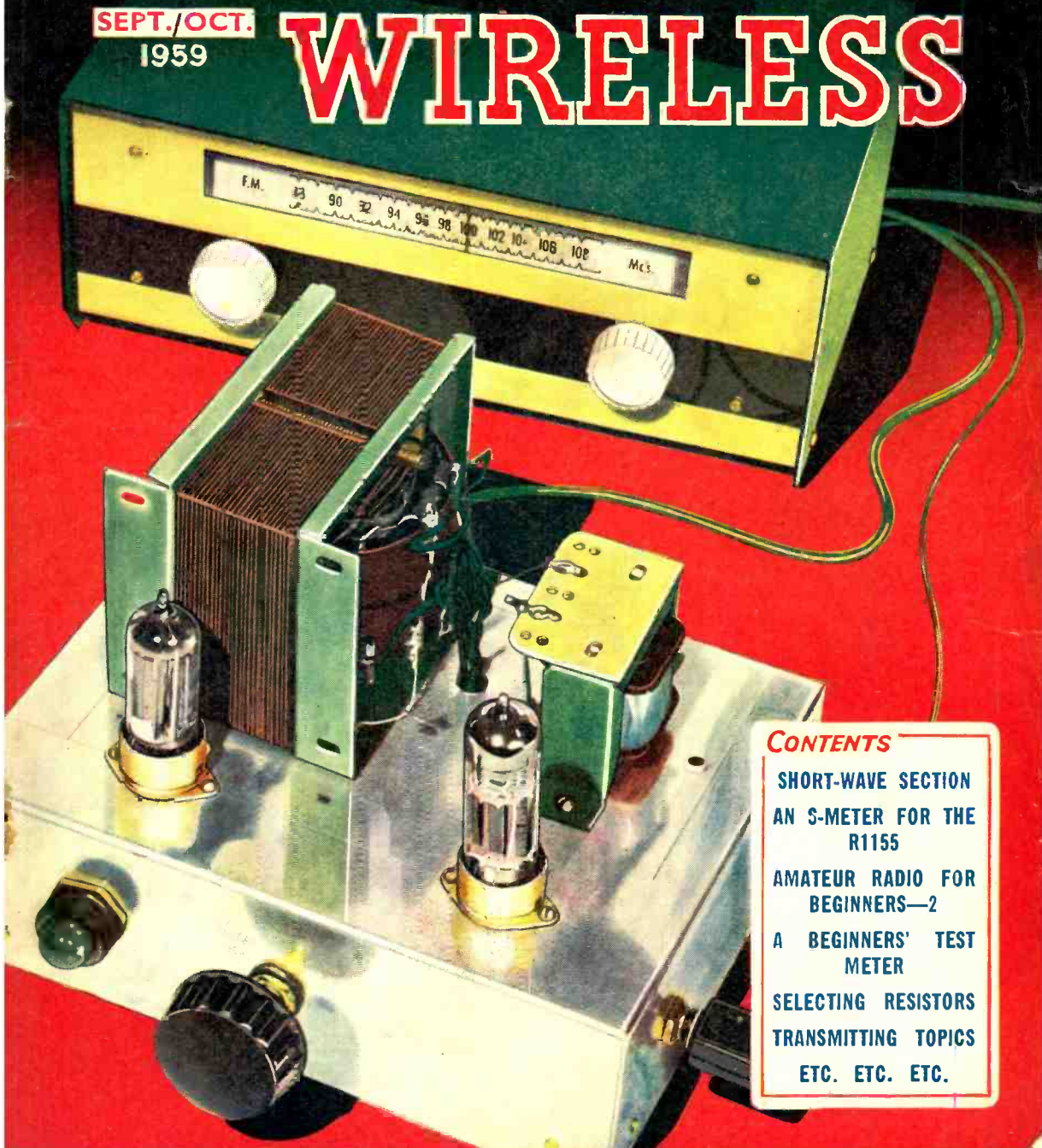


A DIRECT-COUPLED AMPLIFIER

# PRACTICAL $\frac{1}{3}$

SEPT./OCT.  
1959

# WIRELESS



## CONTENTS

- SHORT-WAVE SECTION
- AN S-METER FOR THE R1155
- AMATEUR RADIO FOR BEGINNERS—2
- A BEGINNERS' TEST METER
- SELECTING RESISTORS
- TRANSMITTING TOPICS
- ETC. ETC. ETC.



## miniature TUBULAR ELECTROLYTIC condensers

Types  
CEI32 &  
CEI34

Illustrated  
actual size

These ranges of miniature condensers are additional to the many types of T.C.C. electrolytics already available, and will appeal to all concerned with the design and servicing of equipment in which space is limited.

They are constructed similarly to the well-proved T.C.C. Micropack electrolytic, with aluminium tube and neoprene-faced disc end seals. Terminations are 22 s.w.g. wires, 1½" long, hot solder coated, making them suitable for printed circuit assembly.

The short length of these condensers permits horizontal mounting on printed circuit panels with hole centres as close as 1". Insulating sleeving to cover the metal case (as illustrated in the top photo) is desirable for horizontal mounting and should be specified in such applications.

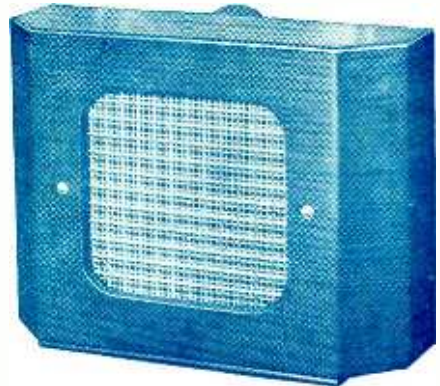
**Temperature Rating:** ability to work satisfactorily at 70°C without voltage derating.

A sub-miniature range for hearing aid and transistor circuitry is also available.



Capacity in µF	Capacity Tol in %	Peak Wkg Volts DC.	Ripple mA.	Dimns. in ins.		T.C.C. Type No.
				L.	D.	
100	-20 +100	6	15	½	½	CEI32AE
100	-20 +100	12	35	½	½	CEI34BE
50	-20 +100	12	45	½	½	CEI32BE
50	-20 +100	25	35	½	½	CEI34CE
25	-20 +100	25	15	½	½	CEI32CE
25	-20 +100	50	35	½	½	CEI34DE
12	-20 -100	50	15	½	½	CEI32DE
8	-20 + 50	150	30	½	½	CEI34FC
4	-20 - 50	150	15	½	½	CEI32FC
2	-20 + 50	350	7	½	½	CEI32LE
1	-20 - 50	450	7	½	½	CEI32PE

**THE TELEGRAPH CONDENSER CO LTD**  
RADIO DIVISION: NORTH ACTON · LONDON · W.3 · Tel: ACORN 0061



The symbol  
of extra  
High Quality

### RADIO & TV TABLES

"WELBECK" (as illustrated) measures 20" x 20" x 20" and is fitted with self adjusting gliders.

Price £3. 15. 0 (inc. P.T.)

"SHERWOOD" will accommodate the largest television receivers; measures 23" high x 25" wide x 22" deep.

Price £5. 5. 0 (inc. P.T.)

"SENIOR", of ample dimensions (18" x 24" x 25" high).

Price £4. 18. 9 (inc. P.T.)

"JUNIOR" measures 21" high and 20" square. Price £4. 10. 0 (inc. P.T.)

"FOREST", a new table in contemporary style; measures 20" x 20" x 20". Price £3. 10. 0 (inc. P.T.)

All are supplied packed flat ready for instant assembly and with the exception of the Welbeck have easy running 2" castors.

## Stentorian

### EXTENSION SPEAKERS

These well designed speakers demonstrate the traditional Whiteley quality at really competitive prices. This range of extension speakers has finger-tip volume control, is superbly finished in polished walnut veneer and provides excellent reproduction.

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

WITH THE  
EXCLUSIVE  
FINGER-TIP  
VOLUME  
CONTROLS


'BUDE' 60/-  
'BEDFORD' 72/-  
'BRISTOL' 86/6

Prices include P.T.

# QUICK, EFFICIENT UP-TO-DATE COMPONENT SERVICE!

### TWO-TRANSISTOR POCKET SET


Can Be Built For **47/6**



**BUILD THE "SKY PIXIE" VEST-POCKET TWO-TRANSISTOR PLUS DIODE RADIO** which gives a superb performance and is highly sensitive. Size only 4 1/2 in. x 3 1/2 in. x 1/2 in. weight 70z. - yet it is a **THREE-STAGE** receiver covering all medium waves, working entirely off a tiny "penlight" battery. Every part tested before despatch! **SPECIAL STEP-BY-STEP PLANS FOR ABSOLUTE BEGINNERS.** Total building cost including case, transistors, etc. **ONLY 47/6 with plans.** Postage, etc., extra. (Parts sold separately. Priced parts list and plans 1/6.) **RUSH YOUR ORDER TODAY!**

### POCKET VALVE RADIO

Can Be Built For **39/6**



Anyone Can Build This Beautiful Precision Pocket Radio in an hour or two. No knowledge whatever needed, our Simple, Pictorial Plans take you step by step! Remarkably sensitive - covers all medium waves, incl. Luxembourg, Home, Light. Size only 2 1/2 in. x 3 1/2 in. x 3/4 in. Not a Toy! But a Real Valve Radio! Uses self-contained battery and is a really person-to-person, pocket radio with Detachable Aerial. **IDEAL FOR BEDROOM, GARDEN, etc.** We supply **ALL** parts necessary together with plans, etc. for the Special Price of 39/6 (Plus 2/6 post, etc.). **BUILD YOURS NOW!** (All parts sold separately.) (Parts list, etc., 1/6. Big demand certain. Send Today!) C.O.D. 2/- extra.

### RECORD CHANGER AND PLAYER BARGAINS!

**B.S.R. MONARCH**, 4-speed, mixer auto-changer unit, model F.A.S. Fully complete with crystal pickups, etc. Brand new. Limited Stocks Only. **GIFT 26/9/6.** (Plus post and packing, etc.) **LATEST "COLLARO"** 4-speed auto-changer with H.P. pickup. Complete in maker's sealed container. **BARGAIN 27/9/6.** (Plus post and packing 1/6.) **"COLLARO" JUNIOR**, 4-speed, single player, with crystal pickup, using H.P.59 cartridge. **OUR PRICE 92/6.** (Plus 1/- post and packing.)

### Can Be Built For 107/6



Choice of beautiful walnut veneered cabinet or ivory or brown bakelite. This is the lowest possible price consistent with high quality. No radio knowledge whatever needed... can be built by anyone in 2-3 hours, using our very simple easy-to-follow diagrams. The terrific new circuit of the "OCEAN-HOPPER" covers all medium and long waves, has razor-edge selectivity and exceptionally good tone. Price also includes neatly drilled and punched chassis, set of simple easy-to-follow plans - in fact, everything! Parts tested before despatch! Uses standard octal-base valves. For A.C. mains 200-250 volts (low running costs - approximately 18 watts). Size 12 1/2 in. x 6 1/2 in. x 5 in. **BUILD THIS LONG-RANGE POWERFUL MIDGET NOW. TOTAL BUILDING COST INCLUDING PLANS, ETC., 107/6.** (Post and packing 2/6.) Parts sold separately. Priced parts list and plans 1/6. C.O.D. 2/- extra.

### COMPONENT BARGAINS!

Red-Spot Transistors, tested, 8/6. White-Spot Transistors, tested, 15/-. Also all Mullard and standard types stocked.

Moving Coil P.M. Speakers, 2 1/2 in. 17/6. 3 1/2 in. 19/6. 4 1/2 in. 19/6.

**ALL TYPES OF COMPONENTS STOCKED AT COMPETITION PRICES**

### PRINTED CIRCUIT POCKET SET

**BUILD THIS 3 TRANSISTOR POCKET RADIO... PRINTED CIRCUIT VERSION!** The "Companion" is comparable in sensitivity to a three-valve battery set, it is exceptionally small in size (1 1/2 in. x 3 1/2 in. x 1/2 in.) and is a self-contained pocket radio that does not need aerial or earth. It has built-in speaker and covers medium and long waves. This unique little set **CAN BE BUILT FOR ONLY 97/6. EVERYTHING INCLUDED!** (Plus post and packing 2/6.) All parts sold separately. Price list, etc., incl. C.O.D. 2/- extra.

### PRINTED CIRCUIT POCKET SUPERHET

**BUILD THIS PROFESSIONAL-LOOKING FIRST-CLASS 6 TRANSISTOR POCKET SUPERHET THE "TRANSIDYNE."** Size only 4 1/2 in. x 3 1/2 in. x 1 1/2 in. Beautiful red and cream plastic case with engraved dial. Set weighs only 200z. with batteries! Covers medium and long waves. Works off two No. 8 batteries. The second I.F. Stage is reflexed to give additional audio gain. In-built ferrite rod aerial and 2 1/2 in. P.M. speaker. This TRANSIDYNE is probably the best set of its kind. It is simple to build and really sensitive. **ALL COMPONENTS INCLUDING CABINET, PRINTED CIRCUIT, TRANSISTORS IN FACT EVERYTHING CAN BE SUPPLIED FOR 111/5/-.** (Plus post and packing 2/6.) All parts sold separately. Price list, circuit, etc., incl. C.O.D. 2/- extra.

### Can Be Built For 47/6

Build this exceptionally sensitive high efficiency Pentode radio. Uses unique assembly system and can be built by anyone without any radio knowledge whatever in 45 minutes. Handsome black-crackle steel case with specially made black and gold dial with stations printed. Size of radio only 6 1/2 in. x 5 in. x 3 in. Covers all Medium and Long waves - uses only one all-day battery. H.P. consumption only 1 to 1.5 m.A. Uses personal phone. Ideal for Bedroom, Garden, Holiday, etc. **BUILD THE "SKYROMA" NOW!** Total building cost - everything down to last nut and bolt - 47/6 (Postage, etc., 2/-) with full set of clear, easy-to-follow plans. (Parts sold separately. Priced parts lists & plans 1/6.) C.O.D. 2/- extra.

### READ WHAT OTHERS SAY!

"I WAS SURPRISED AT THE NUMBER OF STATIONS" L. D. C. of Worcester, writes, " - Just a few lines to let you know how pleased I am with the midget portable radio. I was surprised at the number of stations I could get with a clear performance. The price was a real bargain. Have you lists of other bargains? If so, please send them."

"I MUST SAY I AM VERY PLEASED—" J. W. S. of Scarborough, Yorks, writes, " - I feel I must say I am very pleased in the way you do business and if at any time I require anything, or can recommend you to anyone, I will not hesitate to help you."

"I'VE HEARD MUCH PRAISE OF THEM—" J. E. of Hilton, Nr. Derby, writes, " - I would like one of your portable radio kits as I've heard much praise of them."

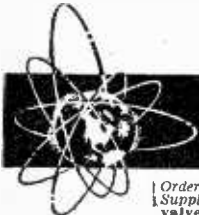
"THIRTY-TWO STATIONS RECEIVED—" J. N. of Oxford, writes, " - Yesterday evening on the Medium Waveband, between 10 p.m. and 10.30 p.m. I counted 32 distinguished stations! I am very pleased with the set, which is well worth the money."

"MY DEEPEST ADMIRATION—" J. R. of North Shields, Northumberland, writes, " - The honest and direct dealing of your firm has earned from me my deepest admiration."

"ITS PERFORMANCE IS ALMOST UNBELIEVABLE" E. F. of Ipswich, writes, " - For so small a set I think it is a wonderful station getter with ample volume on all. Its performance is almost unbelievable, and it is a very convenient little set giving me stations I've never been able to get on a larger set."

### THIS TRANSISTOR SET CAN BE BUILT FOR ONLY 29/6

**VERY SPECIAL OFFER WHILE STOCK OF PARTS LASTS!** - The "Sky-Scout" Pocket two-stage transistor set. Size only 4 1/2 in. x 3 1/2 in. x 1 1/2 in. Covers all medium waves and works entirely off tiny "penlight" battery which costs 6d. and fits inside case. All parts tested before despatch. Can be built for 29/6, plus 2/- post and packing, including Case, Transistor, **STEP-BY-STEP PLANS FOR ABSOLUTE BEGINNERS**, nuts, bolts, etc. (C.O.D. 2/- extra.) Parts sold separately, priced parts list & plans 1/6. **VERY SIMPLE TO BUILD.**



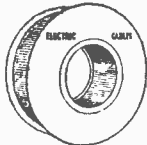
## CONCORD ELECTRONICS

210, Church Road, Hove, Sussex

Dept. PW11

Orders receive prompt attention. Cheques accepted. Cash on delivery 2/- extra. Please print name and address in block letters. Suppliers to Schools, Universities, Government and Research Establishments. Complete range of components and valves stocked. Regret no C.O.D. abroad.

**Versatile Wire**



Single-strand 18-gauge wire with P.V.C. covering which makes it rustproof. Extra strong, will stand tremendous strain. Ideal for gardening, clothes lines, indoor aerials, etc. Also being steel alloy and having a resistance of approximately 1 ohm per yard this can be used for electrical work, soil heating, wrapping round water pipes, etc. New on drum containing 3,000ft. Price 8/6 plus 3/6 carr.

**Medresco Hearing Aid**

As supplied by National Health completely overhauled and in good working order with six months guarantee. Only £3.15.0 plus 2/6 post and ins. Complete with earphone and new ear plug but not batteries, these can be supplied as an extra for 5/- per set. Ardente model, as new, higher gain and self-contained batteries. £7.10.0 or 10/- deposit and 18 fortnightly payments of 10/-.



**"Dim and Full" Switch**

Particularly useful for controlling photoflood lamps which have only a short life at full brilliance. This toggle switch has three positions; the first position puts two lamps in series at half brilliance for setting up, the second position is off and the third position full brilliance for the operation shots. Also useful for controlling night lights, heaters, etc. Price 2/6 each. Plus post fd. Circuit diagram included.

**For Portable Radio or Player**



This fine cabinet as illustrated but less control knobs is available this month at special snip price of 12/6, plus 3/6 post and insurance. Size is 13 1/2 in. x 9 in. x 4 in. and it is nicely covered in two-tone I.C.I. fabric.

**Miniature Microphone**

American made. Dynamic type, real bargain at 2/6, plus 6d. postare.



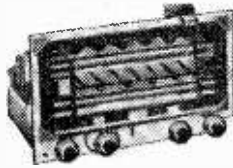
**Unique Opportunity to build Fine Transistor Set**

Constructor's parcel : to build Pocket 6 Transistor Set as currently being sold at £17.7.6. Parcel comprises Motified two-tone cabinet as illustrated, tuning dial, two gang tuning condenser, combined bakelite chassis / printed circuit and easy to follow circuit. Costing value 57 6—offered while supplies last at only 29/6, plus 2/6 post. Suitable for your own circuit or to build original circuit. All parts available at highly competitive prices. Do not miss the tremendous bargain.



**Dulci AM/FM Radiogram Chassis**

Chassis Model H.3. This has three wavebands, F.M. 87-101 Mc/s., Medium Wave 167-540 metres and Long Wave 1,000-2,000 metres, uses 7 of the latest miniature valves and built-in ferrite aerial. "Why not modernise your Radiogram, get the best from modern records with this hi-fi 4 watt output chassis." Price, £19.17.6 or £2 down and 20 fortnightly payments of £1.0.6. Hi-Fi Model H4 PP, £27.18.6 or £2.18.6 down and 26 fortnightly payments of £1.2.0. Note: Hire-purchase figures include insurance for 12 months.)

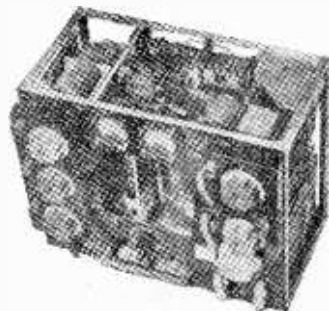


**R.B.C. Television Transistor Set.** All parts available—total cost, including two transistors, with copy of circuit diagram and instructions. £12.19.6. Postage 2/- extra.

**Special Introductory Offer**

Introducing our new 'Inductor 40' Fluorescent fitting. This is a batten type fitting nicely finished, white enamel. Suitable for chain suspension or direct fixing, uses fully compound choke ballast and radio suppressed starter. Offered at a special price this month to introduce it, namely 39/6, complete with tube. Carriage up to 150 miles 5/6; up to 250 miles, 7/6.

**£100 worth of Equipment for 19/6**



The famous R1154—unused but slightly soiled and not tested. Covers 200-500 kc/s, 3-5.5 Mc/s and 5.5-10 Mc/s. Has unique "click stop" mechanism (7 stops) and permits selected frequency to be held, returned to, etc. Hartley oscillator, power amplifier, keying and speech. Wonderful breakdown value meters, relays, switches. Complete with valves—real bargain at 19/6, plus 10/- carriage.

**FOR ADDRESS SEE NEXT PAGE**

**1960 All Mains Amplifier**



Undoubtedly finest value obtainable in amplifiers—powerful three valve circuit ideal for dances, parties, etc. Complete with valves, mains transformers, volume and tone controls, but less chassis, speaker and cabinet. Price only 29/6, plus 2/6 post and ins. Data free with parts or available separately 1/6.

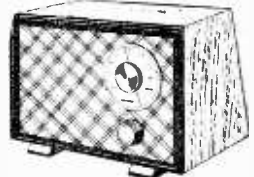
**BEGINNER'S SUPERHET**



All the components, including metal chassis, valves, metal rectifier, coils, tuning condenser, etc., required to build the "Beginner's Superhet" as described in the January, 1968, issue, are available as a parcel. Price £3, plus 3/- post and insurance.

**Stereo Outfit**

Stereo Amplifier outfit comprising 7 watt twin channel amplifier for A.C. mains working and two 8in. P.M. Speakers on veneered and polished corner baffles. Whole outfit giving really terrific reproduction and amazing 3-D effects. £14 complete, plus carriage and insurance. Or £1 down and 23 weekly payments of 10/-.



**New Improved Circuit for the 1960 Skysearcher**

This is a three valve receiver kit using modern circuitry. Ideal as a second set for the bedroom, workshop, etc. All parts including mains transformer, valves, resistors, coils, etc., but not cabinet, chassis or speaker. 29/6, plus post and ins. 3/6. Data free with parts or available separately 1/6.

**A.C./D.C. Multimeter Kit**

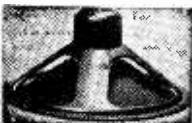
Ranges : D.C. volts 0-5, 0-50, 0-100, 0-500, 0-1000. A.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. D.C. milliamps 0-5, 0-100, 0-500. Ohms 0-50,000 with internal batteries, 0-500,000 with external battery. Measures A.C./D.C. volts, D.C. current and ohms. All the essential parts including metal case, 2in. moving coil meter, selected resistors, wire chr shunts, range selector, switches, calibrated scale and full instructions, price 19/6, plus 2/6 post and insurance.



**Hi-Fi Snip  
Infinite Wall Baffle**

Nicely veneered and polished. Corner fitting (attaches to picture rail). Takes up no floor space. Gives really fantastic results with only low-priced 8in. speaker. Fitting for tweeter. Only 45/- each, carriage and insurance 3/6.

**Speaker Bargain**

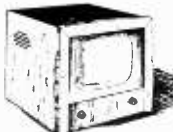


12in. Hi-fidelity loudspeaker. High flux. Permanent magnet type with standard 3 ohm speech coil. Will handle up to 12 watts. Brand new by famous maker. Price 32/6, plus 3/6 post and insurance.

**For Your Lab.**

Resistance substitution boxes are great time savers and you really cannot have too many of them; here then is an opportunity to acquire these at a very low rate. Our R.S. kit available for only 8/6, plus 1/6 postage, comprises one 50k $\Omega$  precision variable resistor 0-100 K $\Omega$ , six 25 watt fixed resistors, one 6-position switch, one pointer knob and one ordinary knob and instructions. This unit when made up will give an infinite variability over the range 100 ohm to 2 meg.

**14in. T.V. Cabinet**



14in. T.V. cabinet of the latest styling—beautifully veneered and polished—limited quantity, sale price 15/- each. Carriage and packing 3/6 extra. Masks 10/- extra.

**Band III Converter**



Suitable for Wales, London, Midlands, North, Scotland, etc. All the parts including 2 EF90 valves, coils, condensers and resistors. (Metal case available as an extra.) Price only 19/6, plus 2/6 post and insurance. Data free with parts or available separately, 1/6.

Please send two more kits, the one you sent last week is performing magnificently. We receive this sort of letter every day of the week, so if you have hesitated because you thought our kits too cheap you need hesitate no longer.

**ASSURE YOUR FUTURE**

The ownership of a good instrument has been the turning point in many a career—it could easily be yours, for you can own the latest Avo Test Instrument for the initial payment of only 10/-. This test instrument is ultra-modern, has a sensitivity of 10,000 Ohms per Volt, measures A.C. Volts 0-1,000 in 5 ranges, D.C. Volts 0-1,000 in 7 ranges, D.C. current at 1 Amp. in 5 ranges and resistance up to 2 Megs. in two ranges.



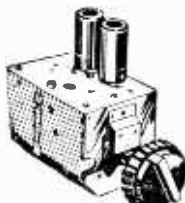
Free Gift. To extend the uses of this instrument, for instance, to measure capacity, inductance, E.H.T., etc., we have developed a range extender scale and operating notes, these will be sent free to purchasers of this instrument. All sent immediately for 10/- deposit, balance by 21 payments of 10/- which includes free insurance against accidental damage for 12 months. Non-callers add 3/6 post and insurance. Cash price, £9.10.0.

**THIS MONTH'S SNIP**

Car Starter Battery Charger—due to a fortunate purchase we are able to offer You a fine ready-made high output battery charger in stove enamelled sheet steel louvered case. New, complete and ready to work, this charger is rated at 12 V, 4 Amps and has a variable rate selector for trickle charging, also a meter to show charging rate. Suitable for 230/250 A.C. mains. Made to sell at 85/- but offers this month at special snip price of 55/-, plus 3/6 post, and insurance.

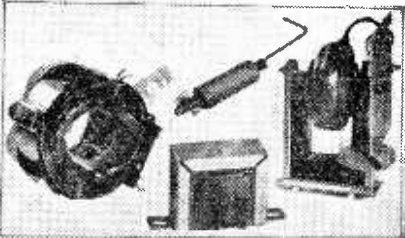


**12-CHANNEL TURRET TUNER**



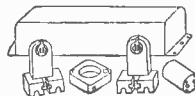
Ideal for converting an old or building into new T.V. These are brand new stock, not surplus, supplied complete with valves and coils for local Band I and Band III stations. Model 1. I.F. Output 33/38 Mc/s series heaters (parallel heaters, 5/- extra). Model 2. I.F. Output 16/19 Mc/s parallel heaters (series heaters, 5/- extra). With instructions and circuit diagram, 79/6, knobs 3/6 extra, postage and insurance 2/6.

**FOUR ITEMS FOR PRICE OF ONE**



Set of modern T.V. parts suitable for modernising old television or for a new one. For wide angle 14in. or 17in. tubes comprises: (1) Line output E.H.T. transformer. (2) 700 scanning coils on ferrite yokes. (3) Width control with ferrite core (4) Frame output transformer. (5) Circuit diagram of a modern television. Offered at the price of the Line output transformer only, namely, 57/6, plus 2/6 post and insurance.

**Fluorescent Lighting**

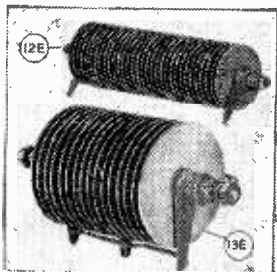


For customers wishing to use fluorescent lighting without metal work, for shop window lighting, etc. We offer complete kits of parts. Five items as illustrated comprising best quality choke ballast, canister starter and white bakelite holders. 40 watt kit, 22/6. 80 watt kit, 26/6, plus 2/- post and insurance.

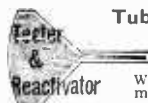
**Miniature Fluorescent Kits**

Kit of parts including tube, two holders, starter, starter holder and choke together with wiring diagram. Price as follows: 6in., 9in. and 12in., 29/6; 21in., 35/-. Post and insurance 2/6 per set.

**Rectifier Bargains**



Selenium rectifier type 12, 500 v. i.A. half-wave, easily rebuilt into full wave or multiple types, contains 30 35 mm. discs. Price 8/6, plus 1/6 post. Type 13, 36 volt 9 amp. easily rebuilt into six full wave charger rectifiers suitable for 6 or 12 volt batteries at 3 amps, contains 24 84 mm. discs. Real bargain at 19/6, plus 1/6 post.



**Tube Tester and Reactivator**

We can supply all the main components for making this unit which will not only test Cathode Ray Tubes but also will reactivate them, supplied complete with full instructions. Price £3, plus 2/6 post and ins.

**T.V. Service Sheets**

200 sheets covering most popular post-war televisions by leading makers—Cosor, Ekco, Ferguson, Eya, etc., £2, post free. PREVIOUS PURCHASERS OF THESE SHEETS PLEASE NOTE: WE CAN SUPPLY SHEETS Nos. 100-200, £1 or 150-200, 10/-.

**Connecting Wire**



P.V.C. covered in 100ft. coils—2/9 a coil or four coils different colours, 10/-, post free.

All items advertised can be obtained from the following Companies.

Electronics (Manor Park) Ltd.  
200, High St. North,  
Manor Park, E.12.

Electronics (Ruislip) Ltd.  
42-46, Windmill Hill,  
Ruislip, Middx.  
Phone: RUISLIP 5780.  
Half day Wednesday.

Electronics (Croydon) Ltd.  
268, London Road,  
Croydon.  
Phone: CRO 6558.  
Half day Wednesday.

Electronics (Finsbury Park) Ltd.  
29, Stroud Green Rd.,  
Finsbury Park, N.4.  
Phone: ARCHWAY 1049.  
Half day Thursday.

## RECORD PLAYER CABINETS

HERE'S UNREPEATABLE VALUE



R.P.6

29/6

Elegant cabinet, cloth covered in grey or red with sunken control panel and speaker fret. Size 13 x 17 x 8in. deep. Takes a B.S.R. Monarch 4-speed autochanger; 7 x 4in. elliptical speaker and most of the modern portable amplifiers. Carr. & Ins. 4/6.

### SINGLE PLAYER CABINET 19/6



R.P.7

Smart cabinet. Size 14½ x 12½ x 6½in. deep. Various 2-tone colour schemes with white handle and piping. Takes T.U.9 B.S.R. single player unit, 4 x 7in. elliptical speaker and amplifier D.1 or D.2. Carr. & Ins. 4/6.

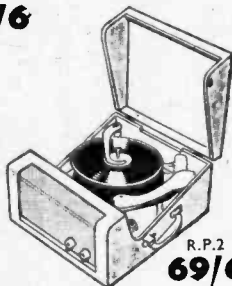


R.P.3

69/6

A delightful looking cabinet 14½ x 17½ x 8½in. in 2-tone leatherette. Will take a B.S.R. Monarch 4-speed autochanger and 6½in. round speaker. Carr. & Ins. 4/6.

A beautifully styled cabinet. Made by a famous manufacturer. In polka dot cloth with clipped lid and carrying handle. Size 16 x 14½ x 8½in. deep. Will take B.S.R. Monarch 4-speed autochanger and 4 x 7in. elliptical speakers and most of the modern portable amplifiers. Carr. & Ins. 4/6.



R.P.2  
69/6

R.P.4

79/6

Stylish cabinet by famous manufacturer. Cloth covered in contrasting colours (red and grey). Grilled front controls panel. Size 15 x 19 x 8½in. deep. Beautifully made—a cabinet of which you can be really proud. Takes 4-speed B.S.R. autochanger, 6½in. round or 4 x 7in. elliptical speaker. Room for any amplifier of your own choice. Carr. & Ins. 4/6.



### STEREOPHONIC CABINET 99/6

Continental style cabinet including extra clip on speaker cabinet. 15½ x 10½ x 24½ in. deep. Takes B.S.R. 4-speed stereo autochanger. Printed circuit amplifier. 8in. speaker. Carr. & Ins. 12/6.

### STEREOPHONIC AMPLIFIER £7.19.6. 12 months' guarantee

Beautifully made for portable stereophonic record players. Latest design with printed circuit. Dimensions 3 x 5½ x 9½in. A.C. only. Mains isolated. Twin amplifiers each side giving 3-4 watts output. Incorporating ECL82 triode pentode valve. Full tone, volume and balance controls. Complete and ready to fit. Knobs 3/6 per set extra. P.P. & Ins. 4/6.

### B.S.R. FUL-FI CRYSTAL TURNOVER CARTRIDGES

Brand new. Including sapphire needles for L.P. and Standard giving fullest range and finest tone obtainable for any player. Can be fitted to all standard pick-up arms. P. & P. 9d. 19/6

### ★ World's Finest AUTOCHANGER

U.A.8. B.S.R. MONARCH 4-SPEED AUTOCHANGER  
£6.19.6



### COLLARO CONQUEST 4-SPEED AUTOCHANGER

£6.19.6

U.A.12. Latest B.S.R. MONARCH 4-SPEED MIXER £8.9.6

T.U.9. B.S.R. MONARCH 4-SPEED STEREO AUTOCHANGER £9.19.6

COLLARO CONQUEST STEREO AUTOCHANGER 11 gns.  
P. & P. on above 5/6.

### PORTABLE AMPLIFIER MK. D.1. 59 6

12 months' guarantee.

Brand new. Latest design with printed circuit. Dimensions 7 x 2½ x 5in. A.C. only. Mains isolated. 2-3 watts output. Incorporating EL84 as high gain output valve. Volume and tone controls. Knobs 2/6 extra. P. & P. 3/6.

### PORTABLE AMPLIFIER MK. D.2. 79 6

Printed circuit. Latest design. Dimensions 7 x 2½ x 5in. A.C. only. Mains isolated 3-4 watts output. Incorporating the latest ECL82 triode pentode output valve giving higher undistorted output. Volume and tone controls. Knobs 2/6 extra. P. & P. 3/6.

### PORTABLE AMPLIFIER D.3. 89 6

De luxe model. Printed circuit. Latest design. Dimensions 7 x 2½ x 5in. A.C. only. Mains isolated 3-4 watts output. Incorporating the latest ECL82 triode pentode output valve giving higher undistorted output. Volume, treble and bass control. Knobs 3/6 extra. P. & P. 3/6.

### PORTABLE AMPLIFIER MK. D.4. 49 6

Brand new. By famous manufacturer. Especially built for portable record players. Dimensions 4½ x 3½ x 4in. A.C. only. 2 valves. EL84 high gain output valve. EZ80 as rectifier. Volume and tone controls. Knobs 2/6 extra. P. & P. 3/6.

### PORTABLE AMPLIFIER MK. D.5. 39 6

Simple circuit employing ECL80 triode pentode output valve giving 2-3 watts output. A.C. only. Mains isolated. Single control for volume and on/off switch with knob. P. & P. 3/6.

### IDEAL FOR STEREOHONIC SOUND

8in. P.M. Speaker 8/9 | With O.P. trans. 10" - 4 x 6½in. P.M. Speaker 12/6 | 7 and 8 x 5in. elliptical speakers 19/6. Post 2/9.

### EXTENSION SPEAKERS 19 9

Polished oak cabinet of attractive appearance. Fitted with 8in. P.M. Speaker W.B. or Goodmans of the highest quality. Standard matching to any receiver (2-5 ohms). Switch and flex included. Ins./Carr. 3/6.



### PHOTOGRAPHIC SLIDE CASE 17/6 (list price £2.10.0)

Rexine covered. Size 8 x 12½ x 2½in. deep. Will hold 150 of those expensive coloured transparencies in numbered partitions. This is the answer to that aggravating search for that particular photograph and will, of course, keep them safe from damage. P. & P. 2/6.



### STURDY CASE 12/6

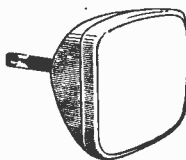
8½ x 7½ x 3½in. deep. Covered in burgundy and grey washable rexine. Strong clasp, hinges and handle. Ideal for portable radio chassis or transistor set. Can be adapted as a record carrying case to hold eighteen 7in. long-playing records. P. & P. 2/6.

# DUKE & CO.

CATALOGUE FREE ON REQUEST.

FOR YOUR  
CONVENIENCE!

EASY NO DEPOSIT—INTEREST  
FREE DEFERRED TERMS  
Send for details.



REPLACEMENT  
RE-BUILT  
T/V TUBES

£8.10.0

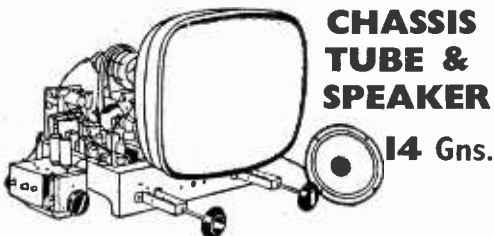
CASH PRICE

★  
12 Months' Full Guarantee.

All sizes except 10in. Completely rebuilt gun assembly, new cathode heaters, etc., giving the high standard required for long picture life, quality and value. Carr. & Ins. 15/6.

★ EXPRESS DESPATCH SERVICE ★

Please 'phone to confirm Tube in stock. Send Telegraph Money Order. Tube despatched Passenger Train same day. This service only available with remittance by a Telegraph Money Order and Cash Sales—not Terms.



CHASSIS  
TUBE &  
SPEAKER  
14 Gns.

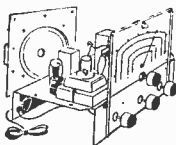
17in. Rectangular Tube on modified chassis. Supplied as single-channel chassis covering B.B.C. channels 1-5 or incorporating Turret Tuner, 50/- extra (chassis purchasers only) giving choice of any 2 channels (B.B.C. & I.T.A.). Extra channels can be supplied at 7/6 each. Chassis size 12 x 14½ x 11in. With Tube and Speaker (less valves), 14 gns. Complete and working with valves and Turret Tuner, 18 gns. 12 months' guarantee on the Tube; 3 months' guarantee on the valves and chassis. Ins. carr. (incl. tube) 25/-.

14" T.V. CHASSIS, TUBE  
& SPEAKER 11 Gns.

As above with 14in. Rectangular Tube. 12 months' guarantee on Tube, 3 months' guarantee on chassis and valves. Chassis with Tube and Speaker (less valves), 11 gns. Complete and working with valves and Turret Tuner, 17 gns. Ins. carr. (incl. Tube) 25/-.

★ T.V. CHASSIS AT  
CLEARANCE PRICES ★  
The Popular 12" Plessey  
chassis 9/6

A bargain for anyone wanting to make up their own T.V. at a very low cost. A chassis in one unit. Less valves and tube. Chassis size 12 x 14½ x 11in. I.F.s 10.5-14 Mc/s. Can be adapted for a 12-channel Turret Tuner and modified to take a larger tube. Carr. & Ins. 10/6.



SUPER CHASSIS 79/6

5-valve superhet chassis including 8in. P.M. speaker and valves. Four control knobs (tone, volume, tuning, w/change switch). Four w/bands with position for gram p.u. and extension speaker. A.C. Ins. carr. 5/6.

SOUND/VISION & I.F. STRIP 7/9

Plessey. I.F.s 10.5 Mc/s sound; 14 Mc/s vision. 8 valveholders. Less valves. Size 8½ x 5 x 4½in. Circuit incl. The tuner unit plugs directly into this chassis. P. & P. 2/6.

SOUND/VISION & I.F. STRIP 2/9

Salvaged. Complete sound and vision strip. 8 valveholders. Less valves. I.F.s 16-19.5 Mc/s. Size 8½ x 4½ x 4½in. Drawings free with order. P. & P. 2/6.

SOUND/VISION & I.F. STRIP 2/9

Salvaged. Superhet. 8 valveholders. Less valves. I.F.s 7.25 Mc/s sound; 10.75 Mc/s vision. Vision complete from input up to video output. Sound complete from input to A.F. amplifier. P. & P. 2/6.

TIMEBASE 2/9

Containing scanning coils, line transformer, etc. Less valves. Drawings free with order. P. & P. 2/6.

T.V. MASKS 10/9

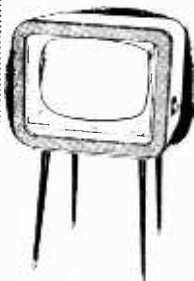
17in. Brand new. Latest pastel shades—pink and blue. P. 2/-.

T.V. MASKS 14/9

21in. as above. P. 2/-.

FAMILY RADIO  
99/6

5-valve (octal) superhet; 3 waveband and gram position; 4 controls. Modern attractive cabinet size 15½ x 18 x 10½in. in cream and brown. Carr. & Ins. 8/6.



★ 17" T.V.  
19 GNS.

While stocks last

FEATURES—

- ★ Beautiful latest finish cabinet in contemporary style covered and washable.
- ★ Polished, legs (18in.) optional extra for 25/-.
- ★ 17in. BRITISH Rectangular Tube. Guaranteed fully for 12 months.

★ 13 channels "Turret Tuned"—ITV/BBC. Extra coils at only 7/6 a pair (with order).

★ Chassis. 14 B.V.S. valves—salvaged but re-conditioned and guaranteed 3 months.

Carr. & Ins. 30/-.

BAKELITE CABINETS 5/9

Brand new. Colour brown. Attractive design. Size 12 x 7 x 5½in. Ideal for small receivers, converters, etc. P. & P. 3/9.

T.V. AERIALS 23/6

For all I.T.A. channels. Outdoor or loft. 3 elements. P. & P. 2/6.

AERIALS 15/6

B.B.C. indoor type. Folded dipole with 12ft. Co-ax cable fitted. Post 1/9.

T.V. AERIALS 7/9

For all channels. Complete with Co-ax cable. For use indoors or in the loft. Postage 1/3.

CO-AX CABLE 6d. yd.

Cut to any length. Good quality. Post 1/6 on 20 yds.

SOLO  
SOLDER-  
ING  
TOOL  
12/6



110 v., 6v. or 12 v. (special adaptor for 200/240 v., 10/- extra). Automatic solder feed including a 20ft. reel of Ersin 64/40 solder and spare parts. It is a tool for electronic soldering or car wiring. Revolutionary in design. Instantly ready for use and cannot burn. In light metal case with full instructions for use. Post 3/6.

POWER PACK & AMPLIFIER 19/6

R.F. E.H.T. not tested. Amplifier stage 6V6 with O.P. trans. with O.P. trans 3 ohms matching. Smoothed H.T. 350 volt at 250 m.a., 6.3 v. at 5 amp., 22 v. at 3 amp., 6.3 v. at 4 amp. and 4 v. centre tapped. Less valves. Drawings free. Size 14½ x 8 x 7in. Ins. carr. 5/6.

POWER PACK & AMPLIFIER 12/6

Output stage 6V6 with O.P. trans 3 ohms choke. Smoothed H.T. 350 v. at 250 m.a., 6.3 v. at 4 amp. and 4 v. centre tapped Less valves. Ins. carr. 5/6.

SCANNING COILS 10/6

Low impedance. 38 mm. Brand new. P. & P. 1/3.

SCANNING COILS 15/9

Wide angle 90 deg. 38 mm. low impedance. P. & P. 1/3.

DUKE & CO.

(Dept. No. 8)

621/3, ROMFORD RD., MANOR PARK, E.12

Tel.: ILF 6001/3





## PORTABLE/MOBILE F.M. TRANS/RECEIVERS BC620

We've done it again! Read the specs, note the price, and rush your order as they are selling like hot cakes.



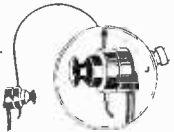
Frequency range 20-27.9 Mc's. Crystal controlled, operating on any two of 80 different channels in 100 Kcs steps. Average range 5-10 miles. Contains 14 valves, meter for checking all filament plate voltages and alignment, volume-control, mike and 'phone inputs. Complete mobile supply unit for 6 and 12 volt operation. Portable dry battery case. All 3 units matching and interchangeable. Battery drain—6 volts, receive 21 amps., transmit 31 amps.; 12 volts—receive 2 amps., transmit 23 amps. \*TS18 HAND SET for above 20-

**Complete Station only**

**£8.10.0.** Carr. 20/-

B.C.650 as above with internal speaker. £9.10.0. Carr. 20/-

**LIGHT-WEIGHT HEAD-SET**  
These H.S. 30 phones are the smallest used by the U.S. Air Force, 250 imp.



using soft rubber miniature ear moulds for maximum music and voice reproduction of the finest quality. Supplied free is a small transformer unit with cord and plug which steps impedance up to 4,000Ω. ONLY 15/- P. & P. 2/6.

**WIRELESS SET NO. 19 MK. 11.** Incorporates "A" Set—TX/RX covering 2-8 Mc/s (37.5-150 metres). "B" Set—VHF TX/RX covering 230-240 Mc/s (1.2-1.3 metres) and intercom. amplifier. Complete with 15 valves, 500 microamp check and tuning meter. circuit and instruction book. (American manufacture.) In magnificent condition. 65/- Carr. 10/-

**"PVE" 10in. HIGH QUALITY SPEAKER.** Supplied in magnificent cabinet complete with 30ft. of lead and plug. Ideal for Hi-Fi and Stereo. Brand New in original packing. 45/- each, carriage 5/-.

**TRANS-MITTER BC625.** Covers 100-156 Mc/s will deliver 15 watts, consists of seven valves (2-832). 3 for modulation, 4 for R.F. Complete with operating details and circuits. ONLY 25/- P. & P. 5/-.

**COMPLETE HEADPHONE & MICROPHONE ASSEMBLY.** A must for every Constructor and "Ham." consists of moving coil, padded headphones, "press to talk" microphone. 10/- P. & P. 3/6.

**ARC-5 VHF RECEIVER.** The smallest ever made, only 14in. x 7 1/2in. x 4 1/2in., weight 1 lb. The ARC-5 is a 10-valve superhet, Xtal controlled on 4 channels between 100-156 Mc/s. I.F. Freq. 6.9 Mc/s audio o/p 300Ω. Brand new, limited quantity, only 70/- carr. 7/6.

**U.S.A. WHIP AERIALS.** 12ft., 12/6. P. & P. 2/6.

**U.S.A. DYNAMOTORS** manufactured by EICOR. Input 12 v. output 400 v. at 190 mA. Size 7in. x 4in. x 4 1/2in. Brand new 45/- Same as above, output 25 v. at 100 mA., size 5 1/2in. x 3in. x 3 1/2in., 30/- P. & P. 3/6 on each.

### U.S.A. BC 312 RECEIVERS

9-Valve Superhet Receiver plus Rectifier with built-in 10 v. D.C. Power Supply. Panel tuneable ant. ckt. and 2 R.F. stages give 0.5-1.5 μv sensitivity for 10 M.W. output. Phase controllable crystal filter gives selectivity. Best bandspread and logging. Vernier knob has 90 : 1 and last knob 25 : 1 ratio. Log scale and the band being tuned appear on dial (1.5-18 Mc/s in 6 Bands). 8C5 oscillates 470 kc/s above R.F. on 1st 3 bands, below on upper 6L7 mixer. 2-6K7 I.F.S. 6R7 det.; A.V.C. 1st A.F. 6C5 pitch controllable oscillator. 6F6 and 5W4 rectifier. Gain control is R.F. on M.V.C. A.F. on A.V.C. Power supply is removable as a unit for Marine or Mobile use. With crystal, valves and manual. £25.10.0. Carr. 20/-.

### HI-FI CO-AX SPEAKERS



**BRAND NEW—U.S.A. MADE**  
15in. Coaxial Speaker. The woofer uses 6.8 oz. Alnico 5 magnet. Has 5in. tweeter and an electronic crossover network to separate the speaker functions. Frequency response: 40-17,000 cycles. Output 15 watts. Input 8 ohms. ONLY 160/- P. & P. 14/-

12in., 3in. tweeter, 12 watts, etc., 120/-

8in., 2 1/2in. tweeter, 10 watts, etc., 90/- P. & P. 4/- on each.

### PORTABLE TRANS/RECEIVER No. 18

A self-contained Trans/Receiver for Telephone and C.W. Range approx. 10 miles. Freq.: 6-9 Mc/s. (50-33.4 metres). Valve line-up: 3 ARP-12, 2 AR-8, 1 ATP4. Complete with aerial, H.T. and L.T. meter and all accessories. Weight, 20 lbs. Size 8 x 10 x 17in. ONLY 70/- Carr. 10/-



### WALKI/TALKI INTERCOM



Boys! They're terrific! Two "space styled" hand telephone units in beautiful two-tone finish. No batteries or soldering required, simply connect twin wire between the two units and talk into microphone or listen on one and listen to speaker or talk on the other. Ideal for intercom from house to house, room to room, tent to tent, etc., operates anywhere even up to 200 yards. Brand New! Complete with 25 ft. of wire. ONLY 6/6 Per Set. P. & P. 1/-

### POCKET TEST METER

**LIST PRICE**  
**£6.19.6.**

**OUR PRICE**  
**£4.15.0.**

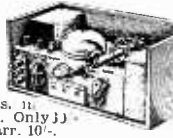
**SAVING YOU**  
**£2.4.6.**



Multi range. 6/30/120/300/1,200 v. A.C. ditto D.C. 0-1 k., 0-1 meg-ohm. A. 400 Micro. A. 12 mA., 300 mA. -∞ to +64DB. 5 ranges: 3in. x 4 1/2in. x 1 1/2in. Large clear dial and leads. List price £6.19.6. Our price £4.15.0. P. & P. 2/6.

### TELEPHONE SETS

Brand new fully portable hand generator, bell, hand set, Morse key, lamps in instructions. Only 1/10 a pair. Carr. 10/-



### VARIAC TRANSFORMERS.

Input 230 v. o/p 0-230 v. 5 a., fully variable, brand new, only £5, carr. 12/6.

**R107 RECEIVERS.** 1.2-17.5 Mc/s. 100-250 v. A.C. and 12 v. D.C. Inputs, full guar. at £8.10.0. Carr. 20/-

**RF UNITS RF26.** 50-65 Mc/s. Brand new, 20/-

**RF UNITS.** RF25, 50-65 Mc/s. Brand new, 20/- RF25, 40-50 Mc/s. Brand new, 8/6. P. & P. 3/- on each. RF26 10-14 Mc/s. 10-60 Mc/s. A.C. mains and 6-V.D.C. Brand new and boxed. £9.19.6. carr. 25/-

**ACCUMULATORS.** 2 volts 16 A.H. (unspliable). Ideal for 8 and 12 volts supply, etc. Brand new. Original cartons. Size 4in. x 7in. x 2 1/2in., 5/6 each. P. & P. 1/6. 3 for 15/- P. & P. 3/6. 6 for 27/6. P. & P. 5/-

### CONTROL BOX—B.C.602.

Complete push-button control box, 4 position and on/off, with dual coloured indicators for instant channel check. In black crackle case 5 1/2in. x 3 1/2in. x 1 1/2in. Bargain price, 5/- each. P. & P. 1/6. Two for 8/- P. & P. 2/6.



### PICTURE FRAME AERIAL.

Incorporates MW and LW aerial with provision for tuning out unwanted signals, noise, etc. Size 8 1/2 x 11 x 1 1/2in. Magnificent appearance. Brand new with full instructions. 12/6. P. & P. 2/6.

**WESTINGHOUSE J.50 PEN-CIL RECTIFIERS.** 500 v. 5 mA., 3/6. P. & P. 1/-

### AERIAL VARIOMETERS.

These magnificent instruments will enable you to receive maximum signal strength on all S.W. receivers. Precision calibrated control. Complete with connection details. 12/6. P. & P. 2/6.



Callers: 87, TOTTENHAM CT. RD., LONDON, W.1.  
Mail orders: (DEPT. P), 32a, COPTIC STREET, LONDON, W.C.1.  
Telephone: MUSeum 9607.

WOT! You don't own a Relda catalogue! It's terrific and fully illus. Only 1/3.

## R.S.C. HI-FI TAPE RECORDER KIT

**REALISM AT INCREDIBLY LOW COST. CAN BE ASSEMBLED IN 1 HOUR**  
 The Recorder incorporates the Latest Collaro Mark IV Tape Transcriber listed £25. The Linear L745 High Quality Tape Amplifier listed £12.12.0. High Flux P.M. Speaker listed 30/-, empty Tape Spool, a Reel of Best Quality L.P. Tape (850ft.) listed 28/6 and a Handsome Portable walnut or Sapele. Size 18in. x 13in. x 9in. High, listed £4 10.0. and circuit. Total cost if purchased individually over £45. Performance equal to units in the £60-£80 class.

**29 1/2 GNS. I.L.P. TERMS. Deposit**  
 Carr. 3 Gns. and 13 monthly payments 53/6.

## HI-FI 8 WATT AMPLIFIER

Special Purchase due to Cancelled Export Order. For 200-250 v. A.C. A limited number is available of these highly sensitive Push Pull units guaranteed brand new and in working order and with separately controlled inputs for 'mike' and gram. etc. LATEST B.V.A. VALVES. Excellent performance.

**£4-19-9** Carr. 7/6.

## R.S.C. A8 HIGH FIDELITY 12 WATT AMPLIFIER

Ultra Linear Push-Pull Amplifier with "Built-in" Tone Control. Pre-amp stages, high sensitivity. Includes 5 valves (907 outputs). High quality sectionally wound output transformer, specially designed for Ultra Linear operation, and reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut." Frequency response  $\pm 3$  db. 30-30,000 c/c.s. Six negative feedback loops. Hum level 71 db. down. ONLY 70 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and practically all microphones. Comparable with the very best designs.

**£7-15-0**

**For STANDING or LONG - PLAYING RECORDS.** For MUSICAL INSTRUMENTS, such as STRING BASS, GUITARS, etc. **OUTPUT SOCKET** with plug provides 300 v. 30 mA. and 6.3 v. 1.5A. For supply of a **RADIO FEEDER UNIT** Size approx. 12-9-7in. For A.C. mains 200-250 v. 50 c/s. Outputs for 3 and 15 ohm speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Unapproachable value, at £7/15-0 or factory built 45/- extra. Carriage 10/-.

If required louvered metal cover with 2

**ACOS CRYSTAL 'MIKE' INSERTS.** Approx. 1in. square. Fly lead connections. Only 5/11 each. Brand New. Round type approx. 1 1/2in. diam. Equipment tested. 4/11 each.

**PICK-UP ARMS** complete with HI-FI turnover crystal head. Acos GP54. Limited number brand new, perfect, at approx. half price. Only 35/9.

**ACOS CRYSTAL MICROPHONES.** Type 33-1. hand or desk. List price 50/- Brand new. cartoned. 29/6.

**EXTENSION SPEAKERS**  
 Ready for use in walnut veneered cabinet.  
 6 1/2in. 2-3 ohms. 29/11.  
 8in. 2-3 ohms. 35/9.  
 1in. 2-3 ohms. 58/9.  
 Very limited number

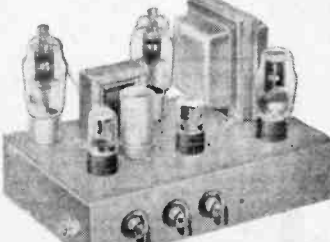


**14 WATT AMPLIFIERS.** Unused and in good order but store soiled. For 200-250 v. A.C. mains input. Outputs for 3 and 15 ohm speaker. Inputs for "mike" and Gram. Limited number, complete with valves. Only 6 Gns., carr. 5/-.

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

Interleaved and Impregnated. Primary 200-250 v. Screened. **TWO SHROUDED DROP THROUGH**  
 250-0-250 v. 70 mA. 6.3 v. 2 a. 5 v. 2 a. ... 16/9  
 350-0-350 v. 80 mA. 6.3 v. 2 a. 5 v. 2 a. ... 18/9  
 250-0-250 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. ... 23/9  
 300-0-300 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. ... 23/9  
 350-0-350 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. ... 23/9  
 350-0-350 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. C.T. ... 23/9  
 0-4-5 v. 3 a. ... 23/9  
 350-0-350 v. 150 mA. 6.3 v. 4 a. 5 v. 3 a. ... 29/9

**FULLY SHROUDED UPRIGHT**  
 250-0-250 v. 60 mA. 6.3 v. 2 a. 5 v. 2 a. ... 17/6  
 Midget type 2 1/2-3 1/2 in.  
 250-0-250 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. ... 26/9  
 300-0-300 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. ... 26/9  
 300-0-350 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. ... 26/9  
 300-0-300 v. 130 mA. 6.3 v. 4 a. 5 v. 3 a. ... 35/9  
 for Mullard 510 Amplifier A.P. 11  
 350-0-350 v. 150 mA. 6.3 v. 4 a. 5 v. 3 a. ... 33/9  
 350-0-350 v. 150 mA. 6.3 v. 2 a. 6.3 v. 2 a. 5 v. 3 a. ... 35/9  
 425-0-425 v. 300 mA. 6.3 v. 4 a. C.T. ... 49/9  
 6.3 v. 4 a. C.T. v. 3 a. Suitable  
 Williamson Amplifier, etc. ... 49/9



carrying handles can be supplied for 18/9. Additional input sockets, with associate Vol. control so that two different inputs such as Gram and 'Mike' or Tape and Radio can be mixed, can be provided for 13/- extra. Guaranteed 12 months. **TERMS** on assembled two input model: **DEPOSIT** 18/9 and 12 monthly payments 18/9. **HIGH FIDELITY MICROPHONES and SPEAKERS** in stock. Keep cash prices or credit terms if supplied with amplifier.

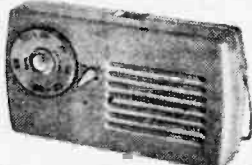
**STAAR GALAXY 4 SPEED MIXER AUTO-CHANGERS**  
 Brand new, cartoned. Turnover sapphire styli. Many exclusive features. Unique design motor virtually free from rumble. For 200-250 v. A.C. mains. Only 25.19.6. while stocks last or fitted Acos turnover head for 78 r.p.m. L.P. or Stereo records. 28.19.6. Carr. 3/9 extra.

**PORTABLE CABINETS.** High Quality Finish. Rexins covered. Attractive design. Inside measurements: 17in. x 12 1/2in. x 8 1/2in. high. Clearance above base-board 5 1/2in. Below 2 1/2in. 69/9 each. Or size 14 1/2in. x 13 1/2in. x 6 1/2in., slightly soiled. Will take 4-speed single player, amplifier and speaker. Only 29/9.

**SPECIAL OFFER.** Two tone Portable cabinet. Gram amplifier. Staar. Changer and 7in. x 4in. P.M. Speaker. 29.19.6. Carr. 10/-.

**THE SKYFOUR T.R.F. RECEIVER.** A design of a 3-valve Long and Medium wave 200-250 v. A.C. Mains receiver with selenium rectifier. High gain H.F. stage and low distortion anode band detector. Power pentode output. Valve line-up 6K7, 8P61, 6V6G. Selectivity and quality are well up to standard, and simplicity of construction is a special feature. To-point wiring instructions and parts list. 19. Maximum building costs £4.19.6. inc. attractive Brown or Cream Bakelite or Walnut veneered wood cabinet 12 x 6 1/2 x 5 1/2in.

## A SIX TRANSISTOR "POCKET" SUPERHET RADIO



All parts including Transistors Printed Circuit Attractive Cream or Coloured Plastic case. Ferrite aerial. 2 1/2in. P.M. Speaker, etc., etc. and full instruction booklet. Size 5 1/2 x 3 1/2 x 1 1/2in. completed Long and Medium Wave and 200 v. push-pull output. Demonstrated at our counter premises.

**£9.19.6**

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

Type BM1. An all-dry battery eliminator. Size 3 1/2 x 4 1/2 x 2 1/2in. approx. Completely replaces battery supplying 1.4 v. and 90 v. where A.C. mains 200-250 v. 50 c/s is available. Suitable for all battery portable receivers requiring 1.4 v. and 90 v. This includes latest low consumption types. Complete kit with diagrams. 39/9. or ready to use. 46/9.

Type BM2. Size 6 x 5 1/2 x 2 1/2in. Supplies 120 v. 90 v. and 60 v., 40 mA. and 2 v. 0.4 a. to 1 amp. fully smoothed. Thereby completely replacing both H.T. batteries and L.T. 2 v. accumulators. When connected to A.C. mains supply 200-250 v. 50 c/s. **SUITABLE FOR ALL BATTERY RECEIVERS** normally using 2 v. accumulator. Complete kit of parts with diagrams and instructions. 49/9. or ready for use. 59/6.

## FILAMENT TRANSFORMERS

All with 200-250 v. 50 c/s. primaries 6.3 v. 1.5 a. 5/8; 6.3 v. 2 a. 7/8; 0-4-6.3 v. 2 a. 7/9; 12 v. 1 a. 7/11; 6.3 v. 3 a. 8/11; 6.3 v. 6 a. 17/6; 12 v. 3 a. or 24 v. 1.5 a. 17/6.

## OUTPUT TRANSFORMERS

Midget Battery Pentode 661 for 354. etc. ... 3/9  
 Small Pentode, 5000  $\Omega$  to 3  $\Omega$  ... 3/9  
 Small Pentode 78,000  $\Omega$  to 3  $\Omega$  ... 3/9  
 Standard Pentode 5,000  $\Omega$  to 3  $\Omega$  ... 4/9  
 Standard Pentode 78,000  $\Omega$  to 3  $\Omega$  ... 4/9  
 10,000  $\Omega$  to 3  $\Omega$  ... 4/9  
 Push-Pull 10-12 watts 6V6 to 3  $\Omega$  or 15  $\Omega$  ... 15/9  
 Push-Pull 10-12 watts to match 6V6 to 3-5-8 or 15  $\Omega$  ... 16/9  
 Push-Pull EL84 to 3 or 15  $\Omega$  ... 16/9  
 Push-Pull 15-18 watts. 6L6. KT66 ... 22/9  
 Push-Pull for Mullard 510 Ultra Linear ... 29/9  
 Linear Push-Pull 20 watts, sectionally wound 6L6. KT66, etc., to 3 to 15  $\Omega$  ... 47/9

## ELIMINATOR TRANSFORMERS

Primarys 200-250 v. 50 c/s.  
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 90 v. 1.5 mA. 4-0-4 v. 500 mA. ... 9/9

## SMOOTHING CHOKES

0-8-15 v. 11 a. 11/9 ; 0-9-15 v. 3 a. 16/9 ; 0-9-15 v. 5 a. 19/9 ; 0-9-15 v. 6 a. 23/9 ; 30 mA. 10 H 200 ohms ... 8/9 ; 30 mA. 10 H 350 ohms ... 5/9 ; 60 mA. 10 H 400 ohms ... 4/11

## CHARGER TRANSFORMERS

All with 200-250 v. 50 c/s Primarys :  
 0-8-15 v. 11 a. 11/9 ; 0-9-15 v. 3 a. 16/9 ; 0-9-15 v. 5 a. 19/9 ; 0-9-15 v. 6 a. 23/9

## COLLARO UC54 3-SPEED AUTO-CHANGERS

With Studio pick-up. Brand new. For 110 v. 50 c.p.s. A.C. mains. Price with 110 v. to 220-250 v. Auto Trans. only 25.19.6. Carr. 5/6.

## COLLARO CONQUEST 4-SPEED AUTO-CHANGER

With high fidelity Studio pick-up. Latest model. Brand new. Cartoned. For 200-250 v. 50 c.p.s. A.C. mains. Our price 27.19.6. Carr. 5/6.

## COLLARO 4-SPEED SINGLE PLAYER

With separate pick-up, GP54 with sapphire styli. For 200-250 v. A.C. mains. £4.10.0.

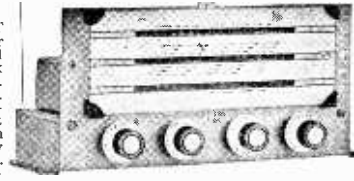
**R.S.C. A12 STEREOPHONIC AMPLIFIER KIT**

A complete set of parts to construct a Stereo amplifier with an undistorted output total 6 watts (3 watts each channel). For A.C. mains input of 200-250 v. Outputs for matched 2-3 ohm speakers. Sensitivity 130 m.v. Gained Vol. and Tone Controls. Preset balance control. Full instructions and point to point wiring diagrams Carr. and pkr. 5/- supplied. Only good quality components and latest high grade valves used. Exceptionally realistic reproduction can be obtained at ample volume for the home, as can be demonstrated in typical surroundings at our County Arcade premises. A really sensational offer.

**£3-19-6**

**AM/FM RADIOGRAM CHASSIS HIGH QUALITY 6-8 WATT PUSH-PULL OUTPUT**

For 200-250 v. Mains. Long wave, Medium, F.M. and Gram. Complete with 3 B.V.A. valves. Guaranteed 12 months. Only 22 GNS. Or Deposit £2.12.0 and 9 monthly payments of £2.12.0.



**STEREO EQUIPMENT OFFER.** Comprising A12 Kit, 2 matched 8in. L'Speakers, and Acos T/O Stereo head suitable most pick-ups. Carr. 7/6

**£6-19-6**

**LINEAR L745 HIGH QUALITY TAPE DECK AMPLIFIER.** With "built in" power pack and oscillator ready for start. For Tape Decks Use ONLY with High or Low Impedance. Playback and Erase Heads, such as Lane, Truvox, Collaro, Brennel, Carr. 7/6 etc. For A.C. Mains and 50 c/s. Linear frequency response of ± 3 db. 50-11,000 c/s. Negative feedback equalisation for 31.7j and 15in. per sec. Output 4 watts. Send S.A.E. for leaflet.

**12 GNS.**

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

A highly sensitive Push-Pull high output unit with self-contained Pre-amp, Tone Control Stages. Certified performance figures compare equally with most expensive amplifiers available. Hum level 70 db. down. Frequency response +3 db. 30-30,000 c/s. A specially designed sectionally wound output linear output transformer is used with 807 output valves. All components are chosen for reliability. Six valves are used. EP86, EP90, ECC83, 907, 807, CZ33. Separate Bass and Treble controls are provided. Minimum input required for full output is only 12 millivolts so that ANY KIND OF MICROPHONE OR PICK-UP IS SUITABLE. The unit is designed for CLUBS, SCHOOLS, THEATRES, DANCE HALLS or OUTDOOR FUNCTIONS, etc. For use with Electronic ORGAN, GUITAR, STRING BASS, etc. For standard or long-playing records. OUTPUT SOCKET PROVIDED for L.T. and H.T. for a RADIO FEEDER UNIT. An extra input with associated vol. control is provided so that two separate inputs such as Gram and 'Mike' can be mixed. Amplifier operates on 200-250 v. 50 c/s. A.C. Mains and has output for 3 and 15 ohm speakers. Complete kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. If required cover as for A8 can be supplied for 18/9. The amplifier can be supplied, factory built with 12 months' guarantee, for £13.19.6. TERMS: DEPOSIT 24/9 and 12 monthly payments of 24/9.

**11 GNS.**

**LINEAR 'DIATONIC' 10-14 WATT HIGH FIDELITY PUSH-PULL ULTRA LINEAR AMPLIFIER.**

For 200-250 v. A.C. mains. Valves ECC83, ECC83, EL84, EL84, EZ81 miniature Mullard. Self-contained Pre-amp. Tone control stage and separate Bass and Treble Control independent 'Mike' and Gram input sockets are provided. Output Matchings for 3 and 15 ohm speakers. Only 12 GNS.; or Deposit 22/3 plus 10/- carr. and 12 monthly payments of 22/3. Send S.A.E. for leaflet.

**LINEAR L10 HI-FI 10 watt Amplifier** and separate Pre-amplifier. 15 GNS. Complete. Send S.A.E. for leaflet.

**LINEAR 150 50 WATT P.A. AMPLIFIER.** High quality and sensitivity. 19 GNS. Send S.A.E. for leaflet.

**R.S.C. 3-4 WATT AT HIGH-GAIN AMPLIFIER**

For 200/250 v. 50 c/s. Mains input. Appearance and Specification, with execution of output wattage, as A5. Amplifier. Complete kit with diagrams. £3.15.0. Carr. 3/6.

**R.S.C. (Leeds) MANCHESTER Ltd. and LEEDS**

**LINEAR L45 MINIATURE 4/5 WATT QUALITY AMPLIFIER.** Suitable for use with any record playing unit, and most microphones. Negative feed-back 12 db. Separate Bass and Treble Controls. For A.C. mains input of 200-250 v. 50 c/s. Output for 2-3 ohm speaker. Three miniature Mullard valves used. Size of unit only 6-5-5 1/2 in. high. Output for 2-3 ohm speaker. Guaranteed for 12 months. Only £5/19/6. Send S.A.E. for illustrated leaflet. Terms. Deposit 22/6 and 5 monthly payments of 22/6.

**R.S.C. 4-5 WATT A5 HIGH-GAIN AMPLIFIER**



A highly-sensitive 4-valve quality amplifier for the home, small club, etc. Only 50 millivolts input is required for full output so that it is suitable for use with the latest high fidelity pick-up heads, in addition to all other types of pick-ups and practically all 'mikes'. Separate Bass and Treble controls are provided. These give full long-playing record equalisation. Hum level is negligible being 71db. down. 15 db. of negative feedback is used. H.T. of 300 v. 25 mA. and L.T. of 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit, or Tape-Deck pre-amplifier. For A.C. mains input of 200-230-250 v. 50 c/s. Output for 2-3 ohm speaker. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with base-plate) with blue hammer finish and point-to-point wiring diagrams and instructions. Exceptional value at only £2/15/-, or assembled ready for use 25/- extra, plus 3/6 carr.; or Deposit 22/6 and 5 monthly payments of 22/6 for assembled unit.

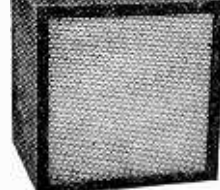
**£8-19-6**

**R.S.C. PORTABLE GUITAR AMPLIFIER JUNIOR, 5 WATTS High Quality output.** Separate Bass and 'Treble' 'Cut' and 'Boost' controls. Sensitivity 15 m.v., High Flux 8in. Loudspeaker 'built-in'. Handsome, strongly made Cabinet (size approx. 14 x 14 x 7in.) finished in satin walnut, and fitted carrying handle. H.P. Terms. Deposit £1 and 9 monthly payments of £1.

**SENIOR 10 WATTS HIGH FIDELITY OUTPUT.** Separate Bass and Treble 'Cut' and 'Boost' controls. Twin separately controlled high gain inputs so that two instruments such as Guitar and String Bass can be used at the same time. Two loudspeakers are incorporated, a high Flux 12 in. for Bass notes and a 7 x 4 in. elliptical for Treble. Cabinet is well made and finished satin walnut. Size approx. 18 x 18 x 8 in. H.P. Terms. Deposit 23/6 and 12 monthly payments of 23/6. Each models for 200-250 v. A.C. mains. Carr. 10/-

**13 GNS.**

**12in. 10 WATT HIGH QUALITY LOUD-SPEAKERS IN POLISHED WALNUT FINISHED CABINET**



Gauss 12,000 lines. Speech coil 3 ohms or 15 ohms. Only £4.19.6 Carr. 5/- Terms: Deposit 11/- and 9 monthly payments of 11/-.

**12 in. 20 WATT HI-FI LOUD-SPEAKERS IN CABINET.** Size 18 x 18 x 8 in. Finish as above. Terms: Deposit 13/10 and 12 monthly payments of 13/10. Only £7.19.6. Carr. 8/6.

**GARRARD 4-SPEED AUTO-CHANGERS.** Type RC120H. Very limited number at only £8.19.6 (approx. halt price). Carr. 5/6.

**PLESSEY DUAL CONCENTRIC 12in. 15 ohms HIGH FIDELITY SPEAKER** (12,000 lines) with built-in tweeter (completely separate elliptical speaker with choke, condensers, etc.), providing extraordinarily realistic reproduction when used with our A8 or similar amplifier. Rated 10 watts. Price only £5/17/6.

**ACOS HI-FI Crystal Cartridges.** (Turn-over type with sapphire stylus.) HGP50. Standard replacement for Garrard and B.S.R. Only 17/9. Stereo Type for 78, C.P. and Stereo records. Will fit B.S.R., Collaro, Garrard, and Galaxy changers. 52/6.

**COLLARO MK. III 3-SPEED TAPE TRANSCRIPTORS 15 GNS. Carr. 7/6**

Limited number brand new cartoned. P.M. SPEAKERS. 2-3 ohm. 5in. 17/9. 6in. 16/9. 8in. 19/9. 10in. 26/9. 10 x 6in. 29/9. 12in. 29/11. 10in. W.B. "Stentorian" 3 or 15 ohms type HF1012 10 watts, hi-fidelity type. Recommended for use with our A8 Amplifier. £4/10/9. 2in. Plessey 3 ohms 10 watts (12,000 lines). 59/6.

**LG3 MINIATURE 2-3 WATT GRAM AMPLIFIER.** For use with above or any other single or auto-change units. Output for 2-3 ohm speaker. For 200-250 v. 50 c/s. A.C. mains. Over-all size 6 1/2 x 4 x 2 1/2 in. Controls: Vol. and Tone with switch. Guaranteed 12 months. Only 55/9.

**SUPERHET FEEDER UNIT.** Design of a high quality Radio Tuner Unit (speciely suitable for use with any of our Amplifiers). Delayed A.V.C. employed. The W.Ch. Sw. incorporates Gram position. Instructions and price parts list with illustration. 2/6. Total building cost £4/15/-. For descriptive leaflet send S.A.E.

**GARRARD 4-SPEED SINGLE RECORD PLAYER UNITS** with turn-over crystal pick-up head. Current model. List price around 10. Only £6.19.6. Carr. 4/6.

Terms: C.W.O. or C.O.D. No C.O.D. under £1. Post 1/9 extra under £2; 2/9 extra under £5. All goods supplied subject to terms and guarantee as detailed in current catalogue. Open 9 to 6.1 Weds. until p.m. Catalogue 6d. Trade supplied. S.A.E. with all enquiries. Mail Orders to 29-31 Moorfield Rd., Leeds 12. Callers to 5 and 7 County (Mecca) Arcade, Briggate, Leeds 1, and Universal Bazaars Ltd., 8-10 Brown St. (Market St.), Manchester 2.

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Brand new original spare parts for AR88 Receivers.

High Resistance Headphones, 4,000 ohms. Brand new, ex W.D. boxed, 10/6 per pair. P. & P. 1/-.

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Microphone Transformers. Balanced input 30 or 250 ohms. U.S.A. manufacture, 7/6. P. & P. 1/6.

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Vacuum Condenser 32,000 V. 50 pF, 25/-, Post free.

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Modulation Transformers (U.S.A. Collins), primary imp. 6,000 ohms. C.T., secondary 6,000 ohms, 20 W., 9/6 each. Post free.

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Telescopic Aerial Masts. Sections, total 11 yards. Immediate erection. £4.10.0 each or £8 per pair. Post free.

Light Headgear Assembly. Ideal for mobile use. Headphones 600 ohms carbon microphone, 18/-, P. & P. 3/-.

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I.F. TRANSFORMERS 4.5 mc/s, American Made in black crackle finish housing, 6/-, P. & P. 1/-.

Thermo-Couple Heating Element. 0.75 Amp in bakelite housing. Made for aerial current meters D.V.52 (G.E.C. made) or other purposes, 10/-, P. & P. 1/-.

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Headphone Matching Transformers. To match L.R. Headphone to H.R. output (6,000 ohms), price 5/6. Seated in small moulded case. 1 in. x 1 1/2 in. easily mounted on cord.

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R109. Covering 2-8 mc/s 6 v. D.C. New and Tested, £4.50. Carriage paid.

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SCR.522. Transmitters. (BC625), including all valves, 22/6. P. & P. 5/-.

SCR.522. Receivers (BC624), including all valves, 25/-, P. & P. 5/-.

Vibrator Unit. 12 v./180 v. 60 m/A. Exceedingly well filtered and smoothed, excellent for car radios. New, incl. one OZ4 valve and vibrator, 27/6. P. & P. 5/-.

No. 62. Transmitter-Receiver. 1.6-12 mc/s in two ranges. Ideal for mobile use. Total 11 valves. Rx—A super with separate mixer and local oscillator. Tx uses QV047 as power amplifier. VFO or switched selected crystals. C.W., phone (grid modulation) metered for operation and valve testing. Pi output to match rod aerials or long wire " Press to send "

operation from mike. Size 8 1/2 in. x 17 1/2 in. x 1 1/2 in. weighs only 29 lbs. Completely self contained with internal power unit for 12 v. operation. Power consumption 4.4. amps on send, 3.4. amps on receive. As new condition, tested, complete with operation instructions. Price, £17.10.0. Delivery included.

## PETHERICK'S RADIO SUPPLIES

(Dept. P.W.)  
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Practical Tube Recording Handbook, No. 1, by Brown, 5/-, postage 6d. Practical Transistor Receivers, Book 1, by Sinclair, 5/-, postage 6d.

Radio Valve Data, by Wireless World, 5/-, postage 6d.

How to Get the Best out of Your Tape Recorder, by Guy, 8/6, postage 9d.

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## SHORT WAVE KITS

H.A.C. were the original suppliers of SHORT-WAVE RECEIVER KITS for the amateur. Over 10,000 satisfied customers.

PRICES FROM 25/- TO 77/-.

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ADDRESS \_\_\_\_\_

# Stern's "fidelity" TAPE EQUIPMENT

## THE FINEST RANGE OF TAPE EQUIPMENT FOR THE HOME CONSTRUCTOR

**A SELECTION OF HIGH FIDELITY PORTABLE TAPE PREAMPLIFIERS**

Adds "Hi-Fi" TAPE RECORDING TO YOUR EXISTING AUDIO INSTALLATION

**IN ALL MODELS WE INCORPORATE THE TYPE "C" PREAMPLIFIER**

**AND OFFER IT COMPLETE IN CASE WITH ...**

- (a) The new "COLLARO" STUDIO 3 Speed Deck Deposit, £7.2.0. 12 months £2.12.1 **£35.10.0**
- (b) The COLLARO Mk. IV "Transcriptor" 3 Speed Deck Deposit, £8.14.0. 12 months £3.3.10. **£43.10.0**
- (c) The New Carriage and Mk. VI Tape Deck Deposit, £3.14.0. 12 months £3.3.10. **£51.10.0**
- (d) The BRENNELL Mk. V 3 Speed Deck Deposit, £10.6.0. 12 months £3.15.7. **£59.10.0**
- (e) The WEARITE MODEL 4A. Tape Deck Deposit, £12.0.0. 12 months £4.7.1.

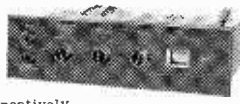


### STERN'S MULLARD TYPE "C" TAPE PREAMPLIFIER-ERASE UNIT

INCORPORATING THE NEW FERROXCUBE POT CORE PUSH-PULL OSCILLATOR and 3-SPEED TREBLE EQUALISATION by means of the latest FERROXCUBE POT CORE INDUCTOR. **COMPLETE KIT £14.0.0**

ASSEMBLED AND TESTED Deposit £3.3.0. and 12 months of £14.11.

ALSO AVAILABLE EXCLUDING POWER SUPPLY UNIT FOR £11.15.0 and £14.10.0. respectively. Carriage and Insurance is 5/- extra. WHEN ORDERING PLEASE STATE MAKE OF TAPE DECK TO BE USED. We present this "Hi-Fi" Preamplifier strictly to Mullard's specification incorporating ONLY NEW HIGH-GRADE COMPONENTS and the SPECIFIED NEW MULLARD VALVES. It comprises a COMPLETELY SELF-CONTAINED UNIT, all components and valves being contained in a well-ventilated Box-Chassis neatly finished in Hammered Gold with a very attractively engraved PERSPEX FRONT PANEL.



#### FOR PERMANENT HIGH QUALITY INSTALLATIONS WE ALSO OFFER (excluding case)

- (a) THE COLLARO Mk. IV TAPE DECK and the MULLARD TYPE "C" PREAMPLIFIER & Power Unit assembled, tested H.P. Deposit £7 and 12 months £2.11.4. **£35.0.0**
- (b) As in (a) above but the Type "C" supplied as COMPLETE KIT OF PARTS **£32.0.0**
- (c) THE TRUVOX Mk. VI TAPE DECK and the assembled Type "C" Preamplifier and Power Unit H.P. Deposit £7.10.0 and 12 months £2.15.0. **£37.10.0**
- (d) As above but the Type "C" supplied as complete KIT OF PARTS **£34.10.0**
- (e) THE BRENNELL Mk. V DECK and the assembled Type "C" PREAMPLIFIER and POWER UNIT H.P. Deposit £9.4.0 and 12 months £3.7.6. **£46.0.0**
- (f) As above but the Type "C" supplied as complete KIT OF PARTS **£43.0.0**
- (g) THE WEARITE 4A DECK with TYPE "C" assembled and tested H.P. Deposit, £11.0.0 and 12 months £4.0.8 **£55.0.0**

(Carriage and Insurance on above quotes 10/- extra.)

PLEASE ENCLOSE S.A.E. WITH ALL CORRESPONDENCE.

**STERN RADIO LTD.**  
109 & 115 FLEET ST., LONDON, E.C.4  
Telephone: FLEET STREET 5812/3/4

**YOU CAN BUILD A COMPLETE HIGH QUALITY RECORDER**

**LIKE THIS for £39.15.0**

Deposit: £8.0.0.  
12 months: £2.17.5.



**WE OFFER THIS SELECTION**

- (a) THE COLLARO Mk. IV TAPE DECK with the assembled and tested HF/TR3 Amplifier **£34.10.0**
- (b) H.P. Deposit £6.18.0 and 12 months £2.10.8 **£30.15.0**
- (c) As above but the HF/TR3 supplied as KIT OF PARTS **£30.15.0**
- NOTE: Messrs. Collaro when supplying the Mk. IV Deck do not wire up the Deck Switch backs. We will do this for £1 or supply a wiring diagram to the Home constructor.
- (c) THE TRUVOX Mk. VI TAPE DECK with the assembled and tested HF/TR3 amplifier H.P. Deposit £7.8.0 and 12 months £2.14.3. **£37.0.0**
- (d) As above but the HF/TR3 supplied as KIT OF PARTS **£33.10.0**
- (e) THE BRENNELL Mk. V DECK with the assembled and tested HF/TR3 amplifier H.P. Deposit £9 and 12 months £3.6.6. **£45.0.0**
- (f) As above but the HF/TR3 supplied as KIT OF PARTS **£42.0.0**
- (g) THE PORTABLE CASE illustrated here (25). 1.200L. EMITAPE (35"-). ACOS CRYSTAL MIKE (35"-). ROLA 10 x 6in. LOUDSPEAKER (30"-) ALL FOR **£9.0.0**

Carriage and Insurance on each above 10/- extra.

**WE HAVE THE NEW 2 SPEED TWIN TRACK TRUVOX Mk VI TAPE DECK IN STOCK £26.5.0**  
DEPOSIT: £5.5.0 12 MONTHS: £1.1B.6

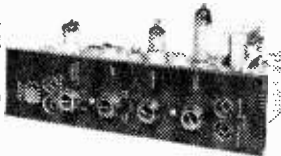
### THE MODEL HF/TR3 TAPE AMPLIFIER

INCORPORATING 3-SPEED TREBLE EQUALISATION by means of the latest FERROXCUBE POT CORE INDUCTOR.

PRICE FOR COMPLETE KIT OF PARTS **£12.15.0**

PRICE FULLY ASSEMBLED & TESTED **£16.10.0**

**HIRE PURCHASE.** Deposit £3.6.6 and 12 monthly payments of £1.4.2. A very high-quality Amplifier based on the very successful TYPE "A" design completed in the MULLARD LABORATORIES. ONLY NEW HIGH-GRADE COMPONENTS are incorporated including MULLARD VALVES and a GILSON OUTPUT TRANSFORMER. Other features are—Magic Eye Recording hand indicator—Effective Tone Control—Monitoring and Extension Speaker Sockets—Has own Power Supply and can be used as independent Amplifier for direct reproduction of Gram Records or from Radio Tuner. Overall size 11in. x 6in. x 6in. Can be supplied for use with Truvox—Collaro—Lane—Brenell or Motok Decks. Please specify which. Send S.A.E. for leaflet or 2/6 for complete Assembly Manual.



#### The New B.S.R. "MONARDECK"

INCORPORATING A CORRECTLY MATCHED PREAMPLIFIER

Deposit £3.12.0 **£17.17.0**  
12 months £1.6.2.

Designed to operate through the Pick-Up Sockets of the standard RADIO RECEIVER through which first-class results are obtained. It consists of a single-speed Twin Track Tape Deck, incorporating a matched Preamplifier, and operates at 3 1/2 in./sec. speed.



The equipment is supplied fully tested and completely assembled on an unpolished wood plinth. It can therefore be "dropped" directly into an existing Cabinet and only requires connections to the mains supply and the Pick-Up Sockets, for which purposes "floating" leads are incorporated on the Preamplifier.

*Still by far the finest value*

**COMPLETE KIT OF PARTS—**

Des'gnd by MULLARD—presented by STERNS strictly to specification. For use with the MULLARD 2-stage pre-amplifier (described below) with which an undistorted power output of up to 10 watts is obtained. This combination is thor-



**MULLARD  
"5-10" MAIN  
AMPLIFIER**

**SPECIFIED COMPONENTS AND NEW MULLARD VALVES**, including **PARMEKO MAINS TRANSFORMER** (which has extra Power available to drive Radio Tuner) and the choice of the latest **Ultra-Linear** or the **PARTRIDGE Output Transformer**.

PRICE COMPLETE KIT (PARMEKO) **£10.00** Alternatively we supply ASSEMBLED and TESTED, **£11.10.0.**

ABOVE INCORPORATING PARTRIDGE OUTPUT TRANSFORMER, **£1.6.0 EXTRA**

**MULLARD'S PRE-AMPLIFIER  
TONE CONTROL UNIT**



Employing two EF86 valves, and designed to operate with the MULLARD 3-3 and 5-10 MAIN AMPLIFIERS, but also perfectly suitable for other makes.

PRICE COMPLETE **£6.6.0** Alternatively: We supply **£8.8.0** (Carriage & Insurance. KIT OF PARTS, ASSEMBLED AND TESTED 5/- extra.)

Our kit is strictly to MULLARD'S SPECIFICATION and incorporates:

- 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.

**MULLARD  
DESIGNS  
FOR THE  
HOME  
CONSTRUCTOR**

**SPECIAL PRICE  
REDUCTIONS**

(a) The COMPLETE KIT OF PARTS to build both the "3-3" MAIN AMPLIFIER and the 2-STAGE PRE-AMPLIFIER CONTROL UNIT **£15.15.0**  
(b) The "5-10" and the 2-STAGE PRE-AMPLIFIER both **£18.18.0** Ass'mbled and Tested H.P.: DEPOSIT **£2.16.0** and 12 Monthly Payments of **£1.7.8**. When ordering include an extra 7/6 to cover Carriage and Insurance. PRICES FOR THE "5-10" ARE SUBJECT TO **£1.6.0 EXTRA** IF THE PARTRIDGE TRANSFORMER IS REQUIRED.

**MULLARD — STERN STEREO DESIGNS**

AVAILABLE  
END OF  
SEPTEMBER

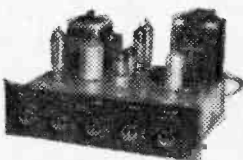
**DUAL CHANNEL  
PRE-AMPLIFIER**

This model incorporates two 2-valve Pre-Amplifiers (described above) combined into a Single Unit, enabling it to be used for both STEREOPHONIC or MONAURAL operation. It is designed primarily to operate with our

range of MULLARD MAIN AMPLIFIERS but will also operate equally well with any make of Amplifier requiring an input of 250 m.volts.

PRICE: COMPLETE KIT OF PARTS **£12.10.0**  
ASSEMBLED AND TESTED **£15.0.0**

FULLY DESCRIPTIVE LEAFLETS with complete price details available end of September.

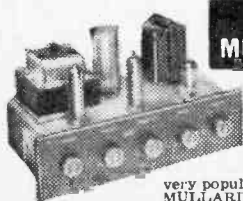


**COMPLETE  
MULLARD 5-10  
AMPLIFIER**

The popular and very successful complete "5-10" incorporating Control Unit providing up to 10 watts high quality reproduction. Input channels only Specified Components and new MULLARD VALVES are supplied, including **PARMEKO MAINS TRANSFORMER** and choice of the latest **PARMEKO** or **PARTRIDGE ULTRA-Linear Output Transformers**. Adequate power available to drive Radio Tuner.

PRICE COMPLETE KIT (Parmeko Transformer).....**£11.10.0**  
Alternatively we supply ASSEMBLED and TESTED..... **£13.10.0**

HIRE PURCHASE (Assembled Amp. only) DEPOSIT: **£2.14.0** 12 MONTHS: **19/10**  
ABOVE INCORPORATING PARTRIDGE OUTPUT TRANSFORMER **£1.6.0 extra.**



**COMPLETE  
MULLARD 3-3**

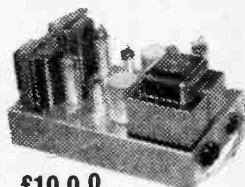
**THE IDEAL  
AMPLIFIER  
FOR A SMALL  
HIGH  
QUALITY  
INSTALLATION**  
COMPLETE KIT OF PARTS **£7.10.0**  
Alternatively supplied ASSEMBLED and FULLY TESTED **£8.19.6** (plus 6/6 coverage and insurance)

H.P. Terms: Deposit **£2.0.0** and 8 Months of **£1.0.0**. Developed from the very popular 3-valve 3-watt design. Complete to MULLARD'S SPECIFICATION including Mullard valves and a **PARMEKO OUTPUT TRANSFORMER**. Send S.A.E. for leaflet or 1/6 for ASSEMBLY MANUAL.

**DUAL "3-3"  
MAIN AMPLIFIER**

Comprises two "3-3" MAIN AMPLIFIERS (described above) on one chassis and is designed to operate with our DUAL CHANNEL PRE-AMPLIFIER for both STEREOPHONIC or MONAURAL operation.

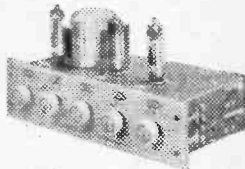
PRICE: COMPLETE KIT OF PARTS **£10.0.0**  
Alternatively ASSEMBLED AND TESTED **£11.15.0** H.P. Terms: Deposit **£2.11.0** & 12 months at 17/-. Its output power is 6 watts (3 watts per channel) and together with our PRE-AMPLIFIER provides a very acceptable STEREO installation.



**COMPLETE  
STEREO AMPLIFIER**

A thoroughly recommended design that very effectively meets the many requests for a low-priced but good quality **DUAL CHANNEL STEREOPHONIC AMPLIFIER**. PRICE: COMPLETE KIT OF PARTS **£8.10.0** alternatively ASSEMBLED AND TESTED **£10.10.0**

Two MULLARD ECL82 Triode Pentode Valves are incorporated in the design: they form a "CLASS A" single-ended output stage in each channel. The input sensitivity is 300 m.volts, therefore when used with most STEREO Crystal Pick-Ups, or Radio Tuning Units, an output of 2 watts per channel is achieved, or similarly when switched to MONAURAL Pick-Up position a combined output of 4 watts is produced.



Please enclose S.A.E. if ILLUSTRATED and DESCRIPTIVE LEAFLETS are required... alternatively the COMPLETE ASSEMBLY MANUALS containing component Price Lists and practical Drawings, etc., are available at 1/6 each.

Only new HIGH GRADE Specified Components and MULLARD VALVES are supplied.

**STERN RADIO LTD.**

# Stern's "fidelity" TAPE RECORDERS

**BEFORE YOU BUY—HEAR THESE RECORDERS THEY ARE COMPARABLE TO THE MUCH HIGHER PRICED MODELS**

**MODEL CR3/S.** Incorporates the New COLLARO "STUDIO" TWIN TRACK 3-Speed Deck H.P. Terms: Deposit £9.4.0 and 12 months of £3.0.2. **£41.0.0**

**MODEL CR3/T.** Incorporates the very popular 3-Speed COLLARO Mk. IV "TRANSCRIPTOR" Deck which has both upper and lower tape tracks..... **£49.10.0**  
H.P. Terms: Deposit £9.18.0 and 12 months of £3.12.7.

**MODEL TR3/Mk. VI.** Incorporates the New TRUVOX Mk. VI TWIN TRACK 2-Speed Tape Deck ..... **£49.10.0**  
H.P. Terms: Deposit £9.18.0 and 12 months of £3.12.7.



Each Model incorporates the highly successful HF TR3 Amplifier (described opposite) thus ensuring truly "Hi-Fi" record and playback facilities.

All prices quoted provide for the COMPLETE RECORDER including CRYSTAL MICROPHONE and 1,200 ft. Spool of Tape.

There is no better value for money Tape Recorder on the market—if you can't call and hear them, send S.A.E. for fully descriptive leaflets.

## "MODERNISE YOUR OLD RADIOGRAM"

**IT IS CHEAPER AND BETTER VALUE TO REPLACE YOUR OLD CHASSIS AND GRAM UNIT !! RADIOGRAM CHASSIS !! !! RECORD PLAYERS !!**

**ARMSTRONG "STEREO TWELVE" ..... £37.16.0**

The most complete AM FM unit yet produced for Stereo, giving 6 watts high-fidelity push-pull output on each channel. 12 watts for monaural.

**ARMSTRONG "JUBILEE" ..... £29.8.0**

An AM/FM chassis with nine valves and with push-pull output stage providing 6 watts.

**ARMSTRONG AM/FM "STEREO 44" ..... £28.7.0**

Provision is made for Stereo and monaural playback from pick-up or tape. Outputs provided for Stereo or Monaural tape recordings.

**DULCI "HAPP" ..... £27.16.6**

An eight-valve AM/FM 4 waveband chassis giving 6 watts ultra linear output.

### AM/FM RADIO TUNING UNITS

**ARMSTRONG "S.T.3" ..... £27.6.0**

A self-powered high-fidelity tuner covering full VHF, medium, and long wavebands with automatic frequency control on VHF.

**DULCI "H4/T" ..... £23.15.8**

A 4 waveband self-powered high-fidelity tuner covering the VHF/FM trans-missions plus the long, medium and short wavebands.

**NEW HIRE PURCHASE TERMS** are available on all above. Illustrated leaflets available—send S.A.E.

### THE DULCI DUAL CHANNEL STEREO

#### PREAMPLIFIERS

**THE "STEREO EIGHT" PREAMPLIFIER ..... £23.2.0**

**THE "STEREO TWO" PREAMPLIFIER ..... £9.9.0**

(Carr. and Ins. 5/- extra.)

**THE LATEST MODELS ARE IN STOCK MANY AT REDUCED PRICES !!**

**SEND S.A.E. FOR ILLUSTRATED LEAFLET**

B.S.R. MONARCH UA8

4-speed mixer Autochanger with Crystal Pick-up

**£6.12.6**

The NEW COLLARO

MODEL RP594 4-speed Single Record Player.

Studio Cartridge **£9.18.9**



The COLLARO "CONQUEST" 4-speed Autochanger, Studio Pick-up ..... **£7.10.0**

The latest COLLARO "CONTINENTAL" 4-speed MIXER Autochanger Studio "O" Pick-up ..... **£8.10.0**

The COLLARO 4-speed Single Record Player, Studio Pick-up..... **£6.6.0**

**THE NEW B.S.R. Model UA12 is in Stock. A 4 "SPEED" MIXER AUTOCHANGER ..... £8.7.6**

UA12 also available incorporating the B.S.R. STEREO Pick-up, plays L.P. and 78 Records ..... **£10.10.0**

B.S.R. MODEL TU9 4-speed Single Record Player, complete with separate Crystal Pick-up ..... **£4.4.0**

Carriage and Insurance on each above 5/- extra.

**HIGH-FIDELITY UNITS ARE ALSO IN STOCK . . . as follows :**

GARRARD MODEL 301 . . . 4HF . . . TA/Mk.II . . . RC90 . . . RC12/4 . . . T.P.A.12 PICK-UP . . . etc.

Send S.A.E. For Leaflet.

**NEW HIRE PURCHASE TERMS ARE AVAILABLE ON ALL EQUIPMENT VALUE £9.0.0 AND OVER.**

### SPECIAL CASH ONLY BARGAIN

A bulk purchase enables us to offer this very useful

**INTERCOM SET OR BABY ALARM for only £5.5.0**

(Plus 5/- carriage & insurance.)

Consists of MASTER UNIT (illustrated) and one EXTENSION, providing 2-way TALK-LISTEN facility. Complete in polished wood cases, size of each only 7 1/2 x 4 1/2 x 5 in. high.

**HOME CONSTRUCTOR**

A RANGE OF "EASY TO ASSEMBLE" PREFABRICATED CABINETS

Designed by the W.B. "STENTORIAN" COMPANY for "Hi-Fi" Loudspeaker systems or to accommodate high-quality equipment. The acoustically designed Bass Reflex Cabinets containing the very successful "Stentorian" Speakers give really first-class reproduction and are well recommended. Models are also available to accommodate high-quality

equipment. Fully illustrated leaflets are available, including complete specifications of the various

STENTORIAN LOUSPEAKERS. PLEASE ENCLOSE S.A.E. WITH ALL CORRESPONDENCE.

Amplifiers, Preamplifiers, Tuning Units, Record Players, etc. All models are very easily assembled, in fact, only a screwdriver is required.

Fully illustrated leaflets are available, including complete specifications of the various

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Fully illustrated leaflets are available, including complete specifications of the various

STENTORIAN LOUSPEAKERS. PLEASE ENCLOSE S.A.E. WITH ALL CORRESPONDENCE.

### A SPECIAL CASH ONLY OFFER !!

This very attractive PORTABLE AMPLIFIER CASE together with a good quality GRAM AMPLIFIER and a matched P.M. SPEAKER.

ALL for ONLY **£87.6** (Plus 7/6 Carr. & Ins.)

The Amplifier consists of a 2-stage design incorporating 3 modern B.V.A. valves and has separate BASS and TREBLE CONTROLS.

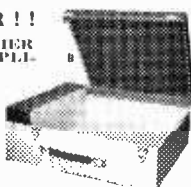
The Portable Case will also accommodate almost any make of Autochanger and is attractively finished in Mushroom Grey Rexine.

WE ALSO SUPPLY SEPARATELY—

(a) The 2-stage (plus Rectifier) AMPLIFIER **£42.6**

(b) THE PORTABLE CARRYING CASE **£3.17.6**

(c) P.M. SPEAKER 18/9 Carriage and Insurance 4/- extra.



### STERN'S MK. II "fidelity"

#### F.M. TUNING UNIT

PRICE **£14.5.0** (Plus 5/- Carr. and Ins.)

HIRE PURCHASE: Deposit £9.17.0 and 12 Monthly Payments of £10.11.

Incorporates the latest MULLARD PERMEABILITY TUNING HEART and the corresponding MULLARD VALVE LINE-UP. A really first-class Tuner, very attractively presented and comparable to many offered at much higher prices. Power consumption is only 1.5 amps. at 6.3 volts and 25 ma at 250 volts.

**HOME CONSTRUCTORS! YOU CAN BUILD THIS TUNING UNIT FOR ONLY £10.10.0 (Plus 5/- Carr. & Ins.)** Please send S.A.E. for fully descriptive leaflet, or the Assembly Manual is available for 1/6.



**109 & 115 FLEET ST., LONDON, E.C.4**

Telephone: **FLEET STREET 5812/3/4**



**EASY TO BUY . . .** (delivered to your door . . . post free). **FASCINATING AND SO SIMPLE TO BUILD** (even for beginners). **PROFESSIONAL IN PERFORMANCE AND APPEARANCE . . . MILLIONS OF HEATHKIT "build-it-yourself" models are in regular use throughout the world because they are so good and such value for money. THEY'LL SAVE YOU POUNDS!**



UXR-1

**TRANSISTOR PORTABLE model UXR-1 . . . . . £16.18.6**

This Dual-wave, 6 transistor portable radio, strikingly styled in handsome solid leather case, is universally admired. The tone is rich and brilliant, and it performs well everywhere, including in a car. Easily built in 6 hours.

**R,C BRIDGE model C-3U . . . . . £7.19.6**

Measures Capacitance, 10 pf (0.0001  $\mu$ F) to 1,000  $\mu$ F; Power Factor; Resistance, 100  $\Omega$  to 5 M $\Omega$  and indicates leakage. Automatic Discharge Safety-Switch.



C-3U



USP-1

**AUDIO SIGNAL GENERATOR model AG-9U . . . £19.3.0**

10 c/s to 100 kc/s. Sine-Wave output 10 V f.s.d. down to 3 mV f.s.d. Less than 0.1% distortion (20 c/s to 20 kc/s). Decade frequency selection. Decibel ranges, -60 to +22. 1% precision resistors.



AG-9U



S-33

**HI-FI STEREO BOOSTER model USP-1 . . . . . £5.19.6**

Enables low-output pick-ups (e.g., Decca ffs), tape heads, and microphones to load fully amplifiers of medium sensitivity.

**5in. OSCILLOSCOPE model O-12U . . . . . £34.15.0**

This fine general-purpose 'scope has "Y" sensitivity of 10 mV/cm. and covers 3 c/s to over 5 Mc/s. Rise time is 0.08  $\mu$ secs or less. Timebase 10 c/s to 500 kc/s in 5 steps. Electronically stabilised. Voltage calibrator.



O-12U



S-88

**HI-FI 6 W. STEREO AMPLIFIER model S-33 £11.8.0**

World's best value in low-price Stereo. 0.3% distortion at 2.5 W./chnl. Ideal for average room.

**HI-FI 16 W. STEREO AMPLIFIER model S-88 £25.5.6**

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# Practical Wireless

VOL. XXXV, No. 632, SEPT. OCT. 1959

Editorial and Advertisement

Offices :

**PRACTICAL WIRELESS**

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## Contents

	Page
Editorial ... ..	455
Round the World of Wireless ...	456
A Direct-Coupled Amplifier ...	458
Selecting Resistors ... ..	460
A Twin Speaker Bass-Reflex Cabinet ... ..	461
A Pre-set M.W. Booster Stage ...	463
A Master Relay Unit ... ..	466
On Your Wavelength ... ..	471
Notes on M.W. Aerials ... ..	472
An S-Meter for the RI155 ... ..	473
A T.R.F. Communications Re- ceiver ... ..	475
A Handy Signal Tracer ... ..	479
Silicon Power Rectifiers ... ..	481
Beginners' Test Meter ... ..	482
Transmitting Topics ... ..	486
Amateur Radio for Beginners ...	493
Shortwave Section ... ..	497
A Microphone Pre-amplifier ...	501
News from the Clubs ... ..	505
Open to Discussion ... ..	509

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

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## THE RADIO SHOW

THE Radio Show, to be held at Earls Court as usual will open to the public on August 26th and close on September 5th. The exhibition will be open from 11 a.m. to 10 p.m. As this issue goes to press, some weeks before the Show opens, there is no evidence of any outstanding developments in the radio industry. No doubt much of the interest this year will centre on high fidelity sound reproduction and especially on stereophonic disc records which are now more readily available than at the previous Show. The Audio Hall, which was introduced last year, will be larger, reflecting the growing interest in that branch of radio.

As usual the BBC will have a large exhibit intended to portray their sound services, as well as their television service. There will also be stands manned by the Forces which will interest many younger readers.

At this time of year many radio clubs and small groups of radio enthusiasts are organising their annual "pilgrimage" to Earls Court and perhaps a word of advice may not be out of place. Remember that a day spent travelling and then walking for several hours around an exhibition such as the Radio Show, before a long journey home will considerably tire the members of the party. The organisers of the party should take this into account and not arrange too strenuous a programme otherwise the pleasure of visiting the Show will be marred by fatigue.

Both PRACTICAL WIRELESS and our companion journal *Practical Television* will be on show at the Exhibition. Our Stand No. 105 is on the ground floor, where members of the editorial staffs of both journals will be in attendance to assist readers with technical queries. We do hope, however, that all readers who visit the Show will call upon us whether they desire advice or not. We look forward to meeting them in person.

In our next issue we shall publish a comprehensive, illustrated survey of trends and developments revealed at the Show for the benefit of those readers unable to attend personally.

### OUR FREE QUERY SERVICE

ONCE again we find it necessary to remind readers of the rules of our Free Query Service. The following points should be carefully noted :

- (i) All queries must be accompanied by the query coupon from the current issue (to be found on page iii of the cover).
- (ii) If a postal reply is required, a stamped and addressed envelope must be enclosed with the query.
- (iii) We cannot undertake to answer technical queries over the telephone.

THE printing dispute which has prevented normal publication of this journal since the issue dated July, 1959, has been settled and we shall now be able to publish normally.

We greatly regret the inconvenience which this dispute has caused to readers, but we are certain they will appreciate that this break in publication has been due to circumstances beyond our control.

Our next issue, dated November, will be published on October 7th

# ROUND THE WORLD OF WIRELESS



## Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of June, 1959, in respect of wireless receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland. The numbers include licences issued to blind persons without payment.

Region	Total
London Postal ... ..	881,820
Home Counties ... ..	882,442
Midland ... ..	651,264
North Eastern ... ..	757,887
North Western ... ..	604,671
South Western ... ..	527,151
Wales and Border Counties ... ..	323,505
Total England and Wales ... ..	4,628,740
Scotland ... ..	565,758
Northern Ireland ... ..	157,797
Grand Total ... ..	5,352,295

## New British Standard

*Fixed electrolytic capacitors (aluminium electrodes) (BS: 2134), Part 2: 1959. List of standard capacitors.*

THIS new publication forms Part 2 of BS:2134 "Fixed electrolytic capacitors (aluminium electrodes)" for use in telecommunication and allied electronic equipment. It specifies patterns, sizes, values and ratings for a range of fixed electrolytic capacitors for use in telecommunication and allied electronic equipment.

Copies of this Standard may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1. Price 5s. (Postage will be charged extra to non-subscribers.)

## Order for Telephone Cable Equipment

AN order for 92 submerged two-way repeaters and 11 submerged equalisers of British design for the trans-Atlantic section of the Commonwealth round-the-world telephone cable, at a cost of about £1,800,000, has been placed by Cable and Wireless Ltd. with Standard Telephones and Cables Ltd., of London.

## By "QUESTOR"

They will be made at Standard Telephones' North Woolwich factory, and will be jointed into the cable (which is to be laid between Scotland and Newfoundland in the summer of 1961).

## R.A.F. Communications System on Maldivé Islands

THE Ministry of Supply, acting on behalf of the Air Ministry, has placed a contract with Marconi's Wireless Telegraph Co. Ltd. for the planning, supply and installation of a high-power radio station at the R.A.F. Staging Post in the Maldivé Islands, which comprise 17 atolls situated some 200 miles off the south-west coast of

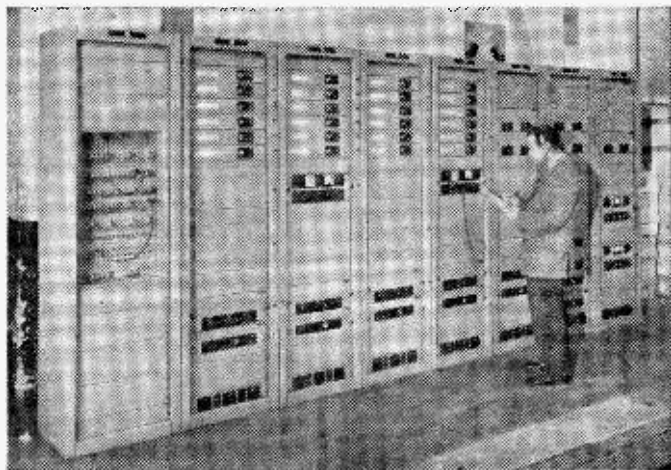
India and 420 miles to the west of Ceylon.

In all, 14 communications transmitters and nine receivers are to be provided together with the necessary drives, duplex receiving units, coaxial feeder exchanges, ancillary equipments, test loads and installation material.

The transmitting station is being built on Hitaddu, one of the 7,000-odd islands in the Maldivé group, and the receiving station is sited on the island of Gan, approximately six miles from Hitaddu.

## Radio Message via the Moon

EXPERIMENTS at Jodrell Bank on the reflection of radio waves from the moon have now been extended in an effort to establish a radio link *via* the moon between the radio telescope at Jodrell Bank and the Air Force Research Centre at Massachusetts in the U.S.A. The first message *via* the moon was sent in morse code and read as follows: "Jodrell Bank to Air Force Research Centre, Cambridge, Massachusetts. We'll have no trouble with fishing



A Marconi drive assembly of the type to be supplied for the Maldivé radio station.

boats on this circuit." Subsequently the intelligibility of voice transmissions was established. The transmitting and receiving equipment used with the telescope was manufactured by Pye Telecommunications Ltd.

### New Computer

A TRANSISTORISED desk-size electronic digital computer, called Sirius, designed to fill the gap in the small general purpose computer field in Europe, is being manufactured by Ferranti Ltd.

It will cost £15,000 and the first production models will be available this autumn. The manufacturing schedule will enable delivery to be made within three months of ordering.

Sirius is believed to be the smallest and most economically priced computer yet made in Europe. It weighs only 5 cwt., measures approximately 7ft. × 3ft. 6in. × 4ft. high, including a standard office desk, and can be powered by plugging into ordinary power sockets in any office or laboratory.

### R.I.C. Chairman

MR. EDWARD E. ROSEN (Ultra Electric Ltd.) has been elected chairman of the Radio Industry Council in succession to Mr. G. Darnley-Smith (Bush Radio Ltd.) who has held the position for the past seven years and previously held the office in 1946-7. Mr. Hector V. Slade (Garrard Engineering and Manufacturing Co. Ltd.) succeeds Mr. Rosen as vice-chairman of the R.I.C.

### V.H.F. Transmitters

THE BBC's television and V.H.F. sound transmitting station at Douglas, Isle of Man, began radiating the Light and Third Programmes on V.H.F. on June 15. The North of England Home Service has been broadcast on V.H.F. from Douglas on 92.8Mc/s since December 23, 1957.

The Light Programme will be radiated on 88.4Mc/s and the Third Programme on 90.6Mc/s, each with a mean effective radiated power of 3.3kW (the same power as is used for the existing North of England Home Service). The transmissions will be horizontally polarised.

### Anechoic Chamber

AS part of an intensive two-year research programme into the causes of transformer noise, the Distribution Transformer Department of Ferranti

### New Film

THE MULLARD Educational Service has announced the introduction of a new teaching film entitled "Photo-Emission." It runs for 18 minutes, on 16mm.



The Ferranti Sirius, a new transistorised desk-size electronic digital computer.

Ltd., at West Gorton, Manchester, have recently completed a new anechoic chamber.

The research programme is being undertaken as a result of the Electricity Board/BEAMA Sub-Committee proposals that manufacturers should take measurements of noise emitted from transformers with a view to the eventual specification of maximum sound levels for transformers ranging from 1,000kVA to 100,000kVA.

### Swedish Fair

THIS year's St. Erik's Fair, Stockholm, will be held from September 2 to 13. British representation is organised by Trade Fairs and Promotions Ltd., subsidiary company of George Newnes, who plan to promote Britain as a principal of the Fair.

The popular consumer goods in the general area will include household machines, textiles, radio and TV, home furnishings, and probably, for the first time since 1952, motor cars.

black-and-white sound film, and is backed up by comprehensive teaching notes.

The film starts by describing the working and construction of a simple photo-emissive cell, and goes on to show some of the early experiments of Elster, Geitel and Millikan. A short survey of the many practical and laboratory applications of photo-emissive cells is given.

"Photo-Emission" is available on hire from the Educational Foundation for Visual Aids, Film Library, Brooklands House, Weybridge, Surrey.

### Radio-telephones for A.E.A.

THE HEALTH PHYSICS DEPARTMENT of the U.K. Atomic Energy Authority are having installed a comprehensive radio-telephone system at eight of their establishments. The Health Physics team keeps a constant check of the level of radioactivity in the area surrounding the establishments. The equipment will enable the teams to report back their findings and receive instructions.

# A Direct-Coupled AMPLIFIER

A SIMPLE TWIN-VALVE PLUS RECTIFIER  
CIRCUIT USING FEW COMPONENTS

By J. S. Kendall

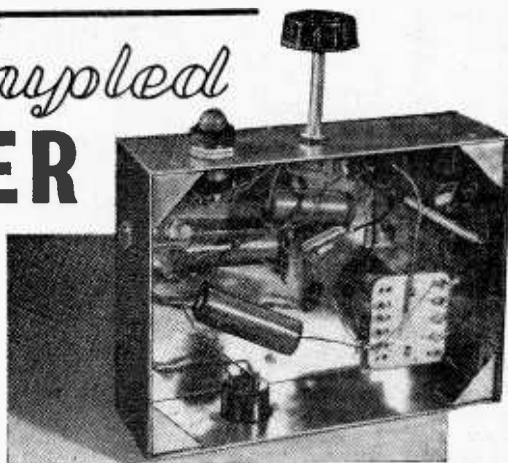
THE direct-coupled amplifier has been a rather controversial circuit ever since the original in the early 1930s. There have been many circuits published by different writers. However, new valves bring new circuits: this circuit uses an ECL82. The circuit is very simple—and can be recommended to the newcomer to the construction of amplifiers.

## Valve

The ECL82 is a triode and output pentode contained within the same envelope. The pentode has the feature that it requires anode and screen voltages of only 200 volts for an output power of 3.5W and a distortion of 10 per cent. This latter figure can, of course, be reduced by the use of negative feedback. The triode section has an amplification factor of 70 with an impedance of 28k. Thus the valve can be used in the conventional type of triode and pentode amplifier with only 200V on the H.T. line or with, say, 250V on the H.T. line in a direct-coupled amplifier.

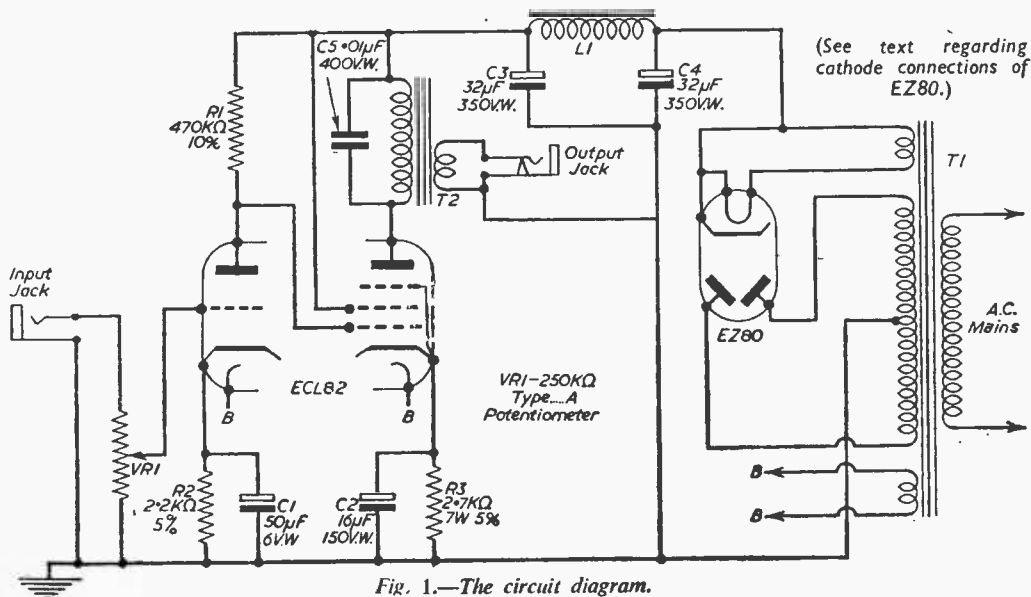
## Components

The mains transformer is of the type known as



a service replacement. It is designed for service work and is therefore readily available at a reasonable price. The valveholders chosen were nylon loaded P.F. moulded types, but this is not essential and the normal P.F. moulded types should be quite suitable. Paxolin types are not recommended, as they break down too easily when used for the rectifier valve. The capacitors used in the original and recommended are tubular types. The constructor must be wary of the low-priced "surplus" capacitors that are too often available at a low price. They may be perfect, but on the other hand they may be old stock and break down—with the cost to the constructor of the rectifier valve and the mains transformer.

The chassis used is a normal 18 s.w.g. aluminium type, but there is nothing to prevent the circuit from being built on one of steel of similar dimensions. The writer has found that the steel



chassis is far less prone to allow parasitic oscillations in the circuit mounted on it.

**Heater Supply**

The matter of the dial light is left to the constructor, and if one is used, it should be connected to the heater line. There is also no reason why in this amplifier both the valves should not be joined to the same heater winding, but it is essential that one side of it, or the centre tap if provided be connected to the chassis and not just left "floating." A floating heater winder can cause endless trouble. If the same winding is used for the heaters of the two valves, the cathode of the EZ80 should not be connected to the heater or a shorted H.T. supply will result.

The circuit of the amplifier is shown in Fig. 1, and its simplicity is striking. There is only one volume control, and three fixed resistors, four electrolytics (two of these are for smoothing) and one small fixed capacitor. As the circuit is of the directly coupled type, certain resistors are critical. For example, R2 should be of 5 per cent. tolerance but need not be a high stability type (British Grade One Standard). R1 is not particularly critical, but should be of 10 per cent. tolerance. Resistor R3 should be of 5 per cent. tolerance and wire-wound.

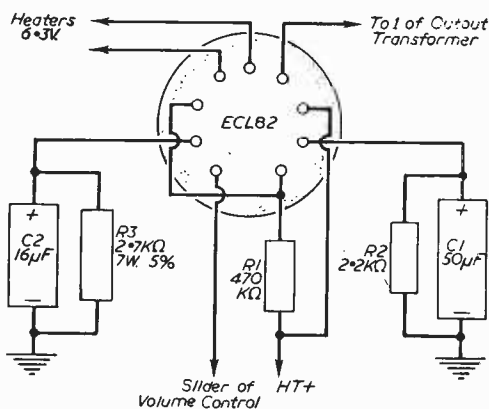


Fig. 2.—Valve base wiring.

**Wiring**

As previously stated, the layout of the circuit is not critical, but a guide to the valve base wiring will be obtained from Fig. 2. The base is as viewed from the underside. The resistor and capacitor from pin two should *not* be wired against each other as the heat from the resistor will cause the insulation of the capacitor to melt.

**COMPONENTS LIST**

- R1—470k. 10 per cent.,  $\frac{1}{2}$  w.
- R2—2.2k. 5 per cent.,  $\frac{1}{2}$  w.
- R3—2.7k. 5 per cent., 7 or 10 w.
- C1—50μF 6 v.w.
- C2—16μF 150 v.w.
- C3—4-32 + 32μF 350 v.w.
- C5—0.01μF 350 v.w.
- L1—H.T. smoothing choke.
- T1—Mains Transformer:  
Primary : 10-0-200/220/240 v. (or to suit mains supply).  
Secondaries : 300-0-300 v. 50mA.  
6.3 v. 1 A.  
6.3 v. 1 A. (optional, see text).
- T2—Output trans ratio.
- VR1—250k. pot. (Type A).
- 1 chassis approx. 6in. x 8in. x 2½in.
- Panel lamp and holder.
- 3-pin mains connector and plug (optional).
- Wire, bolts, nuts, solder, etc.
- Valves : ECL82 and EZ80.

**TABLE OF VOLTAGE READINGS**

With the exception of the voltage at the cathode of the triode section, all readings were taken with a 5,000 ohms per volt meter on the 500 volt range. Cathode of rectifier valve, reservoir capacitor

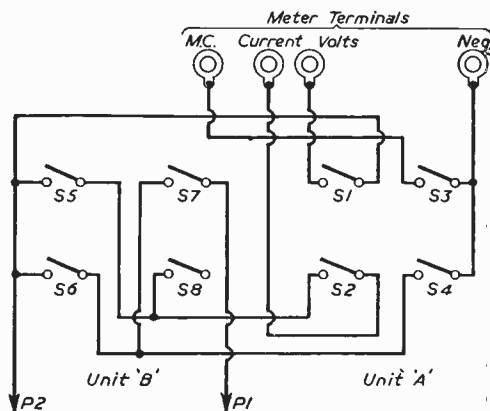
Cathode of rectifier valve, reservoir capacitor	320 v.
Smoothing capacitor, output valve screen	310 v.
Anode of output pentode	300 v.
Anode of triode	70 v.
Cathode of pentode	90 v.
Cathode of triode	0.6 v. (10 v. range)

The best two guide readings are the cathode of the rectifier valve, and the cathode of the output triode. If this latter is low suspect R2, or that C1 is reversed, or if it is very low, that R1 is open-circuit. If the voltage is high, then suspect that R2 is high or open-circuit, low emission triode or that R1 is low in value.

**A SET ANALYSER**

(June issue, page 288)

IN the circuit diagram of the Analyser the two D.P.C.O. switches were shown in block form, and this may have caused confusion in the minds of readers who are not familiar with such switch arrangements. The diagram below, on much the same lines as the one given previously, shows clearly the action of the two switches, and should remove any difficulties.



Switch Position	Closed	Open
Volts	S1, S3	S2, S4
Current	S2, S4	S1, S3
Reverse	S5, S7	S6, S8
Normal	S6, S8	S5, S7

# Selecting Resistors

THE PROBLEM OF TOLERANCE

By J. Brown

**M**OST constructors are well aware of the colour coding of components, especially resistors, but do they consider the fourth colour? This is the colour that denotes the percentage tolerance of the component. In these days of preferred values this fourth colour means a great deal, especially in the fields of television and hi-fi. Manufacturers cannot, under conditions of mass production, be expected to produce the resistor as a precision component. If we require a precision resistor we pay a great deal for the accuracy. The more accurate resistor is only needed in the case of test gear or similar equipment. Many of our advertisers cater for this field.

This article is mainly concerned with the cheaper carbon type resistor. These are normally accurate enough for ordinary electronic work and are selected during the manufacture and colour coded accordingly. The

(Continued on page 480)

CHART OF POSSIBLE VARIATIONS IN RESISTORS FOR 3 TOLERANCES							
1	2	3	Value	plus/minus 10 per cent. Tol.	plus/minus 20 per cent. Tol.	plus/minus 5 per cent. Tol.	
			ohms	ohms	ohms	ohms	ohms
Brown	Black	Black	10	10-11	10-12	—	—
Brown	Red	Black	12	11-13	—	—	—
Brown	Green	Black	15	14-16	12-18	—	—
Brown	Grey	Black	18	17-19	—	—	—
Red	Red	Black	22	20-24	18-26	—	—
Red	Violet	Black	27	25-30	—	—	—
Orange	Orange	Black	33	30-36	27-39	—	—
Orange	White	Black	39	36-42	—	—	—
Yellow	Violet	Black	47	43-51	38-56	—	—
Green	Blue	Black	56	52-61	—	—	—
Blue	Grey	Black	68	62-74	55-81	—	—
Grey	Red	Black	82	74-90	—	—	—
Brown	Black	Brown	100	90-110	80-120	95-105	—
Brown	Red	Brown	120	108-132	—	—	—
Brown	Green	Brown	150	135-165	120-180	145-155	—
Brown	Grey	Brown	180	162-198	—	—	—
Red	Red	Brown	220	198-242	178-264	209-231	—
Red	Violet	Brown	270	243-297	—	—	—
Orange	Orange	Brown	330	297-363	264-396	315-345	—
Orange	White	Brown	390	351-429	—	—	—
Yellow	Violet	Brown	470	423-517	376-564	447-493	—
Green	Blue	Brown	560	504-616	—	—	—
Blue	Grey	Brown	680	612-748	544-820	646-714	—
Grey	Red	Brown	820	738-902	—	—	—
Brown	Black	Red	1k	900-1.1k	800-1.2k	950-1050	—
Brown	Red	Red	1.2k	1.08k-1.32k	—	—	—
Brown	Green	Red	1.5k	1.35k-1.65k	1.2k-1.8k	1.43-1.57k	—
Brown	Grey	Red	1.8k	1.62k-1.98k	—	—	—
Red	Red	Red	2.2k	1.98k-2.42k	1.76k-2.64k	2.19k-2.31k	—
Red	Violet	Red	2.7k	2.43k-2.97k	—	—	—
Orange	Orange	Red	3.3k	2.97k-3.63k	2.6k-4.39k	3.14k-3.4k	—
Orange	White	Red	3.9k	3.51k-4.29k	—	—	—
Yellow	Violet	Red	4.7k	4.23k-5.17k	3.76k-5.64k	4.47k-4.93k	—
Green	Blue	Red	5.6k	5.04k-6.16k	—	—	—
Blue	Grey	Red	6.8k	6.12k-7.48k	5.44k-8.16k	6.46k-7.14k	—
Grey	Red	Red	8.2k	7.38k-9.02k	—	—	—
Brown	Black	Orange	10k	9k-11k	8k-12k	9.5k-10.5k	—
Brown	Red	Orange	12k	10.8k-13.2k	—	—	—
Brown	Green	Orange	15k	13.5k-16.5k	12k-18k	14.3k-15.7k	—
Brown	Grey	Orange	18k	16.2k-19.8k	—	—	—
Red	Red	Orange	22k	19.8k-24.2k	17.6k-26.4k	20.9k-23.1k	—
Red	Violet	Orange	27k	24.3k-29.7k	—	—	—
Orange	Orange	Orange	33k	29.7k-36.3k	26.4k-39.6k	31.4k-34.6k	—
Orange	White	Orange	39k	35.1k-42.9k	—	—	—
Yellow	Violet	Orange	47k	42.3k-51.7k	37.6k-56.4k	44.7k-49.3k	—
Green	Blue	Orange	56k	50.4k-61.6k	—	—	—
Blue	Grey	Orange	68k	61.2k-74.8k	54.4k-81.6k	64.6k-71.4k	—
Grey	Red	Orange	82k	73.8k-90.2k	—	—	—
Brown	Black	Yellow	100k	90k-110k	80k-120k	95k-105k	—
Brown	Red	Yellow	120k	108k-132k	—	—	—
Brown	Green	Yellow	150k	135k-165k	120k-180k	142.5k-157.5k	—
Brown	Grey	Yellow	180k	162k-198k	—	—	—
Red	Red	Yellow	220k	198k-242k	176k-264k	209k-231k	—
Red	Violet	Yellow	270k	243k-297k	—	—	—
Orange	Orange	Yellow	330k	297k-363k	264k-396k	314k-346k	—
Orange	White	Yellow	390k	351k-429k	—	—	—
Yellow	Violet	Yellow	470k	423k-517k	376k-564k	447k-493k	—
Green	Blue	Yellow	560k	504k-616k	—	—	—
Blue	Grey	Yellow	680k	612k-748k	544k-816k	646k-714k	—
Grey	Red	Yellow	820k	738k-902k	—	—	—
Brown	Black	Green	1M	.9M-1.1M	0.8M-1.2M	950k-1,050k	—
Brown	Red	Green	1.2M	1.08M-1.32M	—	—	—
Brown	Green	Green	1.5M	1.35M-1.65M	1.2M-1.8M	—	—
Brown	Grey	Green	1.8M	1.62M-1.98M	—	—	—
Red	Red	Green	2.2M	1.98M-2.42M	2.2M-2.64M	—	—

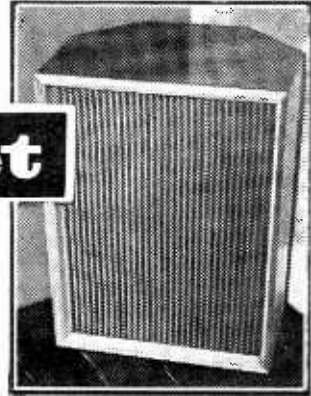
# A Twin Speaker

## BASS



## Reflex

## Cabinet



FINAL DETAILS OF THE CONSTRUCTION WITH INFORMATION  
ON A SUITABLE CROSS-OVER NETWORK By L. F. G. Burrell

(Continued from p. 410 July issue.)

WHEN preparing the battens allow  $\frac{3}{16}$  in. for the depth of the rebated top "d." The overall dimensions for these battens should be the shortest of those taken at all four joints as the top has yet to be trued and squared.

Square up the long batten lengths and with two face edges set the bevel square to  $112\frac{1}{2}$  deg., and work from the narrow face edges or set the bevel square to 135 deg. working the whole bevel. Fig. 4, by marking the bevel on both ends, marking down the length of the timber and planing one bevel first, using it to check the other. When these battens are ready, drill and countersink them at 90 deg. to the bevelled sides for screwing.

### The Battens

The battens should now be screwed temporarily in place on to sides "c" left and right. A temporary batten, cut to the true internal width of the cabinet and pinned across the batten tops, will stop the screwed sides from flapping.

In the same fashion as sides "c" left and right, true up and fix in place the sides "b" left and right. This will be a slightly more complicated

operation than for the former, because of the lack of one square edge; but by constantly offering up and checking in position and by planing only a little at a time a neat joint should result. Follow the same procedure for cutting the back fixing battens as for the side fixing battens, and screw them in place on the last two sides. The back should now be prepared and screwed in place. Do not forget that it sits on top of the baseboard and is screwed from the outside with screws and screwcaps to make it readily removable.

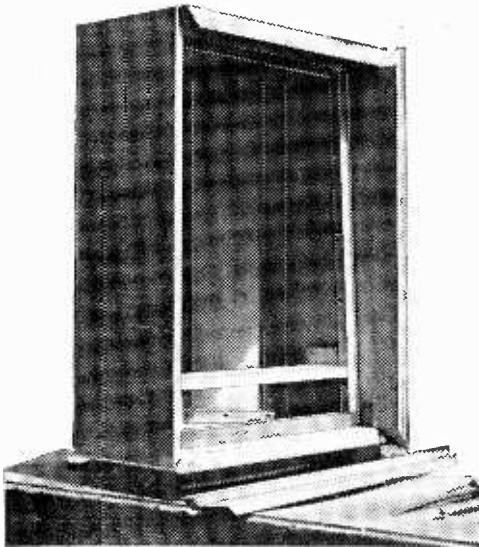
Strip down the work so far and glue and screw in position. (Not the back—screw only.) Check and cramp where necessary to maintain squareness and angles.

### The Top

True up and rebate the top allowing a slight overlap of timber all round for cleaning up later. This rebate should be marked out from internal sizes as existing and should be exactly as the bottom but slight errors in marking out and planing may have occurred.

When the glue on the main carcass has set, the top edges of the cabinet may be trued up for fitting the top. Take care not to split the oak veneer by hasty or careless handling of the plane and *have it sharp and set very fine*. By placing the top upside down on the cabinet, the trueness of the edges can be checked and the squareness of the top with the sides. When the top is a nice tight fit, the top fixing battens should be fixed in place, similar to the bottom ones. When dry clean up any irregularities on mitres or sides of battens and glue and screw in place. Sash cramps will assist in getting a tight joint at the top. A length of softwood with fixed blocks and a set of folding wedges will serve equally well.

Leave cleaning off the top edges until all internal work is done as the projection will serve to protect the corners from damage. Prepare, glue, and screw the baffle board fixing battens in place next (not forgetting their slope) and the two small battens for the deflection board. The deflection board is next; cut it from  $\frac{3}{4}$  in. block board or 1 in. softwood and glue and screw in place. At this stage, the projecting edge of the top may be carefully cleaned off. Work from

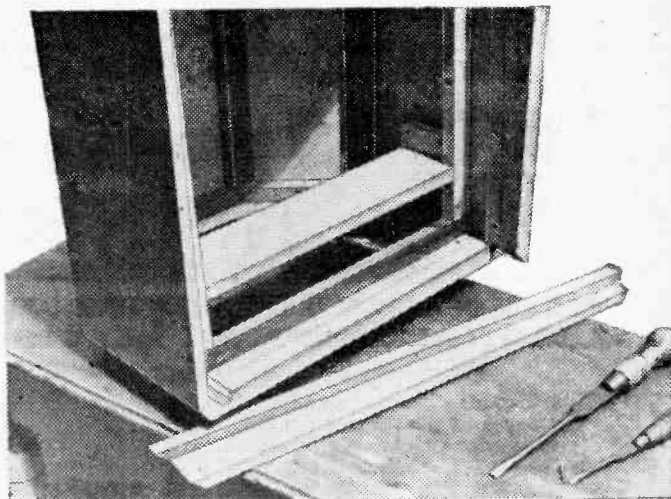


The cabinet in course of construction.

front to back with a finely set, sharp smoothing plane to eliminate risk of damage to top veneer, follow by cleaning front edges in the same way.

**The Front Framing**

The front framing and lining may be either made up from two pieces of timber or if material is available, cut from the solid. The former is easier and cheaper for the amateur and will therefore be described. From  $3\frac{1}{2}$  in.  $\times$   $\frac{1}{2}$  in. and  $1\frac{1}{2}$  in.  $\times$   $\frac{1}{2}$  in. oak cut off suitable lengths and true and square up. Glue up in pairs as in Fig. 1 (c) and allow to set. Clean any surplus glue from the rebate so formed and square up front edge. With bevel-square and try-square mark the mitres and cut off with tenon saw. Clean off the internal bevel and cut to the slope of the baffle board fixing battens. Smooth up the internal faces with glasspaper before gluing and screwing in place. Keep screws  $\frac{1}{2}$  in. away from the baffle board fixing battens. They will then be covered by the baffle board and not spoil the finished appearance.



View showing the bottom of the cabinet.

**The Baffle Board**

The speaker and port holes in the baffle board can be drilled and cut as was the hole in the base. Ensure it has enough play when held in place to allow one thickness of Tygan mesh on each edge. Before screwing the speakers and crossover in place, the face and edges of the holes must be stained black. Lay the Tygan mesh out on a flat surface, place the baffle board on top and stretch and tack the mesh in place.

**Cross-over Unit**

A simple and inexpensive cross-over unit can easily be built and assembled on a ply baseboard about the size of a postcard. Paper block capacitors are necessary, and many of the advertisers in this journal can supply these quite cheaply. Capacitors of the electrolytic type cannot be used.

About four of these block condensers should be secured, say, two  $4\mu\text{F}$  and two at  $2\mu\text{F}$ .

(Continued on page 476)

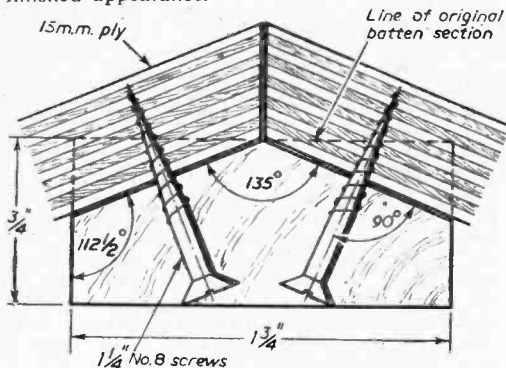


Fig. 4.—Details of the levelled battens.

Cramps should be used to make certain of tight joints in this last operation. When dry, clean off the projecting sides of the framing and the front edges.

**Cleaning Up and Polishing**

Clean up the whole cabinet with No. 1  $\frac{1}{2}$  and No 0 glasspaper using a cork block. A scraper used on any tears or coarse grain will give a superior finish. Any favoured method of finishing may be used: French polish, plastic resin polish or varnish.

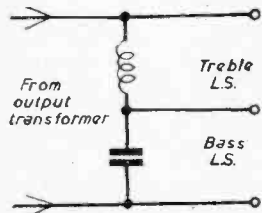
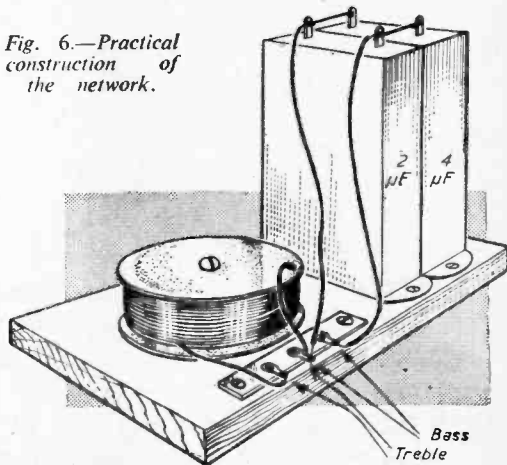


Fig. 5.—Circuit of the crossover network.

Fig. 6.—Practical construction of the network.





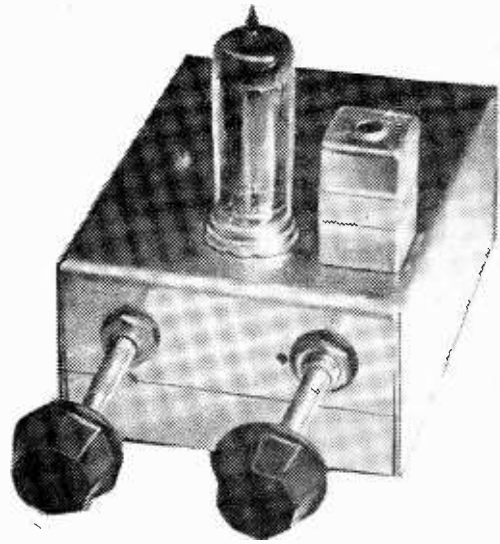
# A Pre-set M.W. Booster Stage

AN ADD-ON UNIT FOR IMPROVING RECEPTION  
By R. M. Terry

**T**HIS add-on unit is intended to give improved reception of one pre-selected station, as well as to allow the receiver to be used in the normal manner. Current may be drawn from the receiver itself in most cases, about 15mA at 200 to 250V and 0.2A at 6.3V being necessary. This slight extra load will usually be within the capacity of the receiver power pack. If circumstances make it impossible to take current from the receiver, then the unit can be provided with a separate transformer and small contact-cooled rectifier, so that external power supplies are not required.

### Switching

The booster has a two-way switch, and this gives untuned operation in one position. The unit then runs as an untuned R.F. stage, the receiver being used on any wavelength, in the normal manner. With the switch in the second position, a pre-tuned dust-cored coil is introduced. This considerably increases sensitivity and volume, and also gives an improvement in selectivity. The larger signal also allows the A.V.C. system in the receiver to function more effectively, and



A.V.C. can also be applied to the booster. As a result the possibility of the station fading, or varying in strength, is much reduced. This is a great advantage with a station such as Radio Luxembourg, for which the booster is primarily designed. But it is worth noting that it can be used with some other pre-selected station, and this is useful in places where some wanted transmission, such as the Third Programme, or Light Programme, is not well received.

### Constructional Details

The circuit is shown in Fig. 1, resistor values being for an EF89 or 6DA6. A chassis 3½ in. × 4½ in. × 2 in. deep will accommodate the parts, and the underneath wiring plan is shown in Fig. 2. There is no wiring above the chassis.

The tag board components can be soldered on first. Extra nuts should be used to space the tag board slightly from the chassis. The H.F. choke is screened, tags projecting through clearance holes as in Fig. 2.

### Wiring

Most of the wiring will be seen from Fig. 2, the change over switch being shown in Fig. 3. Leads are best soldered to the switch tags before the coil is fitted in its clip. All wiring should be reasonably short and direct, and the point marked M.C. consists of a tag firmly bolted to the chassis.

### Power Supplies

Four coloured flex leads are used for power supplies, black indicating H.T. negative, red H.T. positive, and yellow 6.3V for heater. To simplify connecting the unit, a plug can be attached to these leads, with a matching multi-way socket on the receiver. The base from a discarded valve, with holder, would serve. The A.V.C. lead is taken to the A.V.C. line of the receiver, which can usually be located quite easily at the first I.F. transformer, or aerial coils. This connection is not always essential, as will be explained.

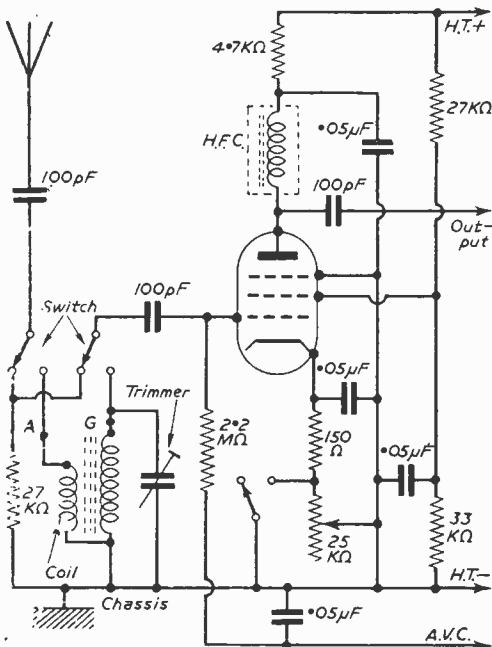


Fig. 1.—Circuit of the unit.

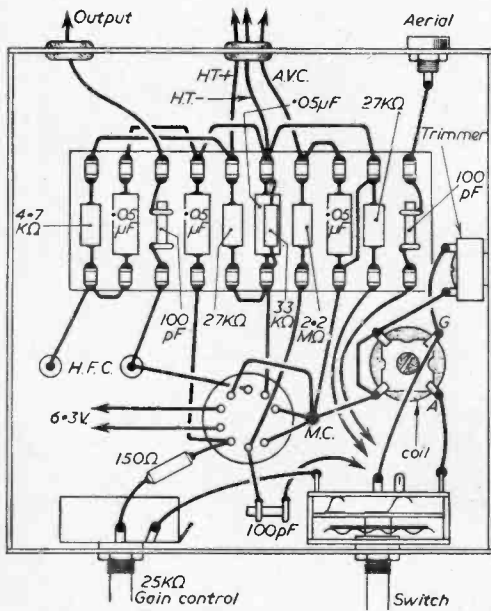
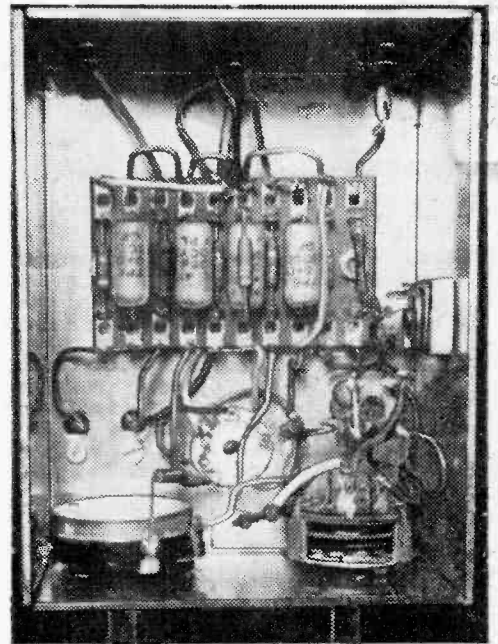


Fig. 2.—Underchassis wiring plan.

The aerial is taken to the aerial socket on the unit, and the lead marked "output" is plugged into the receiver aerial socket. This lead should be short and direct, and clear of the aerial, or it will become necessary to screen it in order to avoid oscillation.

With the receiver switched on, the trimming point for the pre-selected station should easily be found. The unit may be switched to the untuned position, and the receiver tuned in first. Adjustment of the coil will modify frequency, in addition to changing the trimmer setting, so that quite a large band can be covered with one trimmer. However, the maximum trimmer capacity has to be chosen to suit the wavelength in view. For 208 metres, and other stations low in the M.W. band, 50pF is satisfactory. For higher wave-



lengths, more capacity is necessary, and 500pF may be used for the 464 metre Third Programme. In all cases it is only necessary to peak the trimmer (or core) carefully for the best volume, an insulated blade or knitting needle being used for adjustments. The gain control is set to give a suitable degree of amplification. It is desirable to keep the core as far as possible central in relation to the coil, in order to maintain the high "Q" of the coil.

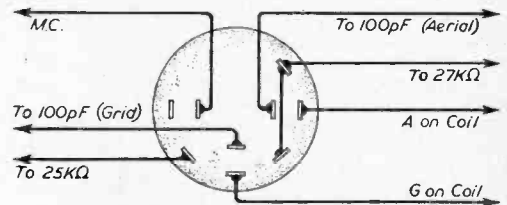


Fig. 3.—Connections to the switch.

**Aerial and A.V.C.**

If an A.V.C. connection is not made to the receiver the 2.2M resistor should be returned to the booster chassis. Using A.V.C. with the booster gives better control of fading, and also allows powerful local stations to be kept under control.

Whether or not the A.V.C. connection is essential depends on the receiver and aerial. A.V.C. action in the receiver is improved when the booster is added, even if A.V.C. is not taken to the booster itself, because there is a stronger signal to work the receiver A.V.C. circuit. But if fading is still troublesome, or overloading arises with the local station, then the A.V.C. connection should be made.

**BOOSTER COMPONENTS LIST**

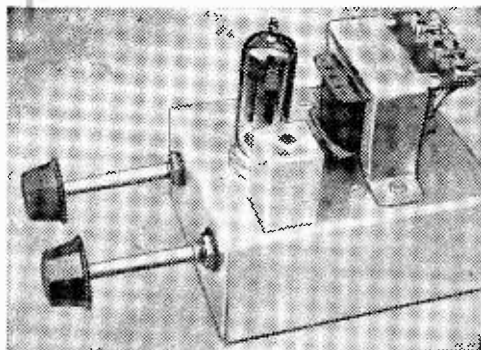
- 2-way, 3-pole switch.
- EF89 or 6DA6 and 9-pin holder.
- M.W. coil.
- 50 pF pre-set.
- Screened H.F. choke.
- Three 100 pF and four 0.05 µF fixed condensers.
- 150 ohm, 4.7 k, 33 k., 2.2 M. and 27 k. resistors.
- 25 k. potentiometer.
- 2 knobs.
- 10-way tag board.
- 4 1/2 in. x 3 1/2 in. x 2 in. chassis.
- Aerial socket, etc.

**POWER-PACK COMPONENTS LIST**

- Mains transformer with 6.3 v. and 220 v. H.T. secondary.
- 250 v., 30 mA. contact-cooled rectifier.
- 2 k. resistor (1 w.).
- 8 plus 16 µF, 350 v., or similar small smoothing condenser.

### Power Pack

Isolation from the mains is very desirable, so a converter transformer with H.T. secondary is used, mounted on top of the chassis near the back. This can be seen in one illustration. Fig. 4 shows the additional components required, suffi-



cient space remaining behind the tag board for these. The contact-cooled rectifier is bolted to the back of the chassis, and any burr should be cleaned from the holes to obtain good thermal

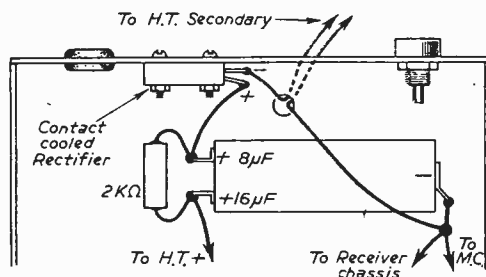


Fig. 4.—Wiring for an internal power supply.

contact. The transformer secondary is taken to chassis and rectifier negative. The 6.3V heater winding is taken to the valve heater, one side of the circuit also being connected to the chassis. The transformer primary is taken to the A.C. mains supply, and if these connections can be made at the receiver transformer or switch, then the receiver mains switch will automatically control the booster as well, so that another switch is not needed.

When H.T. is derived from a separate circuit, as in Fig. 4, the 4.7k anode decoupling resistor and associated .05μF condenser may be omitted.

## Radio Amateurs' Examinations

**SIR**—We have been most interested recently to receive from a number of students applications for details of the Radio Amateurs' Examination and past question papers, arising from the publication in your journal of the interesting notes by Mr. Pearson. It is evident that your journal has quite a wide circulation in view of the number of applications which have reached us a direct result of the publication of your article.

There are, however, two small points to which I feel I ought to draw your attention, although probably the Radio Services Branch of the G.P.O. will have already contacted you in respect of the first. This relates to the exemptions from the Radio Amateur's Examination which previously operated in favour of those who had been serving with the armed forces. These, however, were withdrawn last year and all candidates must now take the theoretical examination.

The other small point is that students making enquiry of us are sending in sums of money varying from 2/6 to 3/-. and in most cases a refund is involved since the pamphlet containing syllabuses costs only 9d. and the papers for the last three years 1/6. so that the total charge is 2/3. I wonder, therefore, if you might feel it useful to make an appropriate announcement in your next issue, since we naturally wish to avoid the delay which occurs when money has to be refunded through our accounts section.

I would like to take this opportunity of express-

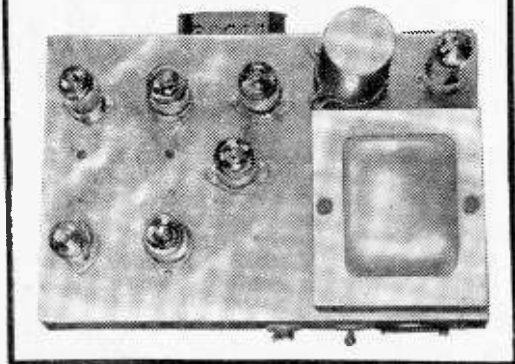
ing my appreciation of the way in which Mr. Pearson has put down the facts for the beginner, and I am quite certain that these articles will serve to stimulate suitable interest on the part of those who have in the past been reluctant to attempt the attainment of a Transmitting Licence.—S. G. CARLOW (City and Guilds of London Institute).

**SIR**—Readers of Mr. J. D. Pearson's article "Becoming an Amateur" (pages 405-6, July, 1959, issue) may be misled by the sections dealing with "Exemption from the R.A.E." and the "Radio Amateur's Certificate." These not only mention exemption from the examination, but also from the Post Office Morse Test. Further, the article stated that the morse test must be taken again if the licence is not taken out within two years of the issue of the Radio Amateur's Certificate.

As this information is based on out-of-date conditions which were discontinued in May, 1958, readers may be interested to know the present position for obtaining Amateur (Sound) Licences.

Applicants must have passed both the Radio Amateurs' Examination and the Post Office Morse Test in order to qualify for a licence. If a licence is applied for more than one year after the date on which the applicant passed the Morse Test, this test must be taken again.—T. A. O'BRIEN (Public Relations Officer, G.P.O.).

# A MASTER RELAY UNIT



THE DESIGN AND WIRING OF THE DISTRIBUTION SYSTEM

(Continued from page 392 of the July issue)

By Hugh Guy

AS was stated in the previous instalment, to facilitate testing, one receiver station is required and can comprise a three position, single pole switch. The general arrangement is shown in Fig. 10.

Connect about 10ft. of wire to the aerial socket and switch on the set. A metered check of the H.T. voltage is advisable to ensure that there are no H.T. shorts and a reading of about 250V will indicate satisfactory operation.

Of the three channels available, select the record programme, and with a pick-up connected to the appropriate input socket, test the operation of this channel with a record. If this channel is to be used with a tape recorder then obviously the tape pre-amplifier output should be used.

In either case the output may appear distorted. This will almost certainly be due to overdriving the input. A fixed value of series resistance should be included in the input circuit—R19 in Fig. 1 (a)—to provide a reduction of input drive.

Now switch to the channel which will provide the Light Programme. Temporarily fix condensers of value 120pF, one each across the secondaries of the aerial and H.F. coils. Tune the H.F. coil by varying the dust-core until the Light Programme signal appears at its maximum strength, then repeat the process with an aerial coil. If the programme appears with both cores adjusted to about mid point of their traverse the cores may be locked using

6B.A. nuts, and the 120pF condensers left in position. If, however, the programme appears at one end of the traverse of the cores then the capacitance should be reduced in value.

The procedure is repeated on the remaining channel to select the regional Home service required. In the London region, capacitors of about 180pF are required. For other regions some experimenting must be attempted: higher values will be required if the wavelength of the desired programme is longer than that of the London region.

Before finally locking the dust cores in position the unit should be left to run for about half an hour to become thoroughly "warmed-up."

## Distribution Systems

The method of laying out the distribution system needs careful attention from considerations of circuit arrangement as certain configurations can introduce serious crosstalk problems.

Crosstalk arises if signal current from one channel is permitted to flow along either conductor of another channel. This second channel will then have two signal currents present, one biasing the other.

The problems of crosstalk become infinitely more serious in the case of receiving stations driving loudspeaker outputs and on relatively long distribution systems balanced and matched lines are a necessary feature.

Dealing first with the headphone type of receiving station, however, the main requirement is that one pair of wires is required for each programme. It is not possible to use a single wire as a common earth return to all three programmes for any given receiving station for reasons stated above. In working out the distribution system, therefore, three pairs of wires must be laid from the master radio relay unit right the way through to the most remote part of the installation. Branch lines of three pairs of conductors are then tapped on to the main distribution line for each receiving station, and the arrangement is depicted in Fig. 11 in block form. This system is not balanced, of course, and neither is it matched, but the degree of crosstalk occurring in such an installation is generally tolerably low.

## The Receiving Stations

Each receiving station has two controls—one for selecting any of the three programmes, and the other to control the volume of the selected programme. Fig. 13 illustrates the way the two

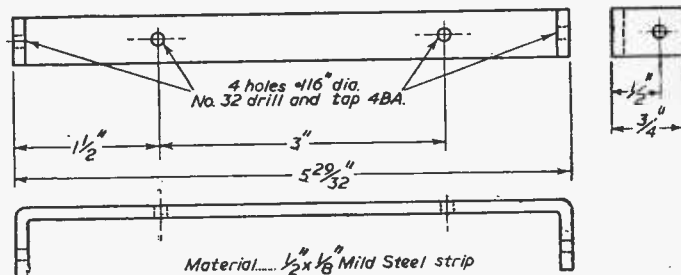


Fig. 8.—Details of the chassis strut.

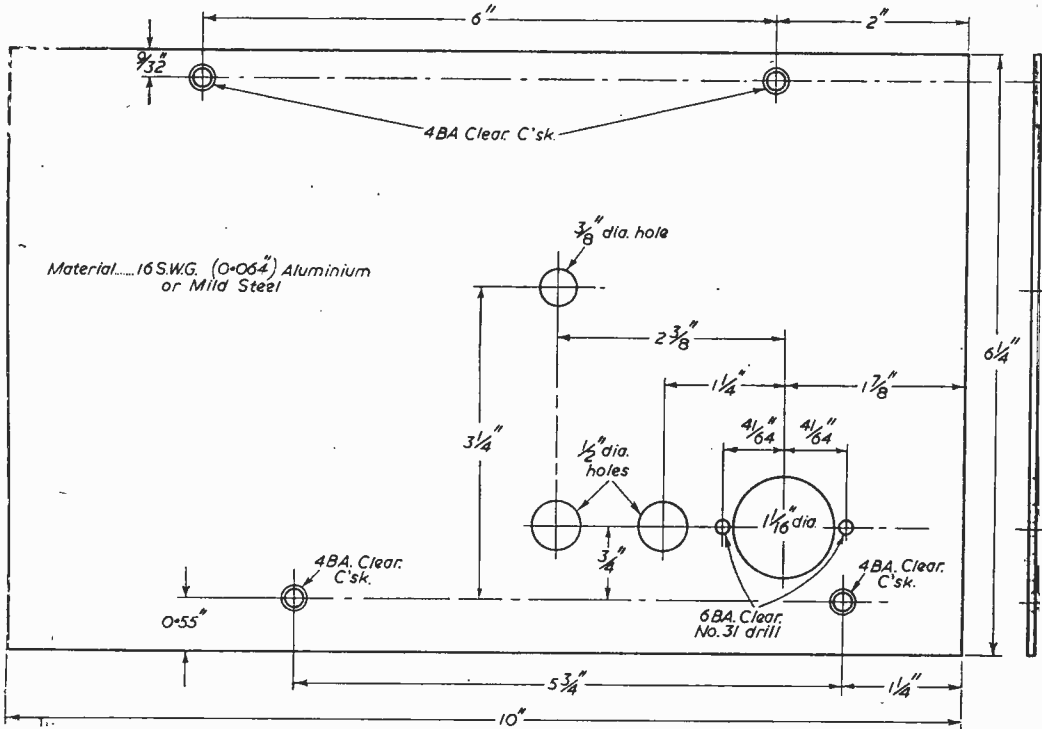


Fig. 9.—Details of the front panel.

In use in a 10-receiving station installation changes in level are unavoidable as the loading on any one programme varies, but this has never proved intolerable in use.

In the loudspeaker-driven case a little more attention to the problems of matching is required and while the distribution system is exactly the same as that shown in Fig. 11, a terminating transformer is required in each receiving station which is always matched to the optimum load impedance (7,000Ω) of the power output stage through the output matching transformer. Use "flat-mains-

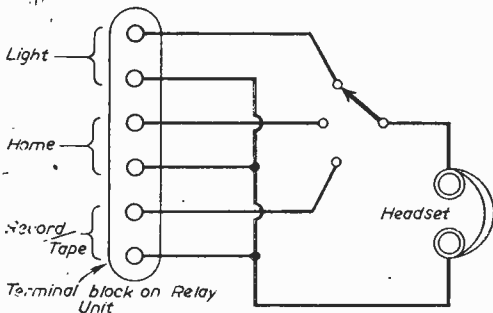


Fig. 10.—Setting up a receiving station for test purposes.

controls are wired and shows that a 3-way 2-pole rotary switch and a 10k volume control are required. The latter should preferably be wire wound for a long trouble-free life.

The headset impedance should lie between 500 and 2,000 ohms, and deaf-aid type earpieces, available cheaply on the surplus market, are ideal for this purpose. Fixed to two plastic or metal tubes specially shaped for the purpose, such earpieces can readily be converted to a stethoscope-like headset.

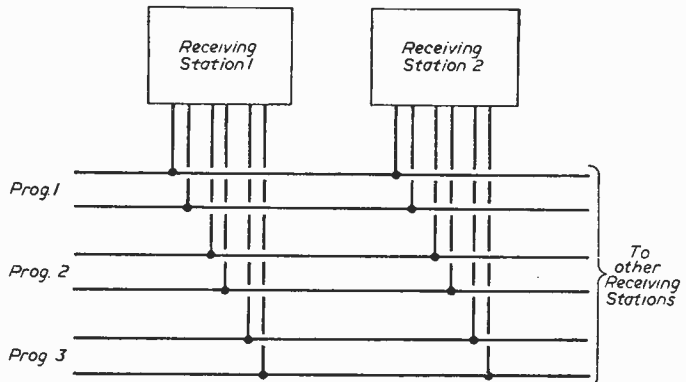


Fig. 11.—Block diagram of connections for distribution system.

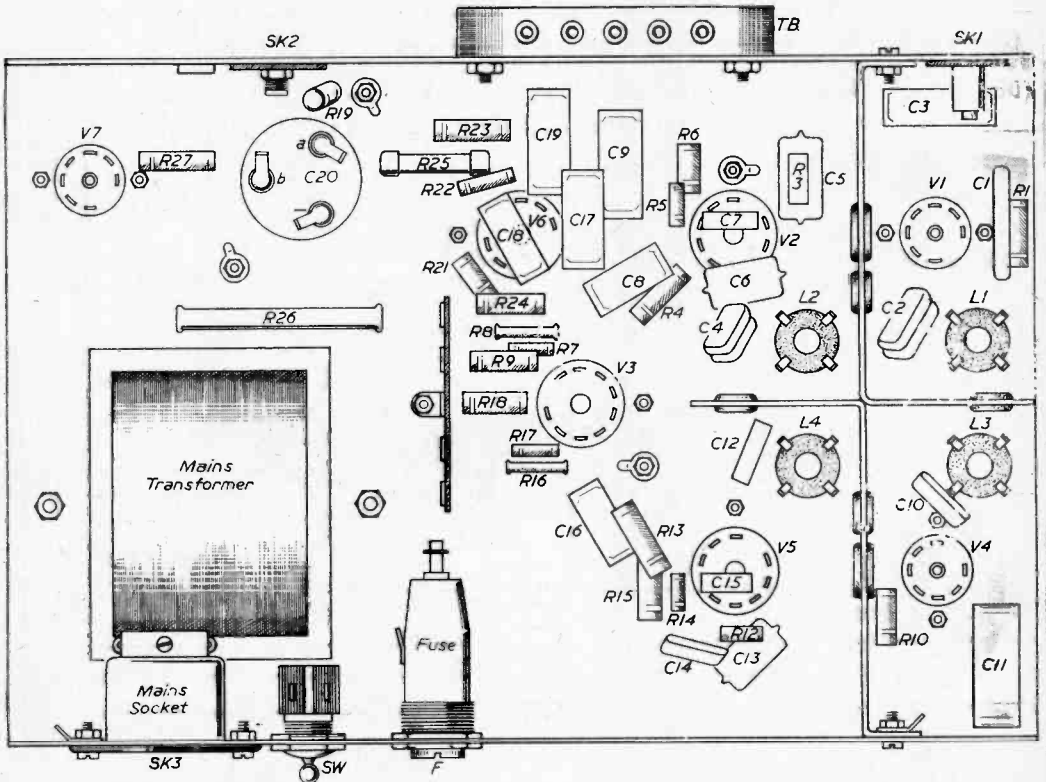


Fig. 12.—Underchassis layout diagram.

twin " p.v.c. wire in the distribution system as this has a characteristic impedance anywhere between 200 and 400 ohms. To minimise losses in the transmission cable the power output transformer is matched to the combined parallel impedance of all the receiving stations, each of which is designed to work from a source with an impedance of about 300 ohms.

**Output Transformer**

The turns ratio required on

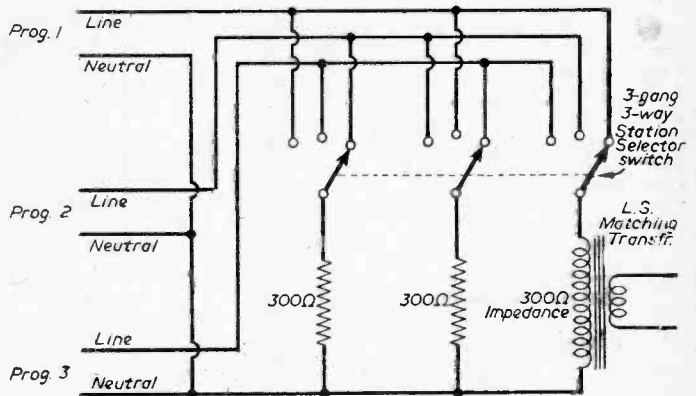
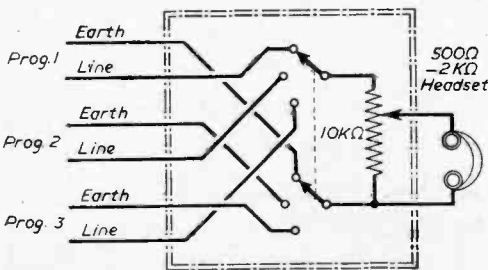


Fig. 13 (Below left).—Selector switch and volume control connections in (mismatched) receiving station using headset.

Fig. 14 (Above).—Matched, unbalanced, receiving station.

the output transformer is therefore dependent on the number of receiving stations installed. If the number of stations is N, then as shown in Fig. 3, the turns ratio must be  $4.8\sqrt{N}$ . For example, if nine receiving stations comprised the

(Concluded on page 474)

# HOME RADIO OF MITCHAM

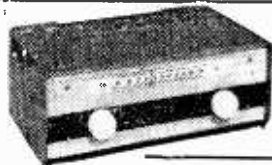
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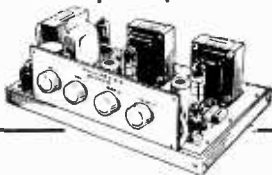
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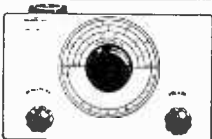
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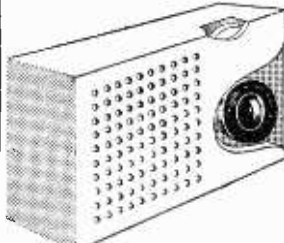
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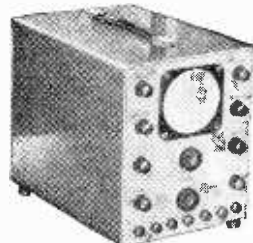
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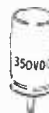
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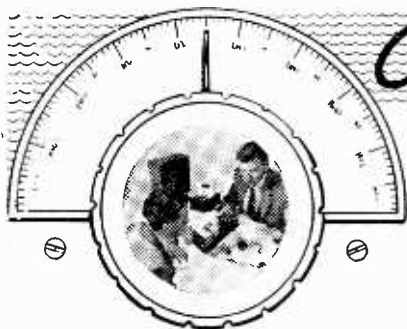
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# On Your Wavelength

BY THERMION

## Current and Potential

I WAS discussing the other day with a member of the technical staff of *Practical Television* the way in which the meanings of the abbreviations A.C. and D.C. have changed. When they were first used, they had the clear-cut meanings of "alternating current" and "direct current." Today, however, we both agreed that they seem to have taken on identities of their own, and the letters are used freely as adjectives. For instance, the statement "I took a reading with the meter, and it was 20 volts D.C. or A.C." is somewhat illogical to say the least, for if A.C. and D.C. are considered as abbreviations, the statement becomes "20 volts, alternating or direct current." As any radio enthusiast knows, voltage, or—rather potential difference, is not the same thing as current, yet how often do we hear similar statements voiced? We all know what they mean, or at least most of the time we do, but since they are really inexact (some would say absurd), should we not try to use more correct and meaningful expressions? The height of absurdity is reached in such statements as "the D.C. current was 20 amps." On the other hand, one cannot say "the D. current was 20 amps.," which is, perhaps, open to misinterpretation. If we say "the current was 20 amps. D.C.," the absurdity still exists. Now, D.C. and A.C. seem to have become separate entities, D.C. meaning anything connected with a current which is steadily flowing in one fixed direction, and A.C. meaning anything connected with the other kind. (To add to the confusion, D.C. is also used to mean direct-coupled.)

## Colloquialisms

TO try to make correct statements all the time might only make matters worse. We do know what we mean by A.C. and D.C., whereas any new term or unconventional expression might create confusion. Of course, it does not much matter in speech—loose statements are the essence of colloquial speech, whether technical or not but in writing or in print, in the pages of this magazine for instance, it is another story. Absurdities are perpetuated when they appear in print, and always seem far, far worse than the spoken word. This may be because we are used to the printed word being authoritative, and correct. It is therefore rather a disillusionment to find ambiguous or absurd statements printed as, say, part of an explanation. A more correct state-

ment, though, may be so verbose and unusual that it stands out more than the one it replaces

"—ages"

ANOTHER term which is loosely employed in many technical circles is "voltage." Quite eminent technical men may be heard to say "the voltage was 30 volts." This should, of course, be "the voltage was 30." The term voltage should not really be employed, however. In early radio theoretical work, electricity is frequently compared with water. The number of amps. flowing in an electrical circuit is compared with the number of gallons flowing in unit time in a hydraulic (?) circuit. Resistance is compared with a constriction, or change to smaller bore, and potential difference with the "head" of water. Suppose a water tank at the top of a hill is connected to a turbine at the bottom. The tank is 500ft. vertically above the turbine; thus the head of water is 500ft. No one would say that the "head-age" or "foot-age" of the water was 500(ft.), so it is surely wrong to say "the supply voltage was 300." The correct statement would be "the potential difference, or P.D., across the supply was 300 volts." Volts are the units in which potential difference is measured, just as feet are one set of units in which head can be measured. You could measure head in other units, such as yards, metres, etc., and potential difference can similarly be measured in units other than volts. I suppose that if volts had been named "emus," we should then talk about an "emu-tage" of 30, etc.!

Again, this looseness of expression does not much matter in speech—it is an aid to conciseness of expression, but I think you will agree, that in print at any rate, it is always best, particularly in technical writing, to be as correct as possible, even risking the accusation of being pedantic, long-winded, or worst of all, old-fashioned and out-of-date. We have been arguing repeatedly over these points for a week or two now; write and give us your opinions, even if you think it a waste of time to discuss points which are perfectly clear to you.

## P.D. and E.M.F.

Talking of P.D. reminds me that there is a great deal of confusion, especially among students of radio and electronics, between P.D. and E.M.F.

There should be none: if definitions are examined, the distinction is clear. First comes the E.M.F.; you cannot have a current unless you push it around. Then comes the current and finally, because of the current, the P.D. Just as (to complete the water analogy) in order to produce a pressure difference across a horizontal tube containing water, the water must be flowing. If you go to the source of Ohm's Law, you will find that the P.D. appearing across a conductor is proportional to the corresponding current flowing.

# Notes on Medium Wave Aerials

INEFFICIENT AERIALS ARE FREQUENTLY USED FOR DOMESTIC RECEIVERS AND  
DEGRADE PROGRAMME QUALITY

By R. Morgan

**T**HERE are very few people who would attempt to run their cars on paraffin but a surprisingly large number operate their medium-wave broadcast receivers on an aerial—if such it can be called—consisting of a few feet of wire attached to a picture rail or even hanging down at the back of the set. The comparison is a just one: the car engine will not yield its maximum performance unless it has the right grade of fuel, and the radio set will not give best results unless provided with a good input signal.

## Aerial Length

There are certain exceptional circumstances in which a very short vertical aerial may be preferable to a large one. This may be so, for example, when the receiver is situated only a few miles from a high-powered transmitter. Here, a large aerial may cause the receiver to be overloaded. Moreover, if the receiver is very simple, containing only a single tuned circuit, it is possible that the additional damping of a large aerial may cause such a deterioration in the selectivity of the receiver that this effect more than outweighs the increased signal. These circumstances are, however, comparatively rare and it is safe to say that insufficient attention is generally paid to the provision of suitable medium-wave aerials. Strangely enough this observation does not apply to television aerials. On the whole these are very good: in fact there are examples of outdoor H's being used where indoor aerials would probably be adequate.

## Aerial Design

The primary object of the aerial is to provide the receiver with an input signal and the aerial should clearly be designed to be as efficient a collector as possible. For medium-wave reception this implies that the aerial should be as large as possible. However, there is another point to be watched: in addition to providing a signal the aerial also damps the tuned circuit to which it is connected. If the receiver is a superhet this damping has a negligible effect on the performance of the receiver because the gain and selectivity of a superhet depend almost entirely on the I.F. amplifier which is unaffected by the properties of the aerial. In general T.R.F. receivers have two or three tuned circuits and an appreciable fraction of the overall selectivity of the receiver is contributed by the tuned circuit to which the aerial is connected. Thus the selectivity of the receiver is, to some extent, dependent on the properties of the aerial and an improvement in selectivity may be obtained by modification of the aerial or by substituting one aerial for another. This is particularly marked in a very simple receiver incorporating only a single tuned circuit.

## Polarisation

We shall now consider the design of medium-wave aerials in more detail. Most medium-wave

transmitters radiate from vertical aerials. Often, in fact, the radiator is a vertical steel mast. Such an aerial radiates vertically-polarised waves and to obtain maximum pickup from these waves, a vertical receiving aerial is necessary. The long horizontal wires so often used for aerials are not, in general, very good collectors. In fact it is true to say that the major part of the pick-up in such an aerial occurs in the vertical download from the horizontal wire to the receiver—and this lead is sometimes screened to minimise interference pick-up!

## Fading

Moreover, surprising as it may seem, horizontal aerials can give more after-dark fading of signals from distant stations than vertical aerials. Although the signals radiated from medium-wave transmitters are, in general, vertically-

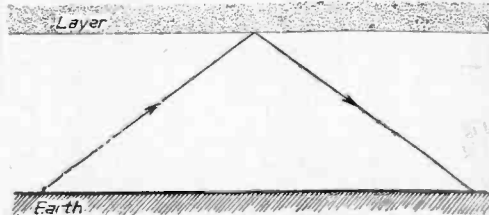


Fig. 1.—Reflection from the ionosphere.

polarised when they are reflected from the ionosphere, some rotation occurs and reflected signals contain varying amounts of horizontally-polarised waves. A vertical receiving aerial does not respond to these reflected waves but receives the vertically-polarised ground wave, which is steady. A horizontally-polarised aerial discriminates against the steady vertical component and favours the varying horizontally-polarised wave. Thus, to keep fading at a minimum, a vertical aerial is desirable.

## Location

For best results the aerial should be outdoors and the ideal position is undoubtedly on a chimney top, where the aerial is well away from domestic sources of interference. Unfortunately it is not always possible to obtain such a favourable site. Good results can, however, be obtained from a vertical rod aerial mounted outside the house or flat on a window ledge, but there should not be a long horizontal lead to the receiver. Such a lead will not only increase fading but will also increase the capacitance to earth of the aerial which inevitably means increased damping and inferior selectivity if the receiver is a T.R.F. For the same reason—to keep capacitance low—the vertical rod aerial should be kept away from the building.\* It may even be advantageous to

(Concluded on page 498)

# AN S-METER FOR THE R1155

THIS CIRCUIT IS BASED ON THE WHEATSTONE BRIDGE NETWORK

By J. A. Ewen

THE basic Wheatstone bridge circuit used on D.C. with a meter as an indicator is shown in Fig. 1. If the potentials of points X and Y are equal, no P.D. exists across the meter and therefore no current flows through it, and in this condition the bridge is said to be "balanced." The condition of balance exists only when the equation  $R1/R2 = R3/R4$  is satisfied, and it will be obvious that an alteration in the value of any one of the resistors forming the

in a drop in anode and screen currents. This is equivalent to an increase in resistance between cathode and anode, and cathode and screen respectively.

If the basic circuit of Fig. 1 is arranged to include the cathode-screen path of a vari- $\mu$  pentode I.F. amplifier as one arm of the bridge, the circuit becomes as shown in Fig. 2. An increase in signal strength causes a higher A.V.C. bias to be applied to the grid of the pentode which, as a result, shows increased resistance between cathode and screen. This causes the bridge to become unbalanced, and the meter gives a reading proportional to the strength of the incoming signal. The resistor R4 has been made variable in order that the bridge may be balanced, i.e., the meter may be set to zero at zero input signal.

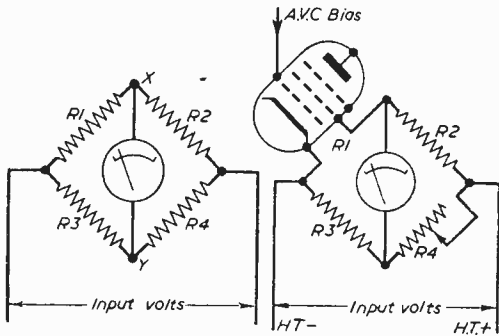


Fig. 1 (Left).—Basic Wheatstone bridge circuit. Fig. 2 (Right).—A pentode I.F. amplifier as one arm of the bridge.

### The Installation

This circuit is easily installed in the R1155 and is sensitive and easy to adjust. The stage chosen for the modifications is V3 (looking at the chassis from the front, V3 is the valve nearest the rear left-hand corner and to the right of the chassis bracing bar). The unmodified and modified circuits are shown in Figs. 3 and 4 respectively. The additional components required are, two 2,000 $\Omega$   $\frac{1}{2}$ W resistors, one 1,000 $\Omega$  w/w pot., one 56k $\Omega$   $\frac{1}{2}$ W resistor, one 500 $\mu$ A meter, one 5.6k  $\frac{1}{2}$ W resistor, one on/off toggle switch. In the writer's receiver, the meter was installed in the position formerly occupied by the tuning indicator. The S-meter zeroing potentiometer was

arms of the bridge will cause an unbalance. A current then flows through the meter and a deflection is obtained.

### Using A.V.C. Voltage

The Wheatstone bridge circuit may be employed to give an indication of the strength of a carrier by utilising the A.V.C. action. An increase in carrier strength results in an increase in negative A.V.C. voltage, which is applied to the grids of the controlled valves to reduce the gain. The negative A.V.C. voltage is produced by the A.V.C. diode which is fed with the I.F. signal from one of the I.F. transformers. It will be clear therefore that no prospect exists of using the A.V.C. voltage directly as a measure of signal strength, for not only would the A.V.C. circuit be unable to provide enough current to operate a meter, but the connection of a meter would completely upset the A.V.C. action.

If, however, some means were available of isolating the A.V.C. circuit from the effects of connecting an indicator, and simultaneously providing some amplification, it would become feasible to use a moving coil meter as an indicator of signal strength.

### The Circuit

In a vari- $\mu$  pentode, the mutual conductance of both anode and screen is varied by varying the grid bias. An increase in negative bias results

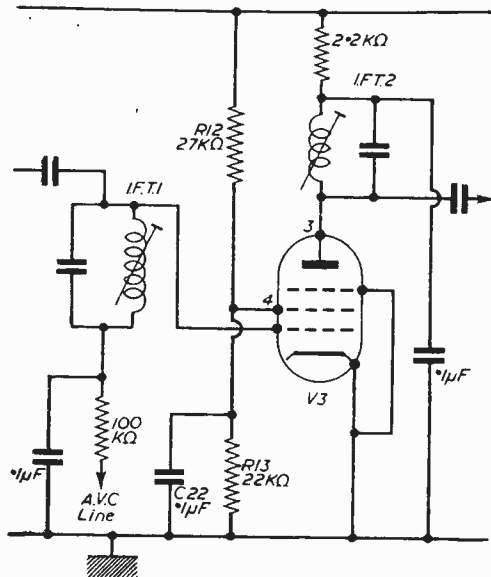


Fig. 3.—The unmodified circuit of V3.

fitted in the position vacated by the "meter deflection" switch, and the S-meter on/off toggle switch was positioned below and to the right of the meter. A 500 $\mu$ A meter was used. This is an ex-Government unit, scaled 0-15 volts.

**Setting-up**

In the writer's receiver, the H.T. line voltage is 210 volts. If a different H.T. voltage is in use, it may prove impossible to zero the meter. In this event, the following procedure should

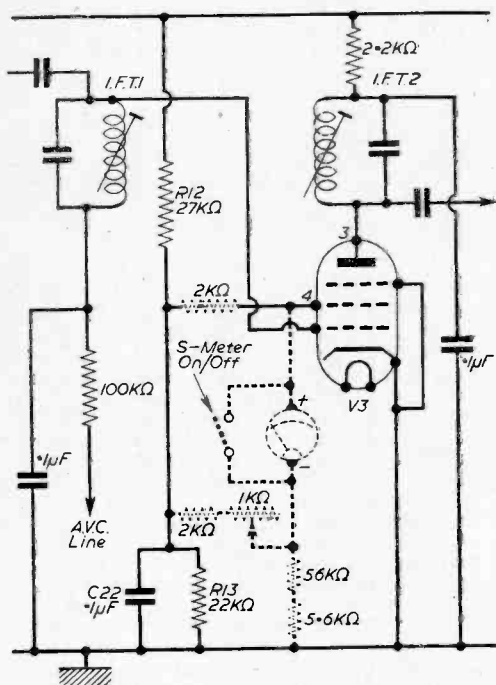


Fig. 4.—V3 circuit with the modification shown dotted.

be adopted: switch A.V.C. on, S-meter on, and short the aerial terminal to chassis. Set the S-meter zeroing potentiometer to mid-travel. Remove the 56k and 5.6k resistors and substitute a 100k potentiometer. Switch the R1155 on, and manipulate the 100k potentiometer until the meter reads zero. Remove the potentiometer from the circuit and measure the resistance used to achieve balance. Substitute an equivalent 1/2W. fixed resistor. The circuit is now ready for use. The meter should be zeroed on each band before use, with the aerial terminal grounded.

**The S-point**

The main use of an S-meter is as a means of giving accurate comparative signal-strength reports. Most transmitting amateurs would agree with this. They are more interested in being able to obtain accurate information about the effect of adjustments made to the transmitter. The circuit described gives a very sensitive response

to changes in carrier level, and in the writer's case, the scale graduations 1 to 9 seem to be acceptable as indicating S1 to S9. Anything above 9 is referred to as "S9+."

**A MASTER RELAY UNIT**

(Continued from page 468)

installation then the ratio of primary to secondary turns would be 14.4 : 1.

At the receiving station each line must always be terminated by a load of 300 ohms, and Fig. 14 shows how a 3-pole, 3-way switch must be wired to achieve this. It will be seen that when a programme is not loaded into the loudspeaker matching transformer, one or other of the remaining two switch wafers connects it to a fixed resistor of 300 ohms.

Details of the tapping on the matching transformer are given separately in Fig. 15, where four different volume levels are obtainable while still maintaining a matched impedance. A universal output transformer may be used here; the taps required are indicated in the figure.

Alternatively it may be necessary to rewind the secondary of an existing output transformer to obtain the required design. If this is attempted then the original turns ratio must be known. Let us assume, for example, that this is 100:1. Then remove the secondary turns on the transformer after stripping out the laminations, noting the total number of turns. Suppose that this number were 30. Immediately it would be obvious that the primary consists of 3,000 turns and that to achieve the four turns-ratios for the transformer of Fig. 15, the secondary would have to be re-wound with a total of 30 × 28 or 840 turns of

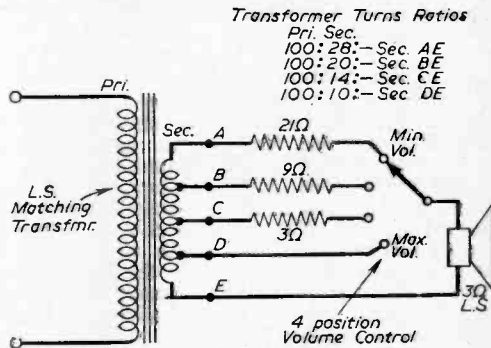


Fig. 15.—Details of 300 $\Omega$  matching transformer of Fig. 14.

wire. Furthermore this winding, comprising the secondary AE, would have to be tapped at 600, 420 and 300 turns to give the three points B, C and D on the winding.

Obviously the wire would have to be of smaller gauge to fit on the winding unless there were ample "window space" on the transformer.

All this extra work is required, of course, to avoid the very great losses that would occur in the line if one were to attempt to match directly into the parallel impedance presented by a system of 3 $\Omega$  loudspeakers.

# A T.R.F. *Communications* Receiver

A SELECTIVE AND SENSITIVE DESIGN WHICH USES PLUG-IN COILS TO ACHIEVE WIDE COVERAGE

By R. H. Wright

**T**HIS receiver has been designed to give good selectivity, adequate volume and a very low noise level.

Reference to the circuit diagram (Fig. 1) will show that it has one tuned R.F. amplifier stage (V1), followed by a grid-leak detector with reaction (L4/C9)—careful use of this reaction control not only permits the reception of C.W. signals but also increases the sensitivity and selectivity of the receiver. The audio output from the detector is resistance-capacity coupled (R6, C11, VR2) to the A.F. amplifier, V3. Output is quite adequate to operate a loud-speaker but, if preferred, high resistance phones may be used, decoupled through C14, the primary of the loudspeaker transformer, T1, forming the anode load of V3.

## Choice of Valves

In the original receiver, EF50 R.F. pentode valves were used throughout; the detector, V2, being operated as a triode (anode, suppressor and screen—pins 2, 3 and 4—being joined together). Miniature valves such as EF91's could, however, be used. Various types of reaction circuits were tried

but the one shown was found to give the smoothest control. For the high frequency bands, C9—the reaction control—should have a slow motion drive. For accurate tuning, a good slow motion drive should also be fitted to the tuning capacitor C4/C5, band-spread on short waves then being unnecessary. An EF50 may seem an unusual choice for an audio amplifier,

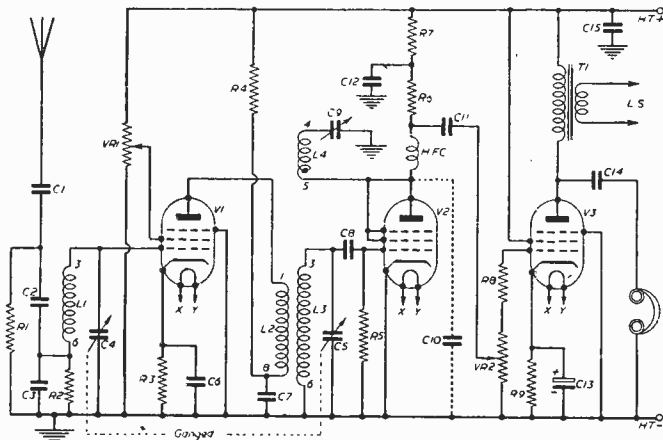


Fig. 1.—The circuit diagram.

but this valve operates quite satisfactorily with no apparent distortion. Two gain controls are provided. VR1 controlling the gain of the R.F. amplifier and VR2 controlling the A.F. gain. VR1 is not by any means a luxury; it is very necessary if overloading of the detector on strong signals is to be avoided. With some EF50 valves in the detector position, it may be necessary to include C10 (100pF) between the detector anode and earth in order to obtain smooth reaction control. Experiment will determine whether or not this capacitor is necessary.

## COMPONENTS LIST

### Capacitors :

- C1—0.001  $\mu$ F.
- C2, C6—0.01  $\mu$ F.
- C3—0.003  $\mu$ F.
- C4, C5—0.0003  $\mu$ F, variable. (Alternatively a two-gang 0.0005  $\mu$ F variable capacitor may be used with 0.001  $\mu$ F, in series with each section.)
- C7, C12, C14—0.1  $\mu$ F, 350v.w.
- C8, C10—0.0001  $\mu$ F.
- C9—0.0003  $\mu$ F variable or 0.0005  $\mu$ F variable with 0.001  $\mu$ F, in series.
- C11—0.05  $\mu$ F.
- C13—25  $\mu$ F, 25v.w., electrolytic.
- C15—1  $\mu$ F, 350v.w.

### Resistors :

(Half watt unless otherwise stated.)

- R1—10k.
- R2—100k.
- R3, R9—330 ohms, 1W.
- R4, R8—4.7k.
- R5—2.2M.
- R6—47k.
- R7—22k.
- VR1—220k, potentiometer.
- VR2—5,000k.
- H.F.C.—H.F. choke.
- T1—Loudspeaker transformer, multi-ratio type.
- V1, V2, V3—EF50 or EF91 valves. (See text.)
- 2 International octal valholders for the coils,
- 3 valholders according to type of valves used.

## Frequency Coverage

In order to have continuous frequency coverage from 175kc/s to 31.5Mc/s (1,700-9.5 metres) Denco Maxi-Q octal base plug-in coils have been used, blue range coils for the R.F. amplifier (L1) and green range coils for the coupling, detector tuning and reaction (L2, L3, L4), one of each type coil being required for each range covered. The ranges covered by each pair of coils are shown below :

Range	Frequency (Mc/s)	Wavelength (metres)
1	.175-.525	1,700-570
2	.515-1.545	580-194
3	1.67-5.3	180-57
4	5-15	60-20
5	10.5-31.5	28-9.5

It will be noted that there is a small gap in the

range between the bottom end of Range 2 coils and the beginning of the Range 3 coils. However, since the coils have variable iron cores, slight adjustment of these cores will enable this gap to be closed. There is, of course, no reason why chassis mounting coils could not be used but plug-in coils were used in order to eliminate the losses, etc., that would accompany the switching for the chassis mounting coils.

### Layout

The layout of the main components does not seem critical so long as the two coils are kept

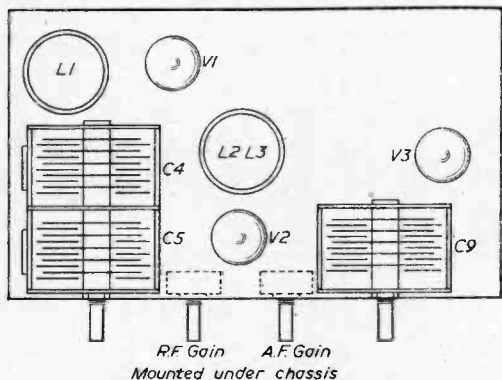


Fig. 2.—Chassis layout.

separated and the wiring of V1 kept reasonably clear of that of V2. Fig. 2 shows the present above-chassis layout of the main components. The chassis, measuring 14in.  $\times$  7in.  $\times$  2½in. gives ample room for the inclusion of a suitable power unit. The power requirements of the receiver are L.T. 6.3V, 0.9 A and H.T. 250V at 30 to 35 mA and can be obtained from a power unit such as that shown in Fig. 3.

When first put into service on each range, tune C4/C5 to a station somewhere about the middle of each range and adjust the core of L1 for maximum signal strength and secure the cores of the two coils in position by means of the locknuts provided. For the reception of C.W. signals, C9 should be advanced slowly until the

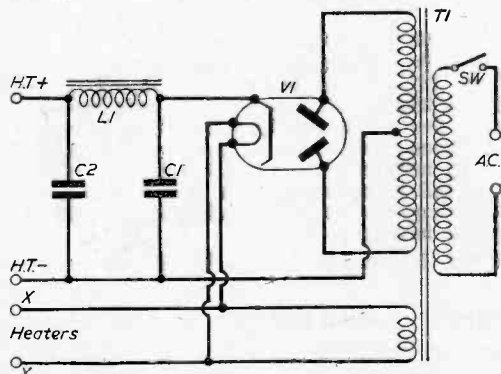


Fig. 3.—The circuit of the power pack.

### POWER UNIT COMPONENT LIST

- T1—Mains transformer; Sec. volts: 250-0-250 (60 mA), 6.3 (2 A).
- V1—Rectifier type 6X5 or 6X5G.
- L1—Smoothing choke, 20 Henry, 60 mA.
- C1, C2—8  $\mu$ F electrolytic capacitors.
- Sw—On-off toggle switch.
- I International octal valveholder for rectifier valve.

detector valve circuit oscillates, as indicated by a faint "plop," but for the reception of telephony or broadcast signals the reaction should be adjusted slightly below the point of oscillation. After a little practice correct adjustment of the reaction control becomes quite easy.

The figures associated with each inductance in Fig. 1 show the pin numbers on the underside of an international octal base to which the respective connections should be made.

### A TWIN SPEAKER BASS REFLEX CABINET

(Continued from page 462)

These can be connected so that different capacities of 2, 4, 6, 8 and 12  $\mu$ F may be tried across the bass speaker. The working voltage of these condensers is not critical.

The required inductance is made from a ½lb. reel of 22 s.w.g. enamelled copper wire. This is hank-wound and taped, with 1½in. inner diameter. This hank-winding often presents a difficulty to the inexperienced and a spool or bobbin may be preferred.

The core of the bobbin should be ½in. thick and 1½in. in diameter and the cheeks are of paxolin or cardboard 2½in. in diameter. These are glued firmly together and a hole drilled through the centre for the fixing screw. The wire may be anchored by small holes in the cheeks. Fig. 6 shows the construction and Fig. 5 the theoretical circuit of the cross-over unit.

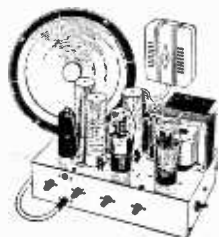
### The Values

With 15 ohms loudspeakers and a cross-over at about 1,000 c/s a capacitor of 6  $\mu$ F is used (4  $\mu$ F and 2  $\mu$ F connected in parallel). This will be found suitable for speakers from 9 to 15 ohms impedance. To lower the cross-over point, increase the capacity to 9 or 10  $\mu$ F. Where speakers of 2 to 6 ohms impedance are used it will be necessary to double the capacity and a wire of heavier gauge used for the inductance to reduce the resistance, say, 18 s.w.g.

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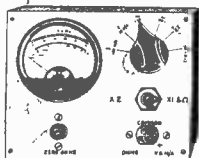
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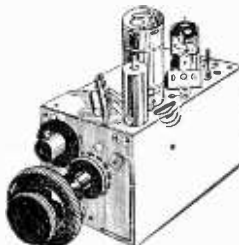
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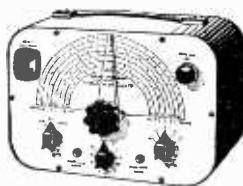


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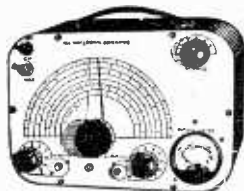


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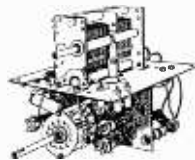
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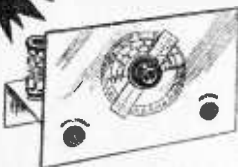
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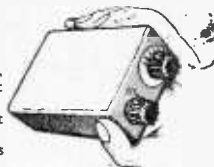


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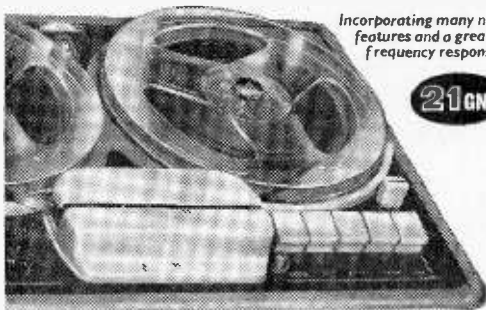
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# A Handy Signal Tracer

A SMALL UNIT WHICH IS BATTERY POWERED AND USES TRANSISTORS IN A TWO-STAGE CIRCUIT By L. Baker

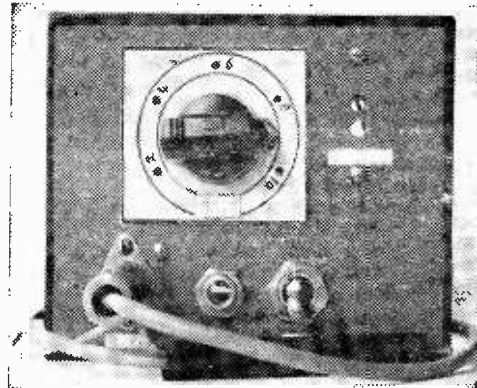
**T**HIS signal tracer is compact, and its power requirements are small. The number of components has been cut to a minimum consistent with good results, a two-transistor resistance-capacity-coupled amplifier being used. Since miniature parts may be hard to obtain it was decided to make use of standard parts for the instrument.

For use on R.F. circuits a crystal diode is utilised and is incorporated in the case of the instrument. The output of the amplifier is fed to ordinary, 2,000Ω. headphones. The case is of plywood and the sides only should first be made up and glued to the front panel cut to suit the sides as shown in the diagram. This panel should be cut to exact size, the components spaced out as shown and holes drilled to suit the components. When this is completed the panel should be glued in place with a good quality adhesive and left to dry thoroughly. A small dial can be made of cardboard and glued to the front panel.

## Construction

Mount the battery clip to the wooden side of the case, holding it in place with a countersunk nut and bolt. Mount on the front panel the input jacks, the 50k volume control, the switch and output sockets as shown. If a small 50k volume control is available with switch so much the better. This switch can be used for switching off the battery and the toggle type switch may be omitted. Mount also the 4-way tag strips on the front panel.

Wire, first, a busbar of stiff copper wire from the positive side of the battery to the earth tag



View of the front panel.

of both jacks and to the volume control, and to one tag on each strip (Fig. 2). Next solder a piece of wire on the negative side of the battery and to the switch. From the "on" side of the switch run a wire to the output sockets and to each tagboard as shown, making the negative voltage available on both tag strips. This considerably simplifies the wiring and makes for neatness.

## Condensers and Resistors

Next, connect the condensers using sleeving over the bare wire ends. It is essential that these be wired with the correct polarity. The resistors are wired direct to the tagboards. If the exact values are not to hand other resistors connected in parallel or series may be used. It is, of course, essential that all soldered joints are good and that the parts are held reasonably firm.

Lastly, the crystal diode and the transistors are installed and positioned as shown. Great care must be taken when connecting these components to avoid damage which can be caused by heat. It is advisable to slip short lengths of sleeving over the leads of the transistors and diode prior to soldering, leaving room to grip the wire leads with long-nosed pliers while actually applying the heat. These will conduct away the heat and prevent damage.

No attempt should be made to make the wiring neat by cutting the leads of the transistors and diode. The soldering iron should be well cleaned and tinned and it is best to allow it to reach full heat and then unplug it from the mains socket using only the retained heat to solder the transistors. Sufficient heat to make the solder flow is all that is required.

## Cable for R.F. Probe

On account of the crystal diode being installed inside the instrument case at the rear of

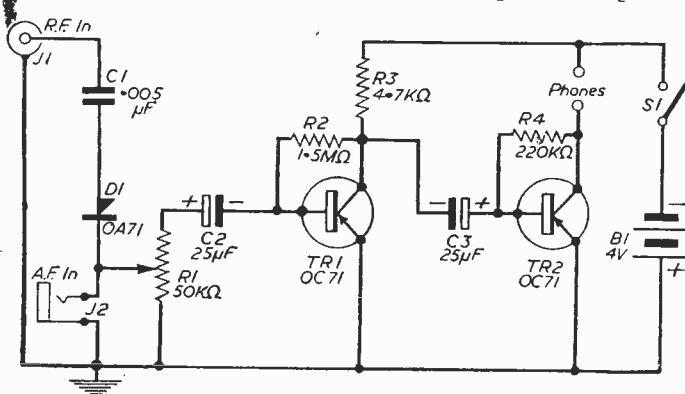


Fig. 1.—The circuit diagram.

the R.F. input jack it is advisable to use only a short length (say, 18in.) of coaxial cable to the tip of the R.F. probe. Approximately 2ft. of cable is used for this, the outer insulation being stripped off to expose the braiding for a length of about 6in. A small hole is made in the braiding 6in. from the end, and the inner conductor is pulled back through this hole leaving 6in. of empty braid. The alligator earth clip is soldered to this braid. An ordinary test probe of the "hollow" type is used for the remainder of the R.F. probe assembly. The inner conductor of the cable is passed through the hollow body of the probe until the exposed part of the braiding just disappears inside the hollow body. The inner conductor is then soldered to the normal tip of the probe in the ordinary way, the surplus being cut off and discarded. The other end of the cable is connected to the plug which fits the R.F. input socket on the front panel. The A.F. probe is made in a similar manner, the only difference being that the instrument end of this cable terminates in an ordinary jack-plug.

It is advisable to make a back-plate of stout cardboard for the instrument. It can be held in place with small wood screws. If desired, the sides of the instrument can be bound with *passee partout* or some other similar tape so that a small amount laps over the edges of the front panel. This gives a very pleasing and professional appearance.

### Using the Tracer

Having made sure that all wiring is correct and in order, the battery should be installed. The instrument should be switched on and the volume control advanced to maximum. On touching the R.F. and A.F. inputs with the finger a loud humming or whistle should be heard in the earphones. If a signal generator is available it should be possible to pick up the modulated tone from the

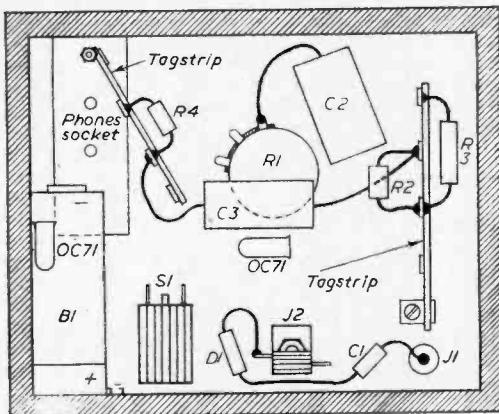


Fig. 2.—Layout of the parts.

generator by connecting the R.F. probe to its output with the output control of the generator set for minimum output signal.

The tracer may be used on circuits in any radio receiver and it is possible to trace the signal and

observe its amplification right through the set. It will be found that it is sometimes not necessary to touch the point under test with the probe, as such a strong signal is present. In this case a small piece of sleeving pushed over the probe tip will allow sufficient pick-up for all normal tests.

The numbered dial on the instrument front is useful for comparative gain measurements. It

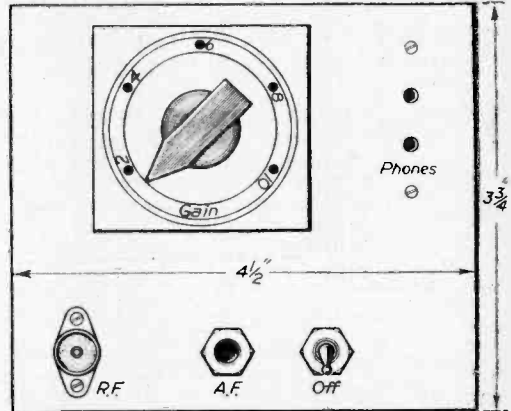


Fig. 3.—The front panel of the signal tracer.

follows that if, say, the signal input to a valve amplifying circuit is audible in the grid circuit with the dial set at 4 and if when checking the anode circuit the signal is such that the dial has to be reset to 2 to give the same amount of volume, amplification is taking place.

## SELECTING RESISTORS

(Continued from page 460)

fourth colour denotes the tolerance as already stated and resistors are available with plus or minus the following tolerances: 1, 2, 5, 10 and 20 per cent. Each tolerance has its own colour so that the constructor can be sure of the tolerance and determine whether the replacement is accurate in its particular circuit. The following colours denote the tolerance:

- 1 per cent.: brown (these are seldom met).
- 2 per cent.: red (these are seldom met).
- 5 per cent.: gold.
- 10 per cent.: silver.
- 20 per cent.: no fourth colour.

Those unfamiliar with the resistor colour code should consult the article in the July issue entitled, "A Beginners' Test-meter"

The amateur often has to replace resistors when servicing his own or the domestic electronic equipment and confusion may arise as to whether a resistor of a certain tolerance can be replaced by one of a different tolerance. The solution to this problem is to replace with exactly the same colour coding, both for value and for tolerance.

The chart on page 460 gives details of the modern preferred values of resistor with the approximate limits of the various tolerances. This should be of assistance to beginners and experienced constructors alike.

# SILICON POWER RECTIFIERS

EFFICIENT DEVICES WITH MANY USES

By E. G. Bulley

THE operation of silicon rectifiers is more or less the same as germanium and selenium types, all being made from materials in the semi-conductor class. Nevertheless, the latest developments of silicon rectifiers have many

advantages especially over those of the selenium type. First and foremost, silicon rectifiers can be operated at much higher temperatures than the other two.

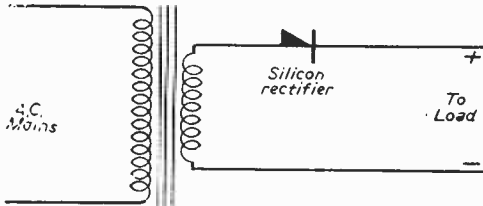


Fig. 1.—Half-wave circuit.

advantages especially over those of the selenium type. First and foremost, silicon rectifiers can be operated at much higher temperatures than the other two.

### Temperature Ratings

Silicon rectifiers can be operated continuously at full ratings at temperatures in the order of 200 deg. F., the reason being that the voltage drop across these devices is much lower and therefore there is less power to dissipate.

Another important advantage is that the silicon type does not lose its conductivity characteristic

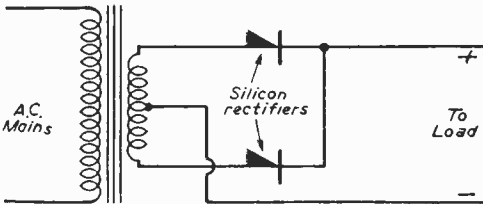


Fig. 3.—Centre-tap circuit.

with age whereas the selenium rectifier does. It will, therefore, be appreciated, that the shelf life of the silicon rectifier is to be preferred. This greatly improved ageing characteristic as well as the higher current capacity and the lower voltage drop will undoubtedly assist the constructor.

### Construction

Silicon power rectifiers will be used in the very near future by amateurs. Many designs are available: these are physically smaller than similar types in the selenium range. Furthermore, their design with screwed ends will enable the constructor to build his own stacks, or secure them as single units direct to the chassis. In the latter case, the chassis can be used as a heat sink.

These devices are obtainable with heat dissipating fins as well as in a large variety of stacks,

### Stacking

Silicon rectifiers are or can be stacked in parallel or series formation; this naturally depends upon the application and rating required. The former type of stacking is to provide the increase of current requirements but, even so, it is advisable to avoid using a parallel operated stack to obtain the current rating if a single unit will provide the rating required.

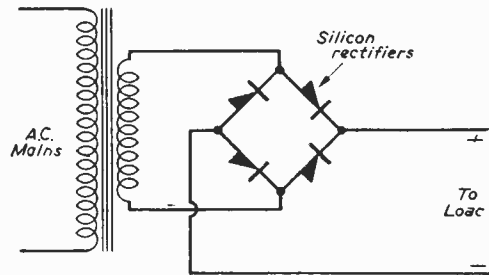


Fig. 2.—Bridge circuit.

The important parameters of silicon rectifiers are based upon the ambient temperature conditions, one such parameter is the maximum allowable D.C. output current which varies with this temperature. Furthermore, the maximum surge current when the equipment is first switched on must also be considered an important characteristic. Another important parameter is that which

(Continued on page 502)

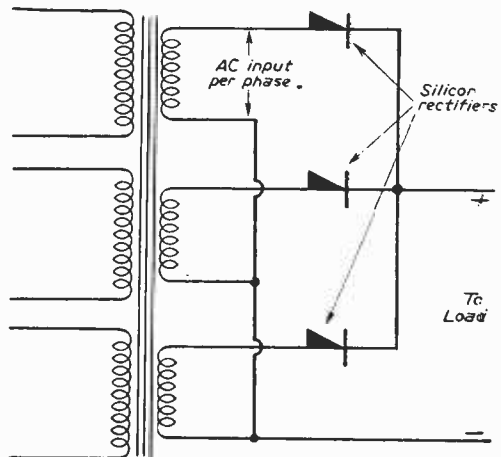
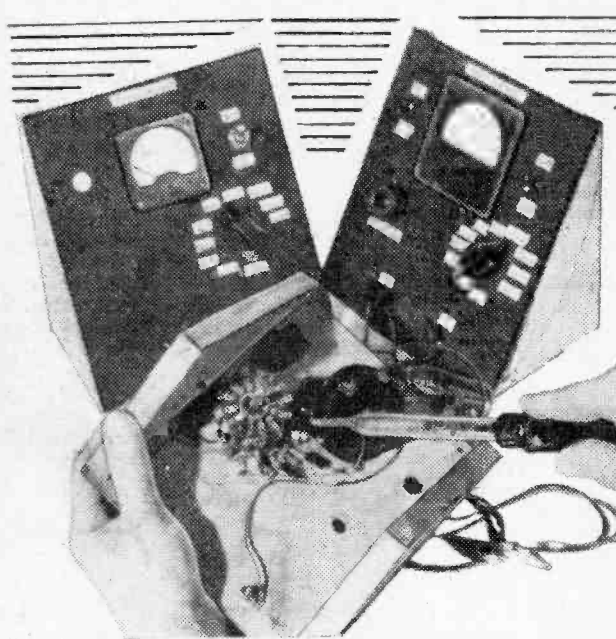


Fig. 4.—Three-phase half-wave circuit.



# A Beginner

## No. 2—THE COLOUR CODE SCOPE OF THE METER

Body red, tip or end green, dot or ring yellow.

If your resistors use this system make quite sure you understand it and if in doubt seek advice before using the resistors.

### System II Explained

Resistors coded with this system may be distinguished by the fact that the colours are all massed towards one end and that the body of the resistor is of a different colour, usually white. The coloured band showing tolerance is away from one end, usually just past the middle of the resistor.

The numbers are read, starting from the end of the resistor and working towards the metallic tolerance colour or the blank end of the resistor if it is a 20 per cent. type.

Thus a 10kΩ resistor using this code is read as follows: First digit is one (brown), second digit is nought (black), the number of noughts required to make the number is three (orange). Thus there are three consecutive rings on the resistor, brown,

**I**N last month's article, a simple 10V. D.C. meter was constructed. Before we proceed to alter the meter to a multi-range voltmeter, we shall deal with the colour code for resistors which was mentioned briefly last month. We repeat Fig. 4 (right) for the convenience of the reader.

There are, unfortunately, two systems of marking the resistors, one cannot foretell which system will be used when you purchase them; there is one blessing in the fact that both systems use the same colours for the same numbers.

### System I Explained

Resistors coded with this system are distinguished by the fact that they have a band or spot in the centre and the colour of the body extends more or less over the whole resistor. The metallic band showing tolerance is at one end of the resistor. If the main body of the resistor is not coloured then it does not use this system.

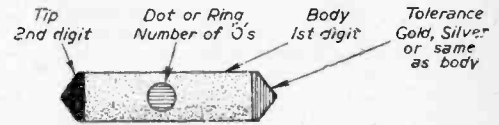
The first digit is shown by the colour of the body (brown), the next by the colour at the end or tip of the resistor (black) and the number of noughts by the dot or centre ring (orange). Fig. 4 (a) and (c) will make this clear.

Suppose we are reading a 10,000 ohm resistor as for the 10V. meter described. We note that "one" is brown, and the next digit is "nought" which is black, and that three more "noughts" are required to complete the number. These three noughts are represented by orange.

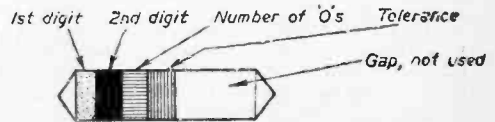
A 1MΩ resistor would show:

Body brown, tip or end black, dot or ring green.

A 250kΩ resistor would show:



Order of reading.....Body...Tip...Dot  
(a) System I



Order of reading Left to Right  
(b) System II



(c) A 10kΩ Resistor (5%)

Fig. 4.—Reading the resistor colour code.

# Test-Meter

## R RESISTORS IS EXPLAINED AND THE EXTENDED

By E. V. King

black, orange and then the gold or other tolerance marking.

A 1M $\Omega$  5 per cent. would thus show:

Brown, black, green plus gold for 5 per cent. tolerance.

A 250k $\Omega$  5 per cent. resistor would show four rings thus:

Red, green and yellow plus the gold tolerance of 5 per cent.

If you are still in doubt about your resistors, ask someone to help you. Do not on any account guess a value, not only would the meter be inaccurate, but there is a good chance of burning it out or bending the needle.

### The Range Switch

Now that you understand the values of your resistors you must examine the switch. The

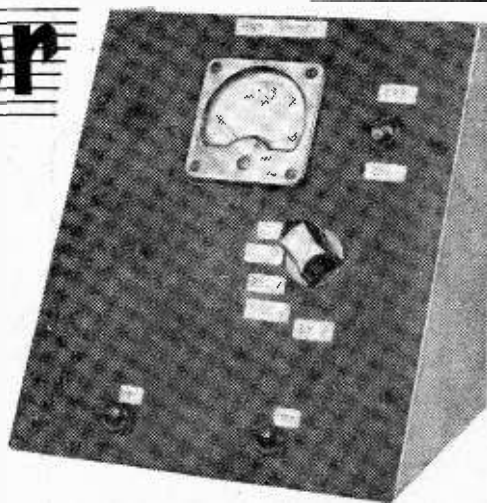
#### COLOUR CODE CHART

Black	: 0	Green	: 5
Brown	: 1	Blue	: 6
Red	: 2	Violet	: 7
Orange	: 3	Grey	: 8
Yellow	: 4	White	: 9
Silver : 10 per cent. tolerance.			
Gold : 5 per cent. tolerance.			

author purchased some two-bank 11-way switches. If not purchased as surplus this switch can be quite expensive, so scan the advertisements or visit the surplus stores. If it is dirty, try to clean it without using any liquid cleaner. If you do have to use switch cleaner, then smear a little lanoline (not Vaseline) or special switch lubricant on the contacts, or over the course of years they will become worn and give bad readings, or in the case of the current ranges could cause a meter burn-out.

If the distance between the wafers is more than  $\frac{1}{16}$  in. it is a good idea to take off one wafer, remove the screws and distance pieces and replace exactly the same way round, using distance pieces cut to  $\frac{1}{16}$  in. and new screws ( $\frac{1}{16}$  in. Whit. from the ironmonger will do).

Refer to Fig. 5 and study your own switch. Let us look at one bank first. Fit a knob on the spindle and turn it round so that as you look at the back of the switch the rotor moves clockwise until it comes against its stop. The central contacting ring will now be connected to one contact.



The multi-range D.C. voltmeter.

This contact is called 1, the next 2 and so on. The contact No. 12 is the one which is always rubbing on to the central, travelling, ring. Thus, in the first position tag 12 is connected to tag 1, and in the second to tag 2 and so on.

### Other Switches

Underneath, the other bank of the switch has exactly similar contacts doing exactly the same thing. If your switch is of a different type do not fit it until you are sure how it works and which tags are the equivalent to "12" on the type drawn. If you are in doubt test out the switch using a torch bulb and battery.

A 12-way, two-pole (two-bank) switch would suit, the spare contact being left unused or joined to number 1 or 11. A switch which joins more than two tags together at one time is not suitable, so if looking through the spares box be careful in your choice.

In order that your wiring plan may match up with the photographs and diagrams published you

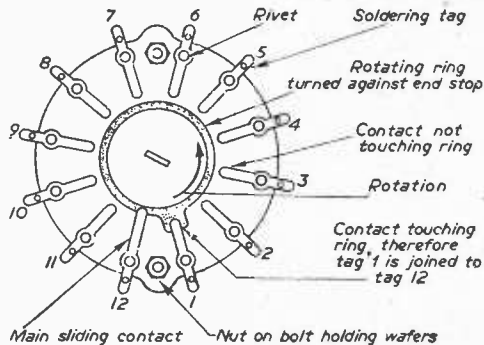


Fig. 5.—The contacts on the switch wafers.

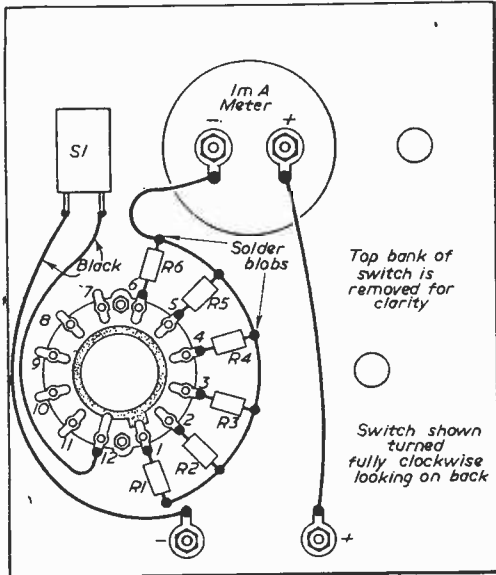


Fig. 6.—Circuit of the multi-range D.C. voltmeter.

must now mount the switch (Figs. 2 and 6) so that the contacts are in the same relative position as in the author's prototypes. The switch contact which rubs the central ring (number 12 in Fig. 5) is placed downwards towards the base or terminals of the multimeter. Fig. 6 makes this position quite clear. Mount the switch very firmly, using a spring washer on the outside. Some switches have a small metallic lug which will grip the hardboard and prevent them from turning. If you use an aluminium panel you will have to drill a small hole to take this lug.

### The Multi-range Voltmeter

You should now have the meter, S1, S2, S3, the terminals and the wiring arranged for the simple 10V. meter.

Remove the 10k $\Omega$  resistor from S1 and the meter, then, referring to Figs. 6 and 7, wire up as follows:—

1. Turn the switch so that the rotor moves fully clockwise when viewed from the rear. The central ring now contacts on to pin No. 1 and we are using the bottom bank of the switch. (the bank nearest to the panel). The top bank, the one nearest to you, is not yet used. Shorten your resistors so that they have about  $\frac{1}{4}$  in. to  $\frac{1}{2}$  in. leads at each end. Tin the leads, scraping them if they are old. Use multi-cored solder. On no account use any acid flux or your meter will definitely not work.

2. Solder R1 (1M $\Omega$ , gold band) to tag one.

3. Solder R2 (500k $\Omega$ , gold band) to tag 2.

4. Solder R3 (250k $\Omega$ , gold band) to tag 3.

5. Solder R4 (100k $\Omega$ , gold band) to tag 4.

6. Solder R5 (10k $\Omega$ , gold band) to tag 5.

7. Take a bare tinned copper wire and solder it to the negative tag of the meter. Now bend it in a semi-circle to contact each resistor in turn.

8. Put a neat round solder blob to connect this wire to R6.

9. Put a similar solder blob to join each resistor to this loop of wire.

10. Join S1 with a black wire to pin 12 of the same bank of the range switch.

11. Check that your resistors are definitely of the right value and are wired to the correct tags.

### Testing the Meter

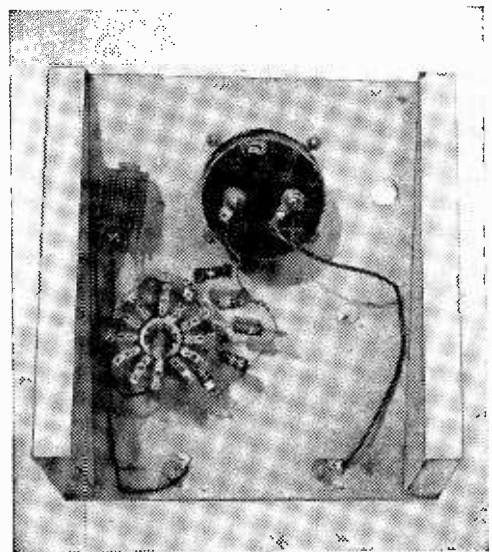
The meter is now finished so far as the D.C. volts ranges are concerned. The beginner may have made some error so it is wise to be careful and proceed as follows:

Put S1 and S2 on the 1,000V. range (using the 1M $\Omega$  resistor), and, using one cell of a torch battery (1 $\frac{1}{2}$ V.), clip the positive lead to the brass cap (positive) and quickly and gently flick the other clip on to (and off again) the bottom of the zinc casing. The meter needle should move only very slightly if at all. If, on flicking the lead, the meter moves over to, say, half way, there is definitely an error in the resistors or wiring and you must find it before using the meter.

Now repeat the procedure on the other ranges in turn. On the 100V. range the needle will move a little, but only about 1/10th of a division. On the 10V. range the needle should, of course, show a value of about 1 $\frac{1}{2}$ V. if you leave the leads in contact with the battery.

Having satisfied yourself that, on doing this test, the needle does not move very much except on the 10V. range, the meter may be given a further test.

If you have one, take a 60V. H.T. battery. Turn the meter to the 1,000V. range. Connect up, flicking first to make sure the needle is not likely to go right over. The needle should show the correct reading, that is just over half of 0.1mA on the meter scale. Now try the other



Rear view of the multi-range D.C. voltmeter.

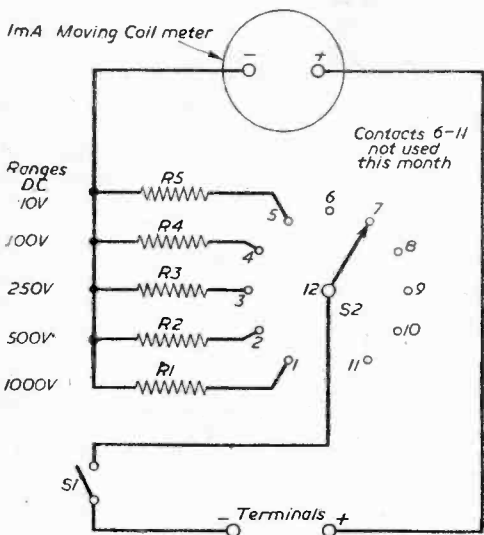


Fig. 7.—Wiring of the multi-range D.C. voltmeter.

ranges in turn, flicking first to be sure the needle will not kick right over; the 10V. range, of course, *must not* be connected to 60V. The 100V. range should give a reading of about 0.6mA (i.e., 60V.) according to the state of the battery

If one of the ranges appears faulty in this testing then the resistor in circuit is most likely to be of the wrong value. If you have been careful over the details given, your meter will work well and accurately, within the limits specified, as soon as it has been completed.

**How to Use the Voltmeter**

*Rules to follow*

1. Always leave the red lead on the positive terminal.
2. Always switch off the meter after use, and before changing ranges.
3. Never anticipate a low voltage. Always commence on the 1,000V. range and work downwards every time you take a reading. (Naturally a 100V. battery cannot exceed 100V., but the above procedure would only waste a few seconds and the beginner should keep to it.)

RA could be a choke, coil or transformer

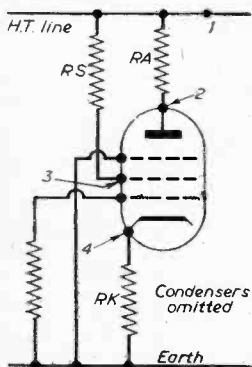


Fig. 9.—Test points in a typical pentode valve circuit.

4. In the ordinary way the negative crocodile clip is fixed to the chassis, or in the case of battery receivers to the negative terminal of the battery. Make sure the lead will not foul any parts.

5. A good test prod which will guard against producing

short-circuits, etc., can be made by clipping the positive clip to the stem of an insulated screwdriver (Fig. 8). You may get added safety by sliding some insulated sleeving over the stem, leaving  $\frac{1}{16}$  in. of metal at the top for the clip and at the bottom for testing. You may adopt the procedure of switching off the receiver under test and clipping the positive lead directly to the part to be tested. This is more certain and less tricky, but takes longer. It is, however, a good procedure for the beginner.

**Tests on a Receiver**

So far the meter works only on D.C. volts, but quite a good number of helpful tests can be made on a faulty receiver.

Refer to Fig. 9. A typical pentode valve is shown, it could be an output type or an H.F. amplifier. Test first between H.T. line (1) and earth. You would expect a voltage of between 150 and 450V. Test between valve anode (2) and earth. You would expect a slightly lower reading, or in some cases a much lower reading. A test between screen grid and earth (3) should give a value of below H.T. voltage if Rs is fitted.

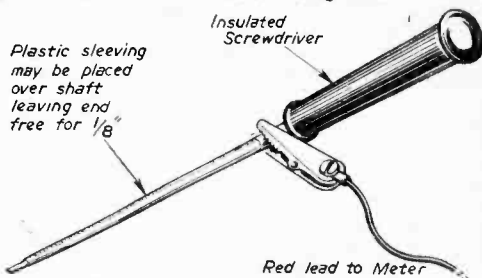


Fig. 8.—An improvised test prod.

If not, it should be the same as the H.T. voltage. The bias on the grid is checked not on the grid but between cathode and earth (4). It should be somewhere between 1 and 30V. Where your tests do not agree with those expected, suspect the associated circuit or parts.

Although the scope of the meter may appear to be somewhat limited, the beginner should find many applications for it. The rules given above concerning the procedure when using the meter are very important and should be followed very carefully in order to prevent damage to the instrument.

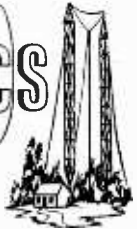
(To be continued)

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# TRANSMITTING TOPICS



V.H.F. PROPAGATION

By O. J. Russell, B.Sc.(Hons.), G3BHJ

V.H.F. propagation has apparently a considerable interest for many readers. It should be realised that this question is considerably more complex than the usual aspects of D.X. propagation on the lower frequencies.

Considerable work was done on V.H.F. frequencies as far back as thirty and more years ago and it was assumed that propagation on the V.H.F.'s was largely confined to "optical" range.

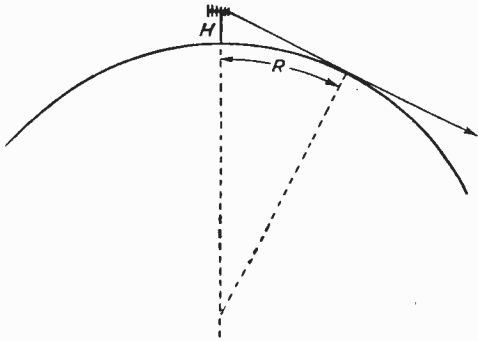


Fig. 1.—Owing to the curvature of the earth, in the absence of an atmosphere, the optical range is determined by geometrical considerations.

However, it was realised that "optical" propagation was not all the story.

### (Optical range

To illustrate the concept of "optical" range, Fig. 1 shows how the range of very short waves, including light waves, may be calculated geometrically, the "radio" horizon in fact being the same as the "optical" horizon. On this basis, the "radio" horizon  $R$  of an aerial  $H$  ft. high is  $R = 1.21\sqrt{H}$  miles. Thus even with an aerial 100ft. high, the "optical" horizon is only some twelve miles away. However, this is not the effective range of communication. The receiving aerial,

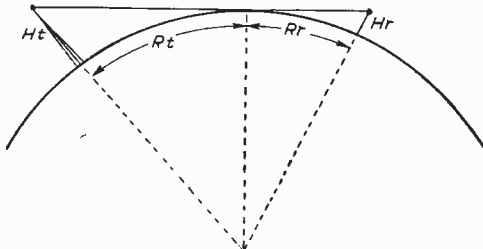


Fig. 2.—For given aerial heights for transmitter and receiver, the optical range for communication is the sum of their two optical ranges.

provided it can just "see" the transmitting aerial, and is raised above the ground, may be well beyond the limit formed by the "optical" horizon of the transmitter. In other words the "optical" horizon would be the transmitter range to a receiving aerial situated at ground level. Fig. 2 illustrates that when both receiver and transmitter operate with elevated aerials, the resultant optical range is the sum of the optical ranges of the two aerials. If  $H_t$  is the height of the transmitting aerial and  $H_r$  the height of the receiving aerial, the optical range ( $R_m$ ) is given by  $R_m = R_t + R_r = 1.21\sqrt{H_t} + 1.21\sqrt{H_r}$  or  $R_m = 1.21(\sqrt{H_t} + \sqrt{H_r})$ .

### Refraction Effects

Even this does not look very promising for V.H.F. QSO's, as two amateurs with aerials 100ft. high, would apparently have an overall range of some 24 miles. Needless to say on the amateur allocations above 50Mc/s. communications are regularly carried on to very much greater ranges. The question arises as to why this should be. The first factor extending range, is the fact that the atmosphere causes slight bending of the waves (refraction). This means that waves which would otherwise travel off into space are bent sufficiently to reach the earth (Fig. 3).

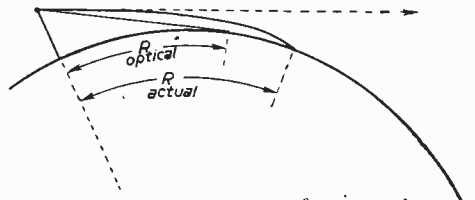


Fig. 3.—Owing to the presence of an atmosphere, radio waves are slightly refracted, so that a wave which would otherwise pass into space may be returned to earth. This effect slightly extends the optical range on V.H.F.

To allow for atmospheric bending, the constant in the equation for optical range may be modified slightly, so that in the presence of the normal undisturbed atmosphere, the effective optical range may be taken as  $R_{opt} = 1.33\sqrt{H}$ . Thus owing to refraction in the normal or undisturbed atmosphere, there is about a 10 per cent. increase in the "optical" range over the strictly geometrical range.

### Signal Strength

There is one point connected with V.H.F. propagation that is not generally realised. One would expect within the optical range of a V.H.F. station that one would receive signals equal to





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DK96	8/9	KT36	29/10	UCF80	16/7	6BH6	9/6			6BV6	7/6			6BV6	7/6	12K7GT	7/6
DL56	8/9	KT55	11/6	UCF80	16/7	6BH6	9/6			6BW7	6/6			6BW7	6/6	12K8GT	7/6
DM70	7/6	KT61	13/6	UCF80	16/7	6BH6	9/6			6C4	6/6			6C4	6/6	13/6	
E450	1/6	KT63	7/6	UCF80	16/7	6BH6	9/6			6C5GT	6/6			6C5GT	6/6	12Q7GT	7/6
EABC80	9/6	KT66	17/6	UCF80	16/7	6BH6	9/6			6C6	5/6			6C6	5/6	12SG7	7/6
EAF42	10/6	KTW61	6/6	UCF80	16/7	6BH6	9/6			6D6	5/6			6D6	5/6	12SH7	6/6
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EB41	8/6	MH41	7/9	VP13C	3/6	6H5GT	2/6			6F6G	7/6			6F6G	7/6	12SK7	6/6
EBC33	6/9	MSP4/5	10/6	VP23	6/6	6J5M	6/6			6FM6	7/6			6FM6	7/6	12SL7	8/-
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EBF89	9/6	N78	19/11		8/6	6J7M	9/6			6F15	14/-			6F15	14/-	12SQ7	8/6
ECC81	8/-	N339	29/10	VR116	4/6	6K7G	6/6			6H6	2/6			6H6	2/6	14S7	17/-
ECC82	7/6	OZ4	5/6	VR150/30	6/7	6K7M	6/9			6H5GT	2/6			6H5GT	2/6	15D2	7/9
ECC83	9/6	P61	3/6		9/6	6K8G	7/6			6J5M	6/6			6J5M	6/6	19BG6G	
ECC84	10/6	PCC84	9/6	VU120A	3/6	6K6GT	7/6			6J6	6/6			6J6	6/6	23/3	
ECC85	9/6	PCF80	9/6	VU39	6/7	6K7GT	5/9			6J7G	6/6			6J7G	6/6	20P1	26/6
ECF80	12/6	PCF82	12/6	(MU12/14)	8/9	6K8GT	6/9			6K7M	6/9			6K7M	6/9	25A6G	10/6
ECF82	13/6	PCL82	12/6		8/9	6L6G	7/6			6K8G	7/6			6K8G	7/6	25L6GT	10/-
ECH21	23/3	PCL83	14/6	VU111	2/6	6L6M	9/6			6K6GT	7/6			6K6GT	7/6	25Z2	9/6
ECH42	9/6	PL38	17/6	W76	7/6	6L7G	7/6			6K7GT	5/9			6K7GT	5/9	30C1	21/11
ECH81	9/6	PL36	15/6	W77	8/6	6L8	11/6			6K8GT	7/6			6K8GT	7/6	30F5	10/6
ECL80	10/6	PL81	12/6	X78	16/6	6N7GT	7/6			6L6M	9/6			6L6M	9/6	30L1	10/6
ECL82	12/6	PL82	8/6	Y63	9/6	6O7G	7/6			6L7G	7/6			6L7G	7/6	30P4	20/7
EF22	8/6	PL83	11/6	YA5GT	6/6	6O7GT	9/6			6L8	11/6			6L8	11/6	30P12	12/6
EF36	5/-	PX25	12/6	YA7GT	12/6	6P5GT	8/6			6N7GT	7/6			6N7GT	7/6	30P16	9/6
EF37A	15/-	PY80	7/6	IC2	11/6	6S7G	7/6			6O7GT	9/6			6O7GT	9/6	35L6GT	10/-
EF39	5/9	PY81	8/6	IC5GT	12/6	6SH7	6/6			6P5GT	8/6			6P5GT	8/6	25Y5	9/9
EF40	14/6	PY82	7/6	ID5	12/6	6S7G	7/6			6S7G	7/6			6S7G	7/6	35W4	8/6
EF41	9/9	PY83	8/6	ID6	12/6	6SK7	6/6			6S7G	7/6			6S7G	7/6	35Z4GT	8/6
EF42	11/-	PZ30	19/11	IH5GT	10/6	6SL7GT	8/6			6SK7	6/6			6SK7	6/6	42	8/6
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EF54	6/6	PEN25	15/-	IN5	10/6	6U4GT	12/6			6SN7GT	9/6			6SN7GT	9/6	50C6D6G	
EF55	10/6	PEN46	7/6	IR5	8/6	6U5/6G5	29/10			6S7G	7/6			6S7G	7/6	29/10	
EF80	8/6	PEN220A		IS4	10/6		17/3			6U4GT	12/6			6U4GT	12/6	50L6GT	8/6
EF85	7/6			IS5	10/6		6/6			6U5G	8/6			6U5G	8/6	75	11/6
EF86	13/6	PENA4	15/-	IT4	6/6	6U7G	8/6			6U7G	8/6			6U7G	8/6	77	7/6
EF89	8/9	QP21	7/6	JA8GT	6/6	6V6G	6/6			6V6G	6/6			6V6G	6/6	80	8/6
EF91	5/9	SP41	3/6	JD6	5/6	6V6GT	7/9			6V6GT	7/9			6V6GT	7/9	142BT	3/6
EF91(BVA)		SP61	3/6	Q4	8/6	6X4	7/6			6X4	7/6			6X4	7/6	185BT	33/2
		SP4/5	10/6	Q5GT	9/6	6X5G	7/6			6X5G	7/6			6X5G	7/6	210DDT	4/6
EL32	5/6	SP47	10/6	354	7/6	6X5GT	7/6			6X5GT	7/6			6X5GT	7/6	210VPT	3/6
EL33	14/6	T41	23/3	3V4	8/6	6J30L2	12/6			6J30L2	12/6			6J30L2	12/6	8/6	
EL38	26/6	TDD1	3C	D41	3/6	7B6	10/6			7B6	10/6			7B6	10/6	301	10/6
EL41	10/6	TDP25	26/6	SR4GY	9/6	7B7	8/6			7B7	8/6			7B7	8/6	302	10/6
EL42	10/6	U10	10/6	SU4G	7/6	7B8	6/6			7B8	6/6			7B8	6/6	304	10/6
EL81	7/6	U14	8/6	SV4	11/6	7C5	8/6			7C5	8/6			7C5	8/6	305	10/6
EL84	9/6	U22	8/6	SY3G	8/6	7C6	8/6			7C6	8/6			7C6	8/6	306	10/6
EM34	9/6	U25	14/6	SY3GT	8/6	7D6	13/6			7D6	13/6			7D6	13/6	807	6/6
EM80	10/6	U37	26/6	SZ4G	9/6	7H7	9/6			7H7	9/6			7H7	9/6	954	2/6
EM81	10/6	U45	14/6	SZ4M	10/6	7Q7	9/6			7Q7	9/6			7Q7	9/6	955	4/6
EY51	10/6	U50	8/6	GA7	12/6	7S7	9/6			7S7	9/6			7S7	9/6	956	3/6
EY86	10/6	U76	8/6	GA8G	9/6	7Y4	9/6			7Y4	9/6			7Y4	9/6	5763	11/6
EZ40	7/6	U191	11/6	GA6C7	6/6	8D2	2/9			8D2	2/9			8D2	2/9	9004	5/6
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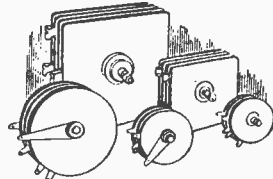
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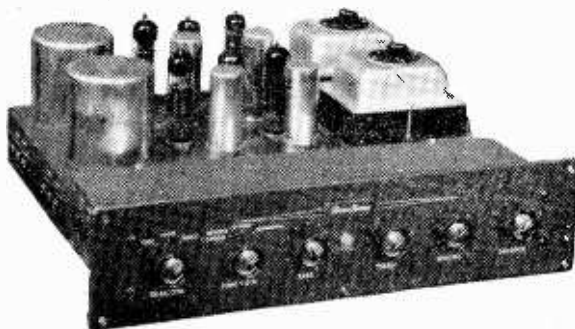
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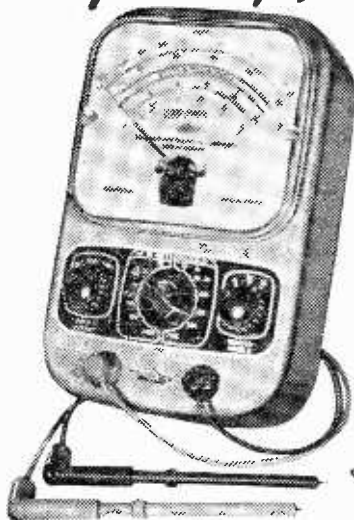
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the "free space" value. Even on a perfectly smooth earth this is not so. As Fig. 4 shows, there is very good reflection from the surface of the earth. Unfortunately, this reflected signal is reversed in phase on reflection, so that with low aerials as shown in Fig. 4, the direct and reflected waves tend to cancel out. Hence it is desirable to use aerials as high as practicable, so that as

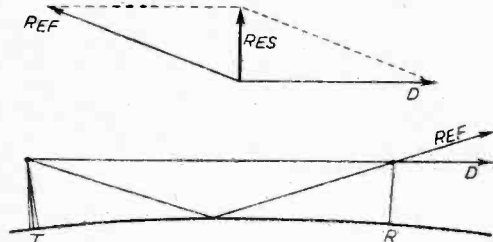


Fig. 4.—The reflected and direct rays within the optical range interfere with each other, so that field strengths recorded may be very much lower than the "free space" values. As the reflected wave is phase reversed on reflection, it tends to cancel out the direct wave. The vector diagram above the main diagram shows that the resultant field is small.

shown in Fig. 5 an appreciable difference is obtained between the two paths. Hence the cancellation of the two signals is less perfect and the received signal is stronger. In practice, the terrain is not perfectly smooth, and reflections occur from the earth and from buildings, giving large fluctuations in received signal as the reflections add or subtract from the direct signal. This is important on V.H.F. television and radio, where siting of the receiving aerial is often quite critical.

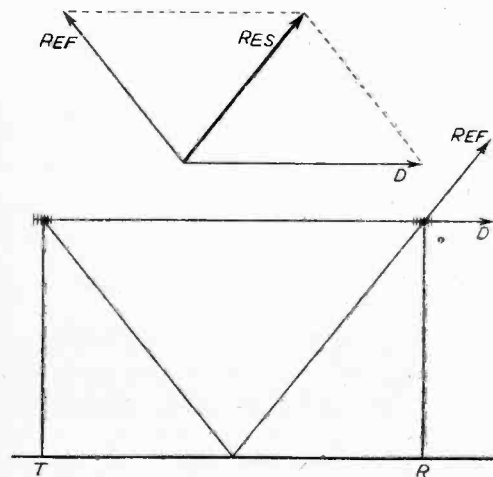


Fig. 5.—Increasing aerial elevation increases the phase difference between the direct and the reflected rays, thus giving a higher resultant field strength. The vector diagram shows that the resultant field is now increased compared with the diagram shown in Fig. 4.

### Dependence on Frequency

Note that unlike the extension of horizon by atmospheric refraction by the undisturbed atmosphere, these reflection effects depend very much on the frequency in use. As the wavelength is reduced, a smaller change in path length is equivalent to a large phase change. Thus blind spots tend to become more numerous on the higher frequencies.

There is another factor which is dependent on wavelength, and which contributes appreciably in extending V.H.F. propagation range beyond the optical horizon. This is diffraction. The radio shadow cast by an obstacle is not precisely sharp, but owing to the wave nature of the radiation,

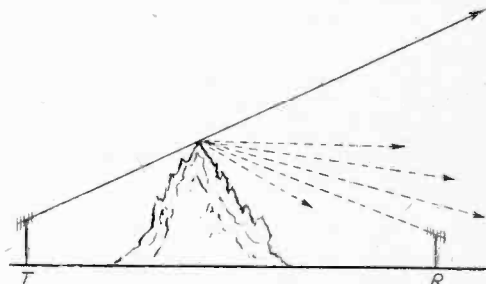


Fig. 6.—Diffraction effects may enable an appreciable amount of signal to be received by a receiving aerial deeply screened by a mountain range or similar sharp obstacle.

diffraction into the shadow occurs. Where the obstacle is the curvature of the earth, diffraction results in an extension of range beyond the optical horizon. This phenomenon may be used to obtain "obstacle gain" from some natural obstacle such as a range of mountains. If V.H.F. energy is directed towards the edge of a range of mountains shadowing the receiving aerial, diffraction may enable sufficient energy to reach the receiver for good communication to be effected (Fig. 6). The extension of range that is given by diffraction effects falls off with increasing frequency, so that at microwave frequencies it is negligible.

### Super-refraction

This does not exhaust the mechanisms by means of which V.H.F. waves may be propagated to distances greatly in excess of the optical horizon. One such mechanism is the phenomenon of "super-refraction." As we have seen, refraction in the normal atmosphere slightly extends the optical range of a V.H.F. transmitter. Under "super-refraction" conditions so-called "anomalous propagation" occurs which may give a great extension of range.

Without an elaborate explanation, anomalous propagation may be caused by a layer of warm moist air overlying colder air at the surface of the earth. Dry misty weather with a high barometer are suitable meteorological conditions. Long range reception of TV signals is one result of this condition, and at times there has been interference to BBC transmissions from Continental TV stations sharing the same channel.

### Ducting

The bending effect occurring by super-refraction may be regarded as if the V.H.F. waves were reflected from the refracting layer. An analogous effect which is more important on the higher frequencies is "ducting." In this phenomenon, the layer of super refracting air acts as a waveguide, and a V.H.F. wave may be "trapped" in such a duct and carried round the curvature of the earth for a considerable distance before escaping again and reaching a distant receiver (Fig. 7). As this phenomenon is strictly analogous to a waveguide, it is more noticeable at the higher frequencies.

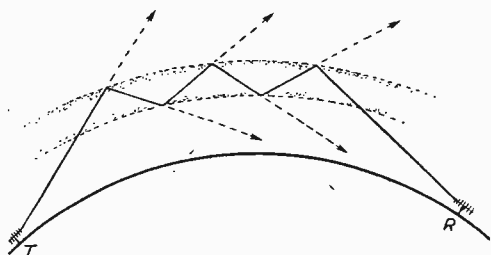


Fig. 7.—A super-refracting duct may convey a trapped wave by internal reflection to great distances, thus giving anomalous propagation to far beyond the optical limit.

Large, stable, ducts necessary for lower frequency propagation by ducting are not formed as often as the smaller ducts which will readily cause long distance propagation of higher frequency waves. Thus ducting is a fairly rare phenomenon for, say, two metres, while at 75cm and higher frequencies it is relatively more common, and has, for example, caused radar systems to give phenomenal range performances occasionally.

It should be noted that optical mirages are closely allied to these V.H.F. wave occurrences, although a layer of heated air to give reflection of light waves usually occurs only in tropical countries. Similarly "ghost pools" looking like water which vanish when one approaches them are often noticed on roads on a hot summer day.

### Other Phenomena

Aurora may cause occasional reflection of waves up to around 150 megacycles. Large meteorites may cause a trail of intense ionisation persisting for minutes sufficient to give reflection. Generally, however, meteorites are too small to give more than a transient reflection. Listening to a V.H.F. or shortwave station well outside its normal range, so that only a weak signal is heard, the persistent listener will notice sudden transient peaks of strong signal every minute or so. At times several of these may run together giving burst of readable signal for several seconds and very occasionally longer. When an intense meteor shower occurs, it may be possible to get a readable signal for appreciable periods. In fact, on ten and fifteen metres when the band is "dead," it is often possible to hear signals jumping up out of the noise due to this effect.

### Scatter Propagation

A further propagation method also enables long distance V.H.F. propagation to be achieved. In fact, it is probably this mechanism which enables weak but readable amateur V.H.F. signals to be sent fairly reliably over distances of a hundred or more miles. This is the much publicised "scatter" propagation mode. Briefly, neither the atmosphere nor the ionosphere are homogeneous and cause a slight but perceptible scattering of radio waves. By this means energy may be scattered back to a distant point (Fig. 8). This method is quite reliable, although high powers and high gain aerials are generally needed for good signals. Even with the power available to amateurs, it can be shown that readable signals sufficient for amateur contacts may be exchanged at distances exceeding a hundred miles. In fact, experience has shown that distant transmitters can be reliably contacted quite well on a 100 per cent. basis, even though signals may be weak over considerable distances regardless of conditions. This does involve good techniques in both transmitting and receiving equipment particularly in aerial efficiency. Naturally, under super-refracting or similar conditions the same path may give tremendous signals, but regardless of these factors

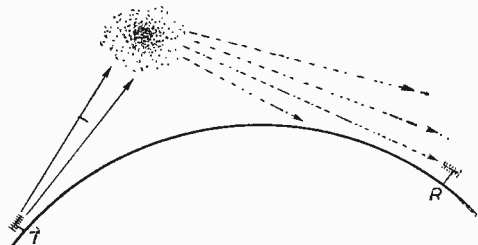


Fig. 8.—In scatter propagation a tiny amount of energy is scattered back from the upper atmosphere and ionosphere.

some sort of signal may be exchanged. Just how far this can be pushed with amateur power limitations remains to be seen. With commercial equipment running kilowatts, reliable communication to a thousand miles or so is feasible.

(To be continued)

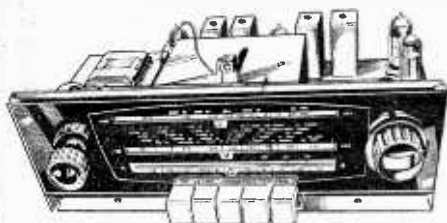
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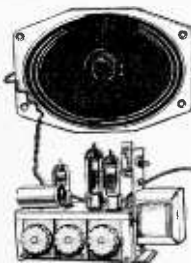
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# Becoming an "Amateur" 99

AMATEUR RADIO FOR BEGINNERS—2

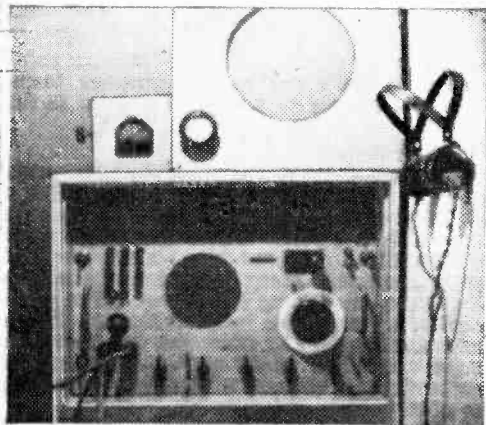
By J. D. Pearson, G3KOC

**I**F the interested reader has taken the steps outlined in the previous article he should by now be settling down to serious study of radio theory. Most of the textbooks recommended by the City and Guilds can be obtained on loan from the reader's local public library, or can be purchased. The latter course is more convenient, but also more expensive.

## Textbooks

The writer used one textbook only whilst studying theory. Most books on the subject assume a certain standard of knowledge on the part of the reader, and an unfortunate choice of textbook by the student often results in early discouragement.

The reader who has taken this magazine for some two or three years will have by him an invaluable series of articles, suitable for beginners, dealing with radio fundamentals. They contain illustrations of simple, practical experiments which will do much to assist students, in a manner which the written word will never usurp.



The rig of Mr. N. E. A. Rush (G3HBZ).

This series of articles was subsequently published in book form under the title "A Beginner's Guide to Radio," and is available from the Book Department, George Newnes Ltd., Tower House, Southampton Street, London, W.C.2. It costs 7s. 6d., or 8s. 3d. post free.

With suitable books in his possession, the beginner should ensure that he has access to all the theory necessary to get him through the R.A.E. A close study of the past R.A.E. exam papers will reveal that the questions are basically the same year after year; they are re-phrased, of course, and the figures altered where necessary, but inevitably they are similar questions for the simple reason that the syllabus is the same.

## Short-wave Listening

There are many home radio constructors who, having built their first one- or two-valve receiver, have stumbled accidentally into amateur radio whilst tuning the "short" wave-bands. Others have built or bought receivers for the sole purpose of listening in to amateur transmissions, their initial interest having been aroused by a chance meeting with a radio enthusiast, or perhaps by a casual glance through a magazine such as this.

If the listener's interest and enthusiasm is not damped entirely after prolonged endeavours to understand the apparent gibberish spoken on the amateur bands, then he may consider himself to be what is known in the amateur radio world as a short wave listener, or SWL. A period as an SWL is the finest possible training for anyone intending to take out a licence, although there are many very experienced SWL's who have no intention of becoming licenced.

## Amateur Bands

There are many ways in which the beginner can make his listening periods more interesting, gaining proficiency in the art at the same time. Obviously the first requisite, assuming that one already has a receiver, is a complete list of the frequency bands on which amateur transmission can be heard. These are given on Page 494.

The beginner may be confused by the frequency/wavelength relationship. As it is essential that he be able to express himself in terms of either, both for the R.A.E. and the correct operation of a short-wave receiver, the subject is dealt with here in as simple a manner as possible.

## Wavelength and Frequency

Radio waves travel at the same speed as light waves, which is approximately 186,000 miles, or 300 million metres, per second. The velocity varies with the medium through which a wave passes, but the above approximation holds good for our purposes. The relation between wavelength and frequency is expressed in the formula

Wavelength =  $\frac{\text{Velocity}}{\text{Frequency}}$  or by substitution of

$W = 300/f$ .  $f$  is the frequency in megacycles per second. Should the wavelength of a particular frequency in kilocycles be required the formula can be written

$$W = \frac{300,000}{f(\text{in kc/s})}$$

A kilocycle is one thousand cycles.

A simple example should suffice to illustrate the formula, e.g., "Express as wavelength a frequency of 30Mc/s." As  $W = \frac{300}{f(\text{Mc/s})} = \frac{300}{30}$  then

30Mc/s corresponds to a wavelength of 10 metres. A point worth noting here is that in formulae of the type just given wavelength is often denoted by the Greek letter Lambda thus:  $\lambda$ .

Most communication receivers of the type used by amateurs are calibrated in terms of frequency.

**Peculiarities of the Bands**

Each of the amateur bands is at its best at a certain time of the day or night, or at a certain time of the year. For instance, on 28Mc/s. or 10 metres—whichever way one cares to refer to it—the variation in conditions takes place gradually over a number of years. But on 1.8Mc/s or 160 metres, the variation occurs daily. During daylight hours this band is used largely for short distance phone contacts up to 30 miles or so, but after dark communication with Europe is possible, and with the U.S.A. given really excellent conditions and an extremely efficient aerial. However, “working” into America is accomplished with much less effort on the higher frequency bands!

The intelligent SWL will learn from experience at what particular time of the day and on which particular band he is most likely to hear from a given country. An apparently “dead” band is not necessarily due to poor conditions but may be simply an indication of lack of activity. This is the case with “160” almost every weekday between the hours of 8.0 a.m. and 5.0 p.m.

**Identification of Stations**

Most S.W.L.’s like to know the geographical location of the stations they hear. Each country has its own internationally assigned call letter or letters. These are usually followed by a figure which in turn is followed by one, two, or three letters. There are various books published in this country and in the U.S.A. to assist in the identification of call signs.

Another aid to the keen SWL is a “DX Zone Map,” and to the licenced amateur who likes to work all the continents, it is almost essential. This type of map is based on a “Great Circle” projection of the globe and enables one to determine the precise compass bearing of any particular station heard, providing its location is known. Conversely, it assists the licenced operator to align his aerial on the correct compass bearing of the country he wishes to contact. Maps published in this country usually have London as the

**THE AMATEUR BANDS**

Frequencies in Mc/s	Known as	or as
1.8-2.0 ...	Top Band	“160”
3.5-3.8 ...	Eighty	“80”
7.0-7.15 ...	Seven	“7”
14.0-14.35 ...	Fourteen	“14”
21.0-21.45 ...	Twenty-one	“21”
28.0-30.0 ...	Twenty-eight	“28”
144.0-146.0 ...	Two	“2 metres”

Table 1.—The most-used amateur bands. (There are five more between 420 and 10,000Mc/s, operation on which entails specialised equipment and techniques.)

focal point: the error involved for places anywhere else in the British Isles can be disregarded.

**The “Q” Code**

This consists of three-letter code blocks, each three-letter group beginning with the letter “Q.” It was originally evolved for use by commercial telegraphy operators in order to expedite traffic handling, which purpose it still serves admirably. Each individual three-letter group can be used as a statement or as a query, depending on whether the group is followed by the mark of interrogation.

An illustration of the usefulness of the “Q”

**COMMON “Q” CODE GROUPS**

QRA—Location	QRO—High power	QSL—Verification
QRG—Frequency	QRP—Low power	QSO—Communication
QRJ—Weak sigs	QRQ—Send fast	QSP—Pass on (message)
QRK—Good sigs	QRS—Send slow	QSV—Series of V’s
QRL—Busy	QRT—Close down	QSX—Listen for
QRM—Radio interference	QRU—Nothing further	QSY—Change frequency
QRN—Atmospheric interference	QRX—Wait	QSZ—Double sending
	QSB—Fading	QTH—Town (or city)
		QTR—Exact time

Table 2.—Amateur “Q” Code groups; in some cases individual meanings will be slightly different from commercial meanings.

Code may be gained from the following example: The letters QRZ signify “You are being called by . . .” When followed by an interrogation mark the meaning is “Who is calling me?” To the telegraphy operator, the first instance entails sending 11 individual morse characters instead of the 54 required to send the statement in full!

**Verbal Shorthand**

There are a great many “Q” Code groups, but radio amateurs use perhaps only a dozen or so. Most of these are used when working phone also, which is a partial explanation of the beginner’s mystification when tuning the amateur bands for the first time! Many licenced operators themselves have been among the severest critics of this practice, although the writer advocates its use. Band conditions being what they are to-day, the longer one takes about saying something the greater the risk of most of it going unheard by the other station, owing to interference.

A list of “Q” Code groups in current use by amateurs is given in Table II.

**The “QSL” Card**

The practice of exchanging printed confirmation of a QSO (contact) is as old as amateur radio itself. Apart from the data relating to the actual QSO (time, date, frequency, etc.), most QSL cards contain details regarding equipment in use and, of course, the sender’s call sign and QTH (address). In the article, we shall discuss the preparation of useful SWL reports and how to write for QSL cards.

We have received two letters arising out of statements made in the previous article, and these are printed in full on page 465 for readers’ information.

(To be continued)





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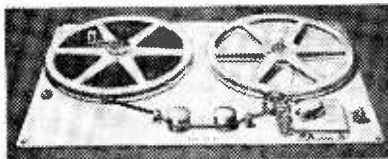
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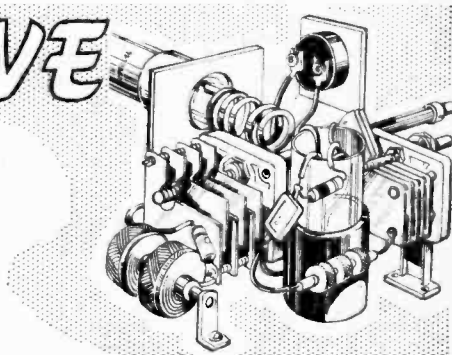
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# SHORT-WAVE SECTION

INDOOR AERIALS FOR THE S.W.L.

By A. W. Mann



**T**HE V-beam aerial is a simple yet efficient type, with marked directional properties depending on the angle between the two arms, and while twin feeder lines may be used if desired it will prove very effective if slung up as a continuous wire with a single wire downlead clipped on at the apex.

## An Adjustable V-beam

A V-beam receiving aerial which is suitable for suspending between two walls of an upstairs room is shown in Fig. 1. The battens could be fixed to the walls or to two shelves. The length of the room will determine the length of the arms, but good results are possible when each arm is 12ft. long.

It should be noted that as we are to use a

single downlead the aerial proper is one continuous length of wire. The construction is as follows: from B1 coiled spring and glass insulator; from the latter to point D, and across to point C then to insulator is aerial wire and terminating with a coiled spring.

The two battens required are of  $\frac{1}{2}$ in. square section. To allow for fixing screws they should be 6ft. 6in. and 5in. long respectively. Eight brass hooks of the screw in type are required. Fig. 1 shows them in position. The distance of the hooks A1 and A2 is 1ft, each side of the centre line. The next two on each side being 1ft. apart.

## Beam Angle

If this diagram is studied it will be seen that the beam angle may be varied progressively so that the open end is 6ft. at its maximum setting, 4ft. at the second setting and 2ft. at the minimum setting. Only two hooks are required at the apex end and these are screwed in  $\frac{1}{2}$ in. each side of the centre line.

The aerial wire should be cut in the first instance so that when complete with insulators and springs it can be hung between hooks A1 and A2 with a reasonable degree of tension. If cut that way it will be found that provided springs which are not too strong are used the tension applied to the next pair of inner hooks and the two outer ones B1 and B2 will not be too great.

## Tension

In the original aerial used by the author an outside aerial tension spring was cut in two and the ends looped to fit the hooks and glass type ribbed insulators. If suitable springs are not to hand endless rubber belts as used for vacuum cleaner motor drives can be used in place of both springs and insulators.

Where an exceptionally long downlead must be used the aerial should be tuned with a series tuner. The downlead used by the writer, however, is only 3ft. 6in. long as the receiver is on a table directly below the apex of the aerial.

The usual loft space will not allow straight lengths of aerial to be run to any extent and therefore various bent runs and formations will be necessary.

In the loft of the older type terrace house a 12ft. whip aerial mounted in its rubber base and screwed to the ceiling batten exactly in the centre

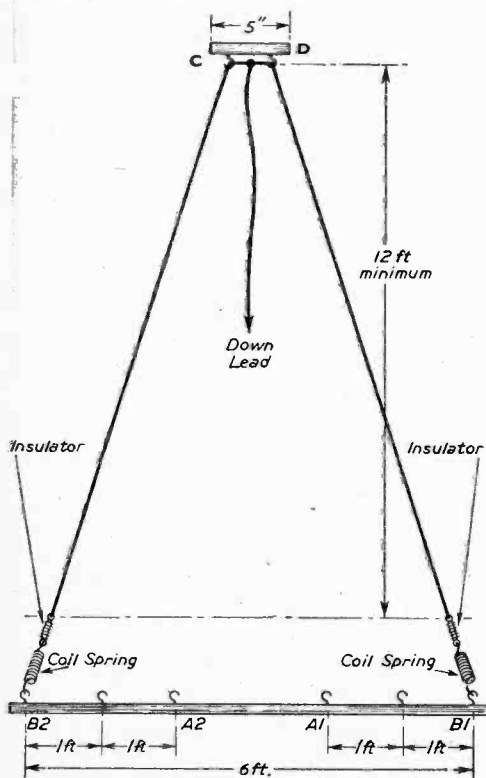


Fig. 1.—An adjustable V-beam aerial.

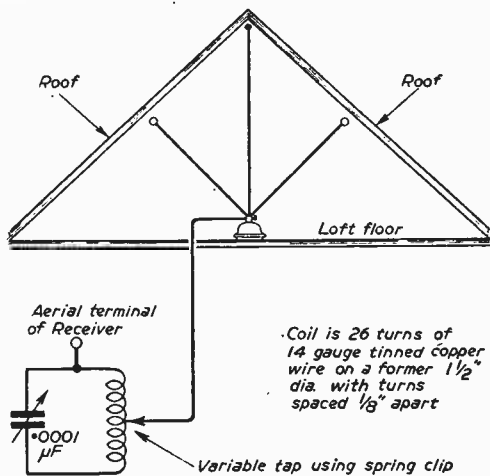


Fig. 2.—A whip aerial mounted in a loft. The radials are attached to the roof members.

of the loft will just clear the rafters supporting the roof. When an aerial of this type is for use with a receiver located in a ground floor room

a very long downlead cannot usually be avoided and care is necessary to avoid damping.

When the downlead is to be run to a receiver located in a room immediately beneath the loft it will be comparatively short and show on tests with the receiver that while satisfactory from the selectivity point of view insufficient pick up is obtained and the signal to noise level unsatisfactory.

### Radials

A substantial improvement can be made by means of either two or four radial elements which consist of suitable lengths of insulated aerial wire coupled at one end to the downlead terminal of the whip base and supported at the other end by the two joists in the case of one pair, and the end walls of the loft in the case of the other pair (see Fig. 2).

The wires run between the walls and the aerial base will be longer than those between the joists if the base is centrally mounted on the floor of the loft. The four elements or radials have to some extent a bottom capacity effect and increase the aerial pick-up. This idea will provide ample scope for experiment as the number of radials can be increased if desired.

## NOTES ON M.W. AERIALS

(Continued from page 472)

incline the rod to true vertical by 10 or 20 degrees in order to do this.

Most television aerials are vertical, of course, and good medium-wave reception can be obtained from a television dipole. The connection of a medium-wave receiver to the twin-wire or coaxial feeder of a television aerial presents an interesting matching problem which is not easy to solve, particularly if it is required that the connection of the medium-wave receiver shall not affect operation of the television receiver. Here is an interesting field for investigation by interested experimenters.

### Indoor Aerials

If it is impossible to erect a roof or window aerial, an indoor aerial is inevitable. Though necessarily inferior to outdoor types, such aerials can give fair results, but it is difficult to keep the capacitance low. The temptation is to conceal the aerial in a picture rail or along a skirting board but these are undesirable sites because the aerial is horizontal and has high capacitance.

Perhaps the best solution to the problem of providing a neat indoor aerial is to use a frame aerial or ferrite rod in the receiver cabinet. Although such aerials can be small, their output is not so much less compared with that of an outdoor aerial as might be imagined. Incidentally, I have recently had occasion to make comparison between a ferrite rod aerial and a good frame aerial and I find the frame aerial is almost equal to the ferrite rod aerial. Although because of the small size, the pick-up voltage is small, it is effectively multiplied by the very high "Q" value of the aerial. The "Q" at medium band frequency being in the region of 250/300.

### Orientation

Both the ferrite rod and frame aerials have directional properties which can prove very useful. For example, if the receiver is orientated to give minimum pick-up of a strong signal, it is often possible to receive other signals on neighbouring frequencies free of interference, a feat which is not possible using a vertical outdoor aerial because this is omnidirectional and cannot be made to discriminate against any particular signal. This feature of the frame aerial or ferrite rod can only be used when the path of the wanted signal makes an appreciable angle with that of the unwanted signal. The adoption of either the frame aerial or ferrite rod aerial involves alteration of the receiver, because it takes the place of the coil of the first tuned circuit, and must be aligned with the other tuned circuits in the receiver, but the alteration is not very difficult and well worth a trial where poor selectivity is experienced.

For those who are troubled with poor selectivity both frame aerial and the ferrite rod offer scope for experiment, by increasing or decreasing the number of turns very, very gradually until maximum selectivity is achieved.

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### INSTRUCTION MANUALS

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# A MICROPHONE PRE-AMPLIFIER

THIS UNIT ENABLES THE MICROPHONE TO BE USED UP TO SOME 200FT. FROM THE MAIN AMPLIFIER  
By J. G. Ransome

THE crystal microphone has proved to be very popular amongst tape-recording amateurs and it has many good features to recommend: good fidelity, compactness, absence of "boom" when overloaded and, of course, cheapness. However, the high terminal impedance and low level of the output (about 60dB down on a comparable moving-coil microphone and transformer) necessitate a short, well-screened connection between amplifier and microphone and this can prove a serious set-back to the use of this type of microphone. This small pre-amplifier has been designed to eliminate both of these difficulties. It is built into the case of the microphone and the whole unit can be made quite compact.

### Operation

The crystal insert feeds the grid of the first triode of the double triode (12AT7) which acts as a voltage amplifier (see Fig. 1). This in turn feeds the second triode which acts as a cathode

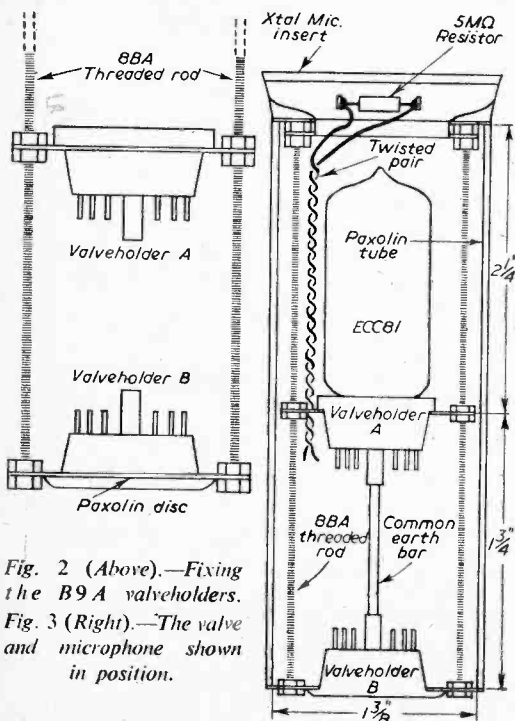


Fig. 2 (Above).—Fixing the B9A valveholders.  
Fig. 3 (Right).—The valve and microphone shown in position.

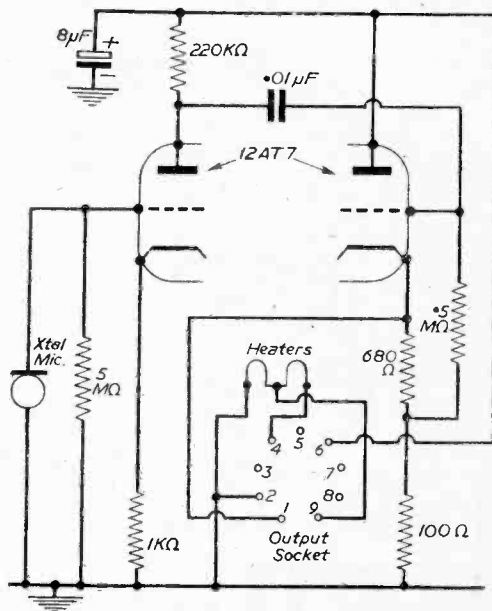


Fig. 1.—The circuit diagram of the unit, showing the connections to the output socket.

follower; the output impedance of the stage is about 250Ω and unscreened wire of up to 50ft. may be used to convey the output of the pre-amp. to the main amplifier, and if screened wire is employed this may be extended to 200ft.

### Construction

The two valveholders are first mounted. Valveholder B is mounted on a disc of paxolin 1 1/4 in. in diameter and secured by means of the 8 B.A. threaded rod. Valveholder A is now mounted as shown in Fig. 2. A short piece of heavy gauge copper wire is soldered between the two earth spigots on the valveholders and forms an earth bar (see Fig. 3). The main wiring is now done. For simplicity the pins on the holders are suffixed by the base letter. Thus, "connect resistor between 1a and 3b" means connect a resistor between pin 1 on base A and pin 3 on base B.

- Connect 0.01μF capacitor between 1a and 7a.
- Wire 220k resistor from 1a to 6a.
- Connect about 4in. of insulated wire to 2a (this will be taken to mic.).
- Take 1k resistor from 3a to common earth bar.
- Wire 4a to common bar.
- Connect 5a to 4b.
- Wire 6a to 6b and connect 8μF capacitor from 6b to earth (pos. end to 6b).
- Take 0.5MΩ resistor from 7a to 7b.
- Wire 680Ω resistor from 8a to 7b.
- Wire 8a to 1b.
- Wire 9a to 9b.
- Connect 100Ω resistor from 7b to common earth.
- Connect 2b to common earth.

Wire 4in. of insulated wire from common bar and twist with piece of wire originating from 2a.

**Testing**

The valve is now inserted in the holder and the amplifier checked. Wire up the B9A plug b shown in the diagram (Figs. 4(a) and (b)). The H.T. may be supplied from the main amplifier via a suitable dropper resistor or it may be taken from dry batteries since the current drain is low (4 or 5mA). The heaters are supplied from a D.C. source of either 6 or 12 volts. This may be obtained from either the heater chain of the main amplifier or from dry cells (four U2 cells seem to take the load quite well). If the heater chain method is used a small rectifier unit will have to be made up as shown in Fig. 5. D.C. heater supplies are used to eliminate hum pick-up that would occur if normal A.C. feeds were used. Connect a pair

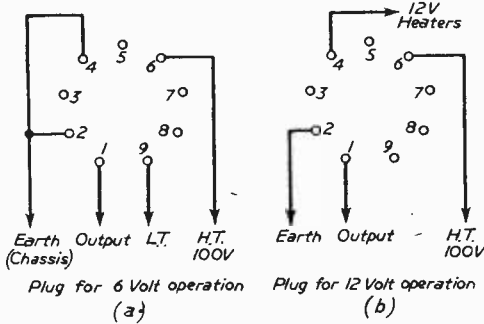


Fig. 4(a) and Fig. 4(b).—Wiring the plug for 6 volt and 12 volt heater supplies.

of headphones across pins 2 and 1, and take a wire from pin 2 to main amplifier chassis. If the pre-amp. is functioning a loud buzz will be heard when the wire going to pin 2 of the amplifier valve is touched. If everything is satisfactory the microphone may be wired in. The microphone to be used is glued to a disc of paxolin 1 1/2 in. in diameter and the whole assembly mounted on the rod. A 5MΩ (or 4.7M) resistor is then wired across the microphone terminals and the two 4in. wires made off on the microphone. The whole unit may then be pushed into a piece of paxolin tube 1 1/2 in. internal diameter. Small holes may be drilled in the outer case for ventilation purposes if this is thought

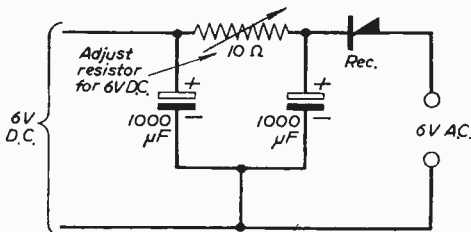


Fig. 5.—Obtaining a D.C. supply for the heater of the valve.

**LIST OF COMPONENTS**

- Resistors : 5 MΩ, 220kΩ, 1kΩ, 680Ω, 100Ω, 500kΩ. (All miniature 1/2 or 1/4 watt.) Variable 10Ω w.w.
- Capacitors : 0.01 μF, 150V.W. ; 8 μF, 150V.W. electrolytic.
- For low voltage rectifier : 1,000 + 1,000 μF, 25V.W. electrolytic.
- Valve : 12AT7, ECC81.
- Rectifier : Low voltage 300mA.
- Nuts, bolts, etc.

necessary. The final check may then be carried out using the main amplifier.

**SILICON POWER RECTIFIERS**

(Continued from page 481)

is termed the maximum peak inverse voltage. This is the peak A.C. voltage that the device will withstand in the reverse direction.

**Efficiency**

This characteristic when at maximum and with the maximum D.C. output flowing determines the maximum full load forward voltage drop. It is this rating that is the measure of the efficiency of the silicon rectifier.

Conventional semi-conductor rectifier circuits are shown in Figs. 1 to 4. these are basic circuits on which the multitude of stacks can be prepared. It may be as well to mention, however, that if the load is capacitive, then the D.C. output voltages are dependent upon the value of the condenser, and likewise, if the load is inductive or resistive the output voltage is different in magnitude.

**Charging Current**

Nevertheless, in the case of capacitive loads, it is advisable to limit the high charging current

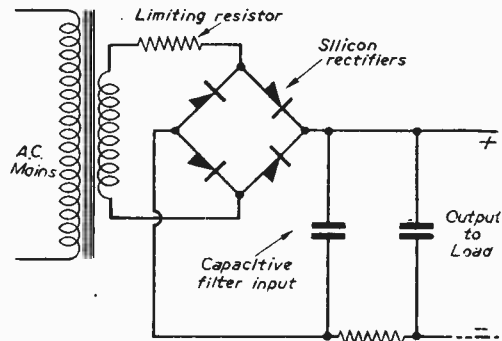


Fig. 5.—Limiting the charging current by means of a resistor.

that flows in the input condenser of the filter. This can be done by including a series resistor in the circuit. Reference to Fig. 5 will clarify this point.

In conclusion, it will be appreciated that silicon power rectifiers will be used in magnetic amplifiers and various control circuits in addition to power supplies and voltage doubler circuits.



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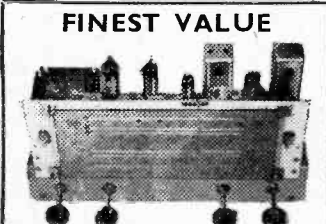
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.05, .1, 1/-, 25, 1/8; .5/350 v., 1/8; 1/350 v., 9d.;
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**AMATEUR RADIO MOBILE SOCIETY**

Hon. Sec.: G. E. Storey (G3HTC), 10, Avon Road, Sunbury-on-Thames, Middx.

**T**HE first rally of the recently formed Amateur Radio Mobile Society took place at Maldon, Essex on Sunday, July 5th, Talk-in stations operated from 10 a.m.

Prizes were awarded for the mobile installation most nearly meeting the requirements relating to safety of equipment as set out in the rules of the Society, as well as many others, including children's competitions.

For full information on all activities, please write to the secretary of the society.

**BRADFORD AMATEUR RADIO SOCIETY**

(Affiliated R.S.G.B.)

Hon. Sec.: David M. Pratt (G3KEP), "Glenluce," Lyndale Road, Eldwick, Bingley, Yorks.

**R**ECENT meetings have included a talk on Power Supplies by Alwyn Stockley (G3EKE), and an instructive lecture with demonstrations on The Behaviour of Aerial Systems by A. R. Bailey, M.Sc. (G3IBN).

Forthcoming events:

September 8th.—"TV Tuners and Printed Circuits." A lecture by J. Davison (G3JKD).

September 22nd.—"Interpretation of Valve Data." Talk by H. D. Kitchen.

October 6th.—Visit to Mullard Film Meeting at St. George's Hall, Bradford.

Anyone interested in radio, television, or both, is invited to attend the meetings, which are held at 7.30 p.m. at Cambridge House, Little Horton Lane, Bradford, 5.

**BRADFORD TECHNICAL COLLEGE**

Address: Central Hall, Bradford, 5. Tel.: 21748.

**T**HE Department of Engineering announces that a course in preparation for the City and Guilds of London Institute's R.A.E. will be held at the college on Thursday evenings from 7 to 9 p.m.

Registration takes place on September 16th, 17th and 18th, 1959. Intending students should contact the college for further details.

**BRITISH TWO-CALI. CLUB**

Hon. Sec.: G. V. Haylock (G2DHV), 167, Engleheart Road, London, S.E.6.

**T**HE Club President is J. MacIntosh (GM3IAA and VSIAA), and Vice-President is R. E. C. Collins (ZC4CH and G2HIL). Membership of the club is open to all radio amateurs who have held at least one overseas call sign. For full details please write to the Secretary, whose address is given above.

**DERBY AND DISTRICT AMATEUR RADIO SOCIETY (G3ERD)**

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

**O**N Sunday, August 16th, a Mobile Rally was held at Rykneld School, St. Alban's Road, Derby. This was organised jointly by the above society and Derby Short-wave Experimental Society (G3EEO). Admission was free and events included a Mobile Competition, a display of radio-controlled model aeroplanes and static exhibitions by G3EKX and the Interplanetary Society. There was a film show for the children.

Weekly meetings continue to be held on Wednesdays at 7.30 p.m. at the Derby and District College of Art, Green Lane, Derby, and we are always pleased to welcome visitors and new members.

**PORTSMOUTH AND DISTRICT RADIO SOCIETY**

Hon. Sec.: A. C. Cake (G3CNO), 7, Wheatstone Road, Southsea, Hants.

**T**HE above society took part in the 1959 N.F.D. and weather, though bad at first, cleared up for most of the latter hours. The operators of the two stations operating are to be congratulated on their capability to work on the "key" non-stop for

24 hours. They were G3ADZ, G3JZV, G3CNO, G6NZ, G3KLM and G3JLO. Harry Woodman and Sam Howard are to be thanked sincerely for their hard work in looking after the "inner man."

**HALIFAX AND DISTRICT AMATEUR RADIO SOCIETY**

Hon. Sec.: A. Robinson (G3MDW), Candy Cabin, Ogdon, Halifax.

**A**T the monthly meeting of the above society held at the Sportsman Inn, Ogdon, Halifax, the lecture was to have been a recording on aerials. Unfortunately, the recording failed to arrive in time, so Mr. H. Brooke (G3GJV/M) nobly stepped into the gap with a lecture on mobile equipment, commencing with a demonstration of a QSO with a fixed station.

At the same meeting it was decided to hold C.W. classes at future meetings.

**RAVENSBOURNE AMATEUR RADIO CLUB**

Hon. Sec.: J. Wilshaw (G3MPX), 4, Station Road, Bromley, Kent.

**M**EETINGS are held every Wednesday evening at 8 p.m. at Malory Secondary School, Launcelot Road, Downham, Kent, where club members operate transmitter G3HEV. New members are always welcome, further details are available from the Hon. Sec.

**READING AMATEUR RADIO CLUB**

Hon. Sec.: R. J. Nash (G3EJA), 9, Holybrook Road, Reading, Berks.

**C**LUB meetings are held on the last Saturday of the month, and new members are always extended a warm welcome. Forthcoming talks will be on SSB equipment, receiver design and construction, and Radio operating in the Merchant Navy.

**GRAFTON RADIO SOCIETY (G3AFT)**

(Affiliated R.S.G.B.)

Hon. Sec.: A. W. H. Wonnell (G2CJN), 145, Uxendon Hill, Wembley Park, Middlesex.

**A**rrangements have again been made with the Holloway L.C.C. Evening Institutes for official courses in the Radio Amateurs examination and Morse (both for beginners) to be held this winter at the Montem School, Hornsey Road, Holloway London, N.7. The classes will meet on Mondays, with a repeat lecture on Tuesdays and Wednesdays, commencing Monday, September 28th, for the Radio Amateurs course at 7.0 p.m. to 9.0 p.m. (Instructors: S. H. Iles (G3BWQ); P. F. Bernal (G3KQZ); R. C. Hills (G3HRH)), followed by the Morse at 9.0 p.m. to 10.0 p.m. (Instructors: L. Barber and A. Ralph). The fee for either course is 20/-, or 22/6 for the two, and application in the first instance should be made to the Hon. Secretary of the Grafton Radio Society, A. W. H. Wonnell (G2CJN), 145, Uxendon Hill, Wembley Park, Middlesex, so that a place may be assured. In the City and Guild's examination held last May another 26 passes were obtained, making a grand total of 111 in the six years this course has run.

In addition to the above, the club meet on Friday evenings commencing September 4th for the usual club activities and new members and visitors are especially welcome.

**TORBAY AMATEUR RADIO SOCIETY**

Hon. Sec.: G. Western (G3LFL), 118, Salisbury Avenue, Barton, Torquay.

**T**HE Club meets every Tuesday and Friday evenings at 7.30 p.m., at the Y.M.C.A. Headquarters, Castle Circus, Torquay. New members are always welcome, and full details of membership etc. are available from the Secretary.

At the Club Headquarters, an all-band transmitter is under construction, and the newly-acquired call-sign G3NJA has been used several times recently from stations installed at local hobbies exhibitions. Over 250 individual contacts were established with stations in the British Isles, Europe and Canada.

Some 30 members were present at the July meeting when Derrick Webber (G3LHJ) gave details of the new SWL contest which he has arranged. This is for a period of six months, and is on the basis of a point per country per band, and the winner will receive a silver trophy. A discussion on "Beam Aerials" proved most popular. Next month Bill Jones (G3BBF) on leave from Libya, will describe how the R.A.F. club (SA2CV) was founded and "put on the air." Visitors to the area are especially welcome to both the monthly meetings at the Y.M.C.A., Torquay, and to our headquarters at 94, Belgrave Road, Torquay, on Tuesdays and Friday evenings.

**WEST KENT AMATEUR RADIO SOCIETY**

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

**T**HE society meets fortnightly on Fridays at 7.45 p.m. in the Adult Education Centre, Culverden House, Tunbridge Wells. Prospective members and visitors are always welcome. It is planned to hold the annual W.K.A.R.S. Mobile Rally on August 23rd in Dunorlan Park, Tunbridge Wells. This has proved to be a very popular site during past years. Further details of membership and the society's future programme can be obtained from the club secretary.

**SOUTHGATE, FINCHLEY AND DISTRICT AMATEUR RADIO GROUP**

Hon. Sec.: A. G. Edwards (G3MBL), 244, Ballards Lane, North Finchley, London, N.12.

**M**EETINGS are held on the second Thursday in each month at Arnos School, Wilmer Way, Southgate (near Arnos Grove Tube Station) at 7.30 p.m. Licensed Amateurs and SWL's are very welcome.

**SLADE RADIO SOCIETY**

Hon. Sec.: C. N. Smart, 110, Woolmore Road, Erdington, Birmingham, 23.

**T**HE Club Station (G3JBN) at The Church House, is available for the use of members for constructional purposes. Instructional Morse classes will be arranged, as required, if intending pupils make a request to the Tech. Sec. or Hon. Sec. Slow Morse transmissions are radiated on the air each Tuesday evening from Station G3AYJ on 1.9 Mc/s at 8 p.m.

**F**orthcoming events:  
September 13th.—Slade Harcourt Trophy D.F. Test.

September 19th.—Members' Apparatus Exhibition. Equipment submitted will be judged for the "Enterprise Trophy," but members not eligible for the competition are requested to bring along their latest piece(s) of home-constructed gear.

September 25th.—"Non-Destructive Testing Techniques." A lecture to be given by Mr. L. T. Perriam, of I.C.I. Ltd.

**WANSTEAD AND WOODFORD DISTRICT RADIO CLUB**

Hon. Sec.: N. B. Hough, 24, Raymond Avenue, South Woodford, London, E.18.

**T**HE above club (G3BRX) is in the process of re-forming, and new members will be more than welcome at the meetings which are held at Wanstead House, The Green, Wanstead, London, E.11, at 8 p.m. on Wednesdays. Full details are available from the secretary.

**PRESTON AMATEUR RADIO SOCIETY**

Hon. Sec.: G. Lancefield (G3DWQ), 35, Brixton Road, Frenchwood, Preston, Lancs.

**T**HE society has recently been very fortunate in obtaining a new QTH at 145, Hammond Street, Preston, and meetings will be held in future each Wednesday evening at 7.30 p.m.

A transmitting licence has been applied for and it is hoped to have the original call-sign (G3KUE) issued again shortly.

The future programme will include basic theory, practical work and Morse instruction. Lectures and visits to places of radio interest are arranged from time to time. New members and visitors are always very welcome.

**COURSES OF INSTRUCTION****WEST LONDON R.S.G.B. GROUP**

**T**HE following classes, organised by the East London R.S.G.B. Group, in conjunction with the Essex County Council are available for all those interested in amateur radio irrespective of whether or not they are members of a Society:

1. *Radio Amateurs' Examination Course.*

Wednesday, 7.15 to 9.15 p.m. Eight-month course for those intending to take the examination.

2. *Morse and Codes of Practice.*

Monday, 7.30 to 9.30 p.m. A six-month course for those who wish to learn Morse up to G.P.O. requirements for an amateur licence. Arrangements have been made with the G.P.O. for those, who, in the opinion of the masters have reached the required speed, to be tested at the College in the evening by a representative of the Post Office.

The venue for the above classes is: The Ilford Literary Institute, High School for Girls, Cranbrook Road, Ilford, Essex.

It is adjacent to Gants Hill Station on the Central London Tube and buses pass the door.

The fees for those living in the Essex County Council area are:

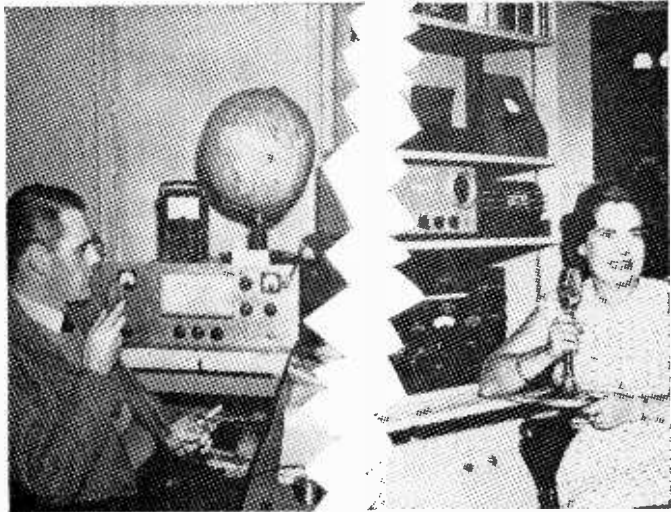
30s. for the R.A.E. Course.

20s. for the Morse and Codes of Practice.

35s. for both Courses.

Students from other parts of London will be admitted as out-County Students provided the local authority is notified. Enrolment nights are: September 7th to 10th, 1959, 7 to 8.30 p.m. Classes commence the week beginning September 21st, 1959.

These classes have been running for the past 12 years and over 200 students have passed the R.A.E. Examination. Those interested should, in the first instance, write to Mr. C. H. L. Edwards, A.M.I.E.E., A.M.Brit.I.R.E., 28, Morgan Crescent, Theydon Bois, Epping, Essex, for the reservation of a place.



*The first-ever simultaneous filming of a Transatlantic link between British and American "hams" was made recently in connection with an STV schools broadcast. A well-known Scottish radio amateur, John Churchill (GM3MBC) was filmed at his home in Glasgow, while in Bryn Mawr, Pennsylvania, another camera crew were recording his conversation with the "queen" of American amateur radio, Mrs. Eleanor Hammonds (W3BIW). John, a professional photographer, has logged over 100 different countries since he first went on the 15-metre band with his simple 45W rig some 18 months ago.*

**INSTRUCTION FOR R.A.E., ETC.**

**T**HE following evening classes organised by the Middlesex County Council are to be held during the Session 1959-60: Brentford Evening Institute, Clifden Road, Brentford.

Radio Amateurs Class ... Wednesdays, 7.0 p.m.

Morse Instruction ... Tuesdays, 7.0 p.m.

Radio Servicing ... Tuesdays and Thursdays, 7.0 p.m.

Classes begin on September 21st, 1959, and prospective students should enrol between September 14th and 17th, 1959.

Northwood Evening Institute, Potter Street School, Northwood Hills, Middlesex.

Courses for the R.A.E., general radio theory, practical radio and Morse instruction commence in September, and enquiries and enrolments should be made between 6.30 and 8.30 p.m. at the Institute September 14th to 16th.

Wesley Institute, Wesley Road, N.W.10.

Radio and TV theory and practical courses will be held on Mondays and Wednesdays at 7.0 p.m. commencing on September 21st, 1959, ending on July 1st, 1960. Fees will be per Session of two Terms—30s. for one evening per week, and 37s. 6d. for two evenings per week. Canteen and parking facilities are available. Postal enrolments should be sent as soon as possible to "Jeanville," Brighton Road, Addlestone, Weybridge, Surrey.

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147GT	13/6/6A8B	9/6/6CH6	11/-/6K8GT	8/9/100C1	9/-/25L6GT	9/6/	9/6/
15CGT	10/-/6A8	4/3/6D2	4/6/6K25	7/6/10C2	12/6/25Y56	9/-/	9/-/
115	18/7/6AG7	5/6/6D3	9/6/6L1	10/8/10C14	9/3/25Z4G	8/-/	8/-/
115GT	10/-/6A8	5/-/6D6	4/6/6L6G	7/6/10P13	12/-/30P12	11/6/	11/6/
14	3/9/6AL5	4/6/6F1	6/6/6L7M	7/6/10P9	10/-/30C1	7/9/	7/9/
1N5GT	10/-/6AM6	4/-/6F6G	6/6/6L18	9/6/10L14	9/6/30P5	7/6/	7/6/
1R5	7/-/6AG5	7/6/6F8M	6/6/6L19	11/6/10L3	7/6/30P11	9/6/	9/6/
184	9/6/6A7E	7/-/6F12	4/6/6L1D3	9/3/10L11	12/6/30L1	8/-/	8/-/
185	6/6/6AG6	9/6/6F13	6/-/6L1D12	8/3/10L12	9/6/30P4	14/	14/
174	5/6/6B7	5/9/6F14	10/6/6L20	8/6/10P13	12/-/30P12	11/6/	11/6/
2A7	8/6/6B8G	3/-/6F15	9/-/6F15	8/3/10P14	12/-/30P16	8/-/	8/-/
2D21	4/6/6BA6	6/6/6F16	8/9/6P25	10/6/10P18	8/6/30P11	11/8/	11/8/
3A4	6/-/6B2B	6/6/6F19	7/6/6P28	9/-/12A6	5/6/35L6GT	9/6/	9/6/
3A5	9/6/6B6G	12/6/6P33	6/3/6Q7G	7/3/12A6	8/6/35W4	8/-/	8/-/
3Q3GT	9/-/6B3M	8/-/6B3M	2/-/6Q7GT	6/3/12A7	6/3/32GT	8/-/	8/-/
3B4	7/3/6B36	7/6/6J5	4/6/6B8A7	6/3/12A7	6/9/35Z4GT	8/6/	8/6/
3V4	7/9/6B7	10/6/6J5G	2/9/6B8D7	8/-/12A7	7/6/42	7/6/	7/6/
5R4GY	9/6/6B7G	8/6/6J5GT	6/3/6B9T	5/-/12BA6	8/-/50C5	10/6/	10/6/
5U4G	6/3/6VW7	7/9/6J6	2/6/6B8H7	4/6/12B26	9/-/50C16	16/	16/
5V4G	10/6/6B8C	5/9/6J7M	6/8/6B8T	6/8/12B27	9/6/30P9T	9/6/	9/6/
5Y3G	8/-/6C3	2/6/6J7GT	6/6/6B8K7	1/8/12C8	8/-/35KU	10/6/	10/6/
5Y3GT	7/-/6C5	5/6/6J7M	7/6/6B8L7GT	6/9/12E1	12/6/24K	10/6/	10/6/
5Z4G	9/-/6C6	4/3/6K6GT	6/6/6B8N7GT	4/9/12J3GT	3/6/61BT	9/6/	9/6/
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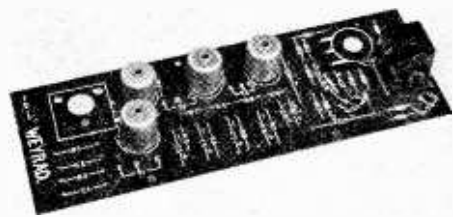
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# Open to Discussion



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

## Transistors v. Valves

**SIR**,—Being a member of what has been referred to as the younger radio set, I would like to say that I detest transistors and continually blow the trumpet of the exalted valve. I would also like to hear more about heaterless valves.—G. F. MATTHEWS (Hove).

## Meter Shunts

**SIR**,—I have noticed in recent issues that many readers have made intelligent contributions to finding formulae for multimeter shunts.

I feel, however, that the author took all these methods into account, and showed the constructors the easiest possible approach by the simple law of ratios, 9 to 1, 99 to 1, etc., and the tolerance of these ratios is exactly the same as for a formula occupying yards of paper. Many of my friends have taken up radio, and look to PRACTICAL WIRELESS for guidance, and I might add that they are acquiring a great knowledge, but when they read these other methods they are apt to become confused. So please let us stick to the formula given in the article; it is self-explanatory, after all.—G. G. BARNES (London, N.W.9).

## Information Required

**SIR**,—I wish to obtain a copy of the November, 1957, issue dealing with the conversion of the BC455 receiver. Can any reader assist me? I am quite willing to pay.

I would also like to hear from anyone who has carried out these conversions or any others.—P. SHORT (5, Saint Mark Road, Hurlyvale, P.O. Edenvale, Transvaal, South Africa).

**SIR**,—Could any reader please give me details of the cheapest way to convert an old 9in. television set (BBC only) for reception on the BBC's V.H.F./F.M. bands?

I would also like to say that I agree fully with the views of G. Plachey and R. S. Jenkins (Open to Discussion, May and June) on transistors v. valves. Although the transistor has some way to go before it catches up the valve, it is catching up fast as is seen by the fact that some experimental transistors are capable of operating at frequencies in excess of 100Mc/s, thus rendering them suitable for use in V.H.F./F.M. equipment;

others can give outputs in the region of 50 watts, at medium fidelity, these finding use in audio amplifiers for dance halls, etc. Also, as has been said before, they have the great advantage of being small.—A. T. WHIPP (Ilford, Essex).

## Transistors

**SIR**,—Every month PRACTICAL WIRELESS is sent to me by friends in Brighton, and I must say that I enjoy every issue of it and, though I receive similar publications from other countries, PRACTICAL WIRELESS is to me by far the most interesting.

Unfortunately, your April issue does not mention transistors, the subject I am most interested in, at least only in the ads. Why is this? Do you think that people have suddenly lost all interest in transistors? It is obvious that nobody wants to build audio-amplifiers all the time and most of the radio amateurs have now sufficient experience to build audio-amplifiers to almost any requirement—but what about radio-frequency amplifiers (for the medium-wave band) and small transmitters with transistors?—WOLFGANG TIBURTIUS (Bilbao, Spain).

## D.F. Loop Data Required

**SIR**,—Several of my yacht-owning friends have expressed interest in a D.F. loop aerial that could be used in conjunction with a transistorised portable receiver modified to receive the M.F. beacons. The commercial directional aeriels appear to be unduly expensive. Has any reader information on the construction of a suitable ferrite rod directional aerial suitable for the purpose indicated?—R. G. WOOD (Flat 46, Grosvenor Garage, Grosvenor Road, Westcliff-on-Sea, Essex).

## "Command" Receivers

**SIR**,—Some years ago, it was possible to obtain coils suitable for converting the "Command" series of receivers to medium waveband operation. I have one of these coils suitable for a BC454 which worked well. I am wondering if the same coil could be used to convert a BC455 or 453; perhaps merely a change of padding condenser would all that is required. I am wondering if any reader has

*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 cover.*

experimented on these lines or has information about a source of supply.—T. M. SANFORD (c/o Avalon Telephone Co. Ltd., St. John's, Newfoundland).

#### Old Parts Wanted

**SIR**—May I through your columns appeal for assistance for the R.A.F. School Radio Club, Nicosia, of which I am instructor. The boys are very enthusiastic, but are hampered by lack of components which are very scarce and expensive. If any reader is clearing out his junk box the surplus would be greatly appreciated and I will be only to pleased to pay package and postage. surface mail is 3s. 6d. for a maximum 22lb. Our most urgent wants are headphones and tuning condensers.—J. W. WEST (1087835 Sgt. West, J., Radio Servicing Flight, Royal Air Force, Nicosia, B.F.P.O. 53).

#### Correspondents Wanted

**SIR**—I am nearly 24 years of age and am very interested in radio, amplifiers and rectifying faults, the designing of power transformers, chokes, etc.

I should like to correspond with amateurs of the same age.—M. A. CHOHAN (Barrack 115, Quarter No. 3, Karachi Airport, Pakistan).

**SIR**—I am nearly 15 years old, and am very interested in amateur radio. I would like to correspond with any S.W.L.'s. of my own age preferably.—H. B. BRODERICK (67, Victoria Park Road, Winton, Bournemouth, Hants).

#### A Comprehensive Valve-tester

**SIR**—I was extremely interested in the valve tester design published in the April and May issues, as I have quite recently completed a somewhat similar instrument for my own use which differs in several respects to the one described.

The panel of my valve tester is made of hard-board faced with a proprietary decorative plastic film sold for domestic use, but which I have found invaluable in building experimental and permanent instruments.

The heater transformer was wound with three secondaries, secondary 1 to give voltages of 0.3 and 0.5; secondary 2 to give a total of 9 volts, tapped at each volt and secondary 3 to give 40 volts tapped at each 10 volts. By using three switches, a one-pole, three-way, a one-pole, ten-way and a one-pole, five-way any voltage between 0 and 49.5 can be obtained in 0.5 volt steps.

I found that calibration of potentiometers was unsatisfactory, particularly of the one used for screen volts as the varying currents drawn by different valves made it impossible to be sure of the setting. Accordingly the anode voltmeter is connected to a D.P.D.T. toggle switch which allows it to be used for measuring anode or screen volts, and is so arranged that a resistance equivalent to the meter resistance is substituted for it in the circuit not being measured.

The same difficulty I found with the bias voltages. In my instrument bias is obtained from an extra winding of No. 38 wire feeding a "pencil" metal rectifier. In order to obtain a satisfactory change in deflection of the meter for measuring mutual conductance, I have arranged the potentiometer with a fixed resistance at either end, in my case each are 1,000 $\Omega$ . The potentiometer is 15,000 $\Omega$  linear, wire-wound, and the output from the rectifiers is 16V. The resistances are arranged with a switch, so that either one or the other (but not both) can be short circuited, which has the effect of altering the potential of the slider by 1V at any position in which it may be. This, I found, was far superior to trying to set and reset a potentiometer to fairly close limits by dial calibration alone.

The meters in my version were actually ex-W.D. 2in. square thermo-coupled ammeters (with couples removed) and recalibrated as required. Both the movements were 3mA full scale milliammeters but I understand that they vary a good deal and in some cases are 20 or 30mA movements.

The whole instrument is housed in a wooden case and has valveholders fitted for all the valves usually met with today.—F. G. MORGAN (Weymouth).

#### A Record Player Auto-stop

**SIR**—I have recently constructed the Record Player Auto-stop described in the June, 1959, issue. I found that, although the switch was quite effective, the vibrations due to the speaker and pick-up were sufficient to actuate the switch before the record had finished, particularly on 45 r.p.m. records where there is a small gap for the run-off groove, and the pivot arm starts to move before the record has finished. I found that a small kink in the leaf blade of the switch soon remedied this and the switch then had a positive action and worked most effectively.

A further fault was that of sparking in the switch due to the highly inductive circuit of the motor, causing a thud in the speaker on switching off. This was effectively remedied by means of a 0.1 $\mu$ F condenser in series with a 47k resistor across the switch to act as a spark quencher.

With reference to Mr. P. Rayner's "Commercial Radio" in "Open to Discussion," I do not think a new commercial network would be successful.—J. A. LE GRICE (Brackley, Northants).

#### SPECIAL NOTE: VALVE PRICES

Owing to the delay caused by the printing dispute, and the fact that advertisements are received so far in advance of the date of publication, readers should note that the prices of valves, etc., quoted in this issue may not take into account Budget reductions in Purchase Tax. Readers should, therefore, check with the advertiser before placing an order, and in the case of the Technical Trading Company, for instance, a list of the current prices of over 800 valves will be supplied by that company on receipt of a stamped addressed envelope.



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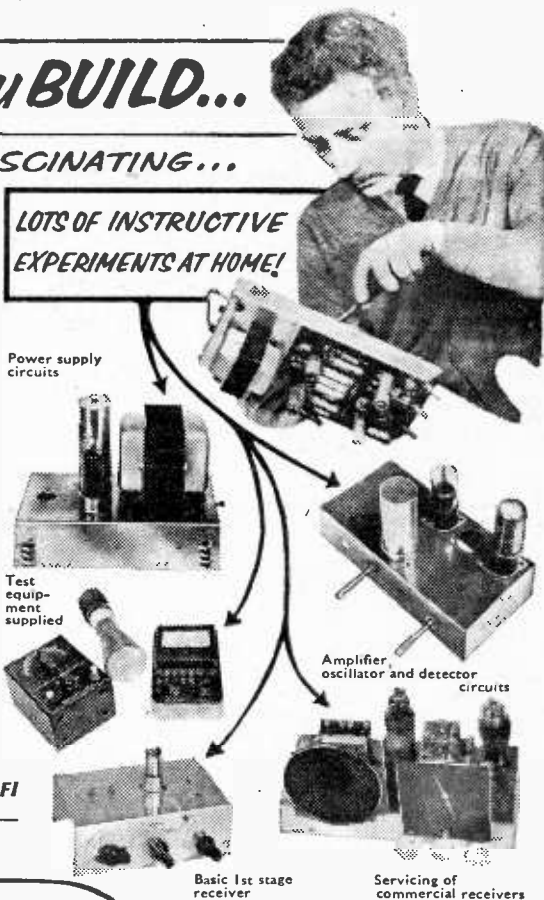


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(Continued)

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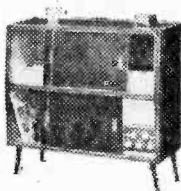
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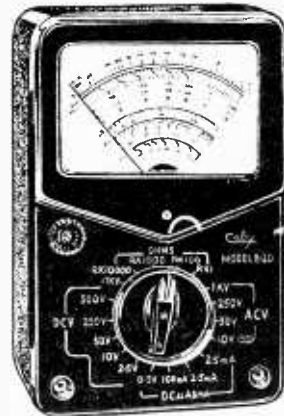
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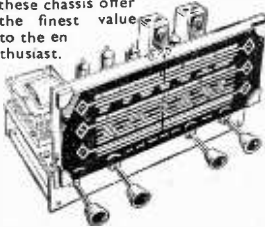
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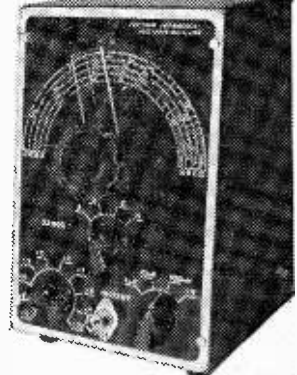
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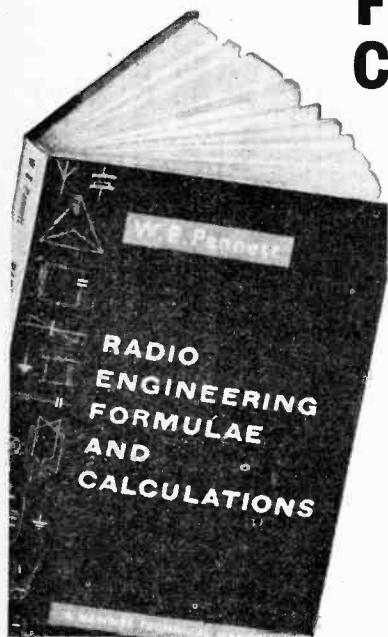
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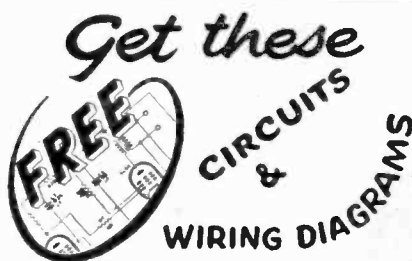
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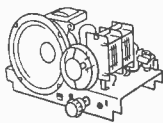
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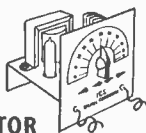
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DF31 10/6	ECL83 18/6	ECL83 18/6	SP41 3/6	5U4 7/6
DF91 7/-	ECL83 18/6	ECL83 18/6	SP41 3/6	5V4G 9/6
DF96 9/6	ECL83 18/6	ECL83 18/6	SP41 3/6	5Y3GT 8/6
DH77 8/3	ECL83 18/6	ECL83 18/6	SP41 3/6	6AT6 18/6
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DK31 9/6	ECL83 18/6	ECL83 18/6	SP41 3/6	6BW7 7/6
DK92 9/6	ECL83 18/6	ECL83 18/6	SP41 3/6	6D2 10/-
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DL91 9/6	ECL83 18/6	ECL83 18/6	SP41 3/6	6K7G 4/6
DL92 8/6	ECL83 18/6	ECL83 18/6	SP41 3/6	6K75 7/6
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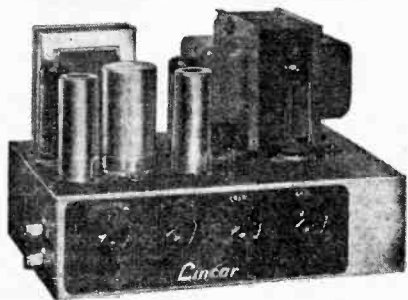
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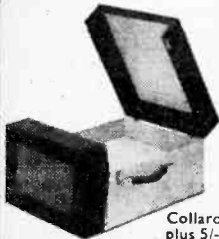
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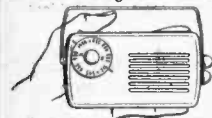
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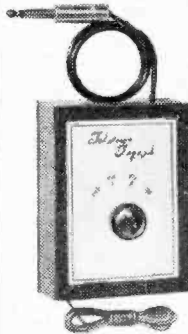
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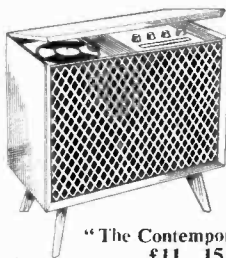
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- Mains Operated : 4/- each  
"Coronet" A.C.4 ... PW100\*  
AC/DC "Coronet" Four  
PW101\*

No. of  
Blueprint

### SHORT-WAVE SETS

#### Battery Operated

- One-valve : 2/6 each  
Simple S.W. One-valver PW88\*

- Two-valve : 2/6 each  
Midget Short-wave Two  
(D, Pen) ... PW38A\*

- Three-valve : 2/6 each  
Experimenter's Short-  
wave Three (SG, D,  
Pow) ... PW30A\*

- The Perfect 3 (D, 2 LF  
(RC and Trans) ) ... PW63\*

- The Band-spread S.W.  
Three (HF, Pen, D  
(Pen), Pen) ... PW68\*

### MISCELLANEOUS

- 2/6 each  
S.W. Converter-Adapter  
(1 valve) ... PW48A\*

- The P.W. 3-speed Auto-  
gram ... (2 sheets), 8/-\*

- The P.W. Monophonic  
Electronic Organ (2 sheets), 8/-

### TELEVISION

- The "Argus" (6in. C.R. Tube) 3/-\*

- The "Simplex" ... 3/6\*

- The P.T. Band III Converter 1/6\*

*All the following blueprints, as well as the PRACTICAL WIRELESS numbers below 94, are pre-war designs, kept in circulation for those amateurs who wish to utilise old components which they may have in their spares box. The majority of the components for these receivers are no longer stocked by retailers.*

## AMATEUR WIRELESS AND WIRELESS MAGAZINE

### STRAIGHT SETS

#### Battery Operated

- One-valve : 2/6  
B.B.C. Special One-  
valver ... AW387\*

#### Mains Operated

- Two-valve : 2/6 each  
Consoelectric Two (D,  
Pen), A.C. ... AW430

### SPECIAL NOTE

THESE blueprints are drawn full size. The issues containing descriptions of these sets are now out of print, but an asterisk denotes that constructional details are available, free with the blueprint.

The index letters which precede the Blueprint Number indicate the periodical in which the description appears. Thus P.W. refers to PRACTICAL WIRELESS, A.W. to Amateur Wireless, W.M. to Wireless Magazine.

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, Strand, W.C.2.

No. of  
Blueprint

### SHORT-WAVE SETS

#### Battery Operated

- One-valve : 2/6 each  
S.W. One-valver for  
American ... AW429\*

- Two-valve : 2/6 each  
Ultra-short Battery Two  
(SG, det Pen)... WM402\*

- Four-valve : 3/6 each  
A.W. Short Wave World-  
beater (HF, Pen, D, RC,  
Trans) ... AW436\*

- Standard Four-valver  
Short-waver (SG, D,  
LF, P) ... WM383\*

#### Mains Operated

- Four-valve : 3/6  
Standard Four-valve A.C.  
Short-waver (SG, D,  
RC, Trans) ... WM391\*

### MISCELLANEOUS

- Enthusiast's Power Am-  
plifier (10 Watts) (3/6) WM387\*

- Listener's 5-watt A.C.  
Amplifier (3/6) ... WM392\*

- De Luxe Concert A.C.  
Electrogram (2/6) ... WM403\*

### QUERY COUPON

This coupon is available until Oct. 6th 1959, and must accompany all Queries sent in accord with the notice on our "Open to Discussion" page, Practical Wireless, SEPT./OCT. 1959.

**DO-IT-YOURSELF!** NO EXTRAS NEEDED; FREE LISTS ON ANY MODEL:  
NEW FREE DESCRIPTIVE BOOKLET

All Components Guaranteed.

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(Two-transistor Pocket Radio)



**72/6** POST FREE

- ★ 4-stage reflex!
- ★ Medium wave: tunable!
- ★ Very sensitive!
- ★ No aerial or earth!
- ★ Complete layout!
- ★ Over 6 months on one battery!
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- ★ Weight only 4 ozs.
- ★ Transistor holders.

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- ★ Ediswan transistors.
- ★ TCC printed circuit.
- ★ 120 mW output push-pull
- ★ Med. and long waves
- ★ Components identified and carded.
- ★ Long-life batteries.
- ★ EASY TO BUILD.
- ★ 2½ in. high flux speaker.

Size 6½ x 3¾ x 1½ in. Weight 20 ozs. Booklet 1/- Post Free.  
All components for construction including cabinet, printed circuit, etc., can be supplied for

**£11.19.6.**

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All parts sold separately.

**PRICE REDUCTION!** NOW IN ITS 3rd YEAR! FIRST AND BEST!  
**"THE TRANSISTOR—8"**

- ★ Tunable over medium and long wavebands.
- ★ 250 mW output push-pull.
- ★ 8 Ed swan Transistors; Transistor holders.
- ★ Internal Ferrite aerial.
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- ★ Pre-drilled cabinet and chassis.
- ★ Easy-to-follow layout diagrams.
- ★ Use it as a car radio.

Push-Pull Portable Superhet

Complete set of parts including cabinet and all components.

**£10.19.6.**

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Size 9 x 7 x 3½ in. Weight 4 lb.

Car radio components. 8/-; 325 mW version with matched XC101's. £11.11.6. P. & P. 2/6. A.V.C., 4/3.

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Size 5½ x 3½ x 1½ in.

SPECIAL PRICE **55/-** P.P. 2/6.

- ★ Attractive moulded cabinet (blue, red or cream) with gold. 12/6.
- ★ J.B. 208 and 176 pf screened tuning gang. 10/6.
- ★ 3 ohm miniature 2½ in. speaker to fit. 21/6.
- ★ 20 : 1 output transformer to match speaker. 10/-.
- ★ 5-transistor printed circuit board. 5/6.
- ★ Circuit of 5-transistor radio and component list. 1/-.

All the above components are made to fit the cabinet and printed circuit. Other components for the radio available.

IDEAL BASIS FOR POCKET TRANSISTOR SET

**AUDIO GENERATOR**

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- ★ Special chassis. ★ Layout diagrams.

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- ★ Overall size 5 x 4 x 3 in.
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Continental	OC44	"	20/-
"	OC45	"	17/-
"	OC72	"	14/-
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718