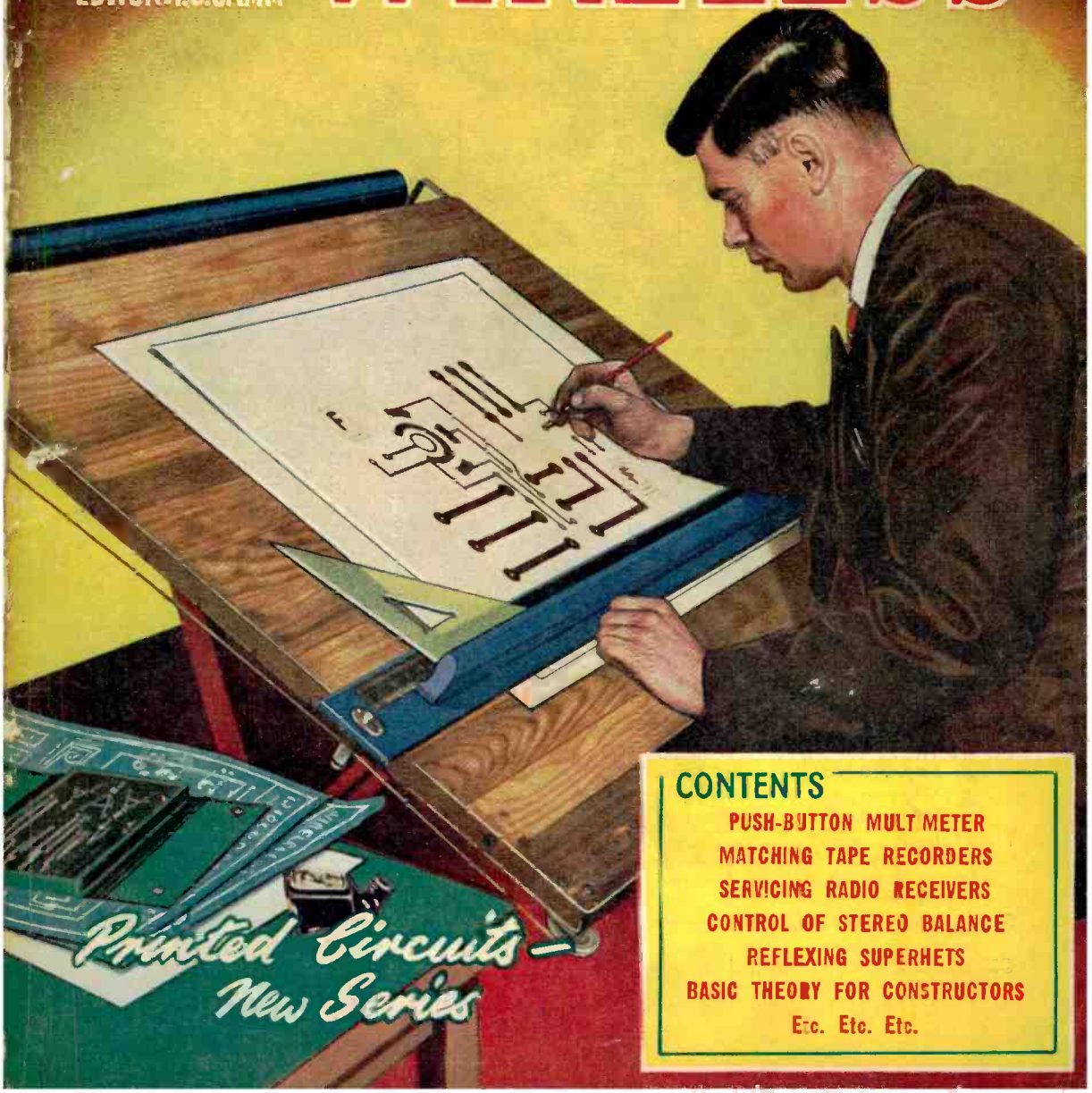
AN ANTI-INTERFERENCE AERIAL

PRACTICAL WIRELESS

1/3

FEBRUARY 1959

EDITOR: E. J. CAMM



Printed Circuits — New Series

CONTENTS

PUSH-BUTTON MULT METER
MATCHING TAPE RECORDERS
SERVICING RADIO RECEIVERS
CONTROL OF STEREO BALANCE
REFLEXING SUPERHETS
BASIC THEORY FOR CONSTRUCTORS
Etc. Etc. Etc.

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 4¼in. x 3¼in. x ¾in., weight under 7oz.—yet it is a **THREE-STAGE** receiver covering all medium waves, working entirely off a tiny "pen-light" battery. Every part tested before despatch! **SPECIAL STEP-BY-STEP PLANS FOR ABSOLUTE BEGINNERS. Total build cost including case, transistors, etc.—everything down to the last nut and bolt—ONLY 47/6 with plans.** Postage, etc. 2/-. C.O.D. 2/- extra. (Parts sold separately. Priced parts list and plans 1/6.) **RUSH YOUR ORDER TODAY!**

POCKET VALVE RADIO

Can Be Built For **37/6**

Anyone Can Build This Beautiful Precision Pocket Radio In One Hour. No knowledge whatever needed, our **Simple, Pictorial Plans take you step by step!** You can't go wrong. Remarkably sensitive—covers all medium waves, incl. **Luxembourg, Home, Light.** size only 2¼in. x 3in. x 5¾in. **Not a Toy! But a Real Valve Radio!** Uses self-contained battery and is a really personal phone, pocket radio with **Detachable Rod Aerial. IDEAL FOR BEDROOM, GARDEN, etc. We can supply all the parts necessary, including Case, Screws, Easy Step-by-Step Plans—in fact everything for the Special Price of 37/6.** (Plus 2/6 post, etc.) **BUILD YOURS NOW!** (All parts sold separately.) Priced parts list, etc., 1/9. **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 UA8. Fully complete with crystal pickup, etc. Brand new—**Limited Stocks Only. GIFT £6/19/6.** (Plus post and packing, 5/-.) **LATEST "COLLARO" 4-speed auto-changer, with Hi-Fi. pickup. Complete in maker's sealed cartons. BARGAIN £7 19/6.** (Plus post and packing 4/6.) **"COLLARO" JUNIOR,** 4-speed, single player, with crystal pickup, using H(TP59 cartridge. **OUR PRICE £2 6.** (Plus 4/- post and packing.)

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 ready 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 12in. x 6in. x 5in. **Build this long-range powerful midget NOW. TOTAL BUILDING COST INCLUDING PLANS, ETC., £5/7/6.** (Post and packing 3/6.) Parts sold separately. Priced parts list and plans 1/9. C.O.D. 2/- extra.

Can Be Built For **107/6**

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. 2½in. **17/6;** 3½in. **19/6;** 5in. **17 6;** 8in. **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 (4½in. x 2in. x 1½in.) 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., 6d. C.O.D. 2 - extra.

PRINTED CIRCUIT POCKET SUPERHET

BUILD THIS PROFESSIONAL-LOOKING, FIRST-CLASS 6 TRANSISTOR POCKET SUPERHET THE "TRANSIDYNE." Size only 6¼in. x 3¼in. x 1¾in. Beautiful red and cream plastic case with engraved dial. Set weighs only 20oz. 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 2½in. P.M. speaker. This TRANSIDYNE is probably the best yet 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 £11/15 -.** (Plus post and packing 2 6.) (All parts sold separately. Price list, circuit, etc., 6d.) C.O.D. 2 - extra.

CAN BE BUILT FOR 47/6

Build this exceptionally sensitive hikh 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 6¼in. x 5in. x 3in. Covers all Medium and Long waves—uses only one all-dry battery. H.T. consumption only 1 to 1.5 mA. 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 6d.) 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 Oxted,** writes, " Yesterday evening on the Medium Wave-band, between 10 p.m. and 10.30 p.m., I counted 32 distinguishable stations! I am very pleased with the set, which is well worth the money —"

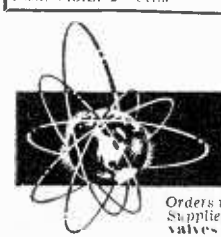
" **MY DEEPEST ADMIRATION—"** **J. R., of North Shields, Northumberland,** writes, " The honest and direct dealing of your firm has earned from me my deepest admiration "

" **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 very economical. Little set giving me all this 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 3in. x 3¼in. x 4¼in. Covers all medium waves and works entirely off tiny "pedlight" 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**

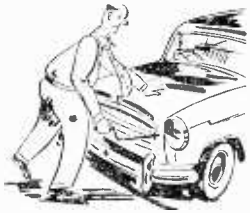


CONCORD ELECTRONICS

69, PRESTON STREET, BRIGHTON. **Dept. PW4**

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.*

Don't Be Caught LikeThis



Car Starter Charger Kit

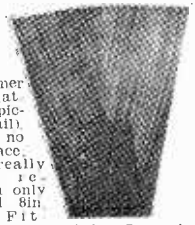
All parts to build 6 and 12 volt charger which can be connected to a "flat" battery and will enable the car to be started instantly. Kit comprising the following :

Mains Transformer	22 6
5-amp. Rectifier	17 6
Regulator Stud Switch	3/6
Resistance Wire	2/-
Resistance Former	2/6
Mains on/off Switch	2/6
0-5 amp. Moving Coil Meter	12 6
Construction Data	1/6

Or if bought all together price is 52 6, plus 3/6 post and packing.

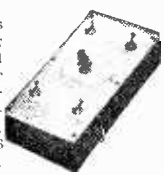
Hi-Fi Snip

Infinite Wall Baffle



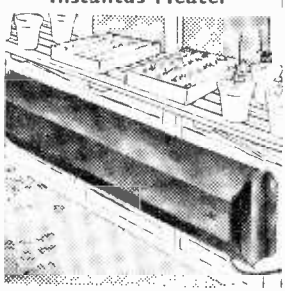
Nicely veneered and polished. Corner fitting (attaches to picture rail). Takes up no floor space. Gives really fantastic results with only low-priced 8in speaker. Fitting for tweeter. Only 45.- each. carriage and insurance 3/6.

Transistor Timer



All the parts for making transistorised Enlarging or Process Timer with constructional details. £2 10'-. plus 2/6 post and pkg.

Instantus Heater



Convector heater. Made from heavy gauge sheet steel (galvanised). For greenhouse, workshop, aviary, etc. 500 watt. £1/12/6 ; 1,000 watt. £2.10/-. 1,000 watt with wired but separate thermostat. £3 17/6. 2K watt free standing or wall mounting. £3 19/6; 2K watt with built-in thermostat. £4 19/6. Carriage and insurance 5 - per heater. ALL ARE GUARANTEED FOR 5 YEARS.

Pullin Series 100 Test Set

Undoubtedly a most useful instrument by a firm long famous for fine instruments, entirely redesigned. It has a square movement with diacon plastic cover this makes for a brighter more readable scale, extra scale length and wide angle of vision. With the test set is included a pair of combined test prods and crocodile clips also a stand for inclining the meter at the best reading positions. Ranges A.C. Volts : 0-10, 0-25, 0-10, 0-250, 0-500, 0-1,000, ditto D.C. A.C. Current 0-100 mA. D.C. Current 0-2.5, 0-10, 0-100, 0-500 mA. Resistance : 0-1M and 0-10K. All at 10,000 ohms per volt. Price £12 7 6, or £1 deposit and 24 fortnightly payments of 10 -. non caller's add 5 - carr. and ins.

FREE GIFT.—All purchasers of the above item this month will receive Range Extender scale and data which add : capacity 2pF.—1mFd., in two ranges. Inductance 0-100 henrys, etc. etc.

Medresco Hearing Aid

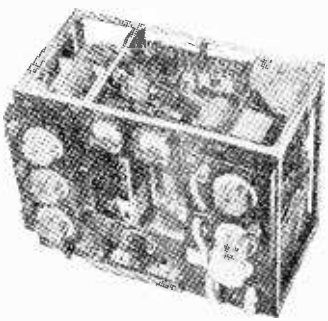
As supplied by National Health, completely overhauled and in good working order with six months' guarantee. Only £3/15 0. plus 2/6 post and ins. Complete with earphone and *new* ear plug but not batteries, these can be supplied as an extra for 5 - per set.

Superior model—new—higher gain—and self-contained batteries £7/10/0. or 10.- deposit and 15 fortnightly payments of 10 -.

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 3D effects. £14 complete, plus carriage and insurance. Or £1 down and 25 weekly payments of 10'-.

Famous Transmitter Virtually Given Away

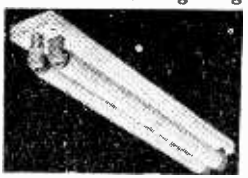


The famous R1154—unused but slightly soiled and not tested. Covers 200-500 Kc s., 2-5.5 Mc s and 5.5-10 Mc s. Has unique "click stop" mechanism (7 stops) and permits selected frequency to be held, returned to, etc. Hartley oscillator, power amplifier, keying and speech. Wonderful breakdown value meters, relays, switches. Complete with valves—real bargain at 29 6, plus 10 - carriage.

Electronic Precision Eqpt. Ltd.

FOR ADDRESSES SEE PAGES 944 AND 945

Fluorescent Lighting



Complete lighting fittings. Built-in ballast and starters—stove enamelled white and ready to work. Ideal kitchen, workshop—anywhere.

Twin 20 approximately 2ft. long complete with two 20W tubes. 39/6.

Single 40 approximately 4ft. long complete with one 40W tube. 39/6.

Inductor 80 approximately 5ft. long complete with one 80W tube. 59 6. Carriage and insurance up to 150 miles 5 3. up to 250 miles 7 6.

Novelty Radio

Completely wired tunable medium and long wave, originally intended for B7G valves and external batteries but could easily be converted for transistors with internal batteries. Less valves and speaker, otherwise complete. 15'-. plus 1 6 postage.

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 a 50 W. precision variable resistor 0-100 K., six 2-3 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.

All for less than the price of the cabinet

Fine walnut veneered, table receiver cabinet complete with metal chassis, three colour glass scale, back plate and scale mounts, as illustrated but less knobs. Offered at less than the price of the cabinet, namely, 39 6, plus 5 - carriage and insurance.

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 3. plus 3/6 post and insurance.

A.C./D.C. Multimeter Kit

Ranges: D.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. 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 batteries. 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 for shunts, range selector, switches, calibrated scale and full instructions. Price **19/6**, plus 2/6 post and insurance.

Cabinet Snip

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

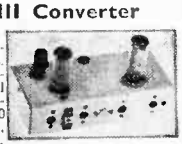
Tube Tester and Re-Activator

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

Motor Snip

Miniature motor 2½in. long x 1¼in. diameter. laminated poles and armature. separate winding for reversing. Operates off 20-30 v. D.C. or off A.C. mains through stepdown transformer. Original cost at least £3 each. Snip price for one month only **6/6**, plus 1/6 postage and insurance.

Band III Converter



Suitable Wales, London, Midlands, North, Scotland, etc. All the parts including 2 EF80 valves, coils, fine tuner, contrast control, 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.

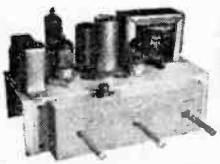
We receive this sort of letter every day of the week, so if you have hesitated because you thought our kits too cheap you need hesitate no longer.

Latest A V O Testmeter

Can be yours for only 10/- deposit and 19 fortnightly payments of 10/-. Like all AVO meters it is a very fine instrument: it has a sensitivity of 10,000 ohms per volt and 19 most useful ranges as follows—D.C. volts 0-1,000 (7 ranges). A.C. volts 0-1,000 (5 ranges). D.C. current 0-1 amp. (5 ranges). resistance 0-2 megs. (2 ranges) (complete with test leads). Immediate delivery. **Cash Price £9/10/0.**

FREE GIFT.—All purchasers will receive Range Extender scale and data which add: capacity 0-1 mfd., in two ranges. Inductance 0-100 henrys, etc., etc.

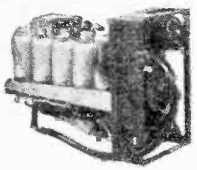
LAST FEW



HIGH FIDELITY AMPLIFIER

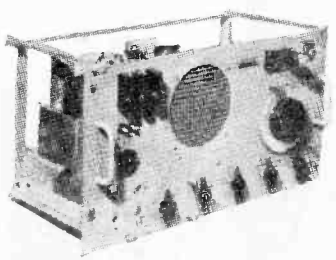
3 valve 4 watt with frequency response better than 40-15,000 C.P.S. Control Panel size 8 x 2½in. comes fixed to chassis but is intended for independent mounting. Separate bass and treble controls giving fullest variation of cut and lift. Separate switch, absolutely no mains hum. Remarkable value at **£4/19/6**.

Complete Walkie-Talkie 25/-



This is the 46 Walkie-Talkie. It has a range of approx. 5 miles—just right for search parties, fire brigades, etc. Operates from dry batteries. Complete with six valves and in metal case. Size approx. 12in. x 6in. x 3½in. Complete but less crystal, not tested nor guaranteed, 25/-, plus 2/6 carriage.

Last Chance for this Fine Bargain



This is a super short wave receiver covering 5-30 metres (10-60 Mc/s). Uses 6 valves. Has R.F. stage, 2 I.F. stages B.F.O., etc. Muirhead instrument drive, two internal power packs, mains and battery vibrator pack. Complete with own P.M. speaker. Provision for phones and speaker muting. Complete in metal transit case; size approx. 21 x 18 x 12in.; weight 70lb. Suitable A.C. mains. 100-250 and 6 volt battery. In perfect condition, practically unused. Tested before despatch and guaranteed. Handbook free with each. Price **£6/19/6**, carriage and insurance 15/-. Or 10/- deposit, plus 15/- carriage, and 15 fortnightly payments of 10/-.

Beginner's Superhet

All the components including metal chassis, valves, metal rectifier, coils, tuning condenser, etc. etc., required to build the "Beginner's Superhet" as described in the January, 1958, issue, are available as a parcel. Price **£3**, plus 3/- post and insurance.

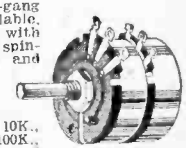
Simplex Transitor Kit

Makes ideal bedroom radio, uses one transistor and one crystal diode. Complete less case **19/6**, case 5/- extra, post and ins. 1/6.

Sapphire Needles

Unrepeatable bargain—new and perfect—two types available: miniature E.M.I. and Standard (trailer). Sale price 1/- each or 10/- doz.

Morganite Potentiometers



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

Connecting Wire

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

Yaxley Switches

4-pole, 2-way	1/6
12-pole, 2-way	1/6
6-pole, 3-way	2/-
3-pole, 3-way	1/6
9-pole, 3-way	2/-
2-pole, 4-way	2/-
4-pole, 4-way	2/9
5-pole, 4-way	2/9
4-pole, 5-way	2/6
2-pole, 5-way	2/6
1-pole, 7-way	2/6
1-pole, 12-way	2/6
2-pole, 12-way	4/6
6-position shorting switch	2/-

Double-pole mains switch for attaching to Yaxley switches, 1/6.

R1155 for Spares

These are less valves but otherwise reasonably complete—ideal for spares—prices £2 to £4 depending on condition—carriage 7/6.

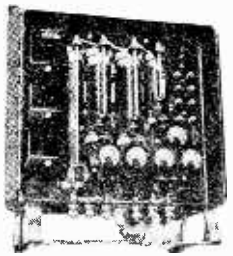
For convenience of callers all items advertised may be obtained from the following companies.

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

Electronics (Croydon) Ltd.
266, London Road, Croydon.
Phone: CRO 6553
Half day, Wednesday.

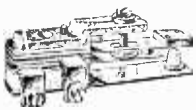
Electronics (Finsbury Park) Ltd.
29, Stroud Green Rd., Finsbury Park, N.4.
Phone: ARChway 1040
Half day, Thursday.

Charging Switchboard



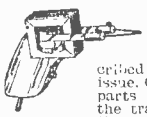
Offered at about one-twentieth of original cost. This is an ex-Government switchboard. It contains three reverse current relays, one voltmeter, one main ammeter, two secondary ammeters and three variable resistors for controlling circuits. These are original cases. Price £2 15/-, carr. 10 -.

Thermostats



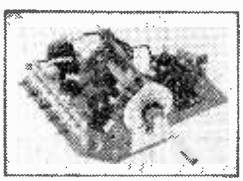
Useful for the control of appliances such as convectors, gluepots, vulcanisers, hot plates, etc. Adjustable to operate over temperature range 50-550 deg. F., fitted with heavy silver contacts. 9/6. Other types : 1½ amp., 3/6 ; 5 amp., 8 6 ; 2 amp. QMB., 5 6 ; 15 amp. QMB. 15 - ; 15 amp., encased wall mounting type, 29 6.

Making a Solder Gun



A 7-second solder gun of the type costing £3-£4 was described in a previous issue. Only two essential parts are required—(a) the transformer and (b) the push switch. These we can supply at 11 6, plus 2 - post. The rest of the parts you will have in your own " junk " box. Copy of the article concerned given free with the kit.

Coil Pack Snip

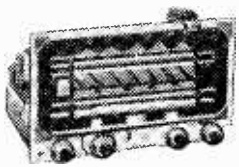


Covers the Medium Waveband 200-550 metres and two short wavebands 35-120 metres and 13-42 metres, for 465 k.c. I.F. Extremely well made, supplied complete with diagram of connections. Only 9'6, plus 1 6 post and insurance.

Saturn Spin Drier

A Spin Drier will not only make Washing Day much less of a burden but will also prevent that damp atmosphere created by wet clothes drying indoors. The Spin Drier illustrated is the famous Saturn which although quite small actually holds as much washing as the larger floor standing type. The big advantage of the Saturn is that it can be stood on the draining board, rinsed washing from the sink is put into it and the water spun out back into the sink, no mess, no special emptying and, being light, it can easily be put into a cupboard or stood on a shelf. Your Wife or Mother will be really pleased with one of these. Price £21.17.6, or £1 deposit and 22 fortnightly payments of £1 each.

Dulci AM/FM Radiogram Chassis

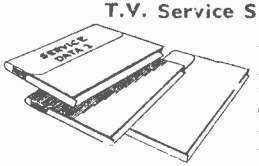


Chassis Model H.3. This has three wavebands, F.M. 87-101 Mc s., Medium Wave 187-540 metres and Long Wave 1,000-2,000 metres, uses 7 of the latest miniature valves and built-in ferrite aerial. " Why not modernise your Radiogram, get the best from modern records with this hi-fi 4 watt output chassis." The price of the H.3 is £20'17'-, or £1 deposit and 22 fortnightly payments of £1. Four waveband model, £24/6 6 (H.4), or push-pull output, £29/3/10—all available on terms.

THIS MONTH'S SNIP

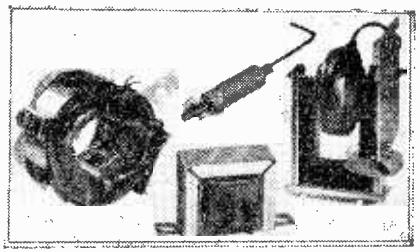
High output car battery charger, gives quick (car start charge) or trickle charge, input standard A.C. mains, output 6 or 12 volt at 1-2½ or 4 amps. With meter and variable charge selector. Complete in hammer finish louvred case. Only 75 -, plus 4 6 carriage, or 10 - deposit and 8 fortnightly payments of 9 -. New and unused, guaranteed for 2 years.

T.V. Service Sheets



150 sheets covering the most popular post-war Televisors by leading makers—Cossor, Ekco, Ferguson, Pye, etc., £1.10.0. post free.

FOUR ITEMS FOR PRICE OF ONE



Set of modern T.V. parts suitable for modernising old televisor 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 televisor. Offered at the price of the Line output transformer only, namely, 57/6, plus 2 6 post and insurance.

Unrepeatable Bargains

Metal Rectifier. Equivalent of RM5—250 mA., 250 v., 12 6.

Welding Transformer. 12 v.-50 amp. continuous rating—intermittent rating for spot welding—exceeds 2,000 amps., 45 -, carriage and packing 5/-.

6ft. Unbreakable Mains Lead. Type of lead fitted to electric razors, makes fine lead for test meters and any other devices where subject to continuous bending. Twin figure eight construction, soft cream P.V.C. covered. Normally costs 2/- per yard—we offer three leads for 2/-.

.1 mFd. 350. Small tubular metal cased condensers made by Dubilier, 2 6 doz.

Connecting Wire P.V.C. Covering. All colours. Sale price 2/6 per 100 ft. coil or 5 coils different colours, 10,- the lot.

50 Assorted Resistors, Well mixed and useful values ½ and ½ watt, 5/- for 50.

Ditto, but 1 watt, 6·8 for 50.

Mains Transformer. Standard 230 v., input 250-0-250 at 80 mA., 6.3 v. at 5 A, 12'6.

Toggle Switch. Standard metal body, type with round dolly,- fixing ring and on'off indicating plate, 1/3 or 12/- doz.

Metal Rectifier, 250 v, 60-80 milliamps, ideal for mains set or instrument or to replace that expensive valve, 4/6.

Screened Cable, Rubber covered flexible with metal braiding, ideal for microphone or gramophone extensions. 4d. per yd., 30/- per 100 yds.

Install 2-way Switches. Our outfit comprises : 30 yd. multicore cable, two 2-way switches, two wood blocks. Full instructions, 9·6 each, post and insurance 2/6.

Long, Medium and Short Wave Coil Pack. An exceptionally well made coil pack which covers the standard long, medium and short wavebands for 465 k c. I.F., complete with diagram of connections. 14/6, plus 1'6 postage and insurance—limited quantity only.

Neon Lamp, midget wire ended. Ideal for making mains tester or for any of the dozen-and-one applications to which a neon can be put, 2/-.

Instrument Transformer. Input 200-230 v., output 6.3 v. at 3/4 amps., and two separate 85 v. 10 milliamp windings which can be joined in series or parallel. 8/6, plus 1/6 post & packing.

3½in. Meter Moving Coil. Flush mounting, really beautifully made by G.E.C. Two types available 500-0-500 microamp and 1 milliamp f.s.d., 37/6, plus 2 - p. & i.

Winking Eye, telephone or circuit indicator, 5 -.

Cathode Ray Tube VCR517, 7'6, carriage, etc., 3/6.

Install Those Extra Power Points: 3 core cable 7.029 (15 amps.) 500 v. grade—a big purchase enables us to sell this at 37 6 per coil (50 yds.), carriage 7/6.

Auto Transformer. Totally enclosed, primary 200-250 v., secondary 110-120 rated 200-250, 27 6, carriage and insurance 2/6.

Dimmer or Regulator. Total resistance 1,000 ohms. Maximum current of .59 amps. This is a beautiful unit which uses a 32 position stud switch, resistance is divided into 31 sections each approx. 30 ohms. In ventilated metal case, size approx. 7in. x 7in. x 5½in. with wall mounting brackets and large control knob, 15'-, plus 2/6 post & insurance.

ELECTRONIC PRECISION EQUIPMENT LTD.

66, GROVE ROAD, EASTBOURNE, SUSSEX

This is the correct address for post orders, and for prompt attention please mark your envelope Dept. 7. Also add enough for postage.

The Popular Stern's "fidelity" TAPE RECORDER for truly "Hi-Fi" Recordings

THEY INCORPORATE

- Choice of the latest COLLARO TRANSCRIPTOR DECK or The NEW TRUVOX MK. IV DECK
- The model HF/TR3 "fidelity" AMPLIFIER. (Described below.)
- ROLA CELESTION 10in. x 6 P.M. Speaker.
- 1,200 reel EMI tape.
- ACOS Crystal Microphone.

PRICE INCORPORATING

COLLARO DECK Mk. IV TERMS. Dep. £9.18.0 and 12 monthly payments of £3.12.7 or Dep. £16.10.0 and 12 monthly payments of £3.0.6. **£49.10.0**

PRICE WITH TRUVOX DECK INCORPORATING REV. COUNTER. **£52.10.0**

H.P. TERMS. Dep. £10.10.0 and 12 monthly payments of £3.17.0 or Dep. £17.10.0 and 12 monthly payments of £3.4.2.

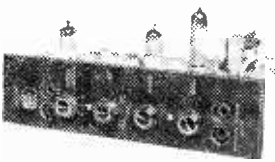
BEFORE CHOOSING YOUR TAPE RECORDER YOU SHOULD HEAR THIS MODEL.—TRULY "Hi-Fi" RECORDINGS ARE OBTAINABLE and it is comparable to much higher-priced Recorders.
Alternatively send S.A.E. for ILLUSTRATED LEAFLET.

(Plus £1 10 0 Carriage and Insurance, of which £1 is refunded on return of Packing Case.)

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 Motek Decks. Please specify which

Send S.A.E. for leaflet or 2/6 for the complete Assembly Manual.

THE NEW MULLARD TYPE "C" TAPE PRE-AMPLIFIER-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.

PRICES . . . INCLUDING SEPARATE SMALL POWER SUPPLY UNIT

COMPLETE KIT OF PARTS **£14.0.0** ASSEMBLED AND TESTED **£17.0.0**

Deposit £3.8.0 and 12 months of £1.4.11.

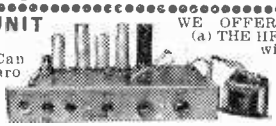
ALSO AVAILABLE EXCLUDING POWER SUPPLY UNIT FOR £11.15.0 and £14.10.0 respectively.
(Carriage and Insurance is 5 - extra.)

WHEN ORDERING PLEASE STATE MAKE OF TAPE DECK TO BE USED. We present this "Hi-Fi" Pre-amplifier 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.

STERNS TAPE PRE-AMPLIFIER and ERASE UNIT

STERN'S MODEL HF/TR1.P

A completely assembled Pre-amplifier with own Power Supply. Can be supplied correctly matched for use with Truvox or Collaro Decks and incorporates Recording Level Indicator and Monitoring facilities. Please send S.A.E. with any enquiry. PRICE **£11.10.0** (Plus 5 - Carr. and Ins.)



WE OFFER YOU . . .
(a) THE HF/TR1.P PRE-AMPLIFIER together with the COLLARO MK. IV TAPE DECK (see note). **PRICE £32.10.0**
(b) THE HF/TR1.P together with the TRUVOX MK. IV DECK (Incorp. Precision Rev. Counter). **PRICE £38.0.0**

HOME CONSTRUCTORS
SPECIAL PRICES FOR COMBINED ORDERS

TO BUILD A COMPLETE PORTABLE TAPE RECORDER . . . ALL EQUIPMENT IS AVAILABLE FOR SEPARATE SALE AT PRICES SHOWN IN BRACKETS . . . WE OFFER—

(a) The PORTABLE CASE illustrated above (£5.0.0). 1,200ft. E.M.I. TAPE (£1.15.0). ACOS CRYSTAL MIKE (£1.15.0). ROLA 10in. x 6in. LOUDSPEAKER (£1.10.0). ALL FOR . . . **£9.0.0**

AVAILABE ON HIRE PURCHASE WITH (b) or (d) below.

(b) The COLLARO MK. IV TAPE DECK (£24.0.0) and the HF/TR3 AMPLIFIER Assembled and Tested. FOR . . . **£36.0.0**

H.P. Deposit £7.4.0 and 12 months of £3.12.6.

(c) As in (b) above, but HF/TR3 supplied as COMPLETE KIT OF PARTS **£32.0.0**

(d) The TRUVOX MK. IV TAPE DECK incorporating Precision Rev. Counter (£30.9.0) and the HF/TR3 AMPLIFIER Assembled and Tested **£41.10.0**

H.P. Deposit £8.6.0 and 12 months of £3.0.10.

(e) As in (d) above, but the HF/TR3 supplied as COMPLETE KIT OF PARTS **£38.0.0**

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

NOTE: Messrs. Collaro when supplying the MK. IV Deck do not wire up the Deck Switches. We will do this at charge of £1.0.0. or supply a Wiring Diagram to the Home Constructor.

Please send S.A.E. with all correspondence.

TO ADD FULL TAPE RECORDING FACILITIES To any modern "Hi-Fi" AUDIO AMPLIFIER (such as our Mullard "5-10" and 2 valve Pre-amplifier) . . . ALL YOU NEED IS . . . THE TYPE "C" PRE-AMPLIFIER and a TAPE DECK . . . WE OFFER—

(a) The COLLARO MK. IV TAPE DECK and the MULLARD TYPE "C" PRE-AMPLIFIER and Power Unit Assembled and Tested **£37.0.0**

H.P. Deposit £7.8.0 and 12 months of £2.14.3.

(b) As in (a) above but the Type "C" supplied as COMPLETE KIT OF PARTS. **£34.0.0**

(c) The TRUVOX MK. IV TAPE DECK incorporating Precision Rev. Counter, and the MULLARD TYPE "C" PRE-AMPLIFIER and Power Unit Assembled and Tested **£42.10.0**

H.P. Deposit £8.10.0 and 12 months of £3.2.4.

(d) As in (c) above but the TYPE "C" supplied as COMPLETE KIT OF PARTS. **£39.10.0**

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

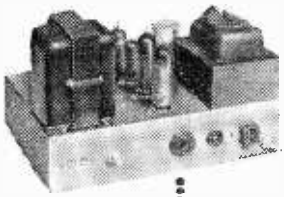
STERN RADIO LTD.
109 & 115 FLEET ST., LONDON, E.C.4
Telephone: FLEET STREET 5812/3/4

AMPLIFIERS PRE-AMPLIFIERS

FOR THE "HI-FI" ENTHUSIAST

MULLARD DESIGNS FOR THE HOME CONSTRUCTOR

THE VERY POPULAR MULLARD "5-10" MAIN AMPLIFIER

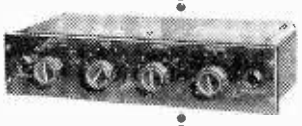


Undoubtedly the most successful amplifier yet designed and used in conjunction with the new Mullard Pre-amplifier, an undistorted power output of up to 10 watts is obtained. Thoroughly recommended to the "Hi-Fi" enthusiast who contemplates a very high quality home installation. In addition the versatility of the equipment makes it quite suitable for use in small halls, etc. We supply complete to MULLARD'S Specification with specified valves and components and including the latest PARMEKO Ultra-linear Output Transformer and the PARMEKO Mains Transformer which has power available to drive Radio Tuning Unit.

COMPLETE KIT OF PARTS **£10.0.0** Alternatively we supply ASSEMBLED & TESTED **£11.10.0**
(Carriage & Insurance 5/- extra.)

THIS "5-10" with the latest PARTRIDGE ULTRA-LINEAR OUTPUT TRANSFORMER for **£1.6.0** extra

MULLARD'S NEW 2-STAGE PRE-AMPLIFIER TONE CONTROL

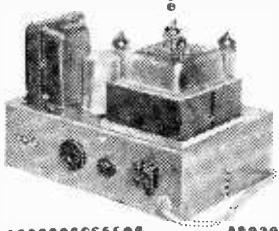


A completely new design employing two EF86 valves, and in particular designed to operate with the Mullard range of Power Amplifiers, but also perfectly suitable for other makes, etc. Briefly it incorporates:

- Equalisation for the latest R.I.A.A. characteristics.
- Input for variable reluctance.
- Magnetic Pick-Ups.
- Input for Crystal Pick-Ups.
- Input for Tape replay.
  - (a) Direct from High Impedance Tape Head.
  - (b) From a Tape Amplifier or Pre-amplifier.
- Sensitive Microphone Channel.
- Wide range Bass and TREBLE Controls.
- Attractive Perspex front control panel.
- Our Kit is strictly to MULLARD'S SPECIFICATION.

COMPLETE KIT OF PARTS **£6.6.0** Alternatively we supply ASSEMBLED & TESTED **£8.0.0**
(Carriage & Insurance 5/- extra.)

THE NEW MULLARD 3-3 MAIN AMPLIFIER



Based entirely on the present very popular "3-3" model and designed to operate in conjunction with the new 2-stage PRE-AMPLIFIER (shown left) thus providing all the facilities associated with the more expensive "Hi-Fi" Equipment. We recommend it as the IDEAL HOME INSTALLATION where very high quality is desired at the lower volume level (up to 3 watts). We supply completely to MULLARD'S SPECIFICATION including the latest PARMEKO Output Transformer, specified Valves and Components. Has power available to drive a Radio Tuning Unit.

COMPLETE KIT OF PARTS **£7.0.0** Alternatively we supply ASSEMBLED & TESTED **£8.0.0**
(Carriage & Insurance 5/- extra.)

Please enclose S.A.E. if ILLUSTRATED and DESCRIPTIVE LEAFLETS are required; the ASSEMBLY MANUALS, containing Practical Drawings, etc., are available at 1/6 each.

Only NEW HIGH GRADE Components and MULLARD VALVES are supplied with these Kits—

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 **£12.10.0**

(b) The COMPLETE KIT OF PARTS to build the "5-10" MAIN AMPLIFIER and the 2-STAGE PRE-AMPLIFIER-CONTROL UNIT **£15.15.0**

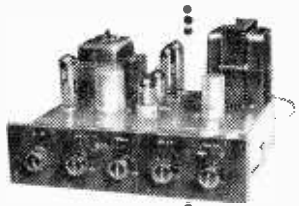
PRICES FOR THE "5-10" ARE SUBJECT TO £1.6.0 EXTRA IF THE PARTRIDGE TRANSFORMER IS REQUIRED.

(a) The "3-3" and the 2-STAGE PRE-AMPLIFIER both ASSEMBLED and TESTED **£15.0.0**
H.P.: DEPOSIT £3.0.0 and 12 Monthly Payments of £1.2.0 or DEPOSIT £5.0.0 and 12 Monthly Payments of 18/4.

(b) The "5-10" and the 2-STAGE PRE-AMPLIFIER both ASSEMBLED and TESTED **£18.18.0**
H.P.: DEPOSIT £3.16.0 and 12 Monthly Payments of £1.7.8 or DEPOSIT £6.6.0 and 12 Monthly Payments of £1.3.1.

When ordering include an extra 7/6 to cover Carriage and Insurance.

THE NEW COMPLETE MULLARD 5-10 AMPLIFIER



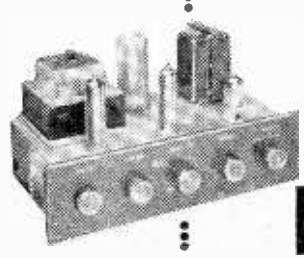
Designed for a simple domestic installation with Genuine High Quality reproduction up to a maximum of 10 watts. Separate BASS and TREBLE Controls are incorporated with switched inputs for 7¾ and L.P. Records plus Radio Tuning Unit.

We incorporate SPECIFIED COMPONENTS and NEW MULLARD VALVES. We also give the purchaser the choice of two of the best ULTRA-LINEAR OUTPUT TRANSFORMERS made—first the latest by PARMEKO, LTD., and also the latest by PARTRIDGE (£1.6.0 extra). We also supply the PARMEKO MAINS TRANSFORMER, and this has extra power available to supply a Radio Tuning Unit. The Control Unit can easily be detached from the Amplifier Chassis for use in a remote position.

COMPLETE KIT OF PARTS (PARMEKO Transformer) **£11.10.0** Alternatively we supply ASSEMBLED AND TESTED **£13.10.0**

H.P. Terms: Dep. £2.14.0 and 12 Monthly Payments of 19/10 or Dep. £4.10.0 and 12 Monthly Payments of 16/8. Send S.A.E. for ILLUSTRATED LEAFLET or 1/6 for the COMPLETE ASSEMBLY MANUAL.

THE NEW COMPLETE MULLARD 3-3



THE IDEAL AMPLIFIER FOR A SMALL HIGH QUALITY INSTALLATION

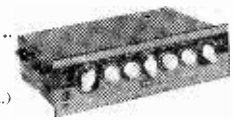
COMPLETE KIT OF PARTS **£7.10.0** Alternatively supplied ASSEMBLED and FULLY TESTED **£8.19.6**
(plus 6/6 coverage and insurance)

Developed from the very popular 3-valve 3-watt Amplifier designed in the Mullard Laboratories. Our kit is complete to MULLARD'S SPECIFICATION including supply of specified components. Mullard valves and a PARMEKO OUTPUT TRANSFORMER. Send S.A.E. for leaflet or 1/6 for ASSEMBLY MANUAL.

STERN RADIO LTD.

STERN'S FOR STEREO

OUR POPULAR MULLARD MAIN AMPLIFIERS ARE RECOMMENDED FOR USE WITH THE DULCI STEREO PRE-AMPLIFIERS



THE "STEREO EIGHT" PRE-AMPLIFIER **£23.2.0** (Carr. & Ins. 5/- extra.)

THE "STEREO TWO" PRE-AMPLIFIER **£9.9.0** (Carr. & Ins. 5/- extra.)

Both Pre-amplifiers can be supplied to correctly operate with our very popular MULLARD "3-3" and "5-10" MAIN AMPLIFIERS (described opposite). For Stereo reproduction TWO Main Amplifiers are necessary, but for normal "Hi-Fi" reproduction the "Stereo Eight" and the "Stereo Two" are perfectly suitable to operate with ONE Main Amplifier and the second Main Amplifier can then be added at any time, thus transforming a standard "Hi-Fi" installation over to Stereo.

FULLY DESCRIPTIVE LEAFLETS ARE AVAILABLE. ENCLOSE S.A.E.

WE OFFER

(a) The "Stereo Two" with one "3-3" MULLARD MAIN AMPLIFIER **£17.0.0**

(b) The "Stereo Two" with two "3-3" MULLARD MAIN AMPLIFIERS **£24.10.0**
(This provides Stereo reproduction of max. 6 watts output and is an ideal Home Installation.)

(c) The "Stereo Two" with one "5-10" MULLARD MAIN AMPLIFIER **£20.10.0**

(d) The "Stereo Two" with two "5-10" MULLARD MAIN AMPLIFIERS **£31.10.0**

(e) The "Stereo Eight" with two "5-10" MULLARD MAIN AMPLIFIERS **£44.10.0**
(This provides for up to 20 watts output.)

(f) The above (e) with one MULLARD "5-10" **£34.0.0**

OTHER STEREO EQUIPMENT AVAILABLE:

GRAM UNITS fitted with Stereo Cartridge by . . . GARRARD—COLLARO LENCO—B.S.R.

These include Autochangers, Single Record Playing and Transcription Units.

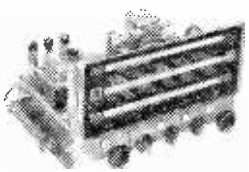
STEREO CARTRIDGES and PICK-UPS by . . . B.J.—GARRARD—COLLARO—LENCO—B.S.R.

(Please enclose S.A.E. with any inquiry.)

HIRE PURCHASE AND CREDIT SALE TERMS ARE AVAILABLE.

TO MODERNISE YOUR OLD RADIOGRAM

THE NEW ARMSTRONG "JUBILEE"



A.M. F.M. RADIOGRAM CHASSIS

PRICE **£30.9.0**

(Plus 7/6 Carr. and Ins.)

HIRE PURCHASE: Deposit £6.2.0. Months at £2.4.8.

Messrs. Armstrong have always been associated with very high-class equipment, and this chassis is undoubtedly one of the best they have ever produced.

MAIN FEATURES

● 6 watts push-pull output with negative feedback. ● 9 valves and 2 diodes. ● Full F.M. band (87-103 Mc/s) plus medium and long waves. ● Automatic frequency control on F.M. ● Adjustable Ferrite rod aerial on A.M. bands. ● Tape playback and record facilities. ● Two compensated pick-up inputs. ● Frequency response 30-22,000 cps. ± 2 dB. ● Separate wide-range bass and treble controls. ● Output impedance for 3-, 7½- and 15-ohm SPEAKERS. ● Tuning indicator. ● Size of chassis 12in. x 8in. x 7in. high.

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 **£8.7.6** (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 Maroon and Grey Rexine.

WE ALSO SUPPLY SEPARATELY—

(a) The 2-stage (plus Rectifier) **AMPLIFIER** **£4.2.6**

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

(c) **P.M. SPEAKER** **18/9**

Carriage and Insurance 4/- extra.

CAR BATTERY CHARGER

We offer a COMPLETE KIT OF PARTS FOR ONLY **£2.15.0**

EASY-TO-FOLLOW ASSEMBLY INSTRUCTIONS ARE INCLUDED.

Will charge 6 or 12 volt Batteries at max. 2½ amps. The design incorporates Ballast Resistor and Fuse, and we supply complete with Metal Box container.

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

Telephone: FLEET STREET 5812/3/4

! ! RECORD PLAYERS ! !

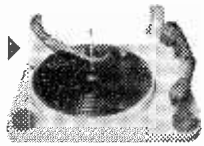
THE LATEST MODELS ARE IN STOCK MANY AT REDUCED PRICES ! ! !

SEND S.A.E. FOR ILLUSTRATED LEAFLET

A FEW CASH BARGAINS

B.S.R. MONARCH UA8 4-speed mixer Autochanger with Crystal Pick-up

£6.19.6



The **COLLARO "CONQUEST"** 4-speed Autochanger. Studio Pick-up **£7.19.6**

The latest **COLLARO "CONTINENTAL"** 4-speed MIXER Autochanger. Studio "O" Pick-up **£8.15.0**

The **COLLARO** 4-speed Single Record Player. Studio Pick-up **£6.19.6**

THE NEW B.S.R. Model UA12 is in Stock. A 4 "SPEED" MIXER AUTOCHANGER. **£8.19.6**

UA12 also available incorporating the **B.S.R. STEREO Pick-up**, plays L.P. and 78 Records **£11.17.6**

B.S.R. MODEL TU9 4-speed Single Record Player, complete with separate Crystal Pick-up **£4.10.0**

(This high output Pick-up is available separately for £1/12/6.)

Carriage and Insurance on each above 5/- extra.

HIGH FIDELITY UNITS IN STOCK

The latest GARRARD TRANSCRIPTION MOTOR "301" with Stroboscopically marked turntable..... **£28.0.11**

The new **GARRARD Model 4HF** High-quality Single Record Player fitted with the latest T.P.A.12 Pick-up Arm and G.C.8. Crystal Cartridge **£19.7.10**

As above but fitted with the G.M.C.5 Moving Coil Pick-up and T.P.1 Transformer **£27.14.7**

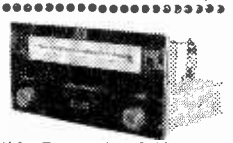
GARRARD Model TA/MK. II Single Record Player fitted with high output Crystal Pick-up detachable Head **£9.15.8**

The **GARRARD T.P.A.12 TRANSCRIPTION PICK-UP ARM** is available separately or with Crystal or Moving Coil Pick-up Heads.

GARRARD AUTOCHANGERS AVAILABLE FROM STOCK. Send S.A.E. For Leaflet.

NEW HIRE PURCHASE TERMS ARE AVAILABLE ON ALL EQUIPMENT VALUE £10 AND OVER.

STERN'S MK. II *fidelity* **F.M. TUNING UNIT**



PRICE

(Plus 5/- Carr. and Ins.) **£15.0.0**

HIRE PURCHASE: Deposit **£3.0.0** and 12 Monthly Payments of **£1.2.0** or Deposit **£5.0.0** and 12 Monthly Payments of **18/4.**

Incorporates the latest MULLARD PERMEABILITY TUNING HEART and the corresponding MULLARD VALVE LINE-UP comprising ECC85, 2 type EF85s (or EF89s) EM84 Tuning Indicator, plus 2 type O.A.79s Germanium Diodes. 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 m/a at 250 volts.

HOME CONSTRUCTORS ! YOU CAN BUILD THIS TUNING UNIT FOR ONLY £11.0.0 (Plus 5/- Carr. & Ins.) Please send S.A.E. for fully descriptive leaflet, or the Assembly Manual is available for 1/6. This contains easily followed PRACTICAL DIAGRAMS together with relative instructions.

HOME CONSTRUCTORS

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 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 STENTORIAN LOUDSPEAKERS. **PLEASE ENCLOSE S.A.E. WITH ALL CORRESPONDENCE.**

R.S.C. BATTERY CHARGING EQUIPMENT

All for A.C. Mains 200-250 v., 50 ccs. Guaranteed 12 months.

ASSEMBLED CHARGERS

6 v. 1 amp 19/9
6 v. or 12 v. 1 amp..... 27/9
6 v. 2 amps..... 29/9
6 v. or 12 v. 2 amps..... 38/9
6 v. or 12 v. 4 amps..... 56/9
Above ready for use. With mains and output leads. Carr. 3/6.

SELENIUM RECTIFIERS

F.W. BRIDGE TYPES

6/12 v. 1 a. 3/11 | **L.T. Types H.W.**
6/12 v. 2 a. 7/3 | 2-6 v. ½ a. 1/11
6/12 v. 3 a. 9/9 | 3/12 v. ½ a. H.W. 2/9
6/12 v. 4 a. 13/11 | **H.T. Types H.W.**
6/12 v. 6 a. 14/11 | 150 v. 40 mA. 3/9
6/12 v. 10 a. 25/9 | 250 v. 50 mA. 5/9
6/12 v. 15 a. 35/9 | 250 v. 80 mA. 7/9
24 v. 2 a. 14/9 | 250 v. 250 mA. 11/9
24 v. 6 a. 26/9

BATTERY CHARGER KITS

Consisting of Mains Transformer, F.W. Bridge, Metal Rectifier, well ventilated steel case. Fuses, Fuse-holders, Grommets, panels and circuit. Carr. 2/9 extra.

6 v. or 12 v. 1 amp..... 22/9
As above, with Ammeter... 32/9
6 v. 2 amps..... 25/9
6 v. or 12 v. 2 amps..... 31/6
6 v. or 12 v. 2 amps. inclusive of Ammeter..... 41/6
6 v. or 12 v. 4 amps..... 53/9

BATTERY CHARGER KIT

6/12 v. 6 amp. consisting of F.W. Bridge Rectifier, Mains Trans. and Ammeter. 49/9. Post and packing 4/6.

ASSEMBLED CHARGER

6 v. or 12 v. 2 amps.

Fitted Ammeter and selector plug for 6 v. or 12 v. Louvred metal case, finished attractive hammer blue. Ready for use. With mains and output leads. Double Fused.

Only **49/9**
Carr. 3/9

Assembled 6 v. or 12 v. 4 amps.

Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvred steel case with stoved blue hammer finished. Fused and ready for use with mains and output leads. Credit Terms: Deposit 14/11 and 5 monthly payments 14/11.

75/-
Carr. 4/6

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

Interleaved and Impregnated. Primaries 200-230-250 v. 50 cc/s. Screened.

TOP 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, 4 a. C.T. 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, Midget type 2½-3-3in. 17/6
250-0-250 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a.... 26/9
250-0-250 v. 100 mA, 6.3 v. 6 a, 5 v. 3 a, for R1355 conversion 31/2
300-0-300 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a.... 26/9
350-0-350 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, 6.3 v. 1 a, for Mullard 510 Amplifier 35/9
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. 200 mA, 6.3 v. 4 a. C.T., 6.3 v. 4 a. C.T., 5 v. 3 a. Suitable Williamson Amplifier, etc. 49/9

FILAMENT TRANSFORMERS

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

CHARGER TRANSFORMERS

All with 200-230-250 v. 50 c/s Primaries: 0-9-15 v. 1½ 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.

SMOOTHING CHOKES

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

OUTPUT TRANSFORMERS

Midget Battery Pentode 66:1 for 3S4. etc. 3/9
Small Pentode, 5,000Ω to 3Ω 3/9
Small Pentode 7/8,000Ω to 3Ω 3/9
Standard Pentode 5,000Ω to 3Ω ... 4/9
Standard Pentode, 7/80/00Ω to 3Ω ... 4/9
10,000Ω to 3Ω 4/9
Push-Pull 10-12 watts 6V6 to 3Ω or 15Ω 15/9
Push-Pull 10-12 watts to match 6V6 to 3-5-8 or 15Ω 16/9
Push-Pull EL84 to 3 or 15Ω 16/9
Push-Pull 15-18 watts, 6L6, KT66 ... 22/9
Push-Pull for Mullard 510 Ultra Linear 29/9
Push-Pull 20 watts, sectionally wound 6L6, KT66, etc., to 3 to 15Ω ... 47/9

ELIMINATOR TRANSFORMERS

Primaries 200-250 v. 50 c/s.
12 v. 40 mA, 5-0-5 v. 1 a.... ... ... 15/9
90 v. 15 mA, 4-0-4 v. 500 mA. 9/9

STAAR GALAXY 4-SPEED MIXER AUTO-CHANGER. A precision manufactured unit with a motor which virtually eliminates "wow" and rumble. Fitted pick-up with dual sapphire tipped stylus. For 200-250 v. A.C. mains. Limited Stocks. Only Brand New, cartoned. **£4-19-6** Carr. 4/6

PORTABLE CABINETS. High Quality Finish. Rexine covered. Attractive design. Inside measurements: 17in. x 12¼in. x 8¼in. high. Clearance above baseboard 5¼in. Below 2¼in., **69/9** each.

SPECIAL OFFER. Above cabinet, LG3 Amplifier, Staar Changer and 6½in. P.M. Speaker. **11 GNS.** Carr. 7/6.

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 bend detector. Power pentode output. Valve line-up 6K7, SP61, 6V6G. Selectivity and quality are well up to standard, and simplicity of construction is a special feature. Point-to-Point wiring diagrams, instructions and parts lists, 1/9. Maximum building costs **£4.19.6.** inc. attractive Brown or Cream Bakelite or Walnut veneered wood cabinet 12 x 6½ x 5½in.

AM/FM RADIOGRAM

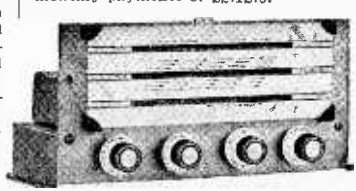
By leading manufacturer. Brand New. Cartoned with guarantee. 4 wavebands including V.H.F. Auto-changes at 3 speeds. Hi-fi duo-point sapphire stylus pick-up. For 200-250 v. A.C. mains. Limited stocks at a fraction of normal price. Credit Terms. Deposit **£6.19.6** and 9 monthly payments of 3 gns. Carr. 10/-.

29½ Gns.

COMPLETE AUTO-CHANGER RECORD PLAYERS. 4-SPEED. By well-known manufacturer. Hi-fi crystal pick-up. Matched amplifier and speaker. Attractive, well-finished rexine covered cabinet. For 200-250 v. A.C. mains. Brand New. Cartoned. Limited number. List price well over £20. **15 Gns.** Carr. 10/-.

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 8 B.V.A. valves. Guaranteed 12 months. Only **22 GNS.** Or Deposit £2.12.0 and 9 monthly payments of £2.12.0.



R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 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 8 x 5½ x 2½in. 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 cc/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.**

STEREOPHONIC EQUIPMENT AT SPECIAL PRICES

(a) Linear L3/3 Stereo Amplifier, **7 GNS.**; (b) Staar Galaxy Auto-Changer fitted Turnover head for Stereo, Long Playing and Standard Records, **£9.19.6.** carr 4/6; (c) Matched 12in. P.M. Speakers in polished Walnut finished wood cabinets, **£6.15.0** per pair; (d) Cabinet Speakers, illustrated below, **£9.19.0** pair; (e) Matched High Flux 8in. P.M. Speakers in polished Walnut veneered Cabinets, **£3.19.9** pair; (f) Matched 6½in. R.A. P.M. Speakers in polished veneered Walnut cabinet, **£3.10.0** pair. or (a), (b) and (c) **19 gns.**, carr. 15/-. (a), (b) and (d) **22 gns.**, carr. 15/-. (a), (b) and (e) **18 gns.**, carr. 15/-; (a), (b) and (f) **17 gns.**, carr. 15/-.

12in. 10 WATT HIGH QUALITY LOUDSPEAKERS 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/-.

D.C. SUPPLY KIT. 12 v. 1 a. consisting of partially drilled metal case, mains trans., F.W. Bridge Rectifier. 2 fuse-holders and fuses. Change Direction switch, variable Speed regulator and circuit. For 200-250 v. A.C. mains. Suitable Electric Trains, etc. Limited number available at **29/9.**

ACOS CRYSTAL 'MIKE' INSERTS. Approx. 1in. sqare. Fly lead connections. Only **5/11** each. Brand New. Round type approx. 1¼in. diam. Ex-equipment, tested. **4/11** each.

R.S.C. A8 ULTRA LINEAR 12 WATT AMPLIFIER

High-Fidelity Push-Pull Amplifier with "Built-in" Tone Control. Pre-amp stages, high sensitivity, includes 5 valves (807 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 +3 db. 30-30,000 c/cs. 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.

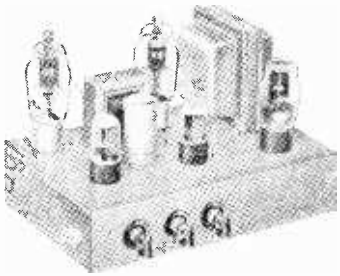
For **STANDARD or LONG - PLAYING RECORDS.** For **MUSICAL INSTRUMENTS** such as **STRING BASS, GUITARS,** etc. **OUTPUT SOCKET** with plug provides 300 v. 20 mA. and 6.3 v. 1.5a. For supply of a **RADIO FEEDER UNIT.** Size approx. 12-9-7in. For A.C. mains 200-230-250 v. 50 c.cs. Outputs for 3 and 15 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/-** or factory built **45/-** extra. Carriage 10/-.

£7-15-0

If required louvred metal cover with 2 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 10** and 12 monthly payments. **18 10.**

HIGH FIDELITY MICROPHONES and **SPEAKERS** in stock. Keen cash prices or credit terms if supplied with amplifier.



COLLARO RC/54 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 **£5/19/6.** 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 **£7/19/6.** Carr. 5/6.

COLLARO 4-SPEED SINGLE PLAYER with separate pick-up, as fitted RC457. For 200-250 v. A.C. mains. **£4/10/0.** Post 3/-.

PICK-UP ARMS complete with Hi-Fi turnover crystal head. Acos GP54. Limited number brand new, perfect, at approx. half price. Only **29/9.**

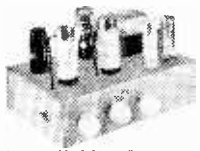
LG3 MINIATURE 2-3 WATT GRAM AMPLIFIER. For use with above or any other single or auto-change units. Output for 2-3 ohm speaker. For 200-250 v. 50 c.p.s. A.C. mains. Overall size 6½ x 4½ x 2½in. Controls: Vol. and Tone with switch. Guaranteed 12 months. Only **55/9.**

SUPERHET FEEDER UNIT. Design of a high quality Radio Tuner Unit (specially suitable for use with any of our Amplifiers). Delayed A.V.C. employed. The W.Ch. Sw. incorporates Gram position. Controls are Tuning, W.Ch. and Vol. Only 250 v. 15 mA. H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size of unit approx. 9-6-7in. high. Simple alignment procedure. Point-to-Point wiring diagrams, instructions and priced parts list with illustration, **2/6.** Total building cost **24/15/-.** For descriptive leaflet send S.A.E.

LINEAR L45 MINIATURE 4-5 WATT QUALITY AMPLIFIER. Suitable for use with Collaro, B.S.R. or any other 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/cs. Output for 2-3 ohm speaker. Three miniature Mullard valves used. Size of unit only 6-5-5in. high. Output for 2-3 ohm speaker. Guaranteed for 12 months. Only **£5/19/6.** Send S.A.E. for illustrated leaflet. Credit Terms. Deposit **22/6** and 5 monthly payments of **22/6.**

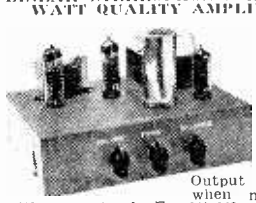
LINEAR 'DIATONIC' 10-14 WATT HIGH FIDELITY PUSH-PULL ULTRA LINEAR AMPLIFIER. For 200-250 v. A.C. mains. Valves ECC83, ECC33, EL84, EL84, EZ81 miniature Mullard. Self-contained Pre-amp. Tone Control stage, and separate Bass and Treble Controls. Independent 'Mike' and Gram input sockets are provided. Output 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.

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 71 db. down. 15 db. of negative feedback is used. H.T. of 300 v. 25 mA. and L.T. of 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit, or Tape-Deck pre-amplifier. For A.C. mains input of 200-230-250 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 baseplate) with Blue hammer finish and point-to-point wiring diagrams and instructions. Exceptional value at only £4 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.

LINEAR STEREOPHONIC L3 3 3+3 WATT QUALITY AMPLIFIER



Output 6 watts when not used with stereo head. For 200-250 v. 50 c.p.s. A.C. mains. Ganged controls, Volume and Tone. Outputs matched by preset balance control. For use with 2 matched 3 ohm speakers. Only requires connecting to Pick-up speakers and mains point. Sensitivity 150 m.v. Supplied with guarantee and instructions. Send S.A.E. for leaflet. Terms available.

7 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/cs. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All components are chosen for reliability. Six valves are used, EF86, EF86, ECC83, 807, 807, GZ33. 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 PROVIDES** 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/cs. 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 paymenis of **24 9.**

11 GNS.

Carr. 10/-

LINEAR 50 WATT HIGH FIDELITY AMPLIFIER. Sensitivity 25 millivolts for full output. Suitable for any kind of microphone or pick-up. Output matchings for 3 and 15 ohm speakers. Brand New. Guaranteed 12 months. For 200-250 v. A.C. mains. Only **19 gns.** Carr. 15/-. Terms available. Twin handled cover available at **25/-.** Send S.A.E. for leaflet.

LINEAR LT45 HIGH QUALITY TAPE DECK AMPLIFIER. With "built in" power pack and output stage. For Tape Decks with High or Low Impedance. Playback and Erase Heads, such as Lane, Truvox, Collaro, Brenell, etc. For A.C. Mains 230-250 v. 50 c/cs. **Linear frequency response of +3 db. 50-11,000 c/cs.** Negative feedback equalisation. Illustrated leaflet 6d.

Ready for Use. ONLY 12 GNS. Carr. 7/6

SPEAKERS. All 2-3 ohms, suitable for use with LG3, L45, A5 or A7 amplifiers. 5in. Goodmans, **17/9.** 7 x 4in. Elliptical Elac., **19/9.** 6½in. Goodmans, **17/9.** 8in. Rola, **19/9.** 10in. R.A., **27/9.** 10 x 6in. Elliptical Goodmans, **29/9.** 12in. Plessey, **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.** 12in. Plessey 3 ohms 10 watts (12,000 lines). **59/6.**

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 HGP59 Hi-Fi Crystal Cartridges, (Turnover type with sapphire stylus.) Standard replacement for Garrard and B.S.R. Only **19/9.**

R.S.C. 3-4 WATT A7 HIGH-GAIN AMPLIFIER

For 230 250 v. 50 c/cs. Mains input. Appearance and Specification, with exception of output wattage, as A5. Complete Kit with diagrams, £3/15/-. Assembled 22/6 extra. Carr. 3/6.

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 5.30: Weds. until 1 p.m. Catalogue 6d. Trade supplied. S.A.E. with all enquiries.

RADIO SUPPLY CO. (LEEDS) LTD.

Mail Orders to 29/31 Moorfield Rd., Leeds 12.
Callers to 5 and 7 County (Mecca) Arcade, Briggate, Leeds 1.

PRACTICAL WIRELESS

EVERY MONTH
VOL. XXXIV, No. 626, FEBRUARY 1959
EDITOR : F. J. CAMM
26th YEAR OF ISSUE

COMMENTS OF THE MONTH

BY THE EDITOR

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The Editor will be pleased to consider articles of a practical nature. Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed : The Editor PRACTICAL WIRELESS, *George Newnes, Ltd., Tower House, Southampton Street, 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.*

INTERESTING BBC STATISTICS

THE BBC issues annually a handbook in which it gives facts and figures relating to its service on sound and television. They are anything but dull and the keen radio enthusiast should obtain a copy. For example, over 140,000 contracts in a year are issued to those who contribute to the programmes. The contracts cover individuals, as well as orchestras. The BBC receives 200,000 letters a year. Last year, they trained 620 students ; 8,000,000 schools pamphlets are produced a year ; the BBC staff numbered 15,472 at March 31st, 1958. There are 157 studios for domestic sound programmes in the U.K. First performances of musical compositions numbered 170 last year. Three hundred and sixty-eight SOS messages are broadcast every year. Three thousand five hundred light entertainment programmes are produced each year for sound radio, including performances in the General Overseas Service ; 30 religious programmes are broadcast every week. External services are broadcast in English, and 41 other languages, for 81 hours every day. These are but a few of the facts in this interesting book which are worth remembering. It includes quick reference tables of all BBC transmitting stations—long, medium wave, V.H.F. and television. There is a map showing the locations. There is a list of the opening dates of TV and V.H.F. stations, as well as several technical articles, including advice on how to get the best reception, wavelength allocation, and an outline of the work of the various engineering departments of the BBC.

THE "P.H." EXHIBITION FREE TICKETS!

THE Practical Householder Exhibition takes place at Earls Court from February 18th to 28th. It will occupy twice the floor space of last year, and there will be many more exhibits and demonstrations. This is the most important exhibition for those interested in do-it-yourself. A free entrance ticket appears in every copy of the March issue of *Practical Householder*, on sale February 6th.

RADIO SHOW 1959

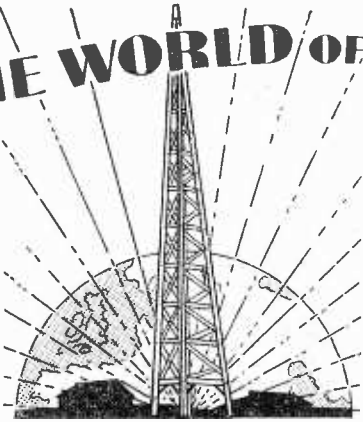
THE 26th National Radio and Television Exhibition will be held at Earls Court, London, from Wednesday, August 26 to Saturday, September 5, with a pre-view on Tuesday, August 25.

PREFERRED VALUES

VERY few components such as condensers and resistors are of critical value. Contributors of articles on the construction of receivers naturally specify the values of the components they have actually used. Our readers, intent on complying in every detail with our published specification, may turn down the alternative of a near value component offered by the dealer, who may be out of stock of the value specified. Readers may quite safely accept a preferred value near to the one specified. Indeed, some of the values specified, if taken from ex-Government apparatus, may no longer be available.—F. J. C.

Our next issue, dated March will be published on February 6th

ROUND THE WORLD OF WIRELESS



By "QUESTOR"

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of October, 1958, 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	1,001,118
Home Counties	1,000,774
Midland	738,355
North Eastern	907,917
North Western	703,059
South Western	611,213
Wales and Border Counties ...	379,205
Total England and Wales ...	5,341,641
Scotland	643,492
Northern Ireland	174,059
Grand Total	6,159,192

Morse Instruction

A R.A.E. course for instruction in morse is held at 7 p.m. on Tuesdays at Yew Tree Schools under West Bromwich Education Committee. Intending applicants are invited to join at once.

International Convention on Transistors

THE Radio and Telecommunication Section of The Institution of Electrical Engineers have found it necessary to hold their International Convention on transistors and associated semi-conductor devices a few days earlier than previously announced. The new dates are 21st-27th May, 1959. The alteration has become necessary through changes in the availability of some of the accommodation at Earls Court, where the convention is to be held.

Associated with the convention will be an International Technical Exhibition covering the manufacturing, application, research, development and other aspects of transistors and associated semi-conductor devices. This exhibition, which will remain open during the period of the convention, will also be held at Earls Court.

Radio Hobbies Exhibition

THIS show, which was held in November last, had nearly 10,000 visitors—3,000 more than last year.

The £400 Racal receiver offered as a free-entry prize was won by Mr. Kenneth R. Rogers, of Hitchin, a Hertfordshire C.I.D. officer, who is an enthusiastic short-wave listener.

Exhibitors were enthusiastic about the success of the show. They did excellent business. One company reported that over 4,000 leaflets describing a particular kit had been distributed and 2,500 enquiry forms had been completed by visitors to the exhibition. The Territorial Army reported that over 30 potential recruits had completed forms and more are expected.

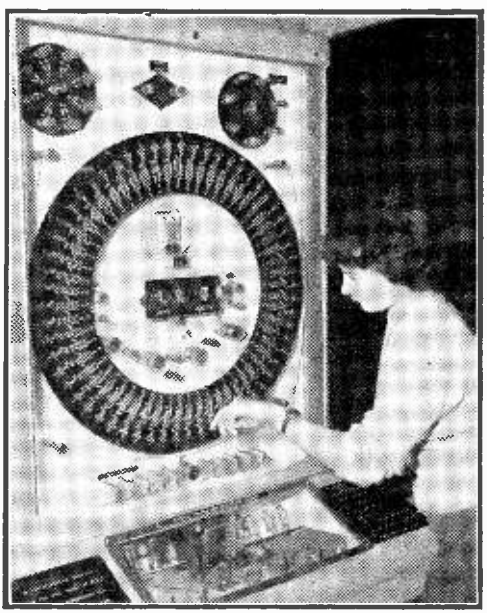
The colour TV arranged by Mr. Bernard Rogers attracted huge crowds and reception was excellent. The Radio Society of Great Britain made over 200 new members at the show.

"Eyes" for Pluto Reactor

A HIGH-DEFINITION closed circuit television system specially developed by E.M.I. Electronics Ltd., for use in nuclear reactors, is in operation at the Atomic Energy Authority's establishment at Harwell.

The cylindrical camera unit, which measures only 3in. in diameter and is approximately 48in. long, is constructed so that it can be lowered through an inspection cover directly into the Reactor Pluto's heavy water. A transparent tube encases it to afford protection.

A remotely controlled mirror mounted in front of the lens enables the operator to view all parts of the interior of the



Miss Carol Creagh checks her watch with an electronic clock. This clock was a working display to show comprehensive collection of valves and components, at the Radio Hobbies Exhibition, held last year, on the Standard Telephone and Cable Company's stand.

reactor, which has been specially illuminated. Switched scan reversal circuits have been incorporated in the camera control unit to compensate for reversal of the mirror's reflection. Remote inspection of many of the reactor components without removal from the reactor now means that radiation hazards to personnel and the time required for preventive maintenance may be greatly reduced. The E.M.I. camera channel works on the 625 line system, and employs the latest construction techniques.

Higher-rated Transistors

THERE is an increasing demand for transistors with higher ratings for specialised applications. To meet this demand Newmarket Transistors have considerably raised the dissipation rating of their audio and R.F. transistors.

This is the result of improved manufacturing processes and application technique. The transistors are now supplied with an increased dissipation rating which can be raised to the maximum rating by mounting the transistors with a special clip supplied by the manufacturers. There is no change in price—the clips are supplied free.

New British Standard

IN this new publication (B.S. 3045: 1958) the sone scale is specified by its relation to the phon scale, the relation used being an approximation based on assessments of the available experimental evidence. It does not necessarily represent the degree of accuracy required for research purposes, nor should it be deemed to serve any function other than the conversion of loudness levels to loudness in sones, and vice versa.

Copies of this Standard may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1. Price 3s.

Automatic Broadcasting is Here

A SOUTH AMERICAN radio station now stays on the air 24 hours a day, seven days a week and is able to broadcast for one and a half days without staff. All station employees have their Saturday afternoons and Sundays free.

Scotch magnetic tape has made this possible. Music and commercials are now recorded on this tape so that the station can transmit automatically, without staff, said a spokesman of the Minnesota Mining and Manufacturing Co. Ltd.

Owner and director of CX28 Radio Imparcial, Montevideo, Mr. Higueira Moran, claims that his station can now make transmissions which are free from unwanted noise and embarrassing "dead air." He now exercises complete control over all his programmes, which are recorded and re-recorded on the tape until perfect. They are then broadcast in the deserted studio.

BBC sound engineers use similar tape, which is made at the 3M Company's factory in Birmingham.

Marconi V.H.F. receiver being used to report progress during Donald Campbell's record-breaking speed event in Bluebird at Coniston Water.

Marconi V.H.F. Radio in Bluebird

DONALD CAMPBELL'S record breaking Bluebird was equipped with Marconi mobile V.H.F. radio. During the record-breaking runs, continuous two-way communication was maintained between Mr. Campbell and his chief mechanic, Mr. Leo Villa, in the control boat. Mr. Campbell reported continually during the runs on the speed and performance of Bluebird, while Mr. Villa kept him informed on the meteorological and water surface conditions.

Mullard Amateur Award

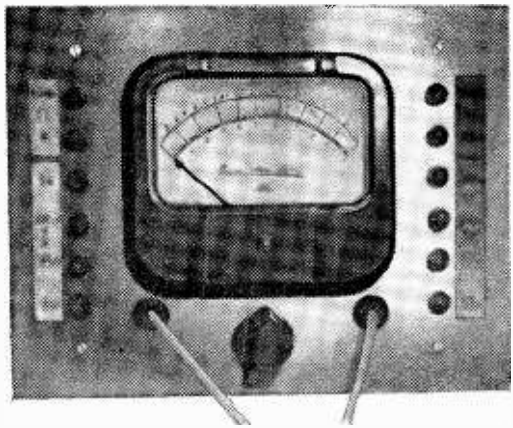
THE Directors of Mullard Limited are presenting, until further notice, a yearly award for distribution by the Radio Society of Great Britain. This award will be made to the member of the Society resident in the United Kingdom who, in the opinion of a Committee set up for the purpose, has through the medium of amateur radio during the preceding calendar year, rendered outstanding personal service to the community by his own endeavours or by his own example of fortitude and courage. The members of the Committee will be three representatives of Mullard Limited and three representatives of the Council of the R.S.G.B. The award will consist of electronic or electrical apparatus and/or books to the value of £25 and a commemorative plaque. It will be presented in April of each year.

Nominations for the award will be invited in January of each year by the R.S.G.B. through its official journal. Every nomination will need to be supported by at least three corporate members of the Society and will be expected to provide a factual account of the personal service rendered by the nominee.

A Push-button Multi-range Testmeter

EASY RANGE SELECTION IS A FEATURE OF THIS WELL-DESIGNED INSTRUMENT

By Hugh Guy



IN a multi-meter using push-button switches any range can be selected instantly by pressing the appropriate button, the previously chosen range being automatically cancelled. Furthermore, such push-buttons are readily available on the surplus market.

By using two such switches, each with six buttons, a versatile universal multi-range instrument can be constructed covering two resistance ranges, two A.C. and four D.C. voltage ranges, and four direct current ranges.

Instrument Ranges

Using a 0-1 mA full-scale deflection moving-coil meter the instrument will have the following ranges:

Resistance 1 k. 100 k.
Current 1 mA, 10 mA, 100 mA, 1 A.
Volts (D.C.) 3 v., 10 v., 100 v., 300 v.
Volts (A.C.) 10 v., 300 v.

These cover most constructional and service requirements, and such a design yields an instrument with a sensitivity of 1,000 Ω/volt.

If greater sensitivity is required then a 0-100 μA meter should be used. With such a movement the resistance range on the meter can be extended, the two ranges then being 0-10 k. and 0-1 megohm. In addition there may be some advantage in redistributing the current ranges to provide readings on the four ranges of 0-100 μA, 0-3 mA, 0-100 mA, 0-1 A. The top limit of 1 amp. may be too low for some uses, particularly for the reader whose principal current measuring requirement is associated with his car electrical system, when 10 amps. would be nearer the mark. These points are at the discretion of the reader and though basically an instrument is described centred on the use of 0-1 mA meter with the above ranges, sufficient information is given in the text to enable each reader to make his own version by using the simple formulæ described.

Accuracy of readings is the main criterion in any instrument, and in a multi-range instrument the accuracy is determined by the circuit conditions in which it is used.

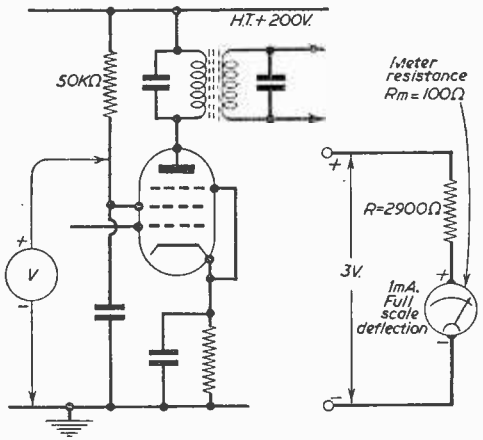


Fig. 1 (Left).—Shows the measurement of the screen voltage of a valve.

Fig. 2 (Right).—Using a meter with a multiplier to read 0-3 v. D.C.

Accuracy

For voltage measurements in a circuit the greater the sensitivity of the instrument the greater the accuracy of the reading. This is not generally appreciated and an example best illustrates the problem.

Consider a typical instance as shown in Fig. 1 where the screen voltage of a pentode is being monitored. This pentode is the I.F. stage of a superhet set and is coupled to the 200 v. H.T. supply via a resistance of 50 k. The screen should be at a potential of 100 v. and the screen current drawn is 2 mA.

If an instrument using a 0-1 mA meter is connected between screen and earth to measure the screen voltage on the 100 v. range, even though the circuit is functioning satisfactorily, the voltage reading will *not* be 100 v. In fact, assuming the screen current remains constant, the meter will indicate approximately 67 volts.

Switching the meter to the 300 volt range would improve matters slightly, giving a reading of 86 v. approximately.

These errors arise because the meter itself must draw a fraction of the circuit current to give a deflection. Therefore, the lower the current drawn, the greater the accuracy of the reading.

This is particularly important when making readings in high impedance circuits such as the one just considered and the only cure is to use a more sensitive instrument.

If, for example, the meter used had been a 0-100 μA movement, then on the 100 v. range in the above example it would have read 95 volts and on the 300 v. range, more than 98 volts.

This is an important point to bear in mind when deciding what sort of meter movement to use if the instrument is to be used for general circuit work.

One final cheering word to dispel any gloom that this thought may have created: the service

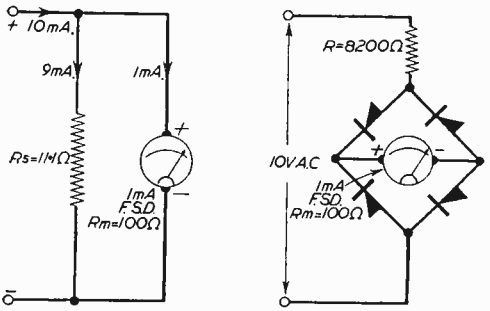


Fig. 3 (Left).—Using a meter with a shunt to read 0-10 mA. D.C.

Fig. 4 (Right).—Circuit with a bridge rectifier to read 0-10 v. A.C. R.M.S.

sheets issued by most reputable radio and TV manufacturers take this limitation into consideration by quoting typical voltage levels in their circuits at values read on a 1,000 Ω/volt instrument.

Basic Meter Circuits: Voltmeter

A moving coil milliammeter can be converted into an instrument reading voltage simply by connecting a resistance of appropriate value in series with it. This resistance is known as a multiplier, and a typical example of the arrangement is shown in Fig. 2. Here a 100 Ω resistance meter with a 0-1 mA movement is converted into a voltmeter with a full-scale reading of 3 volts by the addition of a multipler R of value of 2,900 ohms. This value of R may be calculated for different meters from the formula

$R = \left(\frac{V}{Im} - Rm\right)$ ohms where V is the required full-scale voltage; Im is the full-scale meter current in *amps;* and Rm is the meter resistance, in ohms.

Different full-scale voltage readings and hence range changing is achieved by switching in the appropriate value of R for the range in question.

Current

The same basic movement may be converted into an ammeter (or milliammeter with a different full-scale reading) by connecting a resistance known as a shunt in parallel with the meter. This shunt, value Rs, literally shunts away the difference between the current required to give full-scale deflection of the basic meter and the current that the meter is required to read.

In the circuit of Fig. 3 for example the 1 mA movement is shown connected to read a full scale of 10 mA and to do this the value of the shunt is designed to pass the difference of 9 mA.

Here again the value of the shunt Rs may be varied to obtain different ranges and is calculated from the formula $Rs = \left(\frac{Im}{I - Im}\right) \times Rm$ ohms where I is the required full-scale current in amps the other symbols being as indicated earlier.

Alternating Voltage

The moving coil meter responds only to direct current. Hence to give an indication of alternating quantities the latter must first be rectified. Small bridge rectifiers are available designed specifically for this purpose; in the case of 100 μA instruments it is even possible to use four crystal diodes, such as "Westectors," connected in a bridge circuit (see Fig. 4).

A slight complication is introduced here by the manner in which a meter responds to a rectified alternating current. Meters always indicate the mean or average current flowing whereas the quantity which is always used in A.C. terminology is the R.M.S. (root mean square) value.

This method of specifying alternating quantities arises from a consideration of the power available from an A.C. source compared with that from a D.C. source. If power is measured in the same value of load connected to each supply then the power will be the same when the A.C. source, expressed as an R.M.S. value, equals the value of the D.C. source.

To be of any use, therefore, the average current that the meter reads must be expressed in R.M.S. current. Now for a sine wave the R.M.S. value is always 1.11 times as great as the average value. If it is always assumed that the waveform of the alternating supply being measured by the instrument is sinusoidal then the meter will read R.M.S. values directly if the current through it is increased by a factor of 1.11. This in turn can

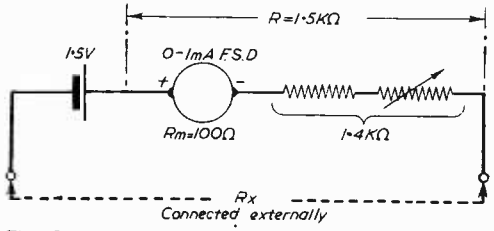


Fig. 5.—A circuit for measuring resistance up to 100 kΩ.

be achieved by reducing the total circuit resistance by this factor, known as the form factor (short for waveform factor). The assumption that waveform is sinusoidal is fair enough for most cases, particularly in mains supply measurement where the distortion present is not sufficient to detract from the accuracy of the reading.

In calculating the multiplier necessary to produce any given full-scale voltage reading on an alternating voltmeter some allowance must be made for the voltage drop across the rectifier and meter combination, and a commonly allowed figure of 1 volt provides a good design value.

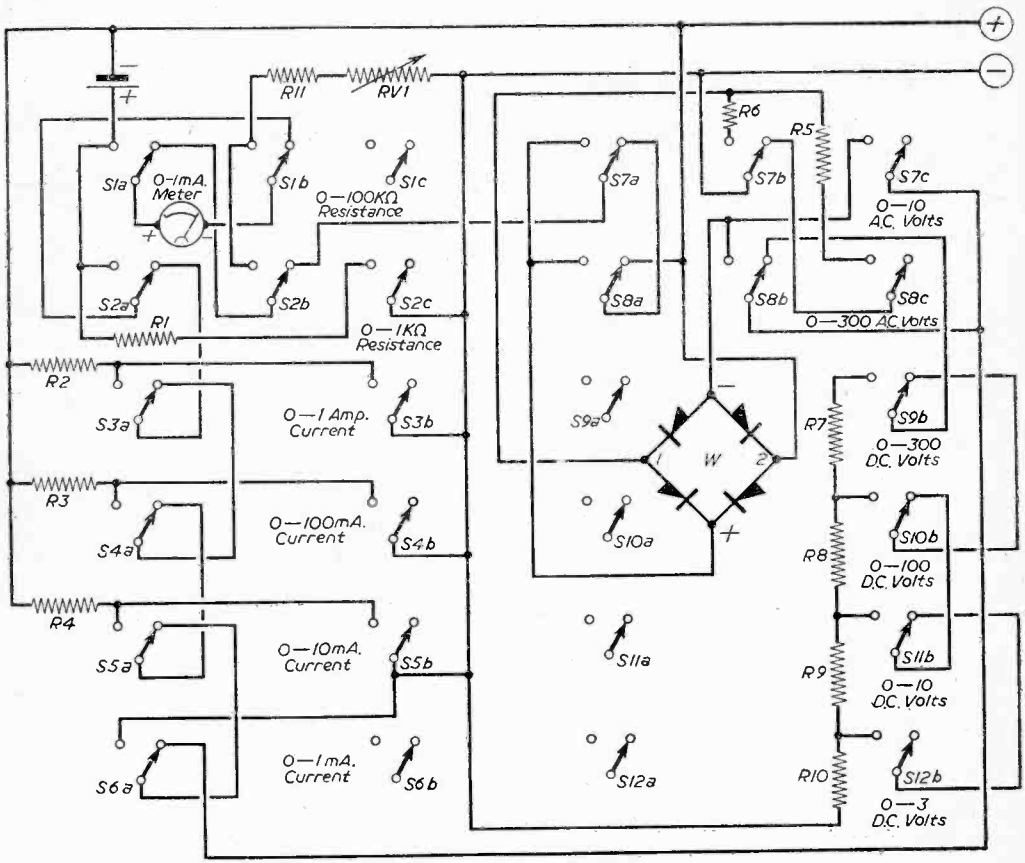


Fig. 6.—Complete circuit diagram of the multi-range meter.

The formula for the multiplier resistance R for A.C. voltmeters is therefore $R = \frac{Vac - I}{1.11 \times Im}$ ohms where Vac is the required full-scale alternating R.M.S. voltage reading.

In Fig. 5 is shown how resistance is obtained by measuring the current flowing through the unknown resistance connected between the two terminals of the meter. The current is provided by a battery which is built into the instrument.

Resistance

Before measuring the unknown resistance the meter terminals must be shorted together and the variable resistance adjusted so that the meter needle just indicates full scale. For the 1 mA meter shown, with the 1.5 v. battery, full-scale deflection is produced when the sum of the fixed built-in resistance, the variable resistance and the meter resistance is 1.5 k, as shown.

The unknown resistance is then connected between the two terminals and the meter deflection falls accordingly. The higher the value of the unknown resistance the smaller the current that flows in the circuit, and hence the smaller the meter deflection. Consequently a separate scale is required for resistance, being interpreted from the current through the series circuit comprised of the unknown resistance, and the meter and internally wired resistances. This scale will not be uniformly distributed and furthermore, unlike the normal meter scale, will have increasing values moving from right to left on the scale. The method of calibration is to be described.

For a meter circuit resistance of R ohms—1.5 k. in Fig. 5—the unknown resistance Rx may be calculated from the formula $Rx = R\left(\frac{1-D}{D}\right)$ ohms where D is the fraction of the full-scale current.

For example, in the meter circuit of Fig. 5, if the meter shows a deflection of 0.4 mA when an unknown resistance is being measured then the value of the latter would be 2,250 ohms. Similarly at a deflection of 0.2 mA the formula shows that the resistance would be 6,000 Ω. The formula, therefore, enables a complete calibration table to be drawn up so that a resistance scale can be drawn on the meter. For the meter circuit of Fig. 5 a value "6,000" ohms would be written against 0.2 mA on the scale of the instrument.

A table showing such a calibration will be given in the next article for a 1 mA movement with a resistance of 100 Ω.

(To be continued)

CONTROL OF STEREO BALANCE

ADDING A SECOND CHANNEL TO EXISTING SINGLE-CHANNEL EQUIPMENT

By G. Earl

NOW that stereo discs and pick-ups are readily available, an increasing number of hi-fi enthusiasts and experimenters are exploring the possibilities of this new sound effect by adding a second channel to their existing single-channel equipment. This is by no means difficult and the expense of the project is considerably governed by the type of equipment already in use. If an expensive hi-fi hook-up is being used on the single channel, then a similar set of equipment will have to be obtained in order to secure hi-fi stereo. On the other hand, if a simple record player type of amplifier at present serves the single channel it will only cost a few pounds to multiply to stereo.

A Stereo Disc

A stereo disc and pick-up provides two signal outputs of the same programme material. However, owing to the positioning of the microphones during the recording process the signals differ in phase and level to match the sound as heard by each ear at the studio. These signals have to be individually amplified so that their particular identity is not destroyed and then applied to separate loudspeakers which are positioned in the listening room to give the optimum stereo effect. The idea is illustrated in Fig. 1.

The pick-up usually has three lead-out wires or three tags, one being common to both signals, (the "earthy" connection) and the other two carrying the individual signals.

Although hi-fi stereo, obtained by way of expensive hi-ti amplifiers and loudspeaker systems, obviously sounds better than stereo derived from simple two-stage amplifiers and inexpensive loudspeakers, a remarkable improvement in quality from a simple inexpensive set-up is possible by running it stereo-wise. This is a rather controversial subject, but in the author's opinion, inexpensive stereo is far better than inexpensive single-channel reproduction and cheap stereo often approaches single-channel hi-fi standards. This, in one instance, was vividly demonstrated during one of the stereo transmissions given by the BBC when hi-fi-flavoured sound was created by an inexpensive table TV set sound channel and an all-dry battery portable!

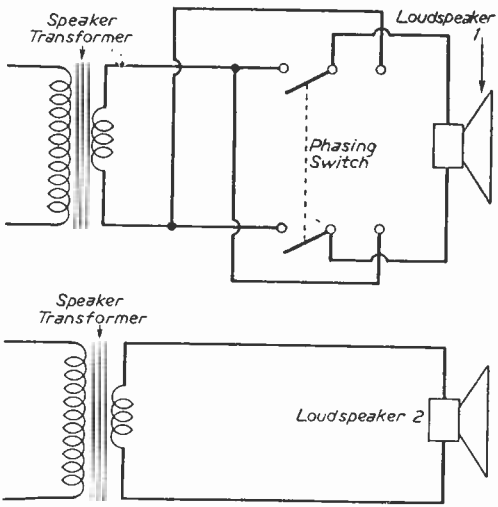


Fig. 2.—Correct phasing can be achieved by reversing the connections to one of the loudspeakers. A convenient phasing switch can be wired as shown.

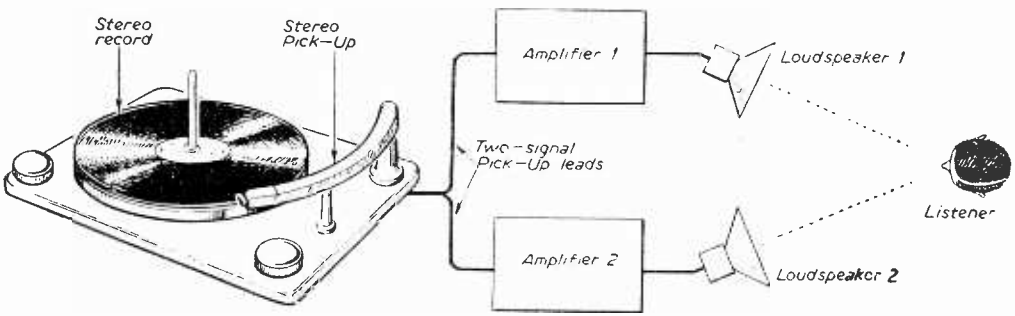


Fig. 1.—The stereo set-up from record to loudspeakers.

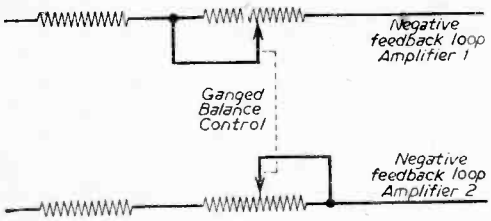


Fig. 3.—Securing a control of balance by ganged variable resistors in the negative feedback loops of the two amplifiers. This arrangement is adopted by Pamphonic.

Balance and Phasing

No matter what equipment is used, the true stereo effect can be obtained only when the two channels are in correct balance and phase. Two-channel stereo amplifiers feature a balance control, which serves over a small limit to increase the gain of one channel while reducing the gain of the other, and a phasing switch, which simply reverses the connections to one of the loudspeakers.

The "Pamphonic" stereo amplifier also has a channel reversing switch so that the signal channels can quickly be reversed. This may be necessary if the signal leads of the pick-up are connected round the wrong way which would give a laterally reversed impression of sound movement and position. However, since the record manufacturers have now an agreed channel recording standard such a switch is not essential (though it may have a convenience value), for once the correct pick-up connections have been established they hold for all records.

Method of Connecting

Fig. 2 shows the method of connecting a phasing switch to one of the loudspeaker circuits. A simple type of double-pole double-throw toggle switch is perfectly suitable for 5- to 10-watt amplifiers, but a more substantial switch should be used on larger amplifiers, bearing in mind that failure of the switch would remove the loudspeaker load and possibly ruin the output transformer and output valves.

When two identical amplifiers are used in the stereo chain it may be a fairly simple matter to balance the outputs by setting the volume controls to similar positions, but if the loudspeakers used differ in sensitivity such settings would not represent equal sound levels from the loudspeakers and one control would have to be retarded or advanced with respect to the other. This fine adjustment is made even more difficult by the speaker positioning and room acoustics, especially if one speaker is slightly shielded by a piece of furniture or curtain.

By far the best idea is to employ a balance control which provides a fine adjustment by increasing the gain of one amplifier while decreasing the gain of the other. The control

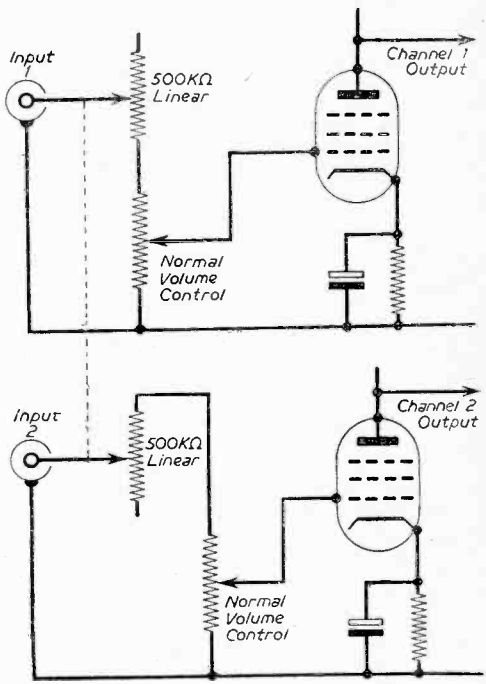


Fig. 4.—This method of balancing makes use of ganged potentiometers in the signal input circuit. The control should be installed preferably in a stage where the signal is at a high level.

should be arranged so that the amplifier gains are equal when the control is adjusted to the centre of its travel. At this point a rough level should be established by the normal volume controls and optimum stereo effect obtained by careful adjustment of the balance control. The true stereo illusion also depends somewhat upon the correct balance of the tone controls, but in some cases enhanced overall performance is possible by applying a little treble boost to the channel dealing with the treble side of the orchestra.

(Continued on page 968)

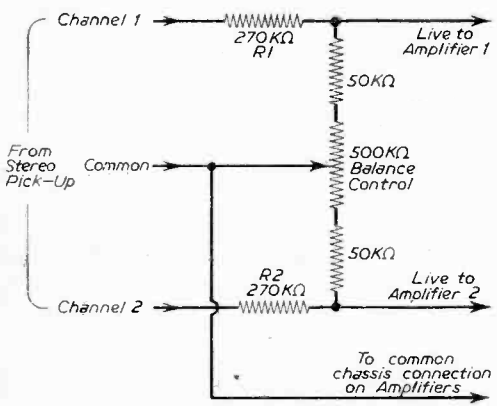


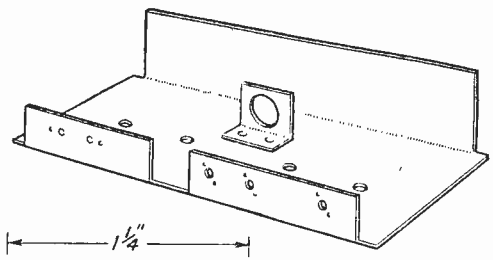
Fig. 5.—A method of stereo balance which is suitable for the less exacting type of amplifier. The circuit can be built into a metal box and connected to the pick-up sockets and pick-up itself through screened cable.

A Radiogram Control Unit

CONSTRUCTIONAL DETAILS OF THE TONE CONTROL FOR THE RECORD PLAYER

(*Concluded from page 903 of the January issue*)

RADIO signals can be adjusted to equal those from the gramophone in the feeders themselves, but equalising 78 to L.P. record output must be included in the control unit as the same pickup and input leads are used. In this particular case, given in the circuit in Fig. 1, shown last month, allowance is made for the fact that the average output on 78 records is about four times that on L.P. records, so at the 78 position R9 is inserted in series and R10 introduced in parallel with the volume control so that the load is 1 MΩ. For L.P. records R9 is shorted out



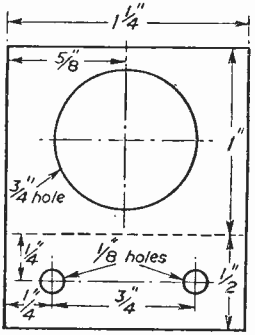


Fig. 4(a) Above.—The chassis folded.
Fig. 4(b) Left.—Bracket for the valveholder.

and R10 is taken out of circuit completely so that the volume control, which is 1 MΩ, provides the only load. To work out the values of R9 and R10 is a simple exercise with resistors in series and in parallel. The total resistive load is to be 1 MΩ and R9 has to be three times the resultant of R10 and VR1 in parallel, i.e., three-quarters of the load of 1 MΩ: the nearest preferred value is 680 KΩ. R10 is the resistance which, in parallel with 1 MΩ, makes 250 KΩ and so is made 470 KΩ. The actual sizes used by the constructor can be adjusted according to the requirements of his pickup. The remaining bank on the switch, bank (c), serves to feed H.T. to the two feeders when they are needed, so that when they are not needed they are rendered inoperative.

Manual Tone Controls

Manual tone controls are provided in the interstage circuit. VR2 provides treble control, giving boost at the upper end of its travel and cut at the lower end. The bass control, VR3, similarly gives boost at the upper end and cut at the lower end. The signal is taken off from the cathode resistor R5 via a screened lead. The power needed from the main amplifier is quite modest, being only .3 amp. at 6.3 volts A.C. for the heater and a maximum of 10 mA at 250 volts for H.T.

Construction

It is recommended that the circuit be made up in the simple fashion given in Fig. 1 without input correction in the first instance. When this is working, and if the pickup to be used needs an alternative type of input circuit, the appropriate components can then be built on, knowing that the main circuit is quite satisfactory. The chassis is made from a piece of sheet aluminium cut to the shape and dimensions given in Fig. 3. Before proceeding to make this up, however, it is as well to give some thought to the way in which the chassis is to be fixed into the cabinet. Much will depend on the cabinet design, but it will be seen that the chassis extends ½in. beyond the sides and is drilled so that it will take four screws which will pass through the chassis into the underneath of the motor-board. The position of holes is given but there is no point in giving actual dimensions where these are likely to vary. This applies to tagboards and the socket strip. These should be measured and the appropriate holes suitably placed.

When this work is completed the flaps on the long sides are bent at right angles so that the work, as drawn, is inside the chassis. The ½in. flaps on the short dimension are not folded—they are for mounting the unit as above. The chassis when folded should appear as in Fig. 4(a). A bracket is needed for the valveholder as in Fig. 4(b). This takes the B9A valveholder which should be orientated so that the space in the pins is towards the mounting flap. Before screwing this bracket, with the valveholder already fixed to it, on to the main chassis a length of wire should be soldered to each pin and identified by means of a label, except for pin 1 to which R2 and C2 should be fixed; pin 5 which should be connected to pin 4; pin 7 to C5 and R6; pin 8 to R4 and C3.

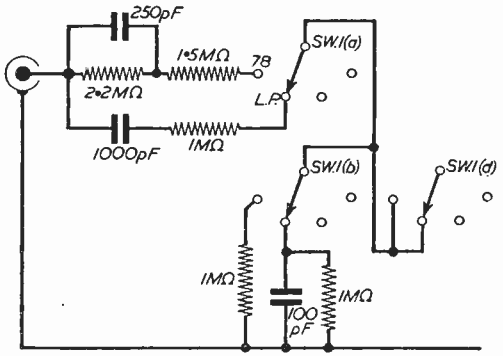


Fig. 5.—Correction for GP20 Hi-g pickup.

Wiring Diagram

Fig. 2 gives the wiring diagram on which the valveholder is shown flat merely for convenience of drawing. The tagstrip is also drawn out of place, and the segments of the switch have also been displaced for the sake of clarity. It will be noticed that the least accessible sector of the switch, i.e., that inside and nearer the chassis is used for switching H.T. This assumes, of course, that those chassis providing the F.M. and A.M. signals derive their power from either the main supply or from a supply separate from the tuners. As shown in Fig. 2, a separate lead is provided to a power supply made up specially for the tuners but actually stored alongside the main amplifier. If the main amplifier is, in fact, to provide power for all units this separate lead will not be required, but it will be necessary to avoid passing the current for the tuners through the resistance smoothing provided on the present chassis. The lead from the tagstrip that goes to the selector switch will therefore need to be connected to the H.T. input point alongside the output sockets and not to the decoupled H.T. point on the tagstrip itself. The third possibility is that the tuning units are self-powered and that it is not convenient to bring the H.T. into the control chassis. It is simplest to arrange for muting on the tuner chassis themselves, if this is found necessary. A switch on the control panel with five segments could be used, of course, using segment (c) to mute, say the A.M. signal, by earthing the lead from the input socket at positions where this input is not needed and using the additional segment to mute the F.M. signal.

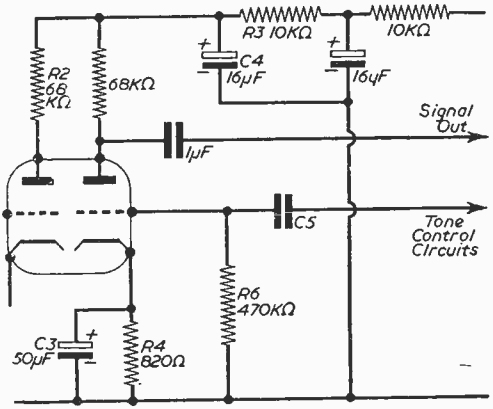


Fig. 6.—Conversion to two-stage amplifier.

Fig. 5 gives the method of adapting the input for correction for specific pickups. This incorporates the circuits recommended for the GP20 Hi-g pickup. Finally, Fig. 6 gives a modification to the circuit to convert the second half of the double triode into an amplifying stage which will cope with either a lower level of input or a lower amplification in the main amplifier itself.

In Fig. 2 of last month's issue, a wire was omitted. This runs from L.P. on the lower left-hand segment of the switch to the moving arm of the upper left-hand segment.

CONTROL OF STEREO BALANCE

(*Concluded from page 966*)

Ganged Controls

Pure stereo amplifiers use ganged volume and tone controls so that the degree of balance adjustment is limited, usually over a range of approximately plus and minus 6db, by the design of the control circuit.

A very effective system, used in the "Pamphonic," is shown in Fig. 3. Here the negative feedback is decreased on one channel and increased on the other as the balance control is rotated. It will be seen that the variable resistors in the feedback loops are wired in opposition, and that at the centre position, corresponding to the theoretical balance point, the resistance is the same in both circuits.

Another idea is given in Fig. 4, which could easily be adapted for use on simple amplifiers which are used for stereophony. The only addition is a two-gang 500 k Ω linear potentiometer. This is connected to the pick-up input circuits in such a way that as the control is rotated the value of the normal volume control is effectively decreased in one amplifier and increased in the other. This, of course, varies the input signals over small limits and balances them when the control is set to the centre of its travel. The normal volume controls continue working in the ordinary way, and these are adjusted first to establish a rough balance and then the balance control is adjusted for optimum results.

Another experimental circuit is given in Fig. 5. This would be suitable for the less exacting types of amplifier, and can be connected between the stereo pick-up and the pick-up sockets of the amplifiers. Resistors R1 and R2 may have to be altered in value to suit the pick-up used and the available gain of the amplifiers. They do, of course, attenuate the signal from the pick-up, but this does not matter a great deal if sufficient compensating gain is at hand. It would be a good idea to build the circuit into a metal box, to serve as a screen, and then wire it to the amplifiers and pick-up through screened cable.

REFLEXING SUPERHETS

IN THIS CIRCUIT THE I.F., DETECTOR AND A.F. STAGES ARE COMBINED

By Richard Page

THE aim of this circuit is three-fold; to save money, space and current. An inspection of the circuit diagram (see Fig. 1) shows that this circuit can be inserted between any conventional frequency changer and output stage and can be used in battery or mains equipment. In the diagram shown a DF96, vari-mu R.F. pentode is used and its control grid is fed from the appropriate pin of a 465 kc/s I.F. transformer in the usual way. This valve amplifies the I.F. signal which appears across the secondary of the second I.F. transformer. It is at this point that the circuit departs from normal practice. The grid/diode pin of I.F.T. 2 is connected directly to the black end of a "Westector" WX6 and the red end of the "Westector" to chassis. The other end of the secondary winding of I.F.T. 2 (AVC/diode load pin) is connected to three points: (a) 470 k resistor, returned to chassis; (b) 500 pF condenser, returned to chassis; (c) 22 k resistor, returned to the A.V.C. pin of the first I.F. transformer. This A.V.C. pin is by-passed to chassis through a condenser *not exceeding* 500 pF, and is also the starting point of the A.V.C. line to previous stages.

L.F. Amplification

Thus we have the detected signal, now at audio-frequency, fed back through the 22 k resistor (R2) and the secondary of I.F.T. 1 to the control grid of the DF96. The valve now acts as a triode audio-frequency amplifier, using the screen as the triode's anode and it is from this electrode that the amplified A.F. signal is passed, via a .01 mfd. condenser, to the grid of the output valve. The 2 megohm grid-leak of DL96 is a potentiometer and is used as the volume control.

The 500 pF condenser (C4) merely by-passes residual I.F. and R.F. currents to chassis and is well worth inclusion.

Output

The output from this circuit is not quite so great as if the normal DF96, DAF96, DL96 set-up is used. This is because DF96 is running at a lower screen voltage than usual and its A.F. amplifying action is that of a triode rather than that of a high gain audio pentode.

The requirements of the circuit are: (a) 25 mA on the L.T. line (50 if the DAF91 is used instead of DAF96); (b) a milliamp or two of H.T. current; (c) the cost of a valve, valveholder and associated components; (d) a good deal of room on the chassis.

For real space-saving the type of Westector the size of a ¼ watt resistor should be used. R6, the auto-bias resistor, should be of a value to give 5.2 (negative) volts bias.

If a DK96 is the frequency changer, and is used according to the maker's recommendations, then the value of this resistor will be about 400 ohms.

A Mains Version

In a mains version of this circuit, in which any suitable vari-mu I.F. valve may be used, the suppressor grid will be connected to cathode and cathode taken direct to chassis. The valve then relies on the biasing voltage fed through R2. The series screen resistor should be higher than normal, since it is also the anode load resistor in the valve's audio-frequency function. A resistor of 100 k is about right. The stage is best followed by a sensitive output valve such as 6F6, EL41 or 50L6.

[*Note: The Westector type WX6 may be obtained direct from the Westinghouse Brake and Signal Co. Ltd., 82, York Way, London, N.1.*]

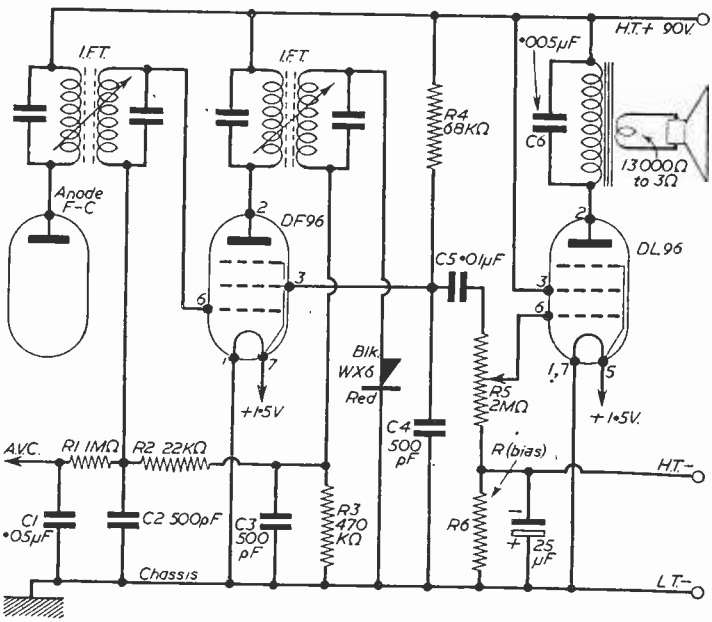


Fig. 1.—Reflex circuit using battery valves.

An Anti-interference Aerial

THIS SYSTEM IMPROVES RECEPTION, PARTICULARLY ON SHORT WAVES

By A. W. Mann

THERE are some locations which from the point of view of the short-wave listener are bad ones owing to electrical interference created by industrial machinery, domestic appliances and motor car ignition.

Suppression at the source often calls for co-operation. This is not always forthcoming and the listener must, therefore, adopt such methods at the receiving position as he can afford to apply in an attempt to improve matters.

Apart from mid-morning periods of domestic activity, and car ignition interference at all times, the author considers his location as fairly good. One of the receivers in use is a very sensitive R1155A. This particular type of receiver has a reputation for having an unfavourable signal to noise ratio when used with a power output stage.

This criticism is not fully justified. In the first instance too many listeners use too high a volume level when listening to far-away places. It is surprising how effective an L.F. volume control can be if fitted and used correctly.

While I have always suspected that some of the background noise attributed to this type of receiver is due to external pick-up by the aerial system, my chief concern was to reduce the effects of electrical interference to a minimum. Mains filters were already in use and the only remedy which showed promise was the erection of an anti-interference aerial. Sufficient space, however, was not available for the erection of either a split doublet or a single ended one.

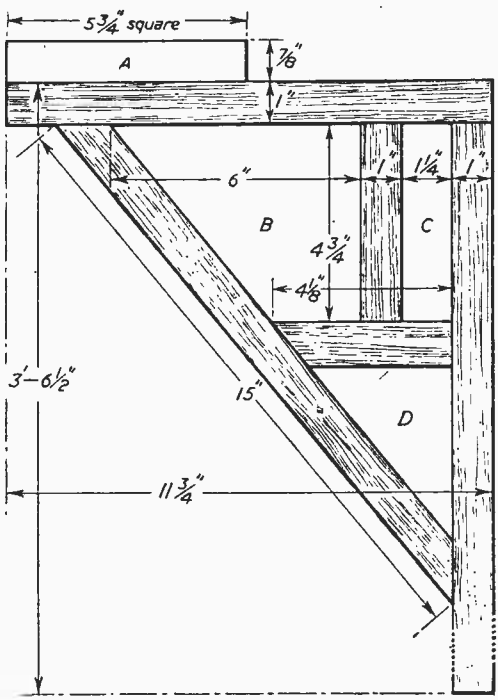


Fig. 1.—Dimensions and structure of the mounting platform of the whip aerial.

Final Choice

A vertical-rod type was the final choice. It was decided to try out an experimental model using an 8ft. whip and mount the system (built as a complete unit) at the top of the 27ft. × 3in. square pole already supporting other vertical aerials.

As cut and try methods applied at the top of a 30ft. ladder set at an acute angle did not appeal to the writer, home-constructed matching transformers were ruled out. A complete anti-interference aerial kit as advertised by Premier Radio in this journal was therefore obtained. The kit, which includes amongst other items two screened matching transformers and 60ft. lengths of aerial wire and screened coaxial-transmission line, was examined and the specification and drawings put in hand.

It was essential that the aerial system should be made and completed in the workshop as a complete weatherproof unit which once erected would remain until such times as repainting was considered necessary. In addition erection and dismantling single handed from the top of the ladder with the minimum of risk was an important factor.

The Aerial Unit

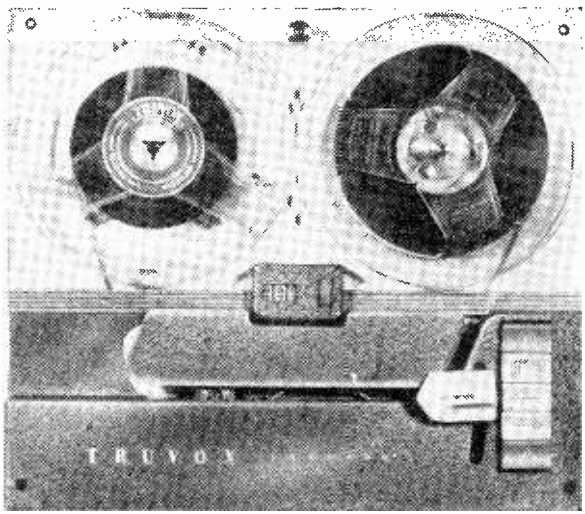
Sufficient 2in. × 1in. white wood was obtained to make the bracket required and in the dimensions of which are given in Fig. 1. Fig. 1 also shows the 5¾in. square platform on which the rubber base of the whip aerial is mounted (see A).

Woodscrews should be used throughout when making this bracket as rigidity is most desirable. It will be noticed that the inside of the bracket is divided into three separate compartments, B, C and D. Compartment B houses the aerial step-down transformer and when the unit is completed it is entirely enclosed and weatherproof. Compartments C and D remain open in order to reduce wind resistance. The bracket when completed should be well painted.

The matching transformer is totally enclosed because all the connecting stubs are at the top of the transformer, and in any case would require some form of protection against the weather. By totally enclosing the stubs and soldered connections the general efficiency of the system will remain constant. When this transformer is used as originally intended (i.e., with doublet aerials) lowering for inspection at intervals is no

(*Continued on page 973*)

BUILD YOUR OWN TAPE RECORDER



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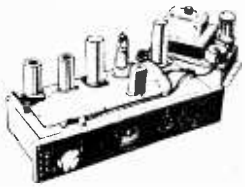

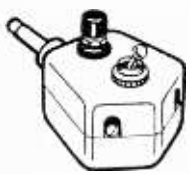

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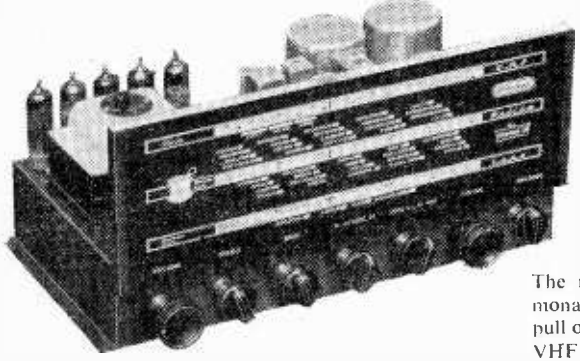

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inconvenience. In this instance the condition of the whip aerial will decide the time for a general overhaul, which in a heavy industrial area will be about two years.

Fitting Up

Before fitting any components in place an $\frac{1}{8}$in. diameter hole should be drilled through the centre of the aerial base platform and bracket top piece into compartment B. A $\frac{1}{4}$in. hole should also be drilled through the base of compartment B and another directly below it, i.e., through the 15in. supporting members (see Fig. 2).

The next item required is the mounting bracket shown also in Fig. 2 together with a small bridge which is needed to mount the earthing terminals. This may be made in the form of an insulated terminal block mounted on a suitable wooden block.

The tin-plate bracket requires a screw hole in each flange and a larger hole in the centre of the $1\frac{1}{2}$in. platform so that the coax. socket at the base of the aerial transformer will pass through and the nut and tighten up as shown in Fig. 2. This coax. connector, by the way, is not used for any purpose in the original instructions so far as connecting up is concerned. When the transformer has been fitted to the bracket the combined unit can be fitted into place in compartment B as shown.

Transformer Connections

The connecting stubs of the aerial transformer are numbered 1, 2, 3, 4 and 5. The aerial lead should be connected to No. 1. This lead should be of sufficient length to pass through the hole in the bracket and base platform and couple to the screw fitted in the inside of the aerial base. The base should then be screwed to the platform.

The coax. screened cable connections are: screening to stub 2; centre conductor to stub 5. A 50 pF capacitator should be connected between stubs 4 and 2. Before soldering the screened cable connections fasten the coax. by means of two small insulated staples to the vertical side of compartment B after passing it through the holes in the bracket and base respectively. Otherwise, the coiled up cable will be suspended from the connecting stubs which could result in fractured joints or stub breakage. Good sound soldered joints are essential and when all the connections are made a double check against the above instructions is recommended.

The coax. cable stapled down one side of the bracket is shown in Fig. 2. It also shows the totally enclosed static discharge unit with a short lead connecting the top end terminal to the outside aerial terminal of the aerial base. The remaining terminal shown as earthed is connected by a length of insulated aerial wire to the earthing terminal at the base of the bracket. When the aerial is erected and in place, another length of wire is taken from the earth terminal to an earth spike driven well into the ground.

The next job is to enclose the compartment completely with tinplate covers cut to size in the manner shown in Fig. 3. The covers after cutting to size should be drilled so that each side has holes for half a dozen small, round-headed screws. Paint these covers well on both sides, and paint the inside edges about 1in. wide all round before screwing in place. Paint the joint edges when this is done. This will result in a weatherproof unit.

Static Discharger

This is built into a two ounce tobacco tin. All necessary dimensions are given in Fig. 4.

Now a word of warning concerning the construction of this unit. The saw-toothed elements

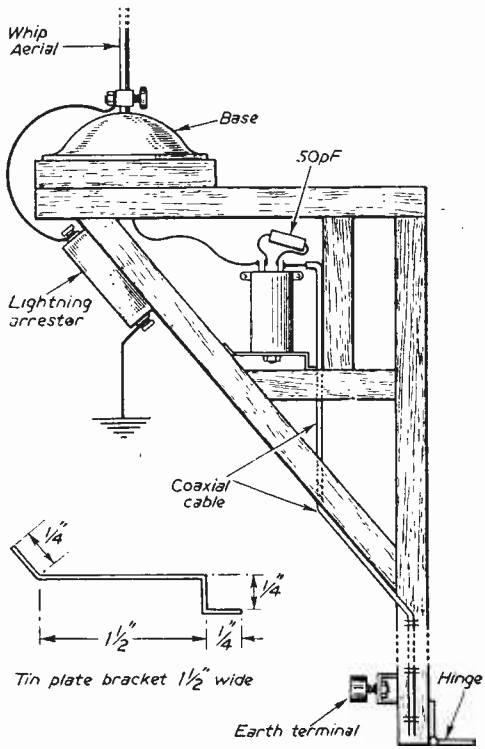

Fig. 2.—The various parts of the aerial system in position. Inset is shown the mounting bracket for the transformer.

must be completely insulated from the tin case, otherwise the aerial system will be earthed. This insulation can be carried out with a very short piece of sleeving, little more than the thickness of the box end fitted on the terminal shanks.

Very thin Paxolin sheet can be used to insulate the terminal base from the box ends and between the box ends. These washers will fit over the terminal shank insulation and butt up against the tin ends and insulate the spark gap elements from the ends.

Cut the spark gap elements so that they overlap one another. Drill a small hole in each end of the elements so that they will pass over the insulated terminal shanks. The ends of the elements when fitted should be clear of the box bottom.

Cut one element to half the inside length of the box. Fit in position and mark off the over-

lap after fitting it in place. Withdraw it and cut it to give a gap of one sixteenth of an inch and having done so file out the saw teeth. Now fit up the complete unit not forgetting the insulation. Having done so check for continuity.

If correctly assembled each terminal and its associated saw-toothed element should give a deflection on the meter or a light if a battery and bulb are used for the test. From the tin case to either terminal or element "no continuity" should result.

Erection

The aerial unit completed has the screened coax. coiled up. Readers will notice that a stout hinge is screwed to the bottom of the bracket. This makes single-handed erection much

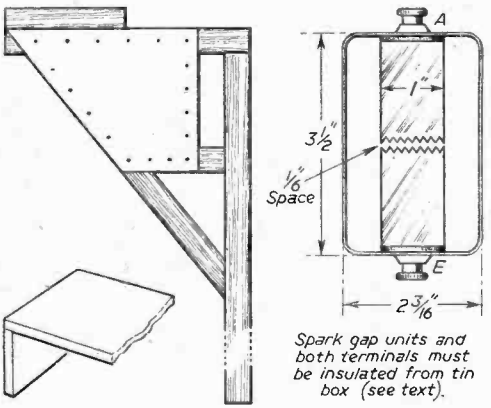

Fig. 3 (Left).—The transformer compartment weatherproofed with tin-plate covers.
Fig. 4 (Right).—Dimensions of the static discharger. Inset shows L-shape of brackets.

easier. The unit less the whip aerial is placed in position squared up and screwed to the pole with two screws. The hinge is then screwed to the pole. The two screws holding the bracket in position are withdrawn and the bracket carefully lowered. The whip aerial is then inserted in the base socket and the aerial bracket lifted into position and again screwed to the pole.

The coax. cable should now be unrolled ready to run to the receiving position, and an earth lead of sufficient length should be taken from the earth terminal to an earth rod driven well into the ground.

The Receiver Matching Transformer

This transformer can be fitted inside the receiver. This applies especially to a receiver which is totally screened, as is the R1155. In the case of this receiver it can be mounted inside an unused D.F. valveholder but must be entirely insulated from it and the chassis. Do a continuity test and make sure of this. No reading should be obtained between the metal case of the transformer and the receiver chassis.

The author has fitted a small Paxolin panel in front of the unused D.F. loop socket. On this is mounted a coax. socket. The centre is connected to No. 5 stub of the transformer, while the outside tag goes to No. 2. The set aerial and earth input should be taken by short leads to stub No. 4 and stub No. 3 respectively. The author has transposed each pair of leads.

Testing

Do not cut the coax. cable until a test has been carried out. Bare the insulation at the end of the cable and fit the coax. plug. Plug into the coax. socket and try out the aerial system on all bands.

Results

Tests carried out with the new system showed that on the two short-wave ranges there was a marked increase in signal strength and a much better signal-to-noise ratio.

In addition motor car ignition interference is entirely eliminated and vacuum cleaner interference considerably suppressed and once tuned to a transmission was well below the signal level except for very weak signals. Had additional height been possible there is no doubt that further improvement would have resulted.

On medium waves clearer reception resulted. The long-wave bands showed a less favourable signal-to-noise ratio but a 14ft. whip or the centre loading of the existing one would provide considerable improvement. The principal interest is, however, on the short-wave bands.

Books Received

ELEMENTARY TELECOMMUNICATIONS EXAMINATION GUIDE. By W. T. Perkins, M.Inst.B.E., A.M.Brit.I.R.E. 318 pp. 187 illustrations. Published by Geo. Newnes Ltd. Price 17s. 6d.

This is the first book of its kind to cover the two main subjects comprising the City and Guilds of London Institute first year Telecommunications Course. It contains a wide selection of questions typical of those which are set by the Institute, and provides model answers. Examination papers set in years 1955 to 1957 are reproduced.

TELEVISION ENGINEERS' POCKET BOOK. By J. P. Hawker. 264 pp., profusely illustrated. Published by Geo. Newnes Ltd. Price 12s. 6d.

This is a new and enlarged edition of the pocket manual and data book which has already found favour amongst engineers and servicemen.

BBC HANDBOOK, 1959, 286 pp. Price 5/-. Published by the BBC.

This gives many interesting facts concerning the BBC programmes and other data. For instance, 200,000 letters a year are received by the BBC; 620 students were trained by the Engineering Training Department; 8,000,000 schools pamphlets are produced in a year; the BBC staff numbered 5,472 at March 31st, 1958. These are only a few of the interesting facts to be found in the latest edition of this Handbook.

Servicing Radio Receivers

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By Gordon J. King, A.M.I.P.R.E.

THIS is a fairly recent model and takes the form of a semi-personal portable suitable for operation on both mains and batteries. It is a two waveband set: L.W. 160-260 kc/s (1,875-1,150 metres) and M.W. 525-1,630 kc/s (570-187 metres), and uses four low-consumption all-dry battery type valves.

On mains it can be powered over the range of 110-120 V. and 190-250 V. D.C. or A.C. 25-100 c.s. while on battery it requires a 90 v. H.T. and 1.4 v. L.T., which is usually supplied by an Ever Ready type B147 unit. This has a life expectation in the region of 100 hours under normal conditions, but can be prolonged by the use of the "battery economy" switch, which is a feature of the receiver.

Reproduction is by way of a 5in. 9,000-line 3-ohm loudspeaker, and the internal aerial is of the ferrite-rod variety. Provision is made, however, for the connection of an external aerial in heavily screened areas and where it is required to receive distant stations.

Circuit Description

The full circuit is given in Fig. 1, and the valve line-up is as follows: V1 (DK96) frequency changer; V2 (DF96) I.F. amplifier; V3 (DAF96) detector, A.G.C. and audio amplifier; V4 (DL96) power output.

The circuit is reasonably conventional and little difficulty should be experienced in following it: L1 and L2 form the windings on the ferrite-rod aerial, and in conjunction with the aerial section of the gang (C6) L1 and L2 in series tune over the L.W. band. When the M.W. push-button is depressed section L2 is short-circuited and L1 serves as the M.W. aerial coil. On L.W. C3 acts as a fixed trimmer, while on M.W. C4 is also brought into circuit and thus constitutes the M.W. variable trimmer.

The oscillator coils (L5 and L6) are common to both bands, but the oscillator section (S3) of the push-button wavechange switch selects the required L.W. or M.W. capacitive loading, and in both cases the tuning is accomplished by the oscillator section of the gang (C12). The oscillator works at 470 kc/s above the tuned signal frequency of the received signal, and the resulting I.F. signal is developed across the first I.F. transformer T1.

This signal, as developed across L4, is applied to the I.F. amplifier valve, V2, and is redeveloped in amplified form across the second I.F. transformer T2. The signal, as across L8, is fed to the signal diode in V3. R11 can be considered as the diode load resistor, and I.F. filtering is accomplished by R10 in association with C22.

The A.F. signal across the load is coupled to the volume control through C24, from which it is applied to the control grid of V3 pentode section through C26. The pentode amplifies the A.F. and the signal appears across the anode load resistor R26. From here it is coupled to the control grid of the output pentode V4 through C28, and in turn is transformed in terms of power of correct impedance to match the loudspeaker by the output transformer T3.

A.G.C. Bias

The D.C. content of the I.F. signal, which increases negatively with signal increase, and is also developed across the load resistor R11, is reflected into the signal grid circuits of V1 and V2 by R7 and R4 respectively. This serves to bias the valves mentioned and provides automatic control of gain (A.G.C.), since the gain of the frequency changer and I.F. amplifier valves is reduced as the signal rises and as the grids are made more negative. The converse happens, of course, when the signal strength drops; for example, when tuning from a strong to a weak signal, or in the event of a signal fade.

Mains Operation

When the receiver is operated from the mains supply both H.T. and L.T. are supplied by the metal H.T. rectifier (Westinghouse type 18RA-1-1-16-1). The necessary circuit changes are brought about by operation of the "battery/mains" switches which, changing from battery to mains operation, are actuated by the insertion of the mains supply socket at the rear of the receiver.

The H.T./L.T. supply is filtered and smoothed by electrolytics EC1, EC2, EC3 and EC4 and R25; R28 is also an aid to filtering as is the H.T. resistor chain. On mains, H.T. is applied to the H.T. rail from the junction of R17 and R21 by way of R25, while the L.T. is applied to the

heater of V4 from the end of R20. The filaments are connected in series in the following order: V4 to V1 to V2 to V3 to chassis. The tap of V4 filament, however, is at +5.2 v. in relation to the chassis, and it is this potential which is used to bias the valves, it being applied to the A.G.C. line. It should be observed that under zero signal condition the signal grids of V1 and V2 are of a potential equal to their filaments, thereby giving the condition of maximum gain. The grids rise negative with respect to the filaments as the result of the normal A.G.C. action, as described.

The pre-set resistor R8 allows adjustment of the filament current. It is accurately set at the factory to suit the output valve, but if this valve is replaced, readjustment of the resistor should be made until an Avo model 8 or similar high-resistance meter indicates 3.9 v. at pin 1 (heater) of V4, after first having established that the mains adjustment tap coincides with the applied mains voltage.

Battery Operation

The receiver is automatically switched for battery operation by the removal of the mains socket at the rear of the receiver. This operates the battery/mains changeover switches which disconnect the mains unit, introduce the batteries and arrange for the valve filaments to be connected in parallel across the L.T. battery.

The H.T. current in R31 produces a potential across the resistor which serves to bias the output valve.

When the economy switch is in the "economy" position, only one half of V4 filament is energised. This reduces the available A.F. output power, of course, but it also results in a 20 per cent. saving of L.T. and H.T. power over the other setting, which switches in both halves of the filament.

Alignment Information

Alignment is best carried out with the receiver operating on batteries.

With a 470 kc/s modulated signal applied to the signal grid of V2 through a 0.1 μF capacitor, the dust-iron cores of T2 should be adjusted in turn for maximum audio output, either as indicated on an output meter connected across the speaker speech coil or direct from the modulation tone from the loudspeaker. The receiver's volume control should be set at maximum, and to avoid errors owing to the action of the A.G.C., the smallest possible input signal, consistent with useable output indication, should be maintained—the input signal being reduced as the circuits approach resonance. This applies throughout the alignment process, and the audio output should not rise above 50 mW.

With the receiver tuned to the high-frequency end of the M.W. band, the generator signal should next be applied to the signal grid of V1, and then the cores in T1 should be adjusted for maximum output. This concludes the I.F. alignment.

Next the M.W. R.F. alignment. After having first ensured that the tuning pointer coincides with the zero mark on the scale when the tuning gang is fully closed, the generator "live" output lead should be connected through a dummy aerial to the receiver's aerial socket and the "earthed"

(*Continued on page* 988)

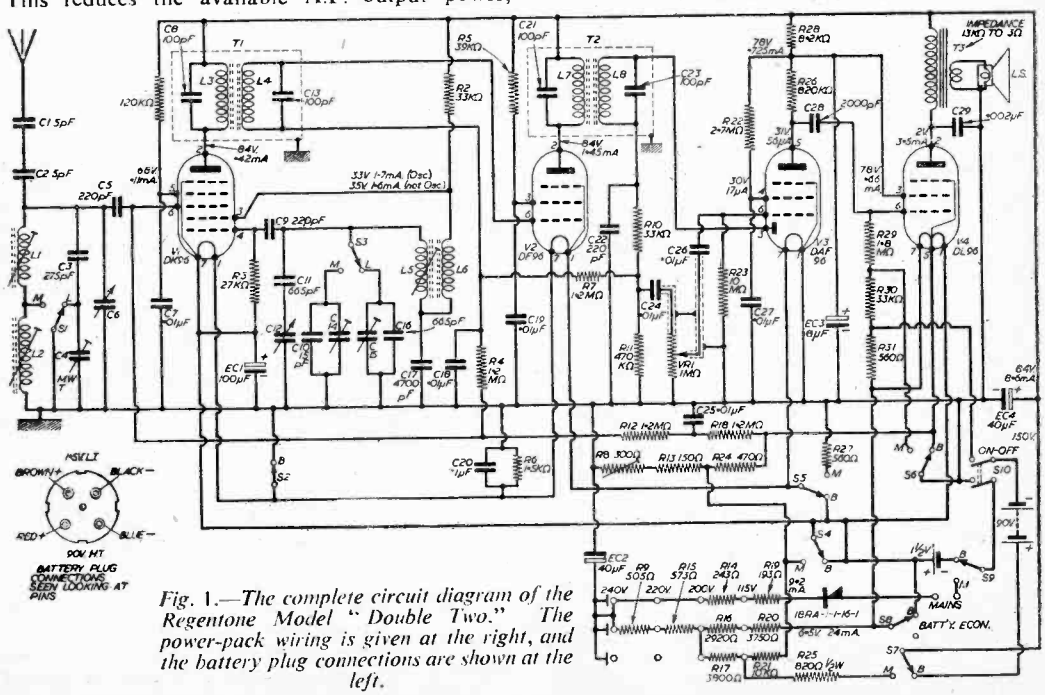
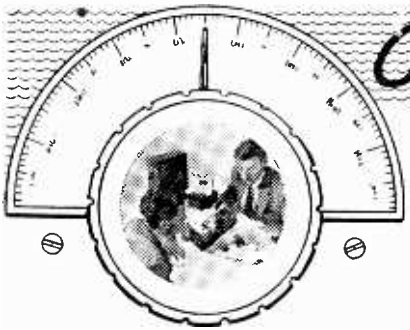


Fig. 1.—The complete circuit diagram of the Regentone Model "Double Two." The power-pack wiring is given at the right, and the battery plug connections are shown at the left.



On Your Wavelength

BY THERMION

The Teenage Cryners

THERE is something really pathetic in watching a theatre audience, at the command of some work-shy teenage singer with a voice like a coalman with the croup, hypnotising an audience into clapping while he sings. What satisfaction they can get out of it, I do not know. The unfortunate result of the publicity accorded to these born-tired buskers, who should confine their activities to singing outside public houses, is that it is encouraging similar born-tired youths to want to do the same.

All Lies?

A MORNING newspaper the other day published a review of a book on the life story of a well-known pop-singing youth. The newspaper published as a result a letter in the following terms:

"*So a smart publicity agent—on his own admission—built up a pop singer by a pack of lies.*

"*Having stated so, will newspapers continue to use his doubtful hand-outs? I rather think so. The motto of some, it seems, is 'anything for a story.'*

"*In this particular instance it is all very harmless, but nevertheless Mr. Kennedy has lied and cheated to 'achieve' what he has, and thinks he is doing himself well by telling the world.*

"*Is it not time that newspapers made an investigation into the facts these smart alecs dish out* ad lib. *instead of blindly publishing them?*

"*Perhaps Mr. Kennedy will now be censored by the Press Council.*"

Verbal Diarrhoea

IN a book concerned with teachers and progress in education, there is an article dealing with the controversial eleven-plus examination system. In that article, the following sentence appears:

"*The main criticism that can justifiably be brought against it is that it has at times been required to accomplish the virtually impossible task of segregating into courses which are sharply differentiated children between whose abilities, attainments and ascertainable needs there is a scarcely perceptible difference.*"

My criticism of this pompous piece of writing, written in the same strain, is that it is prolix, verbose, tautological and tergiversatory. You would need to be 51 plus to get the meaning of it in one go. I gather that what it means is that if you can tell a bright child from a dull one, the eleven-plus tests will confirm it. If you cannot, the test is useless.

Where is Brisbon?

IN giving the Test Match results, the BBC announcers are referring to "Brisbon." Can someone tell me where it is? Do you think they can be referring to Brisbane? I also want to know what are "skettered shaws," "belley," and "kennet," "ars and ars," "yers and yers," "Serviette Union." Also where is Margit? I am glad to see that the *Sunday Times* continues to augment my attack on announcers' English. I gather that the meanings to the foregoing are: "scattered showers"; "ballet"; "cannot"; "hours and hours"; and "years and years"; and "Soviet Union." Incidentally, there is one announcer who bisyllableises "hours" and makes it "owers."

Some of the artists are not beyond criticism. Gladys Morgan, for example, infuriates me by the way she smacks "old" round her chops and makes it "ohuld." To her, "house" becomes "hohse." Let me have your lists of any further monstrosities you hear over the radio or on TV.

Combined TV and V.H.F. Radio

A MANUFACTURER of combined TV and V.H.F. radio receivers says that at first sight, the combined set is technically attractive. When it appears that the TV set already contains almost all the parts necessary for V.H.F. reception it seems a pity not to add the extra coils in the turret and the F.M. detector in order to provide the useful extra band 2 facility.

In practice, it does not work out so happily. If proper attention is to be paid to valve life, extensive switching is required, the heater chain becomes complicated and a thermistor has to be incorporated which lengthens the time it takes before the picture appears when switching to TV either from cold or from V.H.F. The standard sound television I.F. of 38.15 Mc/s is not really suitable for F.M. work, and the audio end of a television set is often of a lower standard than is expected from a radio set. On the whole, then, the V.H.F. performance of the combined sets hitherto on the market has been inferior in most respects, and few engineers have had a good word to say for them.

NEW SERIES

Basic Theory For Constructors

No. 1.—RADIO CALCULATIONS FOR THE BEGINNER

By G. Palmer

A FLOW of electricity constitutes a movement of electrons in a given direction. Electrons move more freely in some materials than in others, and where they move freely the material is known as a conductor. All conductors possess a certain resistance to the flow of electricity, but with good conductors, such as copper connecting leads, the resistance is usually so small that it can be neglected. Materials in which the electrons do not move freely are known as insulators, glass and mica being examples.

In Fig. 1 is shown a resistor connected across a battery. The leads themselves connecting the resistor to the battery have a resistance which is very low in relation to that of the resistor and so are not taken into account in simple circuits. The battery itself also has a certain value of resistance, and is also represented in the circuit in Fig. 1.

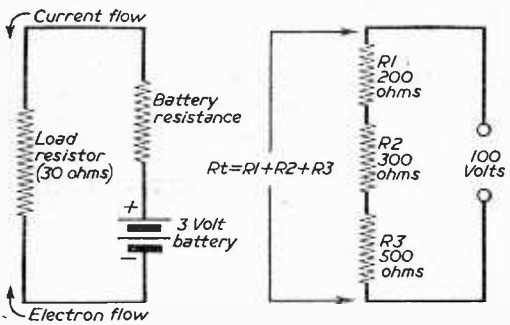


Fig. 1 (Left).—A simple series circuit, illustrating the application of Ohm's law.
Fig. 2 (Right).—Resistors connected in series.

Electrons flow in the circuit from the negative pole of the battery through the load resistor and back to the positive pole of the battery by way of its internal resistance. Current, on the other hand, is said to flow in the opposite direction, that is, from positive to negative. The current flow aspect is purely convention which remains with us from the days before the electron theory was evolved. However, to keep in with convention we will from now on consider current flow, as distinct from electron flow, unless otherwise stated.

The quantity of current in the circuit is governed by the value of the resistance in ohms and the condition and voltage of the battery.

Current is measured in amperes or fractions of this unit. A thousandth of an ampere being a milliampere (mA) and a millionth a microampere (μA).

Ohm's Law

It was discovered by Ohm that the circuit current in amperes is equal to the applied voltage (electro-motive-force) divided by the resistance.

Current is denoted in formulæ by the capital letter I, while voltage and resistance are expressed by capital letters E and R respectively. Ohm's law formulæ may, therefore, be written as: $I = E/R$, $R = E/I$ and $E = I \times R$, the various arrangements being obtained by simple algebraic manipulation.

Thus, if the battery in Fig. 1 is rated at, say, 3 volts and the resistance is 30 ohms, then the circuit current ($I = E/R$) is equal to 3/30, which is 0.1 ampere, or 100 mA.

Internal Resistance of Battery

It will be realised, of course, that the current in the circuit is also flowing through the internal resistance of the battery. When the battery is in good condition, this resistance is very low and does not itself have a large limiting effect on the circuit current. However, as the battery ages the internal resistance rises, and the battery is not capable of supplying the same high current as when new.

Let us suppose that a worn 3-volt battery is used in the circuit in Fig. 1, and that a voltmeter connected across the load resistor indicates only two volts. This means that 1 volt is being lost across the battery resistance. The current in the circuit in this case is in the region of 0.06 ampere (2 volts divided by 30 ohms).

The internal resistance of the battery can be discovered by dividing the voltage lost across the battery resistance by the circuit current ($R = E/I$), that is, by dividing 1 volt by 0.06 ampere, which gives about 16 ohms.

If the load resistance is disconnected and the battery terminal voltage measured with a voltmeter, almost the full voltage of the battery will be indicated. This is because the voltmeter takes only a very small current and the voltage dropped across the battery resistance is correspondingly less.

Here is shown the folly of battery checking with an unloaded high resistance voltmeter, as is practiced in many radio shops. The only real test is to load the battery with a resistance which will pass a current comparable with that which the battery will be expected to supply in service, and then measure the voltage across the resistor. This test will soon reveal a battery which is faulty or which has been in stock for any length of time.

Some radio shops which understand this theory test all-dry L.T. batteries on the "10-amp" range of a multi-meter. This puts almost a dead short across the battery, but provided this is not prolonged, the possibility of the battery being ruined is remote. The current reading to be expected from batteries of various types is gleaned from experience, but if the reading is below an expected average, the internal resistance is high and it is unlikely that the unit would give the expected life span.

(*Continued on page 981*)

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6BW6	10/6	12AX7	9/6	EF80	10 6 SP61 3 6
6C6	7/6	12BE6	10 6	EF91	8 6 UBC41 10 6
6F6	7/6	12K7	8/6	EF92	5 6 UCH42 10 6
6H6	3 6	12Q7	8/6	EL32	5 6 UF41 10 6
6J5	6/6	35L6	9/6	EL84	10/6 UL41 10 6
6J6	7 6	35Z4	9/6	EM81	12/6 UY41 10/6
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6K7	5 6	EA50	1/6	EH18	1 6 VR150 8 6

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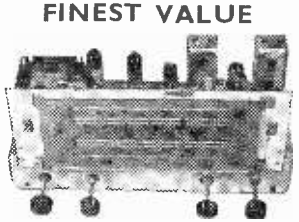

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4 450v.	2 3	250 25v.	2 6	32 350v.	4 -
8 450v.	2 3	500 12v.	3 -	100 270v.	5 6
8 500v.	2 9	8+8 450v.	4 6	2,500 3v.	4 -
16 450v.	3 6	8+8 500v.	5 -	6,000 6v.	5 -
16 500v.	4 -	8 - 16 450v.	5 -	32+32 250v.	4 6
32 450v.	5 6	8+16 500v.	5 6	50+50 350v.	7/-
25 25v.	1 9	16 - 16 450v.	5 6	64+120 275v.	7 6
50 25v.	2 -	32+32 350v.	4 6	64+120 350v.	11 6
50 50v.	2 -	32+32 500v.	7 6	100+200 350v.	12 6

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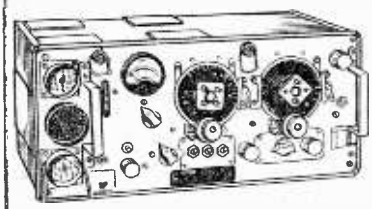

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Resistors in Series

When resistors are connected one to the other, as shown in Fig. 2, they are said to be series-connected, and the total resistance (Rt) in circuit is equal to the sum of the resistor values. For example, Rt=R1 + R2 + R3. In Fig. 2, this gives a total resistance of 1,000 ohms. Thus, by Ohm's law (I=E/R), the current in the series-connected chain is equal to 100/1,000 which is 0.1 ampere, or 100 mA.

Knowing the current and the values of the individual resistors, the voltage developed across each resistor can easily be found. The voltage across R1 is equal to 200 × 0.1 (E=I × R), which, of course, is 20. Similarly, 30 volts are developed across R2 and 50 volts across R3, giving a total of 100 volts, which is as would be expected since it is the value of the applied voltage.

Resistors in Parallel

When resistors are connected in parallel, as shown in Fig. 3, the total resistance (Rt) is expressed as follows:

$1/Rt = 1/R1 + 1/R2 + 1/R3$. Thus, in Fig. 3 we have

$$1/Rt = 1/6{,}000 + 1/3{,}000 + 1/2{,}000$$
$$= (1 + 2 + 3)/6{,}000$$
$$= 6/6{,}000$$

Thus, $Rt = 6{,}000/6$ ohms
$= 1{,}000$ ohms.

The current in the circuit when 100 volts are applied is, therefore, exactly the same as in the circuit in Fig. 2, which is 0.1 ampere (100/1,000), but in the parallel case the voltage is the same across each resistor.

The current through each resistor differs, but can be computed by using I=E/R. If one cares to do a little arithmetic, it will be found that the sum of the resistor currents amounts to 0.1 ampere (which is fairly obvious).

Resistors in Series-parallel

In Fig. 4 is shown a circuit in which there is a combination of parallel-connected and series-connected resistors. As such networks are

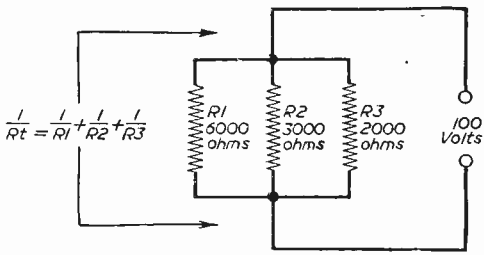


Fig. 3.—Resistors connected in parallel.

frequently encountered in circuit practice, it is well worth while to analyse the one shown in Fig. 4 in some detail.

To find the total resistance (Rt) as present across the supply terminals, it is best to resolve the parallel-connected elements first. The parallel resistance of R1, R2 and R3, it will be recalled, is expressed $1/Rp = 1/R1 + 1/R2 + 1/R3$. Thus, with resistors valued at 6,000 ohms, 3,000 ohms and 2,000 ohms, Rp is equal to 1,000

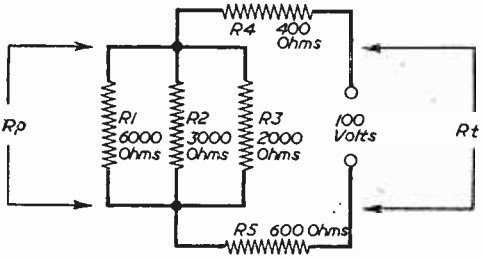


Fig. 4.—Resistors in series-parallel.

ohms. Fig. 4 may now be written in the simplified form of Fig. 5, including Rp as a single element.

This gives three resistive elements connected in series, the total value of which is equal to Rp + R4 + R5, that is 1,000 + 400 + 600 ohms, or 2,000 ohms, which is that value present across the supply terminals.

"Kilo" and "Mega"

At this stage it is convenient to note that, instead of bothering with three noughts when thousands of ohms are dealt with, the small letter k (meaning kilo) may be substituted. 2,000 ohms may thus be expressed as 2k-ohms, as 2kΩ or simply as 2k. Similarly, the capital letter M (meaning mega) may be used in place of the six noughts when the value is in millions

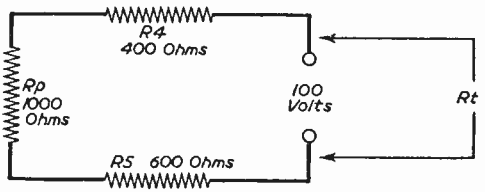


Fig. 5.—The circuit of Fig. 4 can be simplified as above.

of ohms. It is far neater and easier to write 2M, instead of 1,000,000 ohms or 1,000k. It is simply necessary to remember that k means thousand and M means million.

Now to return to the circuit. The current I is equal to the applied voltage E divided by the total resistance Rt (I = E/Rt), which, in this case, is 100/2k, or 0.05 ampere, which is the same as 50 mA.

From this, of course, we can easily discover the voltage across each resistor in Fig. 5. We use the formula E = I × R. This gives 20 volts across R4, 30 volts across R5 and 50 volts across Rp.

Because Rp comprises R1, R2 and R3 in parallel, 50 volts are present across each of these resistors, and since their values are known, we can find the current in each element by using I = E/R. We find that in Rt there is 8.33 mA, in R2 16.66 mA and in R3, 25 mA. Bearing in mind the recurring decimal places in the values of current in R1 and R2, the total current works out to 50 mA, which is as it should be to match the current in the main circuit.

(*Continued on page 1004*)

An Economy Mains Transportable

No. 2.—THIS ARTICLE DEALS WITH THE DRILLING OF THE CHASSIS

By R. Hindle

LAST month the tuning requirements were discussed, and a calculation follows to determine the values of tuning capacitors required.

The calculation is based on the standard formula $f = \frac{1}{2\pi\sqrt{L.C}}$

where f is the frequency in cycles per second, L is the inductance in Henries and C is the capacitance in Farads. It can be converted, expressing f in kc/s, L in μH and C in pF into.

$$= \frac{10^6}{2\pi\sqrt{L.C}}$$

By inversion an expression for C is derived:

$$C = \left(\frac{10^6}{2\pi f\sqrt{L}}\right)^2 = \frac{10^{12}}{4\pi^2 f^2 L}$$

By substitution of the constants for the present problem (f = 200 + 465 = 665 kc/s, L = 100 μH), it will be found that C is approximately 625 pF. The trimmer and strays can be expected to contribute around 25 pF, so that C4 is expected to be about 600 pF. In the case of the prototype it was found that 660 pF was needed.

C1, the aerial capacitor, can be calculated in a similar fashion to tune to 200 kc/s using the inductance of the long-wave aerial winding, but actually this is not necessary because it is easy to find the value experimentally as the oscillator tuning always takes charge, and after bringing the station in on the oscillator circuit it is simply a matter of trial and error, a first approximation having been arrived at by realising that in this case the coil is a normal long wave one such as normally tunes the long-wave Light programme around midway on the dial, and between 200 pF and 300 pF would therefore be expected.

Economy in Design

It was intended to make the receiver as simple

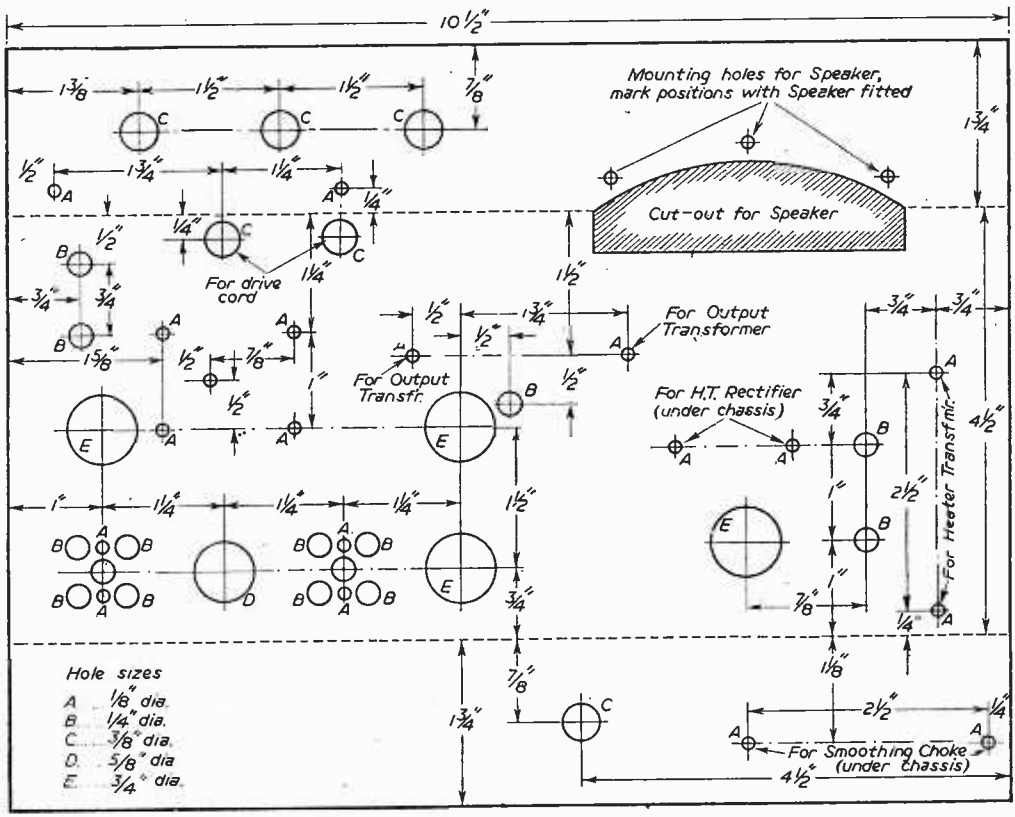


Fig. 2.—Drilling diagram of the top of chassis.

as possible and as a result every component normally used in this type of circuit was critically examined to see if it was really necessary. A.V.C. requires quite a few components and even on the very rare occasions when a more distant station is listened to, many people find the distortion, that is accentuated at intervals by

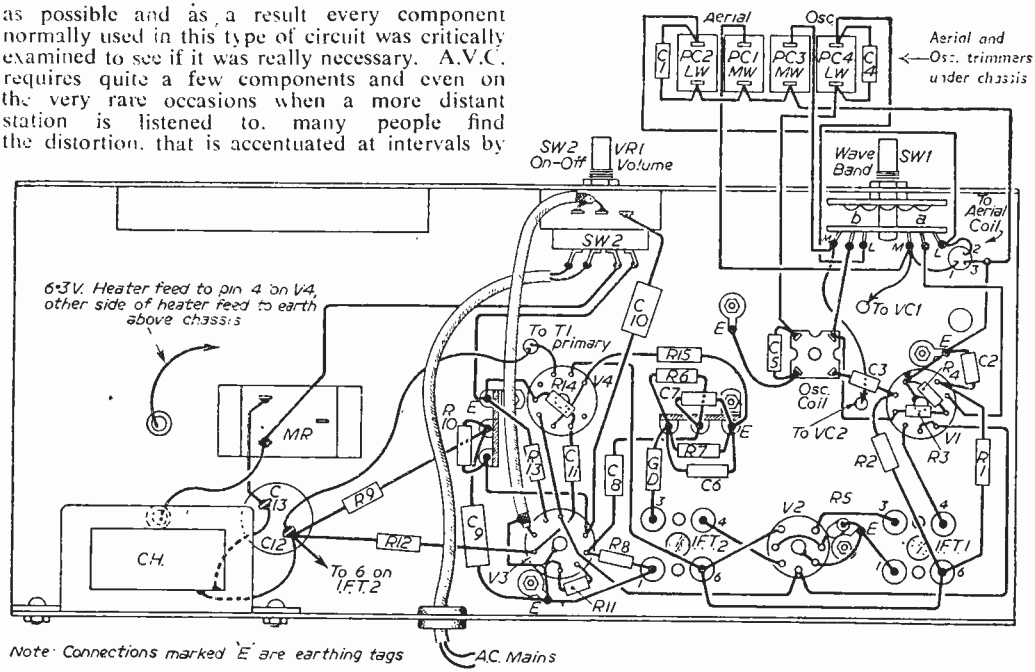


Fig. 3.—Wiring diagram of receiver.

A.V.C., far more distressing than the fading of the signal. The argument in favour of A.V.C. is generally the avoidance of overloading of the pre-volume control stages on a strong signal, but the use of a ferrite rod aerial inside the cabinet makes this very unlikely, except in a few exceptional districts. Application of A.V.C. introduces quite considerable complications apart from the cost of components. This design in its basic form therefore avoids the use of A.V.C.

A major fault of many of these small transportable receivers is that they have insufficient sensitivity and often one has to add a small external aerial for satisfactory results. This results in losing the full benefit of transportability. The avoidance of A.V.C. allows the use of an I.F. amplifier valve of higher gain and a 6AM6 is used in this stage.

The absence of many other components usually found in such a circuit as this has probably been noted. The frequency-changer stage uses a 12AH8 in a fairly conventional circuit except for the apparently missing components. This valve has a simple series screen resistance in place of the usual potentiometer of two resistors to feed it. This is quite as satisfactory in view of the absence of A.V.C.; C2 keeps the screen potential constant from a short term point of view. The cathode resistors of both V1 and V2 are without bypass capacitors. This is not a mistake. In practice these components contribute little to overall efficiency in this type of receiver. The same line of thought leads to the elimination of the usual grid capacitance between oscillator coil and triode grid of the frequency changer. The function generally claimed for this component, i.e., that of providing self-bias for the oscillator, is equally well carried out by the padder C5 which has to be in circuit in any case.

Detection

The third valve of a domestic receiver is commonly a double-diode-triode, one of the diodes being used as a detector. A germanium diode is a very effective detector however and it is cheap and requires no heater current. There is a much greater freedom in connection and so a Brimar GD5 is used. This permits the use of a double triode in the third valve position, each section being used as an audio amplifier so that without any extra valves a higher gain than usual for this type of circuit is achieved. The first stage is decoupled by means of R9, C9 and the arrangement proves to be quite stable. Once more the cathode resistors are without bypass capacitors. The resultant slight negative feedback is not very great and can be afforded in view of the large amount of gain available; if in any given case extra gain could be used the effect of bypass capacitors could be tried, but the prototype gave adequate results. The output valve cathode circuit is similarly treated and no doubt the resultant negative feedback contributes to the clean reproduction of the receiver.

It will be seen that the volume control is placed between the two stages of audio amplification. This is the best place for it since the first stage is not likely to be overloaded when using an aerial inside the cabinet. The problem is to increase the amplification rather than to decrease it. In fact, overloading of this stage is unlikely because it will handle an input signal of 2 volts. In

this position between stages a volume control of normal size can be used, whereas if the control is used as diode load before the first audio stage it will need to be of a lower value than usual, because the germanium diode uses a smaller load than the equivalent valve circuit.

For the H.T. this receiver uses one of the new contact cooled metal rectifiers. This rectifier has two half-wave rectifiers brought out to three tags. The units are in series, the centre tag being connected to the centre-tap, and so can be used as voltage doublers, but in the present case ordinary half-wave rectification is used, connections going only to the outside terminals. The virtue of this type is that it is very small and convenient because it is simply bolted direct to the chassis instead of being fitted to allow for air space around it for ventilation purposes. The chassis itself serves to conduct away the heat and so the need is to ensure that there is a firm contact between the whole under-surface of the rectifier and chassis. A small resistor, R16, can be used to prevent excessive current when the rectifier is connected direct to the mains as in the present design, though it is not absolutely essential. It was not fitted to the prototype of this receiver and all goes well after many weeks of operation. Consequently it does not appear on the wiring diagram, but it is mentioned here because the constructor may wish to take this precaution.

Construction

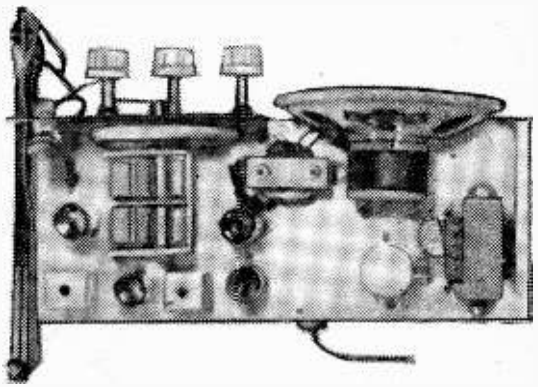
A chassis, dial, drive and knobs were provided with the cabinet used for the prototype and this is the usual practice with cabinets of the type needed for this receiver. The dial is a push fit into the cabinet aperture and does not mount on the chassis itself as may be the case with some alternative cabinets. The advantage of the type that fits into the cabinet is that there is a better dirt seal; it presents a problem of alignment, but this is easily overcome as will be explained later. The chassis is punched for a standard layout using octal valves and this will not suit the present design so it is necessary to make a new chassis. The dimensions of this are the same as the one provided with the cabinet; the holes in the front for the three controls must be in the same places to conform to the cabinet drilling and the single hole in the back for the mains lead must similarly match the one in the loose back of the cabinet. It was found unnecessary to provide for the screwing of the chassis into the cabinet because the fit was tight and the back of the cabinet when screwed into place held the chassis firmly.

The Chassis

The top of the chassis has to be drilled to suit the present design and Fig. 2 gives the layout. The drilling of front and back for the cabinet used in the prototype is also given. The constructor should not drill his chassis until he is sure that the components that he is to use will fit. The position of the holes for the valve holders are indicated, but not the holes for bolting these to the chassis. The best way is to drop the valve holders into the holes as indicated; to turn them until the sockets are in the positions indicated in the wiring diagram (Fig. 3) and then to mark the position for the bolts through the valve holders. Keeping to the layout of the chassis given, it is not difficult to allow for controls in a different place if the cabinet to be used requires it. The only control whose position is critical in relation to the chassis layout is the wavechange switch. The tuning control can be almost anywhere because the run of the driving cord can be changed to suit, and the volume control can also be placed elsewhere provided that the signal leads going to and from it are in the form of screened leads.

The positions of the I.F. transformers are shown in Fig. 2 by means of the centre hole only. Actually it is easier to make a template from the component itself and to use this to determine the position of the holes by putting it on the chassis with the centre hole coinciding with the one marked on the chassis layout than to attempt to mark out the positions by measurement. Take care that these transformers are placed on the chassis with the holes for the mounting screws in the correct positions as given in the layout, and also when screwing them to the chassis see that the connections are in the relative positions indicated on the wiring diagram, Fig. 3.

After folding the chassis, the layout as shown at Fig. 2 being then to the outside, the speaker can be tried in the cut-out provided. Holding the speaker in position so that the three mounting holes are in the position indicated (in the case of the speaker specified there is only one position where this will be so), mark the front of the chassis to coincide and drill holes for the mounting bolts. The actual positions are not given for these holes because once again it is easier to use the actual component as its own template, though care must be used in handling the speaker. It might be necessary to touch up the aperture with a file if the speaker does not fit snugly.



View of chassis from above.

Mounting the Tuning Capacitor

The dial backplate is screwed flush against the front wall of the chassis and the variable capacitor is set in such a position that the spindle projects through the centre hole by about ¼in.

(To be continued)

TAPE-RECORDER MATCHING

IMPROVED RESULTS MAY BE OBTAINED WITH FEW EXTRA PARTS

By J. Brown

MANY owners of tape recorders connect two wires from the extension speaker sockets of a radio set to the input of a tape recorder, usually to the high-impedance input. This is a mismatch, as an impedance of, say, 2 ohms is connected into an impedance of up to 1 megohm at the grid of first amplifier valve in the recorder.

In Fig. 1. is shown perhaps the simplest modification needed, in this a high-impedance output from the radio for the recorder is taken from the anode of the output valve via a blocking condenser. This keeps out the D.C. anode voltage but allows the passage of the audio frequencies. These connections can be permanently wired to a pair of terminals on the radio set for use at any time. The correct connections for obtaining the best results when recording radio are shown in Fig. 2. A connection is taken from the diode side of the volume control of the radio via a resistor/capacitor arrangement to the recorder input. This is again a high-impedance output.

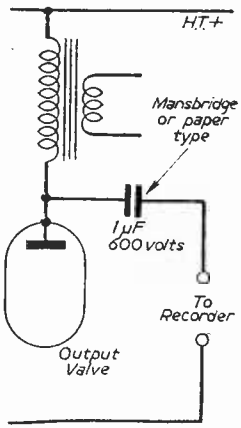


Fig. 1.—Circuit for obtaining a high-impedance output from a radio.

The volume control will not be in operation as far as the recorder is concerned, and the input to the recorder can be monitored by using the internal speaker of the set. If you do not want to interfere with your receiver, you may still obtain better results, by using the method shown in Fig. 3. In this there is an input/output which is reversible by operating the switch. There are four

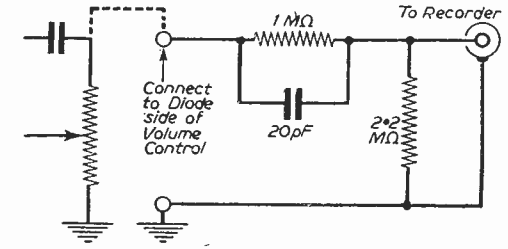


Fig. 2.—Connections to a radio for best results.

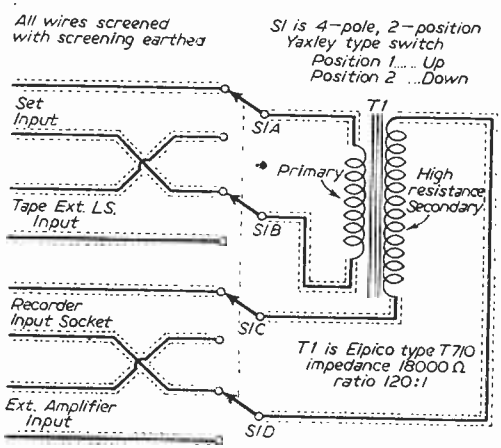


Fig. 3.—Using a transformer for matching.

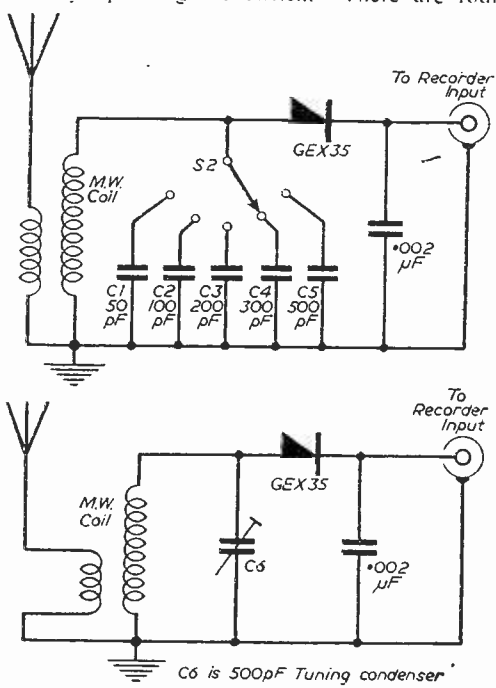


Fig. 4.—Crystal detector circuits which give a high-impedance output.

connections, which may be four sockets or four permanently connected leads. A low-impedance input and high-impedance output or vice versa may be obtained. The ext. speaker wires go to the

(Continued on page 990)

PRINTED

A SHORT SERIES DESCRIBING HOW THE MC
METHODS OF PRODUCTION

PRINTED circuits are by no means a new idea. The first were made in the early years of this century, to manufacture resistance grids, and made their appearance in radio about 1928, when Hescho of Germany produced a variable capacitor complete with wave-change switch having printed silver connections. In World War II they were used extensively by the Americans in proximity fuses, and, after the war, development proceeded on both sides of the Atlantic. By 1950 they were in use here on guided missiles and, soon after, on electronic computers (Fig. 1). The Americans quickly adapted the technique for radio and television, but here radio manufacturers had a more conservative approach, and it was only at the last Radio Show that printed circuits were found to be extensively used on radio and television.

Features of Printed Circuits

Printed circuits have the features of economy, ease of duplication, and reliability. It is necessary to provide some form of mounting for the components, such as a chassis, tag boards, and so forth. The printed circuit takes the place of all these, and, at the same time, provides the wiring between the various components. It may even form certain components, such as a small inductor or capacitor, or a multi-way plug. Cutting and stripping of wires, and attaching them to components, is avoided. In fact, by using automatic assembly and soldering, a labour saving of more than 90 per cent. can be achieved. These methods will be described later in this series. Naturally, these economies can only be realised on quantity production, except in such cases as, for example, a complicated commutator disc, where even one off may pay.

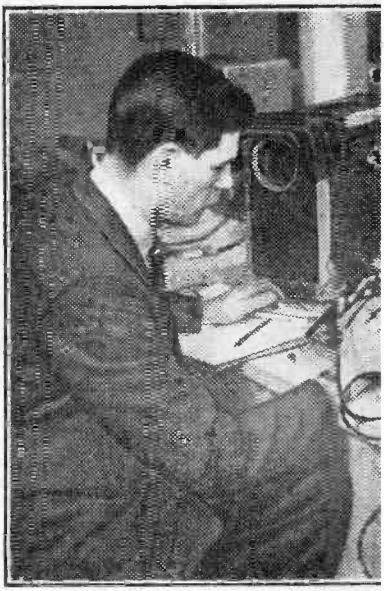


Fig. 5.—An engineer checking the p

Accurate Mass Production

Every circuit of a given pattern is an exact reproduction of the original. Thus, instability or loss of sensitivity by wires either incorrectly placed or of the wrong length is avoided. Furthermore, no wires can be omitted or wrongly connected.

Reliability

Reliability provided the impetus for early use of printed circuits in guided missiles. It is well known that these devices have high acceleration,

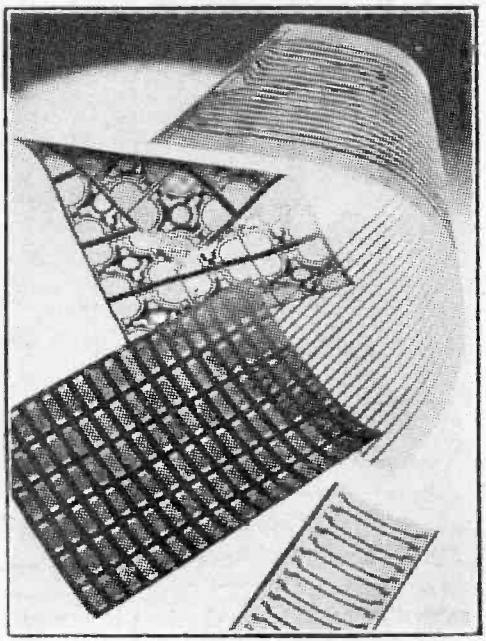


Fig. 3.—Flexible printed circuits produced as described on page 987.

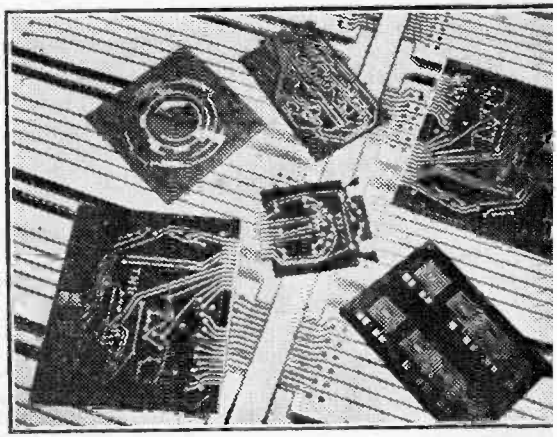
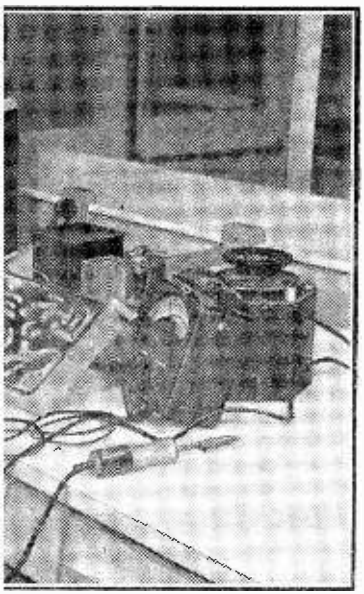


Fig. 1.—Typical printed circuits for computers, etc.

CIRCUITS

ERN CIRCUIT IS DESIGNED AND VARIOUS

By W. G. F. Roberts



type of a printed circuit receiver.

which is specified in such instances as the number of times the force of gravity. Thus, an object accelerated at, say, 10G, weighs ten times as much as it does when stationary. as weight is mass × gravity. Thus. all components and wiring must be firmly fixed. and the printed circuit offers an excellent way of doing it. Of course. the domestic radio receiver is not subject to violent acceleration. but receives instantaneous accelerations through bumps and vibration in transit, and from vibration from the loudspeaker in use. This can lead to broken wires. which use of the printed circuit eliminates. Small wonder. then. why printed circuits are coming into extensive use. and the keen amateur will want to know all about them. especially if he intends to enter the electronic industry.

We will first consider the material of which a printed circuit is made. The method most widely used employs an insulating base material completely covered with copper foil on one or both sides. The copper foil is subsequently etched away to leave the required circuit pattern. The method by which this foil is produced is shown diagrammatically in Fig. 2. It is usually 0.00135in. thick. and it is difficult to roll copper as thin as this. especially as it must be up to 4ft. wide or more to manufacture standard size sheets. The drum slowly rotates in the electrolyte. containing a shaped copper anode. A point on the drum starts to be copper plated as soon as it enters the electrolyte. The drum is made of stainless steel. so that the plating does not adhere. Thus. the copper plating is stripped off as a foil. One side. the one that was in contact with the drum. is smooth and polished. the other has a matt finish which assists subsequent adhesion. This process is known as electroforming. Sometimes foils of aluminium or resistance metals are used.

Base Material

The base is usually made of bakelite sheet. In manufacture. a number of paper sheets. covered with a resin, are laid on top of each other, and a piece of foil, matt side down, laid on top. A stainless steel sheet is then laid on. and the process repeated until a convenient stack is formed. It is then placed between heated platens on a hydraulic press. and each sheet bonded together by heat and pressure. The foil is thus firmly attached to resist all subsequent processes.

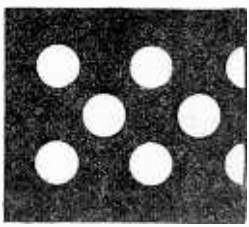


Fig. 4.—Avoiding warping by breaking up large areas.

For radio work. this material is adequate. For other work. a sheet of melamine may be laid underneath the copper to resist tracking. For greater mechanical strength. with slightly worse electrical characteristics. linen is used instead of paper. To withstand military and similar conditions. glass fabric is substituted. and silicone, melamine. or polytetrafluorethylene (P.T.F.E.) resins used instead of the usual phenolic type.

Flexible circuits may also be made by using only a thin sheet of base material (Fig. 3). In some cases. the foil is simply coated with a resin. The latter type has the advantage that it may be of

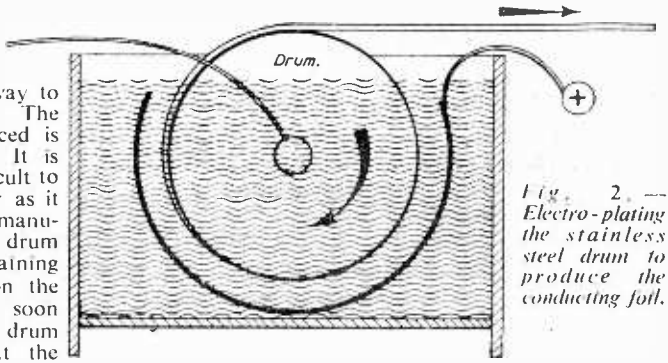


Fig. 2.—Electro-plating the stainless steel drum to produce the conducting foil.

any length. For radio and TV work, the usual material is cold-punching quality, synthetic resin bonded paper sheet, 1/16in. thick, covered with 0.00135in. copper one side.

Having chosen the material, it is now necessary to design the circuit pattern.

Width of Lines

The width of a line on the circuit is determined by the current it has to carry, the permissible resistance, and by considerations of manufacture. For standard 0.00135in. copper foil, the characteristics are:

Resistance: 0.008 ohms per inch at 20°C. for 1/16in. width.

Current: 6 amp. per 1/16in. for 40°C. temperature rise. 1/16in. width is the preferred figure, but if necessary it can be reduced to 1/32in. In rare cases, 0.015in. can be used, but this is expensive because rejects are caused by small pinholes in the foil. There is no upper limit to the width.

Spacing of Lines

The spacing between two conductors is determined by the capacity that can be allowed, and by the flashover voltage. For standard base material we have:

Capacity: Between two conductors $\frac{1}{8}$in. apart the capacity is 0.7 pF per inch, for 1/16in. apart it is 0.85 pF per inch, and for 1/32in. apart, 1.0 pF.

Flashover: Two conductors, 1/32in. apart, flash over at 1.8 kV under normal atmospheric conditions.

One-sixteenth inch spacing is preferred, but may be reduced to 1/32in. Exceptionally, 0.015in. can be used, but the circuit must then be treated with insulating varnish when finished.

Terminations

The conductors terminate in a hole through which the component wire or tag protrudes. The end of the printed wire should have a diameter at least 1/16in. greater than that of the hole, to leave adequate copper area for soldering.

There are one or two other conditions imposed on the designer of a printed circuit. Lines should preferably have flowing curves, and sharp points and corners should be avoided. It is often the practice to break up large areas as shown in Fig. 4, to avoid warping of the board during soldering. New techniques have tended to overcome this necessity.

It is advisable to leave $\frac{1}{8}$in. clear of wiring round the edge of the board, and no hole should be closer to the edge of the board than twice the thickness of the board. In addition, no two holes should be closer than the thickness of the board.

It must be admitted that this seems to be a rather formidable list of restrictions to the designer of printed circuits. However, they are essentially practical, and, if the designer uses lines 1/16in. wide, spaced not less than 1/16in. apart, with $\frac{1}{8}$in. diameter circles for his terminations, and keeps clear of the extreme edge of the board, he will not go far wrong. In the next article, we shall see exactly how this works out in a practical design. A transistorised audio amplifier has been selected for the exercise.

(To be continued)

SERVICING RADIO RECEIVERS

(Continued from page 976)

generator lead should be connected to receiver chassis.

The generator (modulated) and the receiver should next be tuned to 575 kc/s and the core in L5 and the position of L1 on the ferrite-rod aerial should be adjusted for maximum output.

The generator and receiver should be retuned to 1,500 kc/s (200 metres) and then C14 and C4, in that order, adjusted for maximum output. The foregoing adjustments should be repeated to secure optimum tracking.

For L.W. alignment, the receiver and generator should be tuned to 225 kc/s (1,335 metres) and C15 adjusted for oscillator resonance (maximum output). At the same frequency, the position of L2 on the ferrite-rod aerial should also be adjusted for maximum output. The process should be repeated for the best results.

Servicing Notes

Should the receiver operate normally on batteries, but give no signals at all on mains, the trouble may well be caused by failure of the local oscillator. This oftens happens when the metal H.T. rectifier nears the end of its useful life, especially during the winter months when the mains voltage may be low. The H.T. voltage should be in the region of 85 V., and if this is low, attention should first be directed towards the mains voltage selector to ensure that this setting coincides with the applied mains voltage.

If all is well, the voltage at pin 1 of V14 should be checked and, if necessary, R8 adjusted so that it reads 3.9 V. The average voltage across each heater should be close to 1.3 V.

Low emission V1 may result in failure on mains operation, though may not affect battery operation if the L.T. is in good condition. If this is the cause, however, it would be as well to replace V1, even though the set may be used only on batteries, since the batteries will operate the set for a longer period with a new valve.

No results on batteries, but normal on mains, nearly always indicates that the batteries are exhausted, but there is also the possibility that the battery/mains changeover switch is defective or not going properly into position when the mains socket is removed from the set.

Failure on both services should lead first to a check of the filaments of the valves. An open-circuit heater will cause the H.T. line voltage to rise abnormally on mains operation.

Excessive distortion may be caused by V4 having low emission, by C28 having poor insulation or by R26 or R22 having gone high in value. A nearly exhausted battery will give the same trouble, of course, and it should be appreciated that distortion at high volume levels will be greater when the set is used in the "economy" condition.

MAKING OHM-METERS

THE THEORETICAL AND PRACTICAL ASPECTS OF DESIGN

By J. S. Kendall

(Concluded from page 878 of the January issue)

THE 1,000-ohm meter with a 9-volt battery can be used up to 50,000 ohms if it has 50 divisions on its scale. On the other hand, it could not be relied upon to measure less than 20 ohms. The idea of increasing both the internal resistance of the meter and the battery voltage ten times will probably occur to the reader. This will increase the maximum resistance that can be measured to 50,000 ohms with the above-mentioned meter. For low resistance

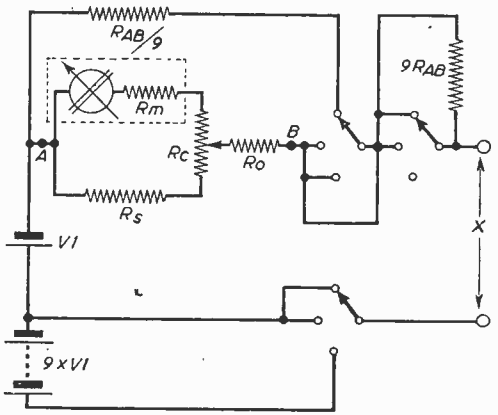


Fig. 7.—Circuit for multi-range compensated ohm-meter.

measurements, say 1/10th of the range of the one just mentioned, it is necessary to keep the battery voltage the same and shunt the meter. One part of the total current must go through the meter and nine parts through a shunt. The circuit is shown in Fig. 4. A further range is shown where 99 times as much current should pass through the shunt as through the meter; since this ratio is nearly 100:1 this figure is used as it is easy to obtain resistors in the ratio of 100:1, but not in the ratio of 99:1. There are, of course, low resistance measuring limits which occur when the current drain is about one ampere. The internal resistances of meters are usually such that the output voltage is halved at this current. The ideal meter movement for this work would be one with, say, a ten micro-ampere movement, as it would allow the use of lower voltage cells and give a higher top reading. Also the Varley silver-zinc cells could be used. These are expensive but exceptionally small and robust. Their voltage is slightly less than that of a dry battery, but they have a very low internal resistance and will give a large current for short periods.

A Compensated Meter

Most of the home-designed ohm-meters do not have any compensation for an ageing battery. With the last meter, it was suggested that several sets of charts be prepared to allow for this. In this case, it is suggested that some sensitivity and accuracy be sacrificed in order that a compensated meter can be made. The latter has the advantage of being quicker to use—the reading can be taken direct from the meter scale instead of from charts. Circuits for such a meter have been published many times and the author has noticed that most contain the same error. A circuit is shown in Fig. 5 and this has appeared in a very large number of articles. It will be seen that the "zero-set" control is in series with the meter and the battery so that the total resistance of the unit is varied in order to make the meter read exactly full-scale with terminals "X" shorted. Since the total resistance of the meter is used as the standard for measuring, the standard is being varied in such a manner that an error of 50 per cent. may occur. The true compensated high-range ohm-meter is shown in Fig. 6. It consists of the meter movement, Rc, and Rs, all in series and forming a complete circuit. The resistance values of all three of these should be as far as possible identical. The meter resistance should be as low as possible. A typical meter for this type of circuit would be a 0-1 mA meter of 100 ohms internal resistance: Rc and Rs would also be of 100 ohms. With the slider of the resistance Rc at either end of the track the total resistance will be 66⅔ ohms, with it at the centre, 75 ohms: Thus, there will be a variation of nearly 10 ohms. This may be regarded as plus or minus 5 ohms and then it does not sound so much. It is, however, a variable error in the meter. With a 1 mA meter and a 1.5 v. cell, it must be arranged that the total resistance between points A and B is such that 1 mA can go through the meter and up to 2 mA through the shunt. Say 1 mA either way—that with 1.5 volts means that a series resistor, Ro, of (750-70) ohms is required (i.e., the value of Ro, the series resistor, is the total resistance required minus the average resistance of the shunt and meter network). Now the basic error mentioned was a matter of 5 ohms either way, and 5 ohms in 750 is under 1 per cent. The meter could be direct reading to an accuracy of some 5 per cent, and this would allow for all errors.

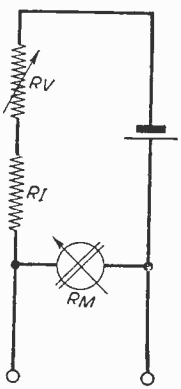


Fig. 8.—Circuit for a compensated ohm-meter for low resistances.

A higher reading meter could be made by increasing both the battery voltage and the series resistor some ten times. Rotary switches should be used and then two or three ranges can be covered on the same switch. A 1/10 range can

be incorporated by the shunting of the low range by a suitable resistor of 1/9th of the total resistance of the ohm-meter on that range. The complete circuit is shown in Fig. 7.

Making a Compensated "Low Ohm-meter"

The compensated "low ohm-meter" is a very useful meter of which the circuit very rarely appears in print. It can be one of the simplest and cheapest meters to make and most of the items can be bought on the "surplus" market.

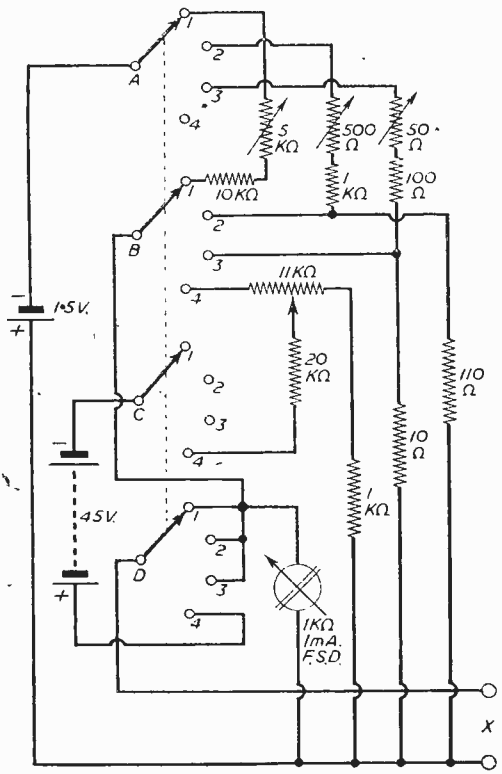


Fig. 9.—Circuit for a comprehensive multi-range ohm-meter.

even the meter if its exact resistance is known. It is most convenient if it is 100 or 1,000 ohms, but one of 10 ohms would be better. The basic meter is shown in Fig. 8. The current through the meter is regulated by the two series resistors R1 and Rv. R1 is of such value that with a new battery the meter can be overloaded to the extent of 100 per cent. Rv has a maximum value of about double that of R1. The greater the battery voltage, the higher will be the accuracy of the meter when complete. The value of R1 should be about 10 times the resistance of the meter. In use the current is set so that the meter reads full-scale deflection. When a resistance is joined across the terminals current passes through the resistance and the reading of the meter falls by that amount. Thus, for example, if half of the total current is taken through the resistance under test, then the resistor will be equal to the resistance of the meter. Again, if the reading only falls by 1/50th of the scale, then the resistance will be 50 times that of the meter. As in all ohm-meters, it is best to use a standard resistance box for the calibration, rather than to attempt to calculate and then to transfer the calculations to the scale of the meter.

A Comprehensive Ohm-meter

For those requiring a comprehensive ohm-meter, a typical circuit with component values is shown in Fig. 9. It was designed for use with a meter of 1,000 ohms internal resistance and of 1 mA full-scale deflection. On the other hand, the meter can be a surplus type made up to 1,000 ohms. Most of the components for the meter need only be of 20 per cent. tolerance. The potentiometers shown were, in the original, "Lab" presets. There are, however, three precision resistors in the meter, 20K 1 per cent. at 1W, 10 ohms and 110 ohms ½W 1 per cent. all to British Grade One Standard. The switch used is a four pole, four way. The meter can be made to cover from 0.1 ohms to 2 megohms in four ranges.

TAPE-RECORDER MATCHING

(*Continued from page* 985)

connections shown: the output to the recorder is also indicated. If the switch is moved to position 2, the process is reversed.

If you live in an area of high signal strength, you can record radio using simple equipment, and Fig. 4 gives effective crystal detector circuits. These are easy to assemble and tune, and no power supply is needed.

Note that some modern recorders have live chassis. A loud hum may be caused or sparks may occur when the connections are made. The remedy here is to isolate the recorder from the set by using the arrangement in Fig. 3, or that in Fig. 5, in which the isolation is carried out with condensers. The high-value resistors are to remove any static.

To explain Fig. 3 in more detail. T1 is a standard output transformer and by switching the windings each side of it can be made to work as input or output. For example, in the positions shown, the input from the extension loudspeaker sockets is fed to the low-impedance winding by S1a and S1b; the output to the recorder is taken from the high resistance winding.

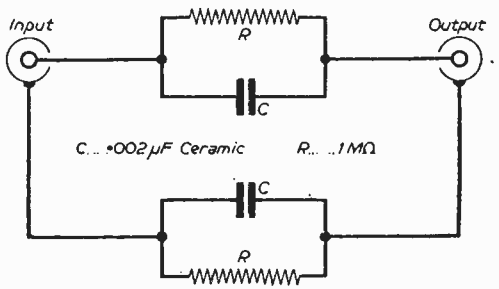


Fig. 5.—Isolating the recorder from the radio set.

TRANSMITTING TOPICS

PROPAGATION

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

WHILE we cannot control ionospheric conditions, we can, by using different wavebands, take advantage of conditions to work DX in given directions. Moreover, some experience of conditions and their seasonal and long-term variation is essential if the DX worker is to make best use of the wavebands available. In fact, of course, so many factors are involved that one is always learning about conditions, and slowly adapting to variations throughout the sunspot cycle. Thus, the experienced amateur generally is able to assess conditions at any given time from past experience, make a reasonable forecast of what conditions *should* be like at any time of the day, and also to "sense" when the

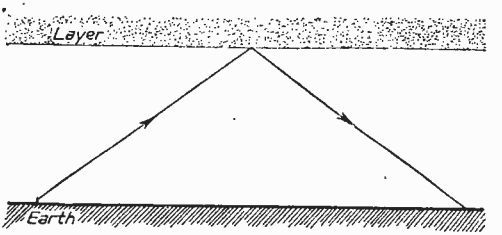


Fig. 1.—Conventional representation of reflection by an ionised layer.

sunspot cycle has advanced to such an extent that his previous experience needs recasting in the light of generally altered overall conditions owing to the change.

The ionised layers depend upon the ionising radiations emitted from the sun for their existence, and the intensity of the solar ionising radiations vary greatly over the years. The sunspot activity of the sun is, in fact, a very good guide to the ionising activity of the sun.

Sunspot Activity

The sunspot activity of the sun follows an approximately eleven year cycle. At present we are just past the peak of the greatest sunspot activity ever recorded. This has meant very good DX conditions extending to long distance propagation on very high frequencies. DX workers are now taking a gloomy view of the possibilities for the future. Because we are now leaving a high maximum, and approaching a coming minimum, that is not necessarily as bad as it seems. In any case, while high solar activity may result in long distance propagation on high frequencies, it may also result in "solar noise outbursts" in which a high level of "hiss" may suddenly swamp signals on the higher frequency bands. Also, solar flares may cause the "Dellinger fade-outs," when charged particles from the sun may cause "radio black-outs." when DX signals vanish. In fact, high solar activity is often accompanied by disturbed conditions, when fade-outs and similar matters may interfere with DX working.

As examples, during a complete "fadeout" when there were no signals audible in the 20 Mc/s region at all, the writer suddenly heard the first Sputnik's signals break in on a dead band. As there was no ionospheric reflection of signals, the Sputnik signals were audible only when it was "above the horizon," and they appeared suddenly, held steady and disappeared abruptly. Also high auroral activity may give a fluttery effect to signals generally. This "polar flutter" is, in fact, noticeable on Alaskan and Californian signals that traverse near the Poles, as well as on signals from Antarctica and Greenland, that originate in polar regions. With high auroral activity such "polar flutter" may be noticed on signals that do not travel near the Poles. In fact, observations of such flutter on signals gives a quick indication of the general extent to which abnormal auroral conditions exist outside the usual Polar regions. In the last two years such conditions have occurred frequently. Further abnormal propagation conditions noticed with high ionisation levels is the reception of "back scatter" signals. Thus British stations working DX may often be heard with a typical fluttery rough QSB on them, when they

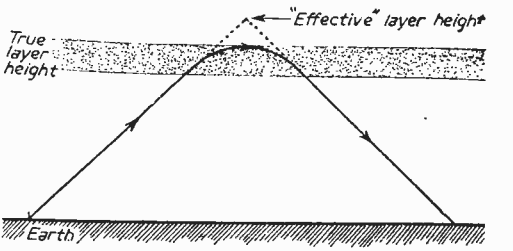


Fig. 2.—A more accurate representation of how a radio wave is bent round and returned to earth in an ionised layer. The actual height of the ionised medium is thus slightly lower than the "geometrical" height of a sharply reflecting "mirror-like" surface.

are well outside the usual reception distances on the H.F. bands. Thus with a good receiver and a beam aerial, "back scatter" QSO's have been enjoyed by the writer with "G" stations throughout England. When working a "DX Threeway," back scatter often enables two British stations to hear each other when both are working the same DX station.

"Round the World Echo"

A further phenomenon is the "round the world echo." Thus when the writer and a local station were working the same DX station, the local station was conveniently right on a "null" of the writer's TA-33 beam aerial. To my surprise, a distinct echo was audible on the local station's signals. This may have been back scatter, but most likely was an actual round the world echo. "Round the world echoes" are, in fact, commonly noticed. Further propagation conditions are commonly noticed, particularly the "lightning" fadeout. Very often the 10 metre band is alive with American signals well after dark. Suddenly,

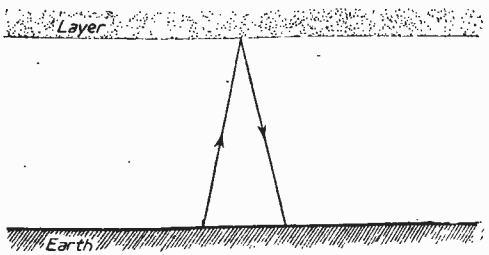


Fig. 3.—At the lower frequencies a wave is reflected even at high angles of incidence.

within a minute, the signals have all disappeared . . . often in "mid QSO." This can be so sudden that the receiver may become suspect. In fact, certain recent spells of "dead bands" have caused amateurs to frantically overhaul receivers, as with a really "dead" band, the usual incoming noise level is virtually absent, and the receiver may really sound "dead." On the other hand the "lively" feel of an open band is usually quite characteristic.

As Fig. 1 shows, rays from a transmitter are reflected to a distant point via the ionosphere. Generally for DX transmissions the F layers are involved. Moreover, although Fig. 1 shows a conventional reflection as at a sharp mirror surface, in fact the "reflection" is a gradual "refraction" process as shown in Fig. 2. Thus the "effective height" of an ionising layer as determined by a simple geometrical process as in Fig. 1, is actually rather higher than the somewhat indeterminate height of the refracting layer shown in Fig. 2. Moreover, the reflection of a radio wave in an ionised layer depends upon the angle at which the wave strikes the ionosphere, the frequency of the waves and the ionisation density in the layer and so on.

For a given intensity of ionisation in the layer, waves of a frequency less than a certain critical frequency will be reflected even if they strike the layer squarely on, that is, approach at right-angles. This is the mode by which even quite local contacts on the L.F. bands are carried on, that is, the waves travel upwards and are reflected down again even at right-angles or nearly so as shown in Fig. 3.

Waves of a frequency higher than the critical frequency will *not* be reflected at high angles of incidence but will pass through. However, such waves if not too high in frequency will be reflected if they strike the reflecting layer at low angles of incidence (Fig. 4). In fact, the *higher* the frequency of the wave, the more glancing the angle necessary before the wave can be reflected. Thus for propagation on a high frequency, only "low angle" radiation is effective as the high angle radiation escapes through the layer, and is not reflected. Moreover, the higher the ionisation in the layer, the higher the angle at which high frequency waves will be reflected. This, of course, accords with normal experience that the higher frequencies become usable only when ionisation is high.

When communication becomes impossible on a given frequency, dropping to a lower frequency will restore communication. In fact, on 10 metres, the top half of the band may be "dead," while the lower half is still wide open for DX working. Thus the C.W. operators at the L.F. ends of the band are in the most favourable position for maintaining communication on a given band.

Multiple "Hops"

The above "background" now gives us enough information to consider how we manage to hear and work DX. Firstly, medium ranges up to, say, 2,000 miles or so *may* be by a "single hop" as shown in Fig. 1. However, longer ranges are by double or multiple "hops," in which the radiation after reaching the ground is reflected back to the

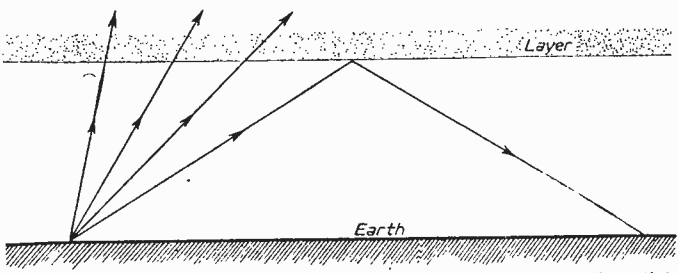


Fig. 4.—At the higher frequencies a wave will not be reflected until it strikes the reflecting layer at a sufficiently low angle. Otherwise the wave travels through the layer and is lost into space.

layer for a second reflection and so on. Of course, although the diagrams show the earth as flat, owing to the curvature of the earth, communication at any given distance can only be by

(*Continued on page 995*)

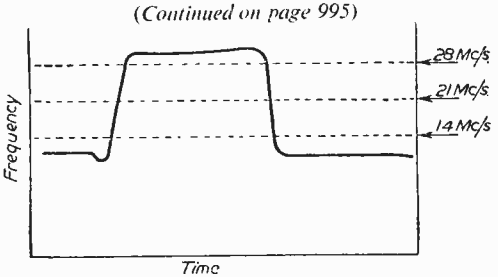


Fig. 5.—A typical propagation chart.

reflected waves, and not by direct "groundwave," so that certain areas may be out of communication because the layer will not reflect waves into them. These "skip zones" are well known, and it will be seen that a given distance may come within or without a skip zone depending upon the ionisation density in the reflecting layer.

A further mode of long distance propagation is the so called "M" Mode. In this, waves may be reflected from a high reflecting layer, and instead of reaching the ground be reflected back up again from a lower reflecting layer before finally being reflected back to earth. The name "M" mode comes from the "M"-shaped path of the rays.

Propagation Charts

These considerations show that the time of day is a very important factor in propagation considerations. Thus, if we consider early morning before the sun has risen, ionisation in the layers will be low, and the higher frequency band will be closed for long distance communication. As the sun rises and ionisation builds up in the layers, progressively higher and higher frequencies will become "open" for communication. Moreover the *direction* in which the band will become open will depend upon geographical factors. Thus, even before sunrise the band may be open towards the *east*, as the sun has *already risen* on countries lying eastwards. Thus, as a matter of experience, we may be working the Middle East on say 15 metres well before the band opens for America. The situation may become quite complicated, when multiple hops and geographical locations in various directions have to be considered. Thus during the summer when we have a "long twilight," bands may remain open for long periods. In winter they may close down very shortly after sunset. For long multiple hop paths to the Antipodes, there may in fact be *two* paths open simultaneously. Thus the "long" and "short" path circuits to Australia are well known, and even VK contacts may often best be made with the beam directed directly *away* from Australia to utilise the "long" path. It is general therefore to construct "propagation charts" for various DX directions on a monthly basis showing which frequency bands will be open at various times. For amateur use these may be constructed on a "maximum useable frequency" basis, showing the highest frequency likely to be useable at any given time.

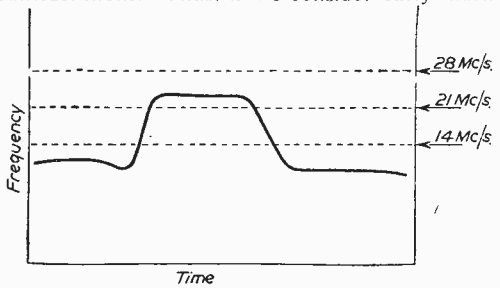


Fig. 6.—With a lower value of ionisation, 10 metres may not "open."

A typical example of such a chart is shown in Fig. 5. It will be observed that directly after sunrise at some critical point along the route, the "MUF" rises sharply and the various DX bands may thus open one after the other. Twenty metres opening first, then 15 metres and finally 10 metres. However, as shown by Fig. 6, at times of lower ionisation or nearer sunspot minima, 10 metres may not open at all. Accordingly the best DX periodicals supply their readers with monthly propagation charts showing the conditions to be expected for various DX areas. Unfortunately no British periodical prints such charts for amateur use, although DX predictions for various operating bands are printed by the R.S.G.B. Fig. 7 illustrates the several differing types of chart that may exists for varying DX locations during the same month.

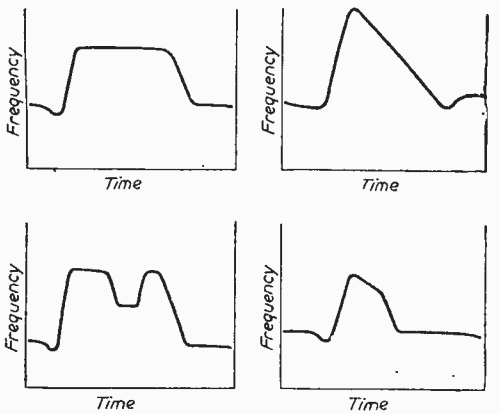


Fig. 7.—Some typical propagation charts for various DX operating circuits.

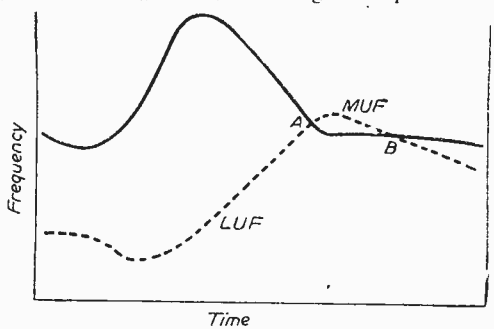


Fig. 8.—If the "Lowest Usable Frequency" is higher than the "Maximum Usable Frequency," as between times A and B, then the path cannot be used.

Furthermore, the MUF (maximum usable frequency) may not be too exact an indication. Thus quite often a band may be just open when the chart says it should be closed and the reverse may also occur. Moreover, the charts refer to average "undisturbed" conditions, and during sunspot cycle peak periods conditions are likely to be disturbed fairly frequently. Under

(Continued on page 1000)

Servicing Without Instruments

FAULT FINDING AND REPAIRS FOR THE BEGINNER

By Gordon Cole

LAST month's article concluded by pointing out the danger of electrical shock which may exist when receivers of the A.C./D.C. type are serviced and for safety it is best to ensure that the neutral wire of the mains supply is connected to the chassis. This is easily established by connecting a household lamp between the chassis and a good earth point, keeping the hands clear of the connections (see Fig. 1). The bulb will light if the chassis is "live," in which case the mains connections to the receiver

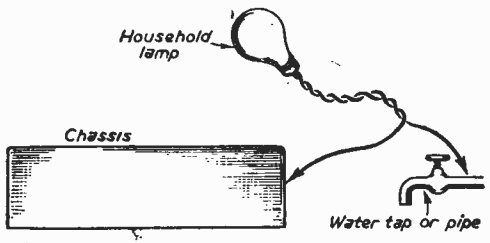


Fig. 1.—It is desirable to ensure that the chassis of the receiver under repair is connected to mains neutral. If the bulb lights, the mains connection to the receiver should be reversed. This applies mainly to sets of the A.C./D.C. type.

should be reversed. A neon lamp or screwdriver-type neon tester is also useful in this respect, since the neon will glow when in contact with a "live" chassis.

The A.F. and Detector Stages

If the tests detailed in the previous article indicate that the output stage is working, then, if the receiver is still dead, simple tests must be made to the stages which supply signal to the output valve. In some receivers the demodulated detector signal is applied to a voltage amplifier triode or pentode to lift the A.F. content to a level suitable fully to drive the output valve, while in other receivers the signal across the detector load itself is applied direct to the output valve.

In Fig. 2 is shown the usual arrangement where a double-diode-triode valve serves as the detector, A.G.C. rectifier and A.F. amplifier. To check whether the signal is coupled from the anode of the triode to the control grid of the output valve a 0.1 μF capacitor can be connected between the chassis and the anode of the triode as shown. If all is well, a fairly loud click will occur each time the capacitor is connected to the anode point. In order to avoid having to discharge the capacitor, it is a good idea to connect across it a 100k resistor.

The next point to make a test is at the grid of the triode. If this point is touched with a finger or with a screwdriver blade on which a finger is resting a loud hum should occur from the loudspeaker if the A.F. section is in order. This test injects a mains signal (50 c/s) into the grid circuit, the signal being picked up by the body from spurious mains fields which are usually present in the proximity of the receiver. Unless there is a powerful mains field radiated by the house wiring, a battery receiver will not exhibit the effect, but on scraping the blade of a screwdriver on the grid connection crackling should be heard from the loudspeaker. When this test is performed, the receiver's volume control should always be set at maximum.

If a signal can be produced at the anode but not at the grid, the trouble lies somewhere in the triode section. There is very little to go wrong here, and it is usually found that either the valve itself or the anode resistor R1 is defective.

Having established that the A.F. and output stages are passing a signal, it is best to check the I.F. amplifier and detector stages in one go, and this is where the buzzer tester can be used to

(Continued on page 999)

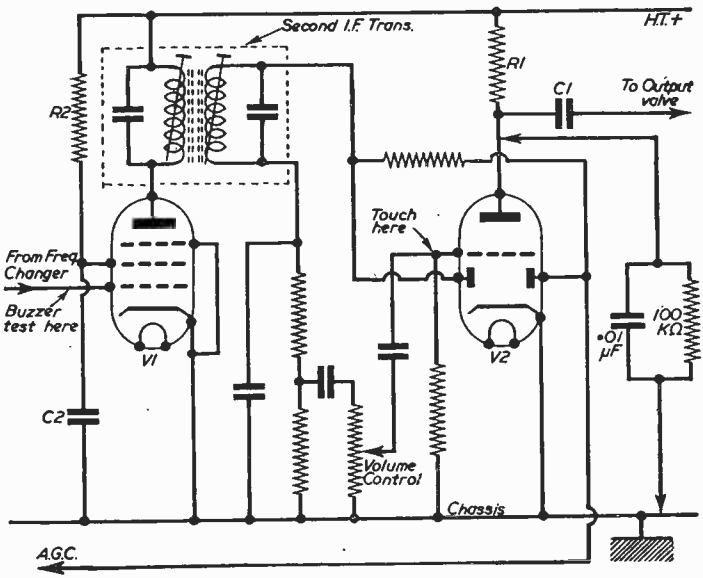


Fig. 2.—A circuit diagram showing the I.F., detector and A.F. stages and various test points.

advantage. This was described in the previous article, but is again shown here in Fig. 3. The rapid make-and-break action of the buzzer produces square waves which are rich in harmonics rising to frequencies well in excess of the broadcast bands, and these signals can be injected, for example, into the control grid circuit of the I.F. amplifier valve (V1 in Fig. 2) to check stage continuity.

If a loud buzz is produced in the loudspeaker when this connection is made, it can be assumed that the I.F. amplifier and detector stages are in order, but if there is no response or if the buzz from the loudspeaker is very weak, attention should be directed towards the I.F. amplifier valve and the components associated with this and the detector circuit.

Under normal conditions, the I.F. valve is fairly warm, though not at such a high temperature as the output valve or rectifier, so if a finger test of temperature reveals that this valve is cool, it may either be low in emission or a component defect may be starving it of voltage. The presence of screen and anode potential can be established by means of a 0.1 μF capacitor. If this is connected between the chassis and either screen or anode it will charge, and a small spark will occur when it is discharged across the chassis or other metal object—the use of a larger value capacitor will produce a larger spark on discharging.

Lack of voltage at the anode is caused by the primary (anode) winding of the second I.F. transformer being broken, while lack of voltage at the screen is caused either by the screen-feed resistor R2 being open-circuit or the decoupling capacitor C2 being short-circuit. In the latter case, however, the excessive current in R2 may cause this resistor to overheat if its value is not too high. If the voltages are present on the valve and it is cool in operation, it should be checked for emission and replaced if necessary.

In some circuits a resistor is connected in series with the cathode of the valve to produce a standing bias, and open-circuit of this component will produce the symptom under consideration, but a quick check is possible by shorting the resistor with a short length of wire while the buzzer signal is applied. If this results in stage continuity, the cathode resistor should be replaced.

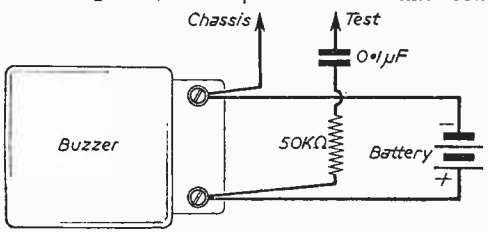


Fig. 3.—A buzzer set-up for test purposes.

If the valve and its voltages are normal, the trouble may be caused either by misalignment of the second I.F. transformer or by a fault in the detector circuit. There is a probability that the detector diode in V2 is faulty, though this is not very likely if the triode is working correctly, though, nevertheless, it may save time to have V2 checked in obstinate cases. A quick test of the components in the detector circuit is possible by injecting a signal from the buzzer into the signal diode circuit of V2. A buzz will be heard from the loudspeaker, the volume of which will be controllable by the receiver's volume control if the circuit is in order. As will be seen, there is little in this section to go wrong, and final testing generally resolves to the substitution of suspect components.

Severe misalignment of the second I.F. transformer may require the use of a signal generator to establish the correct I.F., but the two tuned circuits may be balanced with respect to each other by injecting a signal from the buzzer into the control grid of the I.F. valve and adjusting the I.F. trimmers for maximum output.

The Frequency Changer and Aerial Circuits

If a good signal can be pushed through the receiver from the grid of the I.F. amplifier valve, then the trouble lies somewhere in the frequency changer stage or aerial circuits. The circuit of Fig. 4 shows this section of the circuit relating to a receiver of the A.C./D.C. mode, in which, it will be noticed, the aerial and earth connections are isolated from the chassis by means of capacitors C1 and C2.

If operation of the wavechange switch gives rise to distinct clicks from the loudspeaker the local oscillator and aerial circuits should be investigated. The first move is to disconnect the aerial from the aerial terminal on the set and connect it direct to the signal grid of the frequency changer valve V1. This will bypass the aerial coupling circuits. If signals can now be tuned in there is conclusive evidence that the local oscillator is in order, and that the trouble lies in the aerial coupling circuits. In this case attention should be paid to the aerial section of the wavechange switch, the connections on the tags of the switch and the components between the aerial socket and the coils. If all bands are dead with the aerial inserted correctly in its socket, the lead should again be removed from the socket and applied in turn to the various components between the socket and coils in an endeavour to find the point where the signal fails to pass. For example, the aerial lead could be applied to the coil end of C3 in Fig. 4 or between C1 and C3; if the set works with the aerial connected to the coil end of C3 but not at the junction of C1 and C3, it would follow that C3 is open-circuit.

If it is found possible to receive signals only when the aerial is connected to the signal grid of V1, the alignment of the aerial coils may be adrift or a fault may have developed in the padder capacitor C4. There is also the possibility of an open-circuit aerial winding L1.

If signals cannot be received even with the aerial connected to the signal grid of V1, but if loud crackles result when the aerial wire is drawn across the tag at this point, failure of the local oscillator should be suspected. If all bands are out of action, the most likely cause of the trouble is a low emission valve (triode or oscillator section), but a defect in R1 or C5 would have the same effect. Open-circuit in the resistor

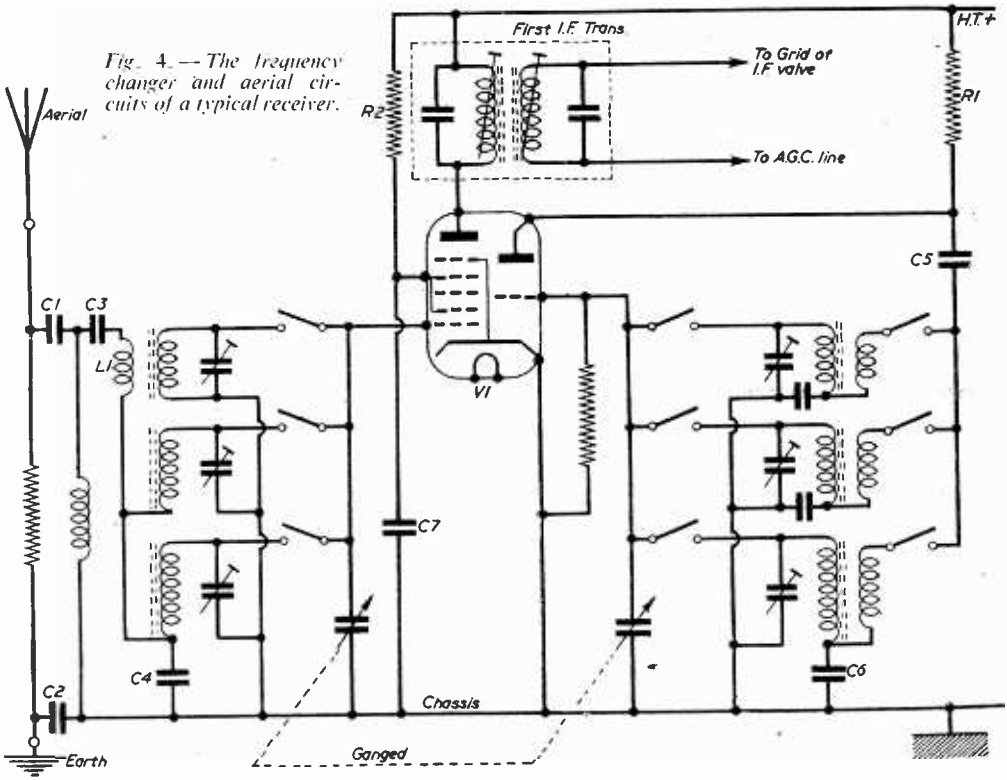


Fig. 4.—The frequency changer and aerial circuits of a typical receiver.

would remove the voltage from the anode of the oscillator valve, and voltage at this point can be proved along the lines already described, while open-circuit in C5 would open the oscillator coupling and mute the oscillator altogether: a quick substitution check is desirable if this component is suspected. If only one band is faulty, a check should be made on the associated padder capacitor, such as C6.

Complete misalignment of the oscillator circuits should not prevent the receiver from working, but would be revealed by the local stations coming in well off their expected points on the dial, and it may be necessary to connect the aerial direct to the signal grid of the frequency changer to get any signal at all.

If V1 stage seems to be totally dead, and it is found impossible to pass the buzzer signal through the receiver from the signal grid point, lack of emission of the valve is a possibility worth investigating. If the valve is only just warm it would also be a good idea to check for the presence of voltage on the anode and screen tags, as in the case of the I.F. amplifier valve. R2 or C7 may be faulty. It sometimes happens that a short occurs in the capacitor, and the resulting heavy current causes the resistor to fail a little while later. There is also the possibility of the primary winding of the first I.F. transformer being open-circuit.

If only a weak buzz is produced in the loudspeaker one of the fixed tuning capacitors in the I.F. can may have altered in value or gone open-circuit. This can usually be proved by applying the buzzer signal at the signal grid of the valve and adjusting the trimmers on the suspect transformer for maximum output. If this necessitates the trimmers being fully compressed or at maximum value, the fixed capacitors should be replaced, or, at least, the capacitor associated with the winding which is not tuning correctly. If the windings are trimmed by dust-iron cores, the effect would be revealed by the output beginning to increase when the core is fully in the winding.

TRANSMITTING TOPICS

(Continued from page 995)

disturbed conditions, anomalous propagation, fadeouts, "polar flutter," strong signals from unexpected areas or blackouts may often occur. A point often *not* shown on these propagation charts we have been considering, is that there is also a complementary curve of the "lowest usable frequency." This is shown on the chart in Fig. 8. When the "lowest usable" frequency exceeds the "highest usable" frequency, obviously communication is impossible. Generally in commercial practice a working frequency below the MUF is selected to ensure that communication will be possible despite fluctuations in the "expected" maximum working frequencies that will be open.

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10W/7—15 k.
10W/8—50 ohms.
10W/342—75 ohms.
10W/998—20 k. pot. (small).
10W/999—20 k. pot. (larger).
10W/1018—2 k.
10W/1025—10 k. pot. w.w.
10W/6341—150 k. pot. pre-set.
10W/1725—½ Meg. pot. min. pre-set.
10W/6662—100 k.
10W/7313—5 k. pot. (carbon).
10W/11382—150 k.
10W/11384—1 meg.
10W/11499—100 k.
10W/11670—5 k.
10W/11674—½ meg.
10W/6289—5 k.
10W/8740—100 k.
10W/16741—200 k.
10W/8750—250 k.

JXS.GC.3610—250 k. pot. (1 side earthed).
HES.GC.3610—250 k. pot. (ordinary).
(Both the above sub-miniature).
NDZA.5077—1 meg. pot.
10C/8924—1 k. pot.
10C/8925—5 k. pot.
10C/8926—10 k. pot.
10C/8927—25 k. pot.
10C/1063—750 k. pot.
10W/16190—20 k. pre-set pot.
10W/10719—5 k. pre-set pot.
10C/8740—100 k. E.H.T. pot.
10C/81376—200Ω pot.

CONDENSERS

1 pF=.000001 μF. 100 pF=.0001 μF. 1,000 pF=.001 μF.

10C/14—.001 μF.
10C/15—5 pF.
10C/16—10 pF.
10C/18—80 pF.
10C/96—100 pF.
10C/97—.002 μF.
10C/347—.01 μF.
10C/432—150 pF.
10C/626—500 pF.
10C/627—.001 μF.
10C/733—25 μF 25 v.
10C/792—500 pF.
10C/793—.001 μF.
10C/796—.05 μF.
10C/798—0.1 μF 1 kV.
10C/799—.15 μF.
10C/960—2.5+2.5+1 μF.
10C/962—As 960.
10C/963—100 pF.
10C/964—.005 μF.
10C/967—.1 μF.
10C/968—75 pF.
10C/969—800 pF.
10C/970—.5 μF.
10C/971—600 pF.
10C/972—200 pF.
10C/974—10-115 pF trimmer.
10C/976—5-60 pF trimmer.
10C/978—15 pF.
10C/979—4 μF.
10C/1271—.02 μF.
10C/2001—2 pF.
10C/2002—4 pF.
10C/2005—.00455 μF.
10C/2006—100 pF.
10C/2007—25 pF.
10C/2008—240 pF.
10C/2009—80 pF.
10C/2011—.002 μF.
10C/2013—1,320 pF.
10C/2014—537 pF.
10C/2015—1,670 pF.
10C/2016—6,170 pF.
10C/2017—300 pF.
10C/2027—5 pF.
10C/2066—3-18 pF trimmer.
10C/2070—3-20 pF trimmer.
10C/2071—3-18 pF ganged.
10C/2072—2-8 pF trimmer.
10C/2073—10 pF.
10C/2075—30 pF.
10C/2076—.003 μF.
10C/2078—50 pF.
10C/2079—50 pF.
10C/2082—2-6.8 pF. variable.
10C/2083—.05+.05 μF.
10C/2084—.1+.1 μF.
10C/2189—.1 μF.
10C/2192—.1 μF.
10C/2235—.5 μF.
10C/2237—.004 μF.
10C/2238—.25 μF.
10C/2239—2 μF.
10C/2240—4 μF.
10C/2347—100 pF.
10C/2428—100 pF.
10C/2599—25 μF.
10C/2624—.1 μF.
10C/2625—.01 μF.
10C/2626—.005 μF.
10C/2627—.005 μF.
10C/2629—.02 μF.
10C/2630—.05 μF.
10C/2649—65 pF.
10C/2920—30 pF.
10C/3027—25 pF.
10C/3043—50 pF.
10C/3055—.01 μF.
10C/3064—300 pF.
10C/3100—.001 μF.
10C/3124—30 pF.
10C/3129—5-60 pF variable.
10C/3192—.0025 μF.
10C/3195—.01 μF.
10C/3196—300 pF.
10C/3303—10 pF.
10C/3317—
10C/3396—.001 μF.
10C/3399—.1+.1+.1 μF.
10C/3401—.5 μF.
10C/3402—8-105 pF variable.
10C/3436—.0001 μF.
10C/3503—8 pF.
10C/3580—.001 μF.
10C/3787—16 μF.
10C/3788—.005 μF.
10C/3789—60 pF.
10C/3790—160 pF variable.
10C/3791—160 pF 2-gang variable.
10C/4099—300 pF.
10C/4100—100 pF.
10C/4232—25 μF.
10C/4250—.001 μF.
10C/4256—
10C/4260—93 pF.
10C/4268—200 pF.
10C/4271—100 pF.
10C/4321—75 pF.
10C/4325—500 pF.
10C/4326—200 pF.
10C/4327—200 pF.
10C/4328—150 pF.
10C/4329—100 pF.
10C/4501—50 μF.
10C/4502—500 pF.
10C/4568—2 μF.
10C/4569—1 μF.
10C/4570—.5 μF.
10C/4572—1 μF.
10C/4632—3 pF.
10C/4633—2 pF.
10C/4922—30 pF.

CONDENSERS—*(Continued)*

10C/4923—160 pF.
10C/4995—100 pF.
10C/5352—.005 μF.
10/C5484—250 pF.
10C/5598—16+8 μF.
10C/5645—.01 μF.
10C/5683—10 pF.
10C/5874—9-175 pF variable.
10C/5875—3-8 pF.
10C/7901—.001 μF.
10C/7906—.01 μF.
10C/8009—500 pF.
10C/8010—.002 μF.
10C/8275—2 μF.
10C/8286—8 μF.
10C/8382—.25 μF.
10C/9097—1 μF.
10C/9629—.05 μF.
10C/9755—.01 μF.
10C/10164—.005 μF.
10C/10165—.1 μF 375 v.
10C/10221—.05 μF.
10C/10226—.0005 μF variable.
10C/10227—3-35 pF variable.
10C/10228—160 pF.
10C/10229—1,050 pF.
10C/10230—3-17 pF variable.
10C/10301—3 pF.
10C/10552—50 pF.
10C/10553—100 pF.
10C/10554—.1 μF.
10C/10568—50 pF.
10C/10607—15 pF.
10C/10629—.01 μF.
10C/10948—20 pF.
10C/11120—.001 μF 1 kV.
10C/11121—.002 μF 1 kV.
10C/11122—.005 μF 1 kV.
10C/11123—.01 μF.
10C/11124—.02 μF.
10C/11125—.05 μF.
10C/11126—.1 μF 350 v.
10C/11127—.1 μF 1 kV.
10C/11128—.25 μF.
10C/11130—.5 μF 350 v.
10C/11131—.5 μF.
10C/11134—.5 μF 500 v.
10C/11140—.004 μF.
10C/11156—.05 μF.
10C/11157—.1 μF.
10C/11394—.25 μF.
10C/11407—200 pF.
10C/11476—.1 μF.
10C/11482—4 μF.
10C/11485—50 pF.
10C/11658—200 pF.
10C/11694—.003 μF.
10C/11748—1.25 μF.
10C/11753—.01 μF.
10C/11754—.05 μF.
10C/11755—4 μF.
10C/11756—.25 μF.
10C/12114—40 pF.
10C/12384—25 μF.
10C/12503—.1 μF E.H.T.
10C/12574—1 μF.
10C/12776—4 μF 400 v.
10C/13194—8 μF.
10C/13212—16 μF 500 v.
10C/13258—4 μF.
10C/13260—4 μF.
10C/13364—.001 μF.
10C/13408—4 μF.
10C/13409—25 μF.
10C/13624—2 μF.
10C/14211—40 pF.
10C/14583—70 pF.
10C/14616—.5 μF.
10C/14719—2 pF.
10C/14757—4 pF.
10C/14758—4 μF 600 v. (paper).
10C/16071—560 pF.
10C/16072—.001 μF.
10A/8496—.01 μF.
AP5073—4 μF 350 v.

Basic Theory For Constructors

(Continued from page 981)

Resistance offered to the flow of current produces heat, just the same as heat is produced when a moving body is subjected to resistance or friction. Power is thus dissipated across a resistance in proportion to the current in it and the voltage across it. This power is measured in watts (W), and is the power rating unit of resistors.

Power Rating

Basically, the power in watts dissipated by a resistive circuit is equal to the voltage across the circuit multiplied by the current flowing through it, that is, $W = I \times E$. Let us take the simple circuit in Fig. 6. Here we have 100 volts across 100-ohm resistor, which gives a current of 1 ampere. According to the power formula, this means that the resistor is going to get pretty hot since it will dissipate 100 watts. It would be of the size, or larger, of a mains dropping resistor used in A.C./D.C. receivers, and would be wire-wound.

If a small wire-wound or carbon resistor were used in this circuit, it would very quickly overheat and burn out.

The power formula can be modified to suit various applications. Instead of writing $W = I \times E$, we can substitute E/R for I, as taken from the Ohm's law formula, which gives $W = (E/R) \times E$, which is the same as $W = E^2/R$.

Similarly, from the Ohm's law formula, we can substitute $I \times R$ for E, which gives $W = I \times I \times R$, which is the same as $W = I^2 \times R$.

We thus have three power formulæ, $W = I \times E$, $W = E^2/R$ and $W = I^2 \times R$. All of these will be found to give the same power (100 watts) when applied to the circuit in Fig. 3.

Other simple transformations of the formulæ which are useful for the constructor are: $I = W/E$, $I = \sqrt{W/R}$, $E = W/I$, $E = \sqrt{W \times R}$, $R = W/I^2$ and $R = E^2/W$.

Another exercise will help. In Fig. 7 is drawn

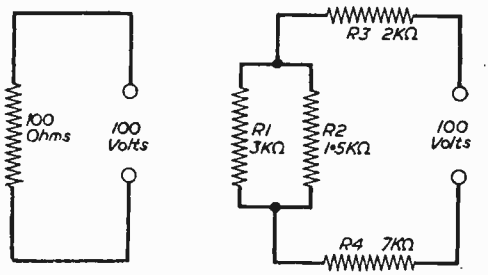


Fig. 6 (Left) and Fig. 7 (Right).—Circuits illustrating the calculations given in the text.

a simple parallel-series resistive circuit. R1 and R2 in parallel equal 1k, while R3 and R4 in series bring the total resistance to 10k. With 100 volts applied to the circuit, $I = E/R$ reveals that the current in R3 and R4 is 0.01 ampere (10 mA), and by using $W = I^2 \times R$, it will be discovered that the power dissipated by R3 is 0.2 watt and by R4, 0.7 watt.

From $E = I \times R$ it will be found that 10 volts are present across the parallel combination R1 and R2, so by using $W = E^2/R$ it will be found that 0.033 watt is dissipated by R1 and 0.066 watt by R2. In practice, ½-watt resistors would be used by all but R4, which would possibly be rated at 1 watt.

ILLUSTRATED CATALOGUE 1/- post 3d.

BUILD A POCKET RADIO with this latest deaf aid complete with crystal mike, on/off and volume controls, subminiature valves, etc., internal batteries, only 5 x 2½ x ⅞in., beautifully styled, offered complete with all required conversion items at the ridiculous price of **80/-.**

COMMUNICATION RECEIVER R1155. This magnificent receiver covers 5 ranges: 75-200 kc/s, 200-500 kc/s, 600-1,500 kc/s, 3-7.5 Mc/s, 7.5-18.5 Mc/s. Fully tested before despatch. Complete with circuit and instruction booklet, **£8.10.0.** Carriage 10/-.

BUILD AN F.M. TUNER with this MINIATURE 373 I.F. STRIP 9.72 MC/S. Complete with 6 valves, 3 EF91, 2 EP92, 1 EB91, F.T.s, etc., supplied with circuit and complete conversion to F.M. Tuner details. The best buy of the year at **40/-** with valves. **12/6** less valves. P. & P. 2/6.

MICROPHONES. BRAND NEW. Throat, magnetic, **4/6**; No. 8 carbon with switch, **6/6**; No. 7 moving coil, **8/6.**

SWITCHES. D.P.D.T. **2/6.** P. & P. 6d.

INFRA-RED MONOCULAR. Ideal for night viewing, etc. Complete with push-button zamboni pile power unit and focus lens. Brand new in beautiful leather carrying case. Originally cost Govt. £40. OUR PRICE **17/6.** P. & P. 2/6.

VIBRATOR PACKS. 12 v. input, 300 v. output at 150 mA., consist of 12 v. vibrator, 4 metal rectifiers, chokes and smoothing condensers, **25/-.** Carr. 7/6. 6 v. input, 230 v. output at 100 mA., complete with 4-pin vibrator, OZ4 rectifier. Fully smoothed, **25/-.** Carr. 3/6.

PORTABLE AMPLIFIER, PRINTED CIRCUIT. Size 6½in. wide, 2½in. deep, 3in. high. Will suit all crystal pick-ups. Output 3 watts. Uses UCL82 output, UY85 rectifier. Volume and tone controls. With circuit diagram. **ONLY 45/-.** 7in. x 4in. elliptical speaker for above, **14/6.**

HEADPHONES. BRAND NEW. American, chamois padded (as illus.), moving-coil 100 ohms, **25/-.** U.S.A. lightweight, Type H.S.30, **15/-.** Low resistance 120 ohms, **6/6.** High resistance, **12/6.** P. & P. 1/6 on each.

PYE 10" EXN. SPEAKER

3 Ω in magnificent cabinet. Complete with lead and plug. Brand new, **45/-.** Carr. 5/-.

T.C.S. TRANSMITTER

Covering 1.5-12 Mc/s (160-80-40 metres) consists of V.F.O., Buffer, Doubler, P.A. with internal push/pull modulator, and provision for V.F.O. or crystal control on 4 channels. Output 40 watts phone, 100 watts C.W. Complete with aerial current and plate current meters.

In excellent condition. **£9.10.0** Carr. 15/-. **T.C.S. RECEIVER, £8.10.0.** Carr. 15/-.

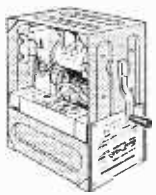
RELDA TRANSFORMERS

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

250-0-250 v. 80 mA., 6.3 v. 3.5 a; 4 v. 4 a; 0-4.5 v. 2 a.	**22/6**
350-0-350 v. 80 mA., 6.3 v. 3.5 a; 4 v. 4 a; 0-4.5 v. 2 a.	**22/6**
250-0-250 v. 100 mA., 6.3 v. 3.5 a; 5 v. 2 a; 6.3 v. 1 a.	**25/6**
300-0-300 v. 100 mA., 6.3 v. 3.5 a; 5 v. 2 a; 6.3 v. 1 a	**25/6**
6.3 v. 2.75 a. Filament transformers	**7/6**
0-12-15-20-24-30 v. 2 a. Filament transformers ...	**20/6**
0-5-11-17 v. 4 amps. Battery charger type	**22/6**

SUPPLY UNIT No. 5

Contains Hand Generator giving 6 v. output with overload cut-out, ideal to boost a flat car battery; 6 volt Vibrator Pack giving 3 volts and 150 volts with output leads, plugs, etc., for Army 38 and 18 sets; Battery box for three 2 v. accumulators. This is a fully portable and multi-purpose power supply unit. BRAND NEW.



ONLY **30/-** Carr. Paid.

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RECEIVER BC624. 100-156 Mc/s, 12 valve Superhet, with R.F., 3 I.F.s, second det., and O./P. stages. Full operating details and circuits, etc. Only **30/-** each. P. & P. 5/-. Mains Power Pack Kit, **42/6.**

TRANSMITTER BC625. 15W. Only **45/-** each. P. & P. 5/-. Complete Trans/Receiver Assembly, **70/-.** Carr. 10/-.

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ONLY 60/- EACH P. & P. 4/-

Consisting of transreceiver covering 7.4-9 Mc/s, range up to 10 miles, complete with 5 valves, headphones, microphone, junction box & 6ft. telescopic aerial. Only requires 120 v. & 3 v., dry battery. These magnificent Walkie/Talkie sets (as used by H.M. Forces) are ideal for any application and can be operated with ease by young and old alike.

TWO FOR £6 POST FREE.

AERIAL VARIOMETERS. These magnificent instruments will enable you to receive maximum signal strength on all Short Wave receivers. Precision calibrated control. Complete with connection details, **12/6.** P. & P. 2/6.

AMERICAN ROTARY CONVERTOR. With cooling Fan. Input 12 v. D.C. Output 250 v. at 90 mA. Completely suppressed. Ideal for running car radio, electric shaver, etc., from battery. Only **17/6.** P. & P. 3/6.

MALLORY 12 v. 4-pin **VIBRATORS.** Brand new, **2/6.** P. & P. 1/-.

WESTINGHOUSE J.50 PENCIL RECTIFIERS. 500 v. 5 mA., 5/-. P. & P. 1/-.

WIRELESS SET No. 19 Mk. II. This famous Transmitter-Receiver 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 inter-com. amplifier. Complete with 15 valve 500 micro-amp check and tuning meter, circuits and instruction book (American manufacture). In magnificent condition, **65/-,** Carr. 10/-, or complete with all attachments, 12 v. supply unit, variometer, control box, aerial, 'phones, mike, **£6.10.0.** Carr. 20/-.

METERS. 0-1 mA. 2in. square. **22/6.** 500 micro-amp. 2in. circular, calibrated 0-15 and 0-600 volts, **17/6.** 1 amp. H.F. 2in. circular, **5/6.** P. & P. 1/6 on each.

TELEPHONE HANDSET. Brand new, **12/6.** P. & P. 1/-.

12 v. SUPPLY UNIT. Output 150 v. at 65 mA. and 40 v. at 35 mA. Brand new. Only **12/6.** P. & P. 3/6.

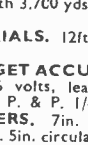
ARMOUR RECORDING WIRE. U.S.A. top quality on original reels. Length 3,700 yds., **8/6.** P. & P. 1/6.

U.S.A. WHIP AERIALS. 12ft., **12/6.** Post Paid.

AMERICAN MIDGET ACCUMULATORS. 36 volts, lead acid type. **2/6** ea. P. & P. 1/-.

PLESSEY SPEAKERS. 7in. x 4in. elliptical 3 ohms. 5in. circular 3 ohms. **14/6** ea P. & P. 1/6.

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



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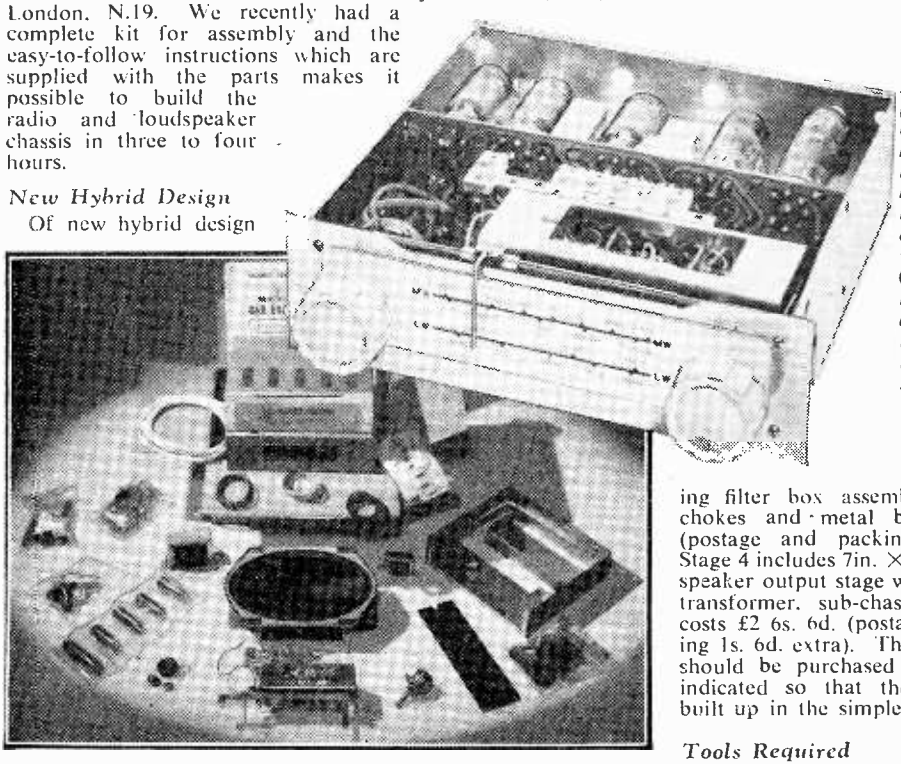
Car Radio in Kit Form

A REASONABLY PRICED RADIO THAT IS SIMPLE TO CONSTRUCT

A NEWCOMER to the D.I.Y. movement is a car radio kit that is supplied by Mayra Electronics Ltd., 551, Holloway Road, London, N.19. We recently had a complete kit for assembly and the easy-to-follow instructions which are supplied with the parts makes it possible to build the radio and loudspeaker chassis in three to four hours.



The illustration shows the kit of parts. The receiver has two-knob control, the one on the right being for tuning and for changing the waveband (pull out for long waves), and the one on the left being the on-off switch and volume control.

New Hybrid Design

Of new hybrid design the receiver uses a transistor with five special Brimar 12 v. valves which gives exceptional power output with negligible fade (even under bridges). The R.F. stage ensures level volume under all conditions.

The radio is for 12 v. operation only with a low current consumption of 1.5 amps. The elliptical speaker measures 7in. × 4in. and gives exceptionally good tonal quality. It has two-knob control, the knob shown on the right of the illustration being for tuning and for changing the waveband (pull out for long waves) and the knob on the left is the on-off switch and volume control.

Various Stages

The receiver measures 8in. × 7in. × 2¼in. and will fit all modern cars. The price of the kit for the complete receiver is £13 10s., and an aerial, if required, costs £1 13s. The kit comprises four stages each of which can be purchased separately if desired. Stage 1 which includes a printed circuit panel including resistors, valve, condensers and transformer costs £5 19s. 6d. (postage and packing 1s. 6d. each). Stage 2 contains general chassis assembly, including tuner units complete, volume control, dial sockets, screws, etc., costs £5 17s. (postage and packing 2s. extra). Stage 3 containing filter box assembly, including chokes and metal box costs 7s. (postage and packing 1s. extra). Stage 4 includes 7in. × 4in. elliptical speaker output stage with transistor, transformer, sub-chassis and plug costs £2 6s. 6d. (postage and packing 1s. 6d. extra). The above items should be purchased in the order indicated so that the set can be built up in the simplest manner.

Tools Required

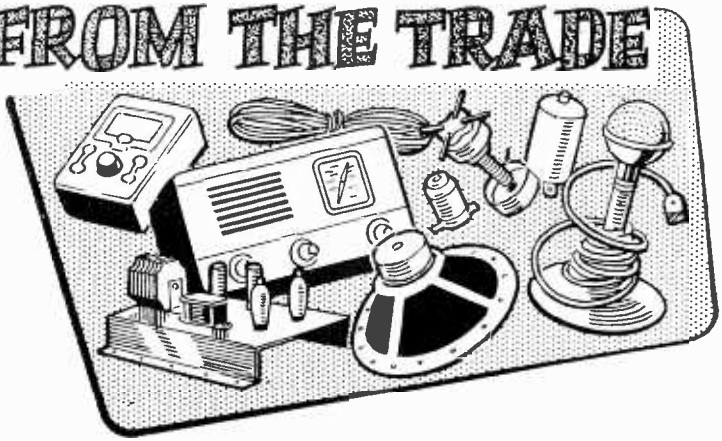
The set can be constructed using only the following tools: electric soldering iron, small screwdriver, pair of cutters, medium-sized screwdriver, pliers and razor blade.

An electric soldering iron with a fine bit is essential when wiring the printed circuit board and these are also available for 12 v. or mains operation from the above firm together with the other tools mentioned if required.

When installed it is essential to fit suppressors to the engine and a complete suppressor kit together with fitting instructions can also be supplied by Mayra Electronics Ltd.

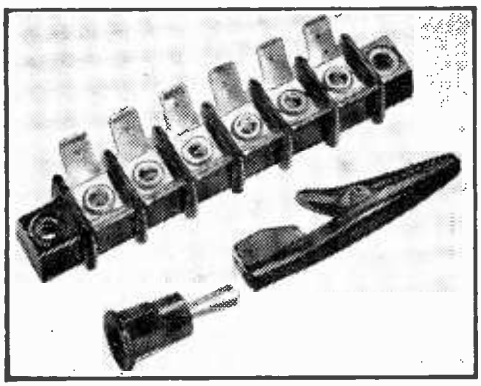
NEWS FROM THE TRADE

LATEST DEVELOPMENTS IN RECEIVERS AND COMPONENTS



TERMINAL BLOCK AND CROCODILE CLIP

CREATORS LTD., Sheerwater, Woking, Surrey, announce their new Faston A-MP type terminal block, which is available in various lengths up to 20-ways, and has been specially designed for use with A-MP type crimped terminals. These blocks accommodate in each way an insert having from two to six tags. Various types of tag are available. Prices vary from 1s. to 5s. each, according to quantity and the type of tag.



Terminal block and new type crocodile clip.

The crocodile clip, also shown on the illustration, is made of polystyrene with a brass insert. Connections can be made to the body of the clip by any standard single stem plug, thus obviating the necessity for an insulated shroud. The overall length of the clips is 2in. These clips, being of plastic, are rust-proof, which makes them particularly suitable for outside applications. Prices are 1s. each and the clips are available in black or red.

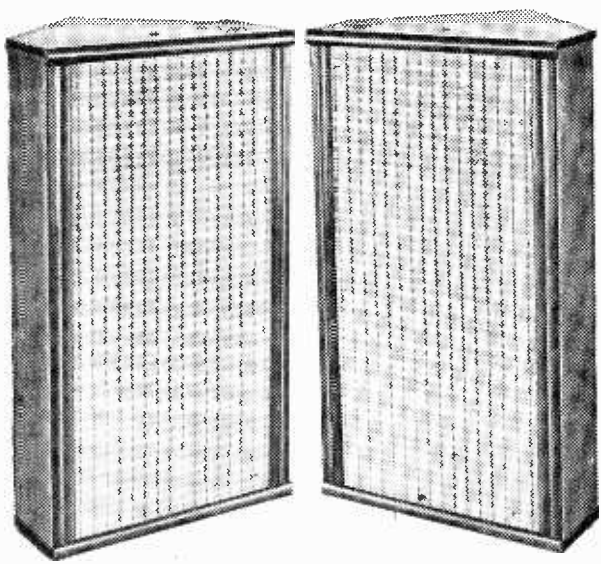
NEWMARKET PRICES

THE Intermediate Power Transistor, which was introduced by Newmarket Transistors Ltd., Exning Road, Newmarket, Suffolk, in April this year, has now been reduced in price by more than one-third. Increases in efficiency and production in the Newmarket factory have reached the stage where it is possible to pass on this price reduction to the customer. It is now hoped that the intermediate power types V60/20IP, V30/20IP and V15/20IP will obtain wider usage in many applications including R.F. transmitters, domestic receivers and D.C. converters.

"STENTEREO" LOUDSPEAKER SYSTEM

AT the Autumn Audio Fair, held in Harrogate in October last year, Whiteley Electrical Radio Co. Ltd., of Mansfield, Notts, introduced a stereophonic loudspeaker system called the W.B. "Stentereo" System. It consists of two corner loudspeaker enclosures which embody many novel features. The enclosures are divided into two sections, the lower section taking the form of an infinite baffle into which may be fitted a W.B. Stentorian loudspeaker type H.F.810 or H.F.812. In the upper section of the cabinet

(*Continued on page* 1011)



W.B. "Stentereo" System consisting of two loudspeaker enclosures.

a type S.510 loudspeaker can be used and the two loudspeakers are coupled by means of a cross-over unit type CX.1500. Provision is made in the upper section of the cabinet for rotating the H.F. loudspeaker on its baffle, so as to obtain the best stereo effect. (A single cabinet may be used for single channel listening.) The unit is 22in. high, 12¼in. wide and 10in. deep. The total cost is £14 12s. 3d. for each cabinet, using the H.F.810, and using the H.F.812, each cabinet would cost £15 13s. 9d.

COAXIAL CABLES

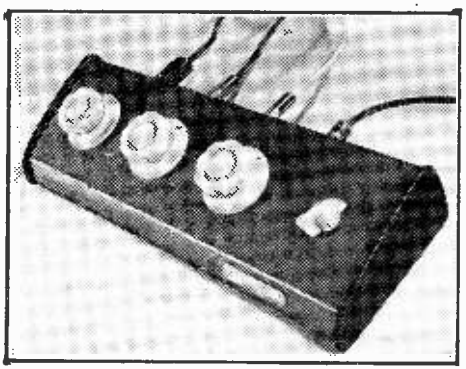
AERIALITE LTD., Castle Works, Stalybridge, Cheshire, inform us that the price of their Aeraxial cable, Cats. 597 and 598 is now 9d. per yard, retail.

A MIXER UNIT

PENCO PRODUCTS, King's Langley, Herts, announce the "Epigram" transistorised pre-amplifier and mixer unit, which has been designed to provide mixing facilities for three channels and is intended for the more serious user of tape recorders and amplifiers. There are three inputs: two for low impedance (15 to 30 ohms) and one for high impedance. There are four controls on the panel: three gain controls, one for each channel, and an on/off switch.

The input sockets at the rear accept standard jack plugs and the output is taken from a standard coaxial socket, and normally is of high impedance. The output lead is supplied with a coaxial plug at one end and screened jack plug at the other and is approximately 1 yard long.

Input matching transformers are not used in the unit and microphony is avoided by the use of transistors. A 4-volt mercury cell is the power supply and as the current consumption is low, the battery has long life. The use of a battery eliminates mains hum which is often a problem in pre-amplifiers. No tone controls are provided on the standard models since these will normally



"Epigram" transistor mixer unit.

be present on the existing equipment. This modern-style unit, some 14in. long, is finished in light-coloured stove enamel, with large cream control knobs.

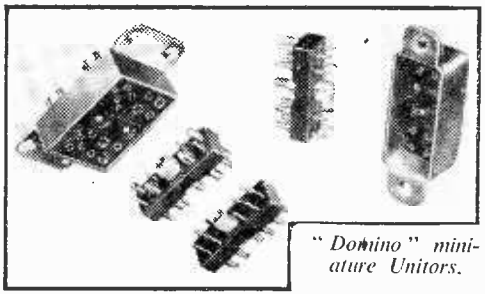
There are two standard models: the MIX/3, at 19 guineas, uses three transistors and feeds into the high impedance, microphone input of a tape recorder or amplifier. The MIX/35, at 25 guineas, uses five transistors to give a greater output signal.

"DOMINO" MINIATURE UNITORS

MORE details are now available regarding the range of "Domino" miniature Unitors originally introduced by Belling & Lee earlier in the year.

These miniature Unitors have been designed for use on small equipment where space and weight considerations prevent the use of the standard Unitor.

There are three basic plug and socket versions comprising two 8-way types (one with four small and four large pins, the other with eight small pins) and one 12-way type. Surface and flush



"Domino" miniature Unitors.

mounting metal shrouds are available to accommodate one, two or three Unitors, thus giving a wide choice of pin combinations and arrangements.

Body mouldings—which are of black, moisture and tracking resistant phenolic material—are coded on each side of both plugs and sockets to facilitate wiring and fault finding.

Plug pins are formed from brass and supplied either gold- or silver-plated. Socket pins are of beryllium copper, slotted to ensure good contact with the plug member. Each assembly has a locating centre pin which polarises the plug on engagement, and an 8 B.A. stud is provided for mounting the Unitor on chassis or panel. (Belling & Lee, Ltd., Enfield, Middlesex.)

ANTI-STATIC RECORD CLEANING KIT

THE Chemicals Division of Thorn Electrical Industries, announce that they have commenced production of a record cleaning kit, to be marketed under the brand name "EXstatic."

The kit comprises a special polythene atomiser bottle containing "EXstatic" cleaning fluid and a foam-plastic pad for distributing the fluid evenly over the record. The pad is non-hardening and can be easily washed. The fluid gives powerful anti-static treatment and safely removes the fine abrasive particles which may be found in the micro-grooves.

The bottle and pad are contained in a small attractive compact. The complete outfit retails at 3s. 6d. and supplies sufficient fluid to treat up to 200 sides of 12in. L.P. records. Thompson, Diamond and Butcher have the sole agency for this product in England and Wales, and their address is 5-9, University Street, London, W.C.1.

NEWS FROM THE CLUBS

NORTHAMPTON SHORT WAVE RADIO CLUB

Hon. Sec. : J. Tate (G3LGT), 57, Edinburgh Road, Northampton.

AT the Annual General Meeting, the following officers were elected : President, B. Sykes (G2HCG) ; Chairman, I. C. Millar ; Vice Chairman, M. Perry (G2ANS) ; Treasurer, B. Cadd ; Hon. Sec., J. Tate (G3LGT) ; and Committee Member, S. Befridge (G3ITW). The meeting also voted that the annual subscription remains at 7s. 6d., and meetings continue to be held at 8, Duke Street, each Thursday. Prospective members and visitors are always welcome.

SPEN VALLEY AMATEUR RADIO SOCIETY Affiliated R.S.G.B.

Hon Sec. : Norman Pride, 100, Raikes Lane, Birstall, W. Leeds.

THE above club are holding their Annual Dinner, at Hagenboch's Cafe, Dewsbury on Saturday, January 24th, at 6.30 p.m. There will be the usual attractions. The Guest Speaker will be Mr. I. C. I. Lamb, Station Engineer of the Emley Moor Transmitter of the Independent Television Authority. Entertainment will be provided by members of the Society. Tickets, price 11s. 6d. each, are obtainable from the Social Secretary, Mr. J. J. Rose, 14, South View Terrace, Hill Head, Dewsbury.

Correction

The fixtures under the heading of The Bradford Amateur Radio Society given in the January issue should have been under the heading of the above society.

THE BRITISH INSTITUTION OF RADIO ENGINEERS

THE following Institution meetings will be held during January :—

London. At London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1.

Friday, January 23rd, 6.30 p.m. Inaugural meeting of the Institution's Medical Electronics Group. An Address will be given by Professor A. V. Hill, C.H., M.A., Sc.D., F.R.S.

Wednesday, January 28th, 6.30 p.m. Papers on Mechanical Speech Recognition : "Theoretical Aspects of Mechanical Speech Recognition," by Professor D. B. Fry, Ph.D. ; "The Design and Operation of the Mechanical Speech Recogniser at University College, London," by P. Denes.

Bristol—South Western Section.

Thursday, January 29th, 7 p.m. "Recent Developments in Printed and Potted Circuits," by H. G. Manfield. At the School of Management Studies, Unity Street, Bristol, 1.

Cardiff—South Wales Section.

Wednesday, January 14th, 6.30 p.m. "Computer Control of Machine Tools," by H. Ogden, B.Sc.(Eng.). At Cardiff College of Advanced Technology.

Edinburgh—Scottish Section.

Friday, January 16th, 7 p.m. "Satellite Development and the Moon Rocket," by P. H. Tanner, B.Sc. At the Department of Natural Philosophy, The University, Drummond Street, Edinburgh.

Glasgow—Scottish Section.

Thursday, January 15th, 7 p.m. "Satellite Development and the Moon Rocket," by P. H. Tanner, B.Sc. At the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow.

Malvern—South Midlands Section.

Thursday, January 29th, 7 p.m. "Industrial and Underwater Television," by B. V. Somes-Charlton. At the Winter Gardens, Malvern.

Newcastle-on-Tyne—North Eastern Section.

Wednesday, January 14th, 6 p.m. "The Design and Construction of an Electronic Digital Computer," by R. W. Walker. At the Institution of Mining and Mechanical Engineers, Neville Hall, Westgate Road, Newcastle-on-Tyne.

Wolverhampton—West Midlands Section.

Wednesday, January 21st, 7.15 p.m. "Learning Machines," by P. Huggins. At the Wolverhampton and Staffordshire College of Technology, Wulfruna Street, Wolverhampton.

THE LONDON SHORT WAVE CLUB

Hon. Sec. : K. R. Piper (G3LOO), 2, Catherina Terrace, Stockwell, S.W.8.

REGULAR weekly meetings are now being held, and quite good attendances are being obtained. We would, however, welcome more members, and visitors.

The Club station should be operational by the time these notes appear, under the club call G2CLR. Activity is at present on Friday only, between 7.30 and 9.30 p.m. all bands from 80 to 10 metres. During the teething period we would appreciate reports from any source, direct to the Secretary or via QSOs.

January 16th. G3MEO/T will be giving a demonstration of amateur TV equipment. This will be an informal "do," questions welcomed.

January 30th (provisional). Cossor lecture on test equipment including oscilloscopes.

Alternate weeks will be devoted to items of internal interest, and instructional features, C.W. class, etc.

HALIFAX & DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec. : A. Robinson, G3MDW.

AT the monthly meeting of the above Society held at the Sportsman Inn on December 2nd, 1958, there was a very good attendance of members to hear a lecture on crystal microphones by Mr. Newman, of Keighley, who illustrated his lecture by the use of slides. The meeting was presided over by Mr. Makin, G3FDC.

The next meeting was held on January 6th, 1959, and Mr. Duncan Enock, G3KLZ, gave a lecture on fault finding made easy.

BRADFORD AMATEUR RADIO SOCIETY

Hon. Sec. : D. M. Pratt, G3KEP, "Glenluce," Lyndale Road, Eldwick, Bingley.

JANUARY 13th. Mobile operation. J. J. Platt (G2VO).

Jan. 27th. Display of members' gear.

February 10th. Colour television. G. N. Patchett, Ph.D., B.Sc., M.I.R.E., M.Brit.I.R.E., M.I.E.E., at the Bradford Institute of Technology.

February 24th. Transmitter design and construction. D. M. Pratt (G3KEP).

March 10th. Junk sale.

March 24th. Annual general meeting.

April 7th. Stereophonic sound reproduction. F. Thislethwaite.

April 21st. Visit to Esholt Sewage Works. Meet at Esholt Hall at 7 p.m.

May 5th. Field day arrangements.

May 26th. Visit to Emley Moor I.T.A. station (date provisional).

June 9th. Oscilloscope design and construction. G. F. Craven.

June 23rd. Subject to be announced later. L. A. F. Stockley (G3EKE).

July 7th. Colour photography. A. R. Bailey, M.Sc. (G3IBN).

July 21st. Informal meeting.

August 18th. Informal meeting.

September 8th. First meeting of new session.

Except where otherwise stated meetings commence at 7.30 p.m. Morse classes are held by arrangement before meetings. We welcome to our meetings all interested in radio or television.

PUBLICATIONS AND CATALOGUES RECEIVED

SEMI-CONDUCTOR BIBLIOGRAPHY from the Newmarket Transistor Co. Ltd. A reference to all that has been published on semi-conductors for the past 15 years.

A GUIDE TO AMATEUR RADIO issued by the Radio Society of Gt. Britain. Price 4s. post free.

R.S.G.B. CALL BOOK. The 1959 Edition of Amateur Radio Stations in this country. By the Radio Society of Gt. Britain, price 4s. post free.

SECOND REPORT OF THE MOBILE RADIO COMMITTEE from H.M. Stationery Office. Price 1s. 6d. net.

VALVES AND SEMI-CONDUCTORS FOR THE RADIO AMATEUR from the Mullard Company. This lists, with abridged data, those valves and semi-conductors which are of especial interest to the radio amateur.

...another TRS Winner

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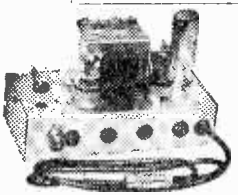
Latest 4-sp. BSR Player Unit and P.U. ... ... £4.12.6 carr. 3/6
2 v. Amplifier wired complete with speaker, etc., on Mounting Board. ... £3. 5.0 carr. 2/6
Contemporary styled light-weight case in Maroon and Grey. 14½in. x 11½in. x 6in. ... ... £1. 7.6 carr. 2/6

SPECIAL OFFER
all 3 units
only **£9** *carr. 4/6*



BAND 3 T/V CONVERTER—180 Mc/s - 205 Mc/s

Suitable for London, Midland, North, Scottish, Welsh and I.o.W. ITA Transmissions.

Mk. 2 Model, as illustrated. Latest Cascode circuit using ECC84 and EF80 valves giving improved sensitivity (+ 18db) over standard circuits. Built-in Power supply AC 200-250 v. Dimensions only 6½in. x 3in. Ht. 4in. Simple and easy to fit—only external plug-in connections, wired, aligned and tested ready for use. State Channel required. **Guar. Bargain Offer**—good results or full refund, only **£3.19.6.** Carr. & Pack., 2/6. Band 1-Band 3 c/o Switch and BBC aerial socket, fitted and wired to converter, 8 - extra.

CONVERTER ACCESSORIES
Band 1-Band 3 Cross-over Unit, 7/6. Var. Attenuators 6db-36db, 7/6. BBC Pattern Filter, 8/6. Band 3 Aerials—outside Single Dipole with 4 yds. co-ax., etc., 13/9. 3 Element Beam, 27/6. 5 Element, 35/-.

VOLUME CONTROLS

10,000 ohms—2 Megohms. All long spindles. Morganite Midget type. 1½" diameter. Guar. 1 year. Log. or Linear Ratios. Less Sw. 3/-. D.P. Sw. 4/9.

RESISTORS.—Full range, 10 ohms—10 Megohms. 20% ½ w. 3d., ½ w. 5d., 1 w. 6d., 2 w. 9d. 10% Hi-Stab. ½ w., 5d., ½ w. 7d. 5% ½ w. 9d. 1% Hi-Stab., ¼ w. 1/6 (10 ohms—100 ohms, 2/-).

RECORD PLAYER CABINETS
Contemporary style, ravine covered cabinet in fawn and brown with cream interior. Size Carr. and 18½ x 13½ x 9d. Ins. 3/6. 8½in., fitted with all accessories, including speaker baffle board and anodised metal fret. Space available for all modern amplifiers and autochangers, etc. Uncut record player mounting board 14 x 13in. supplied.

Cabinet Price **£3.3.0.**

2-valve AMPLIFIER Mk 2
Latest developed circuit giving a higher fidelity response and greater output (2-3 watts) using twin stage valve ECL82 and neg. feedback Tone Control. Complete with knobs wired and tested with 6in. Speaker, etc., ready to fit in above cabinet. Only **£3.19.6.** Carr. 2/6.

RECORD PLAYER BARGAINS
New Reduced Prices!

SINGLE PLAYERS 4-speed **BSR** (TU9), **92 6**; 4-speed **COLLARO JUNIOR, 90 -**; 4-speed **GARRARD** (4 S.P.), **£7.15.0. GARRARD** (TA Mk. II). **£9.5.0.** Carr. and Ins. 3/6.

AUTO-CHANGERS 4-speed **BSR** (UA8), **£6.19.6**; 4-speed **COLLARO, £7.19.6**; 4-speed **GARRARD** (RC121 D Mk. II) Plug-in head, **10 gns.** Carr. and Ins. 5/-. All above units are latest 4-speed models, fitted lightweight crystal pick-up and twin sapphire styli. Complete and ready to use.

FINEST SELECTION AVAILABLE—ALL BRAND NEW AND GUAR.

C.R.T. Heater Isolation Transformers

New Improved types—mains prim. 200/250 v. tapped.

All isolation Transformers now supplied with alternative *no boost, plus* 25%, and *plus* 50% boost taps, **at no extra charge.**

2V.	2A type	12 6	(P. & P. 1/6)
6.3V.	.6A ,,	12 6	,,
10.5V.	.3A ,,	12 6	,,
13V.	.3A ,,	12 6	,,

Other voltages in course of production.
Small size and tag terminated for easy fitting.

JASON F.M. TUNER UNIT 87-105 Mc/s.
Designer Approved Kit of parts to build this modern highly successful unit, drilled chassis and superior type dial. Coils, cans, and all quality components, etc., for only **5 gns.**, post free. Set of 4 spec. EF91s or equiv. valves, **30 -**, post free. Illustrated handbook with full details, **2 -** post free. FREE WITH KIT. 48 hr. alignment service, **7/6** plus 2/- P. & P.

VALVES

NEW BOXED				ALL GUARANTEED	
1R5, 1T4	7 6	DF96	9 -	EF41	10 6
1S5, 1S4	7 6	DK96	9 -	EF80	10 6
3S4, 3V4	8 -	DL96	9 -	EF86	13 6
5Z4	9 6	35L6	10 6	EF91	8 6
6AT6	8 6	EABC80	9 6	EL41	10 6
6K7	6 6	EB91	6 6	EL84	11 6
6K8	8 6	EBC41	10 6	EM85	11 6
6Q7	8 6	ECC82	9 6	EY51	12 6
6S87	8 6	ECC84	12 6	EY86	14 6
6V6	7 6	ECF80	12 6	EZ40	8 6
6X4	7 6	ECF82	12 6	EZ80	8 6
6X5	7 6	ECH42	10 6	EZ81	8 6
7C5	9/-	ECH81	10 6	MU14	9 6
7Y4	8 6	ECL80	12 6	PCC84	10 6
DAF96	9/-	ECL82	12 6	PCF80	10 6

				ALL GUARANTEED	
PCF82	10 6	PL81	14 6	UCH42	10/6
PCL83	12/9	PL84	14 6	UF41	10 -
PL36	13 6	PL82	10 -	UL41	10 6
PL83	11 6	PY80	9 6	UY41	8 6
PY81	9 6	PY82	8 6		
PY83	10,6	U22	8/6		
U25	13 6				

SPECIAL PRICE PER SET
1R5, 1T4, 1S5, 1S4 or 3S4, or 5Y4 ... ... 27 6
DK96, DF96, DAF96, DL96 ... ... 35 -
6K8, 6K7, 6Q7, 6V6, 5Z4 or 6X5 ... ... 35 -

RE-GUNNED TV TUBES
GENUINE OFFER

New Heater, Cathode and Gun Assembly can now be fitted to your old Tube—Reconditioned virtually as new. Fully guaranteed to highest standards—as used by our own Service Dept.

12in. **£8.** 14in. **£8.10.0.** 17in. **£10.**

Regret only Mullard and Mazda types at present. Delivery approx. 7 days. Carr. & ins. 12/6.

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ELECTROLYTICS ALL TYPES NEW STOCK

Tubular Wire Ends		32+32/350 v. B.E.C.	5 6
25+25 v., 50+12 v.	1 9	**Can Types, Clips 3d. ea.**	
25+50 v. T.C.C.	2 -	8+500 v. Dub.	3 -
50+50 v., 4+500 v.	2 -	8+8+450 v. T.C.C.	4 6
100+25 v., 2+450 v.	2 -	8+16,450 v. Hunts	5 -
8+450 v. T.C.C.	2 3	16+16,450 v. T.C.C.	5 6
8+8+450 v. B.E.C.	4 6	32+350 v. B.E.C.	4 -
8+16/450 v. T.C.C.	5 -	32+32/275 v. Hunts	4 6
16,450 v. B.E.C.	3 6	32+32/450 v. T.C.C.	6 6
16/500 v. Dub.	4 -	250+350 v. B.E.C.	8'6
16+16,450 v. T.C.C.	5 6	60/350 v. T.C.C.	6 6
32/350 v. B.E.C.	4 -	60+100/350 v. B.E.C.	11 6
32/500 v. Dub.	5 -	60+250/275 v. B.E.C.	12 6
50+50, 350 v. B.E.C.	6,6	100+200/275v. B.E.C.	12 6

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3 WAVEBANDS 5 VALVES
LATEST MIDGET B.V.A. SERIES

S.W. 16 m.—50 m.
M.W. 200 m.—500 m.
L.W. 800 m.—2,000 m.

Brand new and guar. A.C. 200/250 v., 4 pos. W.C. sw. Short-Medium-Long-Gram. P.U. socket. High Q dust core coils. Latest circuit technique, delayed AVC and neg. feedback O/P 4 watts. Chassis size 12½ x 5½ x 2½in. Dial 10in. x 4½in. Hor. or Vert. station names. Walnut or ivory knobs to choice. Aligned and calibrated ready for use. **Sensitivity and Quality at Low Cost.** Carr. and ins., 4/6.

7 Valve De Luxe, push-pull EL41 version, 7 watt output, with H Duty Output Transformer, £12.10.0. Carr. & ins., 5/-.

SPEAKER FRET.—Expanded Bronze anodised metal 8 x 8in., **2 3**; 12 x 8in., **3/-**; 12 x 12in., **4 6**; 12 x 15in., **6 -**; 24 x 12in., **9/-**, etc.

TYGAN FRET (Murphy pattern) 12 x 12in., **2 -**; 12 x 18in., **3 -**; 12 x 24in., **4/-**, etc.

SPEAKERS P.M. 3 ohm 2½in. Elac, **16 6.** 3½in. Goodmans, **18 6.** 5in. R. & A., **17/6.** 6in. Celestion, **18'6.** 7 x 4in. Goodmans, **13/6.** 8in. Rola, **20 -.** 8in. Special Cone G'mans, **21 6.** 10in. R. & A., **25 -.**

EMITAPE Recording Tape ALL NEW & BOXED.

	Type 88 (Stand.)	Type 99 (Long Play)
3in. ...	175ft., **7 -**	250ft., **9 -**
5in. ...	600ft., **19 -**	850ft., **24 -**
5½in. ...	850ft., **24'6**	1,200ft., **31 6**
7in. ...	1,200ft., **30 -**	1,800ft., **45 -**

Spare Reels (Unboxed) 7in. metal, **1/6**; 7in. plastic (EMI), **3 6.**

RECORDING TAPE.—1,200 ft. on 7 in. Plastic reel 88 type. Hi Quality Product. Each boxed, **22 6**

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80 OHM CO-AX CABLE

Semi-airspaced, low-loss, high quality 80 ohm co-axial. Stranded conductor, standard ¼in. dia. Famous make. **ONLY 8d.** per yard.

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20 yds. ...	12 6	30 yds. ...	20 -
Carr. 1/6		Carr. 2/-	

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Hours: 9 a.m.-6 p.m. 1 p.m. Wed. Open all day Saturday.

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50 yards Thornton Heath Station.

Buses: 130A, 133, 159, 166 and 193

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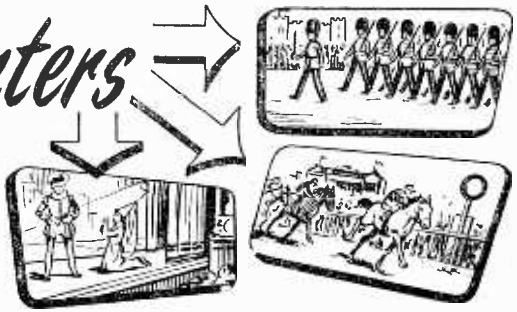


OUR CRITIC, MAURICE REEVE, REVIEWS SOME RECENT PROGRAMMES

"Lizzie Borden"

THE sixth in the *Verdict of the Court* series was an American trial, that of Lizzie Borden in 1893, who was found not guilty of the murder of her father and mother. It made noticeable a point that I have meant to draw attention to before; the increasing and fading out of volume at the commencement and termination of speeches and quotations in this type of programme and the documentary generally. As the narrator introduces a character he is brought on to the stage, as it were, from a great distance away, and, similarly, disappears when he has said his bit and done his stint. Many of his opening and closing words are lost together with, very often, the gist and point of what he is saying.

In this item Bessie Love, Mary Wimbush, Michael Balfour, George Coulouris and James McKechnie simulated the American accent with more realism than is usually imparted to it.

"The Kidders"

In this Monday Night Theatre presentation we had the unusual and unexpected event of the son and daughter of a distinguished English actor and former favourite in American films, brought in specially "as obvious choices for a play demanding authentic American accent and idiom" (*Radio Times*), to wit, Faith and Lyndon Brook, offsprings of none other than Clive Brook. Faith and Lyndon relapsed into the American accent with easy skill and confidence though they have long been living in England.

The "Fifty-one" Society

No more interesting subject than "What Future for Sound Radio" could have been found by the "Fifty-One" Society, so far as radio and television addicts are concerned. With Tom Driberg to initiate the debate and Neil Pearson in the chair, some lively and stimulating discussion resulted. The general consensus was that sound radio definitely had a future and that the drop in licences from the eleven million odd peak in 1951 had probably reached bottom.

"In Town Tonight"

After twenty-five years, *In Town Tonight* has been given an entirely "new look." Instead of the galaxy of visitors from all over the world, engaged, of course, as artists, and really forming an excellent half hour's variety programme: we are given a series of drab and dreary interviews with Londoners. Gone or *Knightsbridge*, the traffic noises, the flower sellers, etc., as well as the visiting artists and "interesting people who are in Town tonight." Instead we have just another interview programme, a variant of *Radio Newsreel*. Very boring and most unoriginal. Franklin Englemann takes John Ellison's place as introducer and Charles Chilton is the new producer.

"Scrapbook for 1918"

I always listen to the *Scrapbooks* with one hand on the volume knob of my set which I turn down for all the marching songs and music hall ditties which are so lavishly sprinkled throughout their pages. They seem so meaningless and incongruous in 1958. "Scrapbook for 1918" was no exception. Dedicated to the men in the services, in honour of the fortieth anniversary of the armistice, it was nothing but a "history" of the last year of the war with England playing the rôle of Atlas. Everyone else had either descended into mutiny or were too late coming in to be of much use. Not a mention of what had gone before. There were many poignant moments but it could have been greatly improved at several points.

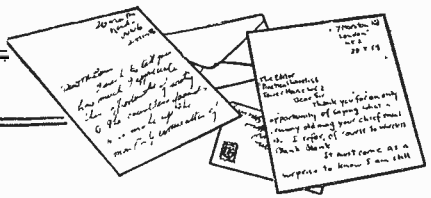
"Town Forum"

I hadn't heard a *Town Forum* before, until I listened to it from Lyons. The team consisted of Rebecca West, C.B.E., Maurice Edelman, M.P., Major-General Lyne, C.B., D.S.O. and Sir Norman Kipping, J.P.; with Denis Morris in the chair. On much the same lines as *Any Questions* and other similar programmes it did not go with the same panache or verve as Freddy Grisewood's show, probably because of the language difficulty. But everyone in Lyons seemed to enjoy it very much.

"With Courage"

Whilst British regimental bands practise "Deutschland Über Alles" and servicemen the "present" to German V.I.P.s, the BBC in the form of unveilings, war plays and *With Courage* programmes, offer us constant reminders of the two great wars of this century. Together with the spate of war films which pour out from the studios on both sides of the Atlantic, we are not likely to embrace our German cousins with the warmth and fraternity that might otherwise pertain. Two of the *With Courage* programmes I heard seemed to lack reality or conviction. Can anybody really be interested in them?

Open to Discussion



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

A Novice Licence

SIR.—I always look forward to my copy of PRACTICAL WIRELESS, and the first page to be opened at is "Transmitting Topics" and then "Open to Discussion," where I saw (page 832, December, 1958) that Novice Tickets got another "airing" by L. J. B., Birmingham.

If only the P.M.G. could see his way to issuing one, I think it would be the answer to clearing the air of *pirates* and gain him an increase in licence fees. I for one would pay twice the normal £2 fee.

Say, after a fixed time lapse of a novice ticket being issued, he was found to operate satisfactory a normal licence could be issued, after all experience on the air is what matters. I should know, I was prosecuted for it, but there are lots still getting away with it and always will when a little enjoyment is forbade them.—P. BLOOR (Burton-on-Trent).

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.

TV on Radio

SIR.—I was extremely interested in both Mr. B. K. Middleton's and Mr. D. Wickham's letters concerning TV sound on radio receivers.

I receive TV on my R.208 (10-60 Mc/s) very easily. The best frequency is 44 Mc/s, however. I can also hear it, still audible from at least 30ft., on 37.8 Mc/s. I receive all programmes (although Light, Home and Third are harmonics) on a 6ft. steel ruler.

I would be glad to answer any letters from readers concerning what one can pick up on a R.208, if they would enclose a stamped, self-addressed postcard.

I also would recommend a R.208 to any readers who want a radio receiving BBC/TV, Light, Home, Third programmes, Moscow, Hams, America and Sweden.—SIMON DIPLOCK (Hill Side, Tonbridge).

Stereophonic Sound

SIR.—We were interested to read your comments on stereophonic sound at the Radio Show. However, we would take issue with you on your remark that demonstrations were held "in almost laboratory conditions." In fact, conditions were very much the reverse, and it is normally to be expected that domestic conditions will give superior results than were to be heard at the Radio Show.

For one thing, in the home the walls are usually made of something more substantial than hardboard and therefore should not flex at low frequency. Nor is it to be expected that there will be a demonstration in the adjoining room operated at such power that at times it almost drowns one's own demonstration. Many of the demonstration rooms were much more "live" than the average living-room owing to the lack of furnishings, and many of the rooms were larger than under normal conditions, which also did not necessarily make matters easier.

The majority of the equipment on the market at present is designed for use in the home, and home conditions, while not necessarily ideal, should give superior results than are to be expected when demonstrations are given under other conditions.—F. H. KNIGHT (Technical Service Department, Cosmocord Ltd.).

Correspondents Wanted

SIR.—I am 17 years of age and I am very interested in radio as a hobby and I would like to correspond with any amateurs of the same age.—J. E. MAYS (20, Bell Lane, Hendon, London, N.W.4).

SIR.—I wish to correspond with short-wave listeners and any radio amateurs who are 14 years of age.—R. A. MCEWEN ("Kiltane," 5, Melville Terrace, Stirling, Scotland).

Using Transistors

SIR.—I have read many criticisms of transistors and should like to add my experiences to those which have already been given on this subject. Firstly, they are definitely worth while, *provided that they are used correctly*. This is the most important point as I have found that many constructors just use them in more or less standard valve circuits and express dissatisfaction at the results. They do not replace the valve. They are a different component, but if used properly they are able to give a very good account of themselves. It is not necessary to use miniature resistors, etc. Some constructors appear to think that they must use miniatures, but naturally, if advantage is to be taken of the small transistors then miniatures enable a small unit to be made up.

8-WATT PUSH-PULL AMPLIFIER

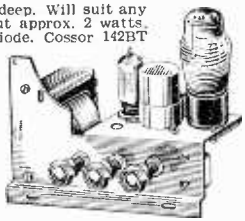
COMPLETE WITH CRYSTAL MIKE AND 8in. LOUDSPEAKER

A.C. mains 100/250 v. Size 10½in. x 6½in. x 2½in. Incorporating 6 valves, H.F. pen., 2 triodes, 2 output pens., and rectifier. For use with all makes and types of pick-up and mike. Negative feed back. Two inputs, mike and gram., and controls for same. Separate controls for Bass and Treble lift. For use with Std. or L.P. records, musical instruments such as Guitars, etc. **£4.19.6** Plus P. & P. 7/6.

Or 35/- deposit Plus P.& P. 7/6, and 3 monthly payments of 25/-.

PORTABLE AMPLIFIER

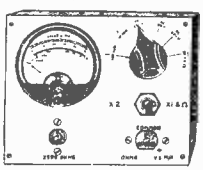
Size 6½in. long, 5in. high, 2½ in. deep. Will suit any type of crystal pick-up. Output approx. 2 watts. Incorporating ECC83 double triode. Cossor 142BT output pentode and contact-cooled rectifier. Fully isolated mains transformer for 230/250 A.C. mains. Base, treble and volume controls.



49/6 Plus P. & P. 3/6.

5in. SPEAKER with O.P. TRANSFORMER, purchased with the above, 18/6, plus P. & P. 1/6.

AC/DC POCKET MULTI-METER KIT

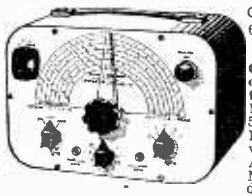


Comprising 2in. moving coil meter, scale calibrated in AC/DC volts, ohms and milliamps. Voltage range AC/DC 0-50, 0-100, 0-250, 0-500. Milliamps 0-10, 0-100. Ohms range 0-10,000. Front panel, range switch, wire-wound pot (for ohms zero setting), toggle switch, resistor and rectifier. In grey hammer finish case.

19/6 Plus P. & P. 1/6 Built and tested 7/6 extra.

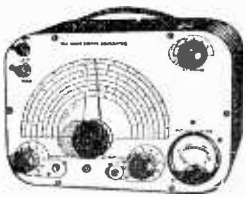
Point to point wiring diagram 1/-, free with kit.

SIGNAL GENERATORS



Cash £6.19.6, or 25/- deposit and 6 monthly payments of £1/6. Post and Packing 5/- extra.

Coverage 100 Kc/s-100 Mc/s on fundamentals and 100 Mc/s to 200 Mc/s on harmonics. Metal case 10in. x 6½in. x 5½in., grey hammer finish. Incorporating three miniature valves and Metal Rectifier. A.C. Mains 200/250 v. Internal Modulation of 400 c.p.s. to a depth of 30%; Modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch, variable A.F. output. Incorporating magic eye as output indicator. Accuracy plus or minus 2%.



Cash £4/19/6, or 25/- deposit plus P. & P. 5/- and 4 monthly payments of 21/6, plus P. & P. 5/-.

Coverage 120 Kc/s-84 Mc's. Metal case 10in. x 6½in. x 4½in. Size of scale, 6½in. x 3½in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30%, modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch, variable A.F. output and moving coil output meter. Grey hammer finished case and white panel. Accuracy plus or minus 2%.

2 Valve and rectifier

AMPLIFIER KIT

Approx. output 2 watts, negative feedback, tone and volume controls. All the parts to make above less chassis speaker and O.P. transformer. (2 of these would be suitable for stereophonic.) 19/6, P. & P. 3/-.

B.S.R. MONARCH

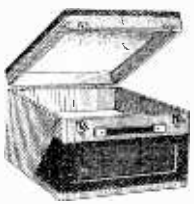
UA8

4-speed, plays 10 records 12in., 10in. or 7in. at 33, 45 or 78 r.p.m. Intermixes 7in., 10in. and 12in. records of the same speed. Has manual play position; colour brown. Dimensions: 12½ x 10½in. Space required above baseboard 4¼in., below baseboard 2½in. Fitted with Full-Fi turnover crystal head.

£6.19.6 Plus 5/- postage & packing, or 25/- deposit and P. & P. 5/- and 5 monthly payments of 27/-.

COLLARO MIXER 4-SPEED AUTOMATIC CHANGER

Model 457. Type "O" Pickup. size 12in. x 13½in. Minimum clearance above baseboard 5in., below 2½in., 10 records. A.C. mains 200-250 v. Turnover crystal head. BRAND NEW. Fully guaranteed. 25/- deposit plus P. & P. 5/- and 7 monthly payments of 25/-. Cash **£8.19.6** Plus P. & P. 5/-



PLAYER CABINET

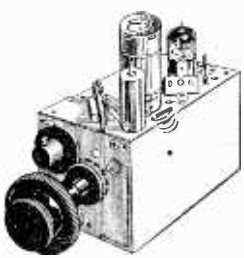
Finished in 2 tone leatherette, will take B.S.R UA8, with room for amplifier and 7 × 4 speaker. Overall size 15½in. × 13½in. × 9½in.

£2.19.6 Plus 5/- P. & P.

13 CHANNEL TUNER

I.F. 11-16 Mc/s. or 34-38 Mc s. (state frequency required) complete with PCF80 and PCC84. These have been removed from chassis.

19/6 Plus P. & P. 2/6. Knobs 3/6 extra.



CONSTRUCTORS' PORTABLE PARCEL

Comprising case, chassis, top plate, scale, 5in. P.M. speaker with O.P. trans., twin gang, 2 470 Kc/s. I.F.s., trimmers, four valve holders, wave-change switch and volume control with switch.

39/6 Plus 3/6 postage & packing.

MAINS TRANSFORMERS

All with tapped primaries. 200-250 volts. 0-160, 180, 200 v., 60 ma., 6.3 v. 2 amps. **10/6.** 320-0-320 v. 75 ma., 6.3 v., 2.5 amp., 5 v., 2 amp., **10/6.** 350-0-350 v. 250 ma., 6.3 v. 7 amp., 5 v. 2 amp., **19/6.** Postage and packing on the above 3/-.

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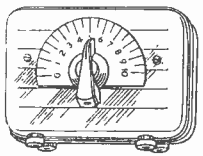
A MINI TRANSISTOR RADIO



AN IDEAL PRESENT

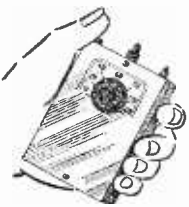
A two-stage highly sensitive circuit uses a new super high gain transistor coil and mini tuning condenser. Gives remarkable performance. With step-by-step instructions. Beginners can't go wrong. Get your order in while prices are low. Send 2/- for wiring diagram and component price list.

Total building costs **37/6**

Includes Plastic case mini ear-piece. Batteries etc. All parts sold separately.

Ideal for:
- Late night listening.
- Children's nursery, etc.

TRANSISTOR POCKET RADIO

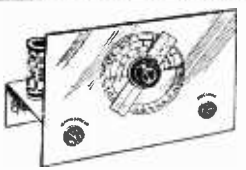


The ideal low cost transistor pocket radio for the beginner. The Two-Stage circuit utilises the new R.C.S. VARILOOPSTICK transistor coil. A specially designed miniature .0005 tuning condenser permits the receiver to be in a case which fits in the palm of your hand. Works for months off small battery costing 7d. Can be built in 30 minutes. PRICE **30/-**

All components are sold separately, full construction data, including plan to parts for 2/-.

IV. WORLD WIDE SHORT-WAVE RADIO

EXPLORE THE WORLD ON SHORT WAVES!



Can be built for from our list of components which can all be purchased separately, covers 10-100 metres and is capable of receiving speech and music from all over the world. Price includes the famous 954 acorn valve and one coil covering 40-100 metres. **35/-**

Provision is made to increase to two or three valves and all components are colour coded. Send 2/- for point to point wiring diagram, layout and price list.

PERSONAL PORTABLE RADIO

THE SET FOR PERSONAL LISTENING

This little set was designed to give you a real personal portable radio that you can listen to anywhere without disturbing others Use it on camping trips, in bed, in your office. Supplied with detachable rod aerial, it covers all the medium waves 200-500 metres. Average building time one hour. PRICE **35/-**

Send 2/- for specification, point to point circuit and parts price list.

Post and packing: Under 10/- add 9d.: under 40/- add 1/6: over POST FREE.

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LOUDSPEAKER ENCLOSURES COMPLETE & SPEAKER UNITS				
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Wharfedale Super 12 FS/AL	£17 10 0	£1 15 3	£1 10 2	£1 1 0
Goodmans Axiom 400	£16 1 0	£1 13 3	£1 7 7	19 3
Goodmans Axiom 300	£11 5 9	£1 4 0	19 4	13 6
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*Grundig TK35 ...	£86 2 0	£8 13 6	£7 8 5	£5 3 3
Sound 555	£68 5 0	£6 17 3	£5 17 8	£1 1 10
Stuzzi Transistor Battery	£72 9 0	£7 15 2	£6 4 0	£4 6 3
*Elizabethan 'Essex'	£68 5 0	£6 17 3	£5 17 8	£4 1 10
Stellaphone	£66 3 0	£6 12 6	£5 14 1	£3 19 5
Sound 444	£47 5 0	£4 14 6	£4 1 6	£2 16 9
*Plus Microphone				
TRANSCRIPTION RECORD PLAYERS				
Garrard 301 Stroboscopic	£23 0 11	£2 17 6	£2 8 3	£1 13 7
Connoisseur Type B	£29 5 3	£3 0 0	£2 10 4	£1 15 0
Lenco GL 58/RD (with Stereo Pickup) ...	£29 3 10	£2 19 6	£2 10 1	£1 14 11

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1A7GT	16/6	6X4	7/-	DF91	7/-	EF91	6/9	PY81	8/6
1D5	9/6	6X5GT	6/6	DF96	8/6	EF92	5/-	PY82	8/6
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1S5	7/6	7S7	9/-	DK92	8/6	EL84	8/9	U50	7/3
1T4	7/-	7Y4	8/-	DK96	8/6	EM80	9/6	U52	7/-
1U5	6/6	12AH8	9/-	DL33	9/-	EM81	9/6	U76	7/6
3A5	10/6	12AT7	8/-	DL35	14/6	EM84	*13/6	U78	7/-
3Q4	8/6	12AU7	7/6	DL92	7/6	EY51	11/6	UABC80	9/-
3S4	7/6	12AX7	8/-	DL94	8/6	EY86	12/6	UAF42	9/6
3V4	8/6	12BA6	8/-	DL96	8/6	EZ40	7/9	UBC41	8/6
5U4G	7/-	12K7GT	7/6	EABC80	7/9	EZ41	10/-	UBF80	9/3
5V4G	11/-	12K8GT	12/6	EAC91	5/6	EZ80	6/6	UBF89	9/6
5Y3GT	7/6	12Q7GT	7/6	EAF42	9/6	EZ81	9/-	UCC84	18/-
5Z4G	9/6	14S7	14/6	EB91	5/6	FW4/500	10/6	UCC85	9/-
6AL5	5/6	19AQ5	7/6	EBC33	7/-	GZ32	11/-	UCF80	19/6
6AM5	5/-	25A6G	11/-	EBC41	9/6	KT33C	8/6	UCH42	9/9
6AM6	6/9	25Z4G	9/-	EBF80	8/9	KT41	14/6	UCH81	9/6
6AQ5	7/-	25Z6G	9/-	ECC91	8/-	KT63	6/6	UCL82	13/-
6AT6	7/3	35L6GT	10/-	ECC82	7/6	MH4	6/-	UCL83	14/6
6BA6	7/6	35Z4GT	7/6	ECC83	8/-	MU14	9/-	UF41	8/6
6BE6	7/-	35Z5GT	8/6	ECC84	9/6	N18	8/6	UF42	15/-
6BH6	9/-	43	12/6	ECC85	9/6	PCC84	9/-	UF89	9/-
6BJ6	7/6	50CD6G	26/9	ECF80	11/6	PCF80	9/-	UL41	9/3
6BR7	10/6	50L6GT	8/6	ECF82	11/6	PCF82	12/-	UL44	22/6
6BW7	7/6	AZ1	12/6	ECH35	10/-	PCL82	12/-	UL84	8/6
6CD6G	26/9	B36	15/6	ECH42	9/6	PCL83	14/6	UR1C	9/6
6F6G	6/6	CL33	16/9	ECH81	8/6	PENA4	11/-	UY1N	12/6
6K7G	4/6	CY31	12/6	ECL80	11/9	PEN36C	9/6	UY21	14/-
6K7GT	6/-	D77	5/6	ECL82	11/9	PEN45	6/-	UY41	6/6
6K8G	7/9	DAC32	10/6	EF39	5/6	PL33	22/6	UY85	7/6
6Q7GT	8/6	DAF91	7/8	EF41	9/6	PL81	15/-	VP4B	9/6
6SL7GT	7/-	DAF96	8/6	EF42	11/6	PL82	8/6	VP41	6/-
6SN7GT	7/6	DCC90	10/6	EF80	7/8	PL83	10/6	VP1321	21/-
6U4GT	11/-	DF33	10/6	EF85	14/-	PY80	8/-	W76	7/6
6V6G	7/-							W77	5/-
6V6GT	7/6							Z77	6/9

Postage 6d. per valve extra.
Any Parcel Insured Against Damage in Transit 6d. extra.

READERS RADIO

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

Finally, do use a heat sink. I have found more transistors which have been ruined by soldering than sets using printed circuits which have been ruined from the same cause.—SERVICE ENGINEER (Wolverhampton).

Ex-Service Reference Numbers

SIR,—In reply to Ian Hetherington's letter on ex-Service reference numbers, I would like to say that, although the actual number in question is not included I do, in point of fact, have a fairly comprehensive list. On this are included potentiometers and Yaxley switches.

I reproduce this list for the benefit of other readers even if not for Mr. Hetherington.

Potentiometer Code.

10C/8924—1 k	52034—25 k
10C/8927—25 k	52035—50 k
10C/8929—5 k	52036—100 k
(=CLR 4003/13 = DB1307/9)	52037—250 k
10C/9328—500 k	52038—370 k
10W/16190—200 k	52039—½ Meg
10W/3731—5 Meg.	52040—1 Meg.
AP/52040—	52041—2 Meg
10C/8740—	52044—5 k + 5 k
10C/10719—	52045—100 k + 100 k
52033—10 k	52046—½ Meg + ½ Meg

Ex-Service Yaxley Switch Code

10 FB 848—S.P.D.T.	10 F 1257—6 connector wave change
10 FB 847—D.P.D.T.	
10 FB 849— D.P. Triple Throw	10 F 3189—D.P.D.T.?

—M. PRITCHETT (Woking).

SIR,—I have access to the stores numbers you require, but I find that 10C/8676 does not exist, but 10W/8676 does. This is a variable, non-sealed resistor type 2154, 1 MΩ ± 20 per cent., 1½ watts. Body sizes: 1-9/16in. diameter, 1-1/32in. depth, 3-pin ½in. long spindle, ¼in. diameter, plain, 7/8in. length.—J. FRANCIS (Winchester).

"An Obscure Fault"

SIR,—I was interested to read about "An Obscure Fault" (J. Nelson, November issue). I have experienced similar trouble on a seven transistor portable I constructed recently. The main difference with mine is that reception deteriorates after the set has been switched on for some considerable time. This condition can be cured by shorting to chassis a resistor limiting the amplitude of the oscillator transistor (this I found out by accident) or by shorting the case of the oscillator transistor to H.T.

My receiver when working normally receives most of the medium-wave stations from 200 metres to 500 metres, making it appear rather more sensitive than Mr. Nelson's.

One thing I am sure of, and that is that the fault does not lie in the output stage, as when I have injected an audio signal into the output stage with the set in its non-working condition the output stage has resolved the signal normally. A meter connected in the push-pull stage gave me a reading of 25 mA consumption (Class B).

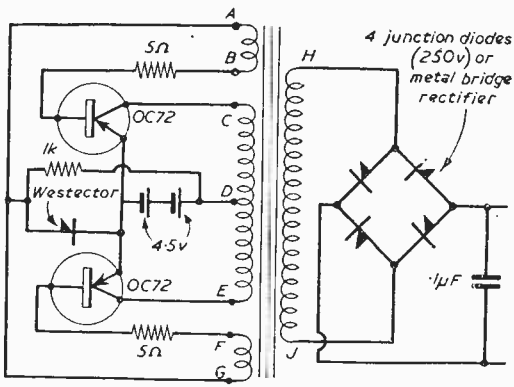
Another fault is that the set, for no apparent reason, fades out and the place of the programme is taken up by a violent crackling noise. This again can be cured by shorting out the above mentioned items. Any clues Mr. Nelson?—D. NEWMAN (S.W.16).

Electronic Flash Unit—Power Section

SIR,—I have had several letters from readers who have successfully constructed the Electronic Flash described in one of my articles recently published, asking for constructional information on the making of a transistor power supply to replace the batteries recommended in the article.

The circuit shown below is designed around the OC72 transistor and gives a power supply delivering approximately 5 mA at 250 volts. A small output transformer can be rewound to give the correct turns ratios as shown in the diagram, particular care being observed in connecting up the windings to give the correct polarity of outputs.

Some adjustment on test may be necessary to get the transistor multivibrator to oscillate; the diode resistance combination is included in the conventional manner to provide a "self-starting" facility. In use,



Circuit of transistorised power section for the Electronic Flash Unit described in the September issue.

the circuit, driven from two "flat" 9-volt batteries, should be switched on prior to closing the circuit connecting the flash electrolytic condensers, via the charging resistance.—HUGH GUY (Sunbury).

TRANSFORMER DETAILS

Turns	Start	Finish	Gauge
100	A	B	28 s.w.g.
300	D	C	28 s.w.g.
300	E	D	28 s.w.g.
100	F	G	28 s.w.g.
3,500	H	J	40 s.w.g.

Information Required

SIR,—Some time ago, I purchased an instrument called a "Portable Dose-Rate Meter Type 11178." It has a 50 μA meter to register the dose. The unit contains three thyratrons in parallel and the current is integrated to work the meter.

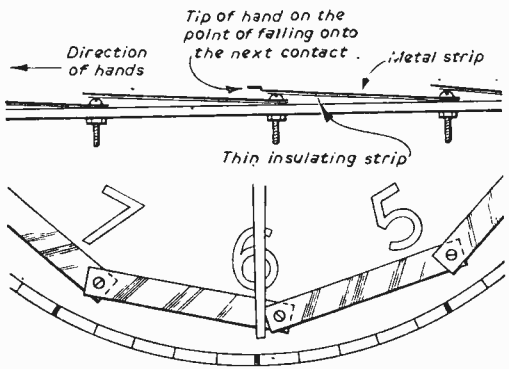
My trouble is the H.T. supply. There are a number of contacts inside the case, but information about the batteries is lacking. If any reader can supply information about the unit, I should be very grateful.—R. A. Y. (Cheam).

SIR,—I have a 1132 RX which covers 100-124 Mc/s which I wish to convert for the 144 Mc/s band and should be grateful for anyone's help.—JOHN R. TYE ("Inter-Nos," Swanton Morley, Dereham, Norfolk).

Automatic Time Switch

SIR,—May I suggest a modification to the automatic time switch described by E. N. Romley in the September, 1958, issue of "Practical Wireless"?

If, instead of studs around the clock face, a series of overlapping metal strips are bolted on, together with slightly shorter insulating strips underneath each, then the hands would always be in contact with a section and would drop from one to the next with a quick make-and-break action, as I have attempted to illustrate in the sketch below.



Proposed modification to the automatic time switch.

I should be interested to hear Mr. Romley's opinion.—A. W. BUCKINGHAM (Southall).

Electronic Organ

SIR.—I am surprised at the amount of interest my letter in the Open to Discussion column of the December issue of PRACTICAL WIRELESS has aroused among readers, and while I do not wish to be discourteous to, or damp the ardour of fellow readers, it must be appreciated that I cannot possibly write out constructional details and draw circuit diagrams, almost daily, for individual enquirers.

What seems to puzzle readers most is the use of a vibrating reed as half a condenser microphone in the organ I mentioned, which is used as the tone generator. It is very simple. Each tongue has adjacent to it a stud, which can be a brass screw, the studs are mounted on an insulated strip and are adjustable. The strip must be firmly mounted for these studs must not vibrate, as there will be a potential of at least 200 volts across tongue and stud, so beware they never touch.

It is better that this voltage should be in steps of 200, 300 and 400, controlled by a switch, and in no circumstances must this be supplied by the amplifier's H.T.: it must be entirely separate. All studs and all reeds are respectively connected very carefully and negative goes to the connected studs and positive to the connected reeds, and the latter with all their frames are earthed. The studs go to the grid of the amplifier, or preamplifier through a 100 kilohm resistor and a .1 μF condenser to earth.

I doubt that many readers could undertake the building of a complete reed organ, so the interested should buy one. There are thousands tucked away in the country which could be bought cheaply. Buy as simple a one as possible, and a harmonium if possible, that has bellows and an air chamber, an American organ is drawn, not blown, and has only the bellows. If there are more than one set of reeds block out the others with cardboard or plastic material, also for a start use the existing bellows and air chamber, you may fit a powered blower later. Also do not to be in a hurry to discard stops: couplers could be useful. Your ingenuity is called for in any such conversion, and since it is conversion I suggest no hard and fast rules can be laid down. —R. H. COWTAN (Thetford).

Beginner's Constructional Course II

SIR.—I recently suggested that I would like to see one of the "Beginner's Course" radios constructed by an absolute beginner. You were good enough to arrange, through your query department, that one was sent to me by a reader from London, E.5.

The radio concerned worked when the reader put pressure on various parts, and he often left a pair of pliers resting on one of the valves. The volume control did not work and the valves lit up like old fashioned bright emitters.

On inspection I found that the following points accounted for all the troubles:

1. Components not done up tight. Earth tags not tight.
2. Nearly every joint was of the "dry" type with the tag not tinned with solder.
3. The filament transformer fitted was not of the type recommended.
4. Some joints had "whiskers" of stranded wire not soldered in a safe position.

I put these matters right and on test the receiver worked very well.—E. V. KING (Author of Beginner's Constructional Course II).

"Making Ohm-meters"

SIR,—There is an error in Mr. Kendall's article on ohm-meters in the January, 1959, issue. On page 878, column two, it is stated that:

$$Rx = \frac{Rm(V1-V2)}{V2} \quad \text{or} \quad Rx = \frac{Rm(V1)}{V2} - 1 \text{ ohms.}$$

This second expression is wrong; it should read:

$$Rx = Rm\left(\frac{V1}{V2} - 1\right) \text{ ohms.}$$

Using the values given in Mr. Kendall's typical calculation, the first expression would give about 1,357 ohms.

Using the formula I give, the correct result is about 358 ohms.—W. E. THOMPSON (St. Leonards).

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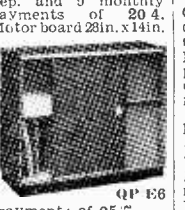

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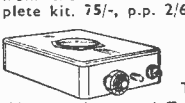

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AMATEUR WIRELESS AND WIRELESS MAGAZINE

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. AW403

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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

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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
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- ★ Variable tuning over medium waves.
- ★ Highly sensitive.
- ★ No aerial or earth.
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- ★ Economical.
- ★ Drilled and mounted chassis.
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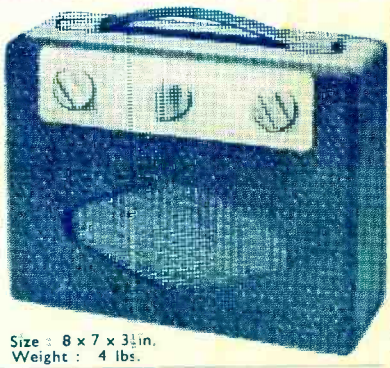

Size : 8 x 7 x 3½in.
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