **$9\frac{1}{2}$ Gns.** P. & P. 4/- including 7 x 4" speaker fitted to baffle, fixing brackets, filter unit, all nuts and bolts with fitting instructions.

Star Features: ★ Handsomely Styled ★ Mullard Valves and Transistors. ★ Push Buttons. ★ 1½ watts Output. ★ Long and Medium Wavebands. ★ Quality Speaker (E.M.I.). ★ Easily Fitted. ★ Radio Luxembourg (and many other foreign stations) 12 volt Positive Earth Only (applies to 99.8% of cars on the road). ★ Dimensions 7 x 2 x 7" depth.

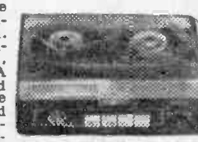
THE "AIR KING"

Our highly successful six-transistor luxury portable with the "SLIM Line" look. To build yourself, with printed circuit chassis for reliability and simplicity in construction. May be used as Car Radio, with full MEDIUM wave and LONG wave coverage.

Look at these features: ★ 500 milliwatt output to high flux 7 x 3½ in. high fidelity loudspeaker. ★ Six selected MULLARD TRANSISTORS in latest supersensitive circuit plus germanium diode. ★ Compact size only 9¼ x 3½ x 6¼ in. high. ★ Attractive three-tone cabinet, black, dark grey and silver grey with gilt control knobs and all gilt fittings. ★ Coax. socket for car aerial. ★ Brand new guaranteed components. ★ Push-pull output. ★ Automatic volume control. ★ Long-life battery. ★ Super-sensitive internal Ferrite rod aerial. Special inclusive price for all required components. ONLY **£7.19.6** (Plus P. & P. 4/-).

Alignment service available. Full assembly details and individually priced parts list, all of which are available separately, price 1/6 post free

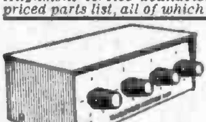
POCKET CORDER TRANSISTORISED RECORDER



Why be bothered with a notepad? Take Pocket Corder with you on those business trips, the mighty Midget is ideal. Simple to operate, a unique 4-way push-button Switch for record/playback, etc., ensures complete ease of handling. A remote Control Switch is also included for discreet recording, fully adjustable speed through the life of Batteries and the volume and tone from the 2½" internal speaker is outstanding. All accessories included such as Leather Case and Accessory Case, Remote Control switch and Crystal Earpiece. Tape, Batteries and Microphone, no other extras required. Up to 34 mins. recording time, operates on 1-9 volt PP3 and 2-1½ volt U12 Pen Batteries. Size 5½ x 4 x 2". Weight 24 ozs. PRICE **12 Gns.** P.&P. 4/-

THE MINICO JUNIOR TRANSISTORISED TAPE RECORDER

Record anywhere any time. A truly portable versatile Recorder with a difference, the highly sensitive Crystal Microphone is built into the Zip Carrying Strap which leaves both hands free to operate your Cine Camera, the Microphone can be removed for office use as a Dictating Machine or for Parties. Outstanding quality of reproduction and tone, up to 45 mins. playing time, twin track and operating on 4-1½ volt Half-Pen Batteries. Robust metal body, size 6½ x 4½ x 2½", weight 33 ozs. Usual price 16 gns. OUR PRICE **£6.19.6** P. & P. 4/- complete with Microphone, Tape and Battery.



TRANSISTORISED SOUND MIXER

Mixing 4 channels from high impedance source, giving professional results, inputs for high impedance Microphone, Tuner, Gram and/or Tape Recorder. Compact and beautifully styled, size 6" x 2½" x 2½". Standard Jack socket inputs.

PRICE **79/6** P. & P. 2/6. including PP3 battery circuit diagram and instructions.

THE HE30 4-BAND COMMUNICATION RECEIVER

Outstanding Bandspread Selectivity and sensitivity with a built-in Q-multiplier combine to make the HE30 one of the finest general coverage bandspread Receivers available at this price. Covering 550kc—1600kc, 4.8 mc — 14.5mc, 1.6mc — 4.8mc, 10.5mc—30mc. For amateur bands an illuminated slide rule dial is provided, calibrated every 5Kcs on 80 and 40 metres taking 16 revolutions of the bandspread dial to cover each of these bands, every 20Kcs on 20 and 15 metres and every 15Kcs on 10 metres plus an edgewise S-meter. For the SWL a 0-100 logging scale for instant reset plus coverage from 0.55–30Mcs. The 8 valve plus Rectifier superhet circuit provides an RF Stage with an Aerial Trimmer for peak performance plus 2 IF Stages for improved sensitivity of 1.0 microvolts for 10db S/N ratio. The B.F.O. variable pitch control can be used to separate CW stations whilst the Q-multiplier adds the selectivity needed for crowded phone band operation. Controls: Function Switch, Audio Gain, Selectivity (Q-multiplier) Frequency (BFO). Band Selector, IF Gain, Trimmer, AVC-MVC Switch, Anl Switch, Main Tuning, Bandspread Tuning and Headphone Jack. Selectivity—60db at 10Kc, 0.8Kc at 6db (with Q-Multiplier) IF-455Kcs. External PM Speaker reqd., 4 or 8 ohms impedance. Output 1.5 watts. 8 modern Miniature B7G Base Valves and 5Y3 Rectifier. Size 15 x 10 x 7½in. Grey crackle finish. Full instructions and circuit diagram supplied. PRICE **40 Gns.** Carr. & Pkg. 15/-.

THE HE-40 4-BAND COMMUNICATION RECEIVER

Completely built and ready to go. Not a Kit. High sensitivity Superheterodyne receiver covering 550 Kc/s —1,500 Kc/s, 1.6 Mc/s—4.4 Mc/s, 4.4 Mc/s—11 Mc/s, 11 Mc/s—30 Mc/s. Covers all amateur, Government aircraft and broadcast stations between 550 Kc/s and 30 Mc/s. Electrical bandspread tuning. Slide rule type tuning dial giving accurate logging of stations. Internal ferrite rod aerial for medium waveband reception and a 59 in. 10 section chromium plated telescopic whip aerial for the short wave bands. Sockets for optional outdoor aerial. Internal high flux monitor loudspeaker. Latest modern miniature B7G base valves. High Q coils and I.F. transformers. Headphone socket (may also be used for external loudspeaker). Automatic noise limiter (ANL) for reduction of external interference. Beat frequency oscillator (BFO) for reception of CW (morse) signals. Receive/Stand-by switch. Signal strength meter calibrated in "S" units and reads to S9+10db. 220/240 volt A.C. mains, 50-60 cycle operation. Handsomely styled cabinet with grey crackle finish and handsome front panel, with chrome and satin chrome fittings. Measures 13½ in. x 8½ in. x 5½ in. (high) and weighs only 11½ lbs. A comprehensive instruction manual is supplied. An ideal receiver for the radio amateur and short wave listeners of all ages. Come and hear this wonderful receiver at any of our many branches. PRICE **£24.15.0** Carr. & Pkg. 12/6.

The NEW CHASSIS PUNCH SET

Five of the most used Hole Punches made of the finest hardened steel will save hours of tedious hand labour, suitable for Aluminium, Sheet Metal, Plastic, etc. Punch Sizes ½"-⅝"-¾"-1"-1½" complete with Tommy Bar, Tapered Reamer, and Zip Fastening Carrying Case. PRICE **49/6** P.&P. 3/6

HI-FI STEREO HEADPHONES

For the connoisseur who requires perfection. Each Earphone consists of a 2½" Dynamic Loudspeaker with a full frequency range, fitted with foam rubber Ear Pads for added comfort to keep out noise and to maintain an excellent bass response. The resistance Junction box with change-over switch provides simple transfer from Phones to Speaker. Specifications: Frequency Range—25-15,000 c.p.s. Input Impedance—16 ohms. Power Rating—½ watt. Weight—13 ozs. PRICE **5 Gns.** P. & P. 2/6. (Junction box 15/- ex.)

SPECIAL PURCHASE! THE SHURE MODEL M3D

Professional Dynetic Stereo Cartridge with diamond Stylus, the Shure Dynetic Moving Magnet System combines the most faithful and distortion-free reproduction with complete reliability. Specifications: Diamond Stylus 0.7 thou. Load imp. 470K ohms. Output 5mV. Range 20-15,000 c/s ± 3db. Stylus pressure 3-4 grammes. PRICE **12 Gns**

Great Britain's Greatest Electronic Hobbies Organisation

SEE PAGE 589 FOR ADDRESSES OF STERN-CLYNE BRANCHES

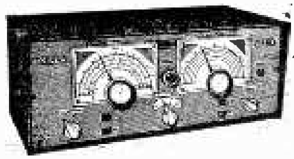
TOP QUALITY—LOW COST CRC AMATEUR RADIO EQUIPMENT

BUILD YOUR SHORT WAVE LISTENING STATION WITH CODAR-KITS.

CR 66 COMMUNICATIONS RECEIVER

THE FINEST SUPERHET KIT EVER OFFERED

★



Frequency Range 540 Kc/s to 30 Mc/s in four Band-switched ranges.

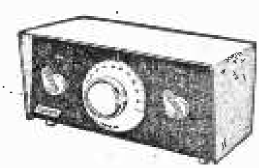
Electrical Bandspread. Coil Unit wired ready and I.F. Transformers factory aligned, no test equipment required. Temperature compensated trimmers. Regenerative I.F. stage for maximum gain and B.F.O. Panel aerial trimmer, separate speaker switch, 3 watts output for external 2-3 ohm speaker. Separate cathode follower for tape recording etc. Valve line-up—ECH81, EBF89, ECC81, EL84, EZ80, EM84. (Optional extra). For 200-250 volt, A.C. Cabinet size 16 x 6¼ x 8¾in.
Complete Kit with 17-page Instruction Manual Carriage 6/-. **£18.5.0**

Tuning indicator parts with EM84 17/6.

H.P. TERMS AVAILABLE ON REQUEST.

★ P.R. 30 R.F. PRESELECTOR ★

Frequency range 1.5-30 Mc/s. Substantially improves the performance of any superhet receiver.



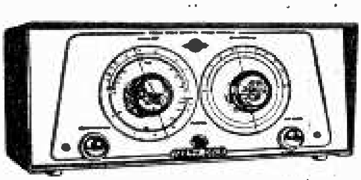
G4HZ writes ". . . *I am delighted with it, it improves my Eddystone 640 in all respects. The difference with the Preselector is fantastic, a weak signal on 15 metres about S2 changed to S8. On the L.F. Bands, unwanted noise and mush is cut out.*
G3RIA writes . . . *The results in conjunction with my Eddystone 888 are amazing. Signals are twice as strong with much higher signal/noise ratio. A first class product well worth the money.*
The P.R.30 uses EF 183 Frame Grid R.F. Amplifier and provides up to 20 dB gain. Features include vernier tuning, gain control, selector switch for either dipole or end fed antenna. External power supplies (obtainable from Rx). Smart styling in grey and black. Complete, ready for use, with all plugs, cables.
Now available in two Models.

P.R.30 for external power supplies 180-250 volts H.T., 6.3 volts .3 amp. L.T. (obtainable from receiver). **£4.17.6** Carr. 3/6.

P.R.30X self powered with internal power supply for 200-250 volt A.C. Will provide 200 volts up to 25 M/a. and 6.3 volts 1 amp. for other accessories. **£7.2.0** Carr. 3/6.

THE NEW CR 45 MAINS T.R.F. SHORT WAVE RECEIVER

World wide short wave reception, North/South America, India, Russia, Far East, Australia, amateurs, shipping, etc.



- ★ **Separate electrical bandspread.**
- ★ **Three slow motion vernier drives.**
- ★ **Low loss polystyrene plug-in coils, factory aligned.**
- ★ **Dials calibrated in frequencies and degrees.**
- ★ **Power output 3 watts for 2/3 ohm speaker.**
- ★ **Valve line-up: ECC81/EL84/EZ80.**
- ★ **Front Panel Silver and Black, control knobs Grey.**
- ★ **Provision for panel phone jack.**

Superb modern styling and Top quality components throughout. Complete CR 45 CODAR-KIT, with valves and 3 Coils, 10-28, 25-75, 60-176 metres. Instruction Manual 11 pages, less Cabinet **£7.5.0** Carr. 4/6.

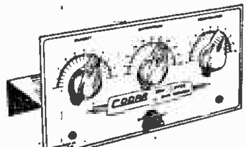
CR 45 Cabinet Silver Grey 12 x 5¼ x 7in. with sliding door for easy coil changing and detachable louvred rear panel **28/6**

Extra coils 4/9 each. All parts can be purchased separately. Instructional Manual only 4/- post free.

★ THE MINI-CLIPPER ★

36/6

- ★ **Miniature 1 valve short wave receiver.**
- ★ **Low loss polystyrene plug-in coils, factory aligned.**
- ★ **Air spaced ball bearing condensers.**
- ★ **Provision to add two-transistor amplifier.**
- ★ **Battery lasts months.**

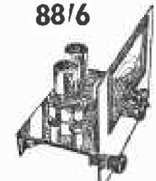


Can be built in one evening, ready to switch on, to bring the fascination of Short Wave listening at very low cost. Complete MINI-CLIPPER CODAR-KIT, valve, and one coil 25-75 metres, Instruction Manual 4 pages, 37/6, carr. 2/6. Extra Coils 4/9 each. Electrical Bandspread available. Instruction Manual only 2/-, post free.

★ THE SUPER CLIPPER ★

88/6

- ★ **Peak Performance short wave battery receiver.**
- ★ **Large precision dial, dual slow motion drives.**
- ★ **Bandspread on all Bands.**
- ★ **High gain valve/transistor hybrid circuit.**
- ★ **2 Mullard transistor amplifiers, pre-assembled and tested.**
- ★ **Low loss polystyrene plug-in coils, factory aligned.**
- ★ **Batteries last months.**



Easy to assemble, this famous Short Wave Receiver brings a new world of listening pleasure to your finger tips. Complete SUPER-CLIPPER CODAR-KIT, valve, transistors, 2 Coils 20-60, 55-180 metres, Instruction Manual 7 pages, 88/6, carr. 2/6. Front Panel, Silver Grey, 10 x 7¼in. 6/9 extra if required. Extra Coils 4/9 each.

CODAR-KITS are famous for PEAK PERFORMANCE, EASY TO FOLLOW INSTRUCTIONS, CLEAR PICTORIAL DIAGRAMS. Some of the Top Quality names who supply material for CODAR-KITS . . . MULLARD, BRIMAR, JACKSON, DENCO, ELECTRONIQUES, THORN A.E.I. etc. etc. . . only the best is good enough for the high CODAR standards which make complete success certain. 6d. in stamps brings illustrated leaflets.

CODAR RADIO COMPANY

BANK HOUSE, SOUTHWICK SQUARE, SOUTHWICK, SUSSEX

G3IRE Canadian Distributors: JAYCO ELECTRONICS, TWEED, ONT. G3IPA

Practical Wireless

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Contents

The Show That Never Was

IN the absence of the customary Radio Show at Earls Court this year, many companies in the radio/TV industry held their own private exhibitions for the trade, primarily retailers and wholesalers. This resulted in the extraordinary situation of something like 30 separate shows of varying size, scattered mainly around the Central London area.

The formidable task of "doing the rounds" was somewhat alleviated by the sheer novelty and by the exotic experience of visiting a galaxy of plushy suites in such buildings as the London Hilton, the Carlton Tower, the Savoy, the Mayfair, the Cafe Royal, etc. This was certainly a contrast to the rather stolid utilitarian exhibition buildings at Earls Court which even the most colourful displays never seem to completely disguise.

It was quickly obvious from a grand tour of the individual shows that the trade was turning out in force, and organisers expressed delight (and some surprise) that attendance was so far in excess of expectations.

The manufacturers were also pleased that the overall cost of mounting their exhibitions was considerably lower than that necessary for a normal Radio Show, with the added advantage of more comfortable surroundings, more space and much greater facilities.

So, from the industry's point of view, the experiment was successful on several counts: costs down, order books full, a more comfortable and a shorter show. But what of the public, who were denied their annual exhibition this year?

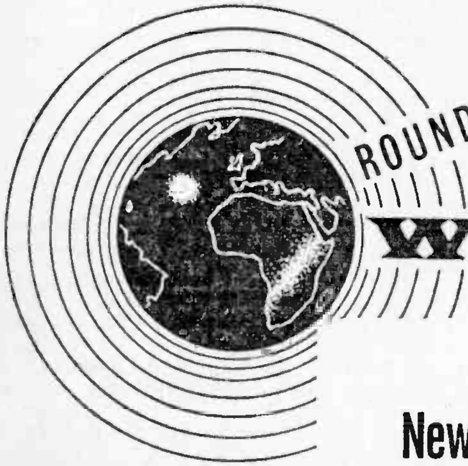
Some manufacturers consider that the impact of the public at the Radio Show on sales is small. They reason that since most prospective purchasers are content to be guided by the advice of their local dealers in the choice of a new set, the main task is to get the products into the dealers' shops. The projection of any "image" or the creation of public demand can best be achieved by planned advertising campaigns.

There is, of course, more than a grain of truth in this and it is probably true to say that only a fraction of the expense involved in exhibiting at the Radio Show is ever offset by sales resulting directly from any demand created at that Show.

And herein, of course, lies the dilemma which caused the cancellation of the Radio Show this year. There has been for years a strong case for a short period trade-only show, with perhaps a different exhibition aimed directly at the public. But it is obvious that here again we are in deep water.

No doubt the industry and the exhibition organisers have already given this problem much thought and will continue to do so. The Radio Show is being resumed again next year under one roof and we hope that in everybody's interest a formula will be found to reconcile the requirements of both trade visitors and the general public. In any event, we shall almost certainly see some changes in the 1964 Radio Show.

Our next issue dated December will be published on November 7th



ROUND THE WORLD of WIRELESS

NEWS AT HOME AND ABROAD

Electrical Engineers Exhibition

AFTER having taken and allocated all available floor space at Earls Court, London, for the Electrical Engineers Exhibition, the organisers have had to partially replan the layout to accommodate extra stands since the demand for exhibiting space has been so great.

To be held from 18th to 25th March, 1964, it will be the only exhibition of its kind in the world that year and, along with the increased number of British exhibitors, many European and other overseas countries will be represented, including 12 from Germany.

TRANSISTORS FROM SOUTH AFRICA

ALREADY South Africa's leading manufacturer of long distance telephone transmission equipment, Standard Telephones and Cables (Pty) S.A. Limited (a subsidiary of the British Firm) will commence manufacture of silicon epitaxial planar transistors at its factory at Boksburg, near Johannesburg, next year.

An agreement between the Boksburg company and the South African government has been reached for the local manufacture of these components, now that the establishment of a South African plant is justified.

New Name for First Radio Firm

ON July 20th, 1897, the "Wireless Telegraph and Signal Company Limited" was officially registered in London as a limited company; total assets £100,000. On the board of directors of this new company was one Guglielmo Marconi—famous pioneer of wireless transmission. In March, 1900, the name of the company was changed—by general consent of the shareholders—to "Marconi's Wireless Telegraph Company Limited".

This, then, became the title under which the world's first wireless manufacturing company was to advance, in the first sixty-odd years of the twentieth century, from a relatively small £100,000 firm exploiting Guglielmo Marconi's patented methods of wireless transmission, to the international organisation it is today, selling electronic equipment to practically every country in the world.

Now, sixty-six years after the company's inception, the name has once again been changed, the widening scope of the products being produced rendering its former title obsolete. The name of the firm's prime mover will not be forgotten, however, when new equipment manufactured under the new title of "The Marconi Company Limited" reaches its customers the world over.

Congress Tapes

AT one of the largest inter national congresses ever hel in the U.K., the Tannoy group o companies made use of four ne RE 301 professional tape reco ders, recently purchased fro EMI Electronics Limited. Thirty three hours of the congress we recorded on these machines a the Royal Albert Hall, Londo where the congress was hel These recordings were made i two languages, and after suitab editing and copying, tapes of th highlights of the congress, si hours in length, were distribute to 56 different countries. Late after further editing, three-hou tapes were made available fo distribution throughout th world.

New V.H.F. Relay Station for Sheffield

UNTIL recently v.h.f. sound transmissions in the Sheffield are originated solely from the BBC's Holme Moss station, which because of the hilly nature of the surrounding country, did no provide total coverage of the area. Now, however, another 240,00 listeners in Sheffield will be able to receive v.h.f. transmission from the new Tapton Hill relay station which recently bega transmitting the North-of-England Home Service, the Ligh Programme and the Third Programme on 94·3Mc/s, 89·9Mc/s an 92·1Mc/s respectively.

All transmissions from the new station will be horizontall polarized.

CRITICAL STAGE OF COMMONWEALTH TELEPHONE CABLE

THE first week of September saw a critical stage in the laying of the Commonwealth telephone cable—Pacific Section. Two cable-laying ships, the HMTS " Monarch " and the C.S. " Retriever " (of Cable and Wireless Limited) faced the task of laying the cable through the Murray Fracture Zone, which is approximately 700 miles north of Hawaii and is the deepest point of the lay between Port Alberni (Vancouver) and Hawaii. Here the ocean is almost 3¼ miles deep and for 60 miles the crews of the ships had to contend with uneven ocean bottom.

However, with yet another part of the mammoth operation over, the forecast looks favourable for the opening of the 8,700 mile cable telephone service linking Britain, Canada, New Zealand and Australia, in December.

Radio Communications Show

THE main feature of the 1963 International Radio Communications Exhibition will be, appropriately enough for this the Golden Jubilee Year show, a display of amateur equipment from 50 years ago, right up to present-day gear.

Every day throughout the show, which will last from October 30th to November 2nd, The Radio Society of Great Britain (the organising body of the exhibition) will be transmitting and receiving on amateur bands under the call signs GB3RS and GB3VHF. Many hundreds of radio amateurs from all parts of Britain are expected to visit the Seymour Hall (Seymour Place, Marble Arch, London) during the time of the show, where displays, competitions, demonstrations, etc., will provide much interest and amusement for all enthusiasts.

As usual, the armed services will be exhibiting along with the G.P.O., but for the first time, this year the BBC has taken a stand.

Amateur television equipment will amongst the displays, with demonstrations of cameras, film and mobile equipment.

With many other interesting exhibits, visitors to the show can look forward to a very memorable occasion.

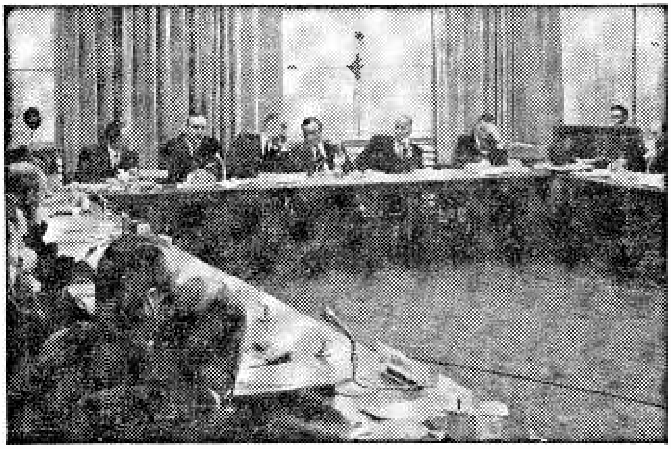
Equipment for Ghana

IN Ghana, where Marconi v.h.f. radio equipment has provided the main trunk telephone services for many years, a new multichannel radio relay system, using the same type of equipment, will shortly be in operation, linking the country's capital, Accra, with the new Atomic Research Institute at Kwabenyan.

An ultimate total of 48 telephone channels will be carried by Marconi HM.100 equipment between the two centres.

INTERPRETATION SOUND SYSTEM

OVERSEAS delegates meeting in the new conference room of the National Coal Board at Hobart House, London, are able to listen to speeches in their own language over a sound system for simultaneous interpretation, manufactured, and recently installed, by Trix Electronics Limited. The installation allows anyone in the room to hear either the spoken address or an interpretation in one of two other languages.



The new conference room at Hobart House, the headquarters of the National Coal Board, where a Trix interpretation sound system has recently been installed.

I.E.E. President

ON 1st October, Sir Albert Mumford, K.B.E., took office as president of the Institution of Electrical Engineers for the session 1963/64. Sir Albert, who is Engineer-in-Chief of the Post Office, was made Knight Commander of the Order of the British Empire in the 1963 Birthday Honours List.

The three I.E.E. division chairmen also elected are; Dr. R. C. G. Williams, Mr. C. D. Wilkinson and Dr. J. R. Mortlock.

RADIO BROADCASTS FOR ADEN

RADIO broadcasts for schools are now taken for granted in the U.K., but for Arab students in Aden, the series of programmes being transmitted by the Aden Forces Broadcasting Association from R.A.F. Khormaksar covering G.C.E. subjects, is proving a worth while addition to their official studies. These weekly broadcasts are being transmitted on an experimental basis, as a prelude to a formal course of study which it is hoped to start in the future.

Beginner's SHORT WAVE TWO

The Blueprint given away free in this issue provides all the diagrams necessary to build this receiver. Newcomers to radio construction will find this design to be straightforward and inexpensive, thus making it an ideal introduction.

BY F. G. RAYER

THIS receiver uses a 954 acorn valve as detector, followed by a 12AT7 twin triode as two-stage audio amplifier. It is constructed on a 7in. x 4in. x 2½in. chassis, and includes a mains power-pack and 2½in. diameter loudspeaker. The panel is approximately 6in. x 7½in. The whole receiver is thus of small size.

The circuit is shown in Fig. 1. The receiver may be used over all frequencies from 1·2Mc/s to 100Mc/s (250-3m). Efficient results are of course obtained at lower frequencies than 1·2Mc/s, but the small size of VC1 makes waveband coverage rather small. For general short wave listening, a single coil covering about 14-40 metres (22-7Mc/s) will be very convenient. A second coil will allow coverage to 2·5Mc/s (120m). Such a pair of coils will allow many of the most useful bands to be tuned. Regeneration is obtained by means of the cathode tap 2 on the coil L1, and is controlled by the potentiometer VR1.

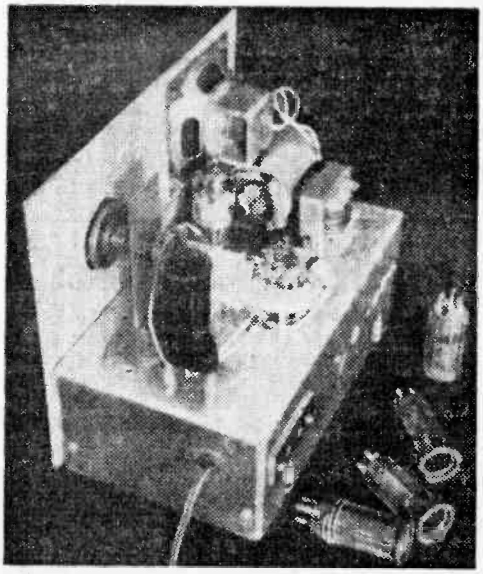
VR2 is the audio gain control, or volume control. The second triode section of the 12AT7 drives the loudspeaker through the matching transformer T1 and provides quite a reasonable output. For the power pack, two small metal rectifiers are employed for full-wave rectification, and complete isolation of the receiver from the mains, is effected by the power transformer T2.

In a receiver of this type, the layout of components in the audio stages and power supply circuit is of little importance. In the detector stage, however, wiring must be short and direct, and construction must be rigid. A valve rectifier, such as 6X4, could be used, and also a larger loudspeaker, if so desired.

Chassis Layout

This is shown in Fig. 2. VC1 is fixed to a stout bracket, so that a ball drive may be added. Tuning is quite critical, and a 2in. dia. knob is recommended. The lug on the drive is bolted to the panel. The drive is fitted with a 0-100 or 0-180 dial, or a pointer, which can be read against scales drawn on card attached to the panel.

The coil holder is mounted about ¾in. above the chassis, using long bolts with extra nuts, or spacing sleeves for this purpose. Coil formers and holders other than those listed may be fitted, or a single coil, permanently wired. There is no need for the coils to be of the diameter given, and other numbers of turns and gauges of wire can be perfectly satisfactory. Changing the diameter or windings will naturally modify the waveband covered, but provided smooth regeneration is obtained, there will be no loss of efficiency.



A rear view of the receiver, with some spare coils.

It is quite feasible to wind coils on old valve bases, or on paxolin tubes attached to old bases. Larger plug-in coils are also available from some suppliers, and can generally be used, if to hand.

Fig. 4(d) shows the underside of the coils, and pin connections. The tuned winding is between pins 1 and 3, pin 3 being earth. All cathode taps are made on this winding, at point 2. The remaining winding is for aerial coupling, the aerial being connected via C1 to socket 4. The remaining end of the aerial coupling winding is taken to pin 3.

All the coils are made in the same way, except for the number of turns and gauge of wire. If valve bases or other coils are used, the holder is selected to suit, and appropriately wired, so that any coil can be inserted.

Windings

On the plug-in coils listed, the following numbers of turns may be used, the ranges specified being approximate.

6·75-22Mc/s 16 turns 30s.w.g., tap at ¾ turn. Aerial coupling, five turns.

2·5-7·5Mc/s 50 turns 32s.w.g., tap at 1½ turns. Aerial coupling, 15 turns.

1·2-4Mc/s 100 turns 34s.w.g., tap at 2 turns. Aerial coupling 20 turns.

14·5-50Mc/s 5½ turns 30s.w.g., tap ¼ to ½ turn. Aerial coupling two turns.

Approx. 40-100Mc/s 2½ turns 20s.w.g. double spaced, tap at ½ turn. Aerial coupling one turn.

The two larger coils have turns side by side. Other coils are on threaded formers, with 21 turns per inch. Aerial windings are near the tuned windings, as in Fig. 4(d). The highest frequency range is with VC1 in the half-closed position (75pF).

Acorn Valve

Pin connections for the acorn valve are shown in Fig. 4(a), the valve being viewed from the anode (long) end. The valve is mounted over a ½in. diameter hole, so that the grid pin is on top, as in Fig. 2, and the anode pin under the chassis, as in Fig. 3.

The valve can be mounted satisfactorily by soldering wires directly to the pins, provided care is taken to avoid breaking the glass seal. Wires must be soldered only to the extreme tips of the pins, and the iron must be at full temperature, and must be removed promptly when the connection has been made.

If a valveholder is used, grid and anode connections may be soldered or clipped on. The leads from R1 and C2 to the grid pin should be extremely short, to avoid hum. If the outside foil of C2 is marked, take this end to VC1.

Loudspeaker and Panel

The panel may be painted, or left clear. It is held to the front runner of the chassis by the swith and the two potentiometers.

A clip holds the twin capacitors C9 and C10 to the chassis, and if this component does not have a metal can forming the negative connection, and in contact with the chassis, a lead should be added from negative to chassis.

The loudspeaker is just high enough to clear the capacitor, and has a matching aperture in the panel. It is secured with countersunk 6B.A. bolts. A square piece of expanded metal loudspeaker fret is then cemented to the panel, over the aperture.

Below the Chassis

Wiring and components are shown in Fig. 3. The two small, contact cooled rectifiers MR1 and MR2 are bolted to one side runner. The Mains transformer wiring should be checked as follows:

Primary to mains, via on/off switch. One 6·3V tag and centre tap of h.t. winding to chassis. Remaining 6·3V tag to tag 9 of the 12AT7 holder, and 954 heater. The h.t. tag to negative on one rectifier. Second h.t. tag to negative on second rectifier.

A tag strip with two insulated tags will be convenient to anchor the mains leads, which pass through a grommet in the chassis. Current is best drawn from a plug fitted with a low rating fuse. The receiver chassis should be earthed.

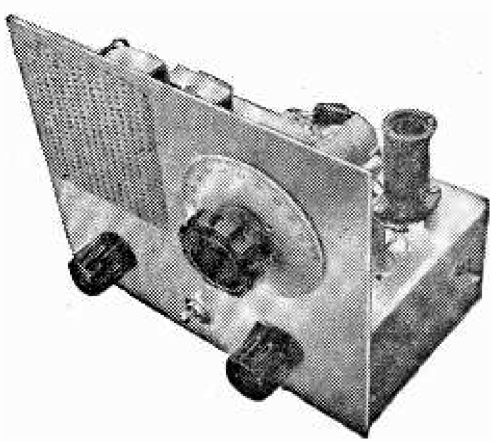
Various points marked "MC" in Figs. 2 and 3 are all soldered to tags which are bolted securely to the chassis. The negative ends of C5 and C8 must be taken to the chassis.

Operating

A regenerative receiver of this type is extremely sensitive, provided regeneration is correctly adjusted. If regeneration is not use correctly, only powerful European and similar stations will be heard.

When VR1 is slowly rotated so as to increase the 954 screen grid voltage from zero, a point will be found where oscillation begins. This oscillation is audible if a station is nearly tuned in, and will be heard as a whistle, or audio tone, which changes in pitch as tuning is adjusted. For maximum sensitivity, regeneration is kept at the point where such oscillation *just* fails to arise. In these conditions, extremely weak signals may be picked up.

Regeneration and tuning are critical, with the high frequency coils, and when receiving weak signals. With the lower frequency coils, and when tuning in stronger transmissions, the setting of VR1 is less important. For powerful stations received without interference, VR1 may be turned back somewhat. But in more difficult reception



The finished receiver.

conditions, VR1 is maintained near the oscillation point, as described, because this increases selectivity, and volume is reduced by VR2, if needed.

If regeneration is too violent and abrupt, with any coil, this shows that the tapping 2 needs to be slightly nearer the earthed end of the coil 3. Aerial loading influences results, and if the aerial is at all long, C1 should be reduced in capacity. This can be done by fitting a 30pF or 50 pF trimmer in this position. For indoor and other short aerials, C1 may be as shown. ■

PRESENTED FREE
WITH
"PRACTICAL WIRELESS"
NOVEMBER 1963

Practical Wireless

Beginner's SHORT WAVE TWO

PRICE 5/-

PUBLISHED BY GEO. NEWNES LTD., TOWER HOUSE, SOUTHAMPTON STREET, LONDON W.C.2.

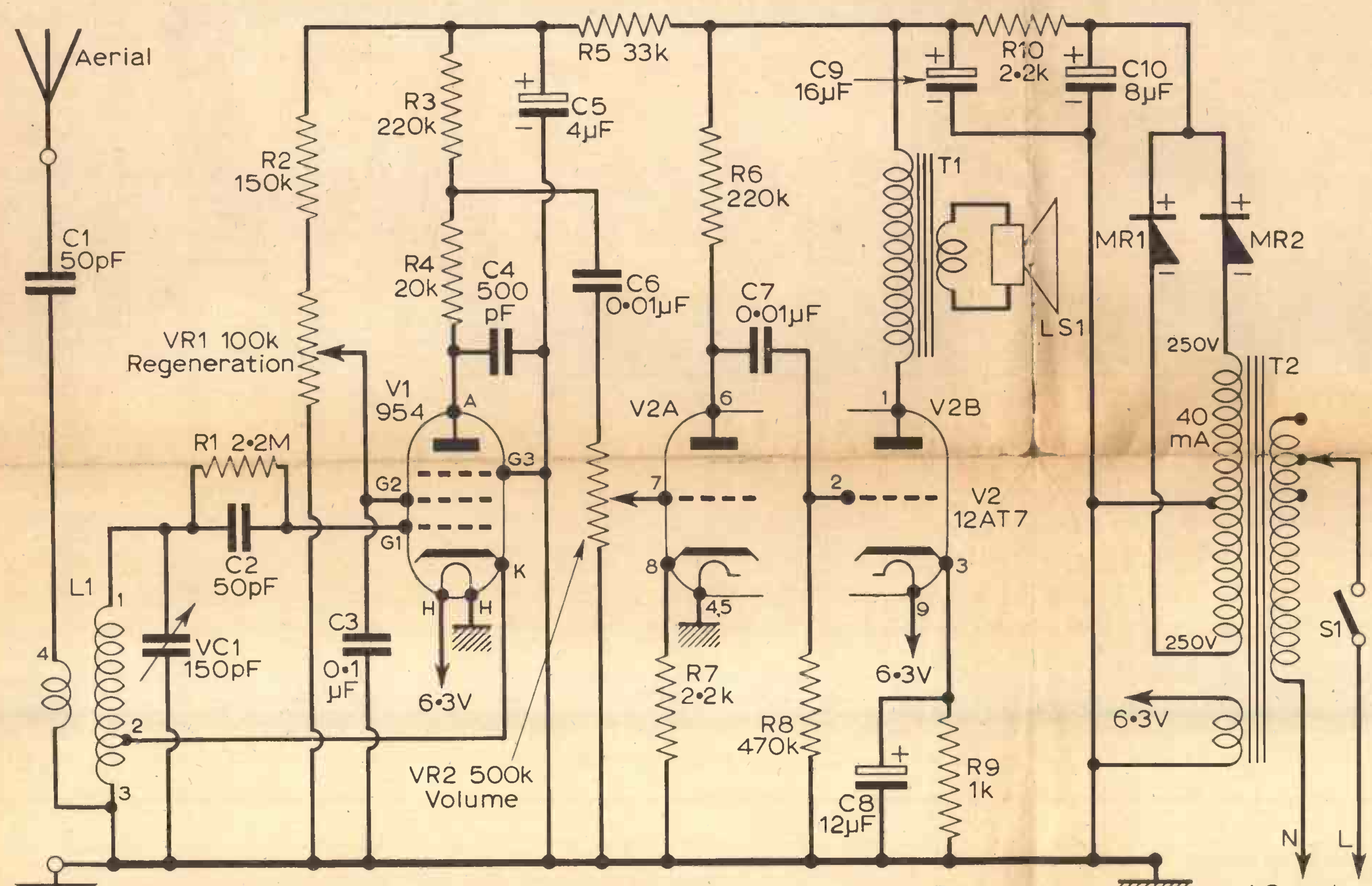


Fig.1 – The circuit diagram.

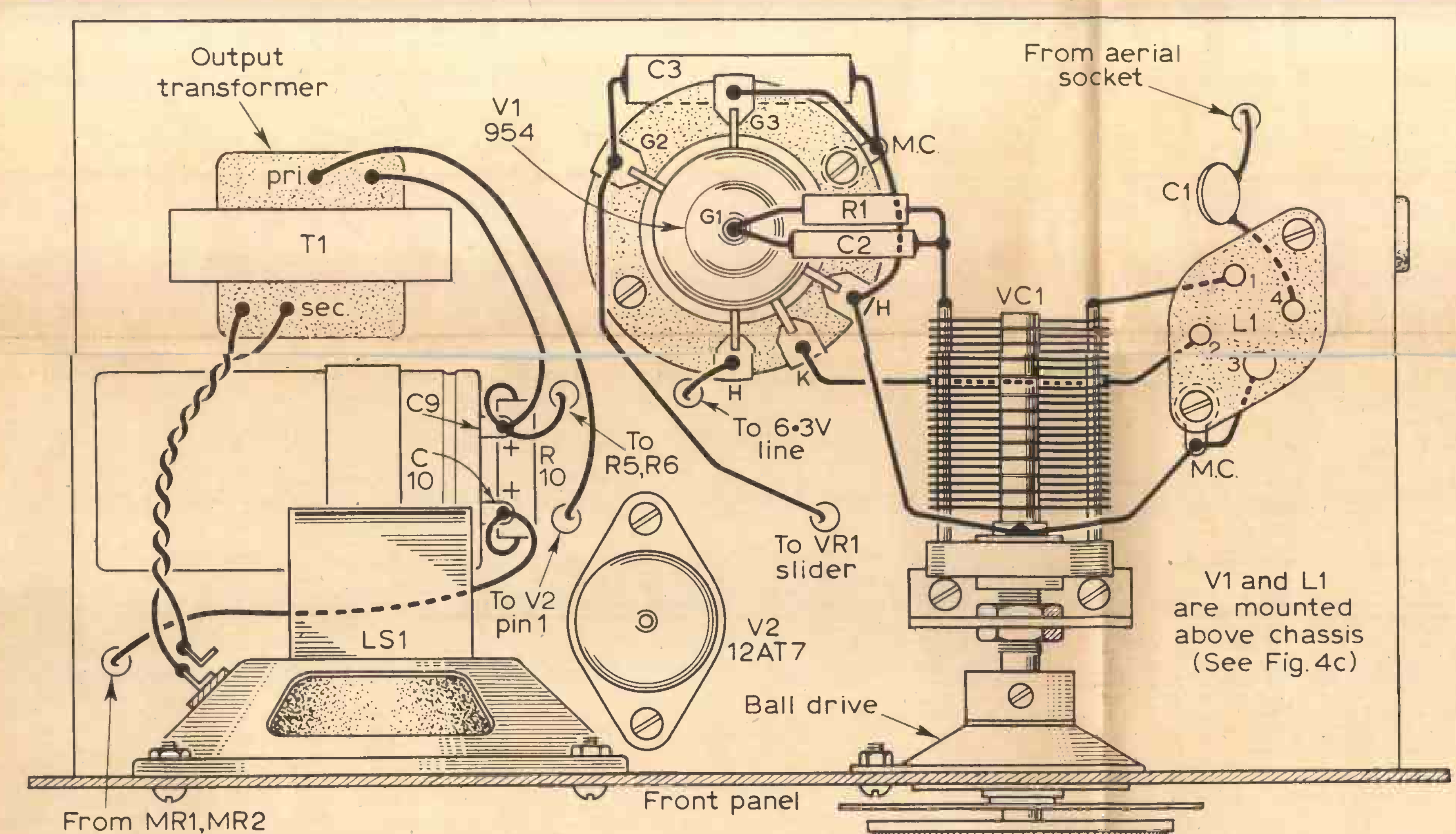
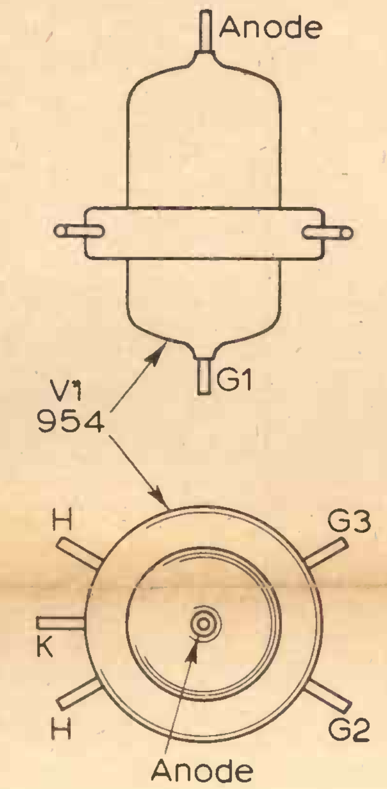
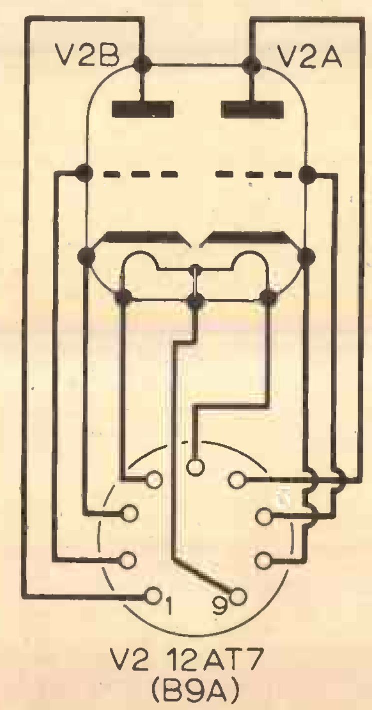


Fig. 2 – Above – chassis wiring.

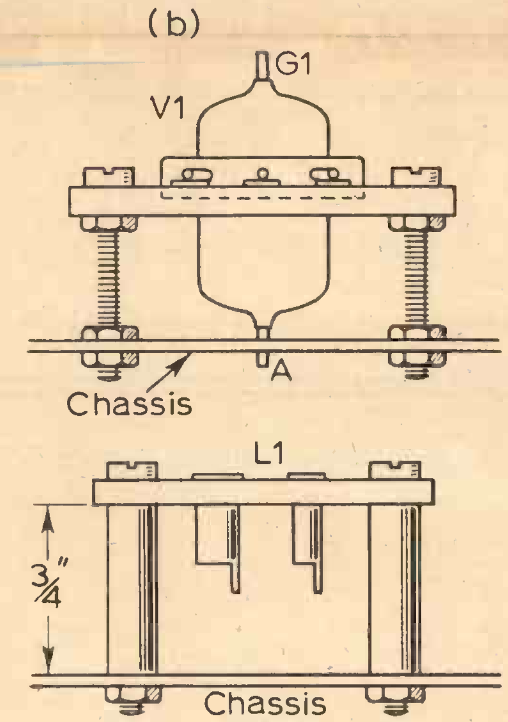


(a)

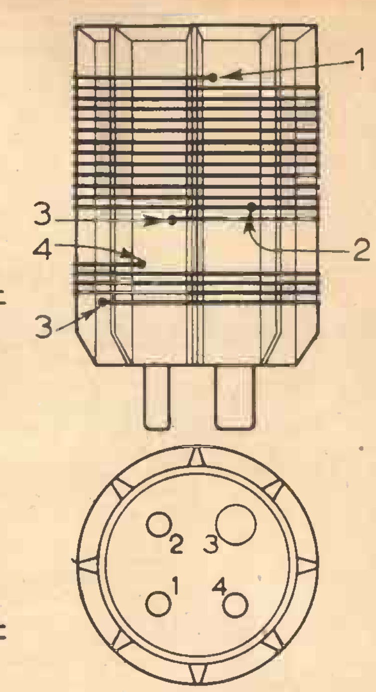


V2 12AT7 (B9A)

(b)



(c)



(d)

COMPONENTS LIST

Resistors:

R1	2·2MΩ	R6	220kΩ
R2	150kΩ	R7	2·2kΩ
R3	220kΩ	R8	470kΩ
R4	20kΩ	R9	1kΩ
R5	33kΩ	R10	2·2kΩ 3W w.w.

All 10%, ½W carbon, except where otherwise indicated
VR1 100kΩ wire-wound potentiometer
VR2 500kΩ carbon potentiometer

Capacitors:
C1 50pF mica or ceramic
C2 50pF mica or ceramic
C3 0·1μF paper
C4 500pF mica or ceramic
C5 4μF electrolytic 350V
C6 0·01μF paper
C7 0·01μF paper
C8 12μF electrolytic 25V
C9 16μF } dual electrolytic 350V
C10 8μF }
VC1 150pF air dielectric variable

Transformers:
T1 Output transformer 60 : 1
T2 Small mains transformer. Tapped primary. Secondaries: 250-0-250V 40mA; 6·3V 1A

Valves:
V1 954 V2 12AT7

Other Circuit Components:
LS1 2½in. diameter loudspeaker 2–3Ω
S1 Toggle switch s.p.s.t.
MR1, 2 Contact cooled rectifier 250V 40mA

Miscellaneous:
Ball drive 6 : 1 ratio. Knobs: one 2in. diameter, two 1in. diameter. One B9A valveholder. Ribbed 4-pin plug-in coil formers (Eddystone). Coil holder (Eddystone). Aerial-earth socket strip. Tag strip (2 insulated). Chassis 7in. x 4in. x 2½in. approx. Panel 6in. x 7½in.

COIL WINDING DATA

1·2–4Mc/s (250–75 metres)
100 turns 34s.w.g., tap at 2 turns. Aerial coupling, 20 turns.

2·5–7·5Mc/s (120–40 metres)
50 turns 32s.w.g., tap at 1½ turns. Aerial coupling, 15 turns.

6·75–22Mc/s (44–13·6 metres)
16 turns 30s.w.g., tap at ¾ turn. Aerial coupling, five turns.

14·5–50Mc/s (20·6–6 metres)
5½ turns 30s.w.g., tap ⅓ to ½ turn. Aerial coupling, two turns.

40–100Mc/s (7·5–3 metres)
2¼ turns 20s.w.g., double spaced, tap at ½ turn. Aerial coupling, one turn.

The two larger coils are close wound. The other coils are on threaded formers, and spaced 21 turns per inch. Aerial windings are near the tuned winding as indicated in Fig. 4(d).

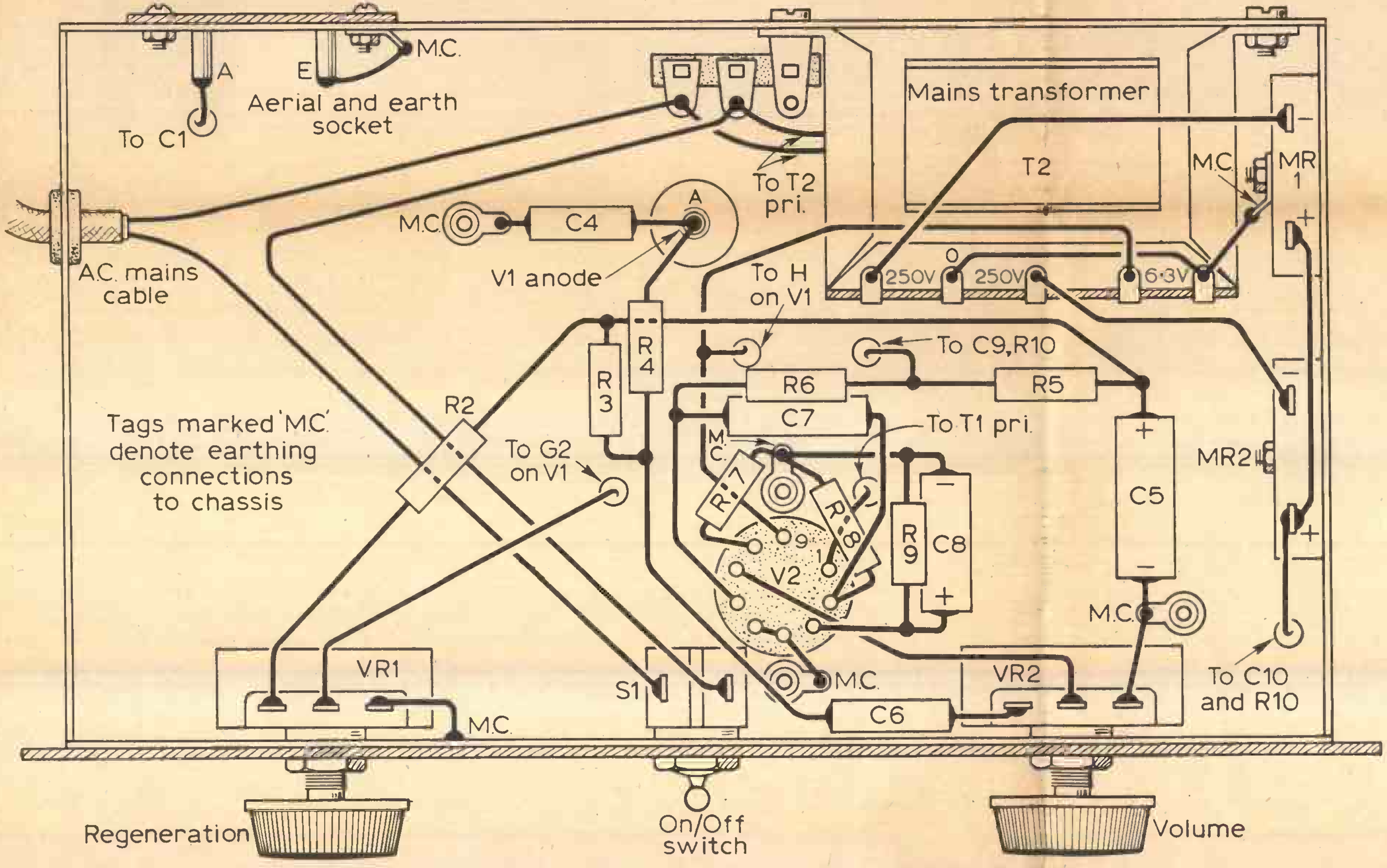


Fig. 3 – Below-chassis wiring.

Fig. 4 – Coil and valve details.

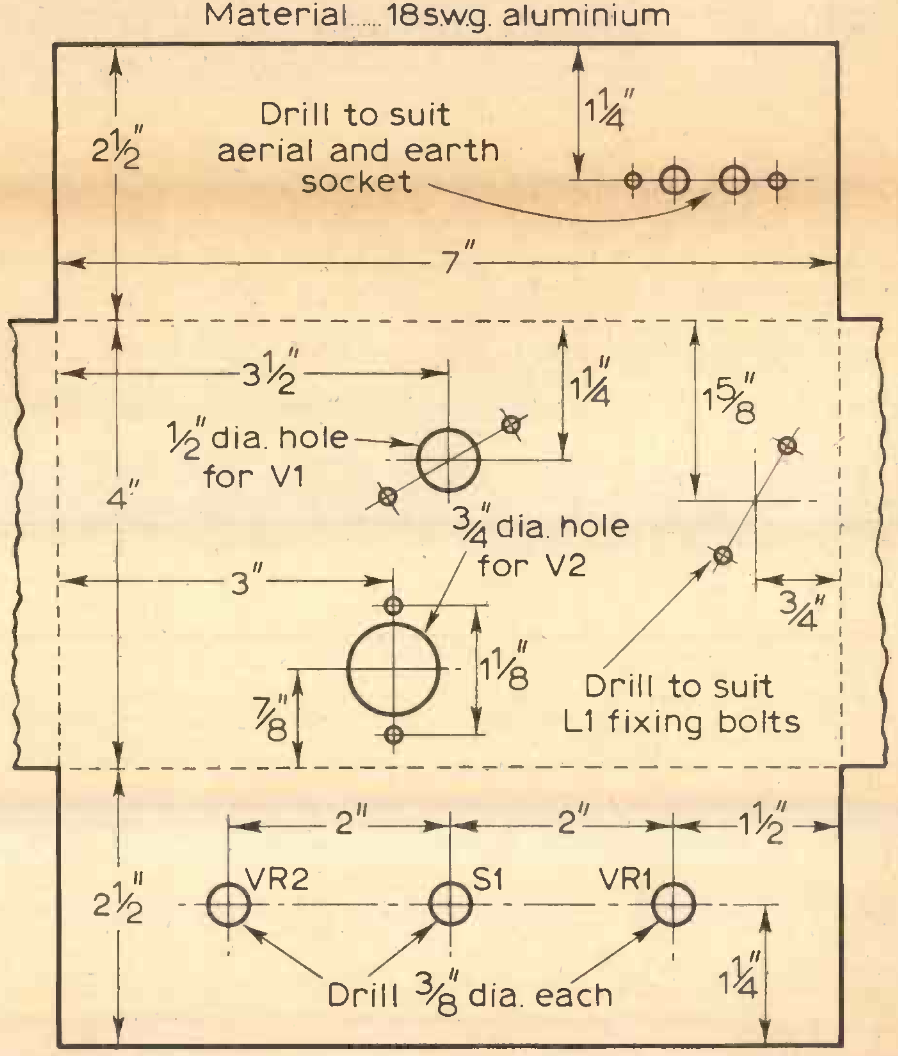


Fig 5 – Chassis drilling details.

SHORT WAVE

BROADCASTING STATIONS

THIS list is not intended to be a complete guide to the many hundreds of short wave broadcasting stations in operation, but it does indicate the stations which, in normal conditions, are most easily heard.

Frequency (kc s)	Wavelength (metres)	Station
5930	50·57	Prague, Czechoslovakia
5960	50·34	Rome, Italy
5990	50·08	Bucharest, Roumania
6005	49·96	R.I.A.S., Berlin, Germany
6010	49·92	Rome, Italy
6025	49·79	Radio Nederland, Holland
6025	49·79	Lisbon, Portugal
6030	49·75	Muhlacker, W. Germany
6035	49·71	Monte Carlo, Monaco
6055	49·55	Schwarzenburg, Switzerland
6065	49·46	Horby, Sweden
6070	49·42	Sofia, Bulgaria
6075	49·38	Osterloog, W. Germany
6090	49·26	Radio Luxembourg
6100	49·18	Belgrade, Yugoslavia
6140	48·86	Voice of America, Tangier
6145	48·82	Allouis, France
6160	48·70	Voice of America, Munich, W. Germany
6165	48·66	Schwarzenburg, Switzerland
6175	48·58	Allouis, France
6190	48·47	Bremen, W. Germany
6190	48·47	Vatican City
7050	42·55	Cairo, Egypt
7105	42·22	Madrid, Spain
7125	42·11	Warsaw, Poland
7135	42·05	Monte Carlo, Monaco
7180	41·78	Baghdad, Iraq
7195	41·70	Bucharest, Roumania
7200	41·67	Belgrade, Yugoslavia
7220	41·55	Budapest, Hungary
7255	41·35	Sofia, Bulgaria
7275	41·24	Rome, Italy
7280	41·21	Allouis, France
7285	41·18	Ankara, Turkey
9009	33·03	Tel Aviv, Israel
9410	31·88	B.B.C. Overseas Service
9475	31·66	Cairo, Egypt
9505	31·56	Prague, Czechoslovakia
9510	31·55	B.B.C Overseas Service
9515	31·53	Rome, Italy
9520	31·51	Voice of America, Tangier
9535	31·46	Schwarzenburg, Switzerland
9540	31·45	Warsaw, Poland
9570	31·35	Shepparton, Australia
9575	31·33	Rome, Italy
9585	31·30	Allouis, France
9620	31·19	Horby, Sweden
9630	31·15	Sackville, Radio Canada
9645	31·10	Vatican City
9665	31·04	Schwarzenburg, Switzerland
9675	31·01	Warsaw, Poland
9700	30·93	Sofia, Bulgaria
9715	30·88	Radio Nederland, Holland
9720	30·86	Radio Nacional, Rio de Janeiro, Brazil
9735	30·82	Deutsche Welle, W. Germany
9745	30·78	Ankara, Turkey
9770	30·71	Vienna, Austria
9780	30·67	Cairo, Egypt
9865	30·40	Djakarta, Indonesia
11705	25·63	Horby, Sweden
11715	25·61	Schwarzenburg, Switzerland
11720	25·60	Sackville, Radio Canada
11755	25·52	Leopoldville, Congo
11800	25·42	Accra, Ghana
11810	25·40	Rome, Italy
11820	25·38	B.B.C. Overseas Service
11830	25·36	Voice of America, Munich, W. Germany and Tangier
11835	25·35	Algiers, Algeria
11865	25·28	Schwarzenburg, Switzerland
11865	25·28	Havana, Cuba
11900	25·21	Paradys, South Africa
11910	25·19	Armed Forces Radio Service, Greenville, U.S.A.
11915	25·18	Voice of the Andes, Quito, Ecuador
11920	25·17	Allouis, France
11925	25·16	Radio Bandeirantes, Sao Paulo, Brazil
11965	25·06	Conakry, Guinea
11990	25·02	Prague, Czechoslovakia
12095	24·80	B.B.C. Overseas Service
15070	19·91	B.B.C. Overseas Service
15080	19·89	Paradys, South Africa
15115	19·85	Voice of the Andes, Quito, Ecuador
15125	19·83	Lisbon, Portugal
15155	19·80	ELWA, Monrovia, Liberia
15165	19·78	Damascus, Syria
15190	19·75	Brazzaville, Congo
15205	19·73	Voice of America, Greenville, U.S.A.
15220	19·71	Shepparton, Radio Australia
15250	19·67	Voice of America, Bethany, U.S.A.
15260	19·66	B.B.C. Far Eastern Station, Malaya
15280	19·63	Armed Forces Radio Service, Greenville, U.S.A.
15290	19·62	Voice of America, Tangier
15305	19·60	Voice of America, Greenville, U.S.A.
15320	19·58	Sackville, Radio Canada
15330	19·57	Voice of America, Greenville, U.S.A.
15370	19·52	Radio Tupi, Rio de Janeiro, Brazil
15385	19·50	WRUL, Boston, U.S.A.
15400	19·48	Rome, Italy
15445	19·43	Brazzaville, Congo
15475	19·38	Cairo, Egypt
17695	16·95	B.B.C. Overseas Service
17780	16·87	Voice of America, Bound Brook, U.S.A.
17795	16·86	Schwarzenburg, Switzerland
17820	16·84	Sackville, Radio Canada
17895	16·76	Lisbon, Portugal
17920	16·74	Cairo, Egypt
21470	13·97	B.B.C. Overseas Service
21495	13·96	Lisbon, Portugal
21560	13·91	Rome, Italy

N.B.—No frequencies are given for *Radio Moscow* or *Radio Free Europe* as the schedules of these stations vary more often than others, but they will usually be heard on several frequencies in each band.

When and Where To Listen

THIS is a far from easy task on which to give specific information. Forecasting propagation on short waves is, in some ways, as difficult as forecasting the weather. There are certain overall patterns but there are very many variable factors which can affect conditions at any one time. The main changes to be borne in mind are the seasonal ones, the difference between daytime and night-time conditions and, above all, the 11-year sunspot cycle.

From now until around 1966 conditions will not change greatly in their main features as we are in a period of low sunspot numbers, and the information given below is meant to apply to this period. Once sunspot numbers begin to increase, the pattern of band usage will change in many ways.

One useful pointer to remember is that broadcasting stations will beam their transmissions to Britain at the time and on the frequencies giving the best chance of good reception. Thus, if Radio Australia broadcasts to us around 07.00 G.M.T. on the 31 and 25 metre bands, that is when expert opinion expects best conditions for the path, although reception from Australia may be possible at other times.

All times quoted below are in G.M.T., using the 24-hour clock system. Let us consider various areas of the world and suggest the best times and frequencies for receiving stations in those areas.

1 **North America and Caribbean area** The best time for this area is between 15.00 and 23.00 during the whole year; in winter the peak is around 18.00 but in summer it is around 20.00/21.00. Western North America is harder to hear, and usually best around 15.00 to 18.00. For broadcast stations, the best bands in winter are 19 metres in the afternoon, then 25 metres after dark In the summer period, 19 metres is usually best. For the amateur bands, 20 metres is the most reliable all the year, during the winter 40 metres and 80 metres can provide North American stations between 23.00 and 05.00.

2. **Central America** This can be an awkward area to hear and the best times are similar to those for North America. For the broadcast bands, as there are not many stations in this area which use the higher frequencies, the best band tends to be 49 metres around 04.00 to 06.00. On the amateur bands, 20 metres is again the most useful, but this area can come through on 15 metres at times when no North Americans can be heard.

3. **South America** The best times are around 09.00 to 11.00 and from 17.00 to 01.00. The Pacific coast tends to be best around 07.00 to 10.00 and later around 20.00 to 02.00. On the broadcast bands, during spring, winter and autumn, 19 metres is best for the morning period, with 25 and 31 metres best for the evening and night. In summer, the early period is not usually feasible, and 19 metres is best for the evening, but this area is not usually heard too well during the summer. On the amateur bands, 20 metres is usually best, with 40 metres possible later at night, and 15 metres is also a good possibility for the early evening.

4. **North Africa and Near East** This area is best around 12.00 to 23.00, although it is possible to hear it almost round the clock. On the broadcast bands, 16, 19 and 25 metres are usually good in daylight, with 31 and 41 metres being better after dark. On the amateur bands, 15 and 20 metres are usually best, on 15 metres 08.00 to 11.00 is often a good time.

5. **Central and South Africa** The best times for this area are between 13.00 and 22.00. On the broadcast bands, during daylight 19 metres is best, but after dark 25 and 31 metres are better, especially in the winter half. On the amateur bands 15 metres is likely to be useful, with 20 metres best around 17.00 to 20.00. This area is possibly one of the few which will be heard during any openings on 10 metres.

6. **North Asia** The best times are around 06.00 to 09.00 and around 20.00, this is not an easy area to hear, especially Japan. On the broadcast bands, 19 and 25 metres are the best. On the amateur bands, 20 metres is probably the only worth-while recommendation.

7. **South and South-East Asia** This is usually best around 11.00 to 17.00. The best broadcast bands are 16 and 19 metres for the earlier part, with 25 metres being most useful later towards the end of the best period. On the amateur bands 20 metres must again be the best suggestion, with just a chance that 15 metres might occasionally open in that direction. During the winter half it is likely that the best period may extend on to around 21.00 with the 31 and 41 metre broadcasting bands being best for this.

8. **Australasia** The best times for this area are 06.00 to 10.00 and, in winter, around 14.00 to 17.00 and around 22.00. New Zealand is not too easy to hear, and is usually better around 09.00 to 11.00. Reception is much better in the spring, winter and autumn than in the summer. In the better seasons, the best broadcast bands are 25 and 31 metres for the morning, 31 and 41 metres in the afternoon and 19 metres for the night opening which is less reliable. On the amateur bands, 20 metres is the favourite with 40 metres useful in winter in the mornings.

9. **Pacific** This is a difficult area usually, and is best around 06.00 to 11.00. There are few high power broadcasting stations in the area, and 19 and 25 metres are the most likely bands. Of the amateur bands, 20 metres is best.

10. **Europe** Obviously, this area can be heard 24 hours a day. On the broadcast bands, 25 and 31 metres are best for Southern Europe with 41 and 49 metres best for Northern Europe, 19 metres can provide European reception during the day. On the amateur bands 20 metres during the day, and 40 and 80 metres after dark are best, but in summer short skip occurs on 15 and 10 metres at times.

Signal Reporting Systems

IT has become the usual practice to use some type of code for giving signal reports. The most usual system in use on the amateur bands is a Readability/Signal Strength code, using a scale from 1 to 5 for readability and from 1 to 9 for signal strength. These are not always used correctly and often when incorrectly adjusted "signal strength meters" are used, reports such as "S9 plus 40 dB" are heard. As will be seen below, S9 means "extremely strong" which can hardly be improved on! Following are the scales for readability and signal strength:

Readability:
R1 Unreadable
R2 Only just readable, and only occasional words heard
R3 Readable, but with considerable difficulty
R4 Readable with almost no difficulty
R5 Perfectly readable

Signal Strength:
S1 Signals only just perceptible
S2 Very weak signals
S3 Weak signals
S4 Fair signals
S5 Fairly good signals
S6 Good signals
S7 Moderately strong signals
S8 Strong signals
S9 Extremely strong signals

For reporting on telegraphy (CW) signals, an additional scale for "tone" is used to indicate the quality of the note. This is also a 1 to 9 scale, as follows:

Tone:
T1 Extremely rough note
T2 Very rough note
T3 Rough, low pitched note
T4 Rather rough note
T5 Musically modulated note
T6 Modulated note, slight whistle
T7 Fairly good note, smooth ripple
T8 Good note, slight ripple
T9 Pure DC note

(If the note seems to be crystal controlled, an "x" is added, if the note is chirpy, a "c" is added.)

The readability/strength code can be used for reporting to broadcasting stations, but a better system for this purpose is the **SINPO** code. This has five scales, each of 1 to 5, as indicated by the letters S (Signal Strength), I (Interference), N (Noise, i.e. static), P (Propagation Disturbance, i.e. fading) and O (Overall quality of reception).

The scale for signal strength is: 1—barely audible; 2—poor; 3—fair; 4—good; 5—excellent. The scales for Interference, Noise and Propagation Disturbance are: 1—extreme; 2—severe; 3—moderate; 4—slight; 5—nil. The scale for Overall quality is: 1—unusable; 2—poor; 3—fair; 4—good; 5—excellent. Thus, in the SINPO code, a perfectly received signal would be given 55555.

THE "Q" CODE

THE "Q" Code is used by aeronautical and maritime services and other commercial services and is very comprehensive in its full form. In its correct use, each group (made up of Q and two letters) can stand either for a question (e.g. QTH? means "*what is your location?*"), or the answer (e.g. QTH means "*my location is . . .*"). Amateurs have adopted certain of the code groups to their own use and the following list shows the more usual ones with their meanings.

QRA Full address
QRH Your frequency varies
QRK Signal strength (also price or value, humorously)
QRL Busy
QRM Man-made interference
QRN Atmospheric interference; static
QRO High power
QRP Low power
QRT Closed down
QRU Nothing further to say
QRV Ready to operate
QRX Wait
QSA Readability of signal
QSB Fading
QSL Acknowledgement of receipt; confirmation of contact
QSO Contact
QSP Pass on a message
QSY Change frequency
QTC Telegram, message
QTH Location
QTR Time check

STANDARD FREQUENCY STATIONS

THE frequencies 2500, 5000, 10000, 15000, 20000 and 25000 kc/s are set aside for station transmitting accurate frequency standards and also time signals in many cases. Some of these stations are:

ATA, New Delhi, India, operating on 10000 kc/s.
BPV, Peking, China, operating on 5000, 10000 and 15000 kc/s.
FFH, Paris, France, operating on 2500 kc/s.
HBN, Neuchatel, Switzerland, operating on 5000 kc/s.
IAM, Rome, Italy, operating on 5000 kc/s.
IBF, Turin, Italy, operating on 5000 kc/s.
JJY, Tokyo, Japan, operating on 2500, 5000, 10000 and 15000 kc/s.
LOL, Buenos Aires, Argentina, operating on 5000, 10000 and 15000 kc/s.
MSF, Rugby, England, operating on 2500, 5000 and 10000 kc/s.
OMA, Prague, Czechoslovakia, operating on 2500 kc/s.
RWM, Moscow, U.S.S.R., operating on 5000, 10000 and 15000 kc/s.
WWV, Washington, U.S.A., operating on 2500, 5000, 10000, 15000, 20000 and 25000 kc/s.
WWVH, Hawaii, operating on 5000, 10000 and 15000 kc/s.
ZUO, Johannesburg, South Africa, operating on 5000 and 10000 kc/s.

In addition, CHU, Ottawa, Canada, transmits on 3330, 7335 and 14670 kc/s.

Most of these stations make speech announcements at intervals, and give their callsigns in morse code. WWV gives time checks and also propagation forecasts.

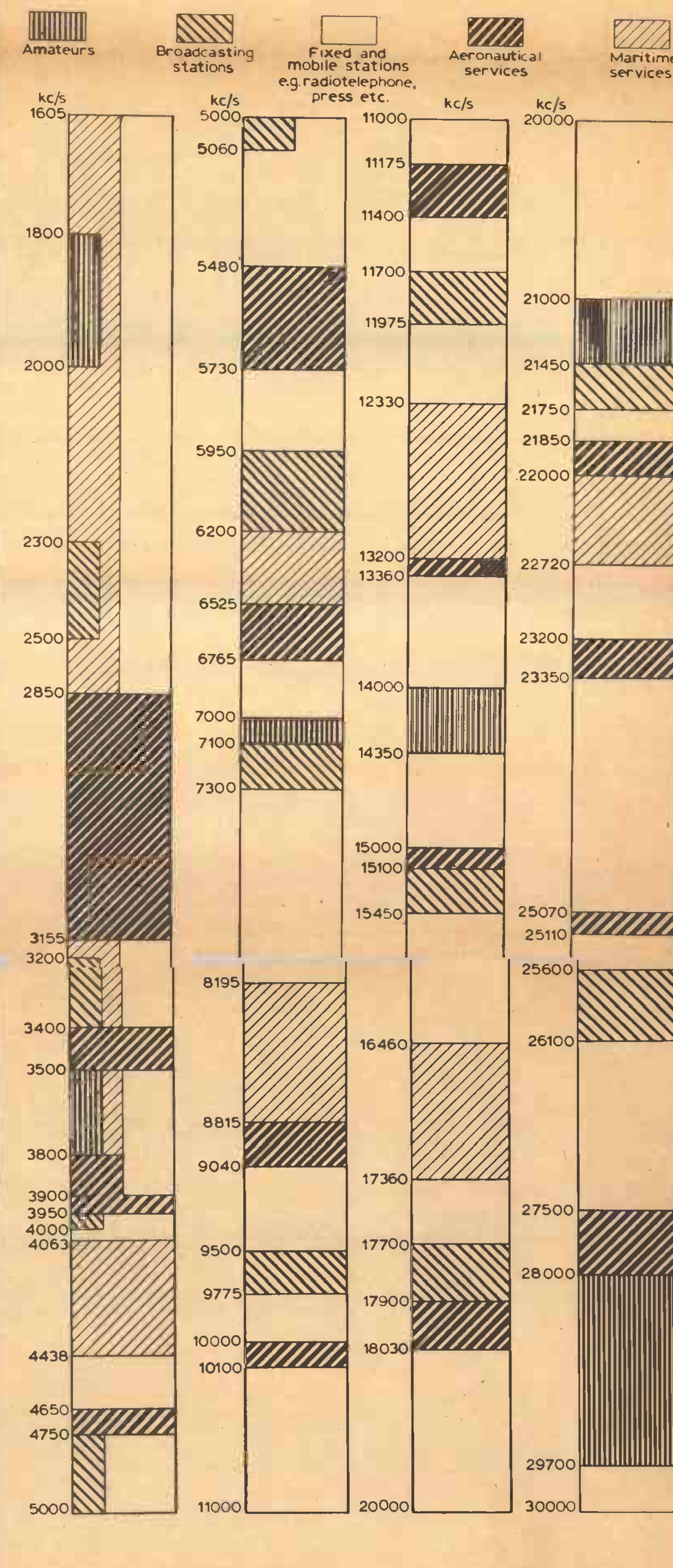
THE SHORT WAVE SPECTRUM

THE International Telecommunications Union is the controlling body over the whole of the radio frequency spectrum and allocations have been made from 10 kc/s to 40 kc/s. The accompanying chart shows the allocations between 1605 kc/s and 30000 kc/s, which is the range generally known as the "short waves". The I.T.U. divides the world into three regions for frequency allocation purposes; Region 1 comprises Europe, Africa, the Near East and the whole of the U.S.S.R.; Region 2 is made up of North America, Central America, South America and Greenland; and Region 3 contains Asia (except the U.S.S.R.) Australasia and the Pacific.

In the main, the allocations in the s.w. range are fairly uniform over all three Regions, but there are a few differences which should be noted.

1. The amateur band 1800 to 2000 kc/s is only available in a limited number of countries.
2. The broadcasting bands 2300 to 2500 kc/s, 3200 to 3400 kc/s and 4750 to 5060 kc/s are classed as "tropical" and are limited to countries in these regions.
3. In Region 2 the amateur band beginning at 3500 kc/s extends through to 4000 kc/s.
4. In Region 2 the amateur band beginning at 7000 kc/s extends through to 7300 kc/s and the allocation 7100 to 7300 kc/s is not available for broadcasting.

The chart obviously has to leave out several minor points of difference, but these are mainly confined to the lower frequencies. The main classes of service are indicated as follows:



AMATEUR CALLSIGN PREFIXES

AMATEUR radio stations, in common with all other communications stations, have to identify themselves by callsigns. Each station has an individual officially allocated callsign which follows a standard pattern, being made up of a prefix, a numeral, and a suffix. The prefix may be one letter, two letters or a numeral and letter, but it is derived from the international list of callsign allocations. The numeral may have some geographical significance, but this is not always so. The suffix may be one, two or three letters; in the bigger countries they are issued in alphabetical order, but in smaller countries they are often issued haphazardly, a popular idea being to allow the operator to use his initials as his call.

To take an example of a callsign—G3AKA. The G is the prefix allocated to England, the figure 3 has no special meaning and the AKA is the suffix. In another case—say W7XYZ. Here the W is the U.S.A. prefix, but in this case the figure 7 indicates that the station is located in a particular area of the U.S.A., and the XYZ is the suffix. One final example—say 5N2ABC. In this case 5N is the prefix for Nigeria, the figure 2 has no significance, and the ABC is the suffix.

The following is an up-to-date list of prefixes, the numeral is only given here where it is necessary to distinguish between countries, for instance VQ is the general prefix for Commonwealth countries in East Africa, but VQ1 is Zanzibar and VQ2 is Northern Rhodesia, so the numeral is virtually part of the prefix in these cases. This list is not intended to be an "official" list of countries, the various clubs and societies each issue their own lists of this kind, which only differ where some of the more out of the way places are concerned.

Occasionally, stations can be heard with additional letters, such as /P or /M after the callsign. Examples of these and their meanings are: /A indicates the station is being operated from another address than that given in the licence. /P means the station is being operated "portable", i.e. not from a mains electricity supply; this letter is usually heard when Field Day contests are being held. /M means that the station is "mobile", i.e. in a car or other vehicle. /MM means "maritime mobile", on board a ship. /AM is "aeronautical mobile", on an aircraft. In the U.S.A., however, /P and /A are not used; instead, the call area in which the station is temporarily operating is added, for instance W2ZZZ operating portable in the W2 area would sign W2ZZZ/2, if he went over to California he would sign W2ZZZ/6. If he crossed into Canada, he might sign W2ZZZ/VE3 and so on.

CALL AREAS

As mentioned above, in certain countries, there is a subdivision into call areas, indicated by the figure in the callsign. Most of the South American countries use this system, and it also applies in Australia, Canada, New Zealand and the U.S.A. Details for these latter four countries are:

Australia VK1—Canberra; VK2—New South Wales; VK3—Victoria; VK4—Queensland; VK5—South Australia; VK6—Western Australia; VK7—Tasmania; VK8—Northern Territory.

Canada VE1—Nova Scotia, New Brunswick and Prince Edward Island; VE2—Province of Quebec; VE3—Ontario; VE4—Manitoba; VE5—Saskatchewan; VE6—Alberta; VE7—British Columbia; VE8—Yukon and North West Territories; VO1—Newfoundland; VO2—Labrador.

New Zealand ZL1—Auckland; ZL2—Wellington; ZL3—Canterbury; ZL4—Otago.

United States of America K/KN/W/WA/WB/WN/WV prefixes: 1—Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont. 2—New Jersey and New York. 3—Delaware, Maryland, Pennsylvania and District of Columbia. 4—Alabama, Florida, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Virginia. 5—Arkansas, Louisiana, Mississippi, New Mexico, Oklahoma and Texas. 6—California. 7—Arizona, Idaho, Montana, Nevada, Oregon, Utah, Washington and Wyoming. 8—Michigan, Ohio and West Virginia. 9—Illinois, Indiana and Wisconsin. Ø—Colorado, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota.

AC3	Sikkim
AC4	Tibet
AC5	Bhutan
AP	Pakistan
BY	China
BV	Taiwan
CE	Chile
CE9	Chilean Antarctic
CEØ	Easter Island
CM	Cuba
CN	Morocco

CO	Cuba
CP	Bolivia
CR4	Cape Verde Islands
CR5	Portuguese Guinea, Principe Is., and Sao Thome
CR6	Angola
CR7	Mozambique
CR8	Portuguese Timor
CR9	Macao
CT1	Portugal

CT2	Azores Islands
CT3	Madeira Islands
CX	Uruguay
DJ	Germany (West)
DL	Germany (West)
DM	Germany (East)
DU	Phillippine Islands
EA	Spain
EA6	Balearic Islands
EA8	Canary Islands
EA9	Ceuta, Melilla and Ifni

EAØ	Spanish Guinea and Fernando Poo
EI	Eire
EL	Liberia
EP	Iran
EQ	Iran
ET	Ethiopia
F	France
FB	Amsterdam and St. Paul Is., Crozet and Kerguelen Is.

FC	Corsica
FG	Guadeloupe
FH	Comoro Islands
FK	New Caledonia
FL	French Somaliland
FM	Martinique
FO	Marquesas Is., Society Is., Tuamoto, Tubuai Is., Clipperton Is.
FP	St. Pierre and Miquelon Is.
FR	Reunion Islands
FS	St. Martin Island
FU	New Hebrides
FW	Wallis and Fortuna Is.
FY	French Guiana and Inini
G	England
GB	United Kingdom (special stations)
GC	Channel Islands
GD	Isle of Man
GI	Northern Ireland
GM	Scotland
GW	Wales
HA	Hungary
HB	Switzerland
HBØ	Liechtenstein
HC	Ecuador
HC8	Galapagos Islands
HH	Haiti
HI	Dominican Republic
HK	Colombia
HL	Korea
HM	Korea
HP	Panama
HR	Honduras
HS	Thailand
HV	Vatican
HZ	Saudi Arabia
I	Italy
IL	Pelagian Islands
IP	Pantellaria Island
IS	Sardinia
IT	Sicily
JA	Japan
JT	Mongolia
JY	Jordan
JZØ	Netherlands New Guinea
K	United States of America
KA	Japan (U.S. Forces)
KB	Baker, Howland and American Phoenix Is.
KC4	U.S. Antarctic and Navassa Island

KC6	Caroline Islands
KG1	Greenland (U.S. Forces)
KG4	Guantanamo Bay
KG6	Guam, Mariana Islands and Marcus Islands
KH	Hawaiian Islands
KJ	Johnston Island
KL	Alaska
KM	Midway Islands
KN	United States of America (novice stations)
KP4	Puerto Rico
KP6	Palmyra and Jarvis Is.
KR	Ryukyu Islands
KS4	Swan Island
KS6	American Samoa
KV	American Virgin Islands
KW	Wake Island
KX	Marshall Islands
KZ	Panama Canal Zone
LA	Norway
LU	Argentina
LX	Luxembourg
LZ	Bulgaria
MP4	Bahrain, Muscat and Oman, Qatar & Trucial Oman
OA	Peru
OD	Lebanon
OE	Austria
OH	Finland
OK	Czechoslovakia
ON	Belgium
OX	Greenland
OY	Faroe Islands
OZ	Denmark
PA	Netherlands
PI	Netherlands
PJ	Netherlands Antilles
PK	Indonesia
PX	Andorra
PY	Brazil
PZ	Surinam
SL	Sweden (Forces)
SM	Sweden
SP	Poland
SU	Egypt
SV	Greece
TA	Turkey
TF	Iceland
TG	Guatemala
TI	Costa Rica
TJ	Cameroon

TL	Central African Republic
TN	Republic of Congo
TR	Gabon
TT	Tchad
TU	Ivory Coast
TY	Dahomey
TZ	Mali
UA	U.S.S.R.
UB	Ukraine
UC	White Russia
UD	Azerbaijan
UF	Georgia
UG	Armenia
UH	Turkoman
UI	Uzbek
UJ	Tadzhik
UL	Kazakh
UM	Kirghiz
UO	Moldavia
UP	Lithuania
UQ	Latvia
UR	Estonia
UT	Ukraine
UV	U.S.S.R.
UW	U.S.S.R.
VE	Canada
VK	Australia
VK9	New Guinea, Papua, Norfolk Island, Nauru, Cocos Is., Lord Howe Islands
VKØ	Australian Antarctica, Heard Island and Macquarie Islands
VO	Canada (Newfoundland and Labrador)
VP1	British Honduras
VP2	Anguilla, Antigua, Barbuda, Brit. Virgin Is., Dominica, Grenada, Montserrat, St. Kitts, Nevis, St. Lucia, St. Vincent
VP3	British Guiana
VP4	Trinidad and Tobago
VP5	Cayman & Turks & Caicos Islands
VP6	Barbados
VP7	Bahama Islands
VP8	Falkland Islands and Dependencies, Grahamland, South Georgia
VP9	Bermuda
VQ1	Zanzibar

VQ2	Northern Rhodesia
VQ4	Kenya
VQ7	Aldabra Islands
VQ8	Mauritius
VQ9	Seychelles
VR1	Gilbert & Ellice Islands, Ocean Islands, British Phoenix Islands
VR2	Fiji Islands
VR3	Line Islands
VR4	Solomon Islands
VR5	Tonga
VR6	Pitcairn Island
VS1	Singapore
VS4	Sarawak
VS5	Brunei
VS6	Hong Kong
VS9	Aden, Socotra, Maldive Islands, Kamaran Islands
VU	India
W	United States of America
WA	United States of America
WB	United States of America
WG	Mariana Is. (novice stations)
WL	Alaska (novice stations)
WN	United States of America (novice stations)
WP4	Puerto Rico (novice stations)
WS6	American Samoa (novice stations)
WV	United States of America (novice stations)
XE	Mexico
XT	Upper Volta
XU	Cambodia
XV	Vietnam
XW	Laos
XZ	Burma
YA	Afghanistan
YI	Iraq
YJ	New Hebrides
YK	Syria
YN	Nicaragua
YO	Roumania
YS	El Salvador
YU	Yugoslavia
YV	Venezuela
ZA	Albania

ZB1	Malta
ZB2	Gibraltar
ZC5	North Borneo
ZD3	Gambia
ZD6	Nyasaland
ZD7	St. Helena
ZD8	Ascension Island
ZD9	Tristan da Cunha and Gough Islands
ZE	Southern Rhodesia
ZK1	Cook Islands
ZK2	Niue
ZL	New Zealand
ZLØ	New Zealand Antarctica
ZM6	Western Samoa
ZM7	Tokelau Islands
ZP	Paraguay
ZS	South Africa
ZS3	South West Africa
ZS7	Swaziland
ZS8	Basutoland
ZS9	Bechuanaland Protectorate
3A	Monaco
3V	Tunisia
3W	Vietnam
3X	Guinea
4S	Ceylon
4U	United Nations
4W	Yemen
4X	Israel
5A	Libya
5B4	Cyprus
5H3	Tanganyika
5N2	Nigeria
5R	Malagasy Republic
5T	Mauretania
5U	Niger
5V	Togolese Republic
5W	Western Samoa
5X5	Uganda
6O	Somali Republic
6T	Sudan
6W	Senegal
6Y	Jamaica
7X	Algeria
9A	San Marino
9G	Ghana
9K	Kuwait
9L	Sierra Leone
9M	Federation of Malaya
9N	Nepal
9Q	Congo Republic
9U	Burundi
9X	Ruanda

SHORT WAVE RECEIVING AERIALS

Details for planning and constructing S.W. aerials to suit restricted environments are given in this article

by A. W. Mann

ALTHOUGH highly efficient short-wave receivers are commonplace today, many are used in conjunction with aerials of comparatively low efficiency. This is, however, often no reflection on the designers or operators but is due to lack of space for outdoor erection of recommended types exactly to specification. But there are many ways in which this problem can be resolved and ample scope for originality.

Vertical aerials are used by many short-wave broadcasting authorities throughout the world and Fig. 1 shows a vertical type receiving aerial which can be erected at a comparatively low cost. All that is required is a pole of 2in. or 2½in. square section, an ex-Services type 8ft two-section whip aerial and rubber mounting base with three bee-hive type insulators and sufficient wire for the down lead.

Note the platform dimensions: 8in. x 6in. x 1in., fitted to the top of the pole, and the method of mounting. Use wood screws in preference to nails. The dimensions should be adhered to as the base flange of the aerial mounting is 8in. diameter. If smaller insulators than the type recommended are to hand they could be used if mounted on 1½in. wooden blocks nailed to the pole.

If insulated wire is used for the downlead do not fix it to the pole by means of insulated staples, otherwise considerable damping will result.

As vertical aerials are omnidirectional, excellent results may be expected providing that they are erected at a sufficient height. The author strongly recommends this type of aerial for use with receivers incorporating one or more r.f. stages.

In the case of regenerative receivers with no r.f. stage, a rigid copper rod is preferable to a rubber-base mounted whip to avoid instability due t swaying in the wind. This does not apply t superhets.

Tuning the Aerial

It is generally appreciated that a tuned aeria system is more efficient than an untuned one an in addition improves the signal-to-noise ratic Fig. 2 shows a pi-type aerial tuner using a multi tapped coil tuned by two variable 200pF capaci tors, the taps being selected by a rotary switch The tuning coil consists of 25 turns of 20 gaug tinned copper wire spaced one diameter of th wire and wound on a 1in. diameter former.

This type of tuner should be built into a meta box. Efficient screening is essential in order t avoid direct pick-up by the coil winding, and t sharpen the tuning.

Tuning Procedure

First tune in a signal on the receiver and the rotate the aerial tuner controls to obtai a peak signal while trying different tappings The optimum tapping is the one at which readjust ment of the tuning controls produces the loudes signal and lowest noise level.

The peak points, which are more or les constant for a given band, are not the same for al

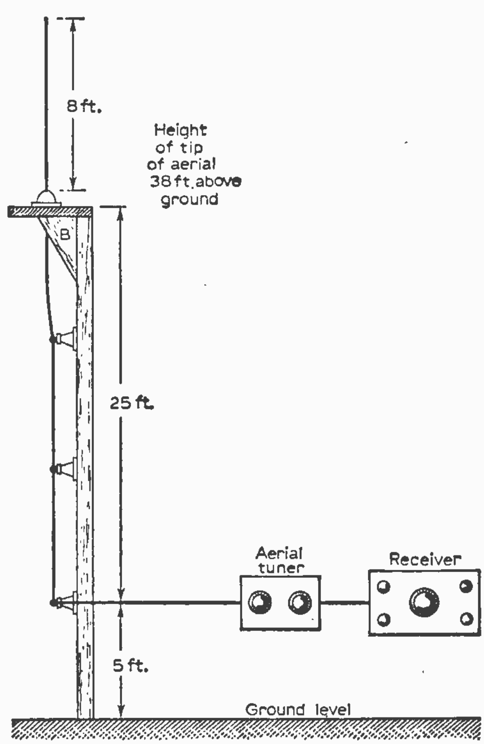


Fig. 1: An inexpensive but efficient vertical aerial.

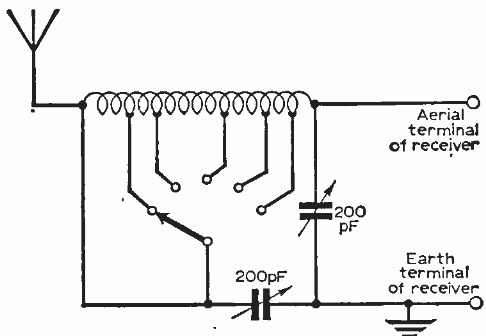


Fig. 2: A pi-type aerial tuner using a multi-tapped coil.

bands, and changing from one band to another calls for retuning of the aerial and some adjustment of the tapping points.

Once the peak points of the different bands have been found, the dial readings and tapping points can be logged for future reference. While additional tuning controls are generally to be avoided if possible, in the case of aerial tuners the advantages far outweigh the disadvantages.

Other Aerial Tuners

At Fig. 3 another very simple yet efficient aerial tuner is outlined. This consists of 26 turns of 14 gauge tinned copper wire spaced $\frac{1}{16}$in. between turns on a $1\frac{1}{2}$in. diameter former. Tapping points are made by spring clips, later to be replaced by a suitable switch.

With this particular tuner no difficulty should be experienced. It is necessary only to set the aerial tuning dial at zero, tune in a signal on the receiver, then tune the signal to maximum volume with the tuner. Try different tappings, then retune the aerial. At one point on a particular turn the actual peak point will be found.

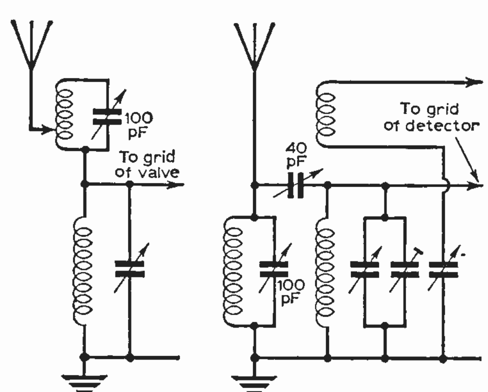


Fig. 3 (left): Another simple aerial tuner. Fig. 4 (right): This method of tuning uses a duplicate set of plug-in coils.

This procedure should be followed on all bands and the tapping points and dial readings noted. It should be remembered that when using tapped coils and spring clips in the initial tests, it is not sufficient to select merely the correct turn on the coil, but also the correct part of the turn from which to take a permanent tap to a rotary switch. This particular form of aerial tuner is ideal for use with receivers of the regenerative type.

Fig. 4 shows a method of aerial tuning in which a duplicate set of plug-in coils is used. This can also be used as an additional selectivity device and wave trap and is suitable for use with regenerative receivers. If used in conjunction with plug-in coils of identical type and make to those in the receiver no difficulty will be found in tuning to resonance. In the case of this and the series tuner of Fig. 3 a slight backing-off from the resonance point will assure stability.

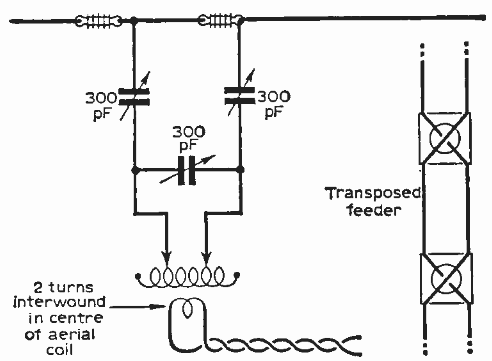


Fig. 5: This tuner is designed primarily for open wire or transposed feeders.

The aerial tuner shown at Fig. 5 is designed for aerials with open wire or transposed feeders. Although it can be used with twisted flex feeders, tuning is rather difficult.

Indoor Directional Aerials

It sometimes happens that the erection of a good outdoor receiving aerial is impracticable or forbidden. The problem is to decide what form an indoor aerial should take.

If a criss-cross roof space arrangement is used with a single wire down lead, the chances are that the latter will be longer than the aerial if the receiver is located in a downstairs room, and furthermore will be heavily damped due to its proximity to walls.

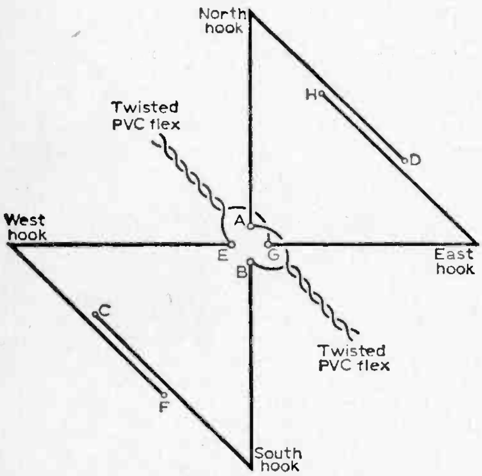
The foregoing remarks are based on personal experience and is the reason why many really sensitive receivers give a below-average performance when used under such conditions. If, however, it is possible to arrange the down lead away from the wall a marked improvement will result. Even so, such indoor aerials are of comparatively low efficiency.

With the foregoing considerations in mind readers should consider the erection of a dipole type, providing that each span can be at least 20ft long.

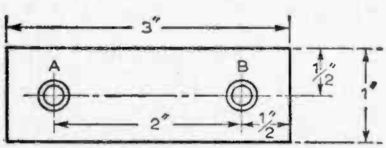
In many instances however, that will be impossible in the average roof space. However, each span can be bent as shown at Fig. 6 and Fig. 7. The spacer shown at Fig. 8 is of plastic or other insulating material fitted with two terminals.

Plastic-covered electrical flex may be used for the transmission line and the switching over from one aerial to the other may be achieved via a relay or a double-pole, double-throw switch. The arrangement shown at Fig. 6 was fully described as relay switched by the author in *Practical Wireless* some years ago.

The use of a single dipole of the forms described



Figs. 6 (above) and 7 (right): Show how indoor aerials may be bent to be accommodated in limited space. Fig. 8 (below): Shows the spacer.



here is not recommended for indoor use as it is very directional. This type of aerial is only recommended when arranged as described due to its broadside directive properties. This means that for east-west reception the aerial must be run north to south and for north-south reception east to west.

If arranged as suggested the twin dipoles will provide world-wide coverage. Anyone using a receiver fitted with an S meter will find that tests using alternative aerials on a given signal will show a marked increase or decrease in signal strength, sometimes from 4 to 5 S points.

During the past 18 months the author has used the aerial shown at Fig. 6 exclusively in conjunction with a Senior National H.R.O. Using the east-west aerial a particular amateur band could appear to be more or less dead, whereas switching to the north-south aerial produced strong signals from some unexpected sources. This shows that although the H.R.O. is of high sensitivity the aerials are also very efficient. For some years this particular arrangement has also been used with the R1155A and R1116A with gratifying results.

General Arrangements

Let us examine the sketch at Fig. 6 in detail. From A to D is a single wire, as is B to C, E to F and G to H. In Fig. 7 we have single wires A to B, C to D, E to F and G to H. Two separators fitted with terminals or suitable sockets and plugs are required, details of which are given in Fig. 8. Stranded insulated aerial wire should be used and the aerial system should be supported by small brass hooks.

A Horizontal U Aerial

Where a short-wave receiver is used in a separate room the aerial arrangement shown at Fig. 9 provides scope for experiment if suspended above the receiver and between the end walls.

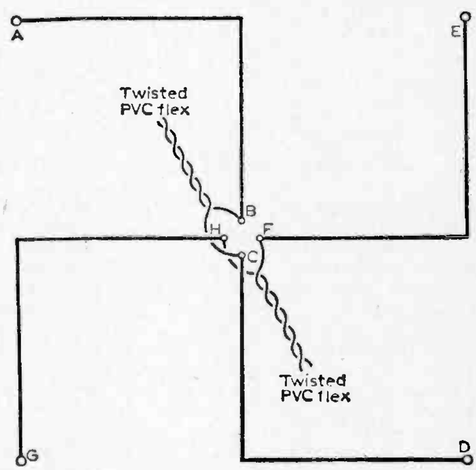
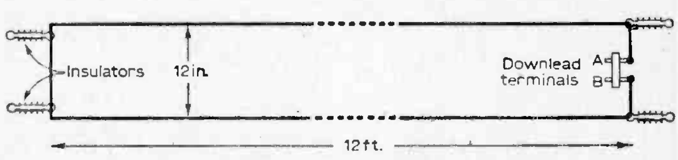


Fig. 9 (below): An aerial suitable for assembling in a room.



The down lead will be a short one and may be fitted to terminal A or B at will. This will alter the aerial directivity to some extent and if used in conjunction with the aerial tuner shown at Fig. 3 will considerably peak signals using either connection. If the terminals are shorted, a definite drop in signal strength will result.

Providing that bare stranded copper wire is used, the down lead may be tapped on at any point by means of a spring clip (such as in the Windom aerial) one-third from either end, although other points may be tried. If an S meter is available the maximum or peak point can be noted, after which the aerial tuner can be coupled in and a further note taken as to the extra gain obtained. ■

A SIMPLE A.M. TUNER

By B. W. Hollinshead

IT is widely accepted that the highest quality of reproduction of radio programmes is obtained by feeding the output of an f.m. tuner into a high fidelity amplifier. The frequency response of these transmissions and their freedom from background noise cannot be matched by even the best a.m. tuners.

However, the disadvantages of the f.m. tuner are its high initial cost, its difficulty to align without proper equipment and the fact that in some areas the v.h.f. service is not readily available.

There must be, however, numerous enthusiasts who would be content with simple equipment, which can be constructed at a comparatively low cost, to feed their amplifiers and tape recorders and it is to these that the following design is offered.

When considering the design of an a.m. tuner two courses are open. The "superhet" tuner is more complex and presents alignment problems similar in many ways to those of f.m. units. On the credit side it must be said that the superhet has superior selectivity and sensitivity to the t.r.f. or straight set.

However, the t.r.f. tuner unit to be described here will give a higher quality output than a superhet and several of the more powerful Continental stations are within its reach as well as the BBC programmes. Added to this the lack of i.f. transformers etc., will considerably reduce costs. The tuner will be suitable for feeding either an amplifier on tape recorder.

Circuit

Only two valves are used in this circuit, which is shown in Fig. 1. The first valve is a variable-mu r.f. pentode, the type used in the original being an EBF89 with the diodes strapped and earthed. This valve was used simply because the writer had one to hand and there is plenty of latitude for the choice of valve to be used in this position. An EBF80 could be inserted without any change of wiring and for those who have them available a 6BA6 on a B7G base, EF85 or EF89 on B9A bases or even the 6K7 on an octal base might be considered. The only requirement would be that the appropriate cathode bias resistor for the valve should be used instead of the 330Ω resistor stipulated in the present case.

The detectors uses a double triode ECC82 or 12AU7. The first half of the valve is strapped as a diode, the second half being used as a cathode follower. This arrangement serves two purposes, the diode noted for its low distortion is an excellent detector, while its inherent disadvantage, that of imposing undue clamping on the tuned circuit thus making selectivity rather poor, being overcome by the high impedance of the cathode follower. The cathode follower also allows a fairly long lead to be used for connecting to the amplifier. An ECC81 (12AT7) or ECC83 (12AX7) might be tried

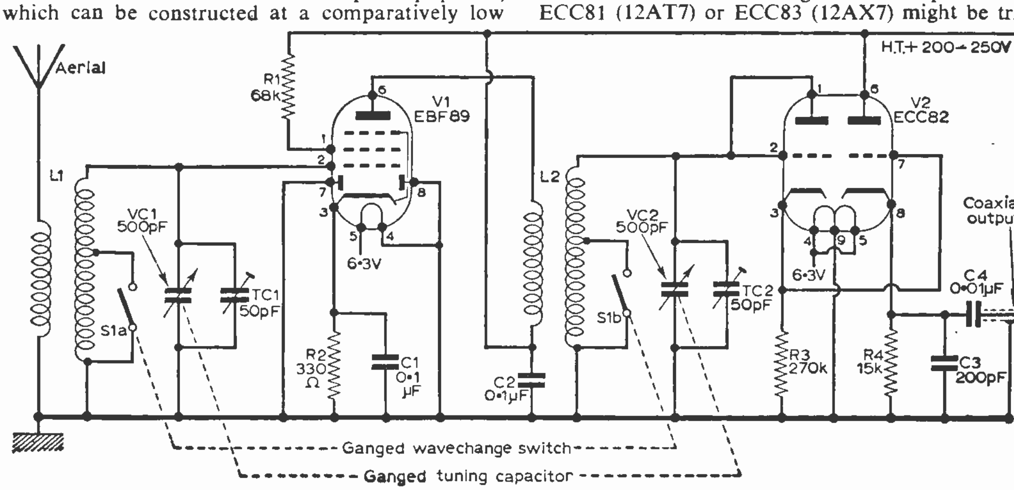


Fig. 1: The circuit.

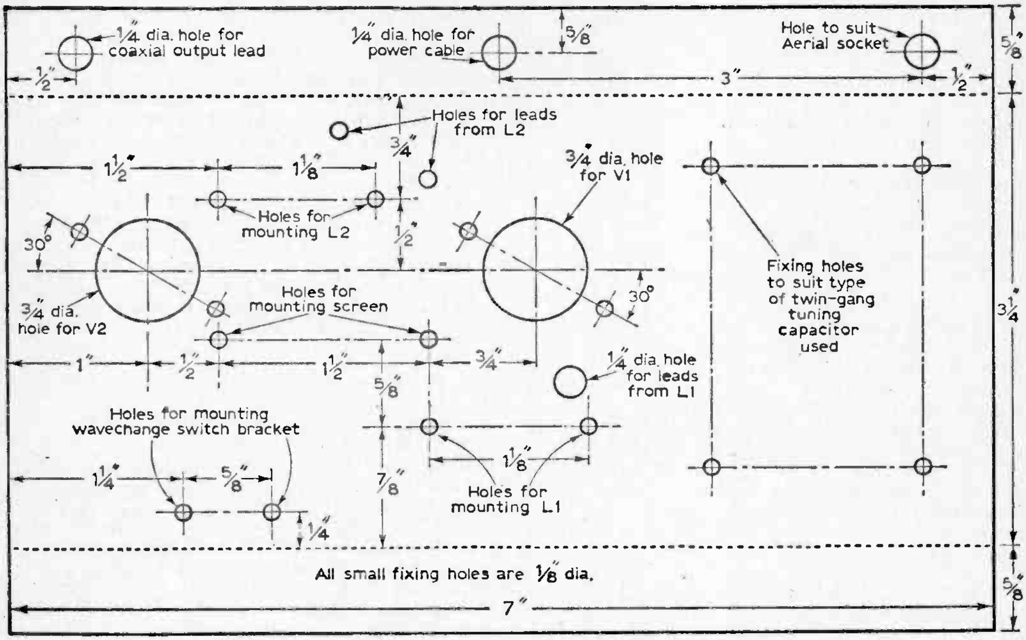


Fig. 2: The dimensions of the chassis.

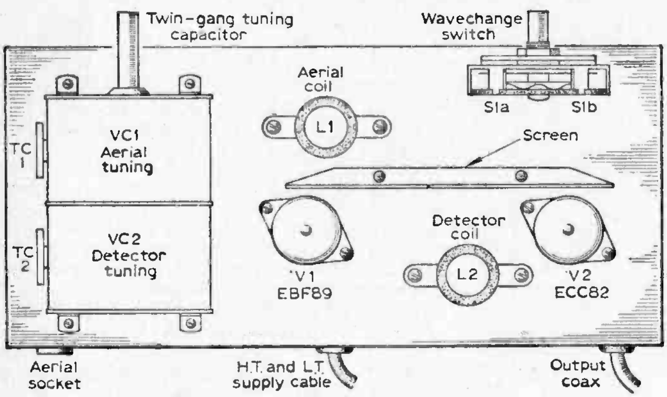


Fig. 3: The above-chassis layout diagram.

in this position if available, having the same base connections. Similarly the octal based 6SN7 or 6SL7 might be tried also.

The R.F. Coils

The coils used in this circuit were Repanco DRM3 dual range t.r.f. coils, the reaction winding being disregarded. These were used for no other reason that the writer had a pair in his spares box, and any similar dual range t.r.f. coils such as the Osmor QA11D or QR11D would suit.

If individual constructors prefer, separate coils could be used for each band but this would add some extra complexity to the switching and cost more. Apart from this the chassis would need to be increased in size to accommodate these extra components. This the writer feels would detract from the designed simplicity of the unit.

The wavechange switch was ar ex-Government single-wafer, two- pole, two-way switch obtainabl quite cheaply and probably to be found in most spares boxes, or could be easily adapted from a similar switch having more poles

A simple epicyclic reductior drive for the two-gang capacitor makes for easy tuning. The trimmers were chassis mountin compression trimmers taken from an old superhet.

Construction

In the writer's tuner the overal size was kept as small as possibl without making the chassis un duly cramped. A small tuning capacitor wa available and a larger component might requir some increase in chassis width. To keep the deptl of the chassis to a minimum, both aerial anc detector coils were mounted above the chassis, ar earthed aluminium screen being fitted as in the drawing (Fig. 3) to prevent any instability. The screen does the job admirably as the tuner is quit stable.

The chassis was cut from a piece of 16s.w.g aluminium sheet measuring 7in. x 4½in. Runner ⅝in. deep are marked and bent on the front anc rear. Full details are given in Fig. 2. All holes ar drilled, those for the valveholders being cut eithe with a chassis punch or by drilling and filing. Th valveholders are then fitted with a solder tag unde each bolt after which the tuning capacitor anc

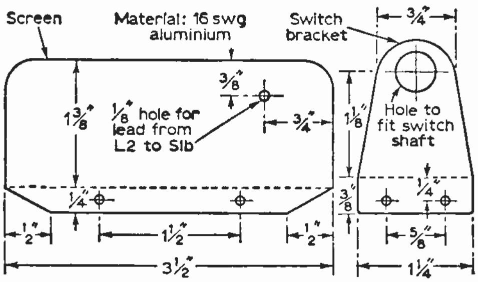


Fig. 4: Details of the screen.

drive are mounted on the right-hand side of the chassis. The method of mounting will vary with different capacitors.

The aluminium screen is drilled after being cut to size according to details given in Fig. 4 and fixed in place with 6B.A. bolts. A bracket is made from aluminium to take the wavechange switch S1 and is bent and drilled so that the switch and tuning capacitor shafts are at the same height. This bracket is also held in place with 6B.A. bolts.

The coils are finally bolted in place with the aerial coil at the front of the chassis and the detector coil behind the screen. The trimmers are soldered directly to the tuning capacitor and the earthed ends bolted to the chassis.

Wiring

As most of the components are small they can be wired directly to the valveholder tags. Tinned copper wire is used for connection and covered with sleeving where necessary. As some single screened pick-up lead was available the grid lead in the detector circuit was screened although it may not have been absolutely necessary to do so.

The diodes, pins 7 and 8 of the EBF89 were strapped together at the valveholder and earthed together with pin 4 as the heater return. Pins 4 and 5 of the ECC82 are taken to the heater supply via pin 5 of V1. Pin 9 goes to earth. The grid and anode pins of the first half of the ECC82 are strapped to form the diode connections.

The h.t. circuit can then be wired. The anode of the second half of the ECC82 takes its h.t. direct from the h.t. rail without the need for an anode resistor. Similarly the h.t. supply to the anode of V1 via the detector coils does not use a resistor. The feed for the screen grid of V1 is via a 68kΩ resistor R1.

COMPONENTS LIST

Resistors:

R1	68kΩ	R3	270kΩ
R2	330Ω	R4	15kΩ

All ½W, carbon

Capacitors:

- C1 0·1μF paper 350V
- C2 0·1μF paper 350V
- C3 200pF silver mica
- C4 0·01μF paper 350V
- VC1 500pF } twin-gang tuner
- VC2 500pF }
- TC1 50pF compression type trimmer
- TC2 50pF compression type trimmer

Valves:

- V1 EBF89 or EBF80
- V2 ECC82

Coils:

- L1, L2 Dual range t.r.f. coils (Repanco DRM3—see text)

Switch:

- S1 Two pole, two-way rotary

POWER PACK COMPONENTS

- R1 1·8kΩ 1W
- C1 32μF } dual electrolytic 350V
- C2 32μF }
- T1 Mains transformer with tapped primary. Secondaries: 0–200V 20mA; 6·3V 1A
- MR1 Contact cooled rectifier, 250V 20mA
- S1 Double-pole, on/off switch

Testing

When all wiring has been completed the tuner can be connected to a suitable power supply which in the writer's case was taken from the main amplifier. A supply of 200-250V at 22mA and 6·3V 0·6A will be required. Should this not be available from the main amplifier a suitable power supply circuit is shown in Fig. 5. This uses a contact cooled rectifier and a transformer from a TV converter.

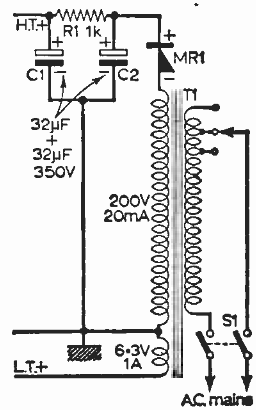


Fig. 5: Circuit of a suitable power-pack.

The output from the tuner is fed via coaxial cable to the amplifier input and a suitable aerial is connected. With the switch in the long waveband position it should be possible to tune the BBC Light Programme at good strength. With the unit switched to medium waves the Home Service is available and, during certain hours, the Third Programme as well. During the evening several Continental stations should be heard. It is only necessary to adjust the trimmers for maximum output and the tuner is completed.

If desired an on/off switch can be fitted to the front of the tuner in the h.t. lead so that the apparatus is always ready for use without waiting for the heaters to warm up.

A pointer was cut from $\frac{1}{16}$in. Perspex and fixed to the epicyclic reduction gear with "Araldite" or similar glue. If a front panel is fitted the hole for the drive must be cut and the panel mounted before the pointer is glued in position. The writer's tuner was mounted in a small box with all leads coming from the rear and station names marked on the front panel with transfers.

In conclusion the writer feels that constructors of this tuner will be agreeably surprised both with the performance of this tuner and also with its simplicity and low cost. ■

A Versatile DOUBLE-TRACE OSCILLOSCOPE

By J. H. B. Gould

CONTINUED FROM PAGE 519 OF THE OCTOBER ISSUI

WHEN two functions have to be compared by means of an oscilloscope, it is often simplest to do this by using a double trace. Normally, a double-trace display is obtained using a split-beam or double-gun cathode ray tube; however, practically the same result can be arrived at with a normal tube, using an electronic trace-splitting circuit. The circuit described here uses one valve: a double triode.

Electronic Trace-switching

In order to produce two traces, a single-beam c.r.t. must draw each trace successively. It can do this in three ways:

(1) By completing the one trace and then going on the other, see Fig. 14(a).

(2) By drawing a small section of one trace, then a small section of the other, and continuing until both traces are complete, i.e. "sampling", see Fig. 14(b).

(3) By drawing one trace several times and then carrying out the same process on the other trace.

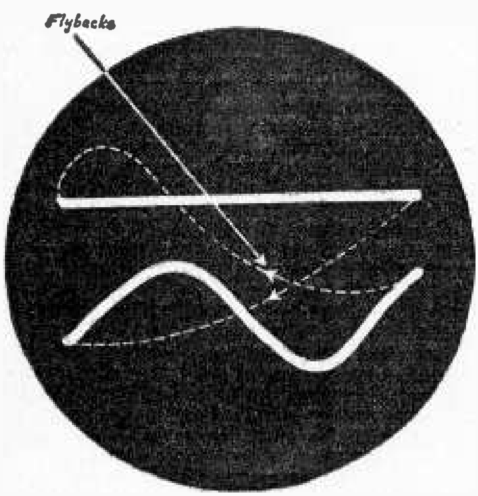


Fig. 14a: Producing two traces from a single-beam c.r.t.: one trace completed, then followed by second trace.

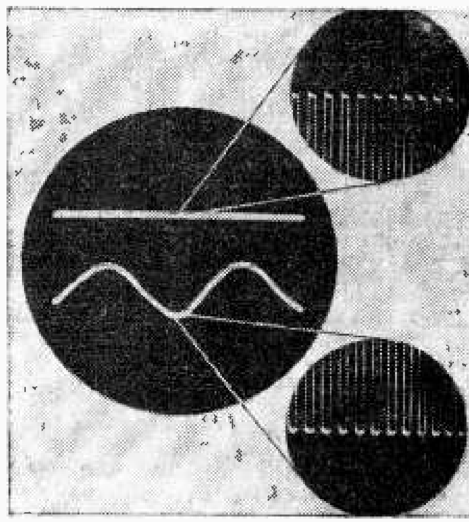


Fig. 14b: Producing two traces from a single-beam c.r.t. "sampling" method.

The circuit can operate in any of thes "modes".

As each trace has to carry different information there must be two Y inputs, switched or gated sc that they are each applied to the Y deflectors onl when the correct trace is being drawn. The existin amplifiers are used for this purpose, controlled b the square-wave output from a multivibrator.

The Trace-switching Circuit

Fig. 16(a) shows a balanced multivibrator, anc Fig. 16(b) indicates the waveform it develops. Th multivibrator is a two-stage, resistance-couplec amplifier in which the output of the second stag is coupled to the input of the first; the circui oscillates by virtue of the positive feedbacl arising out of this coupling. During one half cycle one triode carries a heavy anode current whilst th

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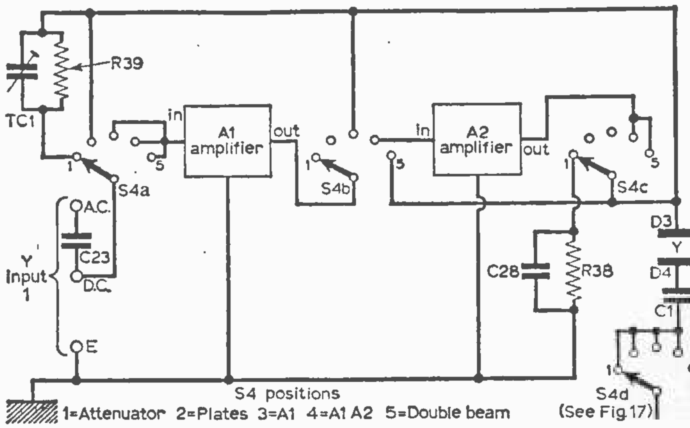


Fig. 15: Selector switching (with beam switching). Otherwise as Fig. 13b.

other triode is cut off; then the situation reverses for the other half cycle. This behaviour makes the circuit ideal for controlling the "gating" amplifiers.

As can be seen from Fig. 16(b), each cathode of the multivibrator carries a large positive voltage for half its operating cycle. In practice, (Fig. 17), each cathode returns to earth via the cathode bias resistor of one of the amplifiers "A1" "A2". In this way, one amplifier is always cut off at any given time while the other is operating normally, feeding the trace.

The "Double-beam" position of the Y selector switch (S4) connects the outputs of both amplifiers in parallel across the deflector plates, and switches on the multivibrator. It does one other thing: it connects the *other* Y deflector plate (conventionally known as "Y2") to the slider of a potentiometer (VR10) forming the anode load of one side of the multivibrator (through what has been up till now the Y-plate bypass capacitor); the purpose of this is to separate the two traces.

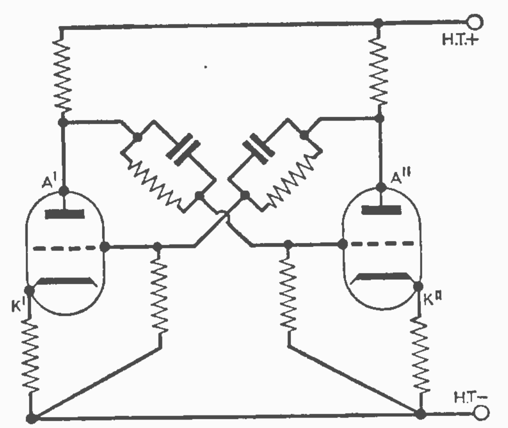
When the trace-splitting circuit is built into the oscilloscope, the output capacitors of the two amplifiers (C27 of Fig. 12) should be shorted out and removed. If this is not done, the capacitor of the quiescent amplifier will act as a frequency dependent shunt across the plates. The only effect this action will have on normal operation is a movement of the trace when switching from "Plates" to "Amplifiers", and this can easily be corrected using the appropriate shift control.

Once the circuit has been set up, there will normally be little need to touch the intensity-balance control (VR11), so a "preset" type of rheostat is quite adequate here. However, occasions may arise in which this control could prove useful; for example, where one trace shows a waveform of much greater amplitude than the other. For this reason, it is wirth while mounting this VR11 on a simple aluminium angle-bracket bolted near to the edge of the chassis just clear of the case (to the rear of hole "H" in Fig. 2, for example). Here, it could be operated when necessary by passing the blade of a screwdriver through a matching hole in the outer case.

Operating the Circuit

The two inputs are fed to the X and Y terminals respectively.

Any of the three previously mentioned operating modes can be set up with this circuit. For mode (1), the multivibrator is synchronised at *half* the timebase frequency; for mode (2) it runs freely at a much *higher* frequency than that of the timebase (or it can be synchronised at a high multiple of the



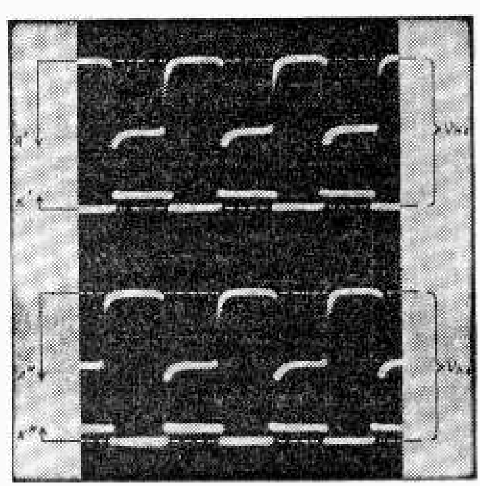


Fig. 16a (above): A balanced multivibrator. Fig. 16b (right): Waveform generated by circuit of Fig. 16a.

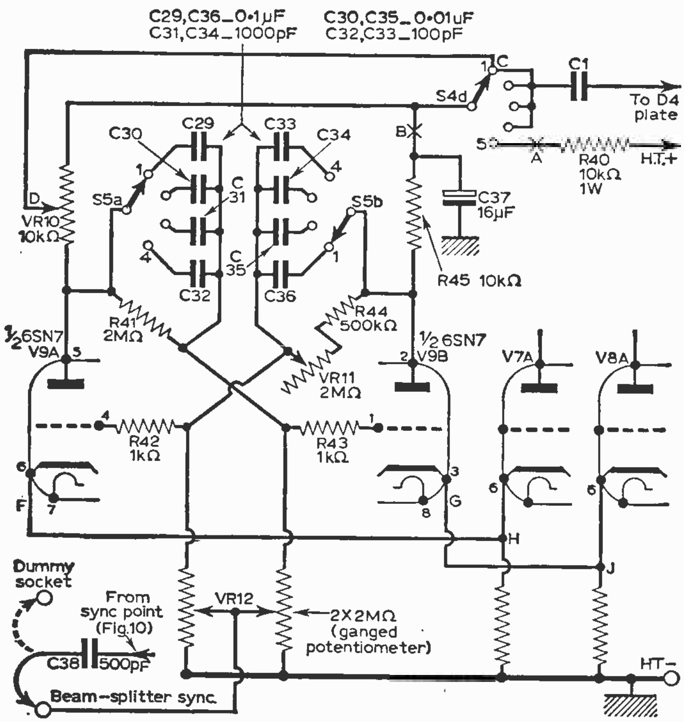


Fig. 17: The trace-splitter circuit, V9a and V9b.

timebase frequency); for mod
(3) it is synchronised at a *sub*
multiple of the timebase fre
quency.

The first mode is the on
most commonly employed. Th
"sampling" mode can find
use at very low timebase fre
quencies where flicker become
a major problem. Mode (3) ha
serious disadvantages, but i
is useful at very *high* timebas
frequencies, when phase shif
in the trace-switching circui
sets an upper limit on its usefu
operating frequency.

Yet a fourth mode of opera
tion is possible. In this, the tw
traces are displayed *side-by
side*. To set this up, the multi
vibrator is synchronised at th
same rate as the timebase an
the trace-separation contro
turned down to zero. Thi
mode can be useful in compar
ing amplitudes, if the gain set
tings of the amplifiers are take
into account.

To avoid damaging the Y
selector switch, the instrumen
should be switched off befor
switching to or from th
"Double-beam" position.

COMPONENTS LIST
FOR INSTRUMENT TYPE 4
(trace-splitter version Figs. 15 and 17)

Resistors:

R40	10kΩ	R43	1kΩ
R41	2MΩ	R44	500kΩ
R42	1kΩ	R45	10kΩ

All 10%, ½W carbon

VR10 10kΩ potentiometer
VR11 2MΩ potentiometer
VR12 2 x 2MΩ twin-ganged potentiometer

Capacitors:

C29 0·1µF paper
C30 0·01µF paper
C31 0·001 µF ceramic or mica
C32 100pF ceramic or mica
C33 100pF ceramic or mica
C34 0·001µF ceramic or mica
C35 0·01µF paper
C36 0·1µF paper
C37 16µF electrolytic 350V
C38 500pF ceramic or mica

Valve:

V9 6SN7

Switches:

S5 2-pole 4-way wafer type rotary
S4 4-pole 5-way wafer type rotary

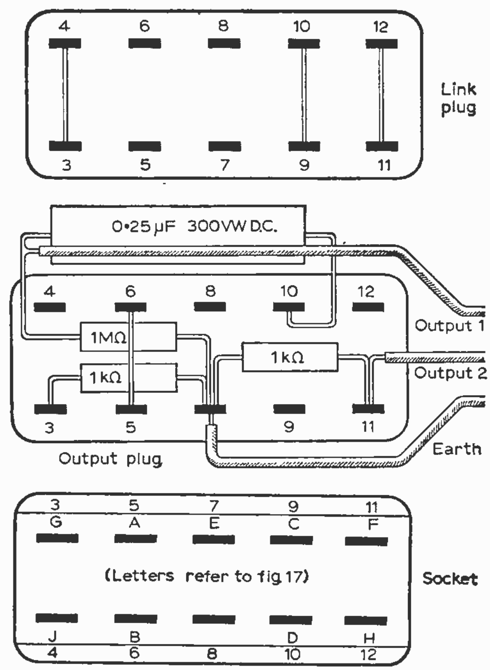


Fig. 18: Link-plug connections for squarewave generato using 10-way Jones plug.

The Controls

There are five controls governing operation of the trace-splitter circuit (see Fig. 17): the Y-selector switch (S4); the trace-splitter frequency switch (S5); the trace-separation potentiometer (VR10); the trace-splitter sync potentiometer (VR12) and the intensity-balance rheostat (VR11).

This last mentioned control has two functions: when the circuit operates in mode (1), it can correct any tendency for one trace to repeat at the expense of the other; in the other two modes it can be used to increase the *brilliance* of one trace relative to the other. As with the timebase, the sync control should be set at the lowest level at which it is effective.

Using the Circuit as a Square-wave Generator

A square-wave generator is useful for such tasks as checking the frequency response of amplifiers or filter networks. In order to use the trace-splitter circuit as a square-wave generator, a number of circuit changes must be made on each occasion. By far the easiest way of making these changes automatically is to use the link-plug method.

For this, a socket is necessary on the oscilloscope. There is not likely to be much room for this on the panel, and it could just as well be mounted on the chassis near to the multivibrator and facing a hole cut into the outer case. A ten-way Jones type connector is ideal for this job, with the *female* member mounted on the instrument to prevent shocks should it be handled accidentally.

The circuit of Fig. 17 must be modified by removing the two leads joining the cathodes of the multivibrator to those of the amplifiers and also that joining the slider of the trace-separation potentiometer (VR10) to the Y selector switch (S4d). These points are then wired to the link socket as shown in Fig. 18.

During normal operation, a link plug is left in this socket; but when a square-wave output is required this plug is removed and replaced by another plug carrying the output leads.

Warning: About 250V d.c. can exist between pin 10 of the square-wave output plug and one of the leads under certain circumstances *after the plug has been removed*. This will persist until the charge on the capacitor has leaked away.

In this condition, the frequency and sync controls retain their original functions. However, the trace-separation control now becomes an amplitude control for Output 1 and the intensity-balance control determines the waveform of the outputs, particularly the "mark-space" ratio.

With the output plug in position, the Y selector switch can operate in any position except "Double-beam", which is now out of action.

The sync input is fed from a socket on the front panel so that the trace-splitter circuit can be synchronised from an external source if desired. To save using a switch, the timebase generator synchronising waveform is brought to another socket by a wander plug, which can be transferred to a dummy socket when using external sync.

This plug and socket arrangement is similar to that used for selecting either internal or external sync for the timebase generator. Details of the additional drilling required are given in Fig. 19. It will be seen by referring to Fig. 1 that the trace-splitter sync sockets are located immediately below those for the timebase generator.

Oscillography

Many excellent oscillograph cameras are available for use with cathoderay oscilloscopes. These are not an economic proposition for the amateur,

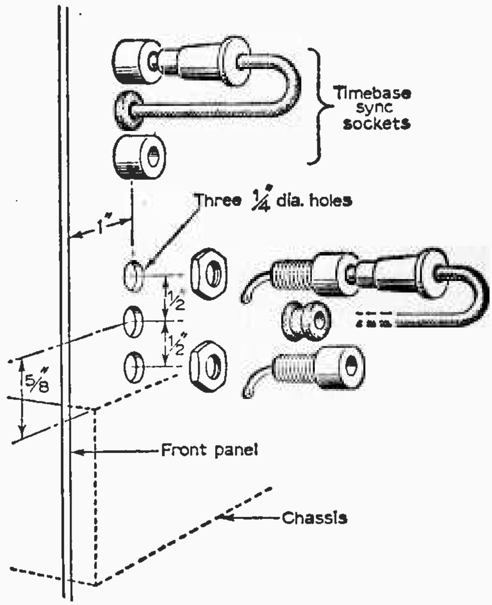


Fig. 19: Trace-splitter sync sockets.

however, and it is proposed to conclude the present series by describing a simple method of using an ordinary 35mm. still camera.

Only recurrent displays will be dealt with, as transient waveforms demand either a motor-driven camera or an oscilloscope equipped with a single-sweep timebase. But it should be remembered that the term "recurrent display" covers not only waveform on a linear timebase, but any kind of steady pattern: Lissajous figures, valve and transistor characteristics, amplifier input/output characteristics and the like.

The screen of an oscilloscope is a very small target for a normal camera, so to obtain any results worth having, the lens must be brought close to the screen. The first problem, then, is to focus the camera at this short range. The simplest method is to use a "No. 3" or +3 diopter supple-

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V. E. HOLLEY describes

the conversion of a CAR RADIO for A.C. Mains Operation

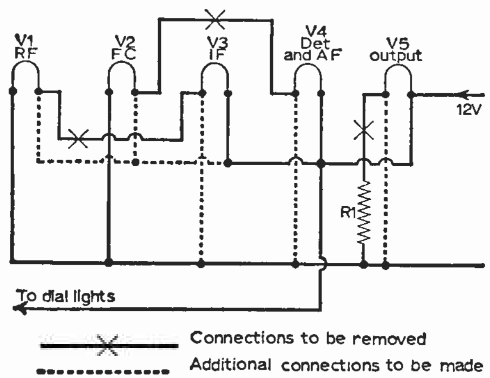
A SIMPLE AND INEXPENSIVE CONVERSION WILL PROVIDE A HIGH QUALITY DOMESTIC RECEIVER

NOW that most car radios of current manufacture employ transistors, the older valve type receivers can often be picked up quite cheaply secondhand. These car radio receivers incorporate an r.f. stage and the gain, selectivity and a.g.c. performance are all better than average kind of broadcast receiver. It is only necessary to provide a mains power pack and a reasonable aerial, to produce a domestic receiver which will give a good account of itself and will be especially useful in areas where reception conditions are poor. Conversion is a simple task which may be undertaken with confidence.

Valve Heaters

Virtually the only alteration required in the receiver itself is to the heater wiring. The heaters will almost certainly be wired in series pairs, a series resistor being used on one valve to complete the pairs for 12V operation. The heaters must be paralleled for 6·3V working. The original circuit will look something like Fig. 1 (solid lines) which shows the connections to be removed and the additional ones to be made. The 12V dial lights will, of course, need to be replaced by 6·3V bulbs.

Fig. 1 (below): A typical heater chain circuit of a car radio.



H.T. Requirements

The h.t. requirement will be between 60 and 70mA as a rule, at a voltage somewhere between 200 and 250. The voltage can be determined within close limits by examination of the output stage.

For example, in the prototype conversion, the output valve, an EL42, was found from the valve list to require an anode voltage of 225. Allowing for bias and for voltage drop in the primary of the output transformer, an h.t. voltage of 235 was deduced. The power pack was designed accordingly to the circuit of Fig. 2. Here, a valve rectifier, 6X4, is used in a full wave circuit and the d.c. voltage available at its cathode is 280 with an 8μF reservoir capacitor. About 45V must therefore be dropped in the smoothing resistor R1. Reference to valve lists showed that the h.t. consumption of the receiver should be about 60mA, and R1 was therefore given a value of 750Ω, which, in association with the capacitors C1 and C2, provides adequate smoothing.

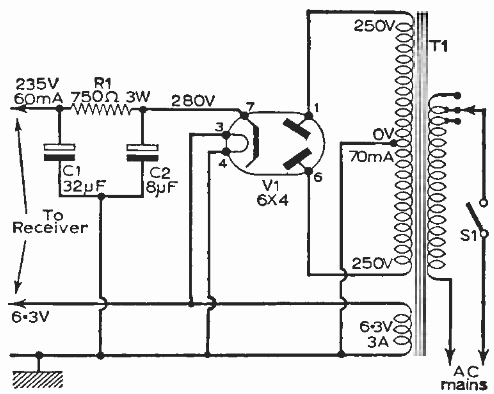
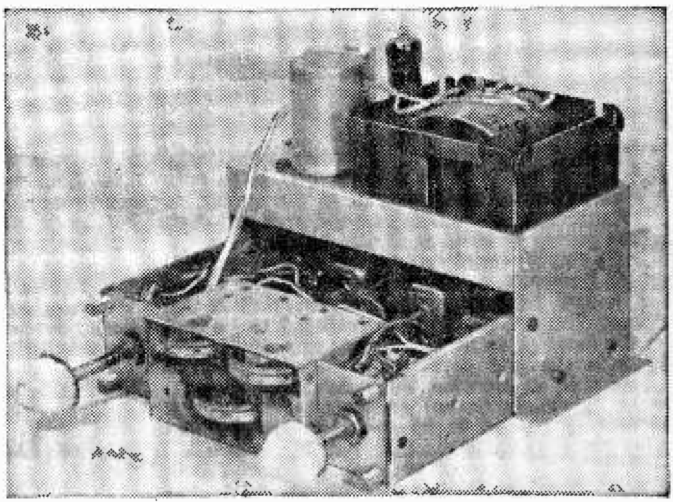


Fig. 2: The circuit of the mains power pack.

The transformer used had only a single 6·3V winding. If a separate rectifier winding is available, it is good practice to use it and so avoid having a large difference of potential between the rectifier heater and cathode. The power supplies can be fed into the receiver through the socket to which the original power pack was connected.

Construction

It is convenient if the new pack can be built on to the receiver to form a single complete unit, and this was accomplished in the writer's case by constructing the pack on a chassis of 18s.w.g. sheet aluminium, fitted over the rear of the receiver as shown in the photograph. This chassis provides support for the new components, covers the rear of the receiver which would otherwise be unprotected after removal from its original case, and leaves a space available above the receiver controls to accommodate a 7in. x 4in. elliptical loudspeaker.



A car radio converted by the author to operate from a.c. mains.

Unless the set to be converted is a very old one, it will conform to the standard car radio measurements of 7in. x 7in. x 2in., and the chassis dimensions given in Fig. 3 will hold good.

The arrangement of the components is entirely a matter of convenience—Fig. 3 gives an idea of the prototype layout together with details of the wiring. The mains supply should be taken into the receiver chassis close to the on/off switch, passed through the switch and taken thence to the mains transformer primary. The original wiring to the switch should, of course, be removed.

Testing

Before putting the converted receiver into service, the h.t. line voltage should be checked at the anode of the output valve and the value of the smoothing resistor altered if necessary to bring the line voltage to within ±10V of the correct value. In this connection, it should be noted that some of the older car radios carry a smoothing resistor and capacitor in the receiver chassis and if these are found to be present, their equivalents, R1 and C1 (Fig. 2), may be omitted from the new power pack. ■

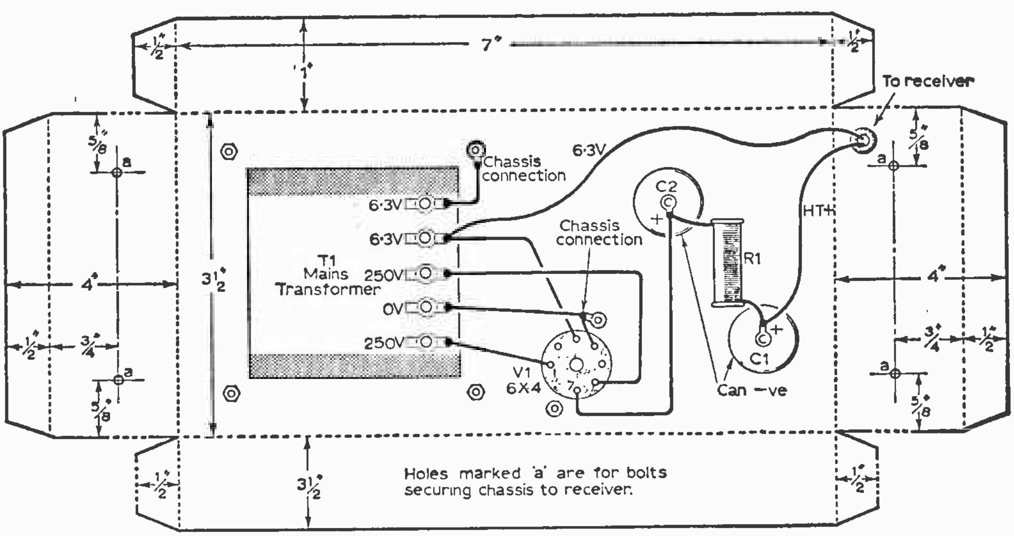


Fig. 3: The wiring diagram and chassis details.

electronic DOOR CHIMES and BURGLAR ALARM

By R. Bebbington

MANY variations are possible on the electronic chimes theme to be described. It is as well therefore to discuss these at the outset so that constructors may weigh up the pros and cons before getting involved in circuit details.

In its entirety the circuit consists of two sections, a high frequency oscillator for the burglar alarm and a low frequency oscillator to produce the chimes. The h.f. oscillator is arranged to be just on the point of oscillation so that any slight variation in the grid capacitance, for example the presence of an intruder, will cause oscillations to cease. This allows the second triode to conduct and to operate a relay in its anode circuit, and the relay contacts supply the chime oscillator with h.t.

Should the constructor already possess door chimes, these can be operated by connecting the relay contacts in place of, or across the existing bell-push. This would, of course, dispense with the circuitry of V2. Alternatively a dummy bell-push could be used consisting of a metal plate connected to V1 grid circuit. As the hand approaches this, the chimes would sound in anticipation, as it were, of the now bewildered caller.

Many other novel uses of this proximity device spring to mind, including displays for bazaars, etc. The relay contacts may be wired to operate bells, bulbs or more ingenious devices.

For the constructor who decides that he is burglar-proof or perhaps has nothing worth stealing, the chime circuit alone is well worth constructing. As this constitutes the heart of the circuit we shall now consider it in some detail.

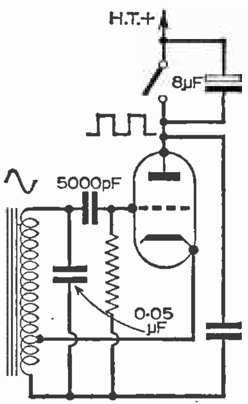


Fig. 1: The basic Hartley oscillator circuit.

Basic Hartley Chime Oscillator

Designed around the ubiquitous 12AU7 double-triode, this Hartley oscillator is capable of realistic chime effects, the basic circuit being shown in Fig. 1. The frequency determining components are the centre-tapped coil and the 0·05µF capacitor across it. The formula for calculating the required values of these components for a given frequency is the well known $f=\frac{1}{2\pi\sqrt{LC}}$. This is less formidable if both sides are squared, and values of L and C can then be easily found by interpolation.

For example: $f^2=\frac{1}{4\pi^2LC}$

therefore $L=\frac{1}{4\pi^2f^2C}$

and $C=\frac{1}{4\pi^2f^2L}$.

Thus for C at 524c/s using 0·05µF the choke required would be

$$L=\frac{1}{4\pi^2f^2C}\simeq 200\text{mH}.$$

It will be noted that this is only calculated approximately, as component tolerances and the self-capacitance of the choke would need to be taken into account for accurate calculation.

Coupling to the valve is via the 0·005µF capacitor and is so small that valve characteristics and h.t. supplies have little or no effect on frequency. This important feature is exploited in the method employed to give the notes their chime-like sound. These are characterised by a rapid initiation of the note and a sustained decay time; the 8µF capacitor in the anode circuit gives rise to the latter effect. On release of the push-button the capacitor tends to charge through the valve and maintains oscillations for a period depending upon the value of this capacitor. As the frequency is substantially independent of the h.t. supply the note remains at the same pitch as it decays. The 8µF gives a decay time of about 1sec.

It will be realised from the foregoing that this circuit could usefully be employed in electronic organ circuits with the sustain capacitor switched in for special effects.

Practical Chime Circuit

For those interested primarily in the chime oscillator a practical circuit is shown in Fig. 2.

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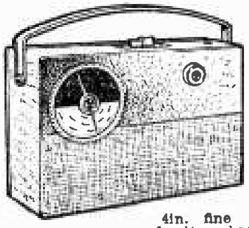

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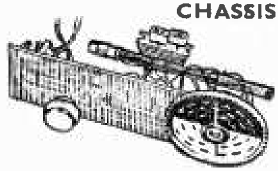

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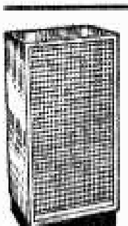

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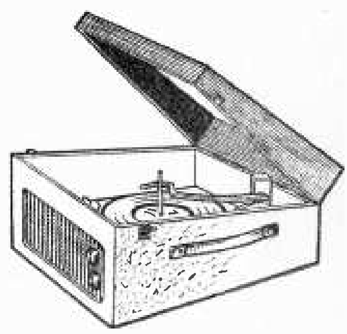

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This combines the basic circuit of Fig. 1 with an amplifying stage to provide the necessary power to supply the loudspeaker.

The push-button S1 used in the original version was an ex-government type, and one set of contacts was arranged to make before the other. This means that the h.t. supply makes momentarily before the auxiliary capacitor is switched across the tuned circuit. On depressing the button the oscillator sounds the note determined by the 0·05μF capacitor C2. As the second contact brings the auxiliary capacitor C1 in parallel, a lower note sounds; when this contact releases the original note is repeated and is sustained for a second or so by the current stored in the electrolytic capacitor C5. Thus three notes are chimed in quick succession, the first and third being of the same pitch.

By suitable choice of capacitor values these notes can be arranged to be of any musical pitch. The three sounded by the values specification in Fig. 2 given were C′ (524c/s), A (440c/s), followed by C′ (524c/s). Appropriately enough, this musical figure is reminiscent of the word "I'm Coming" in the well-known negro spiritual "Poor Old Joe".

An extra push-button S2 is shown connected across the h.t. switch and serves admirably for another door. In this case only the upper note would sound to distinguish it from the first push-button which could be located at the front door.

It will be noticed that the coupling to the output stage is taken from the grid circuit. This is preferable because of the smoother waveform obtainable directly from the tuned circuit than if taken off the anode circuit. There is more than sufficient output to load fully the second stage, and the 1MΩ variable VR1 controls the signal fed to the second grid. The output stage is conventional and any standard output transformer and loudspeaker may be used.

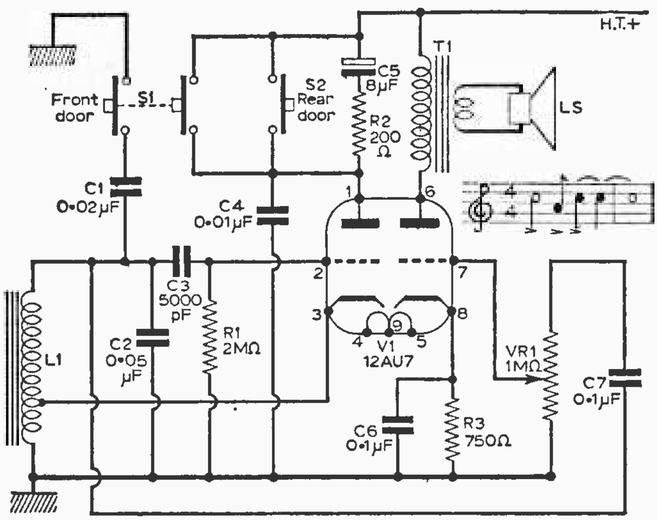


Fig. 2: A practical chime circuit.

COMPONENTS LIST
ELECTRONIC DOOR CHIMES (FIG. 2)

Resistors:
R1 2MΩ R3 750Ω
R2 200Ω
All ½W carbon
VR1 1MΩ carbon potentiometer

Capacitors:
C1 0·02μF paper
C2 0·05μF paper
C3 5000pF ceramic or mica
C4 0·01μF paper
C5 8μF electrolytic 250V
C6 0·1μF paper
C7 0·1μF paper

Miscellaneous:
S1 Push-button switch d.p.s.t. (see text).
L1 Tapped coil 200mH approx., iron core (Repanco AF2).
T1 Standard output transformer (Repanco MOT1).
V1 12AU7 or ECC82.
RL 3000 type relay, 2 make contacts and 1 break contact.

Combined Chime and Alarm Circuit

The circuit for a combined chime and alarm unit is given in Fig. 3. It will be noted that the chimes section is almost identical to the one described above, with the exception that it is controlled by a relay in the alarm circuit instead of by the push-button of Fig. 2.

The first half of V1 constitutes a high frequency oscillator, the frequency being determined by L1 and C2. Here again the frequency is not critical and the coil used had an iron dust core to enable it to be tuned clear of the Light Programme. The grid coupling capacitor VC1 consists of an air-spaced trimmer and this is adjusted so that the tuned circuit is just oscillating. Part of this waveform is rectified by the germanium diode D1 and the resulting d.c. potential employed to bias off the second half of the valve. This bias condition can be critically set by means of the potentiometer VR1.

A metal plate or a strip of foil may be used as the sensing element, the change in capacitance of which stops oscillations and removes this bias.

When the bias is removed the second half of V1 conducts and the relay RL is energised through its own contact RL1. At the same time C2 charges and delays the release of the relay which occurs because contacts are now open. On release, contacts again make and provide an energising circuit once more and a cyclic operation of the relay ensues. This persists until oscillations are

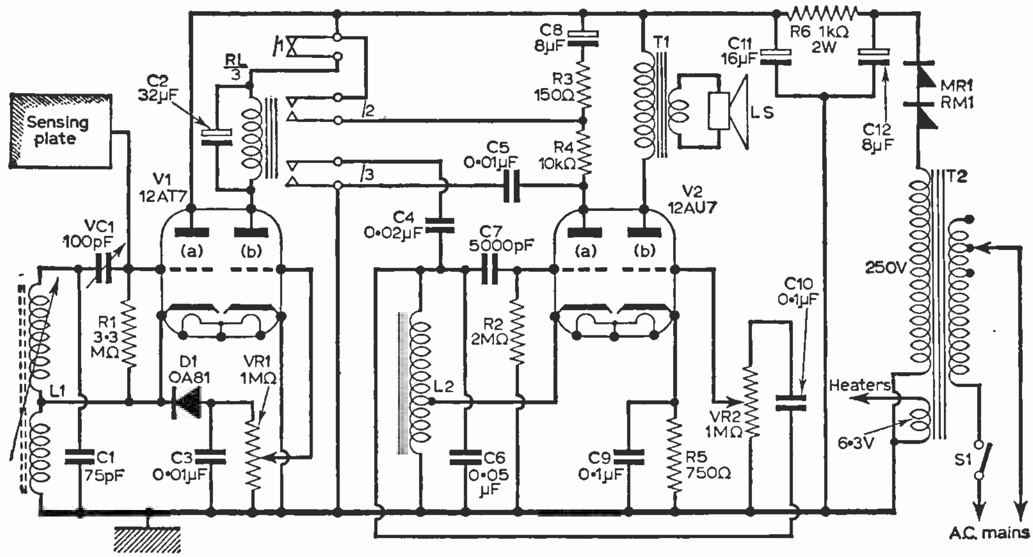


Fig. 3: The circuit of the combined door chimes and burglar alarm.

restored by the removal of the additional capacity, i.e. the intruder.

The other relay contacts switch the chime circuit. Contact /2 provides h.t. and /3 alters the pitch by placing an auxiliary tuning capacitor C4 across the coil L2. As the relay energises, this capacitor will cause the lower note to sound, whilst on release the upper note will ring out due to the sustaining action of C8, and the fact that C4 is not now in circuit.

Power Supplies

The valve heaters may be fed from either a 6.3V or 12.6V winding as convenient. Pins 4 and 5 should be connected to a 12V winding, but if a 6V supply is used pins 4 and 5 should be strapped to one side of the winding and pin 9 used for the other side. The remainder of the power pack calls for little comment, two RM1 rectifiers being used in an orthodox half-wave circuit.

Construction

Very few restrictions are necessary in the methods of construction and layout with regards to the circuits described. Suffice to say that the grid leads for V1 should be kept reasonably short to keep stray capacitances to a minimum. The 100μF variable trimmer VC1 should also be mounted clear of the chassis as neither side goes directly to earth. The chime oscillator section is by no means temperamental and consequently does not dictate any set disposition of components. So plug in that soldering iron and "sound out" these novel circuits! ■

COMPONENTS LIST

COMBINED CHIMES AND BURGLAR ALARM (FIG. 3)

Resistors:

R1	3·3MΩ	R4	10kΩ
R2	2MΩ	R5	750Ω
R3	150Ω	R6	1kΩ2W

All ½W carbon unless otherwise stated

- VR1 1MΩ carbon potentiometer
- VR2 1MΩ carbon potentiometer

Capacitors:

- C1 75pF mica or ceramic
- C2 32μF electrolytic 250V
- C3 0·01μF paper
- C4 0·02μF paper
- C5 0·01μF paper
- C6 0·05μF paper
- C7 5000pF ceramic or mica
- C8 8μF electrolytic 250V
- C9 0·1μF paper
- C10 0·1μF paper
- C11 16μF electrolytic 250V
- C12 8μF electrolytic 350V
- VC1 100pF air spaced trimmer

Miscellaneous

- L1 L.W. coil with iron dust core (Repanco RA1).
- L2 Tapped coil 200mH approx., iron core (Repanco AF2).
- S1 ON/OFF switch
- T1 Standard output transformer (Repanco MOT1).
- T2 Mains transformer, secondaries: 250V, 60mA; 6·3V 0·6A or 12·6V 0·3A.
- V1 12AT7 or ECC81.
- V2 12AU7 or ECC82.

Rectifiers:

- D1 OA81 Germanium diode.
- MR1 Metal rectifier. 2 x RM7 (125V 60 mA).

Showtime Round-up

A summary of the new models seen at the recent series of trade exhibitions. The tables show brand new models only and do not represent the complete range of the manufacturers concerned. See the November *Practical Television* for details of the new TV sets.

TRANSISTOR PORTABLE RADIOS

It was difficult to detect any startling external changes in the wide ranges of transistor radios to be seen, but the tiny "personal" receivers seem to be on the decline and the trend is towards larger receivers with better sound quality.

The number of transistor sets giving short-wave coverage and facilities for receiving the v.h.f.-f.m. programmes is slowly increasing, but even so in these, and almost all other varieties, prices remain keenly competitive and many sets seen represent extremely high value for money. Readers will also note in the details below the appearance of several extremely advanced transistor sets in the higher price bracket.

Some "features" of several years ago are virtually standard fittings nowadays—such things as car aerial sockets and tape recorder sockets. From the presentation point of view more models are appearing with solid wooden cabinets.

THE RADIOGRAM

One of the most obvious impressions gained from the tour of exhibitions was that the radiogram is back with a bang! For some time the radiogram, once almost abandoned, has been

TRANSISTOR PORTABLE RADIOS

Model	*Wavebands*	*Price*	*Notes*
ALBA 111 Starling	LW, MW	11 gns.	3" speaker. Carrying case.
777 Swan	LW, MW	11½ gns.	Wood case, press buttons.
COSSOR CR1310T	LW, MW	13 gns.	Wood cabinet. Push buttons
DANSETTE Herald	LW, MW	15 gns.	Wood case.
Stanmore	LW, MW	16 gns.	Wood case.
Imp	LW, MW	11 gns.	Measures 8 x 3½ x 1½".
International	LW, MW, SW	19 gns.	
EKCO PT426 Valentine	LW, MW	16 gns.	8 semiconductors.
PBT425 Varsity	LW, MW	19 gns.	8-transistor mains/battery receiver.
PT424 New Verity	LW, MW, VHF	22 gns.	9 transistors.
FIDELITY Fairline	LW, MW, SW	17 gns.	12 transistors, meter-type tuning indicator, battery level indicator, dial illumination, etc.
GRUNDIG 99 Transonette	LW, MW, SW, VHF	45 gns.	9 transistors, 1W to 6 x 4" speaker.
203 Export Boy	SW1, SW2, SW3, MW	37 gns.	9 transistors, 1W to 6 x 4" speaker.
Automatic Boy	LW, MW, SW, VHF	£63	Internal batteries or 6/12V car supply, AFC on f.m., T and B tone controls, 2W to 7 x 5" speaker.
TR17	LW, MW, SW1, SW2, SW3, VHF	77 gns.	Two speakers, AFC on f.m., B and T controls, 1·5W output, sockets for ext. aerial, car aerial, pickup, tape recorder, phones and speaker.
KOLSTER-BRANDES WP21 New Lyric	LW, MW	13 gns.	Will amplify incoming 'phone calls and can be used as a baby alarm.
PAM 5215	LW, MW	12½ gns.	
5217	LW, MW	17 gns.	Push buttons.
5219	LW, MW	19 gns.	10 semiconductors.
PERDIO Mini-77	LW, MW	10 gns.	With leather carrying case.
Strand de luxe	LW, MW	12 gns.	With leather carrying case.
PHILIPS 214T	LW, MW	13 gns.	4" speaker. Wood cabinet.
REGENTONE BT22	LW, MW	15 gns.	Measures 11 x 3 x 6¾".
BT23	LW, MW	9½ gns.	Measures 8½ x 2¼ x 5".
R.G.D. B62	LW, MW	15 gns.	400mW to 4" speaker.
STELLA ST430T	LW, MW, VHF	23 gns.	Separate a.m. and f.m. tuning
ULTRA 6114	LW, MW, VHF	15½ gns.	

RADIOGRAMS

Model	*Wavebands*	*Stereo or Mono*	*Price*	*Notes*
ACE Continental	LW, MW, VHF	Mono	45 gns.	Bass and treble controls. 6V. 10 x 4½" speaker.
Slimline	LW, MW, VHF	Stereo	59 gns.	B and T controls, 5W per channel.
Nordic	LW, MW, SW, VHF	Stereo	89 gns.	Two Axion 110 speakers. 40–15000c/s freq. response.
COSSOR CR1504A	LW, MW, VHF	Stereo	TBA	3W per channel via 8 x 5 speakers.
DANSETTE RG250 Sonata	LW, MW, VHF	Mono	59 gns.	8 x 5" speaker.
RG133 Imperial	LW, MW, VHF	Stereo	110 gns.	8 x 5" speakers.
RGS144 Concerto	LW, MW, SW, VHF	Stereo	72 gns.	Decoder for Multiplex.
ELIZABETHAN RG1	LW, MW, VHF	Stereo	67 gns.	10 x 6" speakers. FM multiplex output.
FALCON Manhattan 800	LW, MW, SW, VHF	Stereo	59 gns.	Model 600 is an a.m.-only version at 51 gns.
Tudor 60FM	LW, MW, VHF	Mono	35 gns.	Model 50A is an a.m. version (LW, MW, SW) at 32 gns.
Consort	LW, MW, SW, VHF	Stereo	49½ gns.	
Carmel F24	LW, MW, SW, VHF	Stereo	45 gns.	The F23 is an a.m.-only version at 39 gns.
G.E.C. G985	LW, MW	Mono	TBA	8 x 5" speaker.
GRUNDIG MS20 Hilton	LW, MW, SW, VHF	Stereo	119 gns.	Decoder for multiplex. Provision for reverb.
MS10	LW, MW, SW, VHF	Stereo	93 gns.	As above.
KS80 Baroque	LW, MW, SW, VHF	Stereo	370 gns.	Switchable AFC, 3 tone controls, multiplex decoder, reverb., etc.
MS100 Kingsley	LW, MW, SW, VHF	Stereo	395 gns.	15W per channel, 6 speakers, multiplex decoder, reverb. unit.
PH3030	LW, MW, SW, VHF	Mono	62 gns.	3W via 8½ x 4½" speaker. Table gram.
KOLSTER-BRANDES WG15 Polonaise	LW, MW, SW, VHF	Stereo	66 gns.	
MASTERADIO D573	LW, MW, VHF	Stereo	TBA	3W output via 8 x 5" speakers.
MURPHY A881SR	LW, MW, VHF	Stereo	85 gns.	7 valves and 12 semiconductors. 10 x 6" and 4" speakers in each channel.
PAM 5212	LW, MW, VHF	Mono	42 gns.	Cabinet only 8¼" deep.
5210	LW, MW, VHF	Stereo	57½ gns.	
PHILIPS 420	LW, MW, VHF	Mono	56 gns.	
526	LW, MW, SW, VHF	Stereo	129 gns.	11 valves.
530	LW, MW, VHF	Stereo	77 gns.	Two 8" dual-cone speakers.
REGENTONE ARG22	LW, MW, SW	Mono	37½ gns.	Cabinet only 29 x 14 x 29½".
SRG23	LW, MW, VHF	Stereo	55 gns.	
R.G.D. 209	LW, MW, SW, VHF	Stereo	75 gns.	
210	LW, MW, VHF	Mono	55 gns.	
SOBELL SG674	LW, MW	Mono	TBA	8 x 5" speaker.
STELLA 319A	LW, MW, VHF	Mono	56 gns.	8" dual-cone speaker.
325A	LW, MW, VHF	Stereo	67 gns.	8 x 5" speakers.
326A	LW, MW, VHF	Stereo	86 gns.	8" dual-cone speakers.
ULTRA 3606	LW, MW, VHF	Mono	45 gns.	
3608	LW, MW, SW, VHF	Stereo	59 gns.	

making a come-back. But this year there are more new radiograms than any other type of product. Even companies normally confining themselves to smaller items are now producing radiograms.

The accent was on the "long, low look" type of housing, which has obviously been influenced by the need for wide cabinets in the stereo models. And here it might be mentioned that in all stereo equipment the separate speaker unit idea is fast going out. No doubt manufacturers have discovered that the lady of the house, who often decides ultimately what to buy, dislikes the

PORTABLE RECORD PLAYERS

Model	*Player unit*	*Price*	*Notes*
DANSETTE Monarch	BSR UA15	24 gns.	$3\frac{1}{2}$W output via twin 8" speakers, B and T controls, adaptable to stereo.
ELIZABETHAN Pop-20	Garrard Autoslim	27 gns.	Two 8 x 5" speakers in parallel, B and T controls, Tape and Mic. sockets, speakers detachable from unique styled cabinet.
KOLSTER-BRANDES WRP10 Popette	BSR	15 gns.	
RRP20 Rhythm	BSR	$19\frac{1}{2}$ gns.	
MASTERADIO D576	BSR UA14	TBA	2W output via 7 x 4" speaker.
D577	BSR UA15	TBA	7W push-pull via 8 x 5" speaker. High and low level tape outputs, straight-through amplifier facilities.
McMICHAEL M177	BSR UA15	TBA	7W push-pull via 8 x 5" speaker. Straight-through amplifier facilities, tape sockets, T and B controls.
PAM 5200	4-speed	16 gns.	7 x 4" speaker.
PHILIPS AG4126	4-speed Philips	15 gns.	Operates from six 1·5V batteries.
REGENTONE AHG33	BSR	$14\frac{1}{2}$ gns.	$4\frac{1}{2}$" speaker.
AHG44	BSR	$16\frac{1}{2}$ gns.	8 x 5" speaker. B and T controls.
HG15	BSR	9 gns.	5" speaker.
R.G.D. 165	BSR	17 gns.	8 x 5" speaker, B and T controls.
SILVERTONE AP18	BSR UA15	28 gns.	6W push-pull output to 8 x 5" speaker, B and T controls, adaptable to stereo.

TAPE RECORDERS—

Model	*Deck*	*Tracks*	*Speeds*	*Price*	*Features*
COSSOR CR1621	Own	2	$1\frac{7}{8}$	26 gns.	Battery operated, weighs 8 lb. Provision for mains unit.
DANSETTE Empress	BSR	4	$1\frac{7}{8}, 3\frac{3}{4}, 7\frac{1}{2}$	33 gns.	Many.
ELIZABETHAN LZ27	BSR	2	$3\frac{3}{4}, 7\frac{1}{2}$	27 gns.	3·5W to 7 x 4" speaker, monitor, ext. amp. facilities, etc.
FIDELITY Playmaster	BSR	2	$3\frac{3}{4}$	20 gns.	3W output to 8 x 3" speaker, 3 inputs, monitor facilities. 4-track version at 23 gns.
GRUNDIG TK6	Own	2	$3\frac{3}{4}, 1\frac{7}{8}$	65 gns.	Level meter, monitor, battery operated (transistorised), battery level indicator.
LEE PRODUCTS 802 Shaftesbury		2	$3\frac{3}{4}$	26 gns.	Output 3W.
804 Shaftesbury		4	$3\frac{3}{4}, 1\frac{7}{8}$	33 gns.	Digital counter, monitor facilities.
MASTERADIO D502	BSR	2	$3\frac{3}{4}$	TBA	2·5W to 7 x $3\frac{1}{2}$" speaker.
PHILIPS EL3586	Own	2	$1\frac{7}{8}$	25 gns.	Battery operated with provision for mains unit. 500mW to 4" speaker.
STELLA ST471	Own	2	$1\frac{7}{8}$	26 gns.	Weighs 8 lb. Battery operated. Mains unit available.

untidiness caused by having odd pieces of equipment external to the main unit. There was also a noticeable trend towards the more compact type of cabinet, representing a return to a style that lost favour in recent years.

Most of the new radiograms have f.m. facilities, though there were a few a.m.-only models. Most are for stereo record reproduction but a few mono-only radiograms make their debut.

The prospect of a decision on Multiplex stereo radio broadcasting has prompted several thoughtful manufacturers to produce models wired up for the easy fitting of a decoder unit whenever stereo broadcasting becomes a regular service.

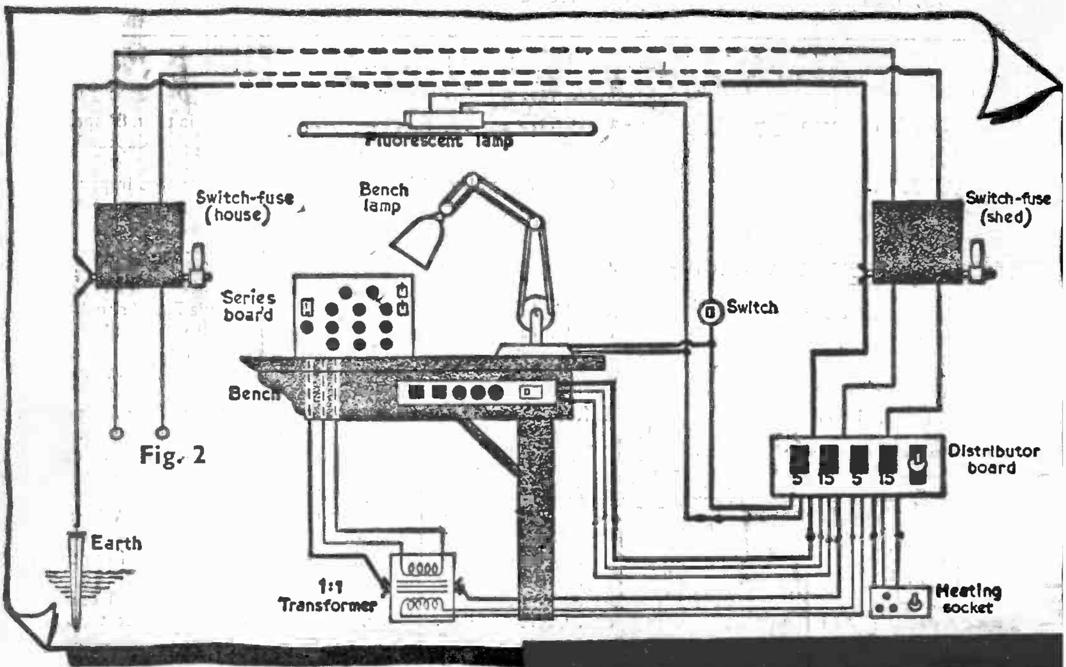
PORTABLE RECORD PLAYERS

These continue to play an important part in the manufacturers' catalogues and a number of new, attractive models were shown for the first time. Most of them are mono, though some are wired for stereo conversion if required. Some have added facilities such as straight play-through. One breaks new ground from the design point of view.

TAPE RECORDERS

The tape recorders on show were not entirely typical of the complete range of products available

—continued on page 657



WIRING U

NOW that the increased constructional activity of the winter months is approaching, the radio and television enthusiast will be checking over his would-be-den, remembering the fine plans for conversion that were formulated in his mind during the summer. At this stage, those plans seem a little ambitious. Converting the potting shed to a workshop has a number of unforeseen snags. The following notes are an attempt to discuss as many of those snags as can be uncovered, and to offer a few solutions.

Supply Regulations

First consideration is the power supply. To comply with the regulations, it must be a separate circuit, completely isolated, fused and switched. This means a switch-fuse at the meter board, a correctly installed run of cable adequate for the proposed load, and a switch-fuse with outlets at the other end. And the local Electricity Board will not connect your switch-fuse to the incoming power line until they are satisfied it complies with both the I.E.E. Regulations and any local interpretations of these.

If one is tempted to by-pass these restrictions, and save time and trouble by plugging the house end of the feed cable into a convenient power point, it should be remembered that in the case of any accident—fire or personal hazard—no insurance company would consider a claim on an uncertified installation.

Perhaps it would be as well for us to know, at the outset, which of the I.E.E. Regulations apply to our conversion of the potting shed. The figures in brackets are those regulations which cover our circumstances, and which will be referred to as we go along. For a more detailed exposition, see I.E.E. Regulations, 13th Edition, 1955, Regulations for Electrical Equipment of Buildings, obtainable from the Institution of Electrical Engineers, Savoy Place, London, W.C.2., price 6/- (paper bound), including postage.

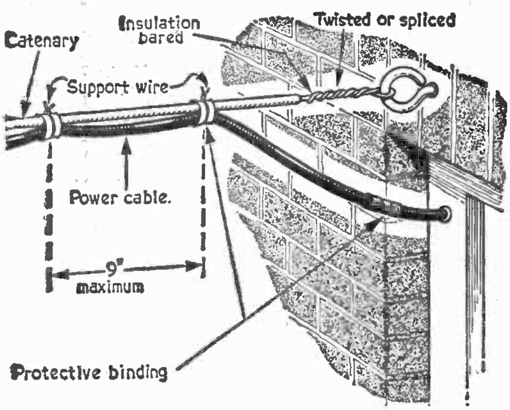


Fig. 1: Using a catenary to carry the power line to the workshop.

The Mains Supply Cable

There are three ways in which we can run the cable from the house to the shed—ignoring such local variations as cleated wiring and insulator supported tough rubber, now frowned upon by many authorities.

First, the cable can be metal-sheathed and run underground, at a depth of at least 18in., (229 B(i)). This is perhaps the best method, but certainly the most expensive, and hardly suitable for the job we are undertaking.

Second, the cable can be run through conduit, (229 B (ii)). Again, this is a satisfactory installation, providing the conduit is of the correct dimensions and properly earthed. But as this is only suitable for a comparatively short run, and there must be no joint in the conduit, and the problem of expense also arises, this method is not so attractive as the next.

Third, a catenary system. By this method, the cable is supported by a separate wire, isolated from the electrical circuit, (229 B (iv)). The wire that forms the catenary must be properly secured at each end, with the minimum of sag. For a short run, it is only necessary to bind the catenary wire to firmly anchored supports, then fix the power cable to it. A longer run may need some form of pulley at one end to strain the loaded catenary into a safe position when the traverse has been completed.

13A fused sockets can be used, (114 B) and if a sub-circuit is wired as a 'ring', up to 10 outlets can be connected to a 30A input, using 7/·029 conductors. Allow a minimum of 100W per lampholder and a current of at least ½A at each 2A outlet.

Taking a practical example, for a small workshop that contains a single bench for radio and television repairs and experiments, we can subdivide the services as shown in Fig. 2. Here we have four separate lines, fed from a distributor board, each line fused, with a common switch that completely isolates the shed wiring. In addition, there is a fused switch at the house end, (112 A and B). The four lines are: Lighting.
Heating.
Bench Power.
Isolated supply.

The lighting, in this case, need only be a fluorescent fitting of some 40W, augmented by a bench-lamp, 60-100W. Total power requirements, 100 + 100 = 200W. (see above).

Heating can be provided by a single-bar space heater of a maximum 1,000W. Use a 13A socket and at least a 10A fuse in the distributor panel.

...P THE WORKSHOP

By Henry Maxwell

Binding the power cable to the catenary is, again, a matter for local specification. The general method, with PVC cable, or the tough-rubber-sheathed (TRS) stipulated by the original I.E.E. Regs., is to bind the power cable to the catenary with a few turns of adhesive tape, and finish with a twist of galvanised wire. For 7/·029 cable, the bindings must not be more than 9in. apart; for larger power cables, a 12in. spacing is used, with a 15in. interval on vertical runs, (210 C). Fig 1 shows the method described.

Choice of power cable depends on the expected load. For a typical small workshop, a 15A supply would be sufficient, for which 7/·029, twin-plus-earth capothene covered cable would be suitable. For higher power loading, 7/·044 can be used, capable of taking a 30A loading. If the earth wire is run separately, it must be capable of carrying three times the current of the fuse rating, (Reg. 406).

Determining the Load

To calculate the loading, let each service that is wanted, i.e. lighting, heating, bench supply, etc., be reckoned as if the consumption was at the maximum.

For example, a full current rating should be assumed for a 15A outlet, (113) but for a consumption of between 15 and 30A several

Bench Power

Here we need a soldering iron, possibly two, one 25W or less for work on printed circuits and in confined spaces, and one of 100W for those occasional large jobs where the smaller iron is inadequate. The latter will only be plugged in when needed, but calculations must allow for it. There will also be a drill, again used only occasionally, and mains-powered bench instruments, such as the signal generator, oscilloscope, valve-voltmeter and stabilised power supply. Total power requirements, about 1,500W, with separate fused outlets and a common 15A fuse.

The isolated line feeds a 1:1 transformer of 250W rating, which supplies a number of outlets (for convenience), and is used for connection of the apparatus under bench test. The reason for this has been stressed often enough in these pages: universal, a.c./d.c. equipment has the chassis connected to one side of the mains input, and thus there is a danger of the operator completing the circuit to true earth via his body and receiving a shock that could at best be unpleasant; at worst. fatal. The distributor fuse will be 5A.

Switch-fuse

The switch-fuse, which should be mounted separately on a panel near the entrance and preferably at a height of at least four feet above floor level, will have a 15A fuse, and 7/·029 twin cable with 3/·036in. earth provides the power supply.

It will be noted that two multiple boards were mentioned in the above description. This is entirely a matter of choice. The author has fitted out several small workshops for his own use and found that the initial expense of a dozen different outlets is more than compensated by the later convenience. Nothing is more frustrating than having to remove and replace a plug for the sake of a five-minute test. Outlets are wired in parallel, with live and neutral poles correctly positioned and earth added where appropriate.

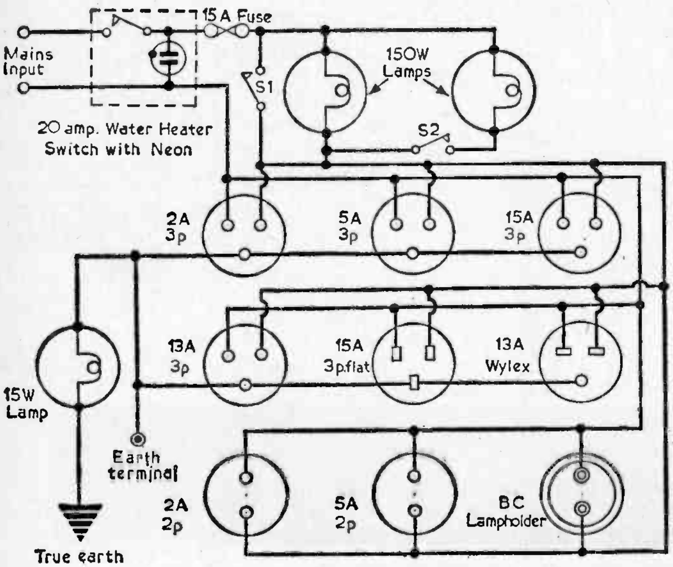


Fig. 3: Details of the series board.

The Series Board

A refinement that is very little trouble to make, but can prove a great boon, is the Series Board shown in Fig. 3.

Basically, this merely includes a couple of 150W lamps, with shorting switches, in series with the live line of the incoming mains. (In the case of the set-up of Fig. 2, this would be the mains from the isolating transformer.) When S1 and S2 are closed, the live line is continuous, and the outlets receive direct continuity. If S1 is now opened, the two lamps are paralleled and in series with the live line: thus, if a piece of equipment with a dead short-circuit is plugged into any of the sockets, the lamps will light to full intensity. If S2 is now opened, only the left-hand series lamp is in circuit.

The purposes of this board, apart from the protection against short-circuited equipment, cover the testing of motorised appliances, vacuum cleaners, drills, etc., of heaters, lamps, radio and television receivers. The single lamp position gives sufficient loading to test small motors, noting the regularity of illumination, which, with practice, can give an immediate indication of faulty brushes, commutators, and armatures. The double lamp position provides 300W in series with the appliance and is used for larger vacuum cleaners, washing machines, etc., and can be handy for indicating those sudden short-circuits in television sets that would normally blow the fuses. Many applications will occur to the reader; testing flexible leads, acting in place of surge limiters for new electrolytic capacitors, checking double-load appliances, such as fan heaters and fires.

Earth Leakage Indicator

A small lamp in series with the earth lead, while retaining the safety aspect, acts as an indication of earth leakage in a set or appliance. By fitting a take-off terminal on the 'hot' end of the lamp circuit, two-pin appliances can also be tested by connecting their casing directly to this point.

It should be noted that the system earth, as shown in Fig. 2, although carried through the whole of the wiring, is best augmented by a separate earth at the workshop end. A long earth can give protection against heavy leakage, but is very often a source of radio noise, especially noticeable when the receiver under test needs a good earth and aerial. This is understandable when we consider that 11ft. of 7/·029 will give a 1V drop if a.c. is applied.

Aerial Installations

Much could be said about aerial installation for the small workshop, but all depends on the

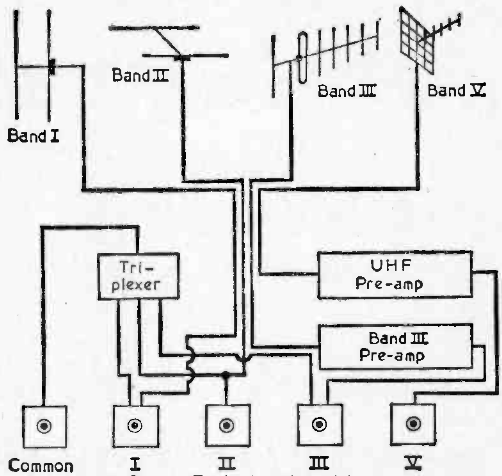


Fig. 4: Typical aerial wiring.

amount of testing and experiment that is to be done.

Fig. 4 shows a sample of the aerial wiring for one 'den' that the author recently equipped. Note that the aerial leads (coaxial feeder) were brought in separately. Although more expensive, this method has definite advantages for the workshop, especially if signal strengths are to be monitored. The Band I and II signals were both sufficiently strong not to need pre-amplification, but Band III has its own pre-amplifier and the wiring is laid in for the u.h.f. band, although there is, as yet, no signal available.

One small refinement is the addition of a triplexer and 'common' aerial socket, which can save a lot of time when a television receiver is being tested. Changing leads every time the channels are switched can be frustrating—and does not do the sockets any good either.

As a final note, remember that aerial feeders must be protected at the vulnerable points where they pass sharp edges, tiles, gutters, brick angles, etc. Fig. 5 shows a specimen run from rooftop through window-frame. Tile clips and gutter clips can be purchased quite cheaply, and a good, secure aerial installation pays for itself in the end.

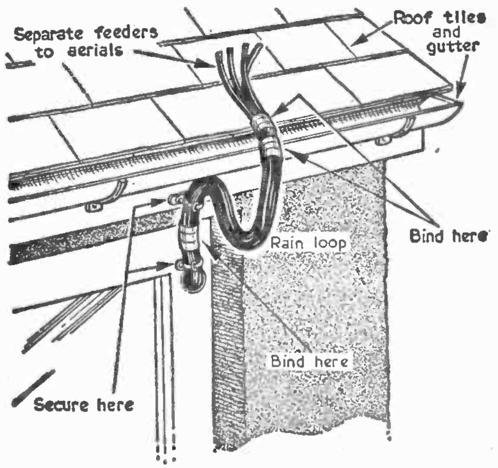


Fig. 5: Protecting aerial feeders.

It will, at least, enable the owner to sit and view in comfort when those gales of winter come howling around again.

The Progressive PORTABLE

This receiver is built in successive stages, each new stage adding to the performance of the set and culminating in a six-transistor, two-waveband portable.

By R. F. Graham

THIS receiver is particularly intended for beginners, because it can be made initially with two transistors only, in its original simple form, the extra stages being added one by one afterwards. As construction proceeds, there are thus only single stages to complete and test, and if any faults should be present, they can easily be located. As the receiver is developed, almost no changes have to be made to the sections already completed. The finished portable uses six transistors, and will give very good results.

As the receiver is a working unit from the very beginning, it is built in such a way as to accommodate the loudspeaker and battery, and the complete unit can be inserted intact in a suitable cabinet, without need to remove control knobs or any other items. It can as readily be lifted from the cabinet, for further constructional work.

When the receiver is out of its cabinet, it is so designed that it will stand upright, in the normal working position, so that it can be aligned and tested. It will also stand on either side, or may be placed flat, either way up, without any possible damage to components. This means that it can easily be handled, or turned over, while building is in progress.

As it is necessary to have components on both sides of the insulated panel, there is sometimes a little difficulty in checking leads which pass from one side to the other. To avoid this possible cause of wiring errors, a clear Perspex panel is used. All wires and parts can thus be seen from either side, and it is at once apparent where all leads go. The use of a transparent panel, in this way will be found very helpful.

To simplify wiring, etc., the set is first put into working condition for medium waves only, but the long wave band can be added at any time.

In the early stages of construction, the output is insufficient for a loudspeaker, so headphones are used. The receiver is, of course, very good indeed for headphone reception, and it may be desired to keep headphones, for personal listening, even when the output stage and loudspeaker have been added. It is also possible to add an external aerial, which is sometimes an advantage when the set is used in a screened locality, such as a vehicle. Running from a small 9V battery is also in order, though a large type 7½V battery can be accommodated, and has a very long working life.

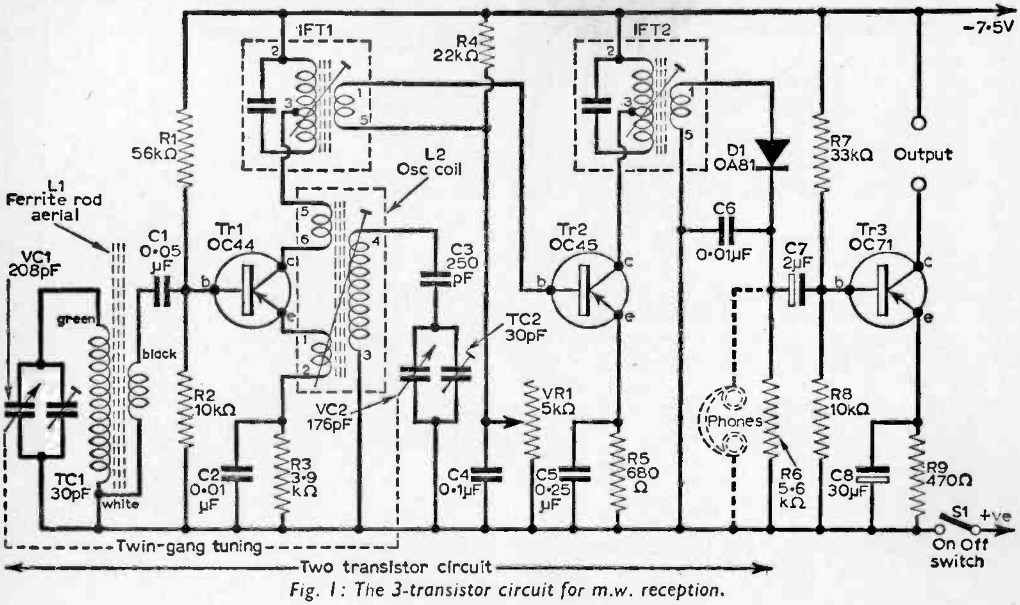


Fig. 1: The 3-transistor circuit for m.w. reception.

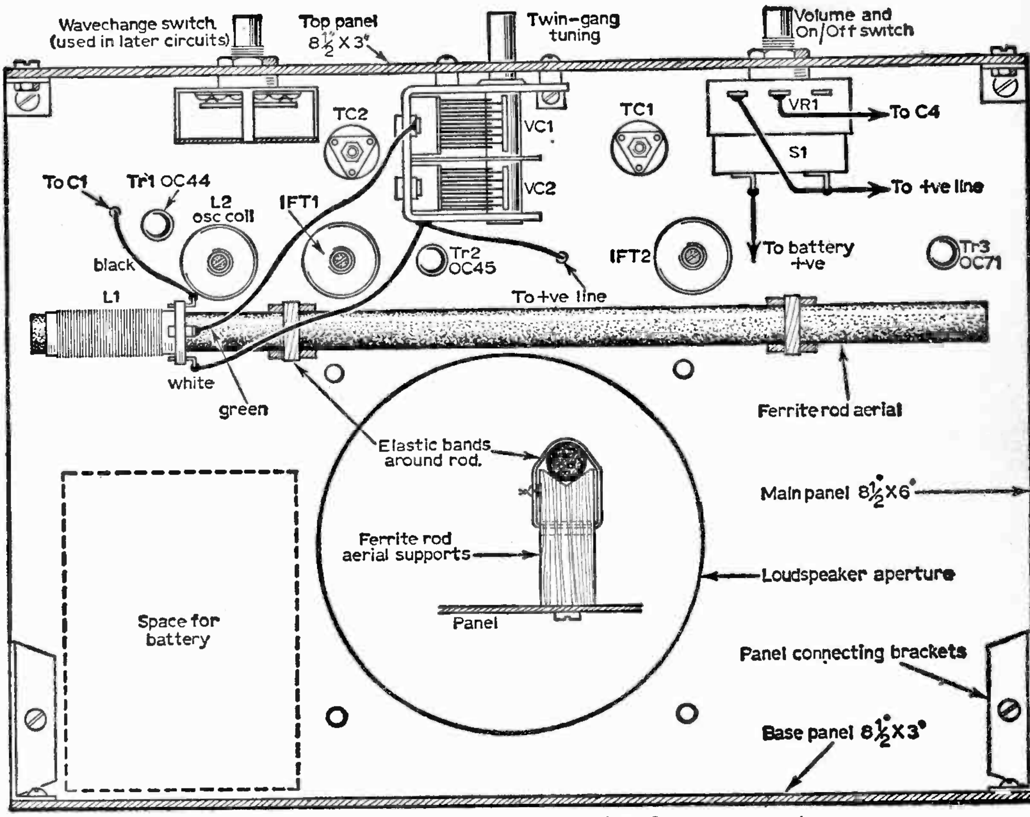


Fig. 2: The wiring on one side (the rear) of the 3-transistor panel.

Progressive Stages

Brief details of the circuits, in the order in which they can conveniently be used, are as follows:

(1) Two transistors, as frequency changer and i.f. amplifier, with diode detector. This allows the f.c. and i.f. circuits to be aligned and got into proper working order at the earliest stage. Volume is controlled by adjusting the i.f. transistor base voltage, and the set is for headphone reception.

(2) An audio amplifier is added, providing a three transistor circuit. This circuit gives very good headphone results, and the a.f. stage will later act as a driver for the output stage.

(3) A Class A output stage is added, making four transistors in all. This gives sufficient output to drive a loudspeaker unit.

(4) The second intermediate frequency stage is added, to obtain a five transistor circuit. The receiver then has a high degree of sensitivity, with good volume from quite a number of stations.

(5) The last transistor is fitted, giving a six transistor set with Class B push-pull output. This allows greater volume than the single transistor output stage.

(6) A long wave coil and trimmers, etc., are added, to permit both long wave and medium wave reception.

As mentioned, the set is complete, self-contained, and in working order, through all the stages given above.

The Perspex Panel

The Perspex panel is 6in. x 8½in. and ⅛in. thick. The loudspeaker opening, 3¼in. diameter, is cut first. This is centrally placed and ½in. from the bottom of the Perspex, as shown in Fig. 2. An adjustable washer cutter is most satisfactory, the cut being to about half depth each side. A fretsaw or similar saw could of course be used instead. It is also possible to drill a ring of holes, remove the centre disc, and clean up with a half round file, though this is more laborious. The loudspeaker is then rested in position, and the four securing holes are marked and drilled.

A line is drawn 1½in. from the top of the Perspex, and the oscillator coil and i.f. transformer are located along this line. The oscillator coil is 1¾in. from the edge. The first i.f. transformer centre is 1in. from the oscillator coil centre, and it is 3in. from the centre of the first i.f. transformer to the centre of the third i.f. Assuming that the full six transistor receiver will be made eventually, the second i.f. will be fitted centrally between first and third i.f. transformers.

Hold the cans with the pins in the position shown in Fig. 3. The exact location of the pins

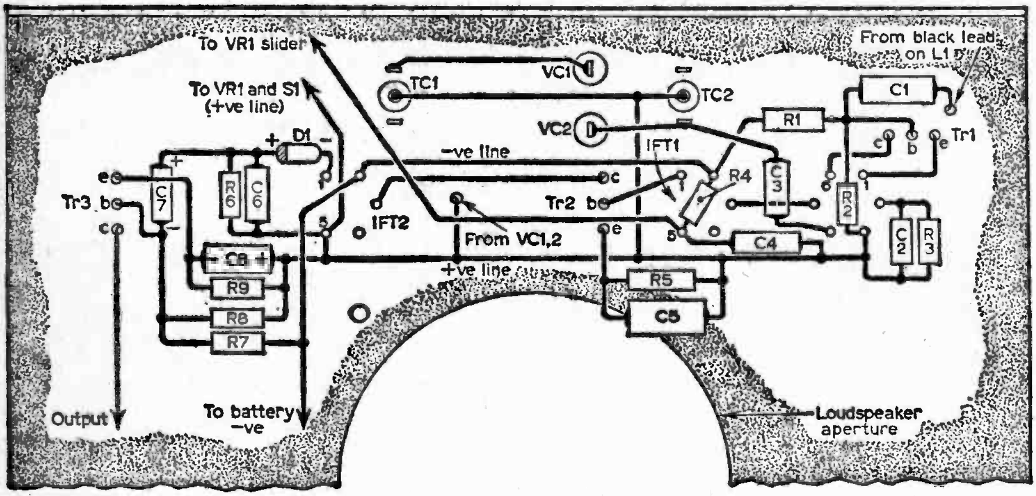


Fig. 3: The front of the panel showing the wiring.

will be seen, and can be marked with a sharp tool. Holes for the can tags and pins are then drilled.

Two mounts for the 8in. ferrite rod are made of insulated material, about 1½in. long. A groove is filed or cut to receive the rod, as in Fig. 2. Screws hold the supports to the Perspex, these screws being 2¼in. from the panel top edge. Each support has a hole drilled through it, so that an elastic band can be placed round the rod, as shown. The ends of the band are joined with thread or a short piece of copper wire.

When the receiver is standing upright, out of its cabinet, it rests on a piece of 3-ply 3in x 8½in. This is held in place by the two brackets shown in Fig. 2. This piece of 3-ply also serves as a shelf to carry the battery.

The control knob panel is of Paxolin, preferably polished, and is also 3in. x 8½in. It is held by three small brackets, one each end, and one near the tuning capacitor, as in Fig. 2, Holes for the volume control and switch are 2in. from the panel ends.

To avoid hand-capacity effects, a piece of aluminium foil about 2½in. x 6in. is cemented to the control knob panel, before fixing the volume control, switch, or tuning capacitor. This also serves to earth the bushes of the volume control and switch.

Holes are drilled directly over the capacitor tags. The control knob panel and 3-ply base should be fitted to the Perspex, as it is then possible to turn the receiver and rest it in any position. There is ¼in. space at the front of the panel. to accommodate capacitors up to ⅜in. in diameter.

To clarify wiring, it is a good plan to use red sleeving for all "earth" or positive circuits, and black sleeving for all negative circuits. Some other colour can then be employed for all the remaining connections. Tinned copper wire, of about 26s.w.g. will be found convenient throughout.

Three Transistors

As the a.f. amplifier is extremely simple, it is included in Fig. 1. To use the receiver with two transistors only, omit Tr3, C7, R7, R8, R9 and C8, and wire the headphones in parallel with R6. Alternatively, it may be preferred to build the three transistor set at once. as any fault in the a.f. stage can at once be checked by connecting headphones across R6.

Thin coloured flex is soldered to the aerial winding tags, for easy identification. Black is one end of the base winding. Green is the tuned winding. Both windings are joined at one end, and the white lead is taken from this point.

Wiring of the rod aerial is shown in Fig. 2. Black passes through a hole to C1. Green goes to the front section of the tuning capacitor. White is taken to the capacitor frame, and a wire passes down from the frame to the "earth line" in Fig. 3.

The trimmers TC1 and TC2 are mounted by passing their tags through holes. Both centre tags go to the earth line, the remaining tags going to VC1 and VC2, as in Fig. 3.

Note that the white spot i.f. transformer is used in the first position, and the blue spot transformer in the final i.f. stage. All the can securing tags are joined, and serve as earth or M.C. connecting points, as in Fig. 3. Pin 4 on each IFT is unused, but should not touch other parts or wires.

There are relatively few parts and connections, and wiring should be quite easy. All transistor leads can be at least 1½in. long. Solder these quickly, to avoid overheating. With the transistors mentioned, the red spot indicates the collector lead, shown by "C" in Fig. 3. The centre lead is the base, marked "B" while the remaining lead is the emitter, "E".

The diode and electrolytic capacitors should be connected in the polarity shown. The diode leads should be at least ½in. long, and soldering should be completed rapidly.

If a receiver has never been constructed before, it will be very helpful to copy the circuit diagram in pencil. As a component is added, or a connection made. draw over the appropriate circuit elements in ink. There should then be no possibility at all of any mistake being made. and if a lead has been omitted, this will be obvious.

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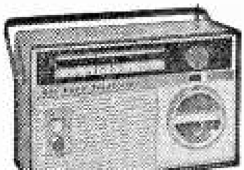
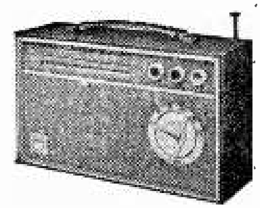


THE SKYROVER
7 TRANSISTOR PORTABLE RECEIVER

THE SKYROVER De Luxe
7 TRANSISTOR PORTABLE



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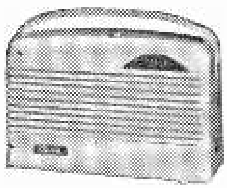

A fully transistorised Portable Receiver made to the highest professional standards—is now available to the home constructor. Comprises 7 Mullard Trans. OC44, 2 OC45's, OC71, OC81D, and 2 OC81's plus OA70 Crystal Diode. Delivers 350 milliwatt output to 4in. high flux speaker—I.F. frequency 470 Kc/s.—fully tunable over medium and long wavebands. All components mounted on single printed circuit board, size 5¼ x 5½in. Attractive two-tone plastic cabinet with carrying handle—size 7 x 10 x 3½in. with easy to read dial and socket for car aerial, choice of Red/Grey, Blue/Grey or all Grey. Complete with full instructions. **All parts sold separately.**

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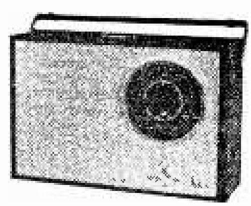

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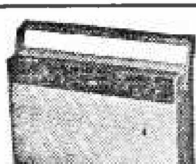

This superhet receiver uses the very latest circuitry, 6 transistors and two diodes and is fully tunable over both medium and long wavebands. First stage uses three Mullard AF.117 alloy diffused transistors with OA79 and OA91 diodes, output—OC81D and two OC81's in push-pull. I.F. frequency 470 Kc/s. Large internal ferrite rod aerial gives excellent reception over all ranges. 3 inch high flux speaker has a maximum output of 330mW. Operates on four 1.5 v. pen torch batteries. All components are mounted on a single printed circuit board. Attractive plastic case with carrying handle—fitted sockets for personal earpieces, tape recorder and car aerial. Size 6½ x 4 x 1½in.

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COMPONENTS LIST FOR COMPLETE SIX TRANSISTOR DUAL-WAVE RECEIVER

Resistors:

R1	56kΩ	*R13	39Ω
R2	10kΩ	R14	56kΩ
R3	3·9kΩ	R15	1·2kΩ
R4	22kΩ	R16	8·2kΩ
R5	680Ω	R17	4·7kΩ
*R6	5·6kΩ	R18	3·9kΩ
R7	33kΩ	R19	1kΩ
R8	10kΩ	R20	1kΩ
R9	470Ω	R21	470Ω
*R10	2·7kΩ	R22	6·8kΩ
*R11	12kΩ	R23	220Ω
*R12	2·2kΩ	R24	100kΩ

All 10%, $\frac{1}{4}$W carbon, except where otherwise stated

VR1 5kΩ potentiometer with s.p. switch (S1)

Capacitors:

C1 0·05μF paper
C2 0·01μF paper
C3 250pF mica or ceramic
C4 0·1μF paper
C5 0·25μF paper
C6 0·01μF paper
C7 2μF paper
C8 30μF electrolytic 15V
*C9 8μF electrolytic 15V
*C10 50μF electrolytic 15V
C11 8μF electrolytic 15V
C12 56pF mica or ceramic
C13 18pF mica or ceramic
C14 0·25μF paper
C15 50μF electrolytic 15V
C16 100μF electrolytic 15V
C17 180pF mica or ceramic
VC1 208pF } Two-gang variable with internal
VC2 176pF } screen (Jackson 00)
TC1 30pF beehive trimmer
TC2 30pF beehive trimmer
TC3 60pF compression type trimmer
TC4 60pF compression type trimmer

Semiconductors:

TR1	OC44	TR4	OC72
TR2	OC45	TR5	OC45
TR3	OC71	TR6	OC72

(TR4 and TR6 should be matched pari)

D1 OA81 diode

Inductors:

L1 8 in. ferrite rod aerial with medium (and long if required) windings (Osmor)
L2 Oscillator coil (Osmor)

Transformers:

T1 Push-pull output transformer with 3Ω secondary (Osmor)
T2 Push-pull driver transformer (Osmor)
IFT1 470kc/s i.f. transformer—white spot (Osmor)
IFT2 470 kc/s i.f. transformer—blue spot (Osmor)
IFT3 470 kc/s i.f. transformer—white spot (Osmor)

Switches

S1 Single-pole on/off (see VR1)
S2 Single-pole changeover switch

Miscellaneous:

LS1 Loudspeaker $3\frac{1}{2}$ in. diameter, 3Ω impedance
Headphones, low resistance (for Circuit Fig. 1 only)
Cream fluted knobs, two 1 in. and one 2 in. dia. Sheet of perspex $\frac{1}{8}$ in. x 6 in. x $8\frac{1}{2}$ in. Paxolin panel 3 in. x $8\frac{1}{2}$ in. Plywood 3 in. x $8\frac{1}{2}$ in. Battery connectors, brackets, etc.

Cabinet:

Plywood $6\frac{1}{2}$ in. x $3\frac{1}{4}$ in. x $\frac{1}{4}$ in.; $8\frac{1}{2}$ in. x 3 in. x $\frac{1}{4}$ in.; $8\frac{1}{2}$ in. x $6\frac{1}{2}$ in. x $\frac{1}{4}$ in. Hardboard 9 in. x $6\frac{1}{2}$ in. Material for covering, handle, etc.
$7\frac{1}{2}$V battery (Vidor L5048, or Ever Ready AD38)

*The components marked * will not be required for the final 6-transistor receiver which will be described in a future issue.*

SUMMARY OF REQUIREMENTS FOR FIRST STAGE OF CONSTRUCTION

Three Transistor M.W. Circuit (Fig. 1)

Resistors: R1–R9, VR1
Capacitors: C1–C8, TC1, TC2
Transistors: Tr1, Tr2, Tr3, D1
Inductors: L1 (m.w. winding), L2
Headphones (low resistance) are required for this circuit

Testing 3-Transistor Set

Medium or high impedance headphones, of moderately low d.c. resistance (say up to about 250Ω) can be connected directly from Tr3 collector to battery negative. Do not leave Tr3 in circuit with nothing connected to the collector. For example if Tr3 is wired in, but the first two stages are to be tested by wiring phones across R6, join a 1kΩ or similar spare resistor from Tr3 collector to battery negative.

Alignment follows usual methods, except that there are only two i.f. transformers. VR1 should be turned about one quarter way up only, and should be turned back, if volume is too great. It is easier to find accurate trimming positions when volume is kept down.

With the three transistors and a $7\frac{1}{2}$V supply, a meter in one battery lead should show about 4mA. If a signal generator can be obtained, align the IFT's at 470kc/s, trim at 210m, and adjust oscillator coil core and aerial winding position at 500m.

Assuming that no signal generator is available, satisfactory adjustments can be obtained fairly readily, if the job is undertaken in the correct manner. The air-spaced beehive trimmers can be rotated with a length of ebonite tube, or similar material, cut at the end to engage the trimmer top. If compression trimmers are fitted instead, make sure these can open to a low capacity. For the coil and transformer cores, file a plastic knitting needle, or strip of insulating material, so that it will fit the core slots. Trying to work with a metal blade will only cause trouble (a suitable trimming tool is often supplied with these components).

If alignment is to be undertaken with no signal generator, first unscrew both trimmers TC1, TC2

—*continued on page 669*

A SIMPLE WAVETRAP

ELIMINATING ADJACENT STATION INTERFERENCE

BY G. J. KING

A BIG medium-frequency reception problem is adjacent station interference. This is troublesome mostly after dusk and towards the high-frequency (low wavelength) end of the medium waveband. It manifests either as a whistle or whistles of varying *intensity* as the wanted station is tuned in and the tuning control is adjusted in an endeavour to clear the background of so-called "monkey chatter".

How the Interference is Caused

Whistles are caused by nearby unwanted signals beating with the wanted signal. When there is only one unwanted signal within audio distance of the wanted signal the two signals produce a troublesome third signal. Let us suppose that the interfering signal is, say, 2 kc/s away from the wanted signal. No ordinary domestic receiver could possibly discriminate between such closely spaced signals, so such a receiver responds to them both.

They both arrive at the detector whose non-linear function cause one of them to be modulated upon the other, and it is here that a signal at the difference frequency is created. This signal "looks" to the rest of the set like true audio—which, of course, it is—and it thus gets through the receiving circuits along with the modulation of both the wanted and unwanted signals.

A 2 kc/s whistle is thus superimposed upon the wanted audio and the unwanted modulation and extremely distressing interference results. As each station is fixed in frequency the frequency difference always remains the same and the whistle holds at its original pitch even when the tuning control is adjusted. All that happens is that the intensity of the whistle varies as *both* signals are brought within the embrace of the receiver response.

Several whistles at different pitches result when more than one interfering carrier or signal falls within the passband of the receiver, but on most modern superhets the response to signals removed by about 6 kc/s or more from the wanted signal is so small as not to cause trouble. Moreover, even if a 6 kc/s plus beat found its way into the audio section very little output would result owing to the treble limitation of the majoriy of domestic audio sections.

This is not meant to be derogatory of design, but simply to illustrate the wastefulness of designing for a wide audio passband when it could never be used on the medium frequencies owing to adjacent station interference problems. In radiograms and models with v.h.f.-f.m. facilities, of course, an extended audio section is extremely desirable, but even so quite a bit of treble cut is demanded to reduce the annoyance value of whistles when working at the top end of the medium waveband — such as on Radio Luxembourg.

Monkey Chatter

Monkey chatter is the effect which is produced by sidebands of an unwanted modulated signal breaking into the narrow spectrum to which the set is tuned. It can be demonstrated by carefully detuning, say, the l.w. Light Programme of the BBC when a good quality "live" programme is being broadcast. As the set is detuned away from the carrier so only the sideband signals of the transmission will be heard, and as the detuning is continued only the high order sidebands produce an output as they "splash" into the receiver's response. Transistor portables are ideal for demonstrating the effect owing to the relatively sharp cut-off characteristics of transistors.

Thus, in addition to whistles, adjacent stations produce monkey chatter symptoms and the combined effect, especially when it is related to several interfering signals, can be very disconcerting. The BBC's solution to the problem, of course, is v.h.f.-f.m. transmissions in Band II, and where possible these should always be used for local programmes. However, the medium frequencies still have to be employed for more distant stations and for Radio Luxembourg, so it is worth while to explore the possibilities of, at least, alleviating the interference effects.

Series-Tuned Rejector

What is wanted is some means of putting a sharp, narrow trough into the overall response curve at the interfering frequency point; but before we go into that let us investigate the overall response curve of an average receiver. Such a curve is depicted in Fig. 1. The overall response extends pretty well 12 kc/s either side of the tuned frequency, but at that displacement the response is zero so an interfering station 12 kc/s away from the carrier would not cause any trouble. In any case, it is unlikely whether the set would give an output at 12 kc/s (as this is very high audio).

However, at 6 kc/s either side of the tuned

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2	7000	80	8/-	4	6000	3	8/-	5	6000	5	8/-	5	9500	5	10/6
2½	7000	35	8/6	4	7000	3	8/6	5	7000	3	8/6	5	10000	3	11/6
2½	7000	50	8/6	4	7000	25	11/6	5	7000	5	8/6	5	9500	25	11/6
2½	7000	80	8/-	4	6000	35	10/6	5	7500	3	9/-	6½	7000	3	11/-
3½	8500(E.M.I.)	3	8/6	4	7000	35	11/-	5	8500	3	9/6	6½	7000	5	11/-
3¾	7000	35	8/6	4	9500	35	11/6	5	8500	5	9/6	6½	8500	3	11/6
3¾	9500	50	10/6	5	6000	3	8/-	5	9500	3	10/6				

Elliptical Size	*Gauss in lines*	*Imped. in ohms*	*Price*	*Elliptical Size*	*Gauss in lines*	*Imped. in ohms*	*Price*	*Elliptical Size*	*Gauss in lines*	*Imped. in ohms*	*Price*	*Elliptical Size*	*Gauss in lines*	*Imped. in ohms*	*Price*
5×3	6000	3	7/6	5×3	9000	25	11/-	7×4	7000	3	10/-	8×2½	9500	4	10/-
5×3	7000	3	8/-	5×3	9000	35	11/-	7×4	8500	3	10/6	8×2½	9500	5	10/-
5×3	9000	3	8/6	6×4	6000	3	8/6	8×2½	6000	3	8/6	8×5	6000	3	8/6
5×3	9000	4	8/6	6×4	7000	3	9/-	8×2½	7000	5	9/-	8×5	7000	3	9/-
5×3	9000	5	8/6	6×4	8500	3	9/6	8×2½	8500	5	9/6	8×5	8500	3	9/6
5×3	6000	25	9/6	6×4	9500	3	10/-	8×2½	9500	3	10/-	10×6	10000	3	19/6
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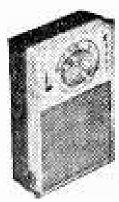

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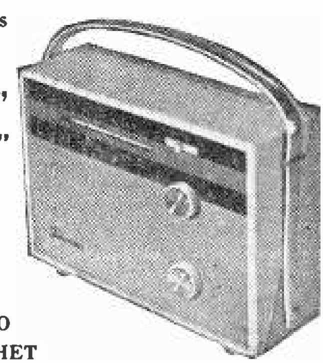

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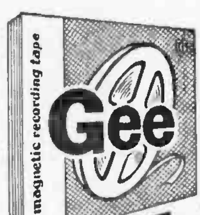

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5in.	L.P.	900ft.	...	10/-
$5\frac{3}{4}$in.	L.P.	1,200ft.	...	12/6
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SPECIAL!! "LAFAYETTE"
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EXCLUSIVE TO GEE'S! AMERICAN "SHAMROCK"
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$5\frac{3}{4}$in.	L.P.	1,200ft.	(LP-12) ..	19/6
7in.	L.P.	1,800ft.	(LP-18) ..	28/6
5in.	D.P.	1,200ft.	(CMXP-12)	32/-
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frequency the response is about 50 per cent of maximum. This is essential, of course, if the medium frequency audio sidebands are to be retained and there is not to be too much treble suppression in the r.f./i.f. stages of the set. This means, therefore, that any interfering signal displaced up to, say, 6 kc/s from the tuned frequency will cause a response or output.

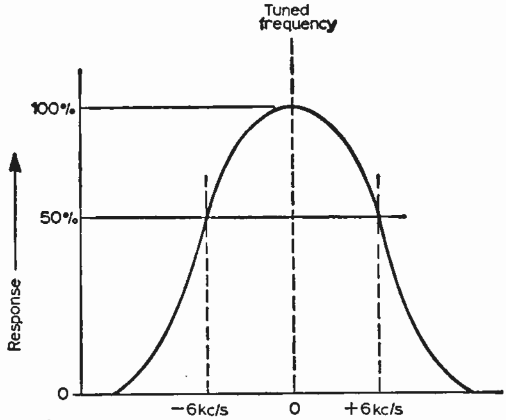


Fig. 1: Response curve of an average receiver. An interfering signal about 12kc/s away from the tuned frequency would not cause any trouble, but a signal 6kc/s away would result in a 6kc/s whistle due to beating as explained in the text.

Now, if the response is narrowed still further, as shown in Fig. 2, although the response to interference 6 kc/s either side of the tuned frequency is only about 5 per cent (26dB down), treble sidebands of the modulation would also be suppressed by the same amount and the reproduction would be very poor indeed.

Suppression of the order of 26dB is not sufficient to "kill" the whistle effect completely, though it goes a long way towards minimising it, and if the treble response of the set is down audio-wise at

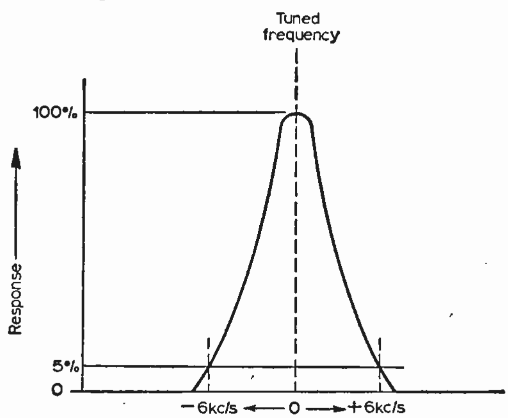


Fig. 2: If the overall response is narrowed as shown here the sideband components of the modulated signal would be severely attenuated and bad treble cut would spoil the reproduction. This is not a solution to the problem of adjacent station interference.

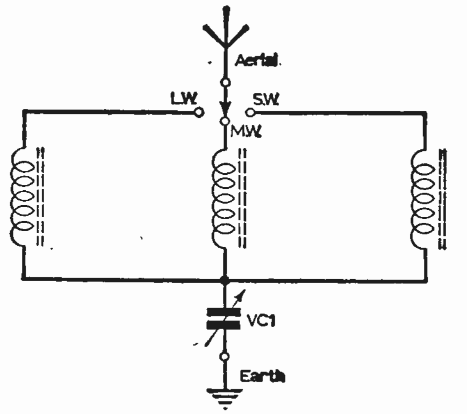


Fig. 3: A simple series-tuned wavetrap or rejector circuit. The coils should have a Q value of preferably not less than 250 and the capacitor should have a maximum value of 500pF for all-wave use, 300pf for m.w. use or 100pF for s.w. use. Connection should be either across the aerial and earth sockets of the set (across the operating frame aerial or ferrite rod winding in the case of a portable) or between the metal chassis of the set and the signal grid on the frequency changer valve. On a.c./d.c. sets capacitive isolation is essential to avoid the risk of electric shock.

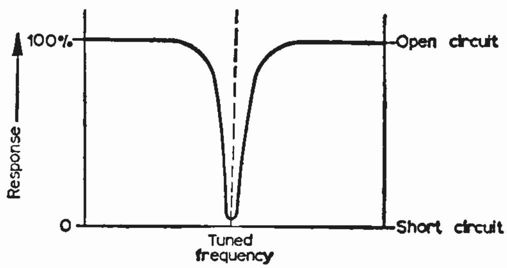


Fig. 4: The type of trough introduced by the rejector.

6 kc/s, then the two attenuating factors together would amost certainly eliminate the disturbance; but narrowing of the overall response is not generally a practical way out of the trouble.

If there is only one interfering signal, the resulting whistle can almost certainly be cleared by a high-Q series-tuned rejector of the kind shown in Fig. 3. Such a rejector "looks" to signal at the tuned frequency as pretty well a dead short, while to signals at frequencies outside the narrow response there is virtually zero attenuation. The idea is shown in Fig. 4.

To get the system to work, the narrow response of Fig. 4 must be superimposed at the point of interfering signal upon the response of Fig. 1, as shown in Fig. 5. Here it is supposed that the interfering signal is plus 4 kc/s away from the wanted signal. Thus, the flylead of Fig. 3 would be connected to the appropriate coil or coil section and VC1 would be adjusted until the rejector is tuned exactly plus 4 kc/s from the wanted signal. As VC1 is tuned over the wanted carrier, the signal would dip, would then rise and close by would be a point where the whistle would disappear almost completely—how well depending

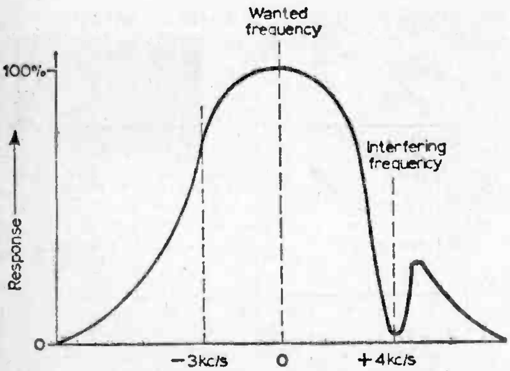


Fig. 5: Here is shown the rejector adjusted to suppress an interfering carrier plus 4kc/s from the tuned frequency of a receiver. The degree of attenuation to the unwanted signal given by the rejector is governed by the efficiency or Q value of the circuit.

upon the efficiency, or Q value, of the rejector circuit.

If there are several whistles, it is not feasible to employ a number of rejector circuits as they tend to interact with each other, and unless the circuits are expensively designed it is virtually impossible to improve matters. Nevertheless, even with several whistles, quite a relief is secured by getting rid of the strongest one.

Connecting the Rejector

The rejector circuit is often best connected between the aerial and earth sockets of the receiver or tuner, but if this results in too much loading across the circuit and a reduction of effective Q, the combination can be tried between the signal grid of the frequency changer valve and the metal chassis of the set.

It is perfectly in order to use the rejector with portable sets. Here it should be connected to chassis on the capacitor side of the rejector and to the slider of the aerial wavechange switch on the other side, so that irrespective of waveband to which the set is tuned the rejector is always effectively across the operating winding of the frame or ferrite rod aerial. On a.c. d.c. receivers care *must* be taken to prevent electric shock—particularly to the uninitiated and the young in the family—and no connection whatsoever should be made direct to chassis. 250 volt a.c. working capacitors of not greater than 1,000 pF should always be used for isolation.

Construction

Construction is very straightforward and needs little comment. The rejector can easily be housed in a coffee, cocoa or tobacco tin. The capacitor and coils should be mounted inside with an outside knob for tuning and a couple of sockets or terminals for connecting to the set.

With an all-wave (or long wave and medium wave) version it is desirable to employ a simple wave-change switch to avoid having to alter coil taps when changing band. Mainly, however, the device is designed to tune the medium waveband only, in which case a high-Q medium wave coil and a tuning capacitor (preferably air spaced) of $0{\cdot}0003\mu F$ are required. Suitable high-Q coils and capacitors are readily available from most of our component advertisers. The coil should have a Q of 250 or so.

The rejector has been used in conjunction with a high-quality a.m. tuner to eliminate most of the mush and whistles around 208 metres with considerable success.

For Television

A similar rejector for suppressing pattern interference due to an unwanted carrier close to the vision frequency on Band I channels can be made along similar lines. A suitable circuit, with construction details, is given in Fig. 6.

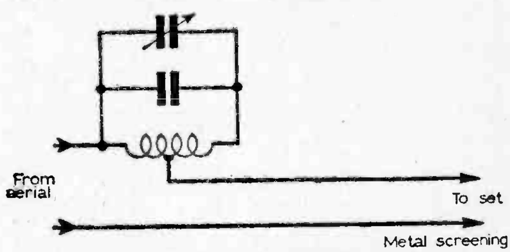


Fig. 6: A simple TV rejector circuit for clearing pattern interference produced by an interfering r.f. signal within the vision passband. The coil is 2 turns of 18s.w.g. tinned copper wire, $\frac{3}{4}$in. diameter, self-supporting, tapped at $\frac{1}{2}$-turn from aerial end.

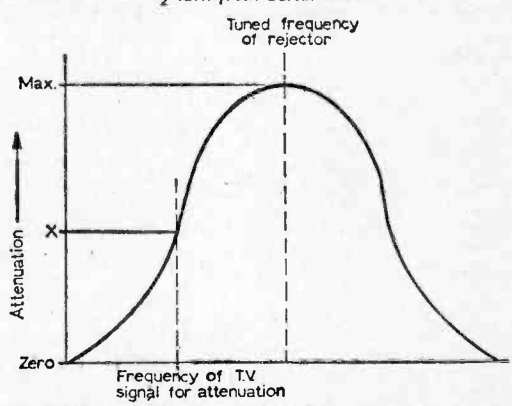
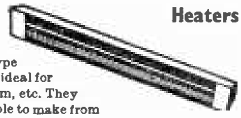


Fig. 7: Showing how the rejector of Fig. 6 can be used as a signal equaliser. Point X on the curve reveals the degree of attenuation.

The idea can also be extended for equalising the signals in Bands I and III at the end of a television downlead. Usually the Band I signal is several times stronger than the Band III signal, meaning that the Band I signal requires a few decibels of attenuation relative to the Band III signal. By using a rejector of the type shown in Fig. 6 is can be adjusted on the Band I channel to introduce sufficient attenuation as to balance with the Band III signal, as shown in Fig. 7. Here the rejector is tuned to one of its sloping sides until the required degree of signal attenuation is introduced. ■

Infra-Red Heaters

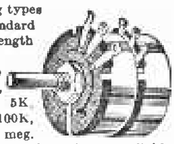


Make up one of these latest type heaters ideal for bathroom, etc. They are simple to make from our easy-to-follow instructions—uses silica enclosed elements designed for the correct infra-red wavelength (3 microns). Price for 750 watt element and metal casing as illustrated 19/6, plus 2/6 post and insurance.

Limited Quantity Only

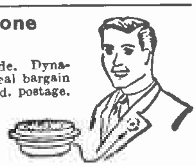
Waterproof heater wire. 16 yds. length. 70 watts. Self-regulating temperature control. 10/-, post free.

Morganite Potentiometers



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

Microphone Inserts



American made. Dynamic type. Real bargain at 3/6, plus 6d. postage.

Crystal type 5/6.

Suppressor Condenser

Stop your drill or other appliances interfering with your or your neighbours' radio or television. Simple instructions given. 1/6 each. 12/- dozen.

Beginner's Superhet

As supplied to many schools and colleges. A simple basic superhet—easy to understand and which can be progressively extended—ideal for students—components include—valves—metal rectifier tuning condenser—I.F. transformers, etc. In fact complete superhet except speaker. Price £3 plus 3/- post and insurance. Data included free or sep. 1/6.

TV CAMERA LENSES

16 mm. lens in mount, f8.5 and triple anastigmatic suitable for vidicon tube, £3.10.0.

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 13½in. x 9in. x 4in. and it is nicely covered in two tone I.C.I. fabric.

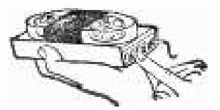
Bargains For Callers

We always have plenty, e.g. T.V. Cabinets, ideal for shelves etc., 2/6 each.

CABINET & PICK-UP

Made for a famous company intending to make a Battery Record Player but changing their minds. This is an extremely fine looking cabinet, must have cost at least £2 to make. It is complete with handle and fasteners as illustrated. Also included in the parcel is a Cosmocord pick-up with crystal cartridge and sapphire stylus. Both items new and perfect. Only 19/6, plus 4/6 post and insurance.

DO YOU EVER FORGET?



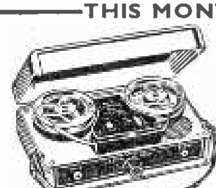
This Pocket Secretary could eliminate the trouble (often embarrassment) your forgetfulness causes you—she will stay in your jacket pocket and as fast as you can think she will capture and store—ideas—notes—formulae — appointments — anything you can say or sing! then at your command she will play them all back to you.

Undoubtedly one of the smallest precision tape recorders made. Entirely controlled by push buttons, you can record and play back with the instrument in your pocket. It is a full-function machine using standard ¼in. tape and easy to replace batteries. Speaking and playing back is from the same (crystal) microphone.

Specifications: Dimensions: 6¼ x 2¼ x 1⅛in. Weight: 14 oz. Recording time: 12 mins., rewinding time 4 mins. Recording system: D.C. Bias. Erasing system: Magnetic erasing, wow and flutter: Within 2%, and frequency response: 500-1,200 c/s (within —6db).

Price £9.19.6. Complete ready to work.

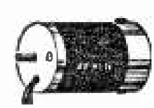
THIS MONTH'S SNIP



Tape Recorder for Spares. This month, if you act quickly, you can have a complete transistorised tape recorder at a "give away" price. The tape recorder has not been used but may be slightly faulty. We therefore sell it for its spares value only. It contains among other things: Tape head, suitable for dual track working. 4 transistor push-pull amplifier. 2½in. P.M. speaker. 3 volt tape motor with pulleys and drive mechanism, volume control, record—erase—playback—off lever action switch. All assembled in a plastic case with carrying handle. Every item listed above is warranted in good working order and if not so, will be replaced free of charge.

The whole offered at less than the value of the amplifier alone, namely 45/-, plus 2/6 carriage.

MAINS MOTOR



Suitable to drive fan, small model drilling machine etc. A.C. only self starting. Size 2in. diameter by 2in. long (plus spindle). Only 9/6, plus 2/6.

Tape recorder type motor syncronous working 230 volts, 12/6, plus 2/6 post. Ditto but more powerful 20/-, plus 2/6.

"CORONET" Mk. III

An excellent pocket size set using 3 MAT transistors for the oscillator and I.F. stages and 3 junction types including a matched pair for the output stage. It fully covers the medium-wave band and that part of the long-wave band to bring in B.B.C. light. The circuit includes a highly efficient slab aerial and Plessey tuning condenser incorporating wave change switch. Overall size approximately 4½ x 2½ x 1½in. Supplied complete with carrying case, this two-wave pocket set is available whilst stocks last at the very low price of £3.12.6.

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 1.2KB in 5 ranges. A.C. voltage up to 1.2KV 5 ranges. D.C. current up to 300mA 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 £3.19.6. Carriage and insurance 5/-.

BUILDING THE DOUBLE BEAM 'SCOPE?

We can supply VCR517 brand new, 9/6, plus 6/6 carriage and packaging, also 1750 v. mains transformer, 22/6, plus 6/6 carriage and packaging. Other parts in stock, send for list.

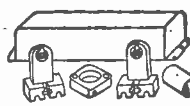
Speaker Bargain

12in. High-fidelity loudspeaker. High flux permanent magnet type with standard 3 ohm speech coil. Will handle up to 12 watts. Brand new, by famous maker. Price 27/6, plus 3/6 post and insurance.

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.

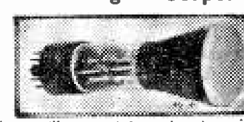
Fluorescent Light Bargain



Kit of parts comprising: choke, two lamp holders, starter holder and starter. 40 watt., 19/6; 80 watt., 27/6.

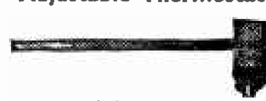
Plus 2/6 post and insurance.

Building A 'Scope?



3in. oscilloscope tube. American made type No. 3FP7, 6.3 v. 0.6 amp. heater, electrostatic deflection, brand new and guaranteed with circuit diagram of scope, 15/- each, plus 2/6 post and insurance.

Adjustable Thermostat



Suitable for Industrial or domestic purposes, such as controlling furnace oven, immersion heater etc. Can also be used as a flamestat or fire alarm. Made by Sunvic these are approximately 17in. long and adjustable over a range 0 to 550 F. The contacts are rated at 15 amps., 230 volts, and the adjustment spindle, which comes to the top, can be fitted with a flexible drive for remote control or just a pointer knob for local control. Listed at £3 or £4 each, these are offered at only 8/6, plus 2/6 postage and insurance.

Ice-Stat

This is a small thermostat which cuts on and off at around freezing point. Has many uses, one of which could be an ice warning device to be fitted under your motor car. Price 7/6. Post 1/-.

SIMMERSTAT HEATER REGULATOR

Suitable to control elements, heaters, soldering irons and boiling rings up to 2,500 watts. Complete adjustable, normal price 55/- each, special snip price 12/6, plus 1/6 postage and insurance.

15 amp. Thermostat

Adjustable over a fairly wide range of temperatures but set for 70°F., suitable for wall mounting to control room heaters. Exceptional bargain at 9/6, plus 1/- post and insurance.

ELECTRONICS (CROYDON) LTD

266 LONDON ROAD, BROADGREEN, CROYDON

(Opposite SAVOY CINEMA)

AUDIO LEVEL INDICATOR

By C. MORGAN

A directional aid for setting up microphones and loudspeakers

THE noise level indicator described in this issue was developed mainly for the setting up of a recording studio. Since then many other practical uses for this very versatile indicator have been discovered. Some of the uses have been to test the sound absorbed by certain materials in use in the studio, setting up of the loudspeakers in a display field so that all sections of the audience receive good information (badly needed in certain open-air displays) and laying out of the stereo loudspeakers to get the best effect possible.

Other applications include the monitoring of recordings, thereby dispensing with the monitoring headphones, leaving the ears free, and enabling the operator to stop the recording when the sound level is too faint to be recorded. It can also be used with an extended microphone on an umbrella to give a directional effect from one position only.

Although sound reflectors are available the price may be beyond the pocket for some enthusiasts, but if an old umbrella is pressed into service, with the microphone positioned as shown in the drawing (Fig. 4), a very directional effect can be produced. This is so effective that the writer has abandoned his solid reflector in favour of a small umbrella which is very portable, takes up little room and can be stowed away when not in use.

The Circuit Construction:

Sound Amplifier Stage

The microphone is of the moving-coil variety, the one in use being an ex-Army hand-set type which requires the use of a step-up transformer. If the intending constructor does not wish to use a moving coil type a crystal type will work just as well but due to the higher output the step-up transformer will not be required.

The output of the transformer, or the crystal microphone, is fed into a two-stage transistor amplifier, the output of which is coupled to a rectifier into a moving-coil meter. The battery supply is 9V, miniature deaf aid type.

No special requirements are specified as to the layout of the wiring, except to keep the connecting wires of the transistors cold when soldering them into position. The use of heat shunts, in the form of a pair of flat-nosed pliers, will suffice.

The mounting of the battery is simplicity itself. Two small pieces of $\frac{1}{16}$in. thick paxolin were obtained from a run-down 90V battery, the brass clips were taken from a $4\frac{1}{2}$V torch battery and bent to suit. These were then clipped to the paxolin with paper staples and a blob of solder placed on each one and marked (−) and (+).

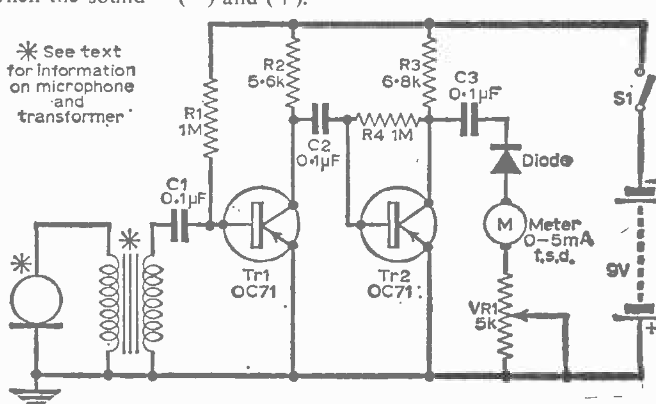


Fig. 1: The circuit diagram.

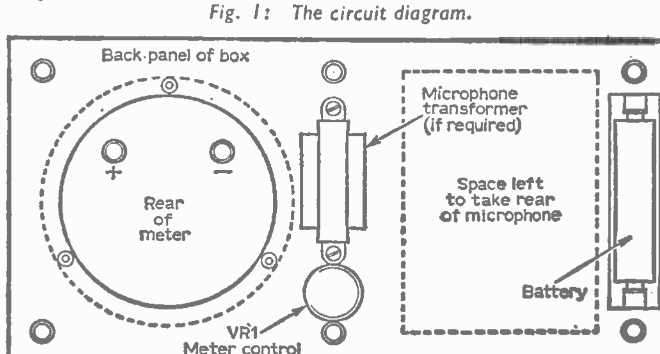


Fig. 2: A view of the assembled unit.

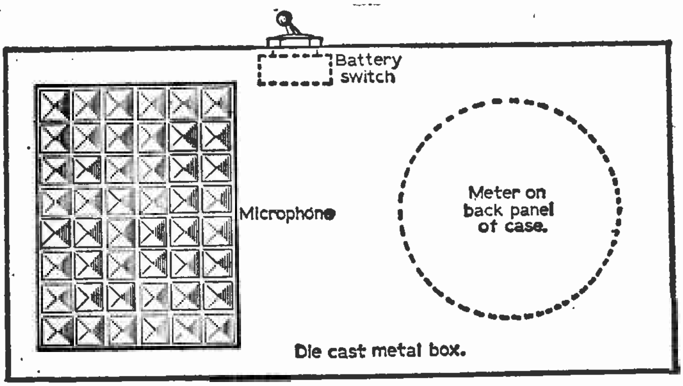


Fig. 3: Details of the front of the case.

The second piece of paxolin was then fitted, two pieces being held in place while the holes to take two self-tapping screws were drilled. The reason why two pieces of paxolin were used is to prevent the connections to the battery (carried by the top piece) shorting out to the case. If the level indicator is to be used with other than gentle hands the battery can be taped into position.

Using the Umbrella as a Sound Reflector

Two types of umbrellas were tried out, the first being a large conventional cloth one. This had a marked directional effect but a lot of sound was lost due to the porosity of the material covering the frame. Painting the inside with a silver paint reflected the sound rather better but also reflected the sun's rays so well that it damaged the plastic container of the mike.

Anyone intending to experiment with the sole purpose of solar heat in mind will have no difficulty in obtaining heat in the order of 112°C+.

The second type of umbrella tried was an Empire one of conventional size, the diameter being only 2ft 6in. across. It is made of plastic, which is an almost perfect medium for reflecting sound, and unless coated with a surface reflecting paint will not damage the microphone.

One other very good point in favour of the Empire umbrella is that the rod supporting the ribs, etc., is made of hollow light metal. When the sound focal point has been found in the umbrella (about 5in. from centre) the handle and the point that projects through the frame can be sawn off. The microphone leads can then be fed through the rod and in that way making a far neater job.

If a ⅛in. diameter "Terry" clip is secured to the microphone with the assistance of a small self-tapping screw the microphone can be slid along the rod to widen or narrow the sound angle.

If, then, the termination of the microphone is plugged into the noise level indicator, and the reflector is beamed on to a distant sound, the meter will indicate when the maximum sound has been obtained.

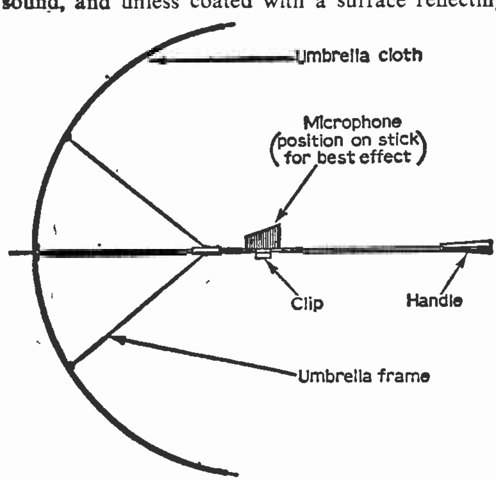


Fig. 4: Details of the modified umbrella.

COMPONENTS LIST

Resistors:
R1 1MΩ R3 6·8kΩ
R2 5·6kΩ R4 1MΩ
VR1 5kΩ miniature potentiometer
R1–R4 are ⅛ watt

Capacitors (paper):
C1 0·1μF C2 0·1μF C3 0·1μF

Semiconductors:
TR1 OC71, or equivalent
Tr2 OC71, or equivalent
D1 Any suitable germanium diode

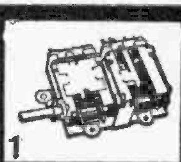
Miscellaneous:
Moving coil microphone and matching transformer. Die cast metal box to suit either internal or external microphone, as desired. Indicator knob and reference dial marker. 9V deaf-aid battery. Paxolin and brass connectors. Self-tapping screws. Insulated connecting wire, etc.

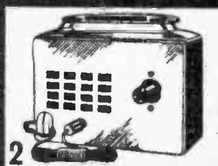
This set-up can also be used for the transmission of sound in mainly one direction only. A miniature (2½in.) loudspeaker was installed in place of the microphone and connected to the tape recorder extension loudspeaker socket. A microphone was set up at a distance of 100yd, using the described noise level indicator.

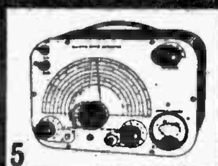
The loudspeaker was placed into position approximately in the centre of the umbrella and then pointed in the direction of the indicator, when maximum signal reading was obtained in that position. The loudspeaker was then moved in and out of the umbrella and a position was obtained on the rod where, if the reflector was taken away, a loss of two-thirds of the total volume was indicated.

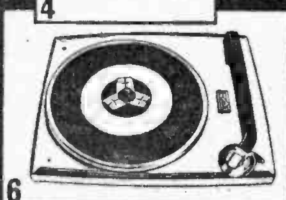
—continued on page 662

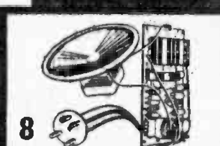
Just a few of our BARGAINS

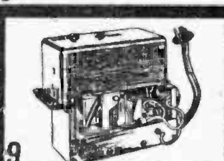


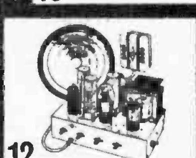


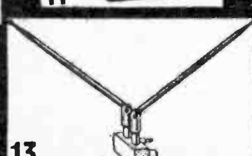












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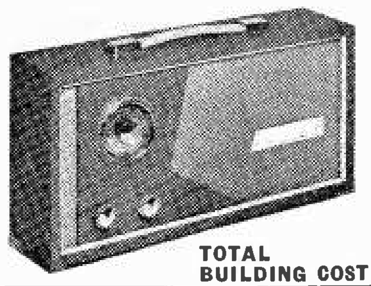

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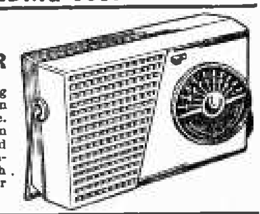

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TEST GEAR techniques

PART 9 OUTPUT METERS AND THE G.D.O.

H. W. Hellyer

IT was the intention, at the outset of this series, to devote the final article to a fleeting review of the rarely used instruments that augment such test gear as has already been described. In particular, the output meter requires brief discussion. The various forms of bridge. Q-meters, transistor testers and waveform oscillators and the handy but little-used G.D.O. were covered in my original synopsis.

But the Editor has pointed out that many of these instruments have been discussed in these pages, and in *Practical Television*, either in constructional articles or during the course of description of more elaborate gear. For example, the Grid-Dip Meter is covered to some extent in an article by A. W. Hartley, in *Practical Television* for August 1963; F. G. Rayer's article on "Amateur Band Frequency Checking" in the September issue of this magazine brings in some valuable information on Absorption meters and Crystal Calibrators: articles by J. H. B. Gould, currently appearing, deal with adjuncts to the oscilloscope, timebases, a.c. amplifiers, square wave generator, etc., as have also the previous series on oscilloscope design by M. L. Michaelis in both magazines, and some handy practical notes on these can also be referred to in *Practical Television*, January 1961, "Oscilloscope Faults", by W. Cleland, as well as in the more recent constructional series "The Henlow Wide-Band Oscilloscope", by D. R. Bowman, (*Practical Television*, June—October 1963).

In the April issue of this magazine, R. P. Hubbard described "A Cathode Ray Level Indicator", with application as visual signal tracer, a.c. bridge null indicator and G.D.O. absorption indicator. The May issue brought us a "Miniature Test Oscillator" by R. Leyland and a "Pocket Signal Injector" was covered in the July issue by R. W. Kneeshaw.

Regular readers will need no reminding of the many other instruments that have been dealt with in past years. My aim, in this concluding article of the series, will be to concentrate on two types of instrument only: the output meter, and the grid-dip oscillator.

Output Measurement

Too often, during alignment, the engineer or contructor "short-circuits" the approved method and uses his ear as an output monitor, instead of the vastly more accurate output meter.

Whereas the human ear is a fallible—even gullible—instrument, which reacts to changes in intensity at different efficiency, according to the pitch and relative loudness of the sound, and varies widely between individuals, the meter can give a much more accurate assessment of power levels and their small variations. Even the simplest set-up of an a.c. meter across the secondary of the audio output transformer will give us a quicker indication of sound intensity changes than we can hear for ourselves. And remember, absolute accuracy of power output is not essential for general alignment: normally. we are adjusting tuned circuits for a maximum reading, and the actual figure on the dial need only be a relative one.

In practice, the sound of a tuning note can become terribly wearisome, and it is better to disconnect the loudspeaker. When this is done it is necessary to provide a dummy load so that the output transformer "sees" the correct matching. Failure to do this will generally end with the screen grid of the output valve glowing red-hot.

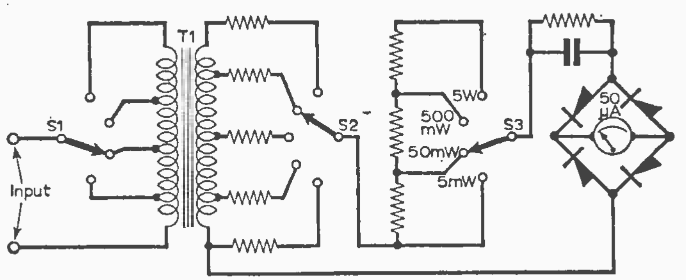


Fig. 1: Circuit of a commercial high and low output meter. S1 is the impedance multiplier, S2 the impedance selector and S3 the meter multiplier. T1 is a tapped a.f. transformer.

Although the meter across the secondary may be thought to be sufficient load in itself, it is nevertheless good practice to shunt a resistor of the appropriate value across the secondary, taking off the a.c. voltage variation with the meter. It should be remembered, too, that output meters usually have variable impedance tappings, and many are suitable for connection to the primary of the output transformer (via a d.c. blocking capacitor, say $0{\cdot}1\mu F$). The circuit of a typical meter of this style is shown in Fig. 1.

A tapped transformer is incorporated, with multiplier tappings, augmented by wire-wound resistors, in the primary winding, and an impedance selector switch in the secondary. A meter multiplier feeds the bridge circuit, allowing the meter, which may be a $50\mu A$ movement, to read off rectified d.c. as output values between 5mW and up to 5W. This type of instrument gives accurate readings for comparative measurement over a fairly wide frequency range. An example of quoted specifications: level within 1dB (±) from 50 to 10,000c/s.

The Decibel

Having mentioned decibels, it may be as well to deal briefly with their use. Several articles on the decibel have appeared in these pages and it is not intended here to waste too much space on basic theory; but as the alignment data published by manufacturers usually states output in dB, some notes may be applicable.

The decibel is a ratio, either between two powers or two voltages. It is important not to confuse the two quantities.

The power ratio is based on the fundamental sensitivity of the ear. When volume is increased, the impression relayed to the brain is proportional to the logarithm of the ratio of the energy of the sound levels. The common log of the two powers gives their relationship in Bels. The Bel is too clumsy a unit, however—the whole range of human hearing from the threshold of hearing to the threshold of pain is covered by only 13 Bels, so this device is divided by ten, becoming the decibel.

Mathematically, N dB=10 log 10 (P2/P1), where P1 is the input and P2 the output power. More practically, P1 may be the first reading, and P2 the second reading, when an alteration in input to the amplifier is made.

For example, suppose the receiver is supplying 1W to the loudspeaker with a specified input, and this input is increased until the output is 2W. We could say the output has doubled, but it would be more accurate (to measure intermediate changes also), to specify a 3dB increase. In actual fact, the figures do not work out quite so neatly, and the increase is really 3·01dB.

Halving the power would give a 3dB decrease, or, a change of −3dB. As our meter gives a readable indication of fractions of a decibel and the smallest change in sound intensity that our ear will discern is about 1dB, depending upon the character of the sound, it becomes apparent why alignment with the aid of an output meter is preferable to judgement of power level with the ear alone. For example, a normal "quiet" listening level of 1·9W increased to 3W gives a 2dB change, readily noted on the meter scale but quite difficult to judge accurately with a single tone of say, 400 cycles, which is modulating the signal generator input.

Voltage and Current Ratios

This ratio, the decibel, is also extensively used for comparison of voltages and currents, but must not be confused with the *power* dB scale of our output meter.

For voltage comparison, it is necessary to specify the resistance across which the voltages are taken. Where the resistance is the same NdB=10 log 10 ($V2^2/V1^2$).

Remembering that a number squared is equivalent to its logarithm X2, we can express this as NdB=20 log 10 (V2/V1).

Where receiver sensitivity is being considered, we are concerned with this ratio, the gain of a stage being the increase of the output on the input. Thus, we can speak of a stage having 20dB gain, meaning that the output is 20dB up, compared with the input, or a ratio of 10:1 (for an input of 0·1V, an output of 1V is obtained. Similarly, a 20dB attenuator would decrease 1V by 10 times, or to $\frac{1}{10}$V.

Other useful ratios are 10dB, actually 3·162 to 1, but near enough 3:1 for normal purposes, and 6dB, the ratio of 2:1, which is widely used in audio work and alignment.

The usefulness of the decibel comes into play when we consider the added gains of several stages. Instead of unwieldy multiplication or division sums, we simply add or subtract the dB ratios. Thus a three-stage amplifier with stage gains of 2, 3 and 10 would have an overall gain of $2\times3\times10=60:1$. In dBs, this becomes, $6+10+20=36$dB.

From the foregoing, it is obvious that to say an output is 10dB means nothing unless we relate our figure to the input. For alignment purposes, a reference output of 50mW may be used, and dB ratios are calibrated on the output meter scale above and below this reference point.

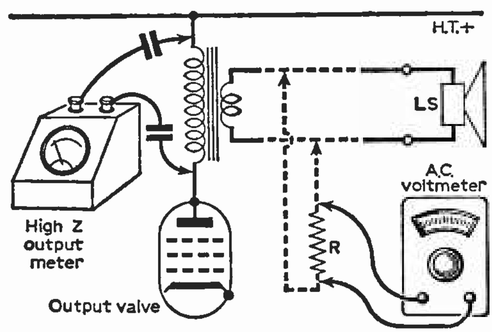


Fig. 2: Methods of connecting the output meter.

Using an A.C. Voltmeter

In practice, it is often desirable to use the output meter across the primary of the output transformer, suitably isolated, as shown in Fig. 2 in which case a direct wattage reading or dB measurement is obtained. The method used in cases where only occasional check on output has to be made is to connect a multimeter, switched to its 0—10V a.c. range across a resistor which is fitted to replace the loudspeaker, or simply across the transformer secondary, leaving the loudspeaker in circuit. The resistor should be equivalent to the impedance of the transformer secondary and preferably wire-wound, to handle the wattage. To calculate this wattage, divide the square of the measured a.c. voltage by the resistance of the output, thus $W=V^2/R$. For example, an indication of 3V across a 2·5Ω load represents a power output of 3·6W.

Transistorised Equipment

Alignment of transistorised equipment sometimes needs a different approach. Output circuits have been developed which employ no output transformer. To disconnect the loudspeaker of such a circuit is impractical, and the meter should be connected across the loudspeaker speech coil as shown in Fig. 3(a) and (b). A 50Ω speech coil

needs the meter switched to its 5—10V a.c. range, and a 5Ω loudspeaker requires a range of 1—2V a.c. for the most accurate readings.

An alternative method is to insert a d.c. milliameter in the battery lead, as shown. The quiescent current of the average set would be between 7 and 10mA, and the current at average listening level from 15 to 25mA. This depends upon the receiver, and reference should be made to maker's specifications when in any doubt.

Grid-Dip Oscillator

This instrument does not receive much use in the radio service department, for the obvious reason that it is quicker to replace a coil than to rewind it, and easier to trust the manufacturer's design of tuned circuits than to modify them in the course of repair. But the amateur is in the happier position of having plenty of time to experiment—and it is worth remembering that in the history of radio, it is his experiments that have brought about the majority of advances. Whereas

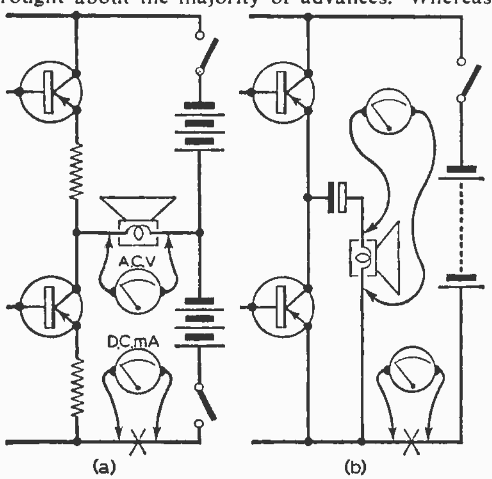


Fig. 3: Alternative methods of transistor output stage measurement.

the position may have changed in the field of television and advanced electronics, where experiment is an expensive business (although not entirely closed, as a survey of our companion magazine, *Practical Television*, will show) there is still plenty of original work going on in the audio field.

From the foregoing remarks it may be thought that the G.D.O. is very much a home-constructed instrument. In fact, there are several quite elaborate pieces of test gear on the market. Typical of the general-purpose design is the Q-Max GD02. This retailed (in 1960) at 15 guineas, with extra coils at 7s. 6d., and covered a frequency range of 1·5 to 300Mc/s with eight plug-in coils. The circuit was built around a double-triode valve, one half as a Colpitts oscillator, the other as h.t. rectifier. The tuning capacitor is driven by a 5:1 slow motion drive, with hair-line cursor, direct calibration and a logging scale. It is mains powered and can be used as resonant frequency tester, in the normal way, as obsorption wavemeter, phone monitor (a jack is provided), oscillating detector and simple signal generator.

Another popular model, covering a 1·7 to 250Mc/s range, in six steps, is the Grundig 701. A four-position switch changes the function of the instrument to (a) a receiver supplying an a.f. signal to a pair of phones; (b) a wavemeter; (c) standard grid-dip oscillator; and (d) modulated signal generator.

Reference to the August 1963 issue of *Practical Television* will show how readily the G.D.O. design can be made up into a practical unit. A. W. Hartley has given explicit constructional details, and it is not my purpose to repeat his information. The following notes on basic design and applications should prove that the G.D.O. is a useful and comprehensive instrument.

Design Details

Whereas the Colpitts oscillator is considered more suitable for a wide frequency range, the alternative simple circuit, as shown in Fig. 4(a), employs a Hartley oscillator and may be more readily constructed from the spares box.

This circuit is deceptively simple. The valve used in the prototype was a 955, but other convenient triodes could be employed. The one component that requires special selection is the capacitor C1, which is a 5pF air-spaced variable with an insulated shaft. C2 and C3 are ceramic capacitors, 50pF and 25pF respectively, R1 is 18kΩ, and L is four turns of 16s.w.g. silvered wire on a ½in. low-loss former. Spacing and spreading the coil turns gave a coverage of 150—200Mc/s with a quite good indication of resonance on the 500μA meter movement.

Fig. 4(b) shows a little more complicated design that had to be developed to widen the range from 130—270Mc/s. C1 was a 35—35pF split stator, C2 and C3 are both 50pF ceramic, and the decoupling capacitors, C4, C5 and C6 are all 1,000pF ceramics. R1 is 22kΩ and R2 is 68kΩ. The coil is simply 1½in. of silvered 14s.w.g. bent into a ½in. U-shaped loop.

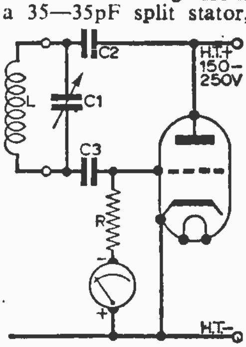
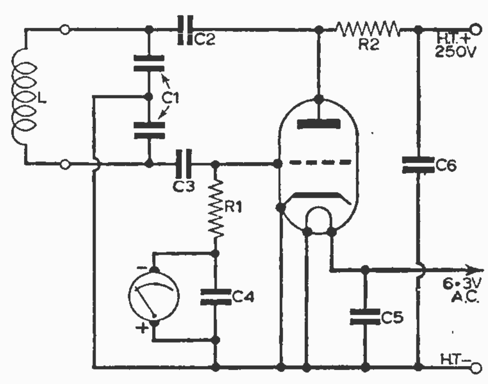


Fig. 4a (right): Hartley and b (below) Colpitts oscillators used as basis of G.D.O.'s.



Calibrating the G.D.O.

Calibration can be carried out in several ways. For high frequencies it is necessary to make up Lecher wire transmission line, which can be two parallel wires of 18s.w.g., insulated at each end from their supports and spaced 2in. apart, fixed as taut as possible.

A single turn loop is soldered across one end of the pair of wires for coupling to the G.D.O. and a knife-edge metal shorting bar placed across the two wires at right angles to alter the length. The coil of the G.D.O. is held close to the loop of the Lecher wires and the shorting bar slid along until a position is found where the grid current reading on the meter dips. The bar is moved along again until another dip is noted. The distance between the two dips is half a wavelength, and the G.D.O. resonant frequency is calculated from the formula

$$f \text{ (in Mc/s)} = \frac{150}{\text{distance}} \text{ in metres, or } \frac{5905}{\text{distance in inches.}}$$

This method is suitable for laboratory work but as length of 40ft or more may be needed, is not practical for the amateur, who may prefer matching the G.D.O. resonant frequency to a known standard from a signal generator or received signal.

First, tune the receiver accurately to the frequency estimated. Note the tuning of known signals and scale off the difference, making allowance for discrepancies of the dial, etc. Better still, inject a known signal from a crystal oscillator or signal generator and listen for zero beat at marker frequencies. After tuning the receiver accurately, couple the G.D.O. loosely to the aerial input circuit and swing the tuning capacitor of the G.D.O. until zero beat is obtained with the marker switched off—that is, with the G.D.O. used as heterodyne frequency meter. Keep the receiver gain down and check for the position of maximum response, to avoid confusion with image frequencies. For further information, refer also to the method used by Mr. Hartley, page 508, August 1963 *Practical Television.*

G.D.O. Applications

The principal use of the G.D.O. is to determine the resonant frequency of a tuned circuit. This is performed as follows.

First, insert a coil covering the possible range, switch *off* the receiver under test, to prevent damping of the tuned circuits by the grid-cathode capacitance of valves. Couple the G.D.O. loosely to the circuit under test and tune for maximum dip. Too tight a coupling will cause the meter reading to pull and experiment will be needed. Check also that spurious results are not obtained by unwanted coupling with adjacent circuits by short-circuiting the tuned circuits individually and noting that the wanted one should upset the G.D.O. meter reading most.

If connections are not easily reached, the tip of a pencil touched on the "live" circuit connections will give quite observable results. If the circuit under test is completely screened, it may be desirable to leave the can in place, and an auxiliary coupling can be made with a piece of p.v.c. wire, twisted around one terminal of the G.D.O. coil and the "live" terminal of the tuned circuit. The wire should be twisted around these points with only its insulation touching, not making a direct connection.

To check closely coupled circuits, such as i.f. transformers, fit a swamping resistor, about 10kΩ, across the circuit *not* under test. Check by the pencil test as stated above.

Testing r.f. chokes and capacitors is best done by short-circuiting their ends and loosely coupling the G.D.O. An open-circuit choke will give an indication of its parallel resonance, a short-circuited choke, its series resonance. Capacitors used as bypass components in r.f. and i.f. circuits may act perfectly well as capacitors but have unwanted inductive effects at the higher frequencies, and if the short-circuiting connections are approximate to the length of the connecting leads *in situ* the G.D.O. will enable us to judge at what frequencies these inductive and capacitative effects cancel, giving the optimum bypass.

To measure inductance, connect the coil across a capacitor of known value and loosely couple the G.D.O. tuning for a dip. Then the inductance in microHenries=

$$\frac{25{,}300}{C\text{ (pF)} \times f\text{ (Mc/s)}}$$

To measure capacitance requires a calibrated variable capacitor to first tune an appropriate coil to a frequency determined by the G.D.O. setting. Then the unknown capacitor is connected across the variable and again a frequency measurement taken. The difference in the two setttings for resonance is equal to the value of the unknown capacitor. If a coil of known value is available, this can be used directly by connecting the unknown C across it and tuning the G.D.O. for resonance, transposing the above formula so that

$$C = \frac{25{,}330}{L \times f.}$$

Aid to Aerial Construction

Aerial checking can be carried out by coupling the G.D.O. as for a tuned circuit, but certain precautions have to be taken. A centre-fed dipole is current-fed on its fundamental frequency and thus the coupling point is shorted out and the G.D.O. coupled by proximity, or with a single turn loop. But on its second harmonic, the aerial is voltage-fed and half sections must be checked individually with the coupling point open-circuited. A single-ended aerial, such as a radio whip-type, is fed at the low impedance point; and the feeder is removed and replaced by a single-turn loop.

Constructing a multi-element array is aided by the G.D.O. by first coupling to the dipole and tun-

—*continued on page 653*

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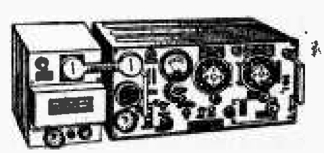

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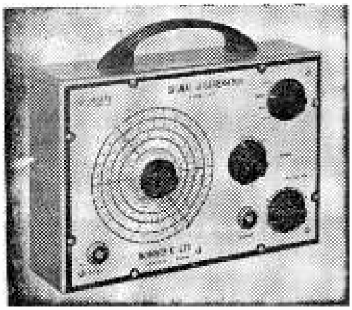

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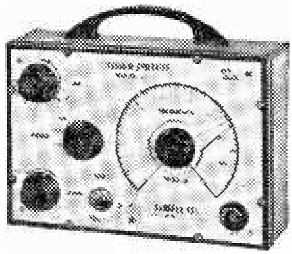

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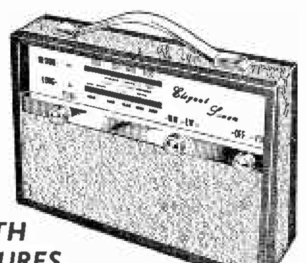

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1P1	6/6	6F12	4/-	16A5	9/-	DL96	6/6	EY81	10/-	U52	7/6
1P10	5/6	6H6GT	2/-	19AQ5	9/6	EB91	4/-	EZ40	5/6	U76	7/6
1P11	6/-	6J7GT	7/6	25A6G	7/6	EBC41	7/6	EZ80	6/-	U78	5/-
1R5	4/9	6K7G	5/6	25L6GT	7/6	EBF80	8/6	EZ81	6/9	U142	7/6
1S5	4/-	6K8G	6/-	30C1	7/6	ECC81	4/-	HVR2	9/6	UBC41	8/6
1T4	2/9	6Q7G	5/6	30L1	7/6	ECC82	6/9	KT33C	6/-	UCH42	9/6
1U5	5/6	6SL7GT	6/-	35L6GT	7/6	ECC83	6/9	N17	5/6	UF41	8/6
3Q4	5/6	6SN7GT	7/6	35W4	8/6	ECC84	6/6	N18	5/6	UL41	8/6
3S4	5/6	6V6G	7/6	35Z4GT	8/-	ECC85	7/6	N19	6/-	UY41	7/6
3V4	6/-	6X4	5/-	5763	7/6	ECF80	6/6	N709	7/-	W17	3/-
5Y3GT	5/-	6X5G	5/9	80	6/-	ECF82	7/6	PCC84	7/6	W76	4/6
5Z4G	7/6	7S7	9/6	DAF91	4/-	ECH42	9/-	PCF80	7/6	W142	8/6
6AK6	5/6	8D3	4/-	DAF96	6/6	ECH81	10/-	PCF82	6/6	X17	4/9
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Design for a Dual-Impedance Loudspeaker

A useful accessory for the workbench.

By K. Berry

IN the course of testing radios, television receivers and amplifiers, a general purpose loudspeaker is often needed for experimental purposes. Sometimes, a low impedance loudspeaker is required and at other times a high impedance instrument will be needed. On such occasions, it is usually necessary first to find a loudspeaker, also an output transformer and then to connect them together and to the equipment under test. This will always be a time consuming and tedious business and to overcome this problem, the author constructed a dual-impedance loudspeaker.

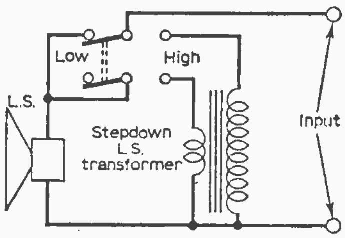


Fig. 1: The simple circuit arrangement of the unit.

The idea, which is very simple, is as follows. An ordinary low impedance extension loudspeaker was obtained, and an output transformer screwed securely inside the case. In the top of the case were fitted two terminals and a 2-pole change-over toggle switch.

The circuit is shown in Fig. 1, and the finished instrument in Fig. 2. The loudspeaker when thus modified, can be set for high or low impedance operation at the turn of a switch.

The output transformer was one taken from an old radio receiver and matches 8,000Ω to 3Ω. It is recommended that a transformer capable of carrying a primary current of about 50mA is used, as some equipments will pass such a current through the transformer.

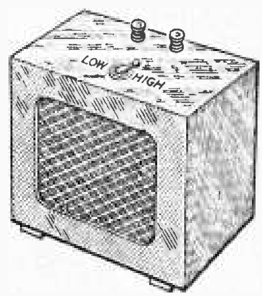


Fig. 2: The finished unit.

Since, in this circuit, the voice coil of the loudspeaker is connected to the primary of the output transformer (when switched for high impedance operation), the loudspeaker chassis or frame could be at a high voltage with respect to earth, and accordingly *care should be taken to ensure that accidental contact cannot be made with the loudspeaker chassis.*

This device has proved to be such a great asset in testing and experimenting that the author wonders how he ever managed without one! ■

TEST GEAR TECHNIQUES

—continued from page 650

ing for resonant frequency. Then, without altering the G.D.O. setting, the additional elements can be added, spaced and adjusted for length until resonance is again obtained. One point worth mentioning is the effect of the earth on tuning. As the array is tuned relative to earth, adjustments should normally be made at the height above ground that it is intended to be used.

These are only a few of the more obvious applications of the G.D.O. A complete article could be devoted to its very versatile capabilities as signal generator and absorption type wavemeter. Various modifications and adaptations can be made to extend the range and sensitivity of the instrument.

Fig. 5 shows one such extension of the previous circuits, where a second valve is used as a d.c. amplifier with a bridge network to enable more accurate reading to be obtained with loose coupling. Here, the valve functions as one arm of a bridge, with the potential developed across the G.D.O. grid leak applied to its grid. As this potential drops, the grid voltage becomes less negative and the resistance of the anode-cathode path decreases. This upsets the balance of the bridge and results in a good, positive indication. R5 is used to set the meter zero.

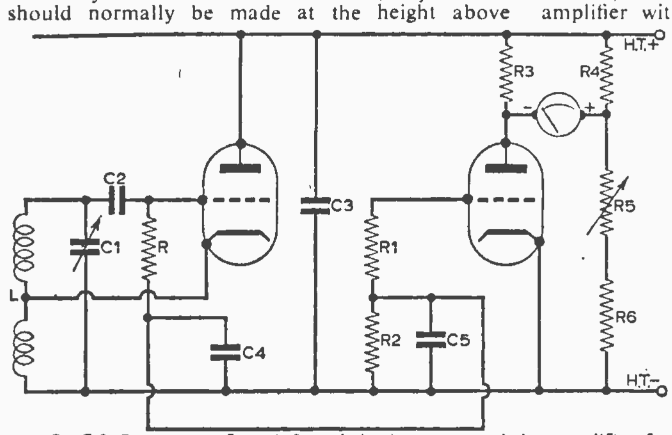
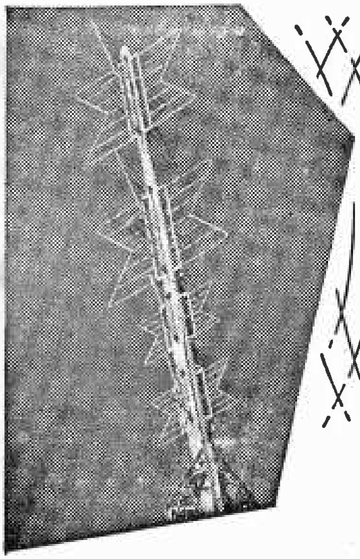


Fig. 5: G.D.O. suitable for v.h.f. with bridge-connected d.c. amplifier for more accurate readings.

In conclusion, the author would like to thank those readers who have written, discussing the subject matter and occasionally pointing out discrepancies. It is regretted that sufficient space is not available to enter fully into the several questions that have arisen. Perhaps later . . . ■



On Your Wavelength

By THERMION

I FEEL compelled to give warning of dangers that may arise from the use of certain mains adaptors with battery type transistor receivers. How widespread this practice has become, I do not know, but I am aware of two recent cases of electrocution caused by transistor receivers operating from a.c. mains supplies through such devices.

In both tragedies, the adaptors were of foreign origin and it is all too obvious that neither of these meet the requirements laid down by British Standards Institute with respect to safety from electric shock and fire.

Mr. J. Robson, of Newcastle, has recently drawn attention to one case of electrocution reported in the press, and he also forwarded a circuit diagram of a Japanese made mains operated power unit which he suspects to be of similar type to the unit involved in this fatality. On studying this diagram I find myself sharing the indignation expressed by this reader. That such a piece of apparatus should be made available to the general public without adequate instructions and warning concerning its use is little short of scandalous.

The unit referred to consists of a metal rectifier fed from the a.c. mains through a capacitor. The h.t. plus output line is separated from one side of the a.c. mains only by a resistor.

Now a very dangerous state of affairs arises when this kind of power unit is connected up to a transistor portable receiver equipped, as so many are nowadays, with a socket for an external aerial and maybe a retractable rod aerial as well. In the majority of cases the aerial socket will be directly connected to the receiver h.t. plus line (signal 'earth')—but this presents no hazard when the receiver is powered by its normal internal battery. Should a mains operated power unit of the type just described be employed as substitute for the battery, the aerial circuit will then be connected to either the neutral or the line side of the mains, depending upon which way round the plug is fitted. There is thus a 50/50 chance that the aerial socket (and, even more serious, the rod aerial) will be 'live' at the full mains voltage.

A Second Fatality Reported

Within a few weeks of receiving information concerning the above case I read of another fatal accident, where a youth was electrocuted in a bathroom. His death was attributed to a mains adaptor which was coupled to a transistor radio. A radio engineer giving evidence at the inquest stated that this particular adaptor (of German manufacture) would be regarded by many in the trade as potentially lethal. Now it was certainly wrong to use a mains powered receiver in a bathroom; frequent warnings are given about this and nobody should be in ignorance on this matter. But this cannot in any way excuse the makers, for if the facts as reported were correct, the power unit was inherently dangerous and had exposed metal which could readily become 'live'.

I would urge all who have any dealings with devices of the nature to examine carefully each particular type that comes into their hands and satisfy themselves that the circuitry, components and mechanical construction are sufficiently sound for the proposed application; check especially that there is no risk of fire due to overheating nor any chance of 'live' parts being touched under normal working conditions.

British Standards Safety Requirements

It is pertinent, finally, to mention some of the safeguards that are embodied in equipment conforming to BS415.

In this Standard certain requirements are laid down for 'non-isolated apparatus'—where direct connection is made between one side of the mains supply and any structural part of the apparatus. (A familiar example is, of course, the a.c./d.c. type receiver). It is stipulated that all terminals and sockets used for making external connections be effectively isolated from those parts of the circuit likely to be at mains potential. Good quality mica or paper dielectric capacitors of at least 750V working are specified for this purpose. In the case of receivers designed for use with an external aerial, the capacitor connected to the aerial socket must be shunted by a resistor of reasonably high value to prevent the accumulation of static charges on the aerial, because such charges could in time cause a breakdown in the isolating capacitor.

The apparatus should be housed in a cabinet or case of adequate strength and well insulated from the live parts. Any openings for ventilation must be of such a size as to prevent live parts within being touched by a finger. Control knobs must be securely fastened so that no portion of the metal spindles remains exposed; if grub screws are used, these must be well countersunk and, preferably, the holes sealed with an insulating substance.

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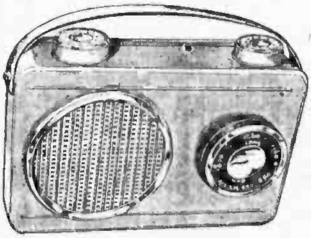

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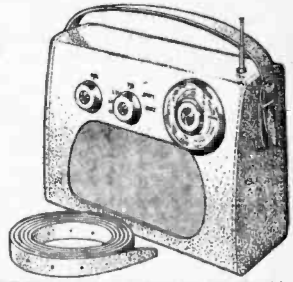
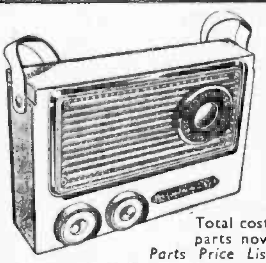


SUPER SEVEN



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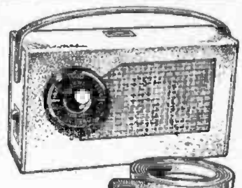

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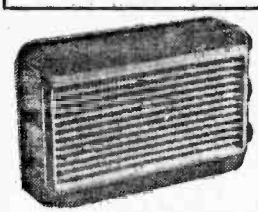

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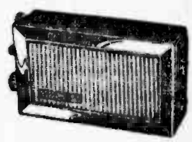

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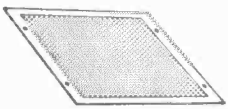

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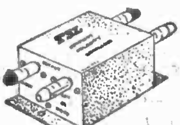

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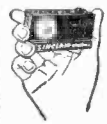

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DOUBLE-TRACE OSCILLOSCOPE

—continued from page 613

mentary lens, either of which can be purchased from a photographic dealer for a few shillings. A supplementary lens is designed for fixing immediately in front of the camera lens in the same way as a filter, and enables the lens to focus down to short distances.

"No. 3" lenses vary somewhat in power according to the manufacturer but a focusing table is available with the lens giving all necessary information. The data for a +3 diopter lens used with a normal type of 35mm. camera are as follows:

TABLE 4: SETTING-UP DATA FOR +3 DIOPTER SUPPLEMENTARY LENS

Camera Scale Reading	*Distance from Lens front to Screen*	*Approximate Field Size*
3·5 ft.	10 in.	4¾ x 7 in.
3 m.	25 cm.	12 x 18 cm.
∞	13·1 in.	5 x 7½ in.

If the camera has a focusing control it should be set at 3.5ft. or 3m., otherwise the "∞" figures can be used.

Special oscillograph film is available, but only in bulk quantities. However, it is quite possible to use whatever film happens to be in the camera at the time, using the exposures given in Table 5.

These values can only be approximate, as the setting of the "Intensity" control on the oscilloscope will have a considerable effect on the result. However, modern films provide quite a wide latitude for error.

TABLE 5: AVERAGE EXPOSURE TIMES FOR AN APERTURE SETTING OF f/11

Film Speed			
BSI Scheiner	*DIN*	*ASA Weston*	*Time*
25°	15°	25	60 sec
32°	22°	125	15 sec
34°	24°	200	8 sec
37°	27°	400	4 sec

With exposure times of this order, the camera cannot be held by hand, and a tripod (or a pile of books at the very least) will be necessary to support it during the exposure. If the camera is equipped with a cable release this should be used.

The actual exposure is best made in a darkened room or with the tube face screened from direct light, otherwise the oscillogram will lack contrast.

If the camera has no "Time" exposure, it may be possible to bring the times given in Table 5 within the range of shutter speeds available on the camera by increasing the aperture of the lens (i.e. reducing its stop number). Here, the rule is to halve the exposure time for each stop by which the aperture is increased. If this is done, however, extra care will be needed in setting up the camera, as the depth of field will be that much less (a permissible error of about a quarter of an inch at f/3.5, as against more than an inch at f/11). ■

SHOWTIME ROUNDUP—*continued*

since they represent, in the main, the more popularly priced models and do not take in the majority of the more specialised manufacturers.

However, the new models seen showed a general improvement both technically and in presentation. With newer and better tape decks, higher quality audio circuits, more facilities and greater flexibility, today's "popular" tape recorder represents extremely good value.

MAINS OPERATED RADIOS

Although there are proportionately few valve mains radio sets, some makers still keep them in production and a few new ones turned up at Showtime.

MAINS OPERATED RADIO

Model	*Wavebands*	*Price*	*Notes*
EKCO U428	LW, MW, VHF	25 gns.	Push button pre-set tuning of up to four VHF stations. Manual tuning for LW and MW.
PHILIPS 417U	LW, MW, VHF	28 gns.	6 x 4″ speaker.
4X23A	LW, MW, SW, VHF	37 gns.	Two 5″ speakers, push-button tone control.
STELLA ST154U	LW, MW, VHF	27 gns.	6V, 6 x 4″ speaker.
ST160A	LW, MW, SW, VHF	37 gns.	7V, two 5″ dual-cone speakers.
UNITRA Goplana	LW, MW, SW, VHF	26½ gns.	Piano-key switching. Wood cabinet.
Alfa	MW, VHF	15½ gns.	Wood cabinet. 1·3W output.
Figaro 3	LW, MW, SW	9 gns.	1·5W output. Plastic cabinet. Wood cabinet version, 9½ gns.
Ramona	LW, MW, SW, VHF	26½ gns.	Unusual cabinet design.

THREE-WATT AMPLIFIER

BY J. D. HASKELL

SPECIFICATION

Total output is 3W at better than 1% total distortion. Frequency response at maximum output 30—20kc/s better than ± 1dB. Hum and noise better than —80 dB at full output. Sensitivity with the loudness control in circuit is about 200 mV and this can be provided by any normal type pre-amplifier.

FOR enthusiasts who are satisfied with 3W of good quality, the following amplifier should suffice. The amplifier is good so far as stability, distortion and frequency response is concerned, and is adequate for all but the most discriminating listener.

The circuit is based upon three valves, these being a 6BR7, and EL84 and an EZ80. Precautions have been taken to ensure adequate valve life, and maximum rating figures are never exceeded. The circuit has three negative feed-back loops; one of these is frequency selective, the other provides current feedback, and the third is a voltage feedback loop.

Loudness Control

Very few, if any, of the cheaper commercial amplifiers on the market have loudness controls.

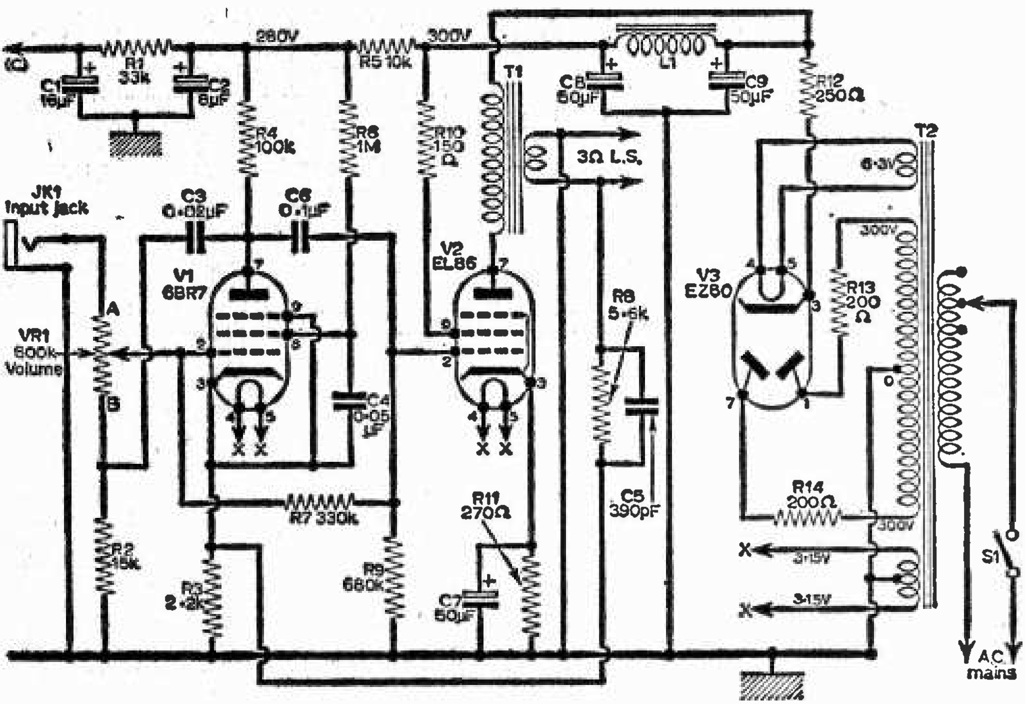

Fig. 1: The complete circuit diagram of the amplifier.

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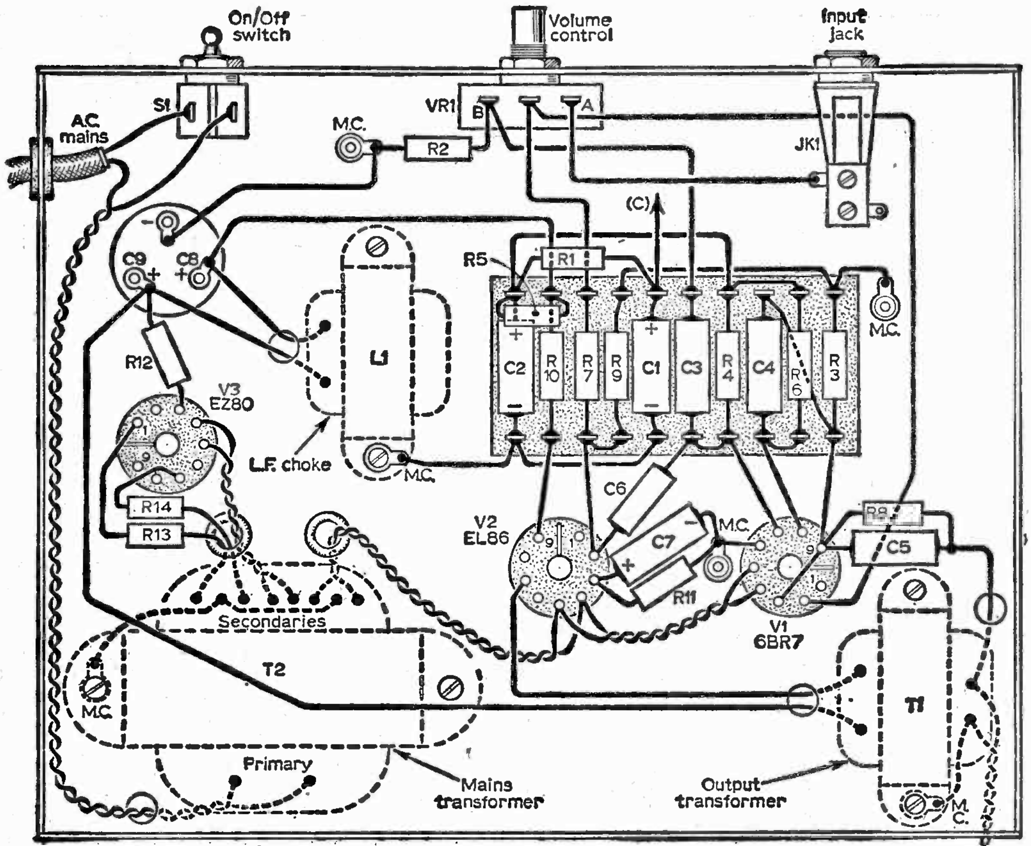

Fig. 2: A suggested layout for the amplifier.

In brief, this is a device which compensates for bass deficiency at low output levels. The loudness control functions as follows:

As the slider of the volume control is moved down towards " B ", i.e. volume decreased, the amount of resistance in series with C3 is reduced and therefore more signal voltage is applied as negative feed-back to the grid. Due to the size of C3 the higher frequencies are readily passed—but very little at the lower frequencies.

H.F. Attenuation

This selective feedback results in attenuation of the high frequencies. It should now be clear that the boost is obtained at the expense of the high frequencies and hence adequate balance may be obtained by varying the setting of VR1. The resistor R2 prevents a short circuit to earth when the slider is at β. The values of C2 and R3 govern the frequency at which this control becomes effective. The adjustment of this control will be dealt with later on in this article.

Feedback

Some current feedback is applied at V1 by omitting the normal cathode by-pass capacitor, and this gives a gradual low frequency rolloff and prevents the amplifier being overloaded at low frequencies. Some additional feedback is applied to the cathode of V1 from the output transformer secondary, via R8 and C5; the latter prevents high frequency ringing and instability and will suffice for any good quality output transformer. If a cheap type of output transformer is used a value of 1,000pF should prove suitable for C5. More feedback is applied to the grid of V1 from the grid of V2 via R7 and this keeps distortion at a minimum. The value of R4 has been chosen to give an essentially flat response up to at least 20kc/s.

Large Coupling Capacitor

The power handling capacity of an EL84 is well known, and hence a large coupling capacitor C6 was chosen to give an adequate bass response. It should also be remembered that if C6 were small in value a noticeable amount of transient distortion will occur due to phase lag in the capacitor. R11 should preferably be a 5% component.

COMPONENTS LIST

Resistors:

R1	33kΩ	R8	5·6kΩ 5% (for 3Ω LS) / 12kΩ 5% (for 15Ω LS)
R2	15kΩ	R9	680kΩ
R3	2·2kΩ	R10	150Ω
R4	100kΩ	R11	270Ω 3W
R5	10kΩ	R12	250Ω 5W w.w.
R6	1MΩ	R13	200Ω 1W
R7	330k 5%	R14	200Ω 1W

All 10%, ½W carbon, except where otherwise stated.

VR1 500kΩ carbon potentiometer, log.

Capacitors:

C1 16μF electrolytic
C2 8μF electrolytic 350V
C3 0·02μF paper 600V
C4 0·05μF paper 600V
C5 390pF ±10% silver mica
C6 0·1μF paper 600V
C7 50μF electrolytic 25V
C8 50μF electrolytic 350V
C9 50μF electrolytic 350V

Transformers and choke:

T1 Output transformer: Primary impedance 5kΩ; secondary 3Ω or 15Ω (Partridge P4073, or Parmeko P2661).
T2 Mains transformer: Tapped primary. Secondaries: 300-0-300V 8mA; 6·3V 1A; 6·3V (centre tapped) 1A.
L1 Smoothing choke. 5H 75Ω 60mA.

Valves:

V1 6BR7
V2 EL86
V3 EZ80

Miscellaneous:

Single pole on/off switch (S1). Input jack and socket. Three B9A valveholders. One 10-way groupboard. Chassis 10in. x 8in. x 3in. approx.—(16s.w.g. aluminium.)

Output Transformer

Regarding the output transformer, no expense should be spared here, and the specified component should be bought if possible.

Adequate decoupling and smoothing is provided by C2, R5, C8 and C9, and hum is at least 80dB below full output. The resistors R13 and R14 are to limit the anode current on the plates of V3, but may be omitted, since the valve is working well within its maximum input rating.

A separate rectifier winding is preferable, though not essential, and if a common winding is to be used it should have a 2A rating. The heater winding in the circuit is centre-tapped to reduce the hum level, but again this could be of the ordinary variety without a centre tap and in this case one side of the winding should be earthed.

Wiring: Good wiring practice should be adhered to and all earth connections are to be made to a bus-bar, this being earthed at the input jack only. A suggested layout is given in Fig. 2.

Setting up: After testing for any possible short-circuits the mains can be applied and about 15 sec. should be allowed for the amplifier to warm up. If you are using it in conjunction with a pre-amplifier the tap for the h.t. is taken from point C in the circuit, about 10 mA is available.

The loudness control is turned to the maximum position and the volume control on the pre-amplifier is adjusted for normal listening level or, better still, for full output. The tone controls are now adjusted to match room acoustics. The pre-amplifier volume control should be left at that setting and the volume of the amplifier adjusted by means of the loudness control; adequate balance will be maintained down to about 1W of output.

Summing up, the above amplifier will compare very well with the best on the market in this price bracket and should provide good quality and trouble-free performance when used with a good quality, correctly housed loudspeaker. ■

Audio Level Indicator

—continued from page 642

The signal supplied to the miniature loudspeaker was a 1,000c/s note obtained from a b.f.o. and recorded on tape, the output to the loudspeaker being in the order of 2W. A dB meter could be used to obtain exact figures of gain and loss.

The position of the loudspeaker and the microphone when mounted on the rod differed very little but the reflected sound from the loudspeaker is masked due to the physical size of the instrument. If one is experimenting in this field of very interesting work it is well to remember that both the loudspeaker and microphone should face the umbrella reflector and not the sound.

Using the Noise Level Indicator Meter.

When the instrument has been completed and is ready for testing first switch on the instrument, then gently tap the microphone. The meter should give some indication by an upward movement. If the instrument is placed with the microphone facing a constant level audio signal the control VR1 can be rotated to give maximum reading.

The noise level indicator is very sensitive and will pick up a slight whisper at a few feet or more, so that when testing adjust the control VR1 if necessary to prevent the meter pointer wrapping itself around the end stop.

If an external microphone is being used, remember to turn down the gain control on the indicator so that if the microphone happens to get a sudden bang the meter will not suffer as a result.

The meter is not calibrated in terms of dB as this would necessitate the use of a decibel meter and a constant signal source, neither of which were available to the author. However, by experimenting a little with the results obtained the constructor will soon be able to use this instrument to a very surprising degree of accuracy in recording sound and setting up for stereo, etc. ■

LETTERS TO THE EDITOR

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

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

EARN YOUR TICKET!

SIR,—If carried to its logical conclusion your correspondent's views on democracy (October '63) would make life quite interesting, no driving tests, no pilots tickets, no building restrictions, perhaps all our problems would then be solved by the undenied right of the amateur physicist to test his home produced H-bomb (power limited to one megaton of course) in his own back yard.

With the arrival of this free radio age the present transistor portable craze among teenagers would be extended to transreceivers with the kids on high street all calling "CQ" to every blonde who walks down the street.

Now as one of the initiated few who managed to pass the "highly technical examination" (I left school 26 years ago at the age of 14), I would like to point out to R.L.J. that if he so desires, and if he has the enthusiasm and willpower to spend a little time in study he too will not find it difficult to become one of the initiated few, otherwise my advice to R.L.J. is to take up bird watching or possibly politics. — C. M. PARRY, GW3PHH, (Tonyrefail, Glam.)

PERMANENT VALVE IDENTIFICATION

SIR,—All amateur radio enthusiasts know the frustration of finding second-hand valves which, although probably mechanically sound, cannot be used because their type numbers have been removed by constant handling. Numerous remedies for this problem have been suggested in the past but none seem to be really permanent. However, I think I have found the answer by etching the number on to the valve envelope with acid.

I first cover a small area of the envelope with wax and then "write" the type number in the wax with a suitable stylus. Next I rub into the number just enough sodium fluoride to fill the depressions. Then I apply a couple of drops of concentrated sulphuric acid—*which must be handled with the utmost care*—and leave the valve undisturbed overnight. The wax can be removed the following morning, when the type number of the valve will be permanently etched on the envelope.—J. H. TURNER (Norwich).

CORRESPONDENTS WANTED

SIR,—A friend and I, aged 12 and 14 years respectively, would like to correspond with other readers of P.W. who are about the same age. We are keen S.W.L.s and are already interested in many aspects of radio and electronics and would therefore be pleased to hear from any young readers of P.W. having similar interests. — P. GASKELL, 131 Greenfield Road, St. Helens, Lancs.

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

. . . the October 1958, the August, September and October 1959, and the February and December 1962 issues of P.W.—J. R. AULT, 17, Hollyhedge Road, West Bromwich, Staffs.

. . . the January and February 1962 issues of P.W.—P. WARREN, 6 Lime Grove, St. Neots, Huntingdonshire.

. . . the February 1961 issue of P.W.—S. MATTHEWS, 13 Wensley Gardens, Leeds 7, Yorks.

. . . the circuit and/or manual for the Hallicrafters S-40B receiver.—M. J. WICKSTEAD, 99 Earlsfield Road, London SW18.

. . . the June and August 1961 and May 1963 issues of P.W.—M. HERRING, 59 Groundwell Road, Swindon, Wilts.

. . . the August 1962 issue of P.W.—D. DAVIDSON, c/o Clark, 43 Acrehill Street, Glasgow E3.

. . . the circuit diagram of a three-waveband H.M.V. receiver, type 482. — P. K. TARLING, 9 Guithavon Street, Witham, Essex.

. . . the issues of P.W. giving data on the No. 19 set and any other information available.—J. SCANLAN, 22 Sidland Road, Barmulloch, Glasgow N1.

. . . the circuit and wiring diagram of the No. 19 set supply unit No. 2.—D. R. BROOKS, 61 Elmsleigh Gardens, Bassett, Southampton.

. . . the issues of P.W. containing information on the R.1155 receiver.—W. DAVIES, 78 Lapwing Lane, Brinnington, Stockport, Cheshire.

. . . a service sheet for the Sharp transistor receiver, model No. BX-326.—G. STEWART, 12 Baronhill, Cumbernauld, Glasgow.

. . . the April 1953 issue of P.W.—A. J. HILLS, 89 Cornwallis Road, Cowley, Oxford.

TREMOLO OR VIBRATO

SIR,—There seems to be some confusion in the minds of some of the contributors to your magazine, with regard to the use of the term "tremolo unit" in describing various devices associated with guitar amplifiers and electronic organs. The confusion seems to arise from a misinterpretation of the musical terms tremolo and vibrato.

—continued overleaf

CLUB NEWS

ISLE OF WIGHT RADIO SOCIETY

Hon. Sec.: Capt. E. C. Dolling, "Sweet Briars", New Road, Wootton Bridge, I.W.

At recent meetings members have been preparing for the increased activity which the approaching winter months will bring. Now that the Society has obtained its own callsign, all efforts are being made to get on the air as soon as possible from their new premises of the Unity Hall, Wootton Bridge.

LOUGHTON AND DISTRICT RADIO CLUB

Hon. Sec.: D. J. Penny, G3PEN, 175 Burrow Road, Chigwell, Essex.

This Club has only recently been formed and at the moment members meet fortnightly at the Loughton Community Centre, Debden, Essex. Separate meetings are held for younger members when instruction on radio theory and morse is given.

MELTON MOWBRAY AMATEUR RADIO SOCIETY

Hon. Sec.: D. W. Lilley, G3FDF, 23 Melton Road, Asfordby Hill, Melton Mowbray, Leicestershire.

On the 19th September the Annual General Meeting of this Society was held in Melton Mowbray. The main item on the agenda was the programme of activities for the winter session, which was discussed and compiled during the evening.

MITCHAM AND DISTRICT RADIO SOCIETY

Hon. Sec.: Alan Thurley, 50 Bruce Road, Mitcham, Surrey.

On 13th September a junk sale was held at the Society's H.Q.

The Society is making preparations to co-operate with the Mitcham District Scouts in the forthcoming Boy Scouts "Jamboree-on-the-Air" which will be held in October. Members for the Society will be operating equipment on the h.f. and 2m bands during this two-day event.

NORTHERN HEIGHTS AMATEUR RADIO SOCIETY

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

On 11th September Northern Heights members were hosts to visiting members of the Manchester Radio Society for a Pea and Pie Supper. Later in the month on the 25th, K. Walton (G3IKS) gave a lecture on "Lightning", explaining its nature and effects. G3IKS illustrated his lecture with dramatic demonstrations using a ½ million volt discharge to produce some considerable "flashes".

Preparations are going ahead to organise a coach party of 40 to visit this year's International Communications Exhibition.

READING AMATEUR RADIO CLUB

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

The only meeting for September was held on the 28th when "Transistor Power Supplies" was the subject of the lecture given by G8SC.

SCARBOROUGH AMATEUR RADIO SOCIETY

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

The month's activities began with a sale of surplus gear on 15th September. On the 12th members made "at home" visits to G8KU, G3NRI, G3NRS and G3JTG.

A week later, "Antennas and Couplers" was the topic under examination, and on the 26th a quiz provided the evening's entertainment.

SHEFFIELD AMATEUR RADIO CLUB

Hon. Sec.: D. A. Justice, G3PYL, 314 Stannington Road, Sheffield 6.

The Club meets on every second and fourth Friday in the month when new members will be welcomed. Members and prospective members are asked to note the new address of the Club secretary as shown above.

WESSEX AMATEUR RADIO GROUP

Hon. Sec.: G. J. Fowle, 138 Surrey Road, Branksome, Poole, Dorset.

It is intended to record all the Group's activities this year on 8 mm. colour cine film.

On 12th September members visited Pool power station and on the 16th an informal get-together was held at the President's house.

At the last meeting for the month, members took part in a quiz and also heard a talk on "Railway Signalling and Communications" which was given by G. J. Fowle.

WEST KENT AMATEUR RADIO SOCIETY

Members operated a 2m station for 24 hours when V.H.F. National Field Day was held on 7/8th September.

The second meeting for the month was devoted to the first of a series of talks and discussions entitled "100 Years of Wireless".

WIMBLEDON AND DISTRICT RADIO SOCIETY

Hon. Sec.: R. G. Baker, G6QN, 1 Boundary Road, Colliers Wood, London S.W.19.

This society has recently been re-established, after a considerable number of years, by the efforts of a small body of local enthusiasts. A *pro tem* committee will continue to function until December, when a properly constituted panel of officers will be elected.

Local radio enthusiasts are invited to attend any of the meetings which are held on the second Friday of each month at the Community Centre, St. George's Road, Wimbledon, London S.W.19.

WIRRAL AMATEUR RADIO SOCIETY

Hon. Sec.: A. Seed, G3FOO, 31 Withert Avenue, Bebington, Wirral, Cheshire.

September activities began with a sale of surplus equipment. This was followed by a talk on "Valve Uses", given on the 18th.

The first meeting in October was the Annual General Meeting, held on the 2nd.

R.S.G.B. Contests for October. R.A.E.N. Rally (6th October); 7Mc/s DX Contest—phone (19th to 20th October) and Second 420Mc/s Contest (27th October).

Correction. We draw the attention of readers to the fact that the South Shields and District Amateur Radio Club's Mobile Rally, which was reported on the September Club News page as having been held on 7th July, did not, in fact, take place, due to an unforeseen incident.

LETTERS TO THE EDITOR

—continued from previous page

The tremolo effect describes the slight variations of frequency which may be produced by an instrument to add "colour" to an otherwise steady note and is, in fact, frequency modulation of the note. The vibrato effect, however, describes the variations in amplitude which may be produced, and is, in fact, amplitude modulation of the note.

The tremolo effect is produced mechanically in the case of a guitar, by changing the tension in the strings by means of a lever and spring system, commonly called a "tremolo arm". The vibrato effect is usually produced electronically in the amplifier system by some sort of amplitude modulator such as described in the March 1963 issue of P.W. In the case of electronic organs both effects may be produced by modulating the oscillators producing the fundamental notes.

The devices described in Practical Wireless for use with guitar amplifiers are amplitude modulation devices and the term "tremolo unit", although used by some manufacturers to describe these units, is quite incorrect and misleading. These devices are "vibrato units". I for one would be very interested to see an electronic device which produces a true tremolo effect with guitar amplifiers!—PETER A. ROE (Aspley, Nottingham).

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We offer a really efficient Mail Order Service on all items stocked. All cash orders are dealt with on the day of receipt.
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● ILLUSTRATED LISTS
Illustrated lists are available on LOUDSPEAKERS, TAPE DECKS, TEST GEAR, GRAMOPHONE EQUIPMENT, AMPLIFIERS. Any will be sent free upon request.

● AMPLIFIER KITS
We have full stocks of all components for the Mullard 510, Mullard 3-3, Mullard 2 and 3 Valve Pre-amp, Mullard Stereo, Mullard Mixer, GEC912 Plus. Fully detailed list on any of these sent upon request.
Instruction Manuals: All Mullard Audio Circuits in "Circuits for Audio Amplifiers". 9/5. GEC912, 4/6. All post free.

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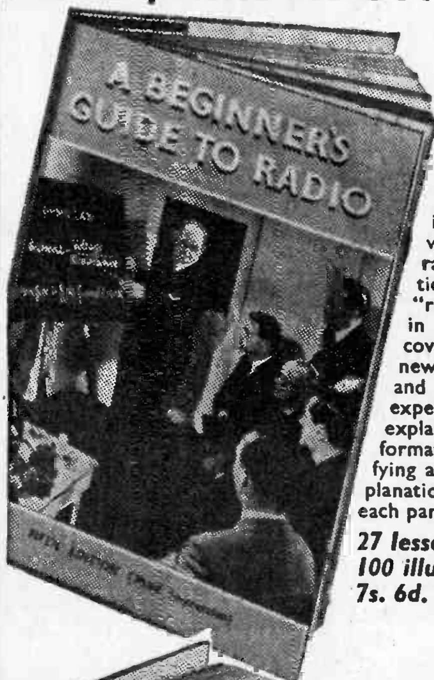

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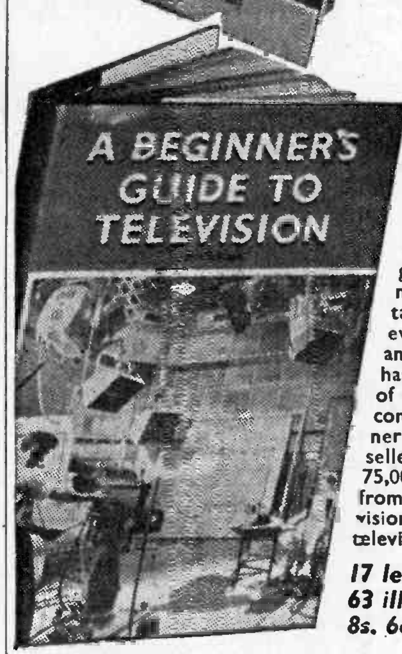

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NEWNES

The Progressive Portable

—continued from page 633

and rotate the oscillator coil and IFT cores until they are about level with the tops of the screening cans.

With the volume control advanced about one quarter, as mentioned, try to tune in the local station. If it is heard, tune it in as well as possible, and adjust the IFT cores for best volume. Signals may become much too loud, in which case the volume control should be turned back.

It should then be possible to tune in some transmission near the high frequency (low wavelength) end of the band; that is, with the variable capacitor nearly open. Rotate the trimmers to bring this transmission up to best volume.

A station of high wavelength (capacitor nearly closed) is then sought. The aerial winding is then pushed along the ferrite rod, to bring this up to best volume.

Repeating the procedure once or twice, with weak signals, should give correct ganging, as shown by full sensitivity throughout the whole tuning range.

If the local station cannot in any circumstances be heard, attach a few feet of wire, as an external aerial, to the green lead tag. This should give a signal allowing rough adjustments to be made. It should then be possible to hear the station with no external aerial, and alignment can then proceed as mentioned.

Adjustment to this part of the receiver will remain approximately correct, even when the other stages are added. In view of the simple nature of the circuit, no particular difficulty should arise in aligning. The most probable faults are wrong band coverage.

If the set does not tune to a high enough wavelength, even with the capacitor fully closed, this can be corrected by screwing the oscillator coil in slightly, and pushing the aerial winding a little farther on the rod.

Should the receiver fail to reach a low enough wavelength, with the tuning capacitor fully open, this indicates that the trimmers are screwed down too far. Unscrew both by an equal amount, then re-trim as explained.

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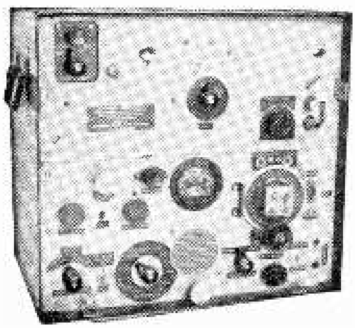

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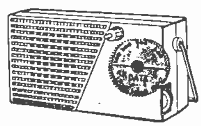

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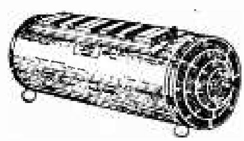

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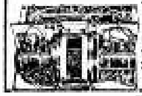

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ALL of these blueprints are drawn full-size and although the issues containing descriptions of these sets are now out of print, constructional details are available free with each blueprint except for those marked thus (*).

Send (preferably) a postal order to cover the cost of the Blueprint (stamps over 6d. unacceptable) to PRACTICAL WIRELESS, Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, London W.C.2.

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SOME EARLIER DESIGNS

THE following blueprints include some pre-war designs and are kept in circulation for those constructors who wish to make use of old components which they may have in their spares box. *The majority of the components for these receivers are no longer stocked by retailers.*

Experimenter's Short Wave	PW30a	2/6
Midget Short Wave Two	PW38a	2/6
Simple S.W. One-valver	PW88	2/6
Pyramid One-valver	PW93	2/6
BBC Special One-valver	AW387	2/6
A One-valver for America	AW429	2/6
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Standard Four Valve S.W.	WM383	3/6
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Standard Four Valve	WM391	3/6
Listener's 5-Watt Amplifier	WM392	3/6

QUERY COUPON

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PRACTICAL WIRELESS, NOVEMBER, 1963.

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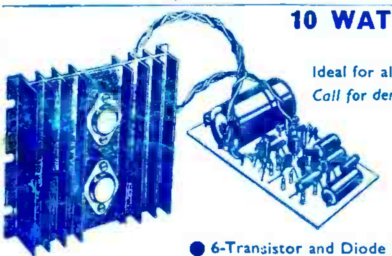

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