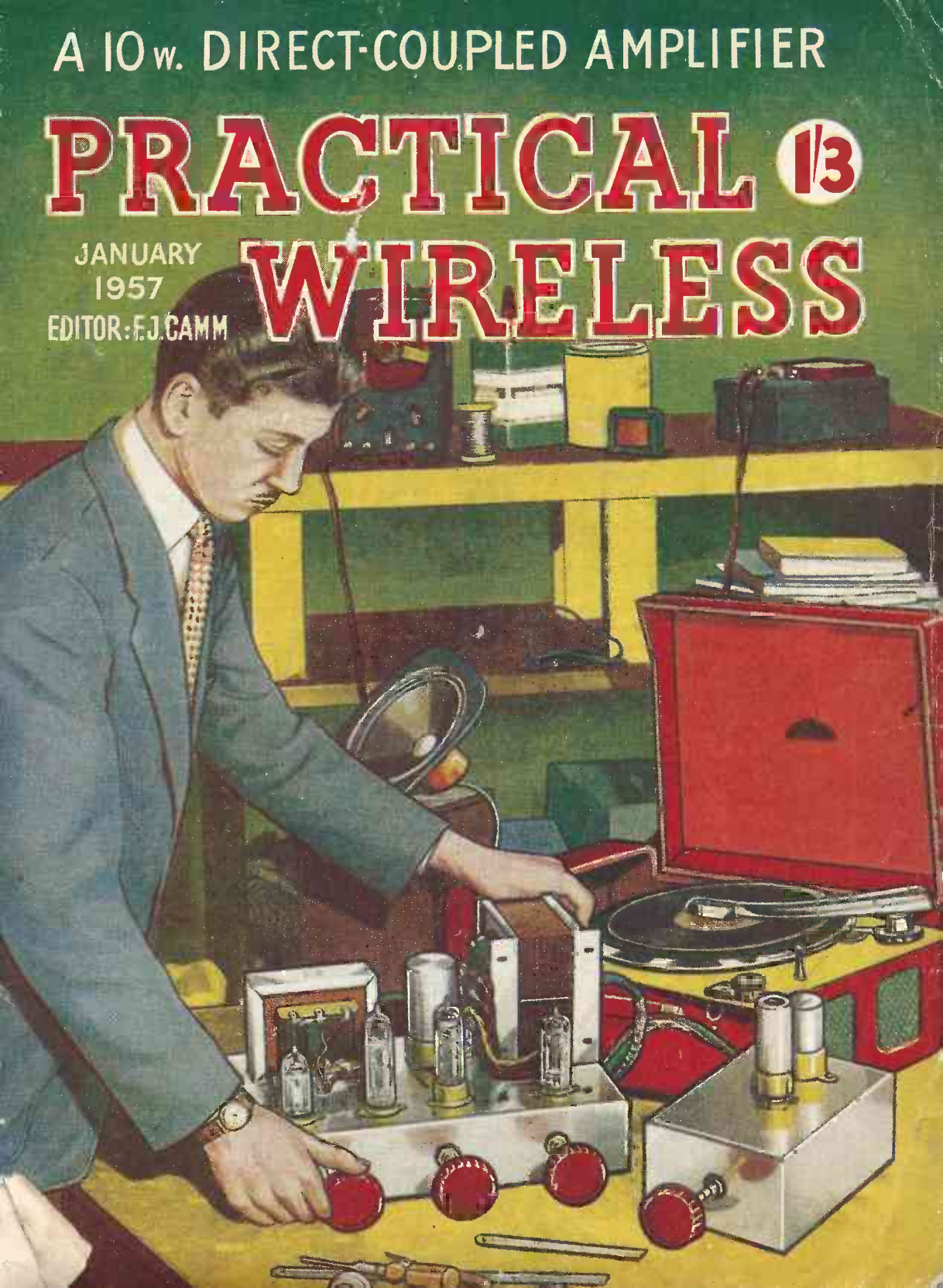
A 10 w. DIRECT-COUPLED AMPLIFIER

PRACTICAL WIRELESS

1/3

JANUARY
1957

EDITOR: F. J. CAMM



TRANSFORMERS, ETC.

HEATER TRANSFORMERS

	each
230 v. Input 2 v. 1.5 amp	5/-
230 v. Input 2 v. 3.0 amp	8/3
250 v. Input 4 v. 1.5 amp.	5/6
250 v. Input 4 v. 3.0 amp.	10/-
230 v. Input 5 v. 2.0 amp.	10/-
250 v. Input 6.3 v. .5 amp.	5/6
230 v. Input 6.3 v. 1.5 amp.	6/9
230 v. Input 6.3 v. 3.0 amp.	10/-
230 v. Input 12 v. .75 amp.	5/9
230 v. Input 6.3 v. 1.5 amp & 5 v. 2 amp.	14/3

OUTPUT TRANSFORMERS

Multi Ratio. Suitable for all ordinary receivers, giving six single ratios. 6/6 each.

HEATER AUTO TRANSFORMERS

Designed to adapt common low tension voltages 4 v., 5 v., 6.3 v. at 3 amps., centre tapped and interchangeable, each, 7/9.

TELEDICTOR TRANSFORMERS TYPE TE8

SMALL MAINS TRANSFORMERS

Suitable for TELEVISION CONVERTERS, Etc.

SPECIFICATION OVERALL SIZE

Primary : 230 v. Clamp Construction 50 c/s

Secondary 1 : 250 3.9in. x 2.4in. x v. 40 mA. 2in. Over Windings.

Secondary 2 : 6.3 Fixing Centres : v. 1.5 A. 3.3in. Price 15/-.

KNOBS -BAKELITE

LARGE PURCHASE—GOOD QUALITY

Type JK1 Cream 1¼in. diameter, Spring Fixing, Fluted Grip.

Type JK2 Brown 1¼in. diameter, Spring Fixing, Fluted Grip.

Type JK3 Brown 1¼in. diameter, Spring Fixing, Plain Grip.

(This one has White Ring on Knob Face.)

All have a small finger flange to avoid marking cabinets.

★ OFFERED AT A FRACTION OF ORIGINAL COST

Price 6d. each, 5/- doz. any types.

COMMERCIAL ALPHA CONVERTOR

Price, £6.15.0.

★Tuneable over Band III Range.
★Single Knob Channel Changing.
★4-Valve Circuit.
★Hammer-Tone Bronze Finish.

NOTE THE PRICE. £6.15.0.

Fully Guaranteed against Faulty Workmanship or Materials (other than valves) for 12 Months.

Our 1956/57 44 page Catalogue is now available. Please send 1/- in stamps.

SWITCHES

WAVE CHANGE SWITCHES, ETC.

3 pole, 4 way	2/9 each
4 pole, 3 way	2/9 each
4 pole, 1 way	1/9 each
1 pole, 12 way	2/9 each
2 pole, 6 way	2/9 each
TRP Switch 2 pole Changeover	1/6 each
3 pole, 3 way, 3 bank.	1/9 each.
2 pole, 3 way, 3 bank,	2/- each.
4 pole, 2 way, 3 bank,	1/6 each.
4 pole, 2 way	2/- each.
1 pole, 8 way,	1/9 each.
2 pole, 2 way,	1/9 each.

Yaxley Type, 1 pole, 3 way 1/9 each
Yaxley Type, 2 pole, 3 way 1/9 each
Yaxley Type, 4 pole, 3 way, 2 bank 2/- each

We have large stocks of Yaxley Type Switches. ALL BRAND NEW. With Long Locating Spindles. Various numbers of Switch and Wafer Combinations. To clear at the SPECIAL PRICE, 9/- Per Dozen, Post 1/6.

HEADPHONES—MICROPHONES

	pair
CLR Low Resistance type 120 ohms	7/6
Throat Microphones, American surplus. Complete with strap, lead and plug type T30B	3/- set
High Resistance Phones, 4,000 ohms. Complete with Jack plug	13/6
High Resistance DLR Phones	16/-

MAINS TRANSFORMERS

3-way Mounting Type

MT1
Primary : 200-220-240 v.
Secondaries : 250-0-250 v., 80 M/A. 0-6.3 v. 4 amp. 0-4 v. 2 amp. both tapped at 4 v., each 19/6

MT2
Primary : 200-220-240 v.
Secondaries : 350-0-350 v. 80 M/A. 0-6.3 v. 4 amp. 0-5 v. 2 amp. both tapped at 4 v., each 19/6

MT3
Primary : 200-220-240 v.
Secondary : 30 v. 2 amp. taps at 3 v., 4 v., 6 v., 8 v., 9 v., 10 v., 15 v., 18 v., 20 v., 24 v., each 19/6

2/- Packing and Post on above Transformers.

PUBLICATIONS

	each
No. 134—F.M. TUNER CONSTRUCTION by W. J. May ★Easy to Build, Point-to-Point Wiring ★Super High Fidelity Response ★32 Pages ★All Components for this Circuit available ex stock...	2/6
A comprehensive Valve Guide Book No. 2: International Edition. Includes all English, American and European receiving valves issued since 1954	5/-
No. 135—ALL-DRY BATTERY PORTABLE CONSTRUCTION. ★Simple and cheap to build ★Point-to-point wiring ★Dual Ferrite aerial for high sensitivity...	2/6
No. 100—A COMPREHENSIVE VALVE GUIDE, Book No. 1. No. 121—A COMPREHENSIVE VALVE GUIDE, Book No. 2 (Characteristics and Base Connections	5/-
No. 103: RADIOFOLDER "A" The Master Colour Code Index for Radio and Television	1/6
No. 114—RADIOFOLDER "E" An inexpensive Tape Recorder	2/6
No. 128 — PRACTICAL TRANSISTORS AND TRANSISTOR CIRCUITS	3/6
No. 130—PRACTICAL F.M. CIRCUITS FOR THE HOME CONSTRUCTOR	5/-
No. 140—T.V. SERVICING FOR BEGINNERS	4/6
No. 142—MODERN T.V. CIRCUITRY AND GENERAL FAULT FINDING GUIDE	4/6
SERVICING THE MODERN RADIO RECEIVER	1/6

Please include 4d. postage per copy.

CHOKES

20H. 250 ohms, 60 M/A. Clamp construction, each	6/-
10H. 200 ohms, 90 M/A. Clamp construction, each	9/3
10H, 200 ohms, 150 M/A. Clamp construction, each	13/-
10H. 300 ohms, 40 M/A Midget Clamp construction, each	5/3

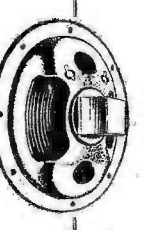
TRANSFORMERS FOR BATTERY CHARGERS

230 v. Input Tapped 6-12 v. 1 amp., each	13/6
230 v. Input Tapped 6-12 v. 3 amp. (Both with tap on Primary for 2.5 v. Pilot light), each	18/-

LOUD SPEAKERS

All P.M. Types Less Transformer

	each
WATERHOUSE 5in. Unit	17/6
PLESSEY 6½in. Unit	18/6
R. & A. 8in. Unit	18/6
PLESSEY 12in. Unit	35/-
LECTRONA 5in. Unit	17/6
GOODMANS 6½in. Unit	18/6
GOODMANS 8in. Unit	19/6
GOODMANS 10in. x 7in. Unit	19/6
R. & A. 6½in. Unit Mains Energised 600 ohms field	17/6
PLESSEY 9in. Unit Mains Energised 600 ohms field	21/-
GOODMANS or LECTRONA 8in. with Output Transformer	21/6



INFRAY LAMP

Means real comfort in bed as it emits Infra Red Rays which warm and keep you healthy.

- Economical.
- Costs only ½d. per hour (elec'y at 1d. per unit).
- Absolutely safe, no health or fire risk.
- Ideal for many other uses—over pet's basket, rearing pup, chicks, over desk, work bench, etc.
- All complete and ready to work.

Price 36/-

Post & Packing 2/-

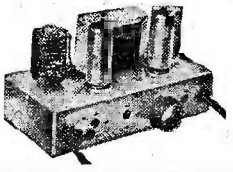
F.M. TUNER

This tuner is based upon the very successful circuit published by Data Publications. We have made up models at all branches and will gladly demonstrate. Stability is extremely good and making and aligning most simple. Cost of all parts including valves, prepared metal chassis, wound coils and stove enamelled scale, slow-motion drive, pointer, tuning knob. In fact, everything needed is **£6/12/6.** Data is included free with the parts or is available separately, price 2/-. Extra for fringe area model, 20/-.

SOMWEAVE

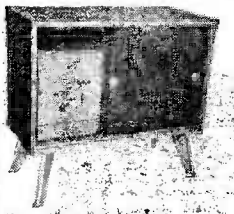
This really lovely loudspeaker fabric we offer at approximately a third of to-day's cost. It is 42in. wide and our price is **12/-** per yard, or panels 12in. x 12in., 1/9 each. This is also very suitable for covering plain wooden case, for portable radio amplifiers, etc.

The "ESTRONIC" Band III Converter



To-day's best value in Band III converters suitable for your T.V. or money refunded. Complete ready to operate, **49/6** non-mains or **69/6** mains, post and insurance 3/6.

CABINETS FOR ALL



The CONTINA

Another addition to our range of cabinets. This is of new revolutionary design, styled after the best of continental radios. Externally, it is finished in highly polished dark walnut veneer, with panelling picked out in gold. Interior is of same very high standard, its veneer being light mahogany which contrasts nicely with the dark walnut and generally gives a very pleasing appearance. The doors slide on metal runners and are fitted with gold insert finger plates. A really excellent cabinet for any home—size 3ft. 1½in. long, 1ft. 3in. deep, 2ft. 1½in. high, including legs which are 10in. from floor. Motor board 12½ x 17in., equipment aperture 17½ x 9½in. gives ample space for 8in. speaker. Ample storage space for recordings. Price **£19/19/-**, carriage and insurance 20/-.

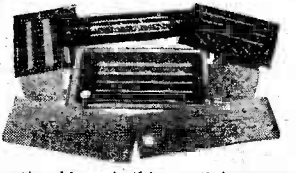
TRANSISTORS

Red spot replaces Mullard OC71, etc., **10/-**. Blue spot suitable R.F. up to 1.6 Mc/s, **15/-** each.

POCKET TRANSISTOR RECEIVER

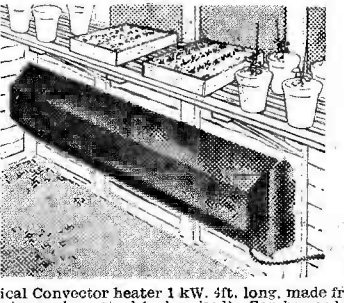
All the parts to build cigarette box receiver, **£2.17.6**, includes Ferrite aerials but not the earpiece, battery or case.

RADIO SCALES 6/6 DOZEN



An exceptional bargain this month is our assorted parcel of radio scales. A most useful collection for all who make up experimental or other radios. We offer twelve assorted scales mostly in two or three colours for **6/6**, plus 2/6 post and packing. Limited quantity only.

INSTANTUS HEATER



Practical Convector heater 1 kW. 4ft. long, made from heavy gauge sheet steel (galvanised). Can be used for any size house, up to three heaters can be controlled by one thermostat.
Price **£2.10.0** or with thermostat **£4.5.0**, carriage 5/-.

Wrap our heater cable around the pipes in your loft to prevent a freeze up. 21 yards with full instructions; 30/-, plus 1/- post and packing.

COMPONENT BARGAINS

.1 mfd. 350-volt metal cased condensers by Dubilier—small size 3/6 doz. or 36/- gross.

Philips Trimmers 0-30 pf. 1/- each or 11/- doz.

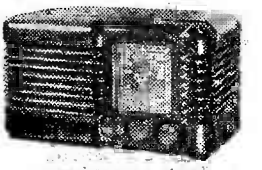
Moulded Mica Condensers, well mixed assortment 3/- doz., 30/- gross.

Silver Mica, well mixed assortment 3/- doz., 30/- gross.

50 mfd. 50 v. Bias Condensers T.C.C. 1/6 each, 15/- per doz.

Ceramic Trimmers, 5 to 30 pf., 6d. each, 5/- doz., 20 to 60 pf., 9d. each, 8/- doz., 20 to 100 pf., 1/3 each, 12/- doz.

Earpiece-microphone. American midget type 3/6 each, 36/- doz.



NEW CIRCUIT

OCCASIONAL 56. We have evolved a new T.R.F. circuit and have had really good results, equal in fact to many superhets. You really should try this circuit. All parts including valves (6K7, 6J7, 6F6 and 6X5) and bakelite case with back cost only **£5/10/-**, plus 2/6 post and insurance. Data included with the parts is also available separately, price 2/-.

DON'T STUMBLE IN THE DARK

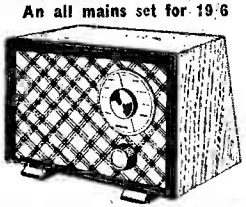
Install 2-way switches.
Our outfit comprises: 30 yds. Multicore cable, two 2-way switches, two wood blocks. Full instructions. 19/6 each (post and insurance 2/6).

ELECTRIC BLANKET WIRE

Waterproof P.V.C. covered, so blanket washable. 16½ ohms per foot—1/6 per yard. 14 yards, ideal for average blanket. £1 post free.

THE SKYSEARCHER

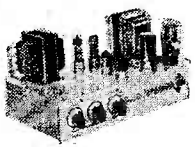
An all mains set for 19/6



This is a 2-valve plus-metal rectifier set useful as an educational set for beginners, also makes a fine second set for the bedroom, workshop, etc. All parts, less cabinet, chassis and speaker, **19/6**. Post & ins. 2/6. Data free with parts or available separately **1/6**. **3-valve battery version also available at the same price.**

FLUORESCENT LIGHTS

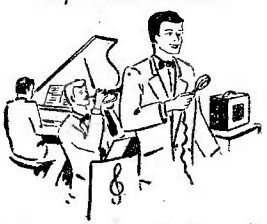
These are a complete fluorescent lighting fitting. Built-in ballast and starters—stove enamelled white and ready to work. Ideal for the kitchen, over the workbench and in similar locations.
Single 40. 4ft. 3in. long, uses a 40 watt tube. Price **39/6** complete with tube. Carriage and ins. 5/6.
Twin 20. Uses 2 20-watt standard tubes. Price **29/6** less tubes. Carriage and ins. 4/6.



MULLARD AMPLIFIER "510"

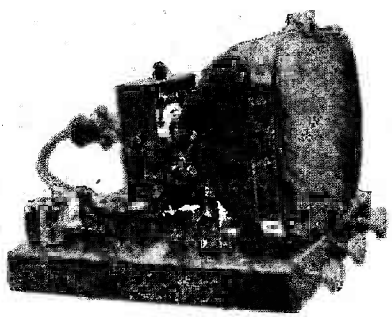
A Quality Amplifier designed by Mullard. Power output exceeds 10 watts. Frequency response almost flat from 10 to 20,000 C.P.S. For use with the Acos "Hi G" and other good pick-ups. Made up and ready to work is **£12/10/-** or **85/-** deposit, plus 10/- carriage and insurance.

19/6 AMPLIFIER



Construct a powerful three-valve mains amplifier. Ideal for dances, parties, etc. Complete less chassis, cabinet and speaker (available if required). Data **1/6** (free with parts).

THE UNI—T.V.



Undoubtedly the most up-to-date televisor for the home constructor. You can build all or only part and the set when finished will be equal to a factory-made equivalent. What other constructor T.V. has all these features?

- ★ Made up units if required.
- ★ All miniature valves.
- ★ Metal rectifier.
- ★ No expensive transformers.
- ★ 13-channel circuitry.
- ★ Multi-vibrator time bases.
- ★ Ferruxcube, E.H.T. and scan coils.
- ★ 34/38 Mc/s I.F.
- ★ Suitable for any modern 12, 14 or 17in. tube.
- ★ Modern contemporary cabinet if required.

The building cost (less tube) is only **£31/10/0**, plus 10/- carriage and insurance. All parts guaranteed 12 months. Full information and data free with parts or available, separately, price **3/6**.

T.V. Commercialising Outfit

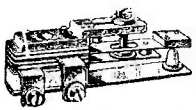
Do it yourself—it's really quite easy.
You will manage it in an evening and we guarantee

SUCCESSFUL RESULTS OR MONEY BACK

Our parcel contains :—	
I.T.A. Aerial	£2.5.0
36ft. I.T.A. Down Lead	12/-
I.T.A. Converter	£6/0/0
Full instructions	1/6

A special bargain price for all the above items if bought together is **£8/10/-** (Post and Insurance 4/6) Or **£2/10/-** down and 7 payments of **£1**.

THERMOSTATS

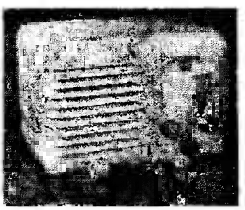


Useful for the control of appliances such as convectors, glue-pots, vulcanisers, hot plates, etc. Adjustable to operate over the temperature range 50-550 deg. F. 1½ amp., 3/6 ; 5 amp. 8/6 ; 2 amp. QMB, 5/6 ; 15 amp. QMB. 15/-.

CHASSIS ASSEMBLY

Superhet Chassis, 3-waveband, coloured scale, scale pan, pulleys, driving head, springs, drum, etc. Scale size 14½in. x 3½in. Chassis size 15in. x 15in. x 2in. Price 15/- plus 1/6 post. Note : We can supply cabinet for this. Price 39/6 plus 5/- carr. and insurance.

MAINS-MINI



Uses high-efficiency coils, covers long and medium wavebands and fits into the neat white or brown bakelite cabinet—limited quantity only. All the parts, including cabinet, valves, in fact, everything, **£4/10/0**, plus 3/6 post. Constructional data free with the parts, or available separately **1/6**.

HUGE MINISTRY PURCHASE

R.1155—yours for £2 down

Frequency 75 kc/s to 18 mc/s—10 valves—metal case—robust receiver—cost over £60 to make—will give years of service, very little used. Price **£10** or 5 payments of **£2**.

Carr. & transit case 15/- ex.

CAR STARTER CHARGER KIT

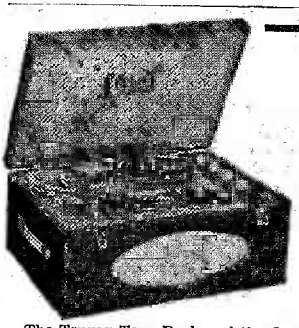
All parts to build 6- and 12-volt charger which can be connected to a "flat" battery and will enable the car to be started instantly. Kit comprising the following :—

Mains transformer	19/6
5-amp. rectifier	17/6
Regulator Stud Switch	3/6
Resistance wire	2/-
Resistance Former	2/6
Mains on/off Switch	1/-
0-5 amp. Moving Coil Meter.....	9/6
Constructional Data	1/6

or if bought all together price is **52/6**, plus 2/- post and packing.

T.R.F. CONVERTER

New this month is a converter for T.R.F. Set Viewmaster Electronic Engineering, etc. Small mods. to the T.V. are necessary as this must be turned into a superhet to stop re-radiating.
Price complete with two valves **£6.10.0** assembled.



UNDOUBTEDLY THE BEST VALUE YET OFFERED

Stern's "fidelity" Tape Recorder

ASSEMBLED & READY FOR USE £43

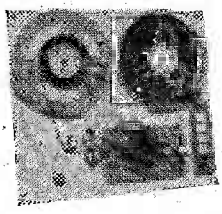
(Plus £1.10.0 Carr. and Insurance. £1 is refunded when packing case is returned to us.)
Terms £21.10.0 deposit and 12 monthly payments of £1.19.10 or £11.0.0 deposit and 9 months of £3.18.3.

IMMEDIATELY AVAILABLE TO MAIL ORDER CUSTOMERS

!! HOME CONSTRUCTORS !!

YOU CAN BUILD IT YOURSELF FOR £40

The Truvox Tape Deck and the Quality Amplifier are supplied tested and ready for use. The actual assembly of the Recorder is simple and only involves a few connections (a connection chart is supplied for this purpose). The items illustrated and described form the complete equipment and each are available for sale separately.

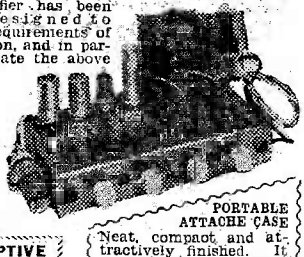


TRUVOX TAPE DECK MODEL Mk. 111/TR7/u

This is Truvox's new "small" design being only 14in. x 13in. The whole instrument is built to close engineering limits resulting in the minimum of "wow" and "flutter" values. It will play the NEW PRE-RECORDED TAPES and takes all standard tapes up to 1,200ft.

MODEL TRI/F QUALITY AMPLIFIER

This amplifier has been expressly designed to meet the requirements of enthusiasts for fidelity reproduction, and in particular to CORRECTLY operate the above TRUVOX DECK. It is supplied complete with a matched Elliptical 3 ohms P.M. Speaker. It incorporates an efficient Tone Control arrangement and has a Magic Eye Level Indicator (Operative on Record). It can also be used as a general purpose Amplifier for high quality reproduction of gramophone records direct from a Gram Unit. Price £14.14.0.



PORTABLE ATTACHE CASE

Neat, compact and attractively finished. It contains concealed pockets for Mike, Mains Lead and reel of tape.

SEND S.A.E. FOR DESCRIPTIVE LEAFLET INCLUDING PRICE DETAILS & H.P. TERMS

SCOTSBOY MAGNETIC RECORDING TAPE

Supplied complete with a 1,200ft. reel of Scotsboy Tape. Price 35/-.

MODEL MIC33/1 ACOS CRYSTAL MICROPHONE

A highly sensitive Mike which accurately matches the input arrangement of the Amplifier. Price £2.10.0.

STERN RADIO LTD.
109 & 115, FLEET STREET, E.C.4
Tel.: FLEet 5812-3-4.

TRANSISTOR PUSH-PULL AUDIO AMPLIFIER
(100 Milliwatts Output)
Build this Push-Pull Amplifier which is ideal for Crystal or Magnetic Pick-up Amplification, Baby Alarm, Microphone Amplifier, etc. Powered by 6-volt Dry Battery lasting for months.
Complete Kit of Parts including 4 Transistors and all Components with Circuit (less speaker), £4.10.0

TRANSISTOR SQUARE WAVE GENERATOR
Ideal for signal tracing. **Complete Kit with 2 Transistors and Components and Circuit. 25/-.**

TRANSISTOR SIGNAL TRACER
Complete Kit with 2 Transistors, Components and 'Phones with Circuit. 42/6.

CATHODE RAY TUBES
VCR138A £1.15.0.
VCR139A. 2½in. **£1.15.0**
VCR97. Guaranteed full T.V. picture (carr. 2/-) **£2.0.0.**
VCR517C. Guaranteed full T.V. picture. **£1.15.0.**
MU-METAL SCREENS for VCR97 or 517. **10/-.**
6in. ENLARGER for VCR97 or 517. P.P. 1/6. **17/6.**

TRANSISTORS

JUNCTION TYPE (Red-Spot) (P.N.P.)
OFFERED AT LESS THAN HALF-PRICE.

Designed for A.F. application up to 800 Kc/s and are suitable for use in amplifiers, Signal Tracers, Local Station Receivers, Radio Control, Oscillators, Transistor Voltmeters, Baby Alarms, Microphone Pre-Amplifiers, etc.

10/- EACH

(Tested and complete with Data & Circuits)

N.B. These Transistors may be used in place of Mullard OC71 or similar Transistors.

R.F. TRANSISTORS (BLUE SPOT) 1.6 Mc/s 15/- each.

PRE-SELECTED TRANSISTOR-SIX PUSH-PULL PORTABLE SUPERHET
Just switch to your favourite Station. No tuning, no aerial or earth. Pre-select 3 stations. Complete with all components and six Transistors. 7 x 4 Elliptical speaker. Teletron Superhet Coils and I.F.T.'s. Powered by 7½ v. dry battery which lasts for months. 150 Milliwatts output. All the above with Circuits, etc. Ready to assemble. **£9.0.0.**

Or with Matched Mullard OC72's (200 Milliwatts Output) and 7 x 4 Elliptical High Resistance Speaker 30/- extra.

Suitable Plastic Cabinet. Easy to assemble 18/6.

Call and hear demonstration model working.

Please note that these Red Spot Transistors are ideal for most circuits including "W.W." Pocket Transistor Receiver and Transistor Amplifier. All Transistors are British Manufactured and Guaranteed. Send for Circuits and Data.

INDICATOR UNIT TYPE 132A
Unit contains VCR517 Cathode Ray 6in. tube, complete with Mu-Metal screen 3-EF50, 4-SP61 and 1-5U4G. Offered BRAND NEW (less relay) at 67/6. Plus 7/6 carr. "Radio-Constructor" scope circuit included.

62A INDICATOR UNIT
Containing VCR97 with Mu-Metal Screen, 21 Valve 12-EF50, 4-SP61, 3-EA50 2-EB34. Plus Pots., Switches, H.V. Cond., Resistors, Muirhead S/M Dial. Double Deck Chassis and Crystal. BRAND NEW ORIGINAL CASE, 67/6. Carr. free.

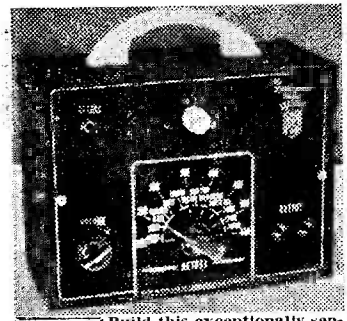
1355 RECEIVER
Complete with 11 valves 8-SP61, 5U4G, VU120, VR92. As specified for inexpensive T.V.
In absolute new condition, 27/6, carr. 5/-
R.F.24 10/-. R.F.25 12/6.
R.F.26 25/-. Brand new with valves, carr. 2/6.

MINIATURE I.F. STRIP TYPE "373" 9-72 MEG.
Brand new miniature I.F. Strip size 10½in. x 2½in. x 3in. high. Valve line-up: 2-EF92, 3-EF91 and EB91. With circuit.
With valves 45/- (less valves 8/-. Post free.)

HENRY'S
(RADIO LTD.)

5, HARROW ROAD, PADDINGTON, LONDON, W.2. TEL.: PADDINGTON 1008-9, 1400

BEGINNERS !—BUILD A CHEAP EASY-TO-MAKE SET



47/6

Build this exceptionally sensitive double triode 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 6½in. x 5in. x 3in. Covers all Medium and Long waves—uses one only all-dry battery. H.T. consumption only 1 to 1.5 mA. Uses personal phone. Ideal for Bedroom, Garden, Holiday, etc. **Many unsolicited testimonials. Mr. Norton of Oxted, writes :** *Yesterday evening on the Medium waveband, I counted 32 separate stations : I am very pleased with the set, which is well worth the money.* **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, etc., 1/6.)

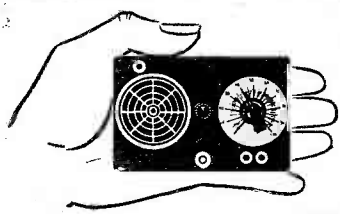
LOOK!

BUILD THIS POCKET RADIO FOR ONLY 37/6

AT LAST ! In response to many requests we now present the **DOUBLE TRIODE "SKYPOCKET,"** a beautifully designed precision **POCKET RADIO.** No radio knowledge needed !—EVERY SINGLE PART TESTED BEFORE DESPATCH : **our simple, pictorial plans take you step-by-step.** This set has a remarkable sensitivity due to painstaking design. Covers all medium waves 200 to 550 Metres. Size only 5½in. x 3in. x 2in. in Strong, Transparent case with panel, cover and ivorine dial. A really personal-phone, pocket-radio **WITH DETACHABLE ROD AERIAL.** Self-contained all-dry battery operation. Average building time 1 hour. **Total Building Cost—including Case, Double Triode Valves, etc., in fact, everything down to the last nut and bolt—ONLY 37/6, with plans.** Postage, etc., 2/-. C.O.D. 1/6 extra. (Parts sold separately. Priced Parts List, etc., 1/6.) **Demand is certain to be heavy —so SEND TODAY !**

107/6

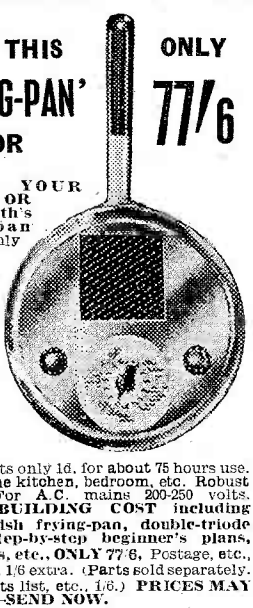
Total building cost including choice of beautiful walnut veneered cabinet or ivory or brown bakelite. **This is the lowest possible price consistent with high quality. No radio knowledge whatever needed . . . can be built by anyone in 2-3 hours,** using our very simple easy-to-follow diagrams. The terrific new circuit of the **"OCEAN-HOPPER"** covers all medium and long waves with optional negative feedback, 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 ! All parts sparkling brand new—no junk ! **Every single part tested before despatching.** Uses standard octal-base valves : 6K7G high-frequency pentode feeding into 6J5G anode-bend detector triode, coupled to 6V6G powerful output beam-power tetrode, fed by robust rectifier. 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. All parts and set of plans, £5.7.6.** (Post and packing 3/6.) Parts sold separately. Priced Parts List, 1/6.



CAN BE BUILT FOR 57/6

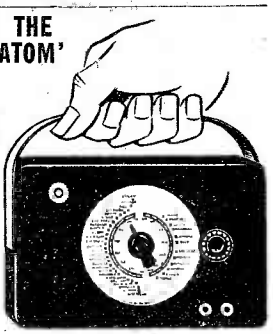
WE'VE DONE IT AGAIN ! . . . our design department in response to a great many requests have designed this **"SKYPIXIE" Vest-Pocket TRANSISTOR RADIO** which gives a superb performance. It is powerful and highly sensitive. Size only 4¼in. x 3¼in. x ¾in. the weight under 7 ozs. !—yet it is a **TWO-STAGE** receiver covering all medium-waves, working entirely off a tiny "penlight" battery, which costs 6d.—fits inside the case—and lasts many months. Uses personal phone and has push-button **LUMINOUS** On/Off Switch. Every part tested before despatch ! **SPECIAL STEP-BY-STEP PLANS for ABSOLUTE BEGINNERS. Total building cost including case, transistors, etc., everything down to the last nut and bolt—ONLY 57/6 with plans.** Postage, etc., 2/-. C.O.D., 1/6 extra. (Parts sold separately. Priced parts list, etc., 1/6.) As the building cost is absolutely "rockbottom" (it might increase later) **DEMAND WILL BE VERY HEAVY —SO SEND TODAY !**

BUILD THIS 'FRYING-PAN' SET FOR ONLY 77/6

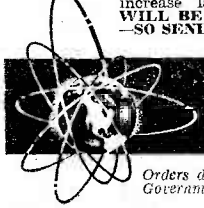


BUILD YOUR MOTHER OR WIFE this **frying-pan radio !** Highly sensitive circuit covering all Medium and Long-Waves. Has normal size speaker and gives excellent tone due to wall "baffle" effect. Costs only 1d. for about 75 hours use. Ideal for the kitchen, bedroom, etc. Robust design. For A.C. mains 200-250 volts. **TOTAL BUILDING COST including mirror-finish frying-pan, double-triode valves, step-by-step beginner's plans, nuts, bolts, etc., ONLY 77/6,** Postage, etc., 2/6. C.O.D. 1/6 extra. (Parts sold separately. Priced parts list, etc., 1/6.) **PRICES MAY GO UP !—SEND NOW.**

BUILD THE 'MINIATOM' FOR 59/6



INTRODUCING THE 'MINIATOM'—to fill a big need ! An exceptionally powerful all-mains one valver. Size only 6¼in. x 4¼in. x 3¼in. **NO AERIAL OR EARTH NEEDED !** Costs approximately 1d. for 250 hours use. Uses latest contact-cooled rectifier and works headphones—completely hum-free—for personal listening, hear all the Continental programmes in bed without disturbing others—it has **LUMINOUS** push-button on/off switch and station printed dial. For A.C. mains 200/250 volts. Covers all Medium-Waves (provision for including Long-Waves). **REALLY LOW BUILDING COST OF ONLY 59/6, including Case, Valve, Nuts, Bolts, Step-by-Step Beginner's Plans,** etc.—**EVERYTHING !** Postage, etc., 2/6. C.O.D. 1/6 extra. (Parts sold separately. Priced Parts list, etc., 1/6.) **THIS WILL BE A WINNER—SO SEND NOW !**



CONCORD ELECTRONICS
69, PRESTON STREET, BRIGHTON **Dept. PWE**

Orders dispatched by return of post. Cheques accepted. Cash on delivery 1/6 extra. Suppliers to Schools, Universities Government and Research Establishments. **Complete range of components and valves stocked.** *CALLERS WELCOME : Shop Hours : 9 a.m to 6 p.m. 1 p.m. Thursdays).*

R.S.C. BATTERY CHARGING EQUIPMENT

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

ASSEMBLED CHARGERS

6 v. 1 amp **19/9**
6 v. or 12 v. 1 amp. **25/9**
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. Carr. 2/6. With mains and output leads.

HEAVY DUTY KIT

12 v. 30 amp. Suitable for Garage or firm with a number of vehicles. Mains input 200/250 v. 50 c/s. Outputs 12 v. 15 amp. twice. Consists of Mains Trans. 2 Metal Rectifiers. 2 Meters, 4 Fuses, 4 Terminals, 2 Rheostats and circuit. Only 9 gns., carr. 15/-.

BATTERY CHARGER KITS

Consisting of Mains Transformer, F.W. Bridge, Metal Rectifier, well ventilated steel case, Fuses, Fuse-holders, Grommets, panels and circuit. Carr. 2/6 extra.

6 v. or 12 v. 1 amp. **22/9**
6 v. 2 amps. **25/9**
6 v. or 12 v. 2 amps. **31/6**
6 v. or 12 v. 4 amps. **49/9**

BATTERY CHARGER KIT

Consisting of F.W. Bridge Rectifier 6/12 v. 5 a. Mains Trans. 0-9-15 v. 6 a. output and variable charge rheostat with knob. Only **45/9.**

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 Carr. 3/6. **46/9**

Assembled 6 v. or 12 v. 4 amps. Fitted Ammeter and variable charge selector. Also selector plug for 6 v. or 12 v. charging. Double fused. Well ventilated steel case with blue hammer finish. **69/9**

Ready for use with mains and output leads. Carr. 3/6.

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

Interleaved and impregnated. Primaries 200-230-250 v. 50 c/s. Screened. TOP SHROUDED DROP THROUGH

250-0-250 v. 70 mA, 6.3 v. 2.5 a. ... **13/9**
250-0-260 v. 70 mA, 6.3 v. 2 a. 5 v. 2 a. ... **16/9**
300-0-300 v. 70 mA, 6.3 v. 2.5 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. **22/9**
300-0-300 v. 100 mA, 6.3 v. 4 a. 5 v. 3 a. **22/9**
350-0-350 v. 100 mA, 6.3 v. 4 a. 5 v. 3 a. **22/9**
350-0-350 v. 100 mA, 6.3 v. 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**
350-0-350 v. 70 mA, 6.3 v. 2 a, 5 v. 2 a. ... **19/9**
250-0-250 v. 100 mA, 6.3 v.-4 v. 4 a, C.T. 0-4-5 v. 3 a. ... **26/9**
250-0-250 v. 100 mA, 6.3 v. 6 a, 5 v. 3 a, for R1355 conversion ... **31/-**
300-0-300 v. 100 mA, 6.3 v.-4 v. 4 a, C.T. 0-4-5 v. 3 a. ... **26/9**
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 v. 4 a, C.T. 0-4-5 v. 3 a. ... **27/9**
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**
450-0-450 v. 250 mA, 6.3 v. 6 a, 6.3 v. 6 a, 5 v. 3 a. ... **69/9**

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. 6 a, **17/6**; 12 v. 3 a or 24 v. 1.5 a, **17/6.**

SMALL POTTED MAINS TRANSF. Removed from New Ex-Govt. units. Primary 0-200-230-250 v. Secs. 250-0-250 v. 60 mA. 6.3 v. 2 a, 5 v. 2 a. Size 3¼ x 4½ x 3in. ... **11/9**

E.H.T. TRANSFORMERS

2,500 v. 5 mA. 2-0-2 v., 1.1 a, 2-0-2 v., 1.1 a for VCR97, VCR517, etc. ... **36/6**

ELIMINATOR TRANSFORMERS

Primaries 200-250 v. 50 c/s **14/9**
120 v. 40 mA, 5-0-5-v. 1 a. **15/9**
90 v. 15 mA. 4-0-4 v. 500 mA. **9/9**

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**; 0-3.5-9-17 v. 3 a. **17/9**; 0-3.5-9-17.5 v. 4 a, **18/9**; 0-9-15 v. 5 a, **19/9**; 0-9-15 v. 6 a, **22/9.**

SMOOTHING CHOKES

250 mA 5 H 100 ohms **12/9**
150 mA 7-10-250 ohms **11/9**
100 mA 100 H 200 ohms **8/9**
80 mA 10 H 350 ohms **5/6**
60 mA 10 H 400 ohms **4/11**

OUTPUT TRANSFORMERS

Midget Battery Pentode 66; 1 for 3S4, etc. **3/9**
Small Pentode, 5,000 Ω to 3 Ω **3/9**
Small Pentode 7/8,000 Ω to 3 Ω **3/9**
Standard Pentode, 5,000 Ω to 3 Ω ... **4/9**
Standard Pentode, 7/8,000 Ω to 3 Ω ... **4/9**
Multi-ratio 40 mA, 30 : 1, 45 : 1, 60 : 1, 90 : 1, Class B Push-Pull **5/6**
Push-Pull 10-12 watts 6V6 to 3 Ω or 15 Ω **15/9**
Push-Pull 10-12 watts to match 6V6 to 3-5-8 or 15 Ω **16/9**
Push-Pull 15-18 watts, 6L6, KT66 ... **22/9**
Push-Pull 20 watts, sectionally wound 6L6, KT66, etc., to 3 or 15 Ω **47/9**
Williamson type exact to spec. ... **85/-**

FOR CALLERS ONLY. WE HAVE MANY CLEARANCE LINES BOTH SMALL AND LARGE, INCLUDING SMALL NUMBER OF 1954 and 1955 AMPLIFIER KITS

MANUFACTURERS' SURPLUS MAINS TRANSFORMERS. Primaries 250-250 v. 50 c/s. Fully shrouded upright mounting 425-0-425 v. 150 mA, 6.3 v 3 a, 5 v. 3 a, **29/11**, post 2/9. Wearite 325-0-325 v. 100 mA, 6.3 v. 2.5 a, 5 v. 2 a, **19/9.** Drop Through Chassis type 250-0-250 v. 70 mA, 6.3 v. 2.5 a, **10/9.**

EX-GOVT. TRANSES. 230/250 v. 50 c/cs 8.8 v. 4 a **9/9**; 460 v. 200 mA, 6.3 v. 5 a, **25/9**; 300-0-300 v. 150 mA, 4 v. 3 a, **9/9**; 0-16-18-20 v. 35 a. **69/6.** carr. 7/6.

EX.-GOVT. SMOOTHING CHOKES

250 mA, 5 H 50 ohms **12/9**
150 mA, 10 H 100 ohms **11/9**
150 mA, 6-10 H 150 ohms Trop. **6/9**
100 mA, 5-H 100 ohms Tropicalised ... **3/11**
Lt.T. type 1 amp. 2 ohms **2/9**

EX.-GOVT. METAL BLOCK (PAPER) CONDENSERS

4 mfd. 500 v., **2/9**; 4 mfd. 1,000 v., **4/9**; 4 mfd. 1,500 v., **5/9**; 8-8 mfd. 500 v., **6/9**; 8 mfd. 500 v., **4/9**; 10 mfd. 500 v., **4/9**; 4 mfd. 400 v. plus 2 mfd. 250 v., **1/11.**

EX-GOVT. ELECTROLYTICS. Removed from unused equipment. 8-16 mfd. 550 v., **1/3**; 16-16 mfd. 350 v., **1/3**; 1,500 mfd. 6 v., **1/9**; 50 mfd. 50 v., with clip, **6d.**

EX-GOVT. DOUBLE WOUND STEP UP/STEP DOWN TRANSFORMER 10-0-100-200-220-240 v. to 5-0-75-115-135 v. or REVERSE. 80/100 watts. Only **11/9.** plus 2/9 post.

EX-GOVT. CASE. Well ventilated black crackle finished, undrilled cover. Size 14 x 10 x 8½in. high. IDEAL FOR BATTERY CHARGER OR INSTRUMENT CASE, OR COVER COULD BE USED FOR AMPLIFIER. Only **9/9**, plus 2/9 postage.

EX-GOVT. VALVES (NEW)

1T4	7/9	6F6G	7/9	6AT6	7/9
1S5	7/9	EF39	5/9	ECC83	9/9
3S4	8/9	6V6GT	6/9	EF80	7/9
5Y3G	8/9	6X5GT	7/9	EB91	8/9
5U4G	8/9	6L6G	11/9	EF36	4/9
5Z4G	8/9	807	7/9	EL32	3/9
6K7G	5/9			EL91	5/9
6K8G	9/9	12A6	7/9	KT44	8/9
6SJ7GT	6/9	15D2	4/9	KT66	11/9
6SLGT	8/9	25Z4G	9/9	SP61	2/9
6SN7GT	8/9	MH4	4/9	35Z4	8/9

EX-GOVT. UNIT RDF1. Brand new, cartoned. Complete with 14 valves, including 5Z4, E.H.T. rectifier, Trans. Choke, etc. Only **29/9**, carr. 7/6.

ELECTROLYTICS (current production) NOT EX-Govt.

Tubular Types		Can Types	
8µF 450 v. ...	1/9	8 mfd. 600 v.	2/11
8 mfd. 500 v.	2/6	16 mfd. 500 v.	3/9
16µF 350 v. ...	2/3	16 mfd. 350 v.	1/11
16µF 450 v. ...	2/9	16µF 450 v. ...	2/9
16µF 500 v. ...	3/9	32µF 350 v. ...	2/11
32µF 350 v. ...	3/9	32 mfd. 450 v.	4/9
32 mfd. 500 v.	5/9	100 mfd. 450 v.	4/9
25µF 25 v. ...	1/3	8-8µF 450 v. ...	2/9
50µF 12 v. ...	1/3	8-16µF 450 v.	2/11
50 mfd. 25 v....	1/6	16-16µF 450 v.	3/11
50µF 50 v. ...	1/9	16-32µF 350 v.	4/9
100 mfd. 12 v.	1/9	32-32µF 350 v.	4/9
100 mfd. 25 v.	2/3	32-32µF 450 v.	5/9
6,000 mfd. 6 v.	3/9	60-100 mfd. 350 v.	6/11
		64-120 mfd. 350 v.	7/9
		100-200 mfd. 275 v.	6/9

Many others in stock.

HUNTS MOULDSEAL CONDENSERS. .005 mfd. 400 v., .01 mfd. 400 v., .04 mfd. 500 v., **5/6** doz. (one type); .1 mfd. 350 v., **8d.** ea.; .25 mfd. 500 v., **1/3**; .5 mfd. 500 v., **1/8** ea.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all dry battery eliminator. Size 5½ x 4½ x 2in. approx. Completely replaces batteries 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 for use, **46/9.**

Type BM2. Size 8 x 5½ x 2½in. Supplies 120 v., 80 v., and 60 v., 40 mA and 2 v. 0.4 a to 1 amp. fully smoothed. **Thereby completely replacing both H.T. batteries and L.T. 2 v. accumulators.** When connected to A.C. mains supply 200-250 v. 50 c/cs. **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.**

H.T. ELIMINATOR AND TRICKLE CHARGER KIT. Input 200-250 v. A.C. Output 120 v. 40 mA. Fully smoothed and rectified supply to charge 2 v. accumulator Price with louvred metal case and circuit, **29/6.** Or ready for use, **8/9** extra.

SPECIAL OFFERS 8-8 mfd. 450 v. small can electrolytics in lots of six, 1/6 ea. Small .0005 mfd. 2 Gangs, **4/9** ea.

T.V. CABINETS. Leading manufacturers surplus. Attractive designs. Walnut veneered, with doors for 15, 16, or 17in. Tube. **£3-19-6.** Carr. 7/6.

EXTENSION SPEAKERS

Ready for use in walnut veneered cabinet.

6½in. 2-3 ohms, **29/6.**
8in. 2-3 ohms, **35/9.**
Very limited number.

VOLUME CONTROLS with long (2in. diam.) spindle, all values less switch. **2/9**; with S.P. switch, **3/9**; with D.P. switch, **4/6.**

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

NEW 1956 Model 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. 1.5 a. 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 17/6. Additional input socket 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** 25/6 and nine monthly payments 22/4.

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

R.S.C 30 WATT ULTRA LINEAR HIGH-FIDELITY AMPLIFIER A6

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, and separate Bass and Treble controls. Minimum input required for full output is only 30 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.** Amplifier operates on 200-250 v. 50 c/cs. A.C. Mains and has outputs 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 17/6. An extra input with associated vol. control so that two separate inputs such as Gram. and Mike can be mixed, can be provided for 13/- extra. The amplifier can be supplied, factory built with 12 months' guarantee, for 50/- extra. **TERMS** for assembled two input model: **DEPOSIT** 28/9 and 9 monthly payments of 28/9.

ONLY 9 GNS.

Carr. 10/-

SUPERHET FEEDER UNIT

Design of a high quality Radio Tuner Unit (specially suitable for use with any of our Amplifiers). A Triode Heptode F changer is used. Pentode I.F., and double Diode Second Detector. Delayed A.V.C. Ae./Grid F/C Coupling is by bottom end condenser Coupling giving freedom from alignment troubles when Ae. of varying lengths and capacity are used. Both Frequency Changers and I.F. valves are A.V.C. controlled from the very low distortion Double Diode so arranged that very high Percentage modulation of the Transmitter can be handled without distortion. The Feed for the delayed A.V.C. is arranged so that A.V.C. distortion is avoided. The Ch. Sw. incorporates Gram. position. Controls are Tuning, W., Ch. and Vol. Output will load most Amplifiers requiring 500 M.V. input depending on Ae. location. 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, instruction and priced parts list with illustration, 2/6. Total building cost, **£4/15/-.** For descriptive leaflet send S.A.E.

GARRARD 3-SPEED MIXER AUTO-CHANGER RC110. For Standard A.C. mains 200-250 v. 50 c/cs. Current Model. Brand new, cartoned. Provision for taking 10 records. Fitted High-Fidelity turnover pick-up head with dual sapphire point stylus for Standard or Long-playing records. Very limited number at only **£7.19.6.** Carr. 3/6.

B.S.R. TU8 3-SPEED SINGLE RECORD PLAYING UNITS for 7in., 10in. or 12in. records at 33⅓, 45, or 78 r.p.m. Supplied with high-fidelity crystal pick-up with dual sapphire point turnover stylus for standard or long-playing records. Only **£4.12.6.** plus 3/6 carr.

3-4 WATT QUALITY AMPLIFIER. Designed for use with B.S.R. or Garrard Autochanger. Fitted separate Bass and Treble controls, Vol. Control and mains switch. Latest type B.V.A. valves used. For 200-250 v. A.C. mains chassis is not "alive." Output for 2-3 ohm speaker. Ready for use. Only **£4/10/-,** carr. 3/6.

ELLIPTICAL P.M. SPEAKER. 7 x 4in. Goodmans. Suitable for above. 19/6.

PICK-UPS. Collaro high-fidelity high impedance magnetic type. Only 31/6. Brand New.

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 preamplifier. For A.C. mains input of 200-230-250 v. 50 c/cs. 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.

PLESSEY 10in. P.M. 3 OHM SPEAKER with High Flux Density Magnet. Recommended for use with above or A7 Amplifier. Only **28/9.**

B.S.C. TA1 HIGH QUALITY TAPE DECK AMPLIFIER. For ALL Tape Decks with High Impedance. Playback and Erase Heads, such as Lane, Truvox, etc. (Unit can now be supplied for use with latest Collaro Tape Transcriptor: refer to TA1C.) For A.C. Mains 230-250 v. 50 c/cs. **Ready for Use. ONLY 11 GNS.**

Positive compensated identification of recording level by Magic Eye. Recording facilities for 15, 7½ or 3¾in. per sec. Automatic equalisation at the turn of a knob. **Linear frequency response of** ± 3 db., 50-11,000 c.p.s. Negative feed-back equalisation. Minimum microphony and hum. High output with completely effective erasure and distortionless reproduction. Sensitivity is 15 millivolts so that any kind of crystal microphone is suitable. Only 2 millivolts minimum output required from Recording head. Provision is made for feeding a P.A. amplifier. Unit can also be used as a gram-amplifier requiring input of 0.75 v. R.M.S. Carriage 7/6. Illustrated leaflet 6d.

P.M. SPEAKERS. All 2-3 ohms. 5in. Goodmans, 17/9. 6½in. Plessey, 16/9. 8in. Plessey, 18/9. 8in. Rola, 19/9. 10in. Plessey Heavy duty, 28/9. 10in. Elac 26/9. 12in. Plessey, 29/11. 10in. W.B. "Stentorian" 3 or 15 ohms type HF1012 10 watts, high-fidelity type. Highly recommended for use with any of our amplifiers. £4/10/9. 12in. Plessey 15 ohm 10 watts, 3 Gns.

PLESSEY DUAL CONCENTRIC 12in. 15 ohm HIGH FIDELITY SPEAKER 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 complete. only £5/17/6.

M.F. SPEAKERS 2-3 ohms, 8in. R.A. Field, 600 ohms, 11/9. 10in. R.A. Field, 1,000 ohms, 23/9. 10in. R.A. Field, 1,800 ohms, 23/9.

COAXIAL CABLE 75 ohms, ¼in. 8d. yard. Twin Screened Feeder. 11d. yard.

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6/12 v. 1 a.	4/11	6/12 v. ½ a. H.W.	2/9
6/12 v. 2 a.	8/9	**H.T. Types H.W.**	
6/12 v. 4 a.	11/9	150 v. 40 mA.	3/9
6/12 v. 4 a.	14/9	250 v. 50 mA.	5/9
6/12 v. 6 a.	19/9	250 v. 80 mA.	7/9
6/12 v. 10 a.	25/9	250 v. 150 mA.	9/9
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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.

THE "SKYFOUR T.R.F. RECEIVER A design of a 3-valve 230-250 v. A.C. Mains receiver with selenium rectifier. It consists of a variable-Mu high-gain H.F. stage followed by a low distortion anode bend detector. Power pentode output is used. Valve line up being 6K7, SP61, 6F6G. Selectivity and quality are well up to standard, and simplicity of construction is a special feature. Point-to-point wiring diagrams, instructions and parts list, 1/9. This receiver can be built for a maximum of £4/19/6 including attractive Brown or Cream Bakelite or Walnut veneered wood cabinet 12 x 6½ x 5½ in.

PRACTICAL WIRELESS

EVERY MONTH EDITOR : F. J. CAMM 24th YEAR OF ISSUE

VOL. XXXII, No. 601, JAN., 1957

COMMENTS OF THE MONTH BY THE EDITOR

Editorial and Advertisement Offices :
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Telegrams : Newnes, Rand, London.
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Transistor Circuits

READERS will have noted that in recent issues we have devoted considerable space to transistors. It is natural that our readers, all of whom are practical constructors, and therefore interested in experiment, should press for more articles on this subject, and we shall continue to publish articles on transistors and their application, increasing the amount of space devoted to the subject as transistors become more readily available. At the present time manufacture is hardly equal to the demands of the industry. They are also at present more expensive. Because of the comparatively low stage gain more of them are required to provide a given output than would be necessary with an ordinary valve circuit. It would be idle for us to publish designs for which transistors are not readily available. Whilst transistorised circuits are the inevitable development and must eventually replace the valve, that time is far distant.

TAPE RECORDERS

THE sales of tape recorders continue to advance with the growing interest in this fascinating branch of electronics. As with radio, clubs are being formed all over the country, many of them operating lending libraries. As with radio clubs, however, we should like to issue a warning. It is that readers should be particularly careful to investigate the bona fides of any club before they part with their money. Especially is this necessary with clubs claiming nation-wide membership. Readers should ask the following questions : Is the club a proprietor's club (that is to say, a club where the founders remain the proprietors and cannot be voted out of office) ?—avoid joining any club where the officers are not elected at an Annual General Meeting ; ask whether an independently audited balance sheet is to be issued to members ; enquire whether the officers are paid or honorary ; ascertain what are the real benefits of membership ; a duplicated news-sheet hardly warrants an annual subscription. If in doubt write to us. Before any club notice is permitted to appear in this journal we first investigate along the lines of the foregoing.

RADIO FILM SHOW

AS briefly announced last month, there will be a radio film show at the Caxton Hall (Great Hall Site) on Thursday, February 21st, 1957. Admission is free, but by ticket obtainable from the offices of this journal. Seating accommodation is limited so you should apply now. Address your letters to : "Film Show," PRACTICAL WIRELESS, address as on this page. The meeting will commence promptly at 8 o'clock in the evening, and there will be an interval for refreshments. Dropping the editorial "we" for a moment, I shall be in the chair. The films to be shown are fascinating and will provide an entertaining evening of educational value.

BINDERS FOR P.W.

LAST month we published details of our self-binders for PRACTICAL WIRELESS. A large number of readers have ordered them, but many of them have omitted to indicate the number of the volume that they required blocked on the spine. When placing an order, therefore, please indicate the number of the volume. Details of these self-binders were given on page 689 of our December issue.

"AMPLIFIERS : DESIGN & CONSTRUCTION"

WE have had a large number of requests during recent years for a book on amplifiers. Readers will be interested to know, therefore, that on February 14th we shall publish "Amplifiers : Design and Construction." It will cost 17s. 6d., by post 18s. 3d. (280 pages and 167 illustrations.) It will contain the cream of the articles on this subject which have been published herein. If you wish to reserve a copy of this limited edition send your remittances to the Book Department, George Newnes, Ltd., address as above.—F. J. C.

OUR NEXT ISSUE, DATED FEBRUARY, WILL BE PUBLISHED ON JANUARY 4th

Round the World of Wireless

By "QUESTOR"

Broadcast Receiving Licences

THE following statement showing the approximate number of Broadcast Receiving Licences in force at the end of September, 1956, 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	1,278,772
Home Counties	1,278,277
Midland	990,586
North Eastern	1,292,412
North Western	980,001
South Western	807,910
Wales and Border Counties ...	509,832
Total England and Wales ...	7,137,790
Scotland	915,652
Northern Ireland	204,508
Grand Total	8,257,950

EMI Telemetry

IT can now be announced that EMI Electronics Ltd. have been commissioned to provide the vital telemetry equipment for the series of experimental high altitude test vehicles (rockets) which will be used in the upper atmosphere rocket research programme to be undertaken by the Gassiot Committee of the Royal Society during the forthcoming International Geophysical Year (1957-58).

The project, which is sponsored by the Ministry of Supply and the Royal Aircraft Establishment, will study a wide range of meteorological, atmospheric and solar phenomena in the upper atmosphere, as well as many aspects of high altitude rocket performance.

The specialised telemetry equipment provided by EMI Electronics will transmit a wide variety of information concerning test vehicle performance and scientific experiments.

BBC Engineering Division Appointments

MR. G. K. DRAKE has been appointed Engineer-in-Charge of the BBC's Television and V.H.F. Transmitting Station at Blaen Plwy in Wales. Mr. Drake joined the BBC at the Alexandra Palace television station in 1938. He subsequently served at a number of the Corporation's transmitting stations and was appointed Senior Maintenance Engineer at the BBC's V.H.F. Transmitting Station at Wrotham, Kent, in 1949. He remained at Wrotham until taking up his present appointment.

Remote Control for Tankers

A REMOTE control device, operated from a tanker moored at the end of submarine cargo loading lines 3½ miles out at sea, which is capable of stopping the cargo loading pumps on shore, has recently been installed at a cost of Malayan $85,000 (£10,000) at Lutong Refinery in Sarawak, British Borneo. This equipment, now in service, was developed jointly by Shell and the General Electric Company Limited, London.

The shallowness of the water prevents tankers from coming close to the shore, and the four loading moorings are situated 3½ miles out. They are connected to the shore by underwater pipelines.

As a tanker approaches the moorings a portable transmitter/receiver is taken aboard. In addition to providing a radio-telephone service with the shore terminal this portable set can transmit on a special "pump control" channel.

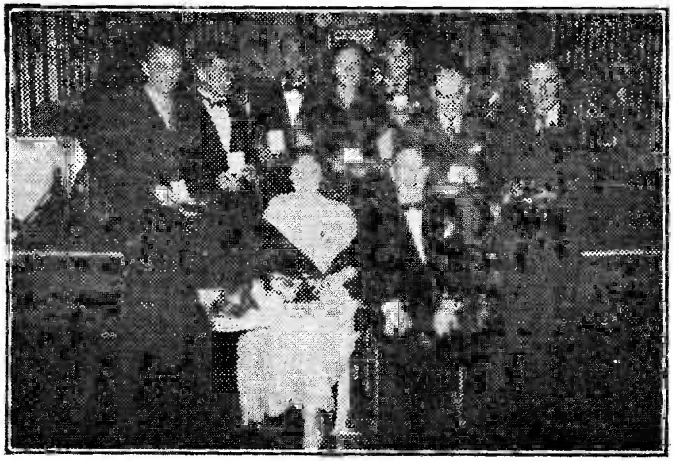
Should it be necessary to stop the pumps in an emergency the pressing of a control button on the operating panel of the portable set overrides the telephone channel and brings the pump control channel into operation. On reaching the shore pumphouse the signal is fed to the particular engines pumping to the tanker on which the button was pressed. Electrically operated valves are then activated and stop the engines.

Lutong refinery, owned by Sarawak Oilfields Limited, one of the Royal Dutch/Shell Group of oil companies, has been completely rebuilt since the war and is now processing crude oil at a rate of some 2.4 million tons a year. The majority of the crude comes from the Seria field in the State of Brunei, which, with an annual output of about 5 million tons a year, is one of the largest single oilfields in the British Commonwealth.

Pye Radio for King Hussein

A PYE radio has been installed in the Royal compartment of the Vickers Varsity aircraft which has just been converted by Eagle Aircraft Services Ltd. for the personal use of His Majesty King Hussein of Jordan.

The radio is a Pye "Continental" car radio which has been adapted to work from the aircraft's 24-volt power supply. It has five wave-



The Whiteley presentation group referred to on the opposite page.

bands—long, medium and three short—and was specially designed for long distance reception and Continental motoring.

The "Continental" is normally available for both 6 and 12 volt systems, and costs 30 gns. inclusive of purchase tax.

V.H.F. for Southern Gas Board

IN an effort to add to all-round efficiency, the Southern Gas Board's Southampton Group is to equip its fleet of maintenance vehicles with very high frequency radio-telephones.

The equipment, which is being supplied by Automatic Telephone & Electric Co. Ltd., is of the latest frequency modulated type. The system will permit full duplex working (simultaneous two-way conversation) and at the base station at the Marine Parade Gas Works there will be three telephone control points. Initially eight vehicles are being fitted with 10-15 watt RL equipment.

Before the order was placed comparative trials were carried out in the area covered by the group using both F.M. and A.M. types of equipment, the marked superiority —both in range and performance— of the F.M. system leading to its adoption.

V.H.F. radio-telephone systems are already extensively used by gas boards in other areas for a wide variety of assignments, including emergency repairs and the laying of new gas mains.

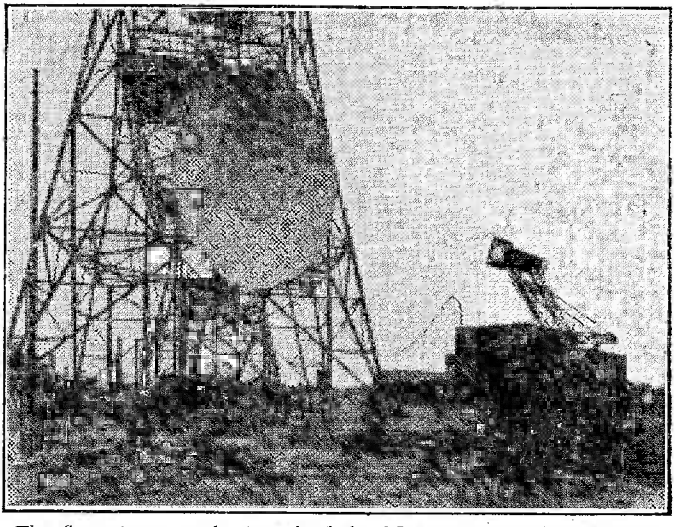
British Research into Tropospheric Scatter

IN common with other countries, intensive research into the possibilities of tropospheric scatter is being carried out in the United Kingdom. It will be recalled that earlier in the year General Gruenther stated that the radar stations of N.A.T.O. from the Arctic to the Mediterranean would be co-ordinated by the use of such techniques.

Marconi's, who have been conducting propagation tests for many years, have now brought into operation a tropospheric scatter link between Gt. Bromley, Essex, and Sutton Bank, near Thirsk, Yorkshire, the distance involved being about 200 miles.

Field strengths are recorded continuously over this link; various types of modulation are available so that studies can be made of multi-path effects, the effect of aircraft and other relevant problems. Preliminary tests have already been made over a 400 mile circuit to Aberdeen, and it is hoped later to establish a link over this distance.

Plans are currently in hand to set up high power (10 kW) transmitters and associated receivers at Newcastle and in the London area with the object of being able to operate up to 36 simultaneous telephone channels or a television link between these points. The equipment is being designed and constructed by Marconi's as a private venture and the link would be used for tests and demonstration only.



The first picture to be issued of the Marconi tropospheric scatter experimental equipment.

Whiteley Presentations

SEVEN members of the staff of Whiteley Electrical were recently presented with gold watches on completion of 21 years' service with the company.

The presentations were made at a Party Dance held at the local Palais de Danse in Mansfield which was attended by over 450 of the staff and workpeople. The names of the recipients were: Miss C. M. Parkin (Sales Accountant), Messrs. T. Barnes (Departmental Manager), T. A. Barrow (Press Shop Foreman), C. F. Gison (Transport Dept.), H. W. Read, M.S.M.A. (Sales Director), C. Smith (Maintenance Engineer) and L. Thorpe (Plating Shop).

In addition cheques were handed to the wives of the male staff who received gold watches.

Talking with Antarctica

DIRECT contact was established for the first time on the evening of Wednesday, October 31st, between members of the Commonwealth Transantarctic Expedition in Broadcasting House and their comrades at Shackleton Base—a distance of nearly 10,000 miles. The following evening a congratulatory message on behalf of the Government, recorded by the Rt. Hon. the Earl of Munster, Minister without Portfolio, was transmitted to the base.

Reception was perfect during most of the half-hour that the circuit was open on that night. The Shackleton Base area is one of the most difficult parts of the world with which to establish radio contact, not so much on account of the great distance but because of the exceptional atmospheric conditions—the "auroral zone"—in which the base is situated.

Obituary—Mr. P. V. Hunter

IT is with deep regret that British Insulated Callender's Cables Limited announce the death of Mr. Phillip Vassar Hunter, C.B.E., Hon.M.I.E.E., a director and former deputy chairman of the company. Mr. Hunter, who was 73, retired from the deputy chairmanship in 1952, but remained on the board as a non-executive director and retained his positions on the boards of several subsidiary companies.

Autochanger Maintenance

HINTS FOR THE SERVICE ENGINEER AND EXPERIMENTER

By H. W. Hellyer, A.I.P.R.E.

A GOOD deal of fine equipment has been built by readers from guidance given in these pages. Much of it is probably superior in performance to and certainly cheaper than the equivalent commercial product. And any enthusiast will testify to the advantage of knowing one's own kit down to the last nut and bolt. But there is one item of equipment that is beyond the scope of the average constructor ; that he has to buy ready made. This is the automatic record changer.

It is an item that is often a source of trouble, prone to baffling mechanical faults which are difficult to locate without the aid of a service manual.

The following notes are offered as a possible aid in the maintenance of these autochangers.

Fault finding can be a tedious business amid the perplexing array of cogs, cams, gears, springs and levers. However, a logical approach to the problem will usually show results. A knowledge of the general principles used in autochanger technique can be a help to the constructor who has to work "in the dark."

First, it should not be necessary to work literally in the dark. The unit plate can be supported at eye level on a table or bench, by employing two similar boxes, making sure that the edges of the plate are firmly seated, level and with switch levers, etc., not fouling. A mirror flat on the table beneath the autochanger is helpful, if one is able to work mirror-wise—not always an easy task. The unit can then be connected, switched on, and all movements studied. The best method is to switch to 33 r.p.m. and lift the platform arm so that the stop mechanism is eliminated and continuous cycling takes place.

The automatic record changer can be regarded as an instrument of three stages :

1. The motor and main drive.
2. The secondary drive and cycling mechanism, and
3. The pick-up head and associated circuits.

The first stage, the motor, is not likely to be very troublesome. Most modern units employ synchronous or induction motors. The circuit of a typical A.C. motor is given at Fig. 1. Apart from obvious short or open circuits in the coils, there is little electrically to go wrong. The condenser is usually a good quality type in these units. Mechanically, the principal points are lubrication and clean bearings. Most are self lubricating, requiring only an occasional spot of oil on the felt pads at the seat of the main bearing.

Motors using commutators, brushes, etc., are probably well known. It need only be mentioned here that the most prevalent faults are dirty armatures, "clogging" of carbon between segments, worn brushes, tight brushes or springs that are distorted, displaced governors, excessive friction at governor.

Tests for faulty armature windings—suspected if overheating or sparking is excessive—can be made by taking resistance readings between segments. Any meter will do for this, it only being necessary to ensure that readings are similar.

The drive from the motor is usually via a rubber-tyred wheel held on a spring bracket so that it engages both with a capstan on the motor spindle and the inner edge of the turntable rim. Fig. 2 shows the system. Faulty rim-drive mechanism can usually be diagnosed by the frequency of the sound, the slowest "knock" indicating roughness of the turntable itself, a faster "knock" pointing to a faulty drive wheel and a very rapid "flutter" or "rumble" indicating that the motor spindle or its capstan are the possible culprits. A frequent fault with the type shown, the popular B.S.R. autochanger, is the slipping down of the capstan on its shaft, causing slow running. Two grub screws hold it in place and resetting is a simple matter. Speed changing is effected by raising or lowering the rubber primary drive wheel by a set of levers actuated by a knob.

There are alternative methods to the one shown, but all work on a similar principle ; a reducing gear engaged by friction forms the primary drive. Sometimes the change of speed is gained by engaging separate drive cams of different diameters.

Care should be taken that oil does not get on the rubber drive wheels or slipping will occur. Indeed, it is a general rule on the modern autochanger to avoid indiscriminate oiling. Loss of friction is a common fault.

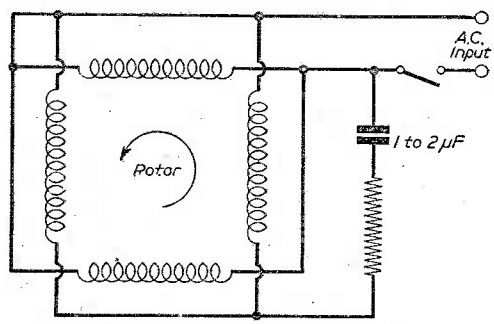


Fig. 1.—Standard motor circuit.

The Secondary Drive

In order to obtain the necessary set of movements of pick-up arm and record spindle a rotating cam-gear is employed. This could, rightly, be called the heart of the machine. It is a gear wheel of fairly large diameter and has various "hills" and "valleys" on its face, with rods and pivots which engage levers at the appropriate point of rotation. There are three principal methods of driving the cam-gear. First, directly from the motor spindle. Secondly, from the turntable rim, and thirdly, from the turntable hub.

The third method is most popular, being used by B.S.R., Garrard, Plessey and Philips and in a modified form by E.M.I. Fig. 3 shows the relative positions and shape of the B.S.R. cam-gear and drive. When the unit is at rest or the mechanism disengaged, i.e.,

the pick-up actually playing, the gap in the teeth of the cam-gear is opposite the turntable hub.

Starting is effected by movement of a pawl and link unit which is pushed by a lever linked to the starting switch and also to the trip mechanism. This latter feature will be considered later.

The action of starting engages the pawl with a raised spline on the turntable hub boss and moves the cam-gear sufficiently for the teeth to engage.

This pawl and friction link is a frequent offender and can cause erratic action. The usual trouble is clogging, due to dirt and grease or looseness of the 6 B.A. locknut, allowing the link to ride over its small stop. Between the two items pawl and link is a fine, circular spring, easily lost if the assembly is dismantled.

Other types of cam-gear and start mechanism vary widely in general design, but all function on the same principle. Initial movement is obtained by engaging a subsidiary mechanism which drives the cogs of the main cam into mesh. (In the case of E.M.I. 'changers, the cam-gear has a rubber tyre, driven by a milled brass bush, instead of cogs, but the principle is similar.)

Some Collaro units employ a secondary drive wheel

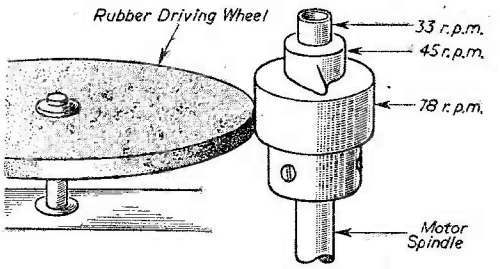


Fig. 2.—The B.S.R. capstan drive (not to scale).

in contact with the turntable rim. Cogs on the hub of this secondary wheel base then engage the main cam. Starting is obtained by a catch lever system on which the secondary drive wheel is mounted.

Other types engage with the motor spindle when starting takes place and some Garrard units use the system of double drive, via two rubber belts. Plessey use an intermediate gear wheel, engaging with the turntable hub and "sprung" out of mesh until the start button is pressed or the trip action operates. Philips have a different method, a subsidiary cog on a swivel arm which is brought into mesh to initiate cam-gear movement. E.M.I. autochangers use a lever with a pivoted end-piece which actually pushes the cam-gear into engagement with the milled brass bush of the hub.

The Cycling Mechanism

Having reached the stage where the motor has been switched on, the speed selected, the primary drive to the turntable and the secondary drive to the cam-gear engaged, we now come to the more complicated part of the mechanism.

It will assist in the general understanding of the various operations if we break down the complete cycle into a series of actions as follows:

1. Start, switch on and engage drives.
2. Next record drops.
3. Pick-up lifts and moves inward.
4. Setting down position of pick-up selected.
5. Pick-up "runs-off" at end of record, operating
   (a) auto-trip, or
   (b) auto-stop mechanism.

In addition there are subsidiary operations: repeat, reject, stop and so on, but these are mainly extensions of those listed above.

Stage 1: Starting.—The action of switching on moves a double set of levers, completing the circuit to the motor and engaging the cam-gear. The principal aspects have been discussed above. Faults to look for are: erratic switch action; loose levers; weak or dislodged return springs; stiff or loose pawls (described above, see Fig. 3); worn cogs or rubber tyres.

The cam-gear now takes over and drives further levers by the action of the various hills and valleys. Different manufacturers employ their own methods and some manufacturers use several varying types of action. There are too many to discuss in detail here,

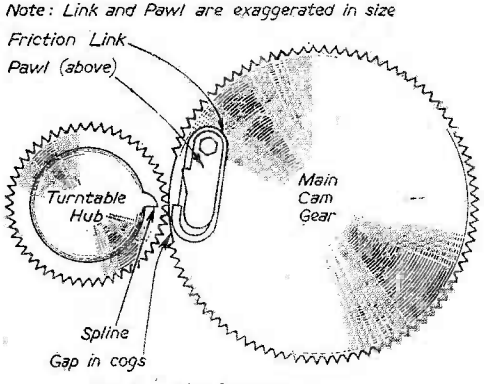


Fig. 3.—The drive cam gear.

but the principle is similar. The writer will be glad to discuss any individual problems which may perplex readers. The B.S.R. autochanger, which is widely used, is a good example on which to illustrate the various actions. Details of its cam-gear are shown in Fig. 3.

As the gear-wheel revolves, an eccentric cam pushes a sliding carriage, bringing about movement of pick-up and Stage 2.

Record Dropping

As the carriage slides laterally a small slot in its underside moves a pivoted spindle lever against the tension of a spring, imparting a "kick" action to a shaped arm just level with the lowest record of the stack (see Fig. 4). The records rest on a step of the centre spindle and are fed to this step by a shaped, slotted pawl in the upper section. Erratic record dropping can be caused by: weak spring at base, loose or dislodged pivot pins (a) and (b), jammed knocker arm, due to grit between arm and spindle wall, or jammed upper pawl, causing two or more records to drop.

Other manufacturers use similar methods, the initial motion being sometimes vertical (Collaro and Plessey), or rotary (E.M.I.), or by pushing the records from the edge (some Garrard models).

Stage 3: Pick-up Arm Movement.—The necessary sequence of movement is vertical, to raise the arm

from rest, lateral, to bring the head over the record, and vertical, to lower stylus to the record. These movements are brought about by the rotation of the main cam-gear. As the carriage (described under Stage 1) moves along it engages with the pick-up base assembly and moves the pick-up inwards; a *U*-shaped link pivoted to a bracket on the carriage raises the arm via a central spindle and further movement of the link past its fulcrum lowers the arm to the record. While the record is being played, the lower part of the base assembly is disengaged.

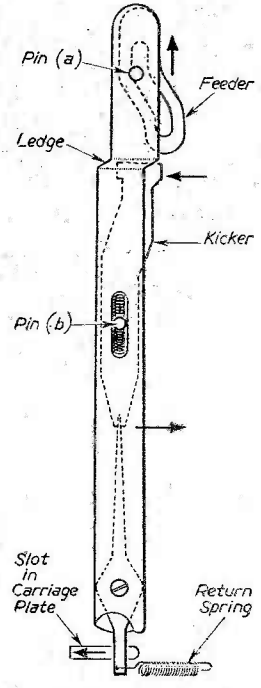


Fig. 4.—The B.S.R. spindle. This drawing as well as Fig. 2 is not to scale.

Other methods of imparting these motions are by rods, rollers or pivoted levers "riding" in shaped depressions in the cam-gear (E.M.I., Plessey and Collaro), or pivoted levers (Philips, Garrard and some Collaro models). Principal causes of failure are jamming of the pick-up lead in the base assembly impeding lateral motion, fouling of rods, etc., in cam-gear groove, binding at pivot points, and cam-gear action failing, to disengage at end of travel, causing repeat action before record plays.

Stage 4: Pick-up Setting Down Position.—The point at which the pick-up head descends to the record is selected by the size of the record on most autochangers, manually on others. As a 10in. or 12in. record drops its edge depresses a lever, setting a limiting stop in the path of the pick-up base assembly. The B.S.R. models use a plastic lever sprung in a sliding plate with a stepped lower portion which stops the movement of the assembly. Failure of its action causes records to be played in the 7in. position. Chief cause of failure is loose pin, relaxed or dislodged spring at upper end of pivoted arm, or a jammed sliding lever.

Other methods are: a swinging arm which rests against the edge of the records (some Collaro and Garrard models), a raised lever tripped by the edge of 12in. records (Philips), a hinged flap raised for 12in. records at the steadying platform (E.M.I.), a small lever for 12in. records, and automatic selection of the 7in. position by the 45 r.p.m. speed switch (Plessey).

Stage 5: The Run-off (a) Auto-trip.—After the record has been played the stylus enters the run-off grooves. These are more widely spaced, causing a rapid oscillatory movement of the arm. Advantage is taken of this rapid movement to actuate a velocity trip in many models.

B.S.R. use the same pawl and link described previously and shown in Fig. 3. Position of the arm relative to centre spindle moves the pushing lever via the pick-up base assembly. The full purpose of the friction link and spring is now seen. When normal playing is in progress the friction link resists the inward movement to a certain extent, preventing premature changing. But the action of the run-off groove causes the push lever to overcome this slight resistance, engage the pawl with the spline on the turntable hub, and initiate cam-gear movement. Thus, it is apparent that a loose link will cause premature rejection and a faulty pawl action will fail to actuate the trip.

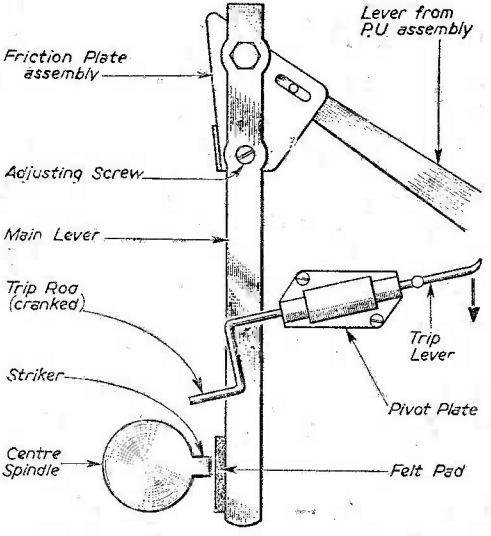


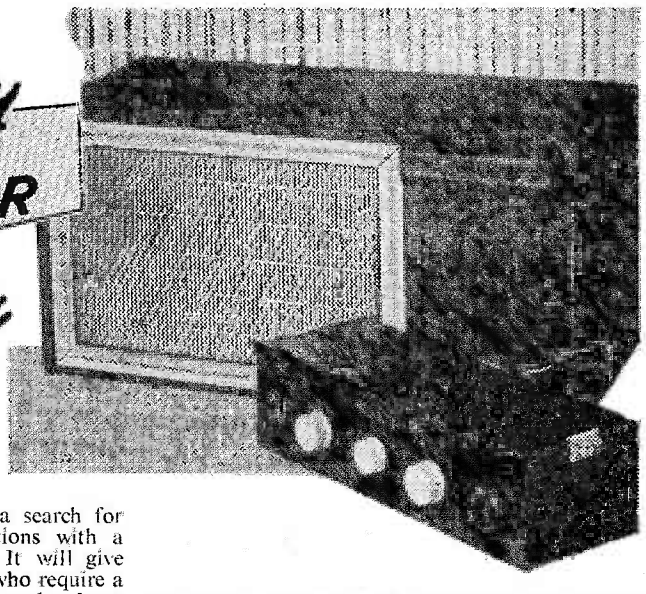
Fig. 5.—Auto-trip mechanism, as used by Garrard. Main lever moves by P.U. lever movement, via friction plate assembly. At ultimate (run-off) groove, lever is thrown into path of striker which makes contact with the felt pad. Owing to the shape of the end an upward and backward movement is imparted, causing rotation (partial) of the trip rod which is angled at its farther end so that eventual movement of the trip lever is in the direction of the arrow in diagram.

The velocity trip usually employs a striker on the turntable boss, which hits a pad on a lever placed in its path by the "throwing" movement of run-off grooves. An idea of the principle can be obtained by a study of Fig. 5. This is the method employed by some Garrard models.

The striker catches the felt pad, which is pushed upwards (due to its privoted mounting). Thus, the associated rod twists, lifting its cranked end, swinging a trip lever which then moves the secondary drive into gear. A friction clutch is employed to prevent premature rejection. Looseness of the pivot bracket and maladjustment of the setting screw which controls the height of the arm on which the felt pad is mounted are frequent causes of faulty action. The pads of the friction clutch grow smooth with time and may require "roughening."

(To be continued.)

A Quality DIODE-TRANSISTOR Receiver



A NOVEL RECEIVER UTILISING TWO DIODES AND THREE TRANSISTORS

By R. V. Moore, B.Sc.

THIS receiver is the outcome of a search for quality reception of local stations with a diode-transistor combination. It will give results which will satisfy those readers who require a receiver for regular use. The quality and volume compare favourably with that of a three-valve T.R.F. receiver.

It should be made clear at the outset that it is essential to employ a good aerial, either outdoor or indoor, and a good earth. The strength of the signal fed into the amplifier from the detector stage influences quality and also volume to a marked degree.

The Circuit

Most of the experimental work carried out was in connection with the detector stage. Consideration was given to employing either transistors or diodes in this stage. Valves were eliminated because of their power requirements. The final circuit is shown in Fig. 1, page 738.

The Detector Stage

A push-pull circuit employing two G.D.3 diodes was used. This proved to be more efficient than any circuit employing only one diode. The circuit was first made using a home-constructed coil, this being wound for medium-wave reception only. However, it was necessary to incorporate long-wave tuning also, because reception of the Light Programme on medium-wave in the author's district is not satisfactory. Efforts were made to construct a dual-wave coil, but results were not satisfactory due chiefly to medium break-through on the long waves. It was necessary, therefore, to have separate coils for the two wavebands. The author has to thank Messrs. Teletron Co., Ltd., for supplying the coils specially to his requirements. They can now be purchased from the firm at 4s. 6d. each, complete with two slugs. As will be seen from the circuit diagram each coil has two tuned windings with a coupling coil between. Switching from medium to long wave is by means of a four-pole two-way rotary switch. A twin gang .0005 variable condenser tunes the two windings on each waveband. The two slugs in the former of each coil are adjusted for maximum volume. Although cheap diodes can be used in this circuit it is not advisable to do so. Better quality and a stronger signal will be obtained by using good diodes. G.D.3, G.D.5, or G.E.X.34 are recommended.

As is well known it is difficult to reach a satisfactory compromise between selectivity and sensitivity in a crystal receiver. Whilst this receiver is better than most, it was nevertheless found necessary to introduce a further measure of control by arranging for means of increasing or decreasing the coupling between aerial/earth coupling coil and the tuned winding. For this purpose a .0005μF variable condenser of the mica dielectric type was connected across the coupling coil. A small coil (100 turns of No. 30 enamelled or D.S.C. wire on a $\frac{1}{2}$in. diameter Alladin former) tuned by a 100 pF trimmer may also be inserted in the aerial lead as an alternative connection to vary the coupling. Thus means were provided for obtaining sufficient selectivity without a marked diminution of sensitivity for what is essentially a local station receiver.

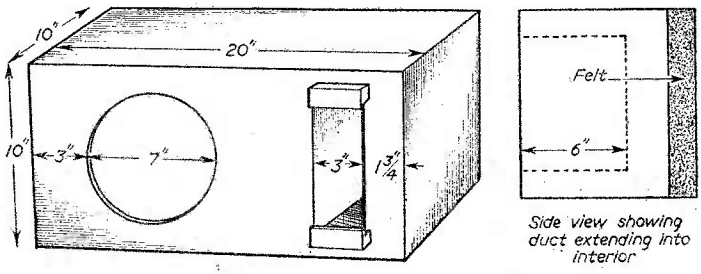


Fig. 3.—Details of the cabinet.

The Amplifier Stage

The amplifier employs three junction transistors, one Mullard OC71 in the driver stage and two Mullard OC72's in push-pull in the output stage. The output from the detector is matched into the amplifier by a step-down transformer, ratio 5 to 1. A small fixed condenser, value 50 to 100 pF, is connected across the primary to eliminate a slight whistle which may sometimes be noticeable. Volume-control is provided by the variable resistance across the secondary of the same transformer. This should have a total resistance of 5,000 to 10,000 ohms and, unless provision is to be made for a separate on/off switch, it should have a double-pole on/off switch incorporated.

A similar type transformer, ratio 5 to 1 step-down, but with a centre-tapped secondary winding, is used in the output stage. Both transformers can be supplied by Messrs. H. Ashworth, of Bradford, at modest prices. The output transformer needs a centre-tapped primary winding and should also match the speech coil of the loudspeaker used. However, matching is not critical, and for a 3-ohm P.M. speaker ratios between 25 and 45 to 1 have proved satisfactory. A fixed condenser across the primary of the output transformer improves quality and tone. The value of this is best found by trial and error, but a value somewhere between .0005 and .005μF should prove satisfactory. Biasing arrangements are as

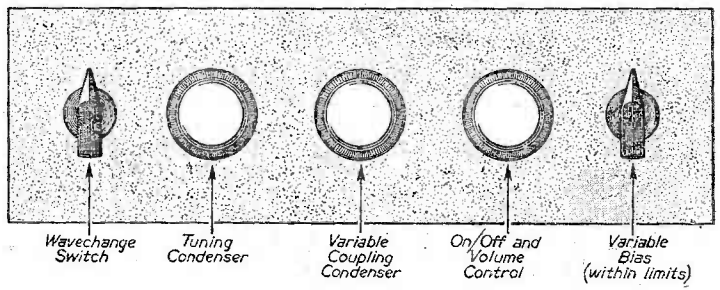


Fig. 2.—The panel layout and controls.

LIST OF COMPONENTS

L1—100 turns of No. 30 wire on ½in. Alladin former.
L2—Teletron coil HD2.M.
L3—Teletron coil HD2.L.
Trim 1—100 pF trimmer.
C1—.0005 twin gang variable condenser, miniature type.
C2—50 to 100 pF fixed condenser.
C3—8 to 12 μF electrolytic type condenser, test 25 volts upwards.
C4—.0005 to .005 fixed condenser.
C5—.0005 mica dielectric variable condenser.
SW—4-pole 2-way rotary switch.
2 diodes, G.D.3 or similar.
T1—Step down transformer, ratio 5 to 1 (H. Ashworth, Bradford).
T2—Step down transformer, ratio 5 to 1, centre tapped secondary (H. Ashworth, Bradford).
T3—Output transformer, centre tapped primary, to match speaker.
R1—220 K ohms.
R2—18 K ohms.
R3—1.5 K ohms.
VR1—5,000 to 10,000 ohms variable resistance with 2-pole on/off switch.
VR2—1 K ohms variable resistance.
One Mullard O.C.71 junction transistor and two Mullard O.C.72 transistors (to be purchased as a matched pair).
Three 4½ volt flat flashlamp batteries.
Aluminium sheet, insulating tape, connecting wire, wood screws, plywood, Bostik, nails, grille, knobs, sockets, plugs, flex from receiver to speaker.
Loudspeaker 8in. P.M. type, although any similar speaker irrespective of size is suitable.

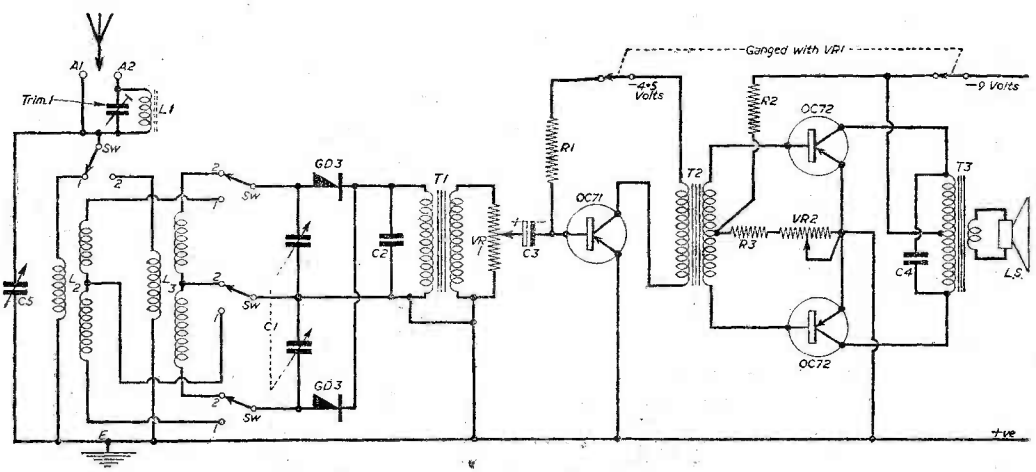
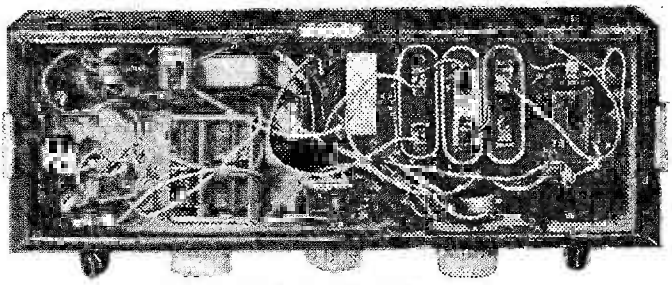


Fig. 1.—Theoretical circuit of the quality diode-transistor receiver.

follows: a 220 KΩ resistance supplies fixed bias to the OC71 from the 4½-volt battery, whilst bias to the push-pull stage is controlled by a fixed resistance of 18 KΩ (R2) and a combined fixed resistance of 1.5 KΩ and a variable resistance of 1,000 ohms (R3 plus VR2). It should be noticed that separate batteries are used for the driver stage and push-pull stage. The latter requires a nine-volt battery which may be two flashlamp batteries, each 4½ volts connected in series. Separate batteries were decided upon for the two stages in order to avoid the extra drain which would have occurred on the first 4½ volts had a tapping been made use of.



A view of the inside of the receiver.

Constructional Details

Since the object in producing this receiver was to obtain quality, it was considered necessary to use separate cabinets for the receiver and loudspeaker. A great advantage of transistor receivers is that they can be made very compact. Accordingly, a small oblong receiver unit was decided upon. This was constructed of plywood and covered with rexine cloth after mounting the components and completing all the wiring except the wires leading to the aerial and earth and loudspeaker sockets on the back panel. These were wired later.

The dimensions of the cabinet were as follows: front and back panels, 12½in. by 3¼in., cut out of 3/16in. plywood; side panels, 3¾in. by 3¼in., cut out of 5/16in. plywood; bottom and top, 12½in. by 4¼in., cut out of 5/16in. and 3/16in. plywood respectively. It was arranged for the top to be sliding (see details later).

First of all the front panel was drilled to take the controls and then the bottom and side pieces nailed on. The various components were mounted in the positions shown in Fig. 2. However, this layout may be varied to suit the components since an ordinary size .0005 twin gang variable condenser may be used in place of the miniature type specified. The transformers should be placed away from the coils and also as far apart from one another as possible. A clip was made to hold the three flashlamp batteries. This was made out of aluminium sheet-size 6½in. by 2in. bent twice at right angles to leave a space 2½in. between to take the 3 batteries. Two holes were drilled in the base of the clip to enable it to be screwed to the wood base of the cabinet. One coil was mounted on the base and the other on the side of the cabinet. Holes were drilled in the back of the cabinet to take the aerial and earth sockets and loudspeaker sockets but the back was not nailed on until all the wiring had been completed, leaving just the connections to these sockets to be completed. The wiring is straightforward; the only precautions to be observed are in the soldering of the diodes and the transistors, and battery connections. Transistors can easily be damaged by heat and the leads should be held with pliers until the soldering is completed, and allowed to cool. Needless to say a method of soldering should be adopted which allows for speed. Thus the leads should be well tinned first and strip soldered by holding the two connections side by side with pliers and applying the soldering iron quickly and removing quickly. Although the need for taking care in the soldering of transistors has been mentioned several times previously in PRACTICAL WIRELESS it cannot be too strongly emphasised that carelessness in soldering transistors will result in irreparable damage.

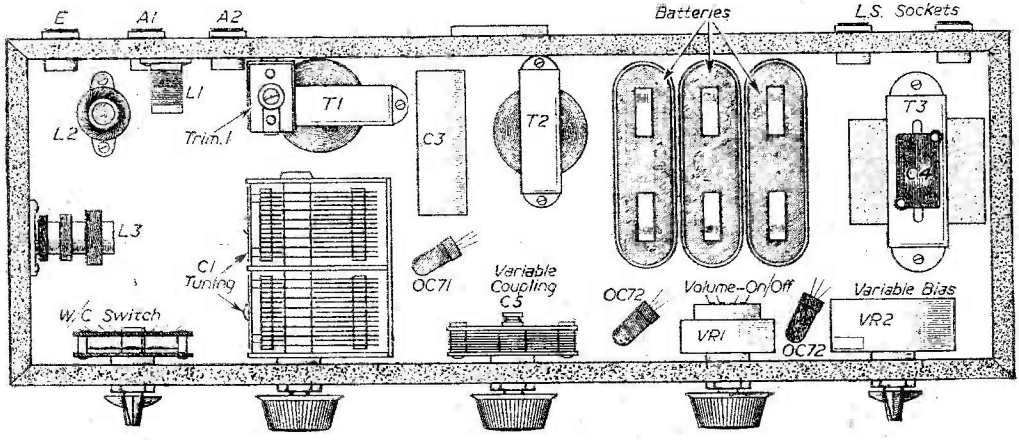


Fig. 4.—This diagram identifies the parts illustrated in the picture above.

Care must also be taken when making the battery connections. Polarity must be strictly observed. If the batteries are connected the wrong way round the transistors will almost certainly be useless afterwards. Connections to the battery prongs were soldered to obviate any unwanted noise due to loose connections in the course of time. After the final connections to the sockets on the back panel had been made the panel was nailed on and the cabinet covered with rexine cloth taking care to make holes in the correct positions for the control spindles. The top was also covered with rexine. Finally, to complete the receiver cabinet three clips were made out of aluminium sheet, each being 1¼in. by 1in. and bent over ¼in. at the top. These were fixed with small screws, one at the back and one at each side in such a position that the top panel could slide under them.

Testing and Adjusting

Before switching on the receiver the wiring should be carefully checked, being particularly cautious in noting that the battery and transistor connections are correct. The local station should be tuned in first on the long and then medium wave and the iron-dust slugs of the coils adjusted for maximum volume. The adjustable (variable) bias resistance, VR2, should be turned to give clearest reception. It should be noted that the bias to the push-pull stage is only variable within certain limits, and it has been so arranged that there is no possibility of exceeding working limits for the transistors, provided the power supply does not exceed 9 volts. If a continuous howling sound occurs when the set is switched on the set should be switched off and the fault located. Possible causes are interaction between transformers and coils if these have been fixed too close, secondary winding of transformer not connected to earth, bias resistances not being of the correct value. As the wiring is not complicated it should not be difficult to trace the fault.

Quality and volume from this receiver are surprisingly good and it is advisable to take some trouble with the loudspeaker arrangements.

The Loudspeaker Cabinet

It was decided to use an 8in. P.M. speaker. First of all experiments were carried out with the speaker mounted on a large baffle board constructed of ½in. plywood. The results were compared with those obtained by mounting in a bass reflex cabinet. The latter proved very satisfactory but as space was at a premium it was desired, if possible, to obtain similar results with something less cumbersome. Accordingly a so-called Helmholtz type of resonator cabinet was constructed and this proved very satisfactory indeed. This type of cabinet is similar to an ordinary bass reflex kind but behind the port is a duct leading into the interior of the cabinet. The size of opening has to be found by trial and error or else means adopted to enable one to vary the size at will.

An examination of Fig. 3 will provide the reader with all the necessary details to make a similar cabinet. Whilst the method of varying the opening adopted by the author is satisfactory it does not result in such a pleasing appearance as would be obtained by inserting the sliding panel at the side of the cabinet and extending the grille over the entire front of the cabinet. It is also suggested that covering with Formica would be better than rexine.

The cabinet requires two panels of ½in. plywood 20in. by 10in. for the back and front, two side pieces of the same plywood size 9in. by 10in., and two pieces 19in. by 9in. for the top and bottom. The front panel requires a hole 7in. in diameter for the speaker and an opening at the other end 7in. by 3in. for the duct. The duct was made out of ⅜in. plywood, two pieces 3in. by 6in. and two pieces 7¾in. by 6in. The slide was 3/16in. plywood, size 4in. by 8in., held in position by two grooved pieces of ½in. plywood. A piece of ¼in. felt, size 7in. by 9in. was stuck on the inside surface of the back panel behind the duct. The duct is "tuned" by means of the sliding panel. The cabinet was completed by fastening a grille over the front with beading.

The results from this arrangement were most pleasing to the ear and many P.W. readers who have not tried this type of enclosure would no doubt find it of advantage to do so, particularly where good response from a speaker is sought without an unduly large cabinet.

In conclusion it should be pointed out that there is nothing to prevent the reader from assembling the transistor receiver and the speaker in the same cabinet. However, by keeping them separate the speaker can be at one side of a room whilst the tuning is near at hand, say at the side of one's armchair.

News from the Clubs

CLIFTON AMATEUR RADIO SOCIETY
Hon. Sec.: C. H. Bullivant (G3DIC), 25, St. Fillans Rd., Catford, S.E.6.

THE annual Christmas Party is being held on 14th December, and as usual a Constructional Contest will form one of the many attractions. A fine selection of useful prizes is being offered and a good entry is expected.

December diary:-
7th—Ragchew.
14th—Christmas Party.
21st—Constructional Evening.
28th—Quiz.

Meetings are held every Friday at 7.30 p.m., at the clubrooms, 225, New Cross Road, S.E.14, when visitors and new members will receive a warm welcome. Details of membership can be obtained from the Hon. Secretary.

EAST KENT RADIO SOCIETY
Hon. Sec.: D. Williams, Llandogo Bridge, Nr. Canterbury.

THE above society is now meeting at Headquarters, Technical College, Longport St., Canterbury, after holidays. Several new members have enrolled and one member has received his call sign, G3LIG. R.A.E. classes have started given by the Hon. Sec. Several members have reached speed of 20 W.P.M. in O.W. classes. It is hoped to have a Tx on the air next year. New members and visitors are welcome.

WALSALL AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: F. J. Merriman (G2FPR), 123, Wolverhampton Road, Walsall.

THE Club meets at the Bradford Place Technical College Annexe, in Walsall, on the second and fourth Wednesday in each month. There is a free room, under adult education schemes. Fee is 5s. per annum and the only requirement for membership is a genuine interest in radio or TV. The Club has six licenced members and accent is usually given to practical aspects of the art when possible, and visits are also arranged to places of radio interest.

RAVENSBOURNE AMATEUR RADIO CLUB
Hon. Sec.: J. H. F. Wilshaw, 4, Station Road, Bromley, Kent.

THE members recently saw the film on Mullard C.R.T. construction. One member has passed the R.A.E. recently; another is building a television Tx gear; and a further one is active with a Panda Cub Tx. The Club operates as G3HEV. Meetings held every Wednesday, 8 p.m. in Science Room, Durham Hill School, Downham—S.W.L.s welcomed

Operating Battery Sets from the Mains

SIMPLE CIRCUITS FOR THE CONVERSION UNITS TO TAKE THE PLACE OF BATTERIES

WHEN mains become available it is often worth while operating an existing battery-type receiver from them, and this is also of great advantage with a portable which is only used out-of-doors during the summer. With mains operation the trouble of replacing batteries is avoided and running costs are very greatly reduced, becoming so small as to be almost negligible. When the cost of a suitable eliminator is balanced against that of the batteries normally used in 12 months, the saving will be very apparent. In addition there is no need to make any alterations to the receiver, which can be used again with a battery when necessary. A portable may thus be mains operated in the winter and serve its usual function, with battery, in the summer.

Two supplies will be necessary to replace the high-tension and low-tension batteries. The older type of battery set will require 2 volts for filaments (to replace accumulator) and 120 volts for H.T. All-dry receivers will usually require 90 volts H.T., and 1.4 volt or 7.5 volts L.T. The voltages necessary will immediately be seen from the usual battery, portables often using combined H.T. and L.T. batteries. For satisfactory mains operation the eliminator will have to provide

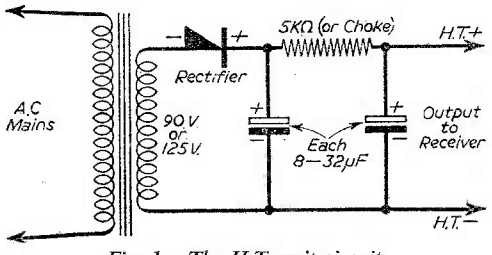


Fig. 1.—The H.T. unit circuit.

these voltages. A little change in H.T. voltage will be of no importance, but the filament voltage will require to be carefully adjusted if the valves are to have a normal life. In any case, it is best to deal with H.T. and L.T. sections of the eliminator separately. There is, of course, no reason why a simple circuit providing H.T. or L.T. only should not be used; when this is done the eliminator is usually for H.T. only in view of the simplicity with which this may be obtained.

H.T. Section

Though current may be derived directly from the mains, this is not recommended, since a transformer isolates the receiver. A suitable circuit appears in Fig. 1. Due to the small current drain, half-wave rectification is satisfactory and no smoothing difficulties arise. Eliminator transformers usually have H.T. secondaries of 90 or 125 volts, and the appropriate voltage is selected for the receiver. A 90- or 125-volt half-wave metal rectifier is satisfactory and occupies little space. If space is unimportant, a 250 volts or similar rectifier, if to hand, is equally suitable. A 20 mA type will deliver sufficient current, though there is no reason whatever why 40 mA or 60 mA rectifiers, if available, should not be used instead.

The capacity of the smoothing condensers is not very important, and they can be of 150 volts or higher voltage-working rating. It is essential that the correct polarity be observed in all the circuits, both as regards rectifier and smoothing condenser wiring. No H.T. smoothing choke is usually required, and a 5-K. 1-watt resistor replaces this. The actual value may be adjusted if necessary, as this will modify the H.T. output voltage to some extent.

The amount of smoothing required, both in the H.T. and L.T. sections of the eliminator, will depend largely upon the receiver. With a sensitive receiver more smoothing will be required than with a simpler set. Insufficient smoothing will be revealed by background hum. Should this arise it is usually quite easy to add further smoothing. Whether the hum arises from H.T. or L.T. supplies can readily be established

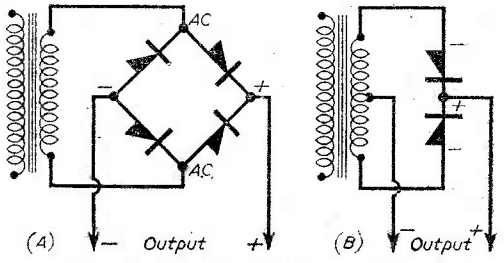


Fig. 2.—Details of L.T. supply circuits.

by drawing H.T. only from the eliminator, and L.T. from a battery, then vice versa. Only in exceptional circumstances (such as a faulty rectifier or condenser) will the H.T. system be responsible.

If the H.T. output voltage is measured with a meter it should be around that provided by the transformer secondary when the set is switched on. For all such tests (including L.T. measurements) a reliable test-meter of the type intended for radio servicing should be used. The cheap, low-resistance type of meter is not suitable and will give misleading readings, due to the current it consumes.

L.T. Supply

Full-wave rectification is best here to simplify smoothing, and "A" in Fig. 2 shows a bridge rectifier. The rectifier shown at "B" is a little cheaper for a given rating, but needs a centre-tapped secondary. The secondary also requires to be of twice the overall voltage—e.g., 12 volts centre-tapped for

6 volts output. As voltage drop arises later in the circuit it is desirable to provide an output of 6 to 9 volts from the rectifier for 1.4- and 2-volt receivers.

The current rating of the rectifier should be equal to, or larger than, the demands of the receiver. A ¼-amp. type will suit small sets; few receivers will require more than ½ amp. A 6- or 8-volt ½-amp rectifier would thus do well for almost any receiver. As with the H.T. circuit, larger rectifiers can be used if already to hand. With many types, red and black will indicate positive and negative respectively, with green for the "A.C." tags in the bridge type.

The usual eliminator transformer will have the two secondaries required, so that only one transformer is necessary for both H.T. and L.T.

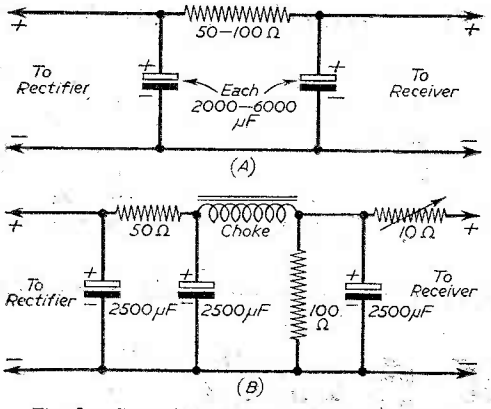


Fig. 3.—Smoothing circuits for L.T. supplies.

Considerable smoothing of the L.T. supply is necessary, to avoid hum, and the relatively heavy current makes minimum series resistance necessary with very large condenser capacities. The simplest circuit which can be employed with success is shown at "A" in Fig. 3 and is quite largely used. The exact value of the resistance depends upon transformer, rectifier and receiver, and is adjusted to obtain the correct filament voltage. With 2-volt valves, operation is less critical, but the filament voltage should be maintained within .2 volt of the correct figure. Normally, better than this will be possible, and a long valve life can then be expected. With the 1.4-volt type the actual filament voltage should lie between 1.25 volt and 1.4 volt. High filament voltages will cause rapid deterioration to the valves, while low voltages are also detrimental in due course. The actual voltage should thus be checked with a reliable meter and adjusted to 2 volts for 2-volt valves, and 1.3 volt for the 1.4-volt valve types. The meter must *not* be of a type taking a large current, or the voltage actually applied to the valves will rise when the meter is removed. Initially, it is wise to make a provisional voltage test with a dummy load, such as a 2½-volt torch bulb, to avoid possible damage due to excess filament voltage.

At "B" in Fig. 3 a 10-ohm wire-wound resistor enables the filament voltage to be adjusted. This is of great advantage, though not provided in cheap, ready-made eliminators. In use, the resistor is reduced in value from maximum, until the filament voltage is brought up to the correct figure. No other adjustment is then necessary.

When further L.T. smoothing is required, a choke is helpful, but it must have a low D.C. resistance. The H.T. type of smoothing choke is useless, for this reason, but will serve well if rewound with wire of about 24 s.w.g. Here, some smoothing and further voltage-dropping is provided by the 50-ohm resistor. The 100-ohm resistor helps to keep the voltage down when no L.T. current is drawn. This is necessary when using condensers of very low rating, such as 3-volt and 4-volt types. The condenser wired to the rectifier should be of a high enough rating for this position—usually 8-volts to 12-volts. Any condensers of higher voltage rating will be perfectly satisfactory, but the high capacities shown are usually of very low voltage rating.

Initially, the circuit at "A" in Fig. 3 can be tried, and will often suffice. If difficulty arises in obtaining the correct filament voltage, the 10-ohm variable resistor can be introduced in one output lead. Should hum be troublesome, a choke or further smoothing condensers can be added. The more sensitive the receiver the greater will be the degree of smoothing required.

Complete Eliminator

Fig. 4 shows a complete circuit and will also help to make rectifier connections clear. It will usually be feasible to build up the unit to such dimensions that it can fit in the position previously occupied by the battery. If a socket from an old battery is fixed to the eliminator case, appropriately wired, it will only be necessary to plug in the receiver when mains operation is required, and a battery may at once be used again when wanted. The socket or sockets will depend upon the battery types. Correct wiring, here, will be absolutely essential.

The case is best made from insulating material, though metal can be used.

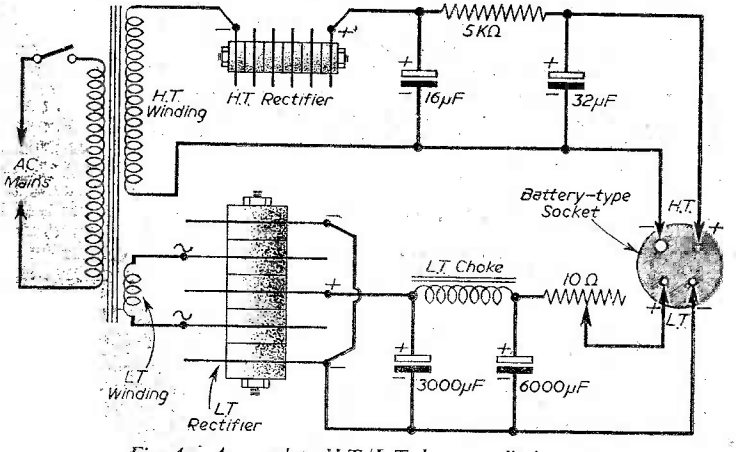


Fig. 4.—A complete H.T./L.T. battery eliminator.

On Your Wavelength

BY THERMION

More Swanky Pronunciations

DURING my month's listening, my blood pressure has again risen on a number of occasions, to hear announcers refer to Field Marshal Montgumery and Sir Cumpton Mackenzie, and Fay Cumpton. Now Compton is a good old Scottish name, and all those possessing it either as a Christian name or as a patronymic are known as the name is spelt. There may be those who like to give the impression that they are a very special brand of Compton, by calling themselves Cumpton, but it is pure snobbery and it is incorrect. Dennis Compton resented being addressed as Cumpton and made a public protest about it. So all of the Comptons must take note that they will not be referred to by me as Cumpton. Most of the announcers seem to have difficulty, like the Yanks, with the vowel sounds. Our announcers like to "put it on," whereas the Yanks especially those who cannot speak let alone sing, like to refer to Rark 'n Rawl. Could not the BBC rehearse them a bit before they are allowed to offend the ear on the air?

Magnetic Tape Player

THE Radio Corporation of America has developed a magnetic tape player which can produce recorded sound and pictures through an ordinary television receiver. Details, however, have not been published, although it is now well-known that this company has developed a method of recording television signals on tape. The problem is the high speed of the tape—something like 15ft. per second.

It is inevitable that we must be able to record television programmes as we can now record sound programmes. The expense of staging a live broadcast of a television play can only be reduced by some such system.

Hot Gospelling

I AM gratified that a large number of readers agree with my views on the hot gospellers who spout their nonsense night by night from Radio Luxembourg. After all, most of this hot gospelling is a highly profitable business, some of it existing to sell religious newspapers. As it is therefore just a commercial business, it is proper, I suppose, that it should buy programme time from this commercial radio station. These ranting, religious revivalists and would-be spell binders do not achieve much. When W. Graham was over here for example, the effect of his perfervid oratory was very short lived. People flocked to see him, not because they wanted their souls saved, or that they were in need of spiritual redemption, but purely as a matter of curiosity. Of the large number who attended one of his gatherings here, only a hundred or so remained afterwards as converts. I have always considered it a shocking thing that the Archbishop of Canterbury should have appeared with W. Graham on the platform at Wembley Stadium. If Cantuar has some time on his hands there are plenty of English institutions, longer established which could do with his support. Be it noted that W. Graham did not accept my challenge to a public debate, so that I could pulverise the stupid beliefs which he is trying to promote. One or two readers have profoundly disagreed with my views, and like the revivallists have quoted the Bible at me, but the devil can cite scriptures and such quotations leave me cold, because I could find a biblical quotation which cancels any one of them out. Really I feel quite sorry for those who believe in the trash which these vain spouters put over. They have inordinate conceit under their outward façade of modesty. They believe that they are great orators when some of them are just humbugs, earning a fat annual fee for it. I wonder if they would remain if the fee were to be withdrawn?

There is one thing which can be said about the BBC religious programmes, they are conducted in accord with the tenents of Christian teaching. They are sincere, and free from ballyhoo. My only fear is that some of them may try to imitate the Yankee hot-gospellers, the modern Sankeys and Moodys, and the Aimee Macphersons. They found it very profitable; but where is the effect of their hot-gospelling today. It soon wears off. Take Graham's campaign over here. It is obvious that it has had no enduring effect. As a form of entertainment or as a variety show it can be justified, just as a crowd will find interest in flocking to see Siamese twins.

Transmitters for Tyre Pressures

AN interesting application of radio to automobile practice is the use of tiny transmitters to indicate tyre pressures. Fixed to each wheel of the car are miniature radio transmitters which are actuated by a switch which is closed when the tyre pressure drops to the danger level. A small receiver fixed to the facia receives impulses radiated by these transmitters. It is an American invention giving a different frequency to each tyre, represented on the facia by coloured light indicators.

Save Us From It

THE Burroughs Corporation of America has announced that it has built an electronic brain melody maker, an electronic device, which, by a series of electronic permutations will produce a melody at the press of a button. This has caused consternation in that home of raucous cacophony Tin-Pan-Alley. No longer, if this machine comes into general use, will it be necessary to publish music composed by Al this, Ed that, and Lou the other. It is claimed that the device can produce at least 1,000 melodies an hour, and that it can turn out more than 10,000,000,000 different tunes without human intervention of any sort. Let us hope, however, that the machine gets the pronunciation right and that it learns to speak English!

EQUALISING CIRCUITS

USEFUL DESIGN DATA FOR THE A.F. ENTHUSIAST

By Hugh Guy

Introduction

A SEEMINGLY endless topic in the field of radio engineering concerns the design of frequency correcting circuits. In audio frequency work they are found in their simplest form as tone control circuits in radios and radiograms, while the more sophisticated versions are widely used in "hi-fi" reproducers, where they are known as equalisers. In video apparatus, too, particularly in television camera circuitry, they are extensively employed this time labelled compensating networks. Whatever their title, and whatever their function, however, each and every one basically performs the same task—namely, that of correcting frequency distortion.

Many mistaken ideas exist about frequency correction, with the result that the enthusiast is sometimes at a loss to know how to design a circuit to correct for any inconsistency in a particular piece of equipment.

This short series sets out to explain the process, and one or two simple design formulæ and practical examples are given to enable the constructor to devise his own circuits without the customary hit and miss approach, which, though sometimes successful, so often leads to frustrating results. Though confined principally to audio frequency circuitry, the techniques outlined in this article are nevertheless identical in some cases to video work, a fact which the enterprising reader will be able to utilise, be he a television enthusiast.

Mechanism of Equalisation

The term "poor frequency response" is often applied to, say, an amplifier to indicate not that the bandwidth of the amplifier is small, but rather than the band of frequencies which the amplifier handles are not all amplified to the same extent. It may be that the middle frequencies from, say, 400 cycles to 3,000 cycles per second are amplified equally, but that as one approaches either the low or the high frequency part of the frequency spectrum the amplification becomes progressively less. This type of response is usually the case with a poor amplifier and is shown in the response curve of Fig. 1. Ideally, all the frequencies must be amplified equally, when the straight characteristic of Fig. 1 would represent the response.

However, the requirements of high gain and constant amplification over a wide band are incompatible and usually ineffective in the case of audio frequency amplifiers, where the source feeding the amplifier does not itself have a flat characteristic. It is customary, therefore, to incorporate networks in A.F. amplifiers whose function it is to alter the frequency characteristic of the incoming signal, so that, in conjunction with the response of the amplifier itself, the final output is as nearly constant at all frequencies as possible. If, for example, the signal fed to an amplifier was finally reproduced with the frequency response of Fig. 1, then a network would be included having the inverse characteristic shown dotted in Fig. 1. The effect would be to allow greater amplification of those frequencies attenuated most in the reproducing equipment resulting in a flat overall output.

In most cases the A.F. amplifier is built to be fed not by one specific type of input, but usually by an input or inputs with unknown characteristics. Therefore, the equalising network incorporates controls to give it a variable equalising characteristic, allowing near-perfect compensation for a variety of inputs.

Estimation of Response

Fundamentally the problem confronting the constructor is, what is the frequency characteristic that is to be compensated? The best way of ascertaining this is by means of a variable frequency source and an oscilloscope or valve-voltmeter.

Either or both of the latter two instruments are connected across the output terminals of the amplifier, which at this stage incorporates no equalising network.

Now the variable frequency source can take a variety of forms; if the amplifier is to be used principally in conjunction with a pick-up, then the source should be a frequency test record. If it is a tape recorder amplifier, then obviously a frequency run on tape should be available. The amplifier alone may be tested by using an audio oscillator of variable frequency. Whatever the source, however, its one

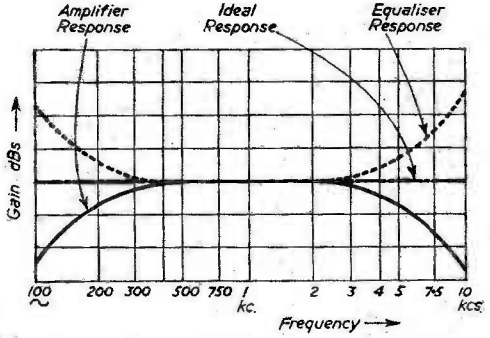


Fig. 1.—Amplifier and equaliser responses.

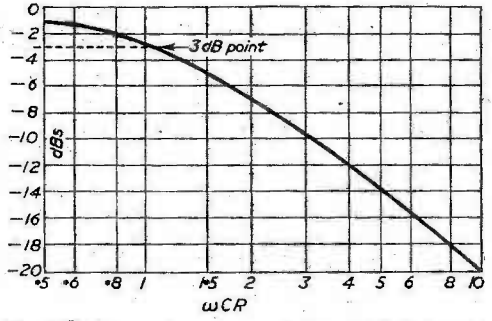


Fig. 2(b).—Impedance versus frequency design curve. Note that the 3dB point is at ωCR1.

important feature must be that of having a constant signal amplitude over the band of frequencies it is reproducing.

In the absence of expensive monitoring apparatus such as the oscilloscope and valve-voltmeter, the enthusiast with a discriminating ear can readily detect changes in level of 2 dbs. and can, therefore, act as his own monitor. The justification here is that in the end it is the human ear which will be the final judge of performance.

The results of a frequency run should be presented in graphical form, plotting gain against frequency, thereby simplifying the task of devising correcting networks by having available a picture of the response and its deficiencies.

It is at this stage invariably that the enthusiast is at a loss. Very often he knows the shortcomings of his gear, but is unable to hit upon a suitable method

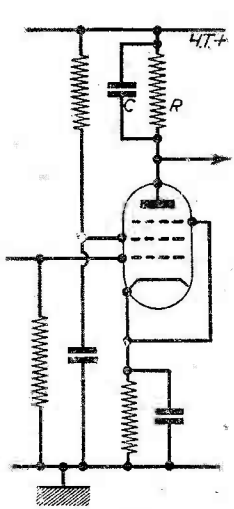


Fig. 2(a).—The R.C. circuit referred to.

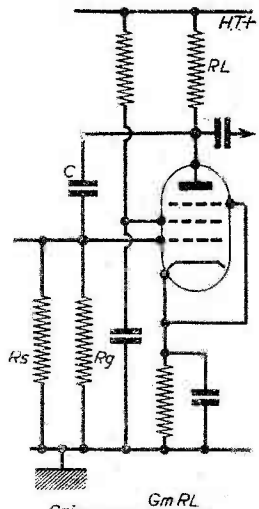


Fig. 3.—Treble cut using negative feedback.

of improving the response. However, by examining the characteristics of one or two simple networks it is possible to draw some interesting conclusions leading to the design of equalising circuits to meet a wide variety of requirements.

Treble Attenuation

The simplest method of limiting the treble response of an amplifier is to connect a condenser across the terminals of the source. Now the "source" can be one of several things. If we are considering the amplifier alone, then it can be the anode load or grid leak of any of the stages in the amplifier. If it is a pick-up, then this is the source, and likewise with any other form of input. To simplify the process and to obtain the most useful result we will consider a valve with a resistive anode load as a source. This valve might very well be part of a resistance-capacity coupled stage in the amplifier, and later we shall see that this same valve can be the equalising stage in a pre-amplifier.

Fig. 2(a) shows the circuit as described. In parallel with the anode load R is a condenser C. Being a pentode stage the gain is Gm.Z where Gm is the mutual conductance of the valve and Z is the impedance of the parallel combination. Examination of this impedance shows why the circuit acts as a treble attenuator.

The impedance is :

$$Z = \frac{R}{\sqrt{1+(\omega CR)^2}}$$ where $\omega = 2\pi f$ and f is the frequency.

As the frequency increases the term in the square root increases and thus Z diminishes. The gain therefore reduces at high frequencies, and the effect of treble attenuation is produced.

Fig. 2(b) shows a graph, the horizontal axis of which is plotted in terms of the product ωCR, illustrating the way in which Z becomes progressively less as ωCR increases. The vertical scale is $\frac{1}{\sqrt{1+(\omega CR)^2}}$ and is given in decibels. This graph shows clearly that while ωCR is less than one, the impedance is nearly constant. When ωCR equals one, however, the impedance starts to reduce. This point is known as the 3 db. point as the impedance is 3 dbs. down on its level at zero frequency, and is used to define the turning point or upper limit of impedance. Beyond this point the graph shows a nearly steady fall, and Z reduces at approximately 6 dbs. per octave.

To design a simple treble attenuator, the designer must know the required 3 db. limit, and the gain desired from the stage at low frequencies. Here ωCR is arranged to be very much lower than one, and hence can be ignored. The gain is then simply Gm.R.

Design Example

If a stage giving a low frequency gain of 100 were required, using a valve with a Gm of 3 mA/v, then the value of R would have to be 33K. If the 3 db point were fixed at 5 kc/s, then the necessary value of capacitor C would be approximately 1,000 pF, quoting the nearest available value. This is easy to verify since at the 3 db. point, the gain is 0.707 of its original value, and $\omega CR = 1$. In other words, the 3 db. point occurs when the reactance of the condenser $1/\omega C$ and the resistance of the anode load R are equal.

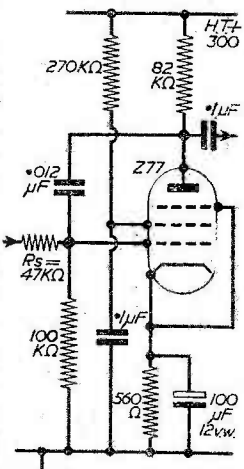


Fig. 4(a). — Practical treble cut circuit.

If the 3 db. point is not known, but the amount of treble attenuation desired at a particular frequency has been decided, then the graph of Fig. 2(b) can be used to assist the design.

Quoting the example above, if the treble response must be attenuated, say, 20 dbs. at 15 kc/s on the low frequency gain of 100, then the graph shows that $\omega CR = 10$ approximately.

The value of C may be determined from this product since ω and R are both known, and the nearest available value that would be used in practice this time would be 3,300 pF. As a matter of interest, with this value the 3 db. point would be 1.465 kc/s.

Naturally the same rules apply for treble attenuation across any resistive load and therefore the above method may be used to design a treble attenuator in the grid circuit of a valve which is fed by a pick-up. Here the value of R will be the resistance of the pick-up in parallel with the grid leak.

The practical version of the circuit of Fig. 2(a), must have a well decoupled cathode resistor. It is also customary to connect the condenser C either from the anode to earth or in parallel with the grid leak of the following stage. In either case the condenser is still effectively in parallel with the anode load.

This circuit is not by any means the only one that will produce a treble cut effect, but being the simplest is ideal for quick and easy design.

Furthermore it may be used with triode stages as well as pentodes if it is remembered that in the triode case resistor R consists of the anode load in parallel with the anode impedance, Ra, of the triode. This is easily explained by examining the expression for the gain of a triode stage. This is given by

$G=\frac{\mu R}{Ra+R}$ where μ is the amplification factor of the valve.

But $\mu=Gm.Ra$. Substituting for μ gives

$G=Gm.\frac{Ra.R}{Ra+R}$

And the "resistance" part of this formula is the parallel combination of the anode impedance Ra and the anode load R.

Bass Boost Circuit

The name "bass boosting circuit" is something of a misnomer really. All such circuits, if they employ nothing more than resistors and condensers in a network, do no more than attenuate the treble frequencies, creating the effect of an increased bass response. The circuit just described is therefore really a bass boosting circuit, but a far better method of achieving this effect is to attenuate the high frequencies by frequency selective negative feedback.

It is well known that an amplifying stage with a gain G will have a reduced gain when negative feedback is applied. Consider the circuit of Fig. 3, for example. This consists basically of a pentode amplifier of much the same type as shown in Fig. 2. The difference here, though, lies in the condenser C, which feeds a large proportion of the anode signal back to the input. Thus condenser C forms a negative feedback path from output to input. The signal fed back will vary from very little at low frequencies to nearly all of the output at high frequencies, depending directly on the reactance of condenser C.

The expression for the gain of the amplifier in this mode of connection is shown in the figure, and is :

$$G=\frac{Gm.RL}{1+\frac{Gm.RL}{\chi}} \quad \text{or} \quad \frac{\chi}{1+\frac{\chi}{Gm.RL}}$$

where $\chi=\sqrt{1+\frac{1}{(\omega CR)^2}}$

If the gain of the amplifier, Gm.RL, is very high, say, 200 or more, then the gain of the equaliser is approximately equal to χ, and thus decreases with frequency. It should be made clear here that R is the parallel combination of the grid leak resistor (Rg in Fig. 3) and the anode load of the preceding stage, or the impedance of the input source if this is not a previous stage.

That is why the source impedance Rs is shown dotted in the circuit in Fig. 3.

A practical circuit of such an equaliser is shown in Fig. 4(a), and its response indicated in Fig. 4(b),

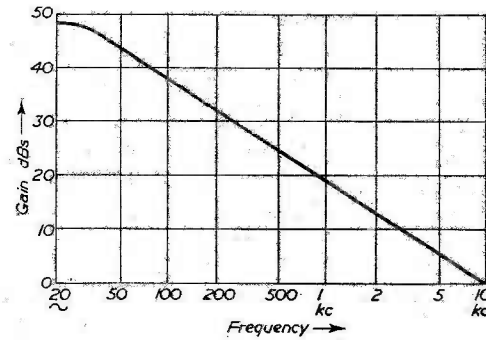


Fig. 4(b).—Response of treble cut circuit.

where the similarity in response with that of Fig. 2(b) may be seen.

The valve used in the circuit is the Osram Z77, a high slope pentode on a B7G base. Triode valves may also be used in the circuit, with less success, however. This is due to the difficulty of obtaining a high gain from a triode stage and the more accurate triode formula given earlier would have to be used, once again remembering that RL is the parallel combination of anode load and anode impedance.

Either of the two types of circuit discussed so far is capable of producing treble cut and bass boost, since the overall effect is the same, as the graphs clearly show; the name by which each form of equalisation is known is largely fixed by the frequency at which the effect the circuit produces becomes apparent.

This similarity of function also exists between treble boost and bass cut circuits. The more precise collective title for these networks is that of "bass cut." Once again it is the 3 db. point frequency which decides the name, a high frequency 3 db. point giving rise to the term "treble boost," and a low frequency point to the second term.

(To be continued)

The Leak "Trough-line" F.M. Tuner

DETAILS OF A NEW IDEA IN F.M. RECEPTION

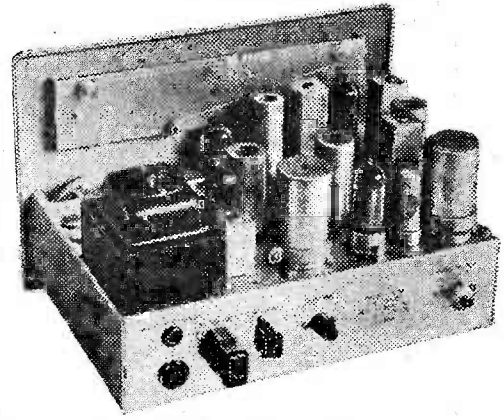
AS a result of both modifications and tests over many months, besides user-tests with some 50 equipments, the Leak Frequency Modulated Trough-line Tuner is now in production.

It is radically different from any other F.M. receiver in its engineering design and circuitry. It overcomes the many disadvantages and faults of many other F.M. tuners or receivers. The quality of short-wave frequency modulated (F.M.) transmissions is better than that of the best recordings, provided the transmitted programme is "live" and that good land-lines are used between the studio and transmitter.

To get the utmost advantage of such superior transmissions, a first-class F.M. tuner is required. It must be sensitive, selective and have no drive after tuning into a station. The listener merely switches on, tunes in and then sits back in comfort.

The prevailing failures of many equipments are :

1. Tuning drift so severe that the station will disappear as the set warms up unless the tuning knob is continually adjusted. This usually means a total drift over 100 kilocycles. For the quality of sound to remain unimpaired, it should not exceed 10 kilocycles per second.



General view of the new tuner.

2. The re-radiation from the tuner should be so low as not to interfere with TV sets in the house or, as is known, with neighbours' sets.
3. A tuning indicator or "magic eye" is often missing. It is impossible to be sensitive by ear to variations of 2-5 kilocycles per second when tuning or find the optimum tuning point. The tuning indicator enables it to be done.
4. The power supply should be built into the receiver.

What is Meant by "Trough-line"

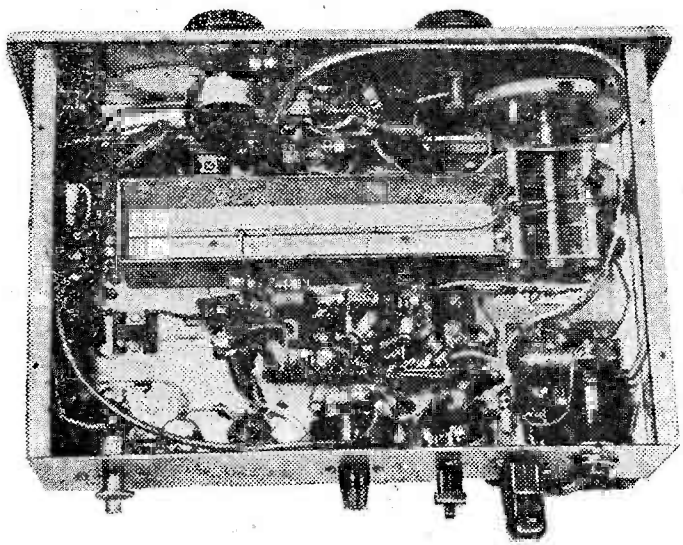
The tuning inductor of the oscillator is a metal trough with a piece of metal passing the length of the trough without touching the bottom or sides. Certain connections are made to the long piece of metal.

The trough-line is employed by the oscillator. This set-up makes the Leak F.M. tuner, so H. J. Leak & Co. Ltd. believe, unique in the world.

The trough-line tuning inductor in conjunction with the application of automatic frequency control results in tuning stability within 5 kilocycles per second from the instant of switching on. The trough occupies much of the space under the chassis and provides some radio-frequency screening.

The oscillator operates on the high side of the signal frequency. Its output is injected into the coupling between the radio-frequency stage and the mixer with second channel signals attenuated at this point.

The intermediate frequency (I.F.) is 12.5 Mc/s. Usually it is 10.7 Mc/s. The 12.5 Mc/s is chosen because it ensures two things. First, the oscillator frequency never operates in Band II and cannot therefore cause interference with other receivers. Secondly, the harmonics of the I.F., generated in the later stage of the I.F. amplifier, do not fall within Band II. At an I.F. less than 12.5 Mc/s



This illustration shows clearly the novel "Trough Tuner" in the centre of the chassis.

such harmonics can be received as " dead " carriers.

The sensitivity is such that excellent reproduction is given whenever the signal appreciably exceeds noise level and is claimed to be the highest on the market. Full limiting for a signal is obtained at 4 microvolts per metre.

The " Magic Eye " connected to the discriminator output is a *very sensitive indicator of mis-tuning*. The eye input is short-circuited 50 times per second by small metal rectifiers supplied from the L.T. windings. When accurately tuned, the discriminator output is nil and the magic eye gives a very sharply defined crisp display. On mis-tuning, the discriminator output causes a blurred display.

Power supplies must be built into a low-distortion, sensitive F.M. tuner, because some 60 mA of H.T. and a few amps of L.T. current are used, and this demand is too great for the tuner to be powered from the " spare supply " socket of any available power amplifier.

Valves

The functions of the valves are :

Pentode radio-frequency amplifier ; triode oscillator ; triode A.F.C. reactance valve ; pentode mixer ; pentode first I.F. amplifier ; pentode second I.F. amplifier ; pentode limiter ; double-diode Deeley-Foster discriminator ; triode cathode follower audio-output stage ; magic-eye tuning indicator ; full-wave H.T. rectifier.

To give the highest possible quality, the radio-detector valve is not used. The Seeley-Foster discriminator employing thermionic diodes has the preceding stage with a limiter, which eliminates amplitude-modulated signals. Thus, the receiver is not affected by ignition and other forms of impulse interference.

The output impedance is low. Long, screened leads can be used to connect the tuner to the amplifier without fear of attenuating or distorting the high audio-frequencies.

The output is approximately 1 volt peak. The tuner, therefore, can be used with any high-fidelity audio amplifier.

The field tests have brought in the opinion that this is the best British F.M. tuner there is, and every user was delighted with its sensitivity and selectivity, particularly in the fringe areas of V.H.F. transmissions.

Dimensions : 10¾in. by 7in. by 7in.
Weight : 10 lbs.
Price (retail) : £25. Purchase Tax, £10 10s.

Power Supplies for Transistors

THOSE concerned with developments in the field of electronics have been aware for some time that the use of transistors would involve new techniques and that new sources of power would be needed to operate equipment containing them.

The first transistors commercially available here were small and low powered. They were well suited for hearing aid use where miniaturisation is a predominant feature. Since size is the determining factor and power is a secondary consideration, miniature and subminiature single cell and two cell batteries are commonly used.

To meet these needs the Ever Ready Company designed and developed the D20, D21, D22 and D23 Transistor Hearing Aid range. They now issue the following information.

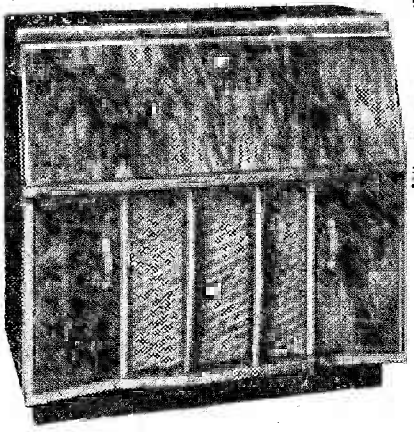
During the current year in the United Kingdom transistors suitable for use in radio receivers, etc., and having a greater power output than those used in hearing aids have become commercially available. Though some types—particularly R.F. transistors—are scarce at the moment, it is expected that adequate supplies will become available during the next 12 months or so.

As a result a considerable expansion in the use of transistor operated equipment may be anticipated in that period. Included in this will be portable receivers of the brief-case type, personal and pocket radios, and in all probability a special set for use in the home. Their use in amplifiers has already commenced and the transistor record player may well become as familiar a household article as the present radio receiver.

To operate these appliances reasonably small low voltage power sources will be needed. For this purpose the appropriate dry battery offers a virtually ideal solution, combining reliability with low running costs. With these factors in mind the Ever Ready Company has developed and is now marketing a full range of transistor batteries capable of operating the various types of transistor equipment which will be available in the foreseeable future. These batteries have the well-known " Batrymax " construction and consequently combine maximum performance with minimum size and weight. Reliability and economy in running costs are features of equal importance.

In connection with transistor equipment and the power sources employed, it is necessary to bear in mind that at the present time we are at the beginning of an era of great expansion. It is inevitable, therefore, that over the next few years considerable development and changes should occur. These changes in transistors and transistor equipment may well call for modification in the sources of power required to operate them. However, we can be reasonably certain that with the knowledge and experience at its disposal the Ever Ready Company will be able to meet those requirements adequately and provide suitable batteries for the purpose.

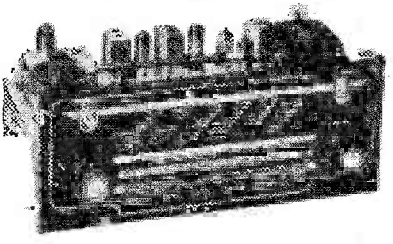
Build yourself a 75gns Radiogram for £54-7-6 only



CABINET CAT. NO. CAB/03

A magnificent Bureau-type Cabinet of the very highest quality in specially selected Walnut veneered exterior. Light Sycamore interior with Rexine lining to match. Outside dimensions: length, 34in., depth 17½in., height 33in. Sloping control panel on right-hand side approx. 16in. x 10½in. Removable baseboard on right side approx. 15½in. x 15in. *Packing and carriage* 25/-.

CASH **£17.6.6**
Or on Credit Terms.



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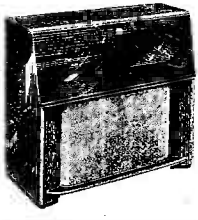

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POWER SUPPLIES

CONSIDERATIONS OF DESIGN WITH CONDENSER INPUT FILTERS

By E. G. Bulley

THIS article covers the essentials of what may be termed low power supplies necessary for the rectification of A.C. in radio receiver practice and similar equipments. Before proceeding, therefore, it is essential that the reader familiarises himself with the fundamentals of rectification using the condenser input filter. Fig. 1 is a typical half-wave supply, wherein, when the voltage on the anode is positive to that of the cathode, a current will flow. Now, as and when the voltage becomes high enough the condenser will become charged. On the next half cycle however, that is, when the anode is negative to that of the cathode, no current will flow, but the

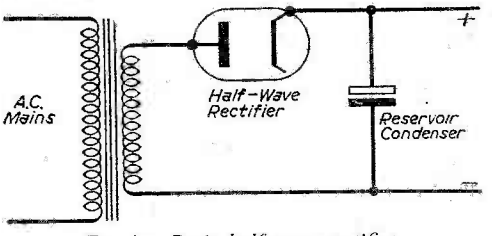


Fig. 1.—Basic half-wave rectifier.

condenser discharges, thus maintaining the output voltage until the next half cycle when the cycle is repeated. So much for half-wave rectification. Now let us analyse Figs. 2 and 2A, which are typical full-wave rectifier power supplies.

In this case, when the voltage on one anode is positive, the voltage on the other is negative, consequently, current flows in the same direction for each half of the valve. The condenser in this case discharges its stored energy in half the time as in the case of half-wave rectification.

Full-wave rectification is, therefore, most commonly used in radio receiver practice, and one will also appreciate that there is much less ripple and therefore the D.C. output is easier to filter or smooth. Before proceeding, however, it is as well to mention, for the benefit of newcomers to radio, that another type of filter exists other than that being discussed. This is

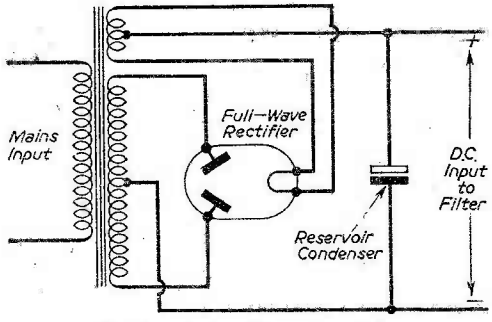


Fig. 2.—Basic full-wave rectifier.

termed a choke input filter, and such are used with mercury vapour rectifiers in transmitting practice. It is not, therefore, intended to mention these further, as they have already been dealt with in this journal by O. J. Russell under the title of "Transmitting Topics."

Mathematics

The reader will appreciate that the mathematics entailed in the design of suitable power supplies

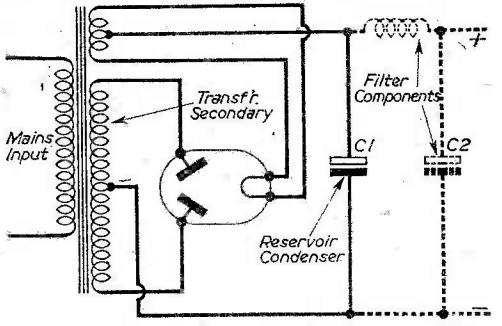


Fig. 3.—The filter components.

using the condenser input filter are very complex, and they are outside the scope of this article, but for the benefit of the newcomer or the radio constructor who requires a quick reference, Table 1 has been compiled. This table should be used in conjunction with Fig. 3. These values assume low transformer resistances and reactances, as the valves are of high impedances. One must bear in mind, of course, that the value of C1 must not be increased beyond that

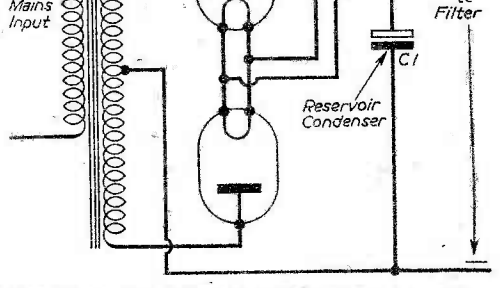


Fig. 2A.—Basic full-wave rectifier using two valves.

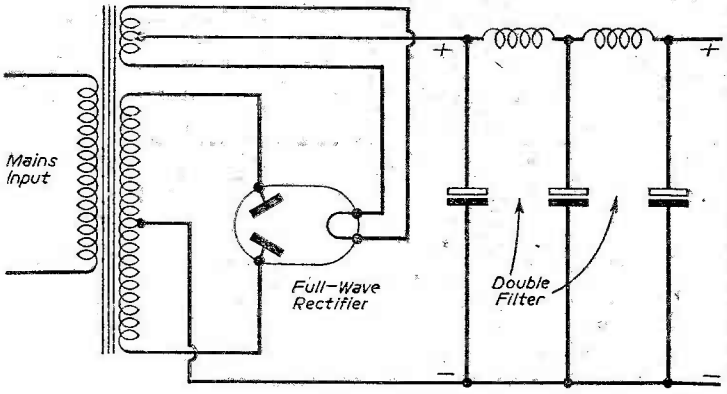


Fig. 4.—A double filter circuit.

stated, otherwise pulses of charging current with peak values will be produced and will be in excess of those specified for the rectifier in question. Failure to observe this will overload the rectifying valve and cause its destruction. One must bear in mind that the rectifier should never be operated above its maximum rated anode voltage, and should be operated within its maximum current rating specified by the manufacturer.

Components

The components necessary for such supplies should be of good quality, for instance the mains transformer should be such that it is rated correctly as well as having good insulation. Condenser C1, as shown in Fig. 3, is termed the reservoir condenser, this being of the electrolytic type. Such condensers are, however, readily available and require little comment, with the exception that they combine both high capacity with fairly small physical size, not forgetting fairly high working voltages.

The working voltages of these condensers are an important characteristic, and it is advisable to adopt one with a higher working voltage than the actual voltage it will have to withstand, that is to say, allow a greater safety margin. For instance, assume the working voltage the condenser will have to withstand is 350 volts, it is far better to have one with a working voltage of 500 volts than one just rated to withstand 350 volts.

The Filter

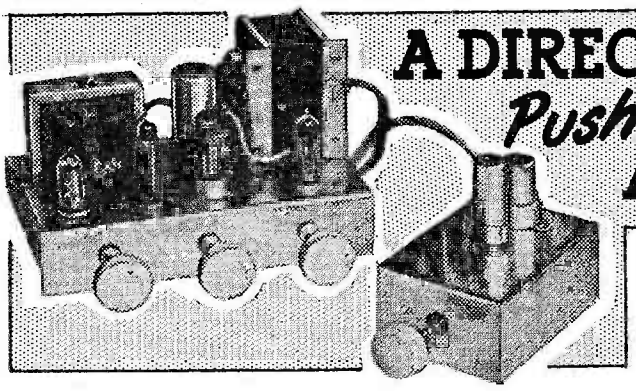
It only remains to give a brief description of the smoothing filter. Reference once again to Fig. 3 will aid the reader to appreciate the following résumé.

The choke should be rated to withstand the current taken by the load. Here again, a higher current rated choke is better, so one has a safety factor. The purpose of the choke is to reject any A.C. component that may have superimposed itself upon the direct current. This will be appreciated when one realises that a choke has an impedance to A.C. The A.C. component is, however, commonly known as the ripple voltage and it is therefore essential that this be reduced to an absolute minimum. To

(*Concluded on page* 786)

TABLE I

Type	*Transformer Sec.*	*Max. Load D.C. mA*	*C1 μF*	*Approx. D.C. output volts*
5V4G	350—0—350	175	8	390
83V	350—0—350	175	8	390
GZ32	350—0—350	175	8	390
5V4G	350—0—350	175	4	370
83V	350—0—350	175	4	370
GZ32	350—0—350	175	4	370
5V4G	300—0—300	120	8	350
83V	300—0—300	120	8	350
GZ32	300—0—300	120	8	350
5V4G	300—0—300	120	4	340
83V	300—0—300	120	4	340
GZ32	300—0—300	120	4	340
5U4G	300—0—300	150	4	300
U52	300—0—300	150	4	300
GZ31	300—0—300	150	4	300
53KU	300—0—300	150	4	300
5W4	350—0—350	100	4	370
5Y3	350—0—350	125	4	350
5Z4	350—0—350	100	4	400
R52	350—0—350	100	4	400
U50	350—0—350	100	4	400
GZ30	350—0—350	100	4	400
6X5	350—0—350	60	4	400
EZ3	350—0—350	60	4	400
U70	350—0—350	60	4	400
UU9	300—0—300	60	8	360
EZ40	300—0—300	60	8	360
66KU	300—0—300	60	8	360
UU9	350—0—350	60	8	425
EZ40	350—0—350	60	8	425
66KU	350—0—350	60	8	425
UU5	500—0—500	120	8	580
1W4/500	500—0—500	120	8	580
APV4	500—0—500	120	8	580
R4A	500—0—500	120	8	580
UU6	350—0—350	60	8	425
UU6	300—0—300	120	8	310
UU6	350—0—350	120	8	385
UU8	300—0—300	250	16	320
UU8	250—0—250	250	16	250
5Y4	300—0—300	125	4	290
80	250—0—250	125	4	220
5W4	300—0—300	100	4	300



A DIRECT-COUPLED *Push-Pull* AMPLIFIER

A USEFUL AMPLIFIER, WITH TONE CONTROL AND PRE-AMPLIFIER

By J. S. Kendall

THERE are many design problems with this type of circuit. One is the matter of the "balanced conditions" of the output valves, as every valve takes a certain small grid current. This develops a positive voltage when passed through a high resistance such as a grid resistor. The normal circuit has two grid resistors of equal value, but this type has a low resistance in one grid circuit and in earlier circuits a strap was made between the two grids with the aid of a resistor of about .5MΩ. This gave a difference of grid voltage of a volt or so; thus one valve was always running with a higher anode current than the other. This gave rise to distortion due to the unequal anode currents in the output transformer. The circuit to be described has a very simple means of setting a perfect balance of anode currents, and thus compensation can be made for valve unbalance or wear.

The Circuit

The theoretical circuit is shown in Fig. 1. The anode load of the first valve is rather high—1MΩ in fact and the screen is fed from the cathode of the output valves, thus the circuit is to a very large amount self compensating for wear in the EF86 and also for changes in H.T. and mains voltages. The static balance control circuit is shown in Fig. 6, and consists of R8, VR1, R9 and R10. The circuit is a simple tapped potentiometer, variable over a small part of the range only, thus the correct bias voltage for the second EL84 can be found correctly.

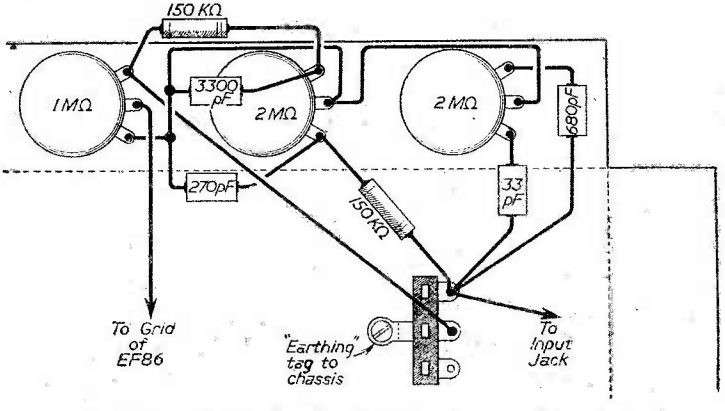


Fig. 2—Wiring details of the tone control section.

Tone Control

The layout of the tone control components is shown in Fig. 2. The choice of components for the circuit is not over-critical, but silver ceramics were chosen for the prototype, as they are very reliable

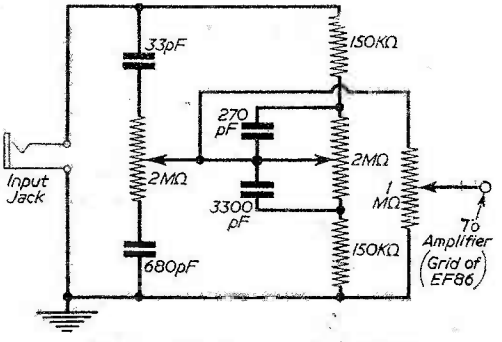


Fig. 3.—The tone control circuit.

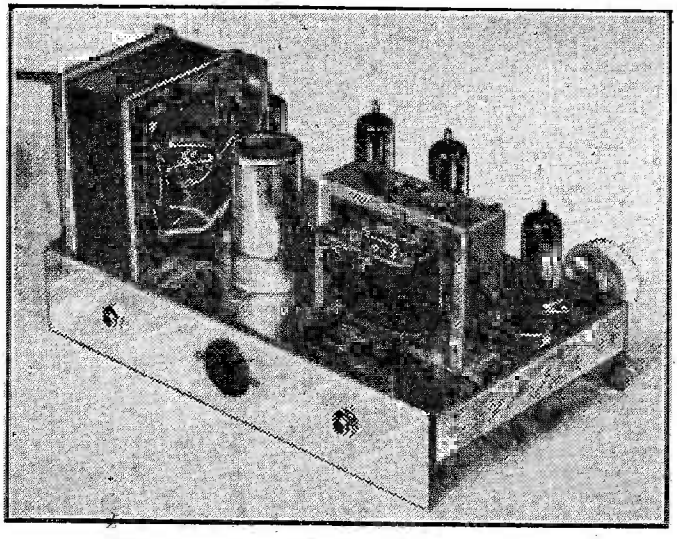
and the price is lower than the silver mica types; type "T" 20 per cent. resistors can also be used with good results. One point that was found was that the tag strip can well be soldered direct to the case of one of the tone control potentiometers. The cases of *all* controls *must* be earthed, or a large amount of interference can be picked up, enough to cause instability in spite of the heavy feedback.

The theoretical circuit is shown in Fig. 3 for those who require a circuit to check against. Various pick-ups require various compensation filters and these will be set out next month.

H.T. Supply

The chassis can be obtained ready punched from Kendall & Mousley Ltd. It is drilled for a choice of two mains transformers, one for use with a feeder and the other without. The spare current when the heavy current transformer is used is a matter of 40 mA which is

ample for most feeders including F.M. The smoothing is of the resistance capacity type and consists of 40 μF reservoir, and a further two 50μF for the other sections. The anodes of the output valves



Three-quarter rear view of the amplifier.

are fed from the first section of the 50μF and the EF86 is fed from the other 50μF.

A separate resistance capacity filter is used for the supply to the feeder or pre-amplifier unit. The circuit is of the distributed load type of push-pull amplifier, thus there are four wires from the valves to the output transformer and one lead from transformer to H.T. The under chassis layout is shown in Fig. 6. The heater wiring of the EF86 and the two EL84s is not shown in full, but the heaters of these valves are joined in parallel and the heater winding centre tap is joined to the cathodes of the two EL84s; this ensures that the heater of the EF86 is positive to the cathode, thus keeping the hum level of the valves to a minimum. A separate earth *must not* be used on the heater centre tap of the cathode coupling resistor or the two valves will be shorted out, thus causing the valves to be very seriously overloaded.

LIST OF COMPONENTS FOR THE 10-WATT DIRECT-COUPLED AMPLIFIER

2 EL84 valves, Mullard.
1 EF86, Mullard.
1 EZ81, Mullard.
R1—250 Ω 10W Lab.
R2—2.7K Ω 10W Lab.
R3—1.5K Ω 10W Lab.
R4—33 ohms, type "T" Lab. 10 per cent.
R5—3.9K Ω type "T" Lab. 10 per cent.
R6—470K Ω type "T" Lab. 10 per cent.
R7—1 m Ω type "T" Lab. 10 per cent.
R8—47K Ω High Stability 1W 2 per cent.
R9—10KΩ type "T" Lab. 10 per cent.
R10—10K Ω High Stability 1W 2 per cent.
R11—See text for value.
R12—750 ohm, 10W Lab.
VR1—25K Pre-set wire wound Lab.
C1—Hunts type JF408T 40 μF 350 volt.
C2-C3—Hunts type KN418A 505—50 μF 350 volt.
C4—Hunts type JD37T 50 μF 50 volt.
C5—Hunts type A300 0.1 μF 150 volt.
C6—Hunts type JF403T 8 μF 350 volt.
2 Three-way tag strips (Kendall & Mousley Ltd.)
3 McMurdo B9A valve holders.

The Layout

The top chassis layout is shown in Fig. 4. The tags on the output transformer are in two layers as it were, the two marked CT are strapped and on each layer are T1 and A1, and on the other T2 and A2. It is not over-important which pair is joined to which valve, but the Rs are taken to the Ts and the Gs are taken to the As. However, the leads from either valve must be joined to the same set of tags, i.e., V1 to T1 and A1, and V2 to T2 and A2 or vice versa. The tags on the secondary are either joined in parallel for 3.75 ohms or in series for 15 ohms. The side of the mains transformer is shown in Fig. 5

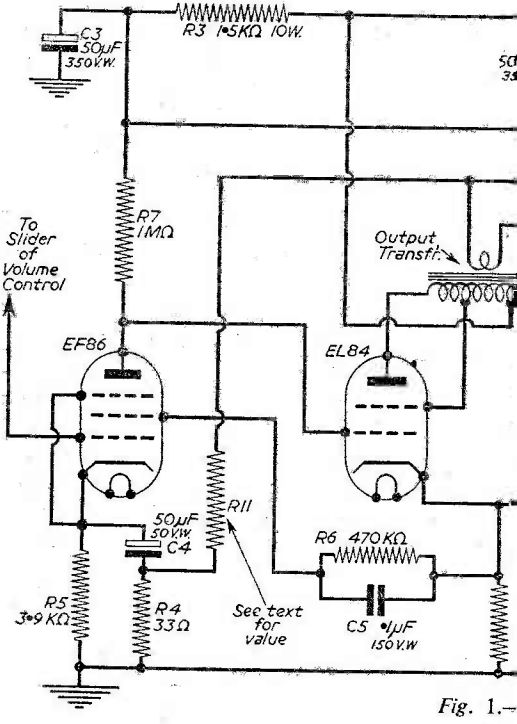


Fig. 1.—

to simplify the wiring of the amplifier.

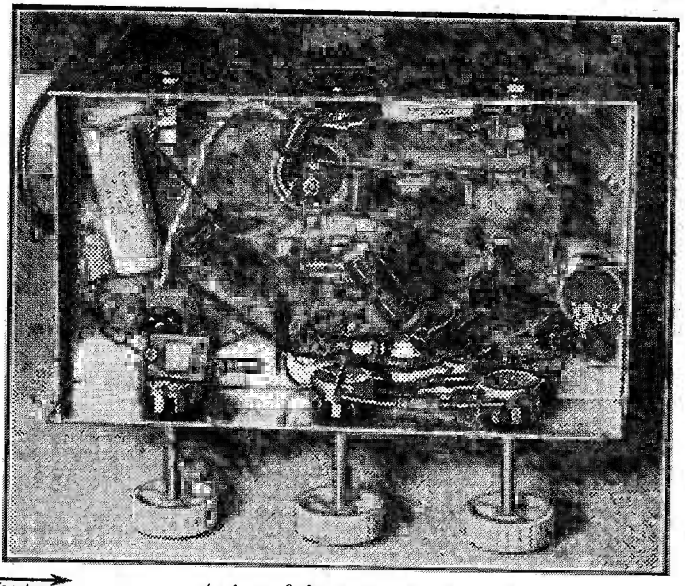
Having constructed the amplifier the first thing is to plug in the speaker and switch on. If a howl results the N.F.B. is incorrectly wired and the leads to the output transformer secondary will have to be reversed. The balance of the currents to the two valves can best be carried out with the aid of a milliammeter; this is joined between the two anodes and the resistor VR1 adjusted until the reading is zero. Here it is better to start on a high range and then switch to a lower range as one gets nearer to a perfect balance.

The negative feedback resistor (R11) will be 390 ohms for a 3.75 ohm output and 680 ohms for a 15 ohm output.

A Pre-amplifier Unit

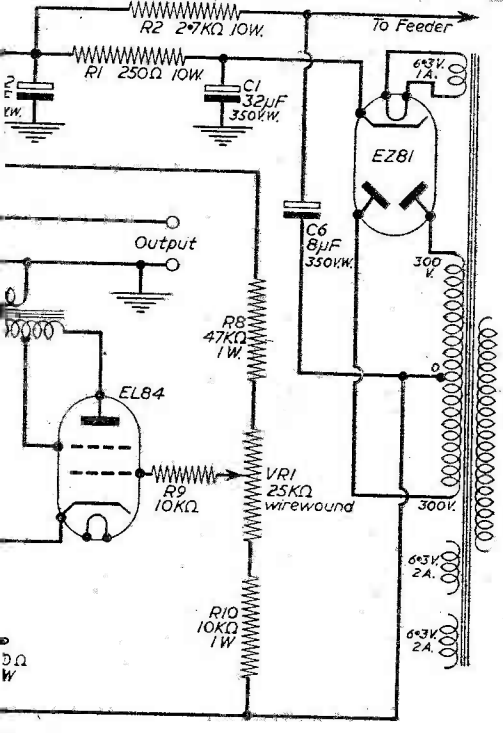
Whilst the amplifier just described has a first-class tone control, it does not incorporate "frequency correction." This latter is required as the bass of the standard records is cut below certain frequencies, these frequencies differing with 78, 45 and 33⅓ recordings. Radio on the other hand is usually not cut so much, and the required amount of correction can be obtained from the tone control of the amplifiers.

The method of obtaining the correction is by providing the amplifier with a large amount of negative feedback and making that feedback frequency selective. That is, at the higher frequencies the gain is quite low, but at the lower frequencies the increased impedance of the capacitors reduces the N.F.B. and allows the gain to rise.



A view of the underside of chassis.

The pre-amplifier unit described here is only 4in. × 6in. × 2½in., with the valve and the capacitor projecting through the top. The valve chosen is the



The theoretical circuit.

1 McMurdo B9A valve holder with skirt and screen.
1 McMurdo International Octal valve holder.
1 McMurdo International Octal Plug (optional).
3 Bulgin K108 pointer knobs or similar.
2 Bulgin J6 closed circuit jacks.
2 Bulgin P.38 jack plugs.
1 Elstone O1/ML output transformer.
1 Elstone MT/MU Mains transformer, but if no feeder unit is required the Elstone MT/5/10 can be used.
1 Special chassis—Kendall & Mousley Ltd.
1 type "9-12" Instrument Case—Kendall & Mousley Ltd.

LIST OF PARTS FOR TONE CONTROL

1 1M Pot. "Lab."
2 2M Pots. "Lab."
1 33pF Ceramicap "Lab."
1 680 pF Ceramicap "Lab."
1 270 pF Ceramicap "Lab."
1 3,500 pF Ceramicap "Lab."
2 150K 20 per cent. type "T" "Lab."
1 triple tag strip.

The tone control unit is suitable, owing to its high impedance, for feeding direct from the pre-amplifier circuit.

Mullard EBC41. The gain is certainly not very high, but quite high enough for the crystal types of pick-up head as well as a radio feeder taken direct from the diode.

The Chassis

The chassis can be obtained in aluminium fully

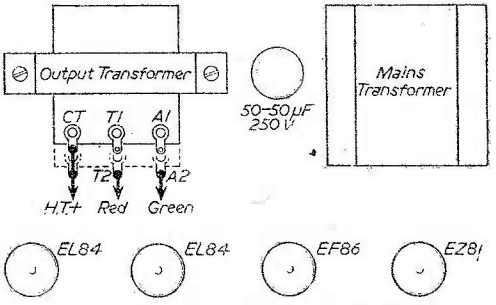


Fig. 4.—Plan of the chassis layout.

punched for assembly. It will be seen that the valve-holder has a raised "blob" of insulating material between two of the pins. The holder should be fixed in place so that the "blob" is as shown. The two orange wires are taken so that one is soldered either side of the "blob" to the pins. The switch can be wired away from the pre-amplifier chassis and dropped in place and soldered to the tags. The jacks can be put in place and the 220 K resistors soldered across them, then the wires from them to the switch wired in and soldered. These latter wires can best be run around the sides of the chassis. The components on the two solder tags can then be wired and soldered in place. Care must be taken in the soldering of the screening of the screened cable. Strip the insulation off the outside of the cable, then by pushing the screening wires to one side, make a hole in the screening, then draw the two wires through the hole. The spare screening can then be soldered to the tag and the ends of the flexible wires wired to the end tag of the solder strip. The anode lead from the .05 μF capacitor can be wired to the valve tag, also from the same tag a 100 K resistor is joined to the 16 μF

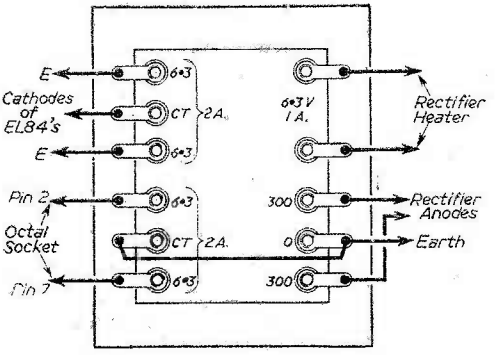


Fig. 5.—Mains transformer connections.

capacitor, another 100 K is joined between the 16 μF and the tag strip along with the red lead.

The cathode connections of the valve can then be wired in, and consist simply of a 2.2 K resistor in parallel with a 50 μF 12 volt electrolytic capacitor.

The orange twin, the red lead and the screened lead can be led out through the hole at the rear of the chassis and laced together to form a cable. For those not experienced in the art of lacing cables, the simplest method of securing at 2in. intervals, with Sellotape can be used. The effect is quite neat.

The fixing of the plug is the last item and the actual connections will be shown next month.

(To be continued)

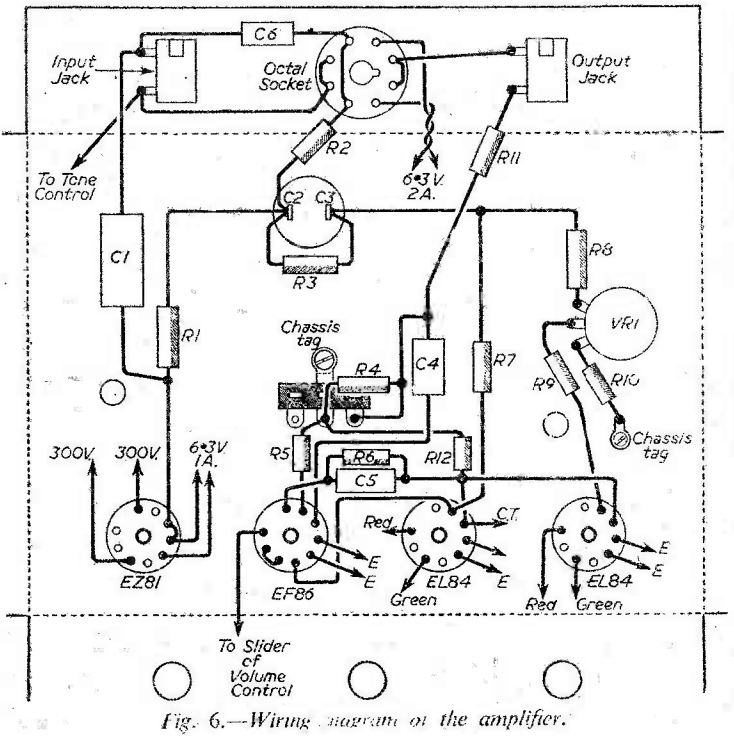


Fig. 6.—Wiring diagram of the amplifier.

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IGRANIC JACK SOCKETS.—P71, 3/4; P72, 3/10. Bulgin Jack Plugs to fit, 3/-.
BELLING LEE PLUGS AND SOCKETS.—Speaker Sockets: L316, Red and Black, 1/- each. Plugs to fit, 10d. each. Co-Ax. Socket L734S, 1/-; L604S, 1/3. Co-Ax. Plug L734P to fit, 1/3.
McMURDO VALVEHOLDERS.—BM9/U, 10d.; XM9/UC1, 1/7; XM9/UG1, 2/3.
SWITCHES.—Specialist Switches. Set of three for the Model A Amplifier, 32/6. One switch for Model B, 16/6.
BULGIN TAG BOARDS.—C120, 1/3; C125, 2/3.
EQUALISER PLUG AND SOCKET.—For Model B. Octal Plug and socket, 2/3.
CERAMIC STAND-OFF PILLAR.—Polar, 1/-.
OSCILLATOR COILS.—Brenell, 8/-.
CHASSIS.—Denco. Ready drilled. Model A, 31/6; Model B, 31/6.
VALVES.—EF86 Mullard, 24/4. Alternative 15/-. ECC83 Mullard, 19/6. Alternative 10/-. EM81 Mullard, 18/1. Mullard EL84, 16/-. Alternative 12/-. OA71 Crystal Diode, 6/-.
POWER PACK.—Chassis Denco, 11/6. Condenser, 50-50 mfd. 350 v. 9/6. Resistor 820 ohm, 3 watt, 2/3. Valveholder BM9/U, 10d. Valve Mullard EZ80 or 81, 11/10. Mains Transformer, Elstone MT3/M, 35/-. Switch, DP Toggle, 5/-. Voltage Selector Panel, 2/-. Fuseholder, 3/9. Fuses 4d. each. Pilot Lampholder, 2/-. 6.3v. Lamp, 9d. Kits or part kits for the above can be supplied on Credit Terms. Send for our fully detailed lists.

MULLARD 510 AMPLIFIER

Full details of all components for this Amplifier were given in our advertisement in the December issue. Fully detailed price list will be sent upon request.

OSRAM "FM PLUS" TUNER PRINTED CIRCUIT VERSION

TCC PRINTED CIRCUIT AND CONDENSER KIT.—Contains the Printed Circuit Panel and all the condensers. £4.4.7.

RESISTOR KIT.—LAB. Kit for Tuner containing R1 to R28, 15/-.

COILS.—Denco. Oscillator Coil, O/L2, 2/-. I.F. Transformers. IFT11/10.7, three required, 6/- each. Ratio Detector Transformer (complete with crystal diodes) O/T2, 19/-. Note: The O/T1 and the O/L1 coils are not required with the printed circuit.

CHASSIS.—Denco. Complete metalwork including Gold Front Panel, Scale Assembly, Drum, Drive Spindle, Pointer, Glass Dial and all fittings, 37/6.

TUNING CONDENSER.—Jackson 17pf. 5096-17-DS, 17/6.

VALVEHOLDERS.—McMurdo Printed Circuit Type, 1/- each. Skirt and can for V2, 1/3.

BELLING LEE PLUGS AND SOCKETS.—Co-ax. Sockets, L604S, two required, 1/3 each. Plugs L734P to fit, 1/3 each.

VALVES.—Osram Z719, 24/4. Alternative 10/- each. Two required. Osram B719, 20/10. Osram W719, 19/6. Alternative 12/6. Two required.

NOISE SUPPRESSION AND TUNING INDICATOR CIRCUITS.—Osram B309 valve, 19/6. Alternative 10/-. Osram EM80 valve, 18/1. Osram L77 valve, 13/11. Alternative 8/9. Resistor Kit containing R29 to R40, 13/-. Condensers, .02 mfd. 350 v., 1/- each. .1 mfd. 350 v.. 9d. .05 mfd. 150 v., 1/6. Valveholder B9A, 10d. each. B7G, 9d.

INSTRUCTION MANUAL.—The manual for the normal wired version is required, 2/6. PRICE LIST FREE. Kits or part kits for the above can be supplied on Credit Terms.

OSRAM 912 PLUS AMPLIFIER

Full details of all components were given in our advertisement in the December issue. Fully detailed Price List available upon request.

GRAMOPHONE EQUIPMENT

BSR UA8 MONARCH RECORD CHANGER.—The latest 4-speed model. Acos turn-over cartridge. Price £9.15.0. Credit Terms Deposit £1.13.0 and seven monthly payments of £1.6.0.

COLLARO STUDIO PICK-UP.—This famous pick-up is now available with one piece arm as well as plug-in head. Can be supplied with the "O" (high output) or "P" (low output) Cartridge. Price £2.19.6.

BSR TU8 MOTOR AND PICK-UP.—Three speed motor and separate pick-up. The pick-up is fitted with the Acos turn-over crystal cartridge. £4.17.6.

COLLARO TRANSCRIPTION MOTOR.—Complete with the Transcription pick-up and insert, £19.10.0. Can be supplied less pick-up at £14.18.0.

TV PATTERN REMOVAL UNIT

Spencer West Type 54. These units will give considerable assistance in removing patterning on the ITA picture. Complete with instruction leaflet, 25/-.
Osmor Band 1 Filter. For removing BBC signal when it is entering the converter via the ITA aerial, 10/-.

TRANSISTORS

MULLARD.—OC70, 21/-; OC71, 24/-; OC72, 30/-. Matched Pairs, 60/-. STC, TJ1 (3X309N), 40/-; TJ2 (3X/391N), 45/-; TJ3 (3X/392N), 50/-; TS1, 18/-; TS2, 21/-; TS3, 24/-; TP1, 40/-; TP2, 40/-.

CRYSTAL SET COMPONENTS

COILS.—Teletron HAX 3/-. Specially made for use with Crystal Diodes. Suitable diodes 2/6.
TUNING CONDENSER.—.0005 mfd., 3/10
CHASSIS.—Small metal chassis with tuning scale and sockets for aerial, earth and phones, 2/9.
TUNING KNOB.—1/-.

CONDENSERS AND RESISTORS

We carry a wide range of these and fully detailed lists are available free of charge.

VIEW MASTER CONVERTER

INSTRUCTION MANUALS are now available. The Manual is a reprint of the articles in "Practical Television." Price 2/6, postage 9d.

TELEVISION ATTENUATORS

Belling Lee Co-Axial plug-in Type. Available in 6db, 12db, 18db, 24db and 36 db. 4/6 each.

CO-AXIAL CABLE

The very best quality semi-airspaced. Entirely suitable for Band III and F.M. 10d. per yard; 82/6 per 100 yard drum.

WHITELEY CABINETS

All these Cabinets are packed flat for easy home assembly. The new Junior Bass Reflex Corner Console, £9.9.0. Bass Reflex Console, £10.10.0. Senior Bass Reflex Corner Console, £11.11.0. All the other Whiteley types are available. Illustrated leaflet available free. Credit terms on these cabinets with a speaker if required.

WHITELEY SPEAKERS

The Whiteley Hi-Fi range of speakers. 10in. HF1012, 93/3. 9in. HF912, 88/6. 8in. HF812, £4.3.6. 8in. T816, the new Treble speaker, £6.10.0. Whiteley Cross Over Unit CX1500 for the T816, 38/6. 8in. HF816, £6.17.0. T10 Tweeter, 84/-. Cross-over Unit CX300 for this tweeter, 30/-. Detailed leaflet on all W.B. Speakers available.

TEST INSTRUMENTS

AVO Meter Model 8, £23.10.0. **AVO** Meter Model 7, £19.10.0. **RADAR** Kilovolter for E.H.T. Measurements, 3 to 30 kv., £3.17.6.

TSL TWEETER SPEAKERS

The new Moving Coil LSH65, 39/6. Cross-over chokes, .84 mH, .9 mH, .6 mH, 1.75 mH. All 3/6 each. Electrostatic, LSH75, 12/6. LSH516, 17/3. LSH100, 21/-. 65 mH cross-over chokes, 7/6 each.

PAPER BLOCK CONDENSERS

Very high grade 2 mfd. 250 v. Paper Block Condensers. Ideal for making up the capacity required for cross-over networks. 2/- each. Brand new. Not ex-Government.

CREDIT TERMS.—Anything we sell can be supplied on Credit Terms. The deposit is 3/- in the £ and the balance payable over 7 months. Send details of your exact requirements and we will submit a quotation.
TERMS OF BUSINESS.—Cash with order or C.O.D. Please add postage under £3. We charge C.O.D. fees on C.O.D. orders under £5.

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KINGSTON-ON-THAMES, SURREY

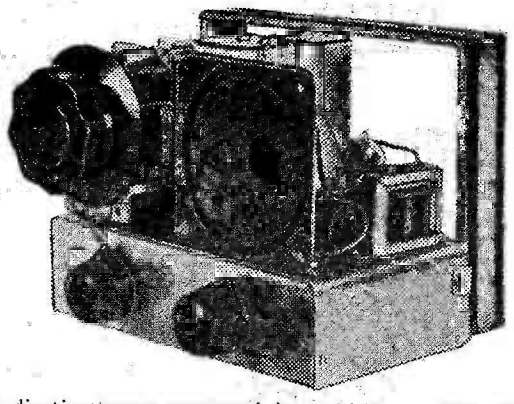
Telephone: KINgston 4099

Shop Hours: Monday, Tuesday, Thursday—9 a.m. to 5.30 p.m. Wednesday—9 a.m. to 1 p.m. Friday, Saturday—9 a.m. to 6 p.m.

A Superhet PORTABLE 4

A SIMPLE-TO-MAKE BATTERY RECEIVER

By F. G. Rayer



IN addition to its sensitivity the main advantage of the superhet type of receiver lies in the fact that no reaction control is required. With portables, where the signal pick-up is small, the reaction control in a non-superhet receiver can be quite critical, but this is wholly avoided in the superhet, where a L.F. volume control can be employed. The receiver described here is accordingly easy to operate by anyone, while ganged tuning does away with difficulties in that direction. If the specified oscillator coils are used, and the frame wound as described, correct alignment throughout the wavebands will be obtained. The oscillator coils have adjustable dust-iron cores, thus enabling the inductance to be adjusted to the required value, and this type of coil is essential in the present case.

It is also recommended that the other specified components be used to avoid difficulty. A W.B. midget speaker is used, this gives excellent results, and as a small output transformer specially for use with this model is available from the same manufacturer no possibilities of mis-matching (and consequent loss of volume) need arise. The specified I.F. transformers, besides providing high gain, have adjusting screws at the top. If transformers with side adjusting screws were used, it would be very difficult to get at these for aligning purposes. It is, therefore, recommended that the speaker, with transformer and coils and I.F. transformers all be obtained from the suppliers listed. If alternatives are used it is necessary to assure that they can be accommodated in the small space available and have suitable characteristics.

Fig. 1 shows the circuit. Long and medium wave coils are quite separate and selected by a three-way switch. One position of the switch provides the "Off" setting, additional contacts taking care of battery and frame aerial connections. A measure of A.V.C. is applied to the I.F. valve, and the diode detector is followed by two stages of L.F. amplification.

Winding the Frame

This was made with ¼in. wood for sides, and 3/16th wood for top and bottom. However, the thickness of the material does not matter, provided the pieces are cut so that the outside dimensions are 5¼in. high by

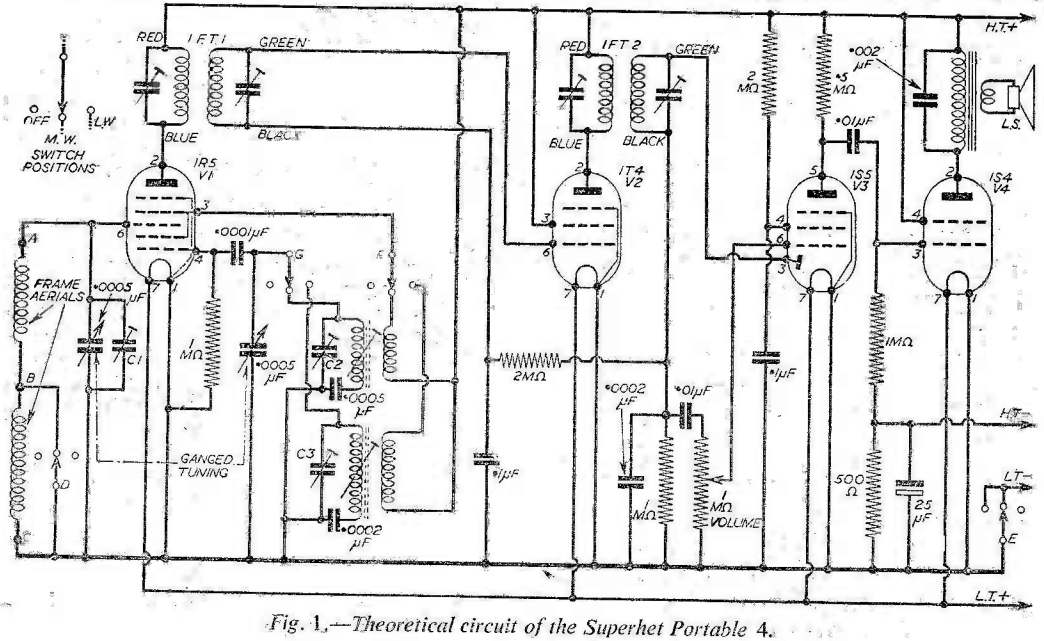
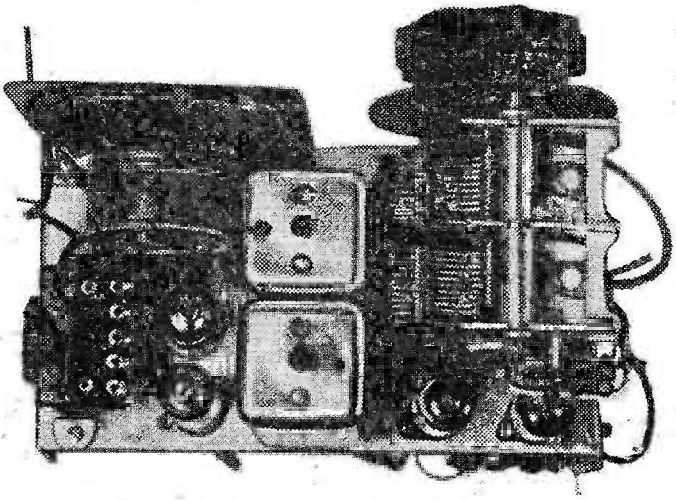


Fig. 1.—Theoretical circuit of the Superhet Portable 4.

7in. wide. Three 6 B.A. bolts are screwed tightly in position for points "A," "B" and "C." The 18-turn section has turns side by side; the 45 turns of the larger section are wound in a pile occupying about ¼in. width. The ends of the windings are soldered to the bolt heads, and point "B" consists of the junction between both windings. The wire should be wound on tightly. Afterwards the corners may be varnished to hold the turns in place. The whole of the frame windings should *not* be varnished in this way, however.

The completed frame is mounted on the rear of the chassis, by two small brackets, when the receiver has been wired up.

Two short lengths of flex run to terminals "A" and "B," from the fixed plates of the tuning condenser (rear section), and wavechange switch, respectively. Lead "C" is taken to one bracket, thus being returned to the chassis.



Plan view of the completed set without the frame aerial.

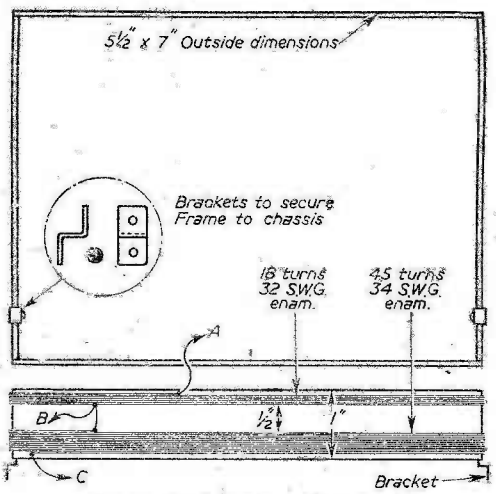


Fig. 2.—Details of the frame aerial.

Chassis Layout and Wiring

The chassis, shown in Fig. 3, is 1¾in. deep, and was bent up to the dimensions given from 20 s.w.g. aluminium. All the drilling should be done before any components are mounted. The tuning condenser is secured by two small brackets, the rear one coming under C1. The speaker is similarly mounted. Holes are drilled under the positions to be occupied by the I.F. transformers, so that leads may pass through. (These will be seen in Fig. 4.)

Only four leads pass through the chassis, except for those already mentioned. These are those from output valve to output transformer, and from each fixed plates section of the gang condenser.

When the valveholders are screwed down position the sockets as in Fig. 4, so that wiring may be followed with no difficulty. All the connections shown in Fig. 4 may then be put on, and a reasonable amount of space exists for the smaller parts. The two .01 μF coupling condensers should preferable be of the mica type, while ½ watt resistors can be accommodated with more ease than the larger 1 watt type.

The lead issuing from the top of one I.F. transformer is not used because the B7G valve types do not have a top cap in any instance.

Coil and Switch Wiring

The switch is mounted on the front runner, with the coils on the side runner, as seen from Fig. 4. Wiring for these parts is shown in Fig. 5, which is a plan view of the side runner and switch. The coils are notched, to identify the tags, and mounted by drilling ¼in. diameter holes and pressing on the clips provided. The slotted ends of the core adjusting screws project outside the chassis.

The two trimmers C2 and C3 are bolted to the chassis, as illustrated, and can be adjusted from behind the receiver. The .0002 μF and .0005 μF condensers in Fig. 5 are fixed padders, returned to the chassis. As in Fig. 4, points marked "M.C." are taken to a tag bolted to the chassis itself.

As a guide, connections are as follows, for the three

(*Continued on page* 765)

LIST OF COMPONENTS

W.B. Stentorian Type S.3.57 Speaker.
W.B. Miniature Universal Output Transformer.
Long Wave dust-iron core oscillator coil; ditto for Medium Waves (Supacoils).
Pair I.F. transformers with top trimmers (Astral Radio Products, 82. Centurion Road, Brighton).
1R5, 1T4, 1S5 and 1S4 valves. 4 B7G holders.
2 gang .0005 μF tuning condenser.
3-way 4-pole small-sized rotary switch.
Three .00005 μF postage-stamp trimmers. .0001 μF, two .0002 μF, .0005 μF, .002 μF, two .01 μF, two .1 μF and 25 μF condensers. 500 ohm, .1 megohm, .5 megohm, three 1 megohm, and two 2 megohm resistors. 1 megohm volume control.
Knobs, wire for frame aerial, and aluminium for chassis.

C.R.T. ISOLATION TRANSFORMER
Type A. Low leakage windings. Ratio 1 : 1.25 giving a 25% boost on secondary. 2 v., **10/6**; 4 v., **10/6**; 6.3 v., **10/6**; 10.8 v., **10/6**; 13.3 v., **10/6**.
Ditto with mains primaries, **12/6** each.
Type B. Mains input 200/240 volts. Multi Output 2, 4, 6.3, 7.3, 10 and 13 volts. Input has two taps which increase output volts by 25% and 50% respectively. Low capacity, suitable for most Cathode Ray Tubes. With Tag Panel, **21/-** each.
Type C. Low capacity wound transformer for use with 2 volt Tubes with falling emission. Input 220/240 volts. Output 2-2½-2½-3 volts at 2 amps. With Tag Panel, **17/6** each.
NOTE.—It is essential to use mains primary types with T.V. receivers having series-connected heaters.

TRIMMERS, Ceramic. 30, 50, 70 pf., **9d.** 100 pf., 150 pf., 1/8; 250 pf., **1/6**; 500 pf., 750 pf., **1/9.**
RESISTORS. All values. 10 ohms to 10 meg., ½ w., **4d.**; ½ w., 6d.; 1 w., **8d.**; 2 w., **1/-.**
HIGH STABILITY. ½ w., 1%, **2/-.** Preferred values 100 ohms to 10 meg.

5 watt	WIRE-WOUND RESISTORS	1/3
10 watt	25 ohms—10,000 ohms	1/6
15 watt		2/-

15,000 ohms—50,000 ohms, 5 w., **1/9**; 10 w., **2/3.**
KNOBS, GOLD ENGRAVED.—Walnut or Ivory, 1½in. diam., **1/6** each. Not engraved, 1/- each.

12/6 PURETONE RECORDING TAPE
1,200 ft. on standard, fitting 7" Plastic reels. Brand new, boxed, 12/6.
Spools 5" metal, 1/6, 7" plastic, 4/3.

O/P TRANSFORMERS. Heavy Duty 50 mA., **4/6**: Multiratio, push-pull **6/8.** Tapped small pentode, **3/9.**
L.F. CHOKES 15/10 H. 60/65 mA., 5/-; 10 H. 120 mA, **10/6**; 15 H. 150 mA., **12/6.**
MAINS TRANS. 350-0-350, 80 mA., 6.3 v. tapped 4 v. 4 a., 5 v. tapped 4 v. 2 a., ditto 250-0-250, **21/-.**
HEATER TRANS. Tapped prim., 200/250 v., 6.3 v. 1½ amp., **7/6**; tapped sec. 2, 4, 6.3 v., 1½ amp., **8/6**; 230 v. to 6.3 v. 3 amp., **10/6.**
VCR97 TESTED FULL PICTURE, 25/-.
COPPER PLATED AERIAL RODS. ¼ x 12in. push fitting, **3/-** doz., p. & p. 1/-.
ALADDIN FORMERS and core, ½in., **8d.**; ¾in., **10d.** **.3in. FORMERS 5837/8** and Cans **TV1/2**, ¾in. sq. x 2¾in. and ¾in. sq. x 1¼in., **2/-** ea. with cores.
TYANA.—Midget Soldering Iron. 200/240 v. or 230/250 v., **16/9.** Solon Instrument Iron, **24/-.**
MIKE TRANSF. Ratio 50 : 1, **3/9** ea.; 100 : 1, **10/6.**
MAINS DROPPERS. 3 x 1¼in. Adj. Sliders, .3 amp. 750 ohms, **4/3**, .2 amp., 1,000 ohms, **4/3.**
LINE CORD. .3 amp., 60 ohms per foot, .2 amp., 100 ohms per foot, 2-way, **6d.** per foot, 3-way, **7d.** per foot.
LOUDSPEAKERS P.M. 3 OHM.
5in. Goodmans, **17/6.** 7in. x 4in. Goodmans, **21/-.**
3½kn. square, Elac., **21/-.** 8in. Elac., **22/6.**
6½in. Goodmans, **18/6.** 10in. R. & A., **30/-.**
T8L Tweeter, LSH75, **8/6.** 12in. Plessey, **30/-.**
8in. M.E. 2.5 k. or 2 k. field, tapped O.P. transf., **24/6.**
CRYSTAL DIODE, G.E.C., 2/-. Crystal Book, 1/-, **GEX34, 4/-.**
HIGH RESISTANCE PHONES. 4,000 ohms, **17/6** pr.

CRYSTAL MIKE INSERT by Acos, precision engineered. Size only 1¼ x 3/16in. Bargain Price **6/6.** No transformer required.

SWITCH CLEANER Fluid, squirt spout, **4/3** tin.
TWIN GANG TUNING CONDENSERS. .0005 mfd. midget, less trimmers, **6/6**; .0005 Standard size with trimmers, **9/-**; less trimmers, **8/-**; ditto, soiled, **2/6**; .0005 mfd. 3-gang, **7/6.**
GOLD CLOTH. 18in. x 25in., **5/-**; 35in. x 36in., **10/-.**

VALVES
A SMALL SELECTION FROM OUR STOCKS

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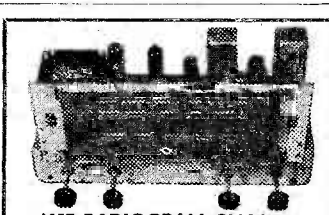
8/6	5/6	1/6	6/6	10/6
1R5	6B8	EA50	6AL5	5Z4
1T4	9D2	9S1	6J5	12AT7
1S5	EF50	2/6	6K6	12AU7
3S4	Equip.	EI148	6K7G	EBC41
3V4	SP61	EB34	EB91	EBF80
5U4	SP41	3/6	HVR2	ECL80
6AM6	EF92	3D6	(Lear)	ECH42
6AT6		6H6M		EF41
6U7		7/6		EF80
6K8		6A6G		EL41
6SL7	7/6	6N7	7/6	EL84
6SN7	6BE6	6X4	EL32	EZ40
6V6GT	6BW6	6X5	HVR2A	KT33C
EBC33	6F6	S07	PEN25	MU14
EF50	6K7GT	EF39	VP23	PY81
Sylv. Red				12K7
EF91		11/6		35Z4
EZ80	EY51	U25	PL81	6Q7



1957 RADIOGRAM CHASSIS
THREE WAVEBANDS FIVE VALVES
S.W. 16 m.—50 m. LATEST MULLARD.
M.W. 200 m.—650 m. ECH42, EF41, EBC41,
L.W. 800 m.—2,000 m. EL41, EZ40.
12 month guarantee.
A.C. 200/250 v. 4-way Switch; Short-Medium-Long-Gram. A.V.C. and Negative feedback 4.2 watts. Chassis 13½ x 5½ x 2¼in. Glass Dial 10 x 4¼in. horizontal or vertical available. 2 Pilot Lamps, Four Knobs, Walnut or Ivory. Aligned and calibrated. Chassis isolated from mains. **T.S.L. Tweeter Supplied Free!**
10 gns. Carr. & Ins., 4/6.
TERMS: Deposit **£5.5.0** and six monthly payments of £1.
MATCHED SPEAKERS FOR ABOVE CHASSIS
8in., **19/6**; 10in., **25/-**; 12in., **30/-.**

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Collaro Auto-changer RC531 for 78 r.p.m. 10in. and 12in. records. Brand new in maker's boxes! High impedance lightweight Pick-up with sapphire needle, will match any Amplifier or Radio. Less than half price.
5 gns. Carr. and Ins., 5/6.
Sorry—No. C.O.D.

£7-19-6 Post Free.
Terms: Deposit £4 and six monthly payments of 15/-.
Brand new Plessey 3-speed Autochanger Mixer. Xtal Head with Duopoint sapphire stylus. Board required 15½ x 12in. Height 5¼in.
Walnut Veneered Playing Desk 10/6 extra.

EXCEPTIONAL OPPORTUNITY
COLLARO 4-speed Single Record Player, including heavyweight turntable and lightweight Studio O Turnover Xtal Pick-up mounted on baseplate. Auto-stop fitted.
OUR PRICE **6 gns.** *carriage 4/-.*
Player Cabinet, 49/6, post 2/6.

ALLDRY UNIT POWER PACK. Replaces Battery B114, etc., 69 v. plus 1½ v. Size 4¼in. x 3¼in. x 1¼in. 4-pin Socket. Same as battery. ONLY 1/- a year to run on A.C. 200/250 v. FAMOUS MAKE. LIST PRICE, 65/-. OUR PRICE, **39/6.** Ready for use.

B.S.R. MONARCH. 3-speed Motor and Turntable with selecting switch for 33, 45 and 78 r.p.m. records. 100-120 v. and 200-250 v. A.C. 50 cps. Also **B.S.R. MONARCH** Lightweight Pick-up with Acos Xtal turnover head, separate Sapphire stylus for L.P. and standard records. **SPECIAL OFFER, THE TWO ! £4.12.6** post 2/6.

T.V. PRE-AMP (McMICHAEL). Tunable Channels 1 to 5. (Will Amplify Output of your Band 3 Converter.) Midget size. High Gain Fringe Model, B.V.A. Valve. Full Instructions. Ready for use. H.T. 200 v., L.T. 6.3 v., .3 amp. required.) BRAND NEW, 25/- each. **MAINS POWER PACK** for above, **25/-** extra.

SUPERHET COIL PACK. 27/6. Miniature size 2¼in. x 2¼in. x 1¼in. **HIGH "Q" Dust cored Coils.** Short, Medium, Long, Gram Switching. Single hole fixing. Complete with connection diagram, and circuit.

TELETRON BAND III CONVERTER
For London, Midland and Northern Transmissions.
Suitable all T.V. makes. T.R.F. or Superhet. Ready wound coils, two EF80 valves, all components, punched chassis, circuit diagram, wiring plans. **COMPLETE KIT** for mains operation 200-250 v. A.C. **£3.10.0.**

As ABOVE less POWER PACK. Requires 200 v. 20 mA. H.T. 6.3 v. .6 a. L.T.,		**£2.5.0.**
Mains Transformers to above Spec.	...	**10/6**
Min. Contact Rect. 250 v. 50 mA.	...	**3/6**
B.V.C./I.T.A. Aerial crossover unit	...	**7/6**
Punched and drilled chassis	...	**3/9**
Larger chassis for Mains Model	...	**6/-**
Teletron Coilset with plans	...	**15/-**
Full plans and circuit details	...	**6d.**

Volume Controls
Long spindles. Guaranteed 1 year. Midget. 10,000 ohms to 2 Meg. No Sw. S.P.Sw. D.P.Sw. **3/-** **4/-** **4/9**
Lin or Log Tracks.

80 ohm CABLE **COAX**
Semi-air spaced Polythene insulated. ¼in. dia. Stranded core. Losses cut 50% **9d.** yd. STANDARD **8d.** yd. ¼in. Coax.

COAX PLUGS ... **1/-** **DOUBLE SOCKET** ... **1/3**
SOCKETS ... **1/-** **OUTLET BOXES** ... **4/3**
BALANCED TWIN FEEDER, 9d. 80 or 300 ohms. **DITTO SCREENED per yd. 1/-.** 80 ohms only.
WIRE-WOUND POTS. 3 WATT. Pre-Set Min. T.V. Type. All values 25 ohms to 30 K., **3/-** ea. 50 K., **4/-.** (Carbon 50 K. to 2 m., **3/-.**)
WIRE-WOUND 4 WATT. Pots. 2½in. Spindle. Values, 100 ohms to 50 K., **5/6**; 100 K., **6/6.**
CONDENSERS. New stock. .001 mfd. 7 kV. T.C.C., **5/6.** Ditto, 20 kV., **9/6**; 100 pf. to 500 pf. Mica, **6d.**; Tubular 500 v. .001 to .01 mfd., **9d.**; .05, .1, **1/-**; .25, **1/6**; m.5, **1/9**; .1/350 v., **9d.**; 1/600 v., **1/3**; .1 mfd. 2,000 volts, **4/-.**
CERAMIC CONDS., 500 v., .3 pf. to .01 mfd., **10d.**
SILVER MICA CONDENSERS. 10%, 5 pf. to 500 pf., **1/-**; 600 pf. to 3,000 pf., **1/3.** **DITTO** 1% 1.5 pf. to 500 pf., **1/9**; 515 pf. to 5,000 pf., **2/-.**

I.F. TRANSFORMERS 7/6 pair
465 Kc/s Slug tuning Miniature Can 2¼in. x 1¾in. x 1in. High Q and good bandwidth.
By Pye Radio: Data sheet supplied.

NEW ELECTROLYTICS. FAMOUS MAKES

TUBULAR		TUBULAR		CAN TYPES	
1/350 v.	2/-	100/25 v.	2/-	8+16/500 v.	5/6
2/450 v.	2/3	8+8/500 v.	4/6	16+16/500 v.	6/-
4/450 v.	2/-	16+16/500 v.		25+25/450 v.	5/6
8/450 v.	2/3		6/-	32+32/350 v.	4/6
8/500 v.	2/9	**CAN TYPES**		32+32/450 v.	6/6
16/450 v.	3/6	Clips	3d.	50+50/350 v.	7/-
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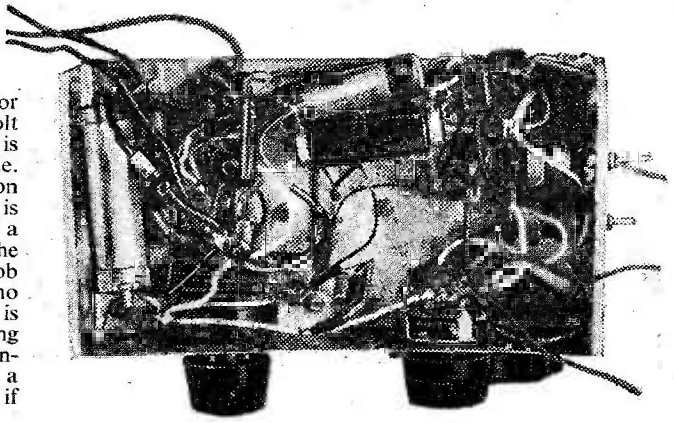
switch positions: 1—Off. 2—L.T. switched on, B on frame switched to chassis, oscillator grid switched to grid winding of M.W. coil, and oscillator anode to anode winding of same coil. 3—L.T. on, oscillator grid to grid winding of L.W. coil, and oscillator anode to anode winding of same coil.

Operational Notes

A 1.5 volt dry battery is used for filament supply. A 45 or 67½ volt standard or midget H.T. battery is used—many types of these are available. Best quality and volume of reproduction will not be obtained until the set is installed in a cabinet, as the lack of a baffle slightly reduces efficiency of the speaker. A 2½in. diameter milled knob was used for tuning, and there was no difficulty in operating. A small knob is useless, here, as it will make tuning very critical and awkward. The condenser is set sufficiently far back for a small reduction drive to be added, if desired.

The four screws on the I.F. transformers should be screwed right down, avoiding undue force, however. Each screw should now be unscrewed two complete turns. All the three trimmers should be set at a midway position, and the core adjusting screws of the coils set so that about eight threads protrude. Upon switching on, the local station should be received. Tune this in accurately with the control knob, and adjust the four I.F. trimmers, one at a time, for maximum volume. (As this is done, it will be necessary to reduce volume by means of the volume control.) Once all the I.F. trimmers have been carefully peaked for maximum volume they may be left untouched.

A station near the low wavelength end of the M.W. band can now be tuned in and C2 adjusted for maximum volume, the gang condenser control knob being moved slightly, as required, to keep the signal correctly tuned in. When this has been done a high wavelength station is tuned in and the *core* of the M.W. coil adjusted, in conjunction with the tuning knob for maximum volume. The same procedure is carried out on L.W. The procedure should then be repeated to balance out any small differences which may have arisen.



Underside view of the set.

If the coil cores are adjusted at the high wavelength end of the bands, and the trimmers at the low wavelength ends, it is not likely that any difficulty will arise. When this is done C1 may be adjusted, low on the M.W. band, for maximum volume, the tuning knob *not* being moved.

As with all portables the frame aerial is directional,

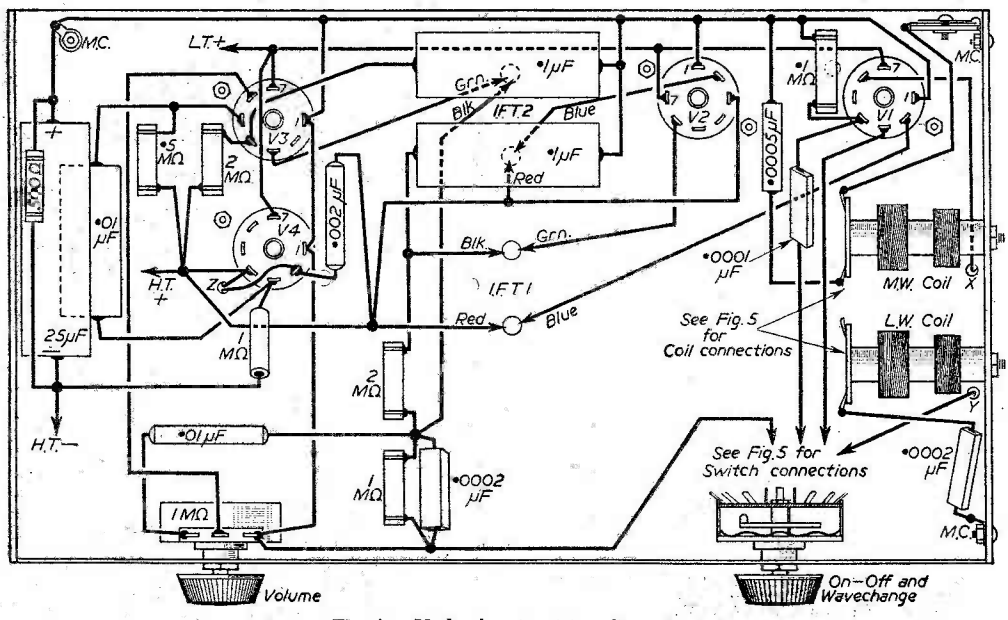


Fig. 4.—Underchassis wiring diagram.

though the sensitivity of the circuit renders this comparatively unimportant. In the localities where the set was used quite a number of stations were well received. Some overloading, causing distortion, arises when receiving local stations, unless the volume control is turned well back. Under these conditions, measured with a 10,000 ohms per volt instrument, nearly 2 volts A.V.C. bias is developed. (This voltage cannot be measured with a meter having a low internal resistance.) Used with a short, throw-out aerial a large number of quite distant stations were received. However, this is not, of course, required for normal purposes.

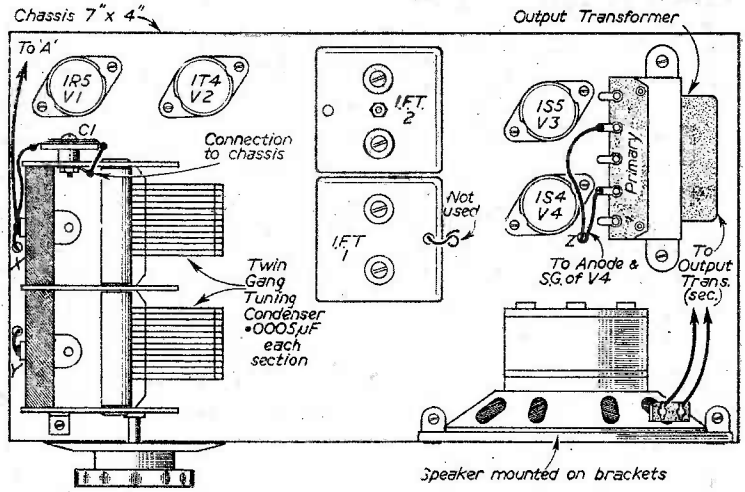


Fig. 3.—Above chassis data.

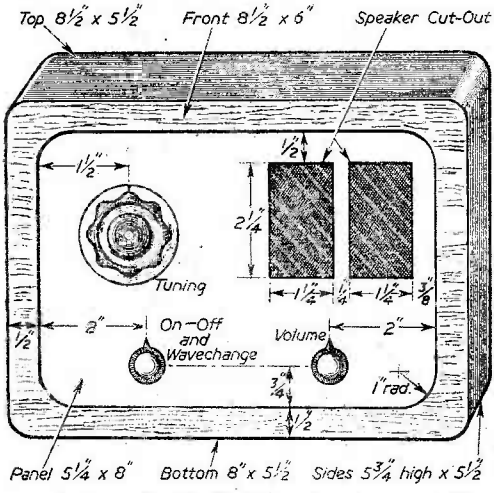


Fig. 6.—Details of the case and controls.

Cabinet for the Superhet Portable Four

The dimensions shown are for ¼in. plywood, and the use of wood of this thickness results in a strong cabinet, and avoids difficulties due to splitting. The receiver panel itself is of thinner material, secured to the chassis by the fixing nuts of the switch and volume control. When the cabinet is completed the receiver, with panel, can be inserted from behind. The panel then comes up against the cut-out front of the cabinet. This form of construction simplifies adjustment to the receiver, as it can be removed, complete, without disconnecting any leads.

The pieces should be sawn accurately, and glass-papered smooth. They are secured together by ¾in. panel pins, the heads being sunk by using a small punch, and the holes filled with plastic wood. The top overlaps the side pieces, but the bottom goes inside the latter. All the edges and joints are smoothed down quite level and afterwards rounded to improve appearance. Varnishing completes the cabinet. A small carrying handle might be secured to the top if this is preferred.

The panel should pass fairly easily into the cabinet

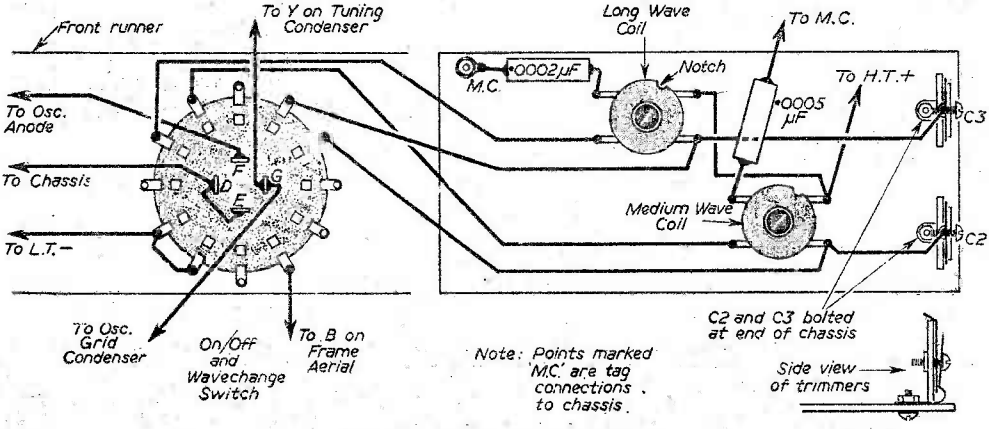


Fig. 5.—Switch wiring details.

TRANSMITTING TOPICS

COMPACT AND MULTI-BAND AERIALS

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

RECENT articles on compact aerials have evoked considerable correspondence, revealing the deep interest that exists in such systems. This is not surprising in view of the restrictions on space that handicap so many in this age of austerity. While few readers are likely to be in quite such a parlous plight, the writer recently had a few local QSO's on Topband using an indoor aerial of some 15ft. This is just to encourage those faced with difficult site problems!

Almost any location *can* be worked on some band or the other, and a study of aerial considerations may often enable efficient operation with very restricted sites. In fact, the writer was able to work some 20 countries upon 40 metres with an indoor aerial in a few weeks of operation, so that DX working is, in fact, possible even under "difficult" conditions. Indeed, with the recent resurgence of conditions, 10-metre DX may be easily worked with indoor aerials and limited power. However, before considering the questions of bands where small aerials are efficient due to the higher frequency, we may consider the plight of the Topband and Eighty enthusiast who is not able to erect even a 132ft. top for 80 metres. In fact, his "clear-run" may be much less than this. The sovereign remedy for "short" gardens is the "All Band" aerial shown in Fig. 1. Basically, this has a 100ft. top and 38ft. feeders. This may be resonated upon all bands from Topband downwards, as has been shown in previous articles, and there is no need for the radiating portion to be *in itself* an exact resonant length. Dispensing with the "fetish" of resonant lengths enables aerials to be tailored into the most unlikely spaces. However, the

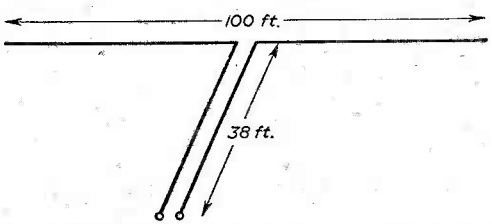


Fig. 1.—The "All Band Special" permits efficient operation upon all the usual amateur bands, performing well on 1.8 Mc/s, despite being shorter than the usual 80 metre half-wave dipoles. It is recommended as a useful standby aerial for all band working, even when separate aerials are available for the higher frequency bands.

reader is warned that the correct tuning network to resonate the "All Band" aerial is necessary. In practice this merely means the selection of either series or parallel tuning as shown by the tabulated instructions in Fig. 1.

Even 100ft. of clear run is often impracticable, even when the aerial is run over the house to obtain the maximum length that can be put up. The old solution may then be resorted to—that is allowing the "excess" length to be disposed of. One way is to run the excess length horizontally at right angles to the main length of the middle of the aerial. Another method in vogue is to allow the excess lengths to "hang down" at each end of the system, as shown in Fig. 2. Thus, with 25ft. hanging down at both ends, some 50ft. of length is saved, and the aerial may be accommodated in the majority of suburban gardens. However, if space is *really* limited, some of the excess length may be doubled back on itself, as shown in Fig. 3, so that in the limit the top section might be reduced to as little as 30ft. or 25ft. Remember that the dangling ends are "hot" from the R.F. point of view, so they should be carefully insulated, and preferably stood off from the aerial pole. Further, the hanging lengths will also act as vertical radiators, and it is quite feasible to adjust the top length so that the two vertical lengths are actually in or out of phase on some bands to give a vertically polarised directive pattern on these bands. Also, while it may *seem* absurd to reduce the top length to some 25ft. or 30ft. and still use it on Topband and 80 metres, remember that where space is limited a loaded aerial would be necessary. Even a highly efficient loading coil will introduce appreciable loss into a small loaded aerial, quite apart from earth loss considerations. By utilising the extra aerial lengths as "loading," both excessive coil and earth losses are largely avoided. Hence the advantage of using such an arrangement even in very restricted spaces. Indoor

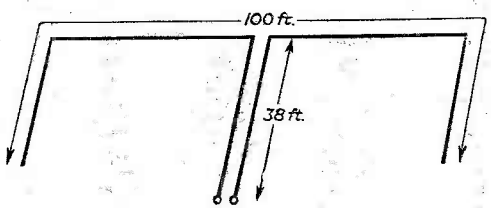


Fig. 2.—In restricted locations the "All Band Special" may be shortened by hanging the ends downwards.

and loft aerials for Topband have been used by the process of zigzagging as much wire as possible to fill a restricted space. Here again the idea was to obtain as much "length" of wire as possible to reduce coil and loading circuit losses. Strange as it seems, within a short range of the writer's present QTH, no fewer than three stations have operated with indoor aerials upon Topband! Needless to say however, Topband is easily the most difficult band for indoor aerials, and generally this is the last resort when an outdoor system is out of the question.

Higher Frequencies

However, upon the higher frequencies the outlook for indoor aerials steadily improves. Upon 40 metres, one highly efficient radiator is the "square loop" system. This is shown in Fig. 4, and is really a centre-fed half-wave aerial bent into a square loop. The main feature, however, is that on 40 metres this aerial fits fairly well round the picture-rail of an average room! In fact, of course, aerials of the correct resonant length could be built for outdoor use on any given band. It is actually an elementary form of Turnstile aerial, its value being that the 40-metre version fits the average room size! Of course, those

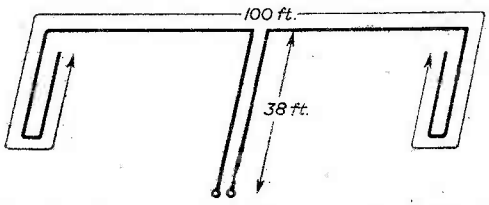


Fig. 3.—In very restricted spaces the "Allband Special" may be further compacted by doubling the ends back. The aerial may then be fitted into a very short space, while retaining better topband efficiency than a short Marconi type aerial.

with very restricted rooms might only be able to work with a 20-metre version. Where the room is such that not all the aerial can fit round the picture-rail, the spare length can either hang down at the open ends, or be formed into an extension of the feed end, so that they are, in effect, a lengthening of the feed length. Feed is exactly as for a centre-fed dipole — that is the shortest feedlength of, say, 300 ohm line is a quarter-wave length of tuned line. It is important to note, however, that this particular aerial is a "one-band" device — on its second harmonic it fires vertically through the roof — so that separate aerials have to be constructed of the correct dimensions for

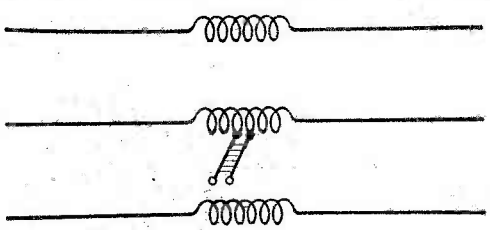


Fig. 5.—A beam array may be compacted by using loading coils. The elements may be reduced to about half their normal length. The element spacing should, however, not be reduced.

multiband operation. However, this need not be an insuperable snag, as the aerial itself is unobtrusive due to its convenient picture-rail fixing, and it is of good performance, being equivalent to a standard half-wave dipole in its radiating properties. In fact, it is upon an aerial of this type that the writer was able to work some 20 countries upon 40 metres from an indoor location. No great importance need be attached to exact squareness either, so that by various compromises such an aerial may be used in the average room for 40-metre operation or, of course, in small rooms for 20-metre operation!

Beam Arrays

The ambition of every amateur is to have some form of beam array. In fact, since the early description by the writer of methods of "compacting" beam arrays, these have become popular in the States, and, more recently, over here as well, and newer developments may be of interest. The "classical" method of shortening aerial elements is by the use of loading coils, and this may be applied to the standard forms of two and three element arrays as shown in Fig. 5. However, it should be noted that practically one runs into trouble if too great a shortening is attempted. Thus a reduction of element length by half is the most that should be attempted, as otherwise tuning adjustments become very critical and losses may become high. Also, of course, one cannot scale down the element *spacings* for a compact beam array without running into insuperable difficulties. With full-sized beam arrays the spacing is seldom less than a tenth of a wavelength, and tuning is very critical despite the full length elements. With "compacted" elements, a safer minimum spacing is 0.15 of a wavelength, that is, around one sixth of a wavelength. Moreover, due to the critical nature of adjustments, the simpler "compacted"

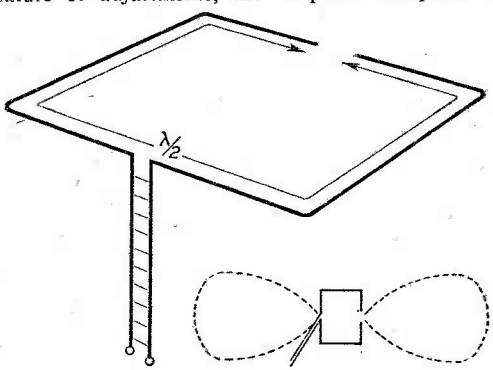


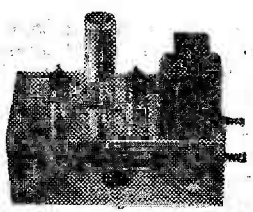
Fig. 4.—A half wavelength of wire, bent into a horizontal square loop, may be centre-fed, and behaves as a dipole. The small figure shows the radiation pattern. This aerial is a "one-band" device, however. Its advantage is that it is a "natural" for fixing round the picture rail of an average room.

beams are usually two-element affairs, as the addition of a third element gives relatively little extra benefit for the increase in size. For 20-metre operation the overall length of 15ft. to which elements may be reduced enables a two-element indoor beam to be used. One method is to use wire elements clipped to the picture-rail so that one can quickly orientate the beam in varying directions.

Stacking

Ambitious amateurs with adequate room may consider emulating the American amateurs who have erected three-element beams for 40 metres using compacted elements. However, once a beam for *one* band has been erected, the improvement in DX working effected leads to a desire for beams for use on the three highest frequency DX bands. With restricted space, the problem resolves into the difficult one of multiband compacted beam arrays. One solution is the "stack" array as shown in Fig. 6.

(*Continued on page 773.*)



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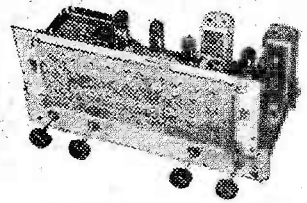

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		PCC84	12/6
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SPEAKER FRET.—Expanded Bronze anodised metal 8in. x 8in., 2/3; 12in. x 8in., 3/-; 12in. x 12in. 4/3; 12in. x 16in., 6/-; 24in. x 12in. 8/6, etc.

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30/30 v., 4/500 v.	2/-	Can Types, Clips, 3d. ea.	
100/25 v. 2/450 v.	2/-	8+8/450 v. T.C.C.	4/6
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8/500 v. Dub.	2/6	16+16+16/350 v.	5/6
8—8/500 v. Dub.	4/6	16+16/450 v. T.C.C.	5/6
8+16/450 v. T.C.C.	5/-	16+32/350 v. B.E.C.	5/-
16/450 v. B.E.C.	3/8	32/350 v. Dub.	4/-
16/500 v. Dub.	4/-	32+32/450 v. T.C.C.	6/6
16+16/450 v. T.C.C.	5/6	60/350 v. T.C.C.	6/6
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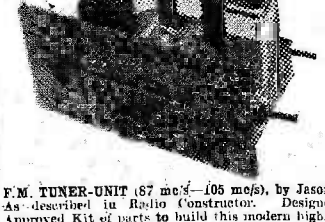
SCOTCH BOY, EMITAPE, etc., 1,200ft., 30/-. Long playing, 1,800ft., reels, 45/-. Paper tape, good quality 1,200ft., 12/6. Reels only, 6in., 3/8, 7in., 4/3



F.M. TUNER-UNIT (87 mc/s—105 mc/s), by Jason. As described in Radio Constructor. Designer Approved Kit of parts to build this modern highly successful unit, drilled chassis and J.B. dial, coils and cans. 4 BVA miniature valves and all components, etc., for only **£6/10/0**, post free. **SUPERIOR TYPE GLASS DIAL** (as illustrated)—Calibrated in Mc/s and edge lit by 2 pilot lamps. 12/6 extra. Illustrated handbook with full details, 2/- post free.

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This is intended to provide gain through stacking, together with a reduced angle of radiation so that DX working is facilitated. By making the stacking distance equal to 5/8ths of a wavelength at 10 metres, and using centre-fed elements that are half-wave on 21 Mc/s, we achieve the following: The array on 10 metres consists of two "extended" elements stacked at the optimum spacing of 5/8ths of a wavelength. On 21 Mc/s we have a stack of two half-wave elements spaced at slightly less than a half wavelength. On 14 Mc/s the array is two compressed stacked dipoles stacked at almost one-third wavelength. This gives a measure of improvement over simple dipoles on all three bands. Moreover, as reflectors are not used, the array need only be turned through an arc of 180 deg. to cover all directions. By feeding in the centre of the vertical bridging feedline with a tuned line, the two elements are fed equally on all three bands, so there are no complicated matching devices at the aerial end. For restricted spaces such an array is well worth experimenting with, particularly if the lower element can be raised at least 16 ft. (and preferably 20 ft.) above ground level.

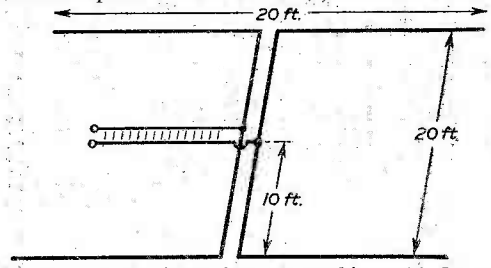


Fig. 6. — A simple stack array, usable on 14, 21 and 28 Mc/s. It improves low angle radiation and provides useful gain on all three of the bands.

The saga of compact and indoor aerials can be extended almost indefinitely. Thus wire aerials of the W8JK type may be slung indoors, the writer has encountered at least one indoor 20-metre W8JK fixed beam and 10 metre wire W8JK beams are so compact that they may be erected on light bamboo spreaders in very restricted gardens. "Flop-over" wire beams of the reflector and director type may also be used in the form of wire elements slung on bamboo spreaders. In fact, wire element arrays have possibilities for restricted outdoor use, especially when only one or two directions can be covered due to space limitations. However, an interesting three-element rotating beam design evolved by G4ZU, and commercially available seems to have solved the question of a reasonably compact three-band beam array. For those who have not seen this array described elsewhere, the following brief description is appended.

G4ZU Beam Array

The G4ZU design utilises an ingenious combination of the properties of transmission line sections with loading coils. The centre radiator is approximately half-wave for 21 Mc/s. Thus it acts as an "extended" dipole on 28 Mc/s, a half-wave dipole on 21 Mc/s, and a compressed dipole on 14 Mc/s. The director operates on 28 and 21 Mc/s, and consists of a 16 ft. element split in the centre. The loading coil is inserted in the centre, and is shunted by an open quarter-wave stub at 10 metres. Thus on 10 metres the quarter-wave stub is an effective short-circuit to the loading coil, and the element behaves as a simple director on 10 metres. On 21 Mc/s the director is loaded by the inductance of the loading coil plus the capacity due to the stub, and this is arranged to load the element so it behaves as a director on 21 Mc/s also. On 14 Mc/s the director still has a slight director action.

The reflector is a three-band device, and the loading coil is shunted with a stub quarter-wave long at 21 Mc/s. Thus, on 21 Mc/s the stub short-circuits the coil, and the reflector behaves on 21 Mc/s a as straightforward reflector. On 14 Mc/s, the reflector is effectively loaded by the coil and stub, and also operates as a coil loaded reflector on 14 Mc/s. On 10 metres each half of the reflector tends to act as a reflector, the system being effectively two phased reflectors. Thus the beam varies from a 14 Mc/s two-element beam, to a three-element 21 Mc/s beam, and a five-element 10-metre beam, due to the action of the coils and stubs. This ingenious system has been patented by G4ZU and is commercially marketed. It is clear that this beam array represents a very neat and effective solution of the problem of designing an effective and compact three-band rotary array. Moreover, the same principles might be applied to make simpler versions where space is extremely limited.

TUNING REQUIREMENTS

Band Mc/s	1.8	3.5	7 and 14	21	28
Tuning	Series	Parallel	Series	Parallel	Series or Parallel

Converting a Portable to Car Radio

AN INTERESTING CONVERSION WHICH IS APPLICABLE TO MOST PORTABLES

By W. B. Cooper

OWING to the cost of car radios it was decided to convert a small battery portable for use as a car radio. Several of my friends, each possessing portables of differing makes and sizes, had used them in their cars, but with only partial success. To place a set of this type on the car seat or parcel shelf is asking rather too much of it, for the set is virtually screened by the car body, and the frame aerial, being directional, is not capable of receiving a steady signal at all times during the car's progress.

Some two years ago I purchased an Ever Ready Sky Queen portable radio and used it only when stationary or when picnicking, etc., for I was afraid to attempt conversion of anything so new. However, when the newness wore off, I considered modifying this receiver for use when the vehicle was in motion, and without disturbing anything in the receiver itself made the first simple modification. This merely consisted of a coupling coil placed in close proximity to the frame aerial; one end of the coil being earthed, the other attached to a telescopic type of aerial. This was done simply by winding six turns round the cabinet itself as shown.

The wire used was fine cotton covered copper wire taken from an old coil. The two ends were taken through small holes drilled in the bottom of the cabinet and terminated on a miniature socket strip at the back. A piece of twin flex with wander plugs on each end was then taken from the sockets in this strip to a small two-pin socket mounted in an accessible place in the car. A pair of wires was then taken from the rear of this latter socket to earth and aerial respectively. The telescopic aerial was fixed temporarily to the vehicle for the initial test. The result was so good that I mounted the aerial (single hole fixing) immediately and enjoyed many hours of good reception. Reversing E or A on the coupling coil made no difference.

The car was a small Austin Seven Ruby Saloon and the set rested on the back seat (passenger side). It was a very simple matter to switch on or off or tune with the left hand. The radio functioned most satisfactorily in this way for well over a year and was still, to all intents and purposes, a portable, for on arriving at a destination it was an easy matter to remove the wander plugs from the rear of the set and lift it out if it was required on the beach or other place inaccessible by the car itself. The six turns of wire were neatly covered by a strip of contrasting passe-partout. The obvious disadvantage was the partial loss of space on the back seat, but as invariably only one person travelled in the back of the car this did not trouble us. Owing to lack of space in the front of the Austin it was not possible to suspend the set from the dashboard or other frontal position.

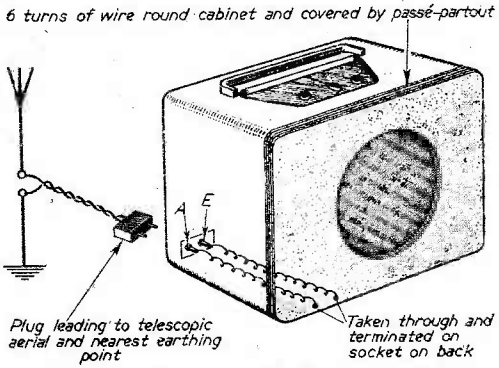


Fig. 1.—How to add the car aerial.

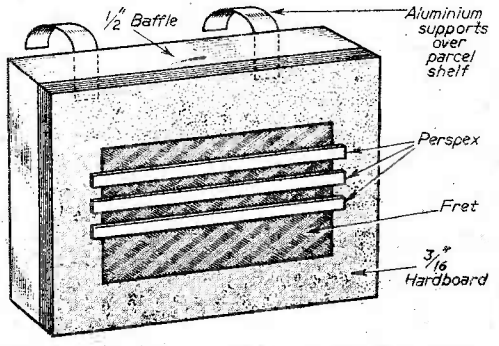
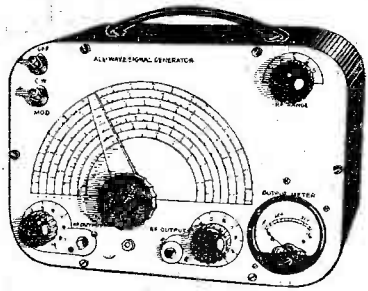


Fig. 5.—The home-made case for the speaker.

Suppression

The only equipment required for complete suppression of R.F. was one 5,000 ohm resistor in the main H.T. lead to the distributor, the resistor being placed as near to the distributor cap as possible (screw in type). There are many different kinds of small portable on the market to-day and nearly all are capable of being used in the way described. Ascertain the place and position of the frame aerial and then wind the coupling coil over it, near it or even on the detachable back. Naturally one will need to experiment a little with the turns ratio for the various positions tried in order to obtain the best signal strength, but this is very interesting work. The Sky Queen, by virtue of its design, and many of the smaller Bush models with frame aerials at the front of the cabinet are ideal for this type of modification. If space is not the all important consideration and portability is still required I feel this is the simple answer to the question of whether or not a

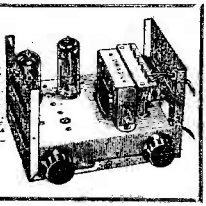
(*Continued on page 777*)



COMPLETELY BUILT SIGNAL GENERATOR

Coverage 120 Kc/s-230 Kc/s. 300 Kc/s-900 Kc/s. 900 Kc/s-2.75 Mc/s. 2.75 Mc/s-8.5 Mc/s. 8 Mc/s-28 Mc/s. 16 Mc/s-56 Mc/s. 24 Mc/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 per cent., modulated or unmodulated R.F. output continuously variable 100 milli-volts. C.W. and mod. switch, variable A.F. output and moving coil output meter. Black crackle finished case and white panel. Accuracy plus or minus 2%. £4/19/6 or £4/- deposit and 3 monthly payments 25/-. P. & P. 4/6 extra.

COMMERCIAL TELEVISION CONVERTER
SUITABLE ANY T.V.
ALL CHANNELS
NO ALTERATIONS TO SET



Complete with built-in power supply 230-250 v. A.C. mains. Crackle finish case 5½in. long, 3½in. wide, 4½in. high. Incorporating gain control and band switch. Illustrated with cover removed.

£3 . 19 . 6 Plus P. & P. 2/6.

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Extension Speaker cabinet in polished walnut, complete with 8in. P.M. P. & P. 3/-. **24/6.**
8in. P.M. Speakers, removed from chassis, fully guaranteed. All by famous manufacturers. P. & P. 1/6. **12/6.**

FAMOUS MAKE

TURRET "TELETUNER"

Covers all Channels, Bands 1 and 3. Valves used: PCC84, R.F. double triode, cascode R.F. amplifier, PCF80, triode pentode f.c. and mixer, I.F. output 33-39 Mc/s. Easily modified to other I.F. outputs. Full instructions and circuit diagram supplied. Complete with 12 Coil Sets. **99/6** post 2/6. Knobs, **3/6.**

Volume Controls. Long spindle less switch, 50 K., 500 K., 1 meg., **2/6** each. P. & P. 3d. each.
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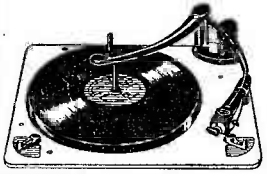
Standard Wave-change Switches. 4-pole 3-way, **1/9**; 5-pole 3-way, **1/9.** Miniature 3-pole 4-way, 4-pole 3-way, **2/6.** 2-pole 11-way twin wafer, **5/-.** 1-pole 12-way single wafer, **4/-.**
1,200 ft. High Impedance recording tape on plastic spool, **12/6,** plus 1/- P. & P.

GARRARD RC/110

3-SPEED AUTOMATIC MIXER CHANGER



Will take 10 records, 7in., 10in. or 12in. mixed, turnover crystal head, brand new, current model. A.C. mains 200/250 v. (List price £14/10/-).

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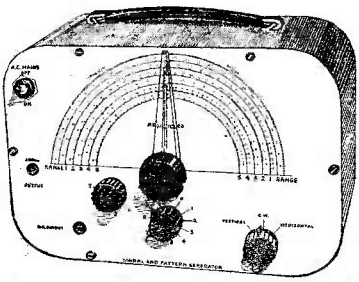

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Or £3 deposit and 3 payments of 30/-.

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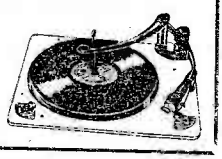

£7.19.6 Plus P & P 5/-.

P.M. SPEAKERS, 6½in., closed field, **18/6.** 8in. closed field, **20/6.** 10in. closed field, **25/-.** 12in., **25/-.** P. & P. on each 2/-.
Valveholders. Paxolin octal, **4d.** Moulded octal, **7d.** EF50, **7d.** Moulded B7G, **7d.** Loctal amphenol, **7d.** Loctal pax, **7d.** Mazda Amph., **7d.** Mazda pax., **4d.** B8A, B9A amphenol, **7d.** B7G with screening can, **1/6.** Duodecal paxolin, **9d.**
Twin-gang .0005 Tuning Condensers, 5/-. With trimmers, **6/6.**

AC/DC MULTI-METER KIT

Comprising 2in. moving coil meter, scale calibrated in AC/DC volts, ohms and milli-amps. Voltage range AC/DC 0-10, 0-100 and 0-500. Milli-amps 0-10, 0-100. Ohms 0-1,000 and 0-10,000. Front panel, range switch, wire wound pot. (for ohms zero setting) two toggle switches, resistors and meter rectifier. Complete in case, grey hammer finish.

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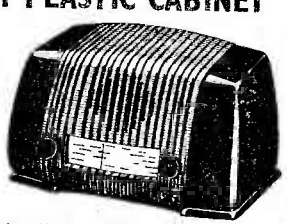
Point to point wiring diagram 1/- free with Kit.

Potato & Vegetable Peeler, by famous manufacturer, capacity 4½ lbs., complete with water pump. All aluminium construction, white stove-enamelled finish. Originally intended for adaption on an electrical food-mixer, can easily be converted for hand operation. **39/6.** P. & P. 3/-.

T.R.F KIT in PLASTIC CABINET

3 valve plus metal rectifier, A.C. mains 200-250 v. Medium and Long waves. In pastel blue or brown. Valve line-up: 2 VR65s and VT52. Size 15½in. long by 9in. high by 7in. deep.



£3 . 19 . 6 P. & P. 4/6.

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Where post and packing charge is not stated, please add 1/6 up to 10/-, 2/- up to £1 and 2/6 up to £2. All enquiries S.A.E. Lists 5d. each.

small portable radio will work in a car. From my experience the answer is very much in the affirmative. Anyone is quite capable of experimenting in this way and all car owners who do possess portable radios will, I am certain, be as pleased as I was if they experiment on similar lines. Those who do not possess portables can easily purchase good second-hand ones cheaply and effect this type of addition to the set for a few shillings.

Further Modification

Last October, however, I changed vehicles and purchased a Morris Minor. Being so used to having such a good travelling companion I decided to carry out an extensive modification to the portable and install it permanently in the car. I therefore decided

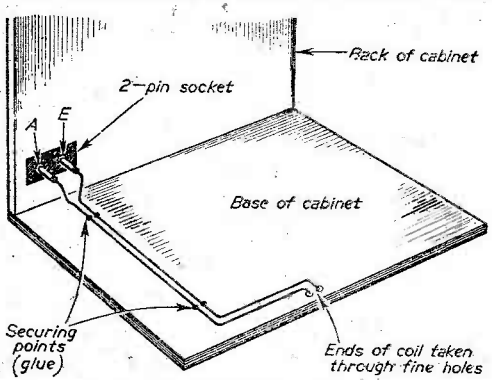


Fig. 2.—How to mount the aerial/earth socket.

to break the set down into three sections — receiver, speaker and power supply — and dispense with the cabinet altogether. This permitted a much more compact arrangement and a proper installation to be carried out. First, therefore, the frame aerial was removed. This was replaced by an aperiodic coupling coil (Osmor QAF5 medium wave aerial coil), this coil being directly coupled to the telescopic aerial, which had been mounted on the nearside front wing.

Directly coupling the coil gave more gain than when wired in the conventional way. The grid tapping of the coil was therefore paralleled to the grid of the mixer valve and the centre of the aerial socket (coaxial type), which had been mounted on the chassis (on an existing screw), the other end of this winding being taken to earth.

In this state the aerial was plugged in and with the set resting on the floor of the car it was trimmed to suit the aerial employed (Ekco CA224).

The Home Service (434 m.) was brought in strongly by adjusting the dust core of the coil, the Light Programme (247 m.) by adjusting the existing trimmer on the set. On switching to the long-wave band no adjustment was necessary as the long-wave loading coil had not been interfered with. The signal strength of the medium-wave Home and long-wave Light Programmes is sufficient to overload the speaker employed. In actual practice these are the two stations used.

Having done this it was necessary to make an attractive box for the set. This was done by using a sheet of tinplate and cutting it as shown to receive the set.

Soldering was easy, the set sliding in and being secured by small self-tapping screws through the base of the box into the existing brackets on the set. The actual size of the box was 10½in. × 5½in. × 4½in., care being taken to allow enough space for the dial pointer to move freely when the Perspex front was mounted. A separate piece of aluminium to which was affixed a double socket was then fastened to the back of the box with self-tapping screws. To this socket ran the wires which had previously been connected internally to the speaker. A hole had been cut to allow the aerial plug to be inserted into the aerial socket on the chassis. Mounting the speaker socket in this way enabled the speaker to be placed anywhere in the car. The speaker normally used is mounted on hardboard and suspended from the parcel tray.

Actually, I have two speakers, the second having a long length of fine flex attached to it. This I use when we wish to listen to a programme when not in the car, the internal speaker merely being unplugged and the extension speaker plug being inserted in its place. (This, I am sure, would also be most useful to people towing caravans.)

There is much to be said for this type of arrangement, for when the car is stationary one can listen for lengthy periods without worrying about the possibility of over discharging the car battery. It is worth mentioning that the battery at present in use was purchased last January, is in use very day, and is still doing all that is required of it.

For the front and sides of the cabinet Formica was used to cover the tinplate, for it toned well with the interior paintwork. (It was not necessary to cover the top, bottom or back for these when mounted were out of sight.)

The Perspex front was removed from the original cabinet, mounted behind the Formica with six small nuts and bolts as shown and then fixed with four self-tapping screws to the lugs on the front of the tin box. When drilling the Perspex to take the small bolts use a sharp drill and drill over wood on a flat surface. The sides were also fastened to the tin, using small self-tapping screws, the top two screws on each side being used to hold the two brackets which were needed to suspend the box under the glove tray (passenger side).

The battery lead was brought out through a slot in the back panel and plugged into the battery, which rests out of sight behind the set itself on the parcel shelf. I did make a tin box to house the battery, thinking that it would be necessary to screen it, but this was found to be unnecessary. Having an independent power supply in this way makes the job of suppression

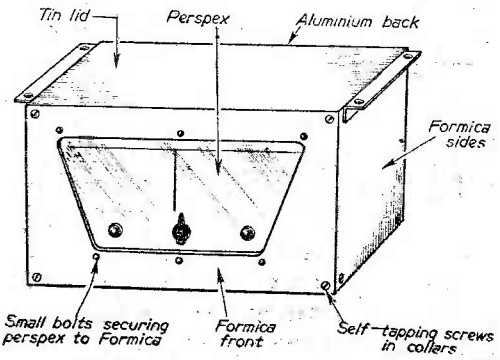


Fig. 3.—The receiver containing case.

easier, and the only suppression used is a resistor in the H.T. lead to the distributor and a .5 μF pigtail condenser placed on the coil between the S.W. terminal and earth. It may be found necessary to suppress the dynamo and this again is done by using a pigtail condenser connected between the larger terminal (charging terminal) and earth. If there is any uncertainly as to which is the right terminal reference to the circuit diagram in the car handbook will be helpful. When making these tests always have the car in the open with bonnet closed and making a good electrical connection to earth. In new vehicles little suppression equipment is required, but in older cars it may be necessary to bond engine to chassis and exhaust system to chassis. This can easily be done using heavy copper braid. If any staccato type of interference persists it may be necessary to fix a resistor (5,000 ohms) in each plug lead, but as indicated, it is usual that only one will be required in the distributor lead.

Interference

I was troubled with interference which persisted on the long-wave band when the car was coasting with engine switched off. This interference gained in intensity on application of the brakes, and from its frequency it was readily discernible as static interference from a brake shoe or shoes binding in the drum. On examination, one wheel was found to be binding slightly and slacking off the shoes produced the necessary cure.

An important point to remember, too, is to see that the set when mounted on its brackets is making a good earth with the car body for much unnecessary interference can result if this is not the case.

As will be seen from the illustration, the finished set is quite compact and reasonably attractive in its appearance, and I am more than pleased with its performance.

I was at one time a little afraid that mounting the set rigidly in the way outlined would have serious effects on the miniature valves employed in it from the point of view of vibration causing internal breakdowns. I need not, however, have been worried for the valves have stood up to the test of time in a most remarkable way. Only one valve, the frequency changer, has been replaced in the past two years and that was due to the emission falling off, and not to mechanical breakdown as a result of vibration.

Many of the new portable radios have similar valve line-ups which work so efficiently at low cost and no one need hesitate in setting about converting these receivers for use as car radios, for I am confident their efforts will be rewarded with unqualified success.

The cost to me of this conversion was approximately 5s., i.e., 3s. for the coil, 1s. for a piece of Formica (off-cut) and 1s. for the small self-tapping screws. Fortunately I found the tin, aluminium, wire and sockets, etc., in my spares box, but it is quite possible buying every item required to do the job for approximately 15s. A good aerial costs about 35s.: this you would need in any case if you contemplated music in your car whether from converted portable or new car radio sources, but here again second-hand bargains are often procurable or a keen experimenter may like to make his own, or mount a simple form of running-board type of aerial (the latter, however, I do not recommend for the type of set in mind).

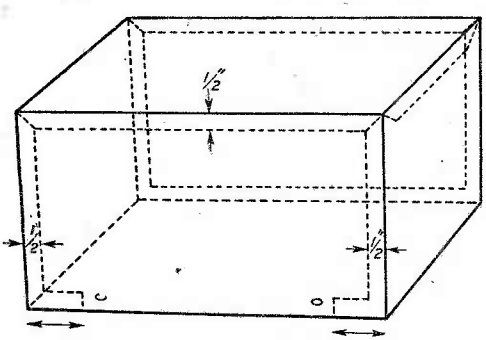


Fig. 4.—Details of the metal box for the set.

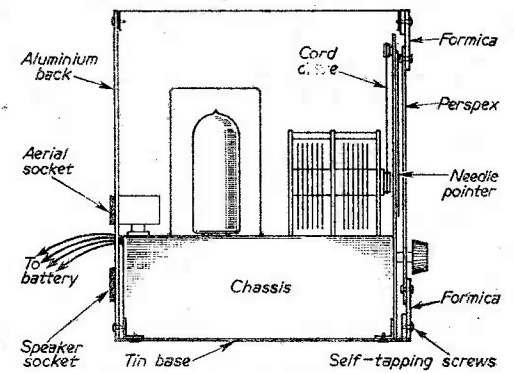


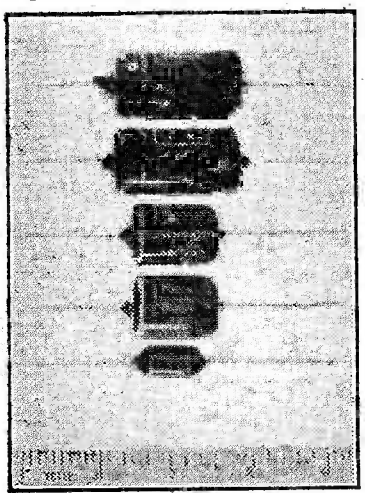
Fig. 6.—Details of the complete assembly.

News from the Trade

NEW PLESSEY PAPER CAPACITOR

A NEW type of paper dielectric capacitor which has a performance comparable with the more expensive metal-cased types is now being manufactured by The Plessey Company Limited.

It is anticipated that the new capacitor, called "Plesseal," will be widely used in domestic radio, television receiver circuits and industrial electronics equipment, and it has been specially designed for long service in conditions of extreme humidity and temperature. Operative temperature range is −30 deg. C. to +85 deg. C., and the component complies with tropical storage requirements R.C.S.11, Grade H2.



The New Plessey Paper Capacitors.

The range extends from 0.005 μF to 1.0 μF and they can be supplied in either standard or logarithmic ranges. Normal capacitance tolerance is ±20 per cent., but tolerances of ±10 per cent. or ±5 per cent. are available at slightly higher cost. Voltages covered are 150, 250, 350, 500, 750 and 1,000 D.C. at 20 deg. C. and for operation at temperatures over 70 deg. C. it is necessary to derate these by 25 per cent.

The component is wound with the outer foil extended to provide an electrostatic screen, and the tinned copper terminal lugs are inserted simultaneously to produce a non-inductive unit. Lugs are shaped and connected to the foils in a manner which allows the contact resistance to be reduced to a minimum. The terminal wire is spot-welded to the lug which is then folded around it and the complete assembly is soldered to provide a solid, electrical and mechanical joint which forms an excellent, moisture-resistant seal.

The finishing process, applied after impregnation, is such that each coat provides a key for, and is effectively bonded to, the next, thus producing a homogeneous covering which extends just past the soldered joint and forms a complete seal around the component. A flexible lacquer final seal completely envelopes the capacitor and assists in completely excluding all moisture from the unit.

The Plessey Company Limited, Components Division, Kembrey Street, Swindon, Wilts.

EDISWAN TRANSISTORS

EDISWAN MAZDA have released in this country the first complete range of metal-clad transistors. The strongly welded metal to metal seal ensures that they are completely impervious to moisture penetration even with high humidity.

The Edison Swan Electric Co., Ltd., 155, Charing Cross Road, London, W.C.2.

NEW MULLARD PULSE MODULATOR VALVE

THE QQV5-P10 is a new Mullard double tetrode valve for use in the pulse modulators of radar and radio equipment. It is capable of delivering pulses of 5 kV, 10 amperes when both sections are connected in parallel. The valve is suitable for pulse durations up to 3 micro seconds and duty factors of 0.001. The anode dissipation is 15 watts maximum and under typical conditions the total power input to the stage is 85 watts.

NEW PLUG-IN END-VIEWING PHOTOCELLS

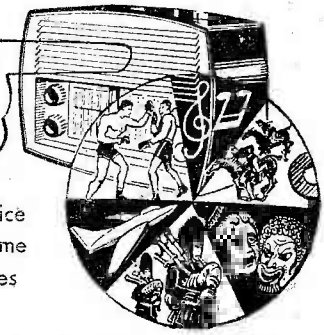
IN some applications the use of end-viewing photocells with wire-in connections is inconvenient or undesirable. Mullard Ltd. have therefore introduced plug-in versions of two of their wire-in photocells. Both have B3A ("pee-wee") bases. The 53CG is a gas filled photocell equivalent to wire-in type 58CG, and the 53CV is a vacuum type equivalent to wire-in type 58CV. Both are sensitive to incandescent and near infra-red light.—Mullard Ltd., Century House, Shaftesbury Avenue, London, W.C.2.

The Ediswan Metal-clad Transistor.

OSMOR TRANSFER INDICATORS

OSMOR are now offering stick-on transfer indicators for the Light, Home and Third programmes. This enables an ordinary dial to be calibrated for F.M. Also, these indicators are very useful for small battery portables for which a small length of Perspex may be used as a dial. The retail price is 1s. 6d. per set.—Osmor Radio Products, Ltd., 418, Brighton Road, South Croydon.

Programme Pointers



Our Critic, Maurice Reeve, Reviews Some Recent Programmes

Plays

"THE Burning of the Maid," a reconstruction of the immortal story of Joan of Arc by Stanley Baron to celebrate the 500th anniversary of her rehabilitation, was an excellently compiled programme, very well produced by Rayner Heppenstall and acted beyond reproach by a lengthy cast of some of radio's most notable names.

As it was mainly concerned with the details of Joan's life and work, all of which Shaw handles so brilliantly in "St. Joan," it shouldn't have been put on only two days after G.B.S.'s masterpiece. Biographically one was made to feel one was listening to the same thing all over again. But it was a fine slice of radio which I enjoyed thoroughly.

Thank heaven there was a total absence of "music," and if ever an argument could be deduced to defend the views on this subject I have so often expressed herein, it was here! "Not a sound was heard, not a funeral note." And not a note was missed! Not even Joan's voices were simulated. The whole story passed serenely by—uninterrupted, unspoiled and unrepentant. Get thee behind me thou infernal noises, whose unwelcome interpolations, preludes and postludes only inflame the nerves and destroy the thread of the piece.

That great play, "Journey's End," was given a very good performance in the first of a Sherriff Festival. John Westbrook, as Stanhope, brought out his "dutch" courage at the expense of his native brand rather a little too much, and a few of his more testy passages seemed a little "recited." Brewster Mason's Osborne was excellent in every way, and made us feel that, as soldiers, we could place just as much trust and confidence in his type of leadership as in Stanhope's. David Enders as Raleigh was also very good. I liked all the others: Ronald Sidney as Mason, Eric Anderson as the Colonel, Richard Gray as the Sgt.-Major, James Thomason as Trotter, and Alan Edwards as Hibbert. Frank Partington was Hardy and Peter Neil a German prisoner.

A new ending was given to the play, greatly inferior to the wonderful one in stage, live productions. Instead of the dugout getting a direct hit—the end of everything for all the protagonists—Stanhope was made to say to the dying Raleigh, "Don't worry: I'm getting you sent down to the field dressing station," or words to that effect. Everybody apparently overlooked the fact that the Germans, having completely broken through and overrun the whole show, Stanhope himself would have been on his way with everyone else to a "cage," and that, if anyone dealt with Raleigh at all, it would not have been Stanhope!

It really didn't matter, of course. The play's great message of the crime, blunder and uselessness of war came over just the same.

Interviews

Gilbert Harding's new series, "On the Spot," is vastly superior to his last one based on telephone interviews. This time he discusses a subject each week with his reporters who, in their turn, have been out in suitable parts of the country fact finding and laying a basis for the programme. I last heard "Farmers and the Harvest," with Robert Reid and Edward Ward, and thought it very interesting. I hope it works up into a successful item.

Quiz and Questions

Quiz and question programmes are always among the most popular with all ages. Whilst the young like to test out their prowess and puff their chests out if successful, their seniors, I doubt not, derive their satisfactions from having escaped from the ordeal of being tested on the Ming Dynasty in China or the XVIIIth in Egypt.

The latest in the former group and wholly topical, is styled "The Floor is Yours," in which a guest is invited to answer listeners' questions put to him by a panel in the studio under a chairman. Telephonic communication was established with the questioner if further elucidation should be required. The first number was based on "Higher Wages For Ever?" The guest was Sir Thomas Williamson, C.B.E., President of the T.U.C.; the panel, Honor Balfour, Stephen Parkinson and George Scott, and the chairman Robert Reid.

Questioners had their queries recorded in their own voices at three guineas per question—why they were not paid three guineas instead of having to stump up, I cannot think.

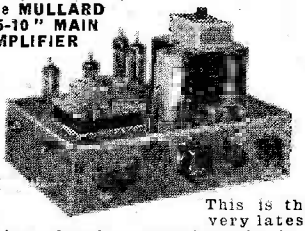
Variety

Ted Ray's voice can, without any aid from the *Radio Times*, be recognised through open window or door as easily as any other now before the listening public. His particularly forceful brand of humour is entirely his own, but his "radionic" marital perplexities are everyone's. His script writers and supporting artists invariably serve him well. In short, a half-hour spent in his genially bamboozling company is bracing, rewarding and thought provoking. (One can seldom come away from his turns without having gathered some new ruse for disguising our "having been late at the office, dear.")

In "The Spice of Life"—each of 45 minutes' duration—Mr. Ray is more of a master of ceremonies than a central figure: consequently there is rather less of him and more of a lengthy supporting cast which features June Whitfield, Deryck Guyler, Gene Crowley, Therese Burton and many others. There is much fun, music, quizzes, many questions, discoveries and what have you with the ubiquitous Mr. Ray always there or thereabouts.

COMPLETE KITS of PARTS for the "HI-FI" ENTHUSIAST

The MULLARD "5-10" MAIN AMPLIFIER

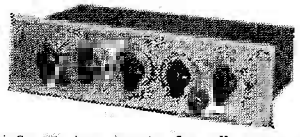


This is the very latest design and needs no recommendation from us. Our Kit is complete to Mullard's specification, including the latest GILSON ULTRA LINEAR OUTPUT TRANSFORMER and the entire MULLARD Valve line up. ALL SPECIFIED COMPONENTS are supplied. **PRICE OF COMPLETE KIT OF PARTS £11.11.0.** (Plus 5/- carr. & ins.).

THE full SPECIFICATION and PRACTICAL BUILDING INSTRUCTIONS for these Units are available for 1/6 each. SPECIAL PRICE REDUCTION. We supply the two complete Kits—Mullard 5-10 and "fidelity" Preamplifier—for **£16.16.0.** We also supply both fully assembled and ready for use for **£19.19.0.**

STERN'S "fidelity" PRE-AMPLIFIER-TONE CONTROL UNIT

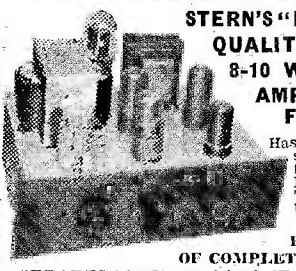
"A design for the music lover"



Briefly it has inputs for all types of MICROPHONES, HIGH and LOW GAIN PICK UPS and a RADIO TUNING UNIT. It incorporates (a) GRAM EQUALISING CONTROL. (b) STEEPCUT FILTER. (c) Continuously variable BASS and TREBLE CONTROLS and a variable OUTPUT CONTROL which enables its use with any type of Amplifier.

PRICE OF COMPLETE KIT OF PARTS (Plus 5/- carr. and ins.). **£6.6.0.** WE ALSO OFFER IT ASSEMBLED, READY FOR USE, **£8.0.0.**

STERN'S "HIGH QUALITY" 8-10 WATT AMPLIFIER



Has power supply for Radio Tuning Unit.

PRICE OF COMPLETE KIT OF PARTS (Plus 5/- carr. & ins.) **£7.10.0.**

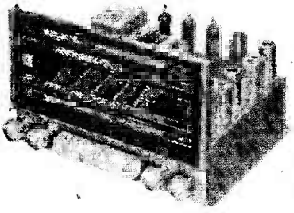
SUPPLIED ASSEMBLED and READY FOR USE. **£9.10.0.** Proved one of the most popular models yet offered to the HOME CONSTRUCTOR. Provides excellent reproduction up to 8 watts, employing 6V6's in push-pull, incorporating negative feedback. Provides for use of both 3 and 15 ohm speakers.

MODERNISE YOUR OLD RADIOGRAM

★ **THE LATEST A.M./F.M. RADIOGRAM CHASSIS.**

★ **A NEW 4-SPEED AUTOCHANGER.**

The NEW ARMSTRONG PB.409 A.M./F.M. Radiogram Chassis



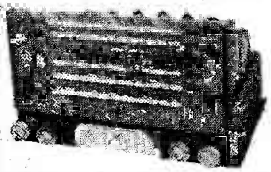
"A chassis for those who want the highest quality." ● A 9 valve line up employing the latest MULLARD preferred-type valves. ● Provides complete coverage of the V.H.F./F.M. Transmissions plus the Short, Medium and Long Wavebands. ● Has Push-Pull Output, with Negative Feedback, for 6 watts peak Output. ● Quick Action "Piano Key" Selectors and separate Bass and Treble Controls. ● Has "Magic Eye" Tuning Indicator. ● Dimensions 13in. x 9¼in. x 8in. high Dial size 11¼in. x 5¼in.

PRICE **£29.8.0.** (Plus 6/- carr. & ins.)

TERMS : Credit **£7.7.0** and 9 monthly payments of **£2.14.0.** H.P. **£17.14.0** and 12 monthly payments of **£1.7.3.**

SEND S.A.E. FOR ILLUSTRATED LEAFLET

STERN'S NEW "Fidelity" COMBINED AM/FM Radiogram Chassis.



A genuinely hand-made chassis providing really high quality on both Radio and Gram.

PRICE £26.15.0. (Plus 7/6 carr. & ins.)

TERMS : **Credit** Deposit **£6.14.0.** and 9 monthly payments of **£2.9.0. H.P.** Deposit **£13.7.6.** and 12 monthly payments of **£1.4.10.**

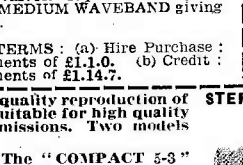
BRIEFLY IT HAS :—

An 8 valve line up incorporating the latest MULLARD preferred-type valves. ● Provides complete coverage of the VHF/FM waveband plus the SHORT, MEDIUM and LONG waves. ● Has EL84's in Push-Pull with negative feedback of 6 watts output. ● Employs "Piano Key" Selector Switches and a Variable Tone Control. ● Contains Gram input socket for both Crystal and Magnetic Pick-ups. ● Provides for use of either 3 or 15 ohm Speakers. ● Has "Magic Eye" Tuning Indicator. ● Dimensions 13in. x 9¼in. x 8in. high. Dial size 11¼in. x 5¼in. SEND S.A.E. FOR ILLUSTRATED LEAFLET.

RECORD PLAYERS THE VERY LATEST MODELS ARE OFFERED AT GREATLY REDUCED PRICES

● **TRANSCRIPTION UNITS.** ● **3 and 4 SPEED AUTOCHANGERS.** ● **AUTOCHANGERS with MANUAL CONTROL POSITION.** Send S.A.E. for ILLUSTRATED and DESCRIPTIVE LEAFLET.

STERN'S "F.M." TUNING UNIT



A 5-valve Tuner incorporating the latest Mullard Permeability Tuning Heart and a "Magic Eye" Tuning Indicator.

PRICE ASSEMBLED & READY FOR USE: £14.10.0. (Plus 7/6 carriage and insurance). TERMS : (a) Hire Purchase : Deposit **£7.5.0** and 9 monthly payments of **18/4.** (b) Credit : Deposit **£3.12.6** and 9 monthly payments of **£1.6.7.**

THE COMBINED AM/FM TUNER is precisely similar in appearance to the above and incorporates 7 valves. It provides complete coverage of F.M. Transmissions and MEDIUM WAVEBAND giving a good selection of foreign stations.

PRICE **£18.18.0** (Plus 7/6 carr. & ins.). TERMS : (a) Hire Purchase : Deposit **£9.9.0** and 10 monthly payments of **£1.1.0.** (b) Credit : Deposit **£4.15.0** and 9 monthly payments of **£1.14.7.**

AN EXCEPTIONAL "CASH ONLY" OFFER

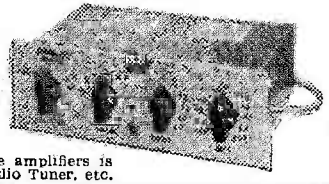
£7.19.6. (Plus 5/- carr. & ins.)

THE NEW 4-SPEED B.S.R. MONARCH

● Complete with High Fidelity Crystal "Turnover" Head which incorporates separate stylus for L.P. and 78 r.p.m. records. ● A "MIXER" Unit that will autochange on 7in., 10in. and 12in. records of same speed. ● Incorporates the Manual Control position.

Expressly developed for very high quality reproduction of Gram. Records and particularly suitable for high quality reproductions of the F.M. transmissions. Two models are available :

STERN'S "COMPACT 5" AMPLIFIERS



(a) The "COMPACT 5-2" A Two-stage high sensitivity Amplifier having SEPARATE BASS and TREBLE CONTROLS and designed to give up to approx. 5 watts with very pleasing quality. PRICE **£5.15.0.** (Plus 5/- carr. & ins.)

(b) The "COMPACT 5-3" A Three-stage version of the "5-2" model but in this case having an additional stage and incorporating Negative Feedback. PRICE **£6.16.0.** (Plus 5/- carr. & ins.)

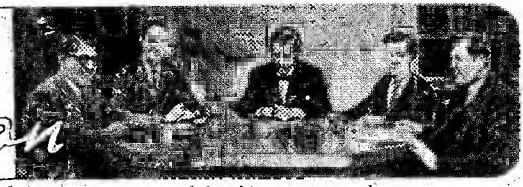
A separate **'POWER' SUPPLY UNIT** to operate with these amplifiers is available for **£2.10.0.** Has additional supply available for Radio Tuner, etc.

CALLERS ONLY

We have in stock various Kits of Parts including F.M. Tuners, A.M./F.M. Tuners, Midget Battery Portable, Mains Units, etc., etc.

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

Open to Discussion



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

Club Wanted

SIR,—Having been a regular reader for some time I have read with interest much of what has passed in "Open to Discussion," technical and otherwise.

I should like to take advantage of this widely read column by asking if there are any radio, etc., clubs in the Walthamstow district catering for beginners (I am 18½). If so, could I contact anyone by means of your journal or otherwise.—B. JENKINSON, 27, Byron Road, Walthamstow, E.17.

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.

Contacts Wanted

SIR,—Having for a long time past been a regular reader of PRACTICAL WIRELESS, I now wish to make use of "Open to Discussion." I would like, through this medium, to get into touch with a fellow reader who has a Command Receiver Type BC454B, as I would like to know the modification this set will need to get it working.—G. E. SMITH, 6, Woodland Close, Trimdon Village, Co. Durham.

SIR,—I am twelve years old and very interested in radio, but I am only a novice and I would be pleased to contact someone about my own age who is interested in this subject.—R. YEATES, The Moorings, Martock, Somerset.

I.F. Strip 373

SIR,—Recently there has been advertised an I.F. Strip 373, of 9.72 Mc/s. They sounded so good at the price (7s. 6d.) that I decided to buy one. They are indeed a wonderful bargain, and from the circuit (included) it seems to me that very few alterations are necessary to make it into a F.M., I.F. and audio O/P strip.

There are a number of ways of using it, depending on the location of the receiving station, but the best I should think is exactly as it was designed, with the necessary alterations for a discriminator.

An article about this Strip, I should think, would be of interest to many of your readers, and I shall certainly be on the look-out.—W. S. HANWAY (Cheltenham).

[*Has any reader any helpful information on this?*—EDITOR.]

F.M. Car Radio

SIR,—Having built a F.M. feeder unit with moderate success, the performance of which is up to my expectations and pleasing, I have been thinking of constructing a complete F.M. receiver for mobile operation, that is for use in a car. As far as I can see there should be no drawback to this technically, but I am not quite clear as to what would constitute a suitable aerial, bearing in mind the horizontal polarization of the signal, also the directional properties of the dipole I am now using.

I find that if the aerial is not directed there is a great loss of the frequencies received and distortion on speech and music.

Therefore, with a car which is constantly changing direction, I think a really efficient aerial system must be thought up.

I would be pleased to have other readers' comments on the project.

I would also like to add my comment on a paragraph on "Car Radio," by "Thermion" in the August issue.

If the set mentioned is an eight-valve superhet it must obviously be one of the well-known push-pull output jobs, possibly with twin speakers, by one of the best manufacturers, and from my experience as an auto-electrician I have found these sets very good.

If the quality is as bad as he said, it is high time he did something about it!!! (and with fewer valves!).—J. C. REVELL (S.W.11).

Licence Fees

SIR,—Is there any way open to us to protest against the monstrous idea that our licence fees are merely taxation and that the BBC is lucky to get any of the money so raised?

More and more of this money has been filched on the grounds that this form of entertainment must bear its share—a feeble excuse which utterly ignores the time given to Government advertising and money diverted to overseas propaganda—and now we have the complete "Nasserisation" of all the licence money.

It is obvious to any listener that the BBC finds funds drying up—otherwise why the "vain repetitions" of programmes of more generous days?

This looks like an even better version of the political confidence trick, if no protest at all materialises.—WILLIAM B. WEST (Deal).

[*Motorists are in the same position with the Road Fund.*—ED.]

Wattage Rating

SIR,—When I buy a condenser the safe voltage is marked on it; but with a resistor I am given a "wattage" and have to do a division sum and extract a square root before I can find out the same information. Should the reason for this be obvious to me or might it be "Open to Discussion"?—R. L. WYNNE (Wallasey).

Training Courses

SIR,—The Doncaster Technical College offers part-time day courses (one day per week) for Radio and TV apprentices up to the Final R.T.E.B. TV Servicing Certificate. In addition a Practical Radio class meets on Monday evenings, 7-9 p.m. This is run for those who do not seek professional qualifications, but are interested in learning more about radio receivers and their operation from a hobby point of view. Supporting classes in electrical theory and mathematics are available if required. Further information is available from the Head of the Electrical Engineering Department at the College. —S. EDWARDS (Head of Department).

"Mouse"

SIR,—I fully support Mr. Buchanan, whose letter was published in PRACTICAL WIRELESS, October issue. The artificial satellite "Mouse" is not bound up with military objectives, and there is no reason why amateurs should not be able to do useful work in connection with it. With a project of this sort the more information gained the better, and the experience obtained in designing and constructing equipment to receive signals from the satellite would in itself be worth the trouble taken.—M. J. S. QUIGLEY (Liverpool, 23).

A Moral?

SIR,—As an old reader I know that PRACTICAL WIRELESS does not encourage letters of a frivolous nature, but the following has a moral which I am sure will be appreciated by the fraternity.

I was listening during last week on the 80-metre band, and came across a very learned discourse on the training of the well-known Alsatian breed of dog, a subject on which the operator was evidently well qualified to speak.

It was very appropriate, therefore, when a morse operator chipped in with a well merited reference to "Shaggy dog" stories, and I should like to send both these gentlemen my compliments on their excellent readable signals, with a sly emphasis on the moral.—B. G. ASHMAN (Stevenage).

Stereophonic Recording

SIR,—I am wondering if there are amongst your readers any other tape recording enthusiasts who have become a little more ambitious and have turned to stereophonic recording.

I have personally experimented in this field for several years. My first attempt was far too big, but after altering circuits, layout, etc., and rebuilding completely four times, I arrived at its present form, only 17¼in. by 15¼in. by 7¾in. This includes two built-in speakers, but it will be appreciated that external speakers, conveniently spaced, produce a far better effect. Two speaker units, fitting together for portability, therefore complete the equipment.

I originally commenced by converting a Truvox tape deck, but have since completely rebuilt it. All switching for motors and amplifiers is synchronised in a press-button unit. This caters for recording from microphones, gram or wireless and playback. The amplifiers may also be used for playing records, bass being amplified by one and treble by the other. (This arrangement is incorporated in certain radiograms on the market to-day wrongly advertised as 3D sound. Though quite pleasing to the ear, this, of course, is not true 3D.) A meter is incorporated for signal level in recording and balancing of the two amplifiers.

At the recent radio show I asked one exhibitor if it was possible to record on his stereophonic unit, a very large and elegant piece of furniture, and he informed me it was not a practical proposition for anyone to make stereophonic recordings. The pre-recorded tapes which have been on the market for about twelve months are excellent and one was being played on this same unit. I could not help but try and compare this with my own efforts. My volume was not as great, but it is more than sufficient for the average home, quality was near enough equal. Added to this, mine is portable and it records, too.—J. S. GILBERT (Knowle).

The Novices' Licence

SIR,—Being a regular reader of PRACTICAL WIRELESS I have followed with special interest views concerning a granting "by the G.P.O." of a licence for the short-wave listener who wishes to transmit by the ownership of a novice licence. The views of some readers condemn this by saying that the amateur bands are overcrowded, and morse, which many like myself would wish to have withdrawn, although necessary when 150 watts or so is used.

The use of the 27 Mc/s band for model control could be used, as I am sure the revenue collected by such a licence would far exceed that collected for model control licences. The power could be limited to five watts, and the use of frequency measurement essential. I sincerely hope that these views and including those of Mr. H. F. Barker, November issue, will have attention by the R.S.G.B. or G.P.O.—F. WALKER (Cambridge).

POWER SUPPLIES

(Continued from page 754)

assist in smoothing out this ripple, another condenser, C2, is connected, the value of which usually lies between 8μF to 32μF, dependent upon the amount of ripple and hum that is to be filtered.

It may well be that the constructor or experimenter prefers to construct or adopt a double type of filter as shown in Fig. 4. This naturally depends upon the individual, the ratings of the extra components being more or less the same as those used in the single filter.

The inductance of the choke can be estimated at being between 10 and 20 henries, although one can use those of higher inductance so long as the current rating is correct. Such chokes are, however, plentiful upon the surplus market.

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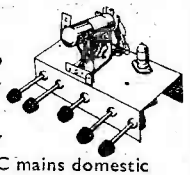

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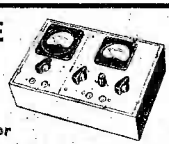

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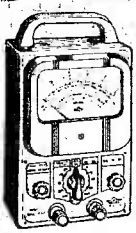

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AMATEUR WIRELESS AND WIRELESS MAGAZINE

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

SPECIAL NOTE

THESE blueprints are drawn full size. The issues containing descriptions of these sets are now out of print, but an asterisk denotes that constructional details are available, free with the blueprint.

The index letters which precede the Blueprint Number indicate the periodical in which the description appears. Thus P.W. refers to PRACTICAL WIRELESS, A.W. to *Amateur Wireless*, W.M. to *Wireless Magazine*.

Send (preferably) a postal order to cover the cost of the Blueprint (stamps over 6d. unacceptable) to PRACTICAL WIRELESS, Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

No of Blueprint

SHORT-WAVE SETS

Battery Operated

One-valve : 2/6 each
S.W. One-valver for American AW429*

Two-valve : 2/6 each
Ultra-short Battery Two (SG, det Pen) WM402*

Four-valve : 3/6 each
A.W. Short Wave World-beater (HF Pen, D, RC, Trans) AW436*
Standard Four-valver Short-waver (SG, D, LF, P) WM383*

Mains Operated

Four-valve : 3/6
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans) WM391*

MISCELLANEOUS

Enthusiast's Power Amplifier (10 Watts) (3/6) WM387*
Listener's 5-watt A.C. Amplifier (3/6) ... WM392*
De Luxe Concert A.C. Electrogram (2/6) ... WM403*

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