ALIGNMENT OF FRAME AERIALS

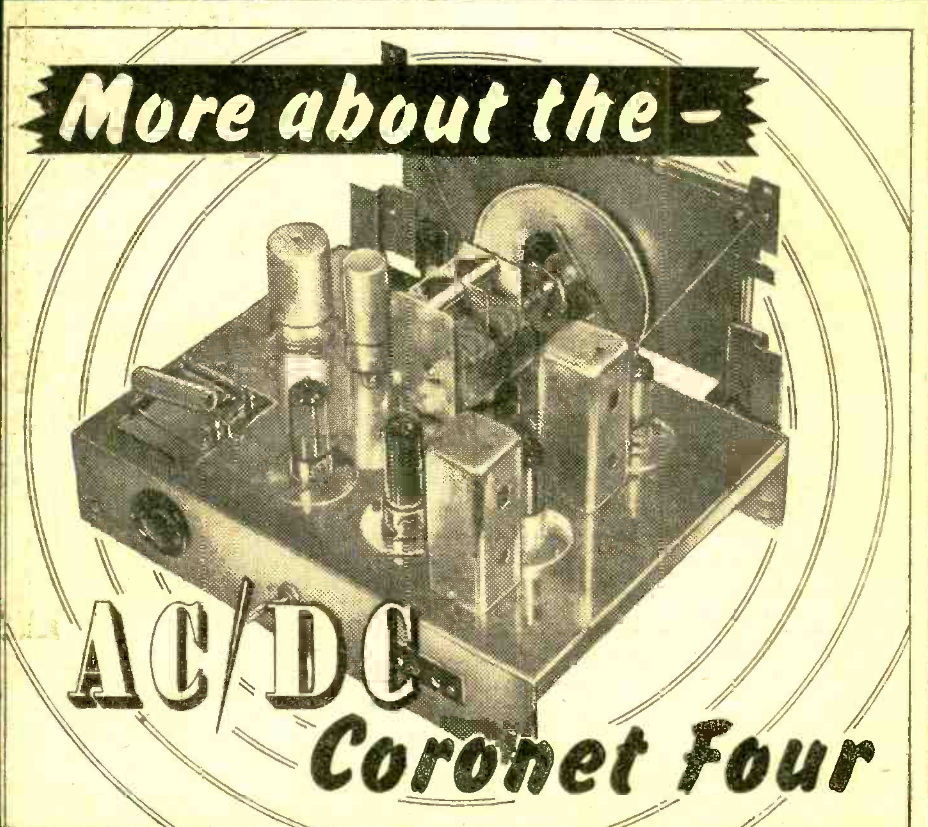
1/-

Vol. 30 No. 569

MARCH, 1954

EDITOR:
F. J. CAMM

PRACTICAL WIRELESS



IN THIS ISSUE:

2 New MODELS

acos quality crystal microphones at a reasonable price

MIC 33-1: A crystal hand or desk omni-directional microphone for the high quality public address and tape recording field, incorporating a specially designed acoustic filter giving a response flat from 30 to 7,000 c.p.s.

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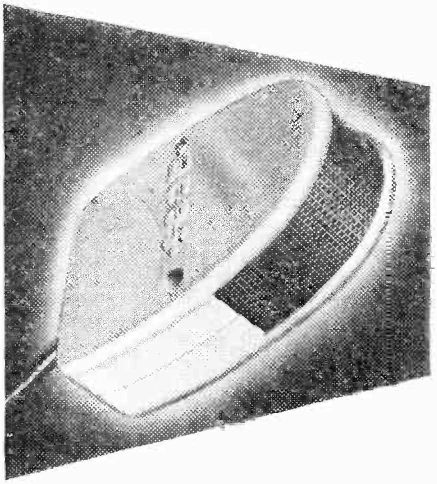

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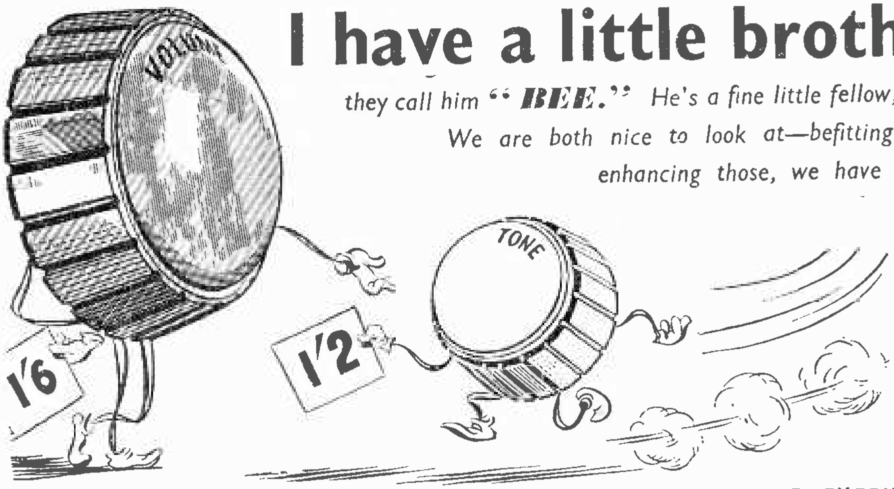

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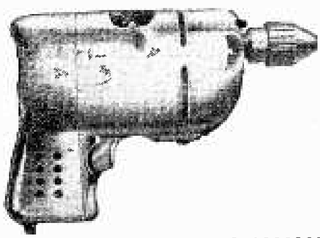

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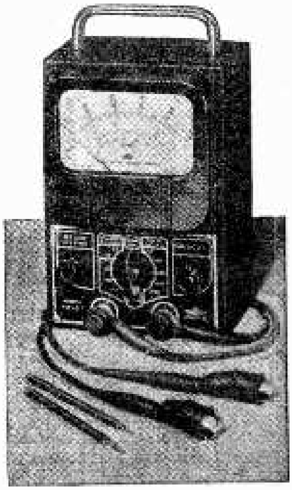

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6G6G	6/6	7C7	8/6	955	6/-	KT2	5/-	U22	8/6
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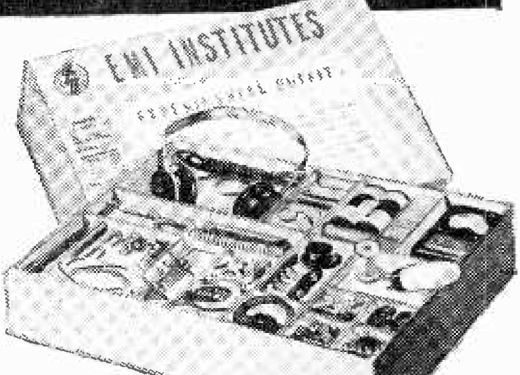

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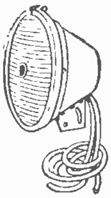

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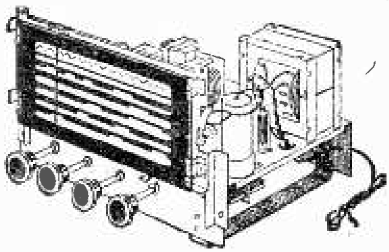

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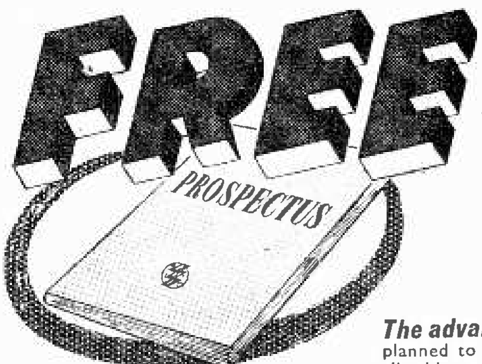

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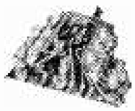

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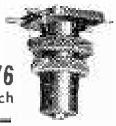
45 K/c. Tape Recorder Oscillator Coil

Type Q T 8

A centre tapped wave-wound coil as illustrated, for TRUVOX and Similar tape-decks. Single screw fixing. Fitted tags. **7/6** each



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An inexpensive but invaluable tool of entirely new design. Cuts two hole sizes with any one reversible punch and die; and can be operated with a spanner or tommy bar. Blanks easily removed. **For use on Steel up to 18 s.w.g; Brass and Dural up to 16 s.w.g. Aluminium and Copper up to 14 s.w.g.**

P. Pat. 11323/53

Type	Hole Sizes	
1	1in. x 1¼in.	Illus. Price List on Request
2	⅞in. x 1¼in.	
3	¾in. x 1⅛in.	
4	1¼in. x 2in	

Tommy Bars available

The OSMOR "JIFFY PUNCH"

for cutting smaller holes neatly and quickly with one blow of a light hammer.

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Type	Hole Size	
A	⅜in.	Illus. Price List on request
B	½in.	
C	⅝in.	

For use on Steel up to 20 s.w.g. Brass and Dural up to 18 s.w.g. Aluminium and Copper up to 16 s.w.g.

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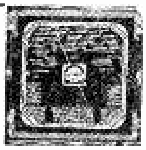

Type A GLASS DIAL ASSEMBLY (as illus.), measuring 7 in. x 7in. (9½in. x 9½in. overall) mounts in *any* position on or above the chassis and works with any type of drive. Choice of two 3-colour scales—G1 (L.M.S.) or G2 (M.S.S.). Price complete, 24/6. P. & P., 1/6. Pulley assembly for right-angle drive if required, 1/9. Escutcheon 4/-.

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Overall size 5¼in. sq., Printed Area 4in. sq. Cream back-ground, 3-colour. **Type M1**, L.M.S. waves, **M2**, L.M. waves. **M3**, M. & 2/S waves. Price 3/6 each. Pointer, 1/6.
Drum, Drive, Spring and Cord to use with both types of dials, 3/2.

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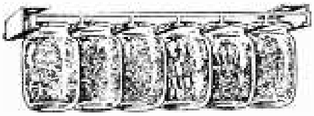
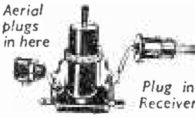


Keep those small components—etc., neatly stored yet visible by using an

OSMOR "JAR-RACK"

(If you're a generous husband you'll buy one or two for your wife's larder, she will appreciate the extra space they make!) Holds 1 lb. jam jars with or without lids. Easily removed, cannot fall out. Just the thing for the tidy "HAM" or Radio Dealer.
Type 1 for wall-fixing, 6/9 each, holds 8 jars. (Jars are not supplied but are easily obtained.)
Length 24in., enamelled olive green.
Type 2 (as illustrated) for screwing under a shelf, 5/9 each, holds 6 jars. Length 18in., enamelled green.
Post and packing, 1/- (either type).

OSMOR "Station Separator"



Type	Metres
1	141-250
2	218-283
3	267-341
4	319-405
5	395-492
6	455-567
7	1450-1550
8	410-550k/c

This is a device on the well-known "wave - trap" principle, which will reject an undesired signal when inserted in the aerial lead. Easily tuned to eliminate any one Station within the ranges stated. Fitting takes only a few seconds. Sharp tuning is effected by adjusting the brass screw provided.

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Practical Wireless

EVERY MONTH
VOL. XXX, No. 569, MARCH, 1954

Editor: F. J. CAMM

22nd YEAR OF ISSUE

COMMENTS OF THE MONTH

By THE EDITOR

THE BATTERY CORONET FOUR

THE two versions of the Coronet Four so far produced have been for A.C. and A.C./D.C. We have not overlooked those who are still compelled to operate battery receivers and they will welcome the news that, in next month's issue, we shall commence publication of constructional details for the Battery Coronet Four. It will make use of the same major components, the circuit being virtually unchanged, except for those modifications necessary to adapt it for battery operation. Some of the components will, of course, have different values but readers may like to commence to collect those parts such as the tuning unit, tuning dial, etc., common to the three versions of the Coronet Four. Whilst we are dealing with battery receivers, those still operating the old Fury Four will be glad to know that the modern version of this famous receiver is now in an advanced stage and constructional details will follow the battery version of the Coronet.

CAR RADIO—NEW M.O.T. LICENCE REGULATION

EVERY application form for a Road Fund licence for a motor car contains a new question which must be answered. Applicants are asked whether their car is equipped with radio and, if so, whether a BBC licence has been obtained for it. This new quiz has been interpreted by some as an unwarranted interference with the liberty of the subject and that the M.O.T. has exceeded its powers in imposing it. Some, indeed, have refused to answer the question, but the M.O.T. say they are well within their rights in insisting upon the question being answered, and that failure to answer the question would entitle them to withhold the licence. We have taken legal advice on the matter and we are informed that it is a case which is arguable at law. We hope, therefore, that a test case will be brought to settle the problem. It is our view that the M.O.T. has arrogated unto itself powers which it does not possess, wide though its existing powers are, to make regulations without reference to Parliament. We must be particularly careful, even in small things, to hang on to the liberties left to us, otherwise we shall become a police state. It is not the business of the licensing authority to act as detectives for the Post Office.

Carried to extremes, one may be asked before a TV licence is installed whether one has a refrigerator, a vacuum cleaner, electro-medical or other electrical apparatus capable of causing interference with TV, and if so whether such apparatus is fitted with suppressors!

VACANCIES IN THE R.A.F. RADAR REPORTING UNIT

THE Royal Auxiliary Air Force, No. 3700 (County of London) Radar Reporting Unit for the first time for some years now needs recruits owing to over rapid expansion. This unit is the only one in the London area which trains radar operators. It is a mixed unit, and whilst a knowledge of radar is not necessary a basic idea of radio is most useful in training responsible operators to man the radar defences of this country.

Much of what this unit does is, of course, screened by security, but briefly it trains radar operators and mechanics to operate and maintain the aircraft early warning system so vital to this country's survival in the unhappy event of future hostilities. Both men and women volunteers are required. For evening training periods the pay is now 3s. 6d. to 4s., according to rank for a two-hour period, plus 2d. per mile travelling allowance. Full details are available from The Officer Commanding, No. 3700 (County of London), Radar Reporting Unit, 23, Bridford Mews, London, W.1.

There must be many hundreds of readers of this journal who could help in this important work which is both pleasant and interesting and provides free training of value in civil life.

OUR BLUEPRINT SERVICE

WE often receive letters from readers complaining that components for some of our receivers are difficult to obtain. During the past two years we have removed a number of receivers from our blueprint list because of this and replaced them with designs of a more modern type. We have here a difficulty, however, because we also receive letters from constructors who have, during the years, accumulated large numbers of components which are no longer made and asking for designs incorporating them. We are, therefore, retaining in our list certain of these older designs, where modification to suit modern components would not occasion any difficulty. In general, whenever we produce a design we also produce a blueprint for it, but we are unable, of course, to control the supply of components. We are always delighted, however, to help readers by suggesting alternatives.—F.J.C.

ROUND the WORLD of WIRELESS

Broadcast Receiving Licences

THE following statement shows the approximate number of sound receiving licences issued during the year ended November, 1953. The grand total of sound and television licences was 13,216,644.

Region	*Number*
London Postal ...	1,670,288
Home Counties ...	1,455,467
Midland	1,280,992
North Eastern ...	1,666,324
North Western ...	1,298,559
South Western ...	1,020,934
Wales and Border ...	650,316
Total England and Wales	9,042,880
Scotland	1,111,360
Northern Ireland ...	216,177
Grand Total ...	10,370,417

The Cup Final

WHILE many League clubs are still battling through the early rounds of the F.A. cup competition, the BBC have already reached an agreement with the Football Association to broadcast on sound and television the whole of the final match from Wembley Stadium on May 1.

"Romance of Radar"

MR. E. J. DOHERTY recently gave a talk to children at the Sir John Cass College, Jewry Street, Aldgate, the subject of his lecture being "The Romance of Radar."

In his demonstrations he used a whistle to show the effect its echoes had on the radar screen of an oscillograph.

Radar Equipment for French Air Force

THE French Embassy in London have placed an order in excess of £100,000 with E.M.I. Factories Ltd.

This order is on behalf of the French Air Ministry, who will shortly take delivery of 100 Airborne Navigational Aid Equipments, including spares and test gear. These are Rebecca Mark IV medium range homing devices which, used in conjunction with ground beacons, enable aircraft to be directed accurately to particular sites.

Rebecca Mark IV was developed by E.M.I. in conjunction with the British Ministry of Supply and is produced by E.M.I. Factories Ltd.

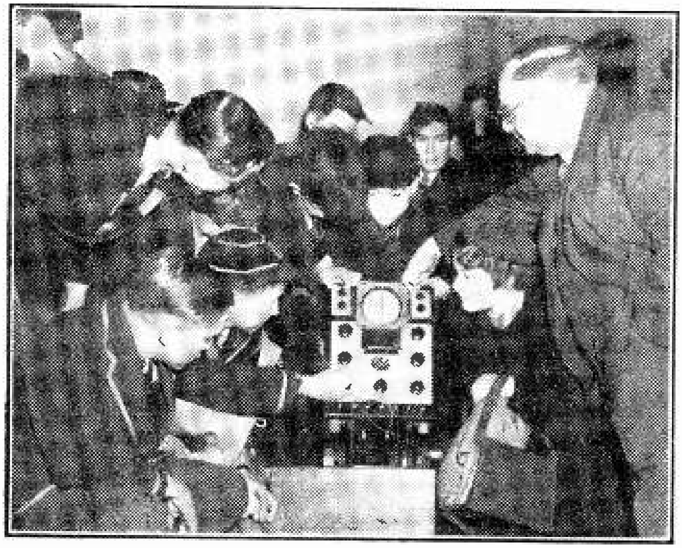
"Laurence Olivier Presents"

BEGINNING on February 2 the Light Programme presents a series of sixteen weekly half-hour programmes under the title "Laurence Olivier Presents." These are dramatised short stories in most of which Sir Laurence will appear as actor and host, although, in some cases, the star part may be given to an actor of world renowned fame. The programmes are produced by Harry Alan Towers with special music composed by Sidney Torch. Among the stories which will be heard are "The Purse," by Balzac; Robert Louis Stevenson's "Markheim" and "Dr. Jekyll and Mr. Hyde"; "The Canterville Ghost," by Oscar Wilde; Dickens' "Bardell Versus Pickwick," and H. G. Wells' "The Country of the Blind."

The guest artists so far chosen are Orson Welles, who will be heard in Pushkin's "The Queen of Spades"; Sir Ralph Richardson in Conrad's "The Tale"; Michael Redgrave in "The Overcoat," by Gogol, and Robert Donat and Rene Asherson in Stevenson's "The Sire de Maletroit's Door."

Himalayan Expedition

IN conjunction with Marconi's Wireless Telegraph Co., Ltd., Auto Diesels Ltd., of Uxbridge, are loaning small generating sets for working the portable radio equipment of the Himalayan expedition financed by the *Daily Mail*, which left London early in January. The sets will operate at an altitude of 20,000 ft. in temperatures of −40 deg. to −60 deg. Under these conditions the engine-generator will be required to provide an output of 200 watts at 12-15 volts D.C. and will work direct into the motor-generators on the radio equipment.



Mr. Doherty shows his young audience the oscillograph at his recent lecture at the Sir John Cass College, Aldgate.

Daventry Transmitter

THE BBC announces that the Third Programme transmitter at Daventry, working on 464 metres (647 kc/s), has now resumed transmission on full power. This will have improved reception, especially for the more distant listeners. Further adjustments to the aerial system are being made to reduce the fading which is experienced at night time in the more remote areas.

Wireless Saved the Eiffel Tower

IT is now revealed that the Eiffel Tower would long ago have disappeared had it not been for wireless, despite the fact that for generations it has been one of the greatest attractions of the city.

The 50th anniversary of the wireless station on the Eiffel Tower has recently been celebrated. It was first a purely military post, created in 1903 by General Ferrié, then a captain in the Engineer Corps.

One of the chief workers was not forgotten during the celebrations, Raymond Braillard, chief of the Eiffel Tower station early in the century. He was responsible for the first radio programme.

One of the functions of the Eiffel Tower to-day is to broadcast the midday and other time signals to all shipping crossing the Atlantic.

B.E.A.M.A. Appointment

MR. E. S. WADDINGTON, F.S.E., A.M.(s.a.), I.Mech.E., M.Inst.W., Associate.I.E.E., Associate (s.a.), I.E.E., of Philips Electrical Limited, Industrial Products Department, has been re-elected vice-chairman of the Arc Welding Plant Section of British Electrical and Allied Manufacturers' Association.

Appointment of I.P.R.E. Officers

AT the Annual General Meeting of the Institute of Practical Radio Engineers, Group Captain (Ret.) V. H. Whatling and Mr. C. H. Gardner were elected honorary vice-presidents of the Institute. Mr. C. H. Gardner, a past President, was also appointed liaison officer between the Institute and other interests in the radio industry.

Change of Address

THE Glasgow District Office of Edison Swan Electric Co. Ltd. has moved into new premises at 167, St. Vincent Street, Glasgow. Telephone number Central 0687/8/9 as before.

From January 5th, 1954, all departments, including the Cathode Ray Tube Service Depot (new telephone number Central 2206), have operated from this address.

Obituary

WE regret to announce the death of Mr. C. F. Cogswell, A.C.A., secretary of Philips Electrical Limited, on Monday, December 28th, at his home in

The late Mr. C. F. Cogswell

Hayes, Kent, after a long illness. Mr. Cogswell, who was 55, leaves a widow and two sons. He joined the company (then known as Philips Lamps Limited) as secretary in December, 1928, and became secretary of many of the Philips Subsidiary Companies and also a director of several of them. During the 1914-18 war he was a pilot in the R.F.C.

Although he always preferred to keep in the background, his unfailing sense of justice and constant preoccupation with the welfare of the employees earned the respect of all of them, and the loyal affection of those who were privileged to know him well.

Philips Radio Crusade

ONE hundred dealers, whose efforts to re-establish the popularity of sound radio in their particular area have proved the most outstanding, will sail from London for the Mediterranean on 22nd May as the guests of Philips Electrical Ltd.

This is the date upon which the new 28,000 ton P. & O. Liner S.S. "Arcadia" begins her maiden Mediterranean cruise. Ports of call on this 13-day cruise will be Ceuta, Naples and Barcelona, and the vessel is due back at Southampton on 4th June.

Best Radio Student

THE Bronze Medal of the City and Guilds of London Institute for the best student in Great Britain in the 1953 Intermediate Radio Servicing Examination has been awarded to John McCubbin, 306, Todd Street, Glasgow, E.1.

McCubbin, who is employed by Messrs. James Anderson & Son (Glasgow) Ltd., is a student in the radio technology classes at Allan Glen's Further Education Centre, Glasgow. He is now in the fourth year, studying for the Radio Trades Examination Board, Final Certificate.

This is the first time the bronze medal has gone to Scotland.

Roadmen Directed by Radio

BIRMINGHAM Corporation is considering the use of radio as a means of directing Council roadmen from one job to another.

To give the idea a trial, an experimental radio telephone system has been installed in a city engineer's department tower wagon for three months. Roadmen, it is hoped, will be able to move from repair job to repair job much more quickly if given instructions immediately by radio, time being an important factor during bad weather conditions.

It is understood that the only other town to carry out similar tests is Southport in Lancashire.

B.I.R.E.

THE following meetings will be held during February, 1954:

London Section.—Wednesday, February 17th, 6.30 p.m., at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1.—"Electronics in Film Making," W. D. Kemp and B. R. Greenhead (High Definition Films Limited).

North-eastern Section.—Wednesday, February 10th, 6 p.m., at Neville Hall, Westgate Road, Newcastle-upon-Tyne.—"Some Aspects of Micro-wave Aerial Design," J. Bilbrough (Microwave Instruments Limited).

West Midlands Section.—Tuesday, February 23rd, 7.15 p.m., at Wolverhampton and Staffordshire Technical College, Wulfruna Street, Wolverhampton. Details from the Local Secretary, Mr. R. A. Lampitt, A.M.Brit.I.R.E., 20, Northfield Grove, Merry Hill, Wolverhampton.

Modifying the Testmeter Type "E"

DETAILS FOR ADAPTING THE METER TO TEST A.C. VOLTAGES

By B. L. Morley

SOONER or later the amateur constructor feels a real need for a reliable testmeter giving a range of A.C. and D.C. volts, D.C. current and direct measurement of resistance in ohms.

Unfortunately, such instruments are rather expensive and are beyond the pocket of many; but there is a very useful instrument on the ex-Government market which meets most of the requirements mentioned above and is available for a very reasonable price.

This meter is known as the Testmeter Type "E" and has been made by the Avo company.

The instrument can be bought for as little as 49s., and it has the following D.C. ranges:

D.C. volts	D.C. current
0-2 v.	0-20 mA.
0-20 v.	0-100 mA.
0-200 v.	0-200 mA.
0-1,000 v.	0-2 amps.
	0-20 amps.

Resistance readings: 0-10,000 ohms.

It also incorporates a switching device which multiplies the D.C. voltage ranges by two, thus giving 0-4 v., 0-40 v., 0-400 v. and 0-2,000 v.

The instrument uses a small 1.5 v. cell for the resistance range, the battery being housed within the case. A U10 battery can be used for this purpose.

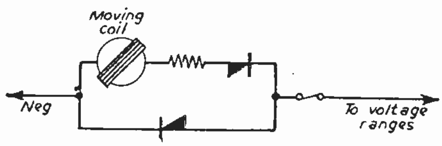


Fig. 2.—Basic circuit.

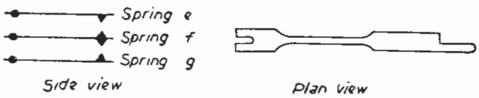


Fig. 3.—Details of the three spring contacts required.

The scale is marked 0-40, 0-20, 0-10 amps and volts, and 0-5,000 ohms, and infinity on the resistance range. (Fig. 1.)

Normal voltage ranges require a total current of 1¼ mA for full-scale deflection and therefore give a figure of 800 ohms per volt. This figure puts it well above many other meters classified as "inexpensive," and enables quite accurate readings to be taken.

One important feature it does not possess is a range of A.C. volts, and this is probably the reason for its being rather neglected by the amateur.

It is possible to modify it for A.C. voltages by the inclusion of rectifiers in the circuit. Undoubtedly, the best method is to use a bridge rectifying circuit across

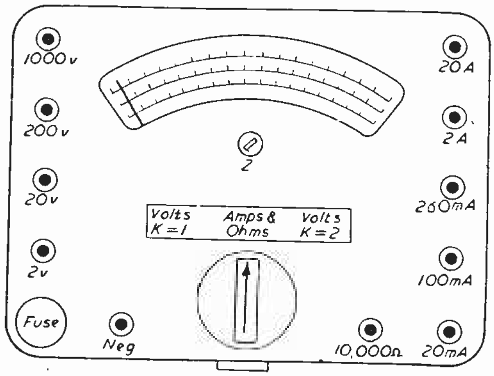


Fig. 1—Face panel of the meter.

the moving coil. However, such a method would involve a complicated switching device and would be rather difficult to mount within the narrow confines of the case.

A more simple solution to the problem was sought which could be undertaken even by the novice with the aid of a few simple tools.

It was decided to use crystal diodes in a straightforward rectifying circuit as shown in Fig. 2, and while some efficiency is lost on the A.C. ranges, it was considered that the simplicity of the scheme coupled with the ease of modification justified the use of the circuit.

The loss in efficiency on the A.C. range is just under 10 per cent.; this means that 1/10th must be added to the reading given by the meter. For example, if the meter reads 200 v. on A.C., then the actual voltage is 220 v. The D.C. readings are unaffected.

The parts necessary for the modification are given below. The only tools needed are a pair of pliers, soldering iron and a 1/16th inch drill.

PARTS

Two crystal diodes type CG4 (B.T.H.).
One spring contact set (see text).
Odd length of wire, solder and insulation tape.

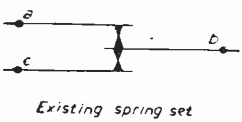


Fig. 4.—Diagram of the existing contacts in the switch.

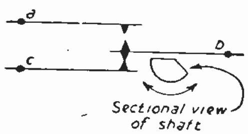


Fig. 5.—A sectional view of the cam.

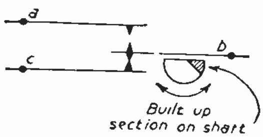


Fig. 6.—Showing the shape of the cam to be built up.

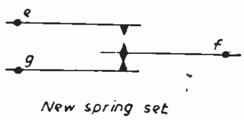


Fig. 7.—Diagram of the new spring set arrangement.

The spring contact set may need some explanation. What is required is three spring contacts such as are used in ex-Government and ex-G.P.O. relays. Fig. 3 shows in detail the types required.

Modifying the Switch

The major modifications of the meter are to the switch which is marked " Volts K=1," " Amps and Ohms," " Volts K=2."

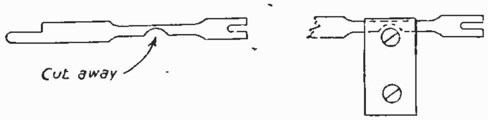


Fig. 9.—Mounting the new spring contacts.

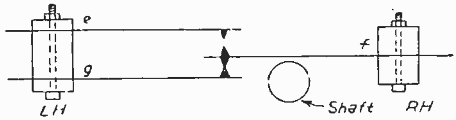


Fig. 10.—Plan of the new springs in position.

Fig. 4 shows a diagram of the existing contacts in the switch. With the switch on " Volts K=1 " position the contacts a and b are made. When the switch is in either of the other two positions the contacts b and c are made, the contacts a and b being open.

The operation of the contacts is brought about by the cam formation of the ebonite shaft of the switch.

Fig. 5 shows a sectional view of the cam, the switch being in mid-position (amps and ohms) ; it will be seen that if the shaft is rotated to the right the cam will operate the spring set so that a and b are closed and b and c are open. This is when the switch is in the " Volts K=1 " position.

Further examination will show that if the shaft is rotated to the left instead of to the right, then b and c will remain closed and a and b will stay open.

Now the first requirement of our modification is to arrange that if the shaft is rotated to the left (K=2), then a and b springs close and b and c open.

To do this a cam must be built up so that it is shaped as shown in Fig. 6. The method of doing this will be explained later. It will be observed that under these conditions rotation of the shaft either to the right or to the left will operate the spring set.

An additional spring set is required made up from the parts mentioned previously. They function in a similar manner by operation of the shaft of the switch.

The new spring set arrangement is shown in Fig. 7. It is required that springs f and g are closed, f and e being open when the switch is in K=1 and also the " Amps and Ohms " position, and for f and e to be closed while f and g are open when the switch is in the K=2 position.

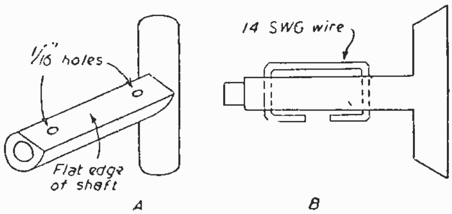


Fig. 11.—Fitting the new " cam."

A summary of the required spring operations is given below :

Position of switch	Spring set	Position of contacts
K=1	X	a & b made, b & c open
,,	Y	f & g made, e & f open
Amps and ohms	X	a and b open, b & c made
,,	Y	f & g made, e & f open
K=2	X	a & b made, b & c open
,,	Y	f & g open, e & f made

Fig. 8 gives a semi-exploded view of the existing spring set mounting. The new springs are fitted on the same mounting above the existing ones.

Two bolts are provided for holding the springs, and it will be necessary to undo partially the top bolt on both left-hand and right-hand mountings so that the new springs can be slipped in.

An insulating tube is already fitted over the bolt, and each new spring will have to be cut slightly so that it can be inserted between the paxolin leaves, the top edge of the spring being level with the top of the paxolin strips (Fig. 9). The top bolts are then tightened so that the new springs are held firmly in position.

It is important to note that the dome contacts of the springs must be opposite each other, as shown in Fig. 10.

There should be no difficulty in getting access to the spring sets as the back of the meter can be easily removed by undoing the four brass retaining bolts.

It may be found easier to mount the springs if the switch is removed. To do this release the split pin, take off the washer, and then gently pull the switch out from the front of the meter.

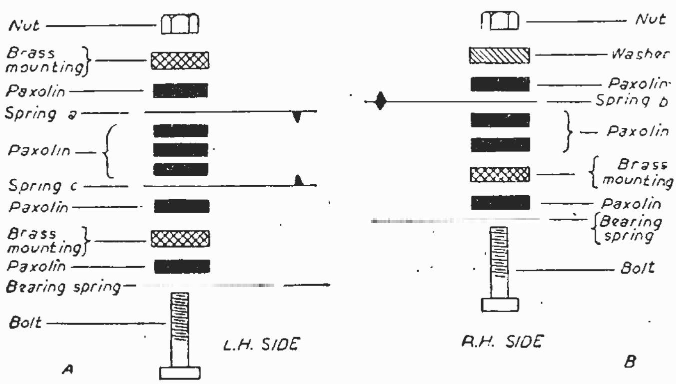


Fig. 8.—Semi-exploded view of the existing spring mounting.

Modifying the Shaft

The shaft is now modified, to enable the " cam " operations to be made as the pointer of the switch is moved.

It will be found that when the switch is in the K=2 position a flat side of the shaft is facing the moving spring arm. This flat section must be formed into a cam so that spring b and spring f are both operated when the switch is moved to K=2.

The simplest method found was to drill a $\frac{1}{16}$in. hole $\frac{1}{8}$in. from the two ends, on the flat portion on which it is desired to make the cam. A short piece of 14 s.w.g. wire was then bent and worked through the holes, as shown in Fig. 11. This provided enough lift to operate the springs.

The wire is withdrawn and the shaft reinserted into the meter ; the wire can then be reinserted into the holes and bent as shown in the figure. The washer and split pin at the retaining end of the shaft can be replaced. Note that the wire lies along the length of the shaft (flat side) so that both springs b and f are lifted when the switch is in K=2 position.

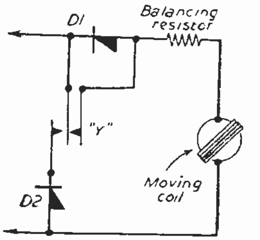


Fig. 12.—The theoretical circuit.

The springs can be adjusted so that the contacts are made and broken in accordance with the plan given previously.

Wiring

The meter can now be wired. Fig. 12 shows the theoretical circuit. When the switch is in the K=1 or the amps/ohms positions, the diode D1 is short-circuited and the diode D2 is out of circuit. When the switch is operated to the K=2 position the short-circuit is taken off D1 and D2 is connected across the meter.

Fig. 13a shows the part of the circuit wiring which requires alteration, and Fig. 13b shows the crystals wired in, the heavy lines denoting new wiring, the light lines denoting existing wiring remaining *in situ*.

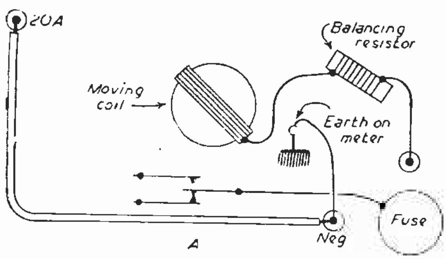


Fig. 13a.—The part of the wiring to be altered.

Only the actual wires associated with the modification are shown.

It will be found that the crystals can be fitted among the other components, as shown in Fig. 14. D2 should be covered with insulation tape, but D1 can be left bare. All new wires should be insulated.

Do not allow the soldering iron to linger when soldering the wires to the diodes or the material enclosing them will be melted.

Testing

All that remains to be done is to mark the front of the meter. By the side of K=1 put " D.C." and by the side of K=2 put " A.C."

The meter can now be tested by putting the switch to K=1 and testing a D.C. voltage, and then switching to K=2 and testing an A.C. voltage.

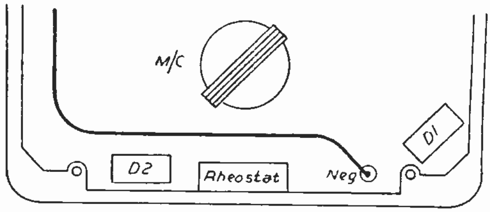


Fig. 14.—The position of the crystals.

Note that the K=2 no longer operates on the D.C. side so that the multiply-by-2 facility has been lost. The meter now reads A.C. instead of D.C. multiplied by 2 and the loss will not be found inconvenient as existing D.C. ranges are adequate for all normal purposes.

Remember that all A.C. voltages are multiplied by 2 so that the full ranges of the meter are now :

D.C. volts	A.C. volts	D.C. mA.	
0-2 v.	0-4 v.	0-20 mA.	0-10,000 ohms
0-20 v.	0-40 v.	0-100 mA.	
0-200 v.	0-400 v.	0-200 mA.	
0-1,000 v.	0-2,000 v.	0-2 amps.	
		0-20 amps.	

Note that the less the current consumed by the meter the greater the accuracy. As an example with the meter under test a more accurate reading was obtained on the 0-2,000 v. scale when testing 350 v. A.C.

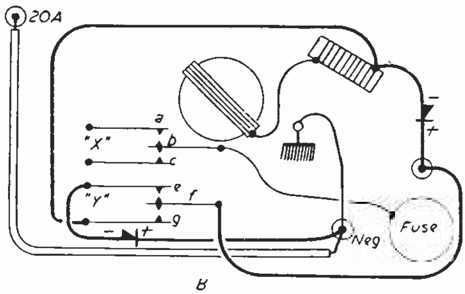


Fig. 13b.—New wiring denoted by heavy lines.

It would be unwise to test A.C. voltages greater than 1,000 v. on the meter because of the possibility of breakdown in the insulation.

Improving SUPERHET *Performance*

SOME HINTS FOR MODIFYING EXISTING RECEIVER CIRCUITS IN ORDER TO OBTAIN BETTER STABILITY AND IMPROVED RESULTS

By K. C. Ireland, A.R.I.C.S.

THIS article has been written for the beginner and young enthusiast bearing in mind that these amateurs are unlikely to have access to test instruments.

Many newcomers to radio consider the superhet difficult to understand and for this reason adopt the policy of leaving it alone. Do not be deterred, on this account, from experimenting with this type of set, as you will find much that is fascinating.

The writer first became acquainted with the superhet many years ago and gained his introduction to the subject via a publication written by the Editor of this journal. I suggest the beginner obtains a book on the subject and digests the general principles of its functioning. He will realise that there is nothing too difficult either in its fundamentals or construction that the average amateur cannot understand or tackle. He will probably also realise, having once grasped the underlying principles, that the circuit has tremendous potential amplification and that if this could be used to the full a very efficient receiver would result. I do not propose to delve into the theory of the superhet in this article but go right on to the practical side of improving an average type of set of this class.

Let us take as our example the normal five-valve superhet of commercial design built, say, about 12 years ago. This will have a frequency changer valve, intermediate amplifying stage, second detector and automatic volume control stages in one valve and a pentode output stage. Sometimes there is a first audio A.F. valve incorporated with the second detector and automatic control circuit for volume control.

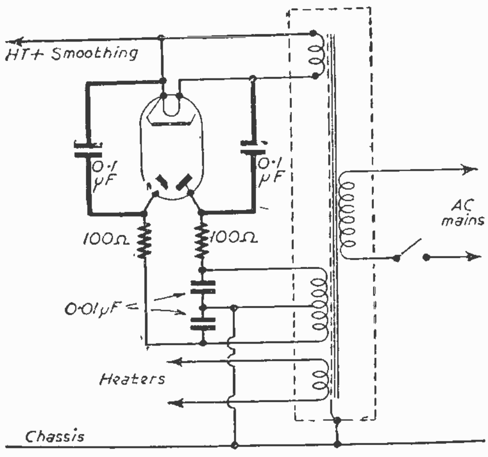


Fig. 1.—The heavy lines show the modifications to be made to avoid modulation hum.

We will also assume that our set is operated from A.C. mains, and therefore the fifth valve will be a rectifier to supply smooth D.C. current for the anodes and screens of the amplifying valves.

The designer of such a commercially built set is catering principally for the average listener rather than the enthusiast, and absolute stability and ease of operation are important factors which he must take fully into account when deciding between high efficiency or docility.

One way of achieving this stability is to use ample screening in all the "hot" circuits, and although this may produce the desired result as far as stability is concerned high performance may be sacrificed by providing capacity losses between screens, i.e., earth and leads carrying minute voltages often at high frequencies (I am referring now to short-wave reception).

My policy is to omit screening wherever possible in those stages of the receiver carrying H.F. currents and to obtain stability without sacrificing efficiency, without screens, if this can be arranged. I believe in ample screening on the audio stages where losses from screening do not arise.

Let us assume that our receiver suffers from the following defects:

1. Modulation hum.
2. Overall high hum level.
3. Lack of sensitivity on the short waves.
4. Quality of reproduction is flat and uninteresting.

I will deal with numbers 1 and 2 first and 3 and 4 in a stage-by-stage analysis of what can be tried to improve each valve and its associated circuits.

Stage-by-Stage Analysis

It will be appreciated that no single set will require all these refinements that I am suggesting but they are based on notes made on a number of sets over the past years.

1. *Modulation hum.* The elimination of this annoying trouble is fortunately a comparatively simple matter. The hum is mostly apparent when tuning through a powerful short-wave transmission and can be recognised by the fact that it is tunable with the signal. It is due to poor voltage regulation modulating the oscillator anode voltage. An almost certain cure is the provision of smoothing at the source of H.T. supply and a .1 μF. condenser

connected across each anode and heater of the rectifier. At the same time include R.F. stoppers and filter condensers as shown in Fig. 1. The latter refinement is not necessary for the removal of modulation hum. The R.F. stoppers should have a resistance of about 100 ohms and be of about 3-watt rating. All condensers should be rated for 1,000 volt working to ensure complete safety for the rectifier.

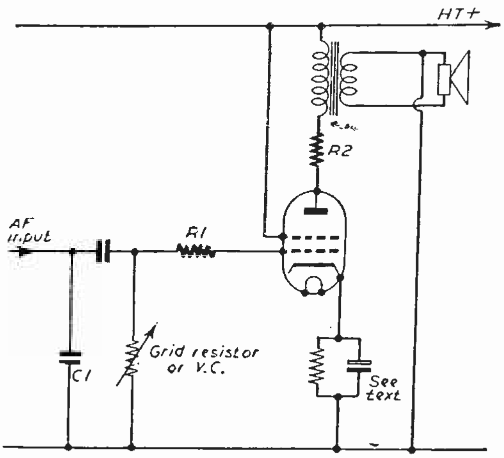


Fig. 2.—H.F. stoppers are shown here at R1 and R2.

2. *Removing hum.* A lot of time can be spent eliminating this trouble. I remember one set which defied all efforts. Increasing the capacity of the smoothing condensers had little effect. Wiring a further choke in series with the existing one only decreased the available voltage to the valves. It had been noticed that even with the volume control at minimum the hum persisted and it was apparent that the mains transformer, rectifying valve, mains energised speaker or output stage must be suspect. Changing the L.S. and rectifier did not improve matters.

It was decided to remove the mains transformer and examine this. On taking off the half-shroud cover it was noticed at once that a number of the top layers of the windings were loose and, in addition, the whole of one winding could be moved slightly on the core. It was now apparent that the hum was caused through magnetic induction vibrating the windings, and this was being transmitted to the speaker in the form of a 50-cycle hum. The transformer was heated in front of the fire and coated with pitch (obtained from old H.T. batteries). Bolts and nuts holding core laminations were tightened in a vice and the transformer refixed in the set mounted on hard rubber washers. As these insulated the core from the chassis, a stout earthing wire was connected to two of the mounting bolts and really well soldered to a large tag bolted through the chassis. No further trouble was experienced.

If the mains transformer, speaker, smoothing choke and condensers are of good quality and adequate size (electrically), there is little risk of hum if only one audio stage is used. There is greater risk with two, and care should be taken amply to decouple the anode of the first stage and all leads to signal grids and volume-control well screened and earthed.

I also believe in earthing the metal frame of the loudspeaker, particularly when a mains energised speaker is used; there is always the danger of stray currents from the field causing puzzling hum.

Now let us see what can be done with regard to faults No. 3, i.e., lack of sensitivity, and No. 4, poor quality reproduction. It is usual to find in sets built about 1940 that the tag group board system of wiring has been used. It obviously helped mass production on a conveyor belt. But if you examine a set wired in this manner you will find that many long leads (a potential source of hum) have to be employed to get from widely separated components to the group board. Examine your set and decide which of the boards can be dispensed with by wiring from point-to-point and then deal with these stage by stage through the set.

Secondly, provide each valve with its own stout earthing connection; this will facilitate the rewiring. It is usually quite a simple matter to use a holding-down bolt as the anchor point.

In Fig. 7 I have shown a typical group board applicable to the R.F. pentode of the I.F. amplifier. Note, even in a simple example, how many less joints there are to solder and the smaller space occupied by the components when point-to-point wiring is adopted and leads are shorter and more direct. Do make certain, however, that the contact between chassis and anchor tag is perfect; a number of poor earthing points will give rise to all manner of curious effects in the superhet.

Thirdly, provide each valve with its own H.T. feed back to the smoothed output from the rectifier. A common coupling point can cause instability. I appreciate that this suggestion may conflict with suggestion No. 2 about short connections, but much can be achieved with a little forethought before wiring. [A separate H.T. line will do much to reduce the risk of interstage interference and break-through. It also has the advantage of enabling the correct voltage to be applied to the electrodes of the valve without upsetting others and to decouple where required, although it is not usual for a simple superhet to require heavy decoupling.

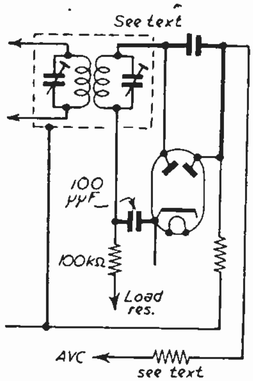


Fig. 3.—I.F. stoppers fitted in the second detector stage.

Stage by Stage

I will now deal with the circuit stage by stage, commencing with the rectifier and working back to the aerial. I feel that it is better for the beginner to carry out modifications in this order as he will be working on familiar ground when dealing with the rectifier and audio stages, as these do not differ from those used in a straight circuit. By working this way he will be better able to assess the value of improvements when he reaches the more intricate circuits, confident that the output stages are stable.

Rectifier (Fig. 1)

The suggested refinements for this stage were discussed earlier in these notes and I do not think it necessary to go beyond this. If the speaker is mains energised it will probably be fitted with a hum-bucking coil. Try shorting this out ; it may improve the bass response, but generally little will be gained as this coil has a very low resistance.

Output Stage (Fig. 2)

The additions that can be made to this circuit are shown in Fig. 2 and consist of a grid-stopper of 5,000 ohms to prevent any residual I.F. voltages from reaching the grid of the output valve and causing instability. R2 can be added as an anode stopper against parasitic oscillation. Remember, this resistance must carry the full anode current and must be capable of doing this without overheating. A resistor rated at three watts will be suitable for most valves likely to be found in the average receiver.

I will not deal with tone controls as it is most likely that the set will be fitted with one, either variable or fixed, and this can remain. C1 can be added as a precaution to by-pass to earth any I.F. voltages which may get as far as this ; a value of .0001 μF is suitable.

Providing a negative feedback system to the audio stage is very useful in securing stability and for improving general overall response, but there is little scope with only one audio stage of including this. There is insufficient gain available to offset the amount which must be tapped off to provide the feedback voltage. You might care to try omitting the output bias condenser, as by so doing a proportion of the available A.F. voltage is made common to anode and grid circuits which gives in effect a simple feedback system.

Some readers may consider all these refinements unnecessary in a low-power amplifier of simple design, I feel, however, that they are particularly necessary where amplification is confined to one stage, for the reason that on many occasions the set will be working at full gain and, therefore, in its most dangerous condition (in so far as risk of instability is concerned). In a high-gain amplifier, with two or more stages of amplification, the necessity of running at full gain rarely arises.

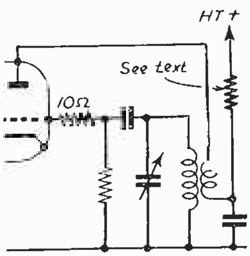


Fig. 5.—Modifying the oscillator section of the frequency changer.

Second Detector (Fig. 3)

This operation is usually performed by one diode of a dual purpose valve, and there is little that can go wrong or that can be improved. There might be a slight risk of instability and if not already fitted try an I.F. stopper of 100,000 ohms in series with the load resistance with a small, fixed condenser of about .0001 μF as by-pass to cathode for any I.F voltages. No screening should be necessary on this stage in a well-designed set.

Automatic Volume Control Stage (Fig. 3)

A.V.C. will aid stability generally over the circuit, but does impose a damping effect. To offset this try reducing the value of the diode coupling condenser (as low as 20 pF can be tried). This will reduce the damping on the I.F. transformers and so increase volume and also improve transient notes. At the same time increase the value of the A.V.C. filter resistance from the usual ¼ megohm or ½ megohm to 1 megohm or even more. This higher value may reduce the overall damping effect of the A.V.C. circuit and thereby increase efficiency.

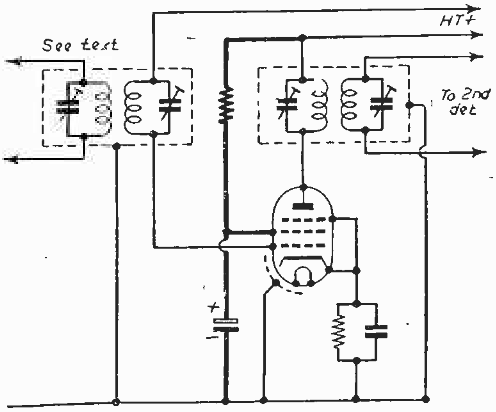


Fig. 4.—Decoupling the screen-grid of an I.F. stage.

Intermediate Frequency Amplifier (Fig. 4)

This is one of the "hot" circuits. It has two functions to perform : to provide the high amplification of the R.F. signals passed to it from the frequency changer and at the same time control selectivity. Practically all the R.F. amplification is carried out by this valve, and if efficiency is to be maintained care should be taken to see that none is lost or wasted. Some screening is essential here, but let us see what can be done to reduce this to a minimum and at the same time keep the stage stable and under control.

If the valve is metallised I have found it better to scrape this from the glass and completely screen the valve in a metal can, not forgetting to provide a few ventilation holes at top and bottom. My experience is that the metallising tends to flake from the glass under heat and age and provide poor contact and worse screening. Do not enclose a metallised valve in a can ; it will over-heat.

Make the flying lead from the I.F. transformer to the signal grid as short as possible, and try an unscreened lead here—there is no reason why a well-designed set should become unmanageable by reason of the omission of the screened lead. If you find screening of this lead is necessary, make the signal carrying wire as thin as possible and thus reduce to a minimum the losses to earth due to the capacity effect of the screen. If the screen of the R.F. pentode is not decoupled try doing so using a 20,000 ohm resistance as a basis for experiment with a .1 μF condenser to earth. The voltage drop caused by the resistor may help stability in this stage.

Frequency Changer and Oscillator (Fig. 5)

I will deal with these as one stage partly for convenience and also because the beginner will probably think of them that way, as the two stages are combined in one valve performing two distinct operations, i.e., as a generator of local oscillations and as a mixer of these oscillations with the signal oscillations received via the aerial and tuning coils.

If the oscillator section of the valve oscillates too hard, or not sufficiently, then sensitivity will be poor—so give some attention to the oscillator anode voltage ; experiment with a variable resistance in the anode lead and adjust this to give a nice control over the whole of the band. When you are satisfied, the variable resistance can be substituted by a fixed resistor of the correct value. I have found a voltage of about 70-80 suitable for a valve of the TH4 type.

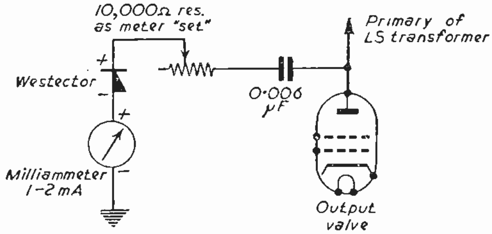


Fig. 6.—A simple output meter.

It is as well to provide a small resistor (10 ohms) soldered direct to the oscillator grid pin socket as a precaution against instability on the short waves.

Make certain that all leads to the oscillator section are short and stout enough to be unaffected by vibration. Powerful signals from a loudspeaker situated in the same cabinet as the chassis can start vibrations of sufficient intensity to cause the oscillator to "spill over."

If the lead from the aerial socket to the wave-change switch is screened, omit the screen. This lead will often be carrying small voltages at high frequencies when screening will cause losses. I think it better to rely on the screening provided to the I.F. stage where losses will be lower because the frequencies carried by this stage are lower.

Simple Alignment and Trimming

Accurate alignment of the superhet is essential for high efficiency, particularly on the short waves. Very often a slight adjustment of the trimmers will make a marked difference to the performance. No elaborate test gear is required, in fact it can be done by ear without any visual aids ; but I have found a small output meter on the lines shown in Fig. 7 very useful and interesting. A milliameter, small Westector, condenser and variable resistance are all that are required. If room can be found on the front of the cabinet these can be wired permanently into circuit and will form a useful tuning indicator.

We will assume that our set is working on all wavebands and that there are no serious defects in its performance. Connect a normal aerial to the set, and with volume at maximum and wave-change switched to medium band tune in a weak but constant signal at the low end of the dial. Adjust each trimmer on the I.F. transformers for maximum reading on the meter. Commence with the secondary of the second transformer and work back to the primary of the first. Do this two or three times and satisfy yourself that you cannot get a higher reading. When this has been done tackle the oscillator trimmers.

Keep to the medium band and adjust the oscillator trimmer for maximum reading; do this a number of times on the one station, remembering that each adjustment of the trimmer will necessitate retuning the set slightly. Any small discrepancies between the dial reading and the correct frequency of the station can be ignored. Now tune to a known station at the top of the dial and note the reading—if the error approximates to the other you can be reasonably sure that the oscillator tracking is accurate. Try adjusting the trimmer on this new station and note any improvement by reading the meter. Now go back to the first station and check the dial reading. If this has remained steady give a final adjustment here. If the dial settings are not seriously out I am in favour of sacrificing accurate dial readings for maximum results.

The simple procedure outlined above is usually sufficient to provide good signals over the whole of the medium band. Trimming of the long-wave band is similarly carried out. The oscillator trimmer settings, however, will not be so sharp. Endeavour to get a station at each end of the band. This is not always easy as the number of stations is limited, but it is satisfying to know that the set is tracking accurately right through the band.

Alignment of the short-wave band is rather trickier, the oscillator tuning will be very sharp and care must be used not to miss the point of maximum meter reading.

Again use stations of known frequency, one at each end of the dial to commence with, and checking with other known frequencies between these points. One point to watch on this band : if a station comes in at two points choose the one with the highest frequency (or lowest wavelength). This is because the oscillator frequency is normally arranged higher than the signal frequency in order to keep the frequency ratio between top and bottom of the tuning range as low as possible.

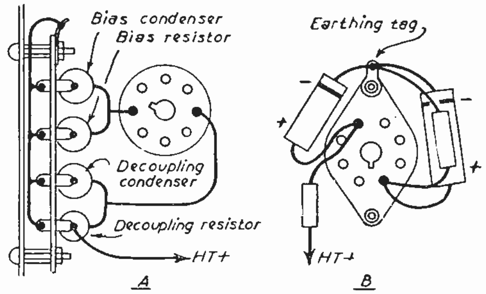


Fig. 7.—Typical wiring arrangements discussed by the author.

Do not use a metal screwdriver when adjusting any trimmers ; the added capacity of metal and fingers will seriously upset your adjustments. I have found a piece of hardwood, chisel-pointed at one end, quite satisfactory.

TRANSMITTING TOPICS

MAINS TRANSFORMER MODULATION

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

THE cost of modulation transformers capable of handling reasonably high audio powers often causes speculative glances to be cast at a mains transformer that the enthusiast may have lying around. Surely if a good transformer could be impressed for modulation service, then the cost of a standard modulation transformer, might be saved? This is often by no means an unimportant consideration, as money saved in one direction may very well be spent on some other necessity. Some notes on possibilities of economy in this direction may accordingly be of interest.

In some cases, first-class results may be obtained with a mains transformer, but it must be clearly understood that there are certain limitations. A great deal depends on the mains transformer design and as modulation conditions are rather different from the original purpose of the transformer, it is as well to pick a really substantial transformer even if only a moderate audio power is to be used. The writer has heard of high-power transmitters using mains transformers successfully, and up to 60 watt carrier levels no trouble should be experienced. Naturally, of course, one would hardly go out and buy a new transformer for such work, it is more suggested as an idea for utilising any "spare" transformers. Resourcefulness and improvisation is the hallmark of the true amateur, and the writer has known of several amateurs successfully employing mains transformers in modulators. The writer himself has often employed this dodge, and to date has never actually purchased a genuine modulation transformer, despite several years of 'phone operation.

The simplest "mains transformer" modulation circuit is shown in Fig. 1. This actually employs the voltage tappings on the mains input side as an auto-transformer. It is, in fact, a somewhat refined version of the Heising system of choke modulation. The refinement consists of the fact that the mains voltage tappings enable some control over the matching of modulator to power amplifier to be effected. Thus, with the usual mains voltage taps of 200v., 220v. and 240v., we can, by selecting tap positions, have stepped up or stepped down ratios of 1 to 1, 1.1 to 1 and 1.2 to 1. This allows of matching load impedances up to 1.44 to 1, either up or down. While it is unlikely that an exact match will be obtained in this way, it does enable a much better match than the simple Heising choke control system. One attraction is that a faulty transformer, that still has an intact primary, may be used in this way if the fault is only due to a break in some other winding.

Using a single 6L6 as the modulator valve, the writer has used this system to modulate an 807 PA running with inputs of up to 25 watts with good reports. In fact, recently good quality reports were received when using plain Heising modulation without the benefit of the better matching that is available with the tapped system.

It should be noted also that, with this system, it is absolutely necessary to operate the audio modulator valve in Class A. However, it is possible to parallel modulator valves to get increased audio power, but if this is done a difficulty arises. First the H.T. requirements for, perhaps, an 807 valve are for H.T. at some 600 volts or so for the R.F. stage. However, the use of, say, 6L6 valves in the modulator to give some 11 watts of audio requires on reference to the Class A conditions for the 6L6 some 350 volts of H.T. It may be necessary, there-

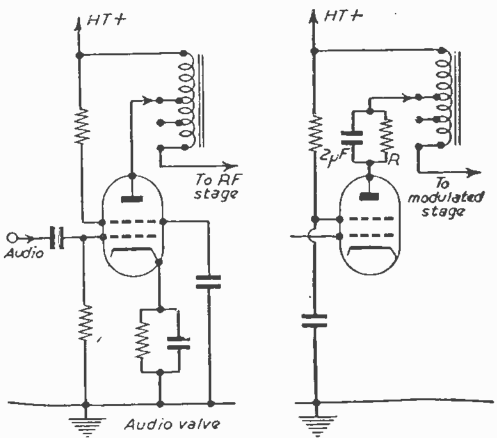


Fig. 1 (left).—The tapped primary winding of a mains transformer enables some degree of load matching to be effected.

Fig. 2 (right).—A dropping resistor R, by-passed by a condenser, enables the modulator valve to run at reduced H.T. volts.

fore, to cut down the H.T. to the 6L6s. This can be done with a resistance by-passed as in Fig. 2.

Higher Powers

There are more troubles, for there is a second difficulty to consider. If we parallel up the audio valves, we automatically halve the load required if we use two valves, or, if we use three or four audio stages, we shall then require a third or a fourth of

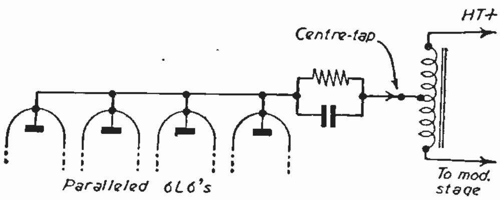


Fig. 3.—Paralleled modulator valves enable higher power output. The centre-tapped high voltage secondary enables a match to be made. A centre-tapped choke is also suitable in such a circuit.

the load resistance required for one valve. We shall have doubled, tripled or even quadrupled the audio power available, so that if matching can be achieved, we shall be able to modulate correspondingly high R.F. inputs to the P.A. stage. Ideally, four paralleled 6L6s would modulate some 90 watts of R.F. input to a P.A. stage. This is so attractive an idea that the arrangement shown in Fig. 3 merits attention. In order to obtain the high step-up necessary to match the low load required by four paralleled audio tubes to the relatively high load of a Class C R.F. stage, the H.T. windings of a centre-tapped H.T. secondary of a mains power transformer are suggested. This will give a voltage step-up of 2 to 1, and hence a load resistance step-up of 4 to 1.

To take a specific case, suppose our P.A. stage is a pair of 807s running at 140 mA. at 600 volts, which is an input of 84 watts. This represents a load impedance of $\frac{600}{140} \times 1{,}000\Omega = 4{,}300\Omega$. As a single 6L6 gives 11 watts of audio and requires a load impedance of just 4,200Ω, then four 6L6 tubes paralleled will give 44 watts of audio and require a load of one-fourth of 4,200Ω. However, by using the step-up circuit of Fig. 3, we can just nicely match four 6L6s into 4,200Ω. The actual match to a P.A. representing 4,300Ω will, for all intents and purposes, be perfect. Moreover, 44 watts of audio will ideally modulate an 88 watt P.A., so in fact, this gives us a little audio in hand.

The only snag likely to arise is the possibility of parasitics in the paralleled 6L6s, and this can be dealt with by the use of parasitic suppressing resistors of some 10,000Ω taken directly to the grid pin of each 6L6 and an anode stopper resistance of 100Ω in each anode lead. The four tubes will draw some 200 mA., so that a fairly husky power pack is needed. However, with nearly 100 watts input to the P.A., adequate power supplies are needed. Moreover, as the audio valves operate in Class A, the regulation of the power pack can be very poor without affecting results. Furthermore, the inputs can be scaled down for lower powers, and the number of 6L6 tubes in parallel altered, so as to adapt conditions for various R.F. power levels.

It should be noted that the matching difficulty is the reason why the conventional push-pull arrangement cannot generally be used with a mains transformer. With the usual high voltage secondaries, the effect is a large step-down to the primary side, so that one would not match a conventional P.A. stage of high load resistance value. If a transformer with the usual primary and a centre tapped secondary rated for perhaps 120-0-120 volts is available, this would provide a fair match from a push-pull audio stage to an R.F. stage connected to the primary. However, husky transformers having relatively low voltage centre-tapped secondaries are not very common. Accordingly, methods that have been suggested here are necessary to obtain effective use of the more usual mains transformers as modulation transformers.

A final application of the mains transformer in a practical modulator is also useful. Certain audio amplifiers with high power output are often advertised as surplus. Some of these may have perhaps 500Ω impedance outputs. It is often possible to match this 500Ω output with a mains transformer to an R.F. stage. Thus, if the 500Ω output is connected to the 200 volts primary of a 350-0-350 secondary transformer, this gives a step-up in voltage of 3.5 to 1, and consequently a load step-up of $(3.5)^2$ to 1, that is, 12.3 to 1. Accordingly, the 500Ω output is thus matched to 6,150Ω. In this way, such amplifiers may be matched approximately to a P.A. stage. To quote an example, G2BFQ is one station successfully employing this subterfuge.

Another possibility is the use of a filament winding to match a 5Ω or 10Ω output of an audio amplifier to the primary of a mains transformer so that it will

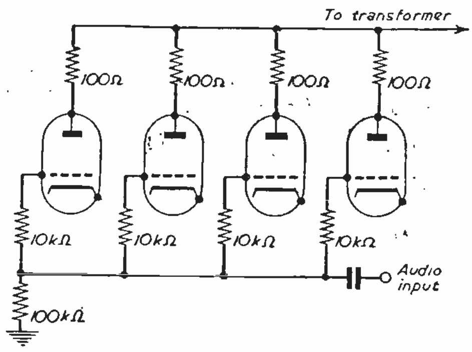


Fig. 4.—Anode and grid stoppers are desirable precautions in the use of paralleled modulator valves.

match into a P.A. stage. Various possibilities exist of this nature, so that a little thought may often enable an efficient modulator to be improvised at little cost. This is often more satisfying than taking the easy way out. Also, in emergency, the ability to improvise speech equipment may be useful when the "genuine" transformer gives up.

On Your Wavelength

By Thermion

How Many Battery Set Users ?

I AM glad to learn that this journal proposes to produce a battery version of the Coronet so that all readers may enjoy listening to this latest of our receivers especially designed to celebrate our 21st Birthday. Whenever a blueprint is mooted, the problem always arises as to whether it should be for a mains or a battery receiver ; and if the former, whether it should be A.C. or A.C./D.C. We cannot, for obvious reasons, give three blueprints, and the matter is usually decided by the relative number of queries received on the three types. I readily concede that this may not always lead to a right decision. It may be that battery sets are so reliable that there is no occasion to ask a query concerning them.

From trade statistics it is plain that the demand for battery receivers is diminishing as the country becomes more and more within the scope of the grid. However, whichever decision is arrived at, it disappoints those in favour of the other two classes. It proved to be so in the case of the Coronet. We had the usual crop of queries from those unfortunates whose houses are still wired for D.C. and from those others equally unfortunate who are without electricity altogether. Of course, a solution could be found in a mains-battery design, but the disadvantages of that from a constructor's point of view are obvious. In fact, we have had very few enquiries for mains/battery receivers and a comparatively small number for D.C. receivers. It is only fair, however, that all sections of readers should be satisfied and would-be Coronet operators still tied to accumulators and dry batteries will read in the next issue of our battery Coronet Four, which makes use of most of the key components of the mains versions. You may therefore start gathering the parts together.

The Fury Four

THE new edition of the Fury Four is well advanced and will follow the Coronet. That famous receiver made history. It was announced to the world by means of large-scale advertisements in all the national newspapers and the entire front page of the *Daily Mail* was secured to carry our advertisement relating to the free gift blueprint.

My Fury Four is still operating, although I have made additions and it is now housed in a radiogram cabinet. It was the mains versions, of course, that I built. Except for the change of a valve or so and a condenser, it has given me trouble-free service.

In the early days of this journal we received some complaints that we dealt with too many battery receivers. Now the position is reversed !

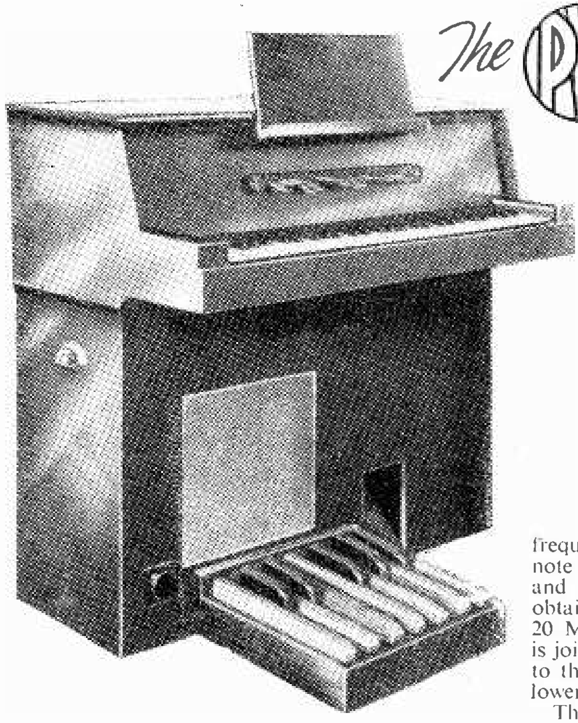
Another Liberty to Go ?

THERE was a lively discussion in the office the other day concerning the new clause in the application form for Road Fund Licences which calls upon the applicant to state whether his car is fitted with a radio set and if so whether he has taken out a licence for it. My contribution to the discussion was that if the M.O.T. is undertaking the work of collecting licence fees for the BBC it could happen that we may not be able to purchase a radio licence unless we can prove we have paid the dog licence. This tendency to take away our liberty by a process of gradualness, so that we scarcely notice it, needs to be watched. We have lost a large number of our liberties since 1939. I have examined the powers conferred upon the Minister of Transport in relation to his authority to make regulations without reference to Parliament and I can find nothing therein which gives him power to act as a tax collector for radio licences, which have nothing whatever to do with the Ministry of Transport. There have been protests from all over the country regarding this matter, but the M.O.T. blandly states that it is acting within its rights without quoting its terms of reference. I for one do not accept their statement and I hope that some motorist will make a test case of it. Here is a case for the R.A.C. and the A.A. It should be no concern of any Government department to probe into the affairs of another. I do not have to tell the milkman before he issues a supply that I have paid my grocer's bill and am therefore a good business risk !

Should I be Sacked ?

A READER from Northern Scotland, who says that he has taken our journal from its first issue, and who incidentally is in favour of more battery receivers being described herein, in a postscript asks the editor to sack me. Just like that ! He disagrees with my views and so would prefer to see me plodding my penurious way as Fleet Street paragraphist instead of, as he thinks, besmirching these pages with views which are unpalatable to him. My fans must rally round. Strange to say, the Big White Chief just tossed the letter over to me with the wry comment that he proposed to do nothing about it and would I like to reply to it ? I have done so with the polite suggestion that it has taken him 21 years to express his view ! Perhaps the remoteness of his demesne is responsible for the remoteness of his views. How hard is the task of a contributor ! If he is outspoken he is too forthright. If he dons the velvet glove he is not sufficiently outspoken. Anyway, the views I have are not formed lightly and I shall continue to express them with the same vigour as hitherto whilst space is allotted to me for that purpose. I do not expect all to agree with me.

Not so long ago a keen Scotch nationalist objected to a criticism in this journal of Lord Reith who, in this reader's eyes, could do no wrong.



The PW FULL-COMPASS Electronic ORGAN

This Month Details are Given of the Connections for the Main Busbars and Stop-key Circuits

By W. J. Delaney (G2FMY)

(*Continued from page 98 February issue*)

AT the end of the keyboard the earthing strip is taken round to the common earthing point.

The leads are then attached to the tops of the groups of resistors on the distribution strip, making certain by means of the colour code that the top note (f1) on each socket is taken to the top octave, and proceeding down the strip so that all the octaves will be of the same coloured leads and the notes will run in correct sequence. The four chassis provide the 60 notes—the top C not being used if one is fitted to the keyboard. Whilst connecting these leads to the distribution strip the pedal circuits may be completed.

For the single octave pedals beat notes are produced by mixing a tone with its fifth. Low C on the strip, for instance, has a frequency of 64 c.p.s., whilst the G above it has a frequency of 96 c.p.s. If these are mixed in the correct proportion the "difference frequency" of 32 c.p.s. is produced, and this is the frequency of the note C one octave below the lowest note on the keyboard. Only 12 notes are employed, and the correct proportion of the two notes is obtained by linking the two relative notes through a 20 MΩ resistor (or two 10 MΩ joined in series). It is joined from the top of the group of three resistors to the centre of the two right-hand resistors on the lower 12 as shown in Fig. 25.

The turned-up ends of the lower resistors on the distribution strip have now to be connected together in groups of 12, all the right-hand resistors being joined, then the centre ones, and finally the lower ones. This will leave 14 separate busbars, one of which is the pedal bus (that joined to the right-hand resistors of the lower dozen). The busbars are now to be joined to single busses, the linking being by means of a 1 MΩ resistor, which, in conjunction with a small condenser, form click filters. The complete circuit of this part of the instrument is given in Fig. 22. Note carefully that the single octave busbars are shown as viewed from the front of the instrument. If a mistake is made in the wiring of the outside pair of resistors in each group it will not matter much as when the instrument is tested it will readily be apparent and will merely call for a change-over of the 4ft. and 16ft. leads to the stop key switches. The single collector busbars are connected to the stop

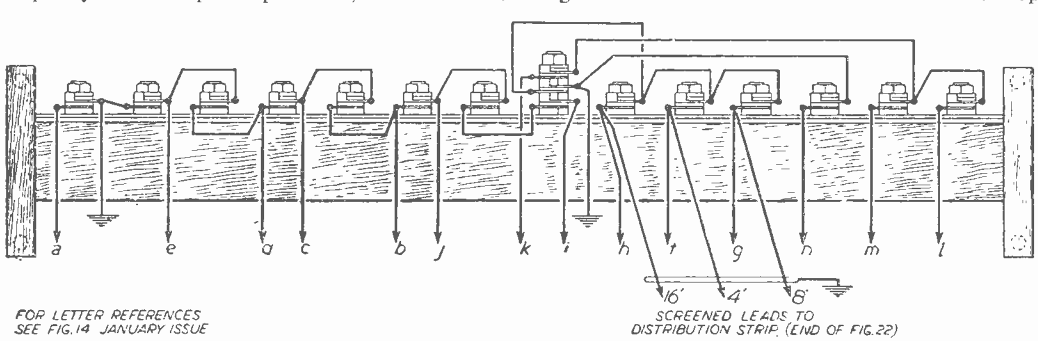


Fig. 23.—Details of connections to the stop-key switches.

keys, short screened leads being soldered to the centre immediately opposite the relative stops, a hole being made in the vertical screening box to permit the leads to pass through. The linking of the separate octave busses should also be carried out in screened leads to prevent interaction with one another, the screening box round the entire distribution strip taking care of hum.

Stop Keys

The stop keys or tone switches should now be wired; the full arrangement being shown in Fig. 23. The small pre-amp should be placed on the cover over the keyboard, and the extending screened multi-cables, shown in Fig. 14 of the January issue, should be joined to the keys as indicated, noting carefully the lettered references. The screening should extend as far as possible, although, due to the spacing between the stop keys, two or three inches of unscreened lead must remain here and there. This will not introduce any trouble, however, and when finally connected the linking wire should be soldered to the screening as near to the stop keys as possible, this linking wire being taken to the "string" switch (extreme left viewed from the rear) and thence across to the screening covering the three screened leads from the distribution strip to the other earthed points on the stop keys, and so on to the earthed socket on the keyboard (socket "A" in Fig. 14). The signal-light holder should be attached to the end of the stop key mount and two leads attached to it, one lead going to the common earthing wire and the other to the other 6.3-volt heater socket. Note that the volume control has an earth connection also, and this should be of the type having a metal covering which can be soldered, or fitted with a soldering tag, and it should be earthed to the common earthing wire just mentioned. A soldering tag should also be attached to the metal front of the stop key assembly and earthed so that the volume control is screened. With some volume controls it may be found desirable to make a small metal box to fit right over it, but this will only be found on test.

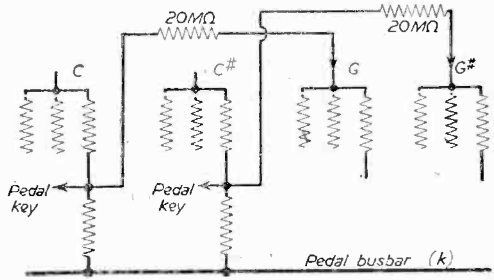


Fig. 25.—Details of circuit for obtaining the pedal notes.

Hum

This part of the wiring is very important and is the only point where hum can be introduced. Screening must, therefore, take place at every available exposed point (except for a maximum of three inches which is unavoidable in the case of some wiring to the stop keys), and if possible one single wire should be used between the socket "A" and the pilot lampholder, all screened leads and earth points being taken to it by the shortest possible route. Again, reference is made to the illustration at the foot of page 679 of

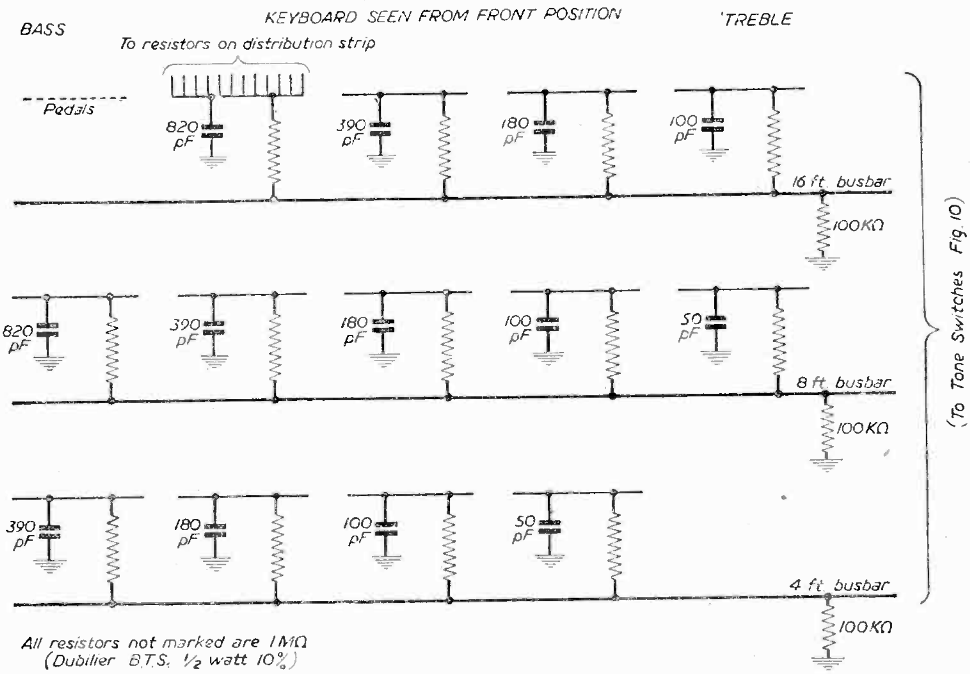


Fig. 22.—Details of main and octave busbar connections—with click filters.

the November issue. A lid covers the box containing the distribution strip but was removed for the purposes of the photograph. On the right of the strip the dozen leads on top carrying the 20 MΩ resistors for the bass section may be seen. The mains plug "X" in Fig. 19 should be attached to about 2ft. of ordinary 5-amp lighting flex and is later inserted in a socket linked with the normal mains supply to the organ. The 1 μF condenser should be of the standard

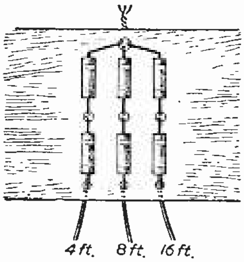


Fig. 24.—Connections to the divider network for the main outputs.

Mansbridge or paper type and should be rated at 500 volt working. A surplus condenser, tested for power factor, etc., was used here.

Pedal Clavier

A further 12-way screened lead (or separate screened leads) is now attached to the centre of the pedal resistors on the distribution strip and taken down to a 12-way socket, if the organ is to be portable. If portability is not required the leads may be taken straight down and attached to a Bulgin 12-way socket, type V.H.80, mounted on the front of the main body of the organ as shown in the illustrations. Connections to the 12 pins are arbitrary, but they must be sorted out when attaching the leads from the actual pedals to the 12-pin plug (Bulgin type P.245) so that each goes to its correct note. A Jones 12-way plug and socket (surplus) were used in the original model to couple the two sections of the 12-way cable as this was intended to be portable. Again, the screening must be earthed. The actual pedals may be made from stout timber to any desired style, the original being 1in. hardwood, hinged with ordinary brass hinges at the front end, and a single strip of ½in. phosphor-bronze strip being run right across the rear wooden supporting strip. At the top of each pedal a short contact was screwed so that when in the rest position the contact was touching the long strip. The latter was earthed by soldering a long flex lead taken through the hole in which the expression pedal is mounted, and a clip at the end enables this to be attached to the chassis of the amplifier. This saves using a 13-position socket which is not available (12 connections for the notes plus the earth connection). A strip of felt along the upper strip prevents the pedals from being noisy, and a three-inch spring is mounted in a hole drilled in the lower part of the wooden framework and into each pedal. Any desired form of springing and mounting may be used here, and there is nothing to prevent the constructor from making a radial pedal board similar to the standard and using long pedals if desired. At the moment, however, no increase beyond the 12 notes may be made. Experiments are being undertaken with a view to using a full standard pedal clavier, but the same principle of "beat notes" does not work out, and calls for extra components.

Amplifier

All that now remains is the power amplifier, and this will be described in the next and final instalment.

(To be concluded)

Mullard Filmstrips

A SERIES of twenty filmstrips, covering the two final years in the Ordinary National Certificate Course in Electrical Engineering, has recently been produced by the Technical Publications Department of Mullard, Ltd. It is understood that these filmstrips are the first of their kind to be produced to cover a specific course of study. Although prepared primarily for the assistance of lecturers and teachers in technical training establishments, many of the strips will undoubtedly be found suitable for senior science classes in grammar schools and for staff and apprentice training.

In producing this new series of filmstrips the Mullard Company have had the advice and assistance of an advisory panel composed in the main of teachers in technical colleges. The strips were made and will be distributed by Unicorn Head, Visual Aids, Ltd.

Teaching notes are provided with each strip. In preparing these notes no attempt has been made to produce "potted" text books or to impose on the lecturer any preconceived method of exposition. In general, the notes are confined to brief statements of the principles illustrated and to short descriptions of the apparatus shown.

The majority of the illustrations are either in the form of diagrams, graphs and the like to illustrate principles and methods of construction; or drawings and photographs showing equipment under construction, examples of modern apparatus and typical installations. In selecting the diagrams, care has been taken to avoid the obvious and those of the simpler type that can be easily drawn on the blackboards.

The complete list of filmstrips in the series are as follows:

E21—Magnets and Magnetic Materials.
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E23—D.C. Machine Construction.
E24—Armature Windings.
E25—Armature Reaction.
E26—Commutation.
E27—D.C. Motors—Applications and Control Gear.
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E29—The Cathode Ray Oscilloscope.
E30—Filament Lamps.
E31—Discharge Lamps.
E32—Photometry.
E33—Indicating Instruments—Fundamentals and Construction.
E34—Energy Meters.
E35—Alternating Currents and the Alternator.
E36—Vectors.
E37—Transformers.
E38—Rectification.
E39—Power Distribution Systems and Equipment.
E40—Underground Power Cables.

ALIGNMENT OF FRAME AERIALS

OVERCOMING GANGING DIFFICULTIES IN PORTABLE RECEIVERS

By R. A. Hill

MOST constructors appear to regard circuits employing frame aerials as either "stumbling blocks" or causes for spending much time and patience. If the steps described below are followed, with the aid of only an additional .0005 tuning condenser and an external aerial, it is possible to line up the aerial and oscillator sections quickly and accurately.

Although the example used here shows a single-wound oscillator coil and 1R5 battery valve, the principle applies to all types of superhets whether or not they use mains or battery valves, and single or double wound oscillator coils, with or without cores, the cores simply replacing the trimmers.

Method

Position the tuning scale and complete all wiring of the circuit with the exception of the aerial section of the frequency changer as shown in Fig. 1. It is assumed that the I.F.T.s are aligned as most types can be purchased aligned ready for use. Solder a 10 kΩ resistor from signal grid to earth, attach the aerial to the grid and switch on. The oscillator section can now be aligned.

On M.W. adjust C1 on H.F. end of scale, using a suitable station, e.g., Light Programme, 247 metres, and then C3 to position North Regional or a similar station on the other side of the scale. Repeat until no further adjustment is necessary and the stations are in their correct positions.

Do the same for the L.W., using C2 and C4. Most constructors obtain the best results on 1,500 metres, as this is usually all that is required of the L.W. especially for small portables.

Aerial Section Alignment

Now we come to the second stage, the alignment of the aerial section.

From the writer's experience, rectangular-shaped frames proved more successful than square or round shapes. The number of turns depends upon the gauge of wire and size of frame, but for M.W. wind on an average size former about 20 turns of 28 gauge wire, remembering that it is easier to take off than add on.

Remove 10 kΩ resistor used in previous stage and connect frame in its usual place, leaving the aerial connected to the grid, not forgetting to connect the appropriate section of the 2-gang tuning condenser, as shown in Fig. 2. Then disconnect the oscillator section of the tuning condenser, substitute the .0005 mentioned before (this gives independent control over the two circuits) and tune with this condenser any station on the waveband. Swing gang condenser to give maximum volume. When the frame aerial is correctly adjusted, maximum volume will be obtained when the scale pointer indicates the station tuned. If maximum volume is obtained with pointer at higher frequency, then turns will have to be removed and vice versa.

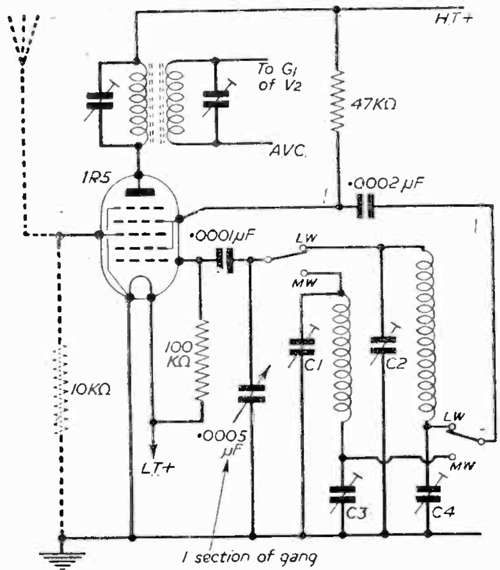


Fig. 1.—Alignment of the oscillator stage.

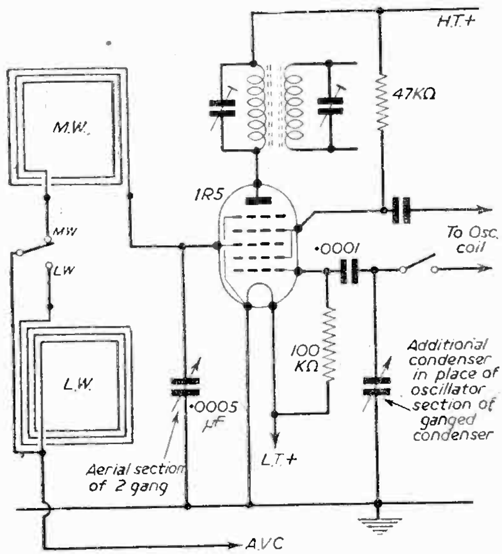


Fig. 2.—Tuning of the frame aerial.

Avoid Stray Capacity

Stray capacity must be avoided by placing the frame aerial in the position it will finally occupy and keep the connecting leads short. Remove the external aerial and, remembering that the frame aerial is directional, check several stations to see that maximum volume is obtained in the correct positions.

Finally, remove single condenser and reconnect gang section and the set will be aligned. A very *slight* adjustment of the trimmers C1 and C3 may be necessary when all connections are made to obtain maximum volume, but care must be taken not to adjust incorrectly.

Summary

In conclusion, although the preceding instructions seem lengthy, it is hoped that it can be followed by the beginners in wireless who are making their first portable. For the more advanced constructors, I have tabled in note form below the various steps :

1. Solder 10 kΩ resistor from signal grid to earth of F.C. and attach aerial.
2. On M.W., adjust C1 and C3 to give correct positions of stations.
3. Replace oscillator section of tuning condenser by separate tuning condenser, remove 10 kΩ resistor, and connect frame aerial, tuning condenser (as original circuit, but add external aerial). Tune a station with oscillator condenser and adjust frame aerial turns to give maximum volume when this station is indicated on tuning scale. Remove aerial when nearly correct and work on pick-up of frame aerial. Repeat for L.W.
4. Remove separate condenser and reconnect as with original circuit, adjusting C1 and C3 for final adjustments if necessary.

To those who wonder why an external aerial is necessary, the reason is that until the two circuits are nearly matched, the pick-up is so small that it makes it very difficult to hear the station being tuned. Home Service stations are easily identified when different regional items are being broadcast ; a point which can be misleading especially at a time like this.

Obtaining Bias in A.C./D.C. Amplifiers

A Novel Way of Obtaining Bias in High Power or Medium Power Amplifiers where the H.T. Voltage is Limited to That of the Mains

By J. S. Kendall

D.C. mains supplies to universal amplifiers present a problem that for a long time has been rather difficult to overcome. It is that of obtaining bias and yet keeping up the H.T. voltage. It must be remembered that there are voltages dropped across the rectifier and the smoothing choke. The design of highly efficient British valves for the output circuit have both increased the power output and reduced the bias voltage required. An example of this is the Mullard UL41 which gives 1.35 watts output with 100 volts anode and screen but requires only −5.7 volts bias. On the other hand, the International type 25A6 gives only 1 watt with the same anode voltage. This valve, however, requires a bias of −16 volts. Again the first valve requires 29 mA, whilst the second requires 22 mA, meaning that whilst less bias is required for the first valve the voltage dropped across the rectifier and the smoothing choke is increased. We would therefore seem to be moving in a vicious circle.

One way of getting the power from universal circuits has been by placing the output valves in parallel. Referring back again to the manufacturer's figures, the output of a pair of UL41 in push-pull with 170 volts anode and screen will give 9.0 watts for 10 per cent. distortion, but if the voltage is raised to 200 volts the output will be increased to 12.5 watts. In the first of these two figures the bias is taking 12 volts of the voltage applied, whilst in the second it is 15 volts. If this bias voltage did not have to be taken out of the cathode circuit there could be a still higher power output. One obvious way to get over this would be to use batteries, but if these are not in first class condition they will soon cause the output valves to be damaged due to passing an excessive anode current.

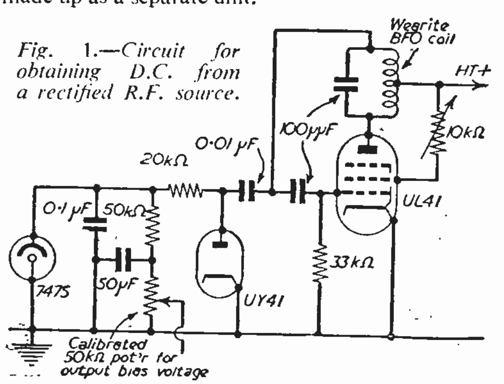
One method, however, that is now coming into use is the use of a D.C. supply rectified from an R.F. oscillator. Mullard Ltd. have recently published a new circuit in which an H.F. oscillator of 2 Mc/s is used. The circuit, whilst being quite useful, is not easily adatped for various other circuits. A suitable circuit is given in Fig. 1, in which the oscillator valve is a UL41, with a UY41 for the rectifier, a 7475 being used as a reference voltage.

The coil used is a Wearite P type B.F.O. which will oscillate at about 500 kc/s with a 100 pF condenser shunting it ; this latter component should be of high quality as it has to stand quite a high voltage. The potentiometer in the screen circuit is to reduce the drive power of the valve ; on 110 mains the full voltage will be required, whilst on 230 volts the power will have to be reduced so that not too much power is wasted. The adjustment of the oscillator is correct when the 7475 stabiliser tube is glowing steadily.

The required output voltage can be obtained then by calibrating the potentiometer direct in volts, which can be done quite simply with a linear wire-wound pot. Each volt takes about 3 degrees, the complete 240 degrees of rotation giving 50 volts—the 50K fixed resistor will have to be a close tolerance resistor as 50K is not a preferred value.

The unit is one that is quite useful in the districts where the mains are D.C., and if required can be made up as a separate unit.

Fig. 1.—*Circuit for obtaining D.C. from a rectified R.F. source.*



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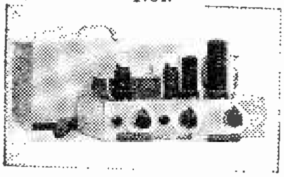

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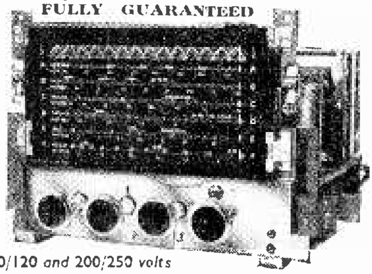

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The Beginner's Guide to RADIO

The Eleventh Article of a Series Explaining the Fundamentals of Radio. This Month Condensers are Further Considered By F. J. CAMM

I HAVE already briefly touched upon electrolytic condensers, but it is necessary now to explain in greater detail how they work.

The main advantage is the relatively large capacity obtainable for small physical dimensions. They differ radically from other types. We have seen that a condenser is a device for storing electrical energy and that in its simplest form it consists of two metal plates separated by a layer of insulating material, such as ebonite, glass, waxed paper or air. We have seen that an electric current is in reality the movement of small particles called electrons and that a condenser acts as a sort of electron reservoir. If we apply the poles of a battery, which is in effect a kind of electron pump delivering electrons at its negative pole and receiving them back at the positive pole, to the plates of the condenser, then one plate will acquire an excess of electrons and the other a deficit. The amount of electrons which can be "poured" into one plate of a condenser or drain from the other constitutes the "charge." The amount of the charge produced by unit pressure (1 volt) is a measure of the capacity of the condenser. We know that the capacity of a condenser is usually measured in microfarads and that the capacity is controlled by three things: the effective area of the plates, counting both sides; their distance apart and the nature of the dielectric. The larger the area of the plates the larger will be the capacity, and the closer they are placed together the more the capacity will increase. Actually the capacity does not vary directly with the distance between the plates, but is inversely proportional to the square of the distance. Thus, if the distance is halved the capacity becomes four times as great, and vice-versa. It is known that some dielectric materials give a larger capacity for a given size and distance apart of the plates than do others. This is called the *dielectric constant*. That of air is taken as unity, whilst most other substances show a higher figure. If two plates are fixed a certain distance apart in air, providing a capacity of, say, 1 microfarad and a piece of ebonite is slipped between them it will be found that although the plates are still the same size and distance apart, their capacity has increased two or three times. If in place of the ebonite a piece of ruby mica is used the capacity may increase as much as eight times. Thus, the dielectric constant of mica is eight. The dielectric, therefore, is of great importance in considering the efficiency of a condenser, for if it is a poor insulator the electrons collected on one plate will slowly leak through to the other side and so the condenser will become discharged. A good condenser will hold its charge for some considerable time. In the timebase of TV receivers it is necessary to control the time of charge and discharge.

If a condenser is momentarily connected across a high-tension battery and then removed, it should be possible on joining the two terminals of the condenser together after several hours to get quite a fat crisp spark.

Dielectric Strength

Apart from a condenser's ability to retain its charge and hence to give back as much energy as is put into it, there is the question of the *dielectric strength*. If the plates are very close together and the voltage (pressure) of the charging current is very high, it is possible for the insulation between the plates to break down altogether. This is a common fault with some of the cheaper receivers. A spark jumps between the plates cutting its way through the dielectric and so the condenser is completely discharged. Dielectric strength, therefore, is of great importance, especially in the power circuits of mains sets. Of the various substances used as dielectrics, mica has the greatest dielectric strength, paper is next and air lowest of all. Thus, the chief qualifications of a fixed condenser are good insulation and high dielectric strength. In some cases, more especially when used in H.F. circuits, a condenser must also be *non-inductive*. This means that it must in no way have the properties of a tuning coil. It must have no *inductance*. You may often see condensers marked

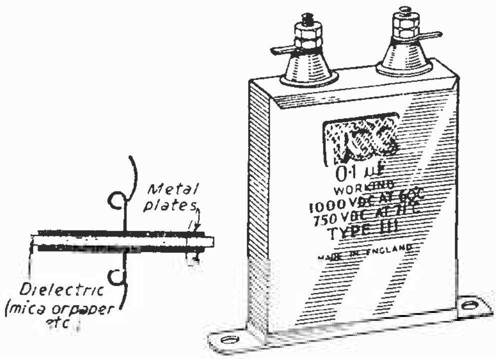

Fig. 46.—Principle of a fixed condenser and a typical "paper" type fixed condenser.

"non-inductive." How it is possible for a condenser to act like a tuning inductance may not at first be very clear, but if you consider the ordinary paper condenser you will see the reason. This type consists of two long strips of metal foil separated by layers of paper. The two strips form the plates and the paper the dielectric. In order to make the condenser compact, the whole thing is rolled up into a little bundle with the paper between the foil. Obviously the strips now form small coils and if the connection to each strip is taken from one end only, they will act as miniature tuning coils. The remedy for this consists

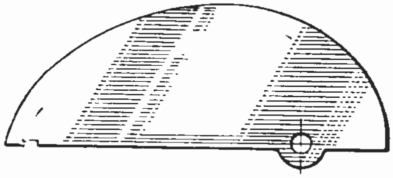

Fig. 47.—The popular "square law" condenser plate shape. (See last month's issue.)

in making contact with each turn of the foil. This is done by arranging for the foil strips to protrude slightly from the sides of the bundle—one strip to one side and one to the other. These are pressed over and coated with solder so that all the turns of each strip are connected together.

Now condensers of this type are very efficient and quite compact in sizes up to 1 or 2 μF, but above this capacity they become rather bulky. Clearly there is a practical limit to the thinness of the foil employed, and also the paper dielectric cannot be reduced in thickness beyond a certain limit, otherwise it will be liable to puncture.

This is where the electrolytic condenser steps in. If you compare the size of that shown in Fig. 49 with the equivalent paper condenser you will see the considerable saving in space effected by the electrolytic type. There are also other advantages, such as its self-healing properties, but we will deal with those while describing the principle and construction of the condenser.

Electrolytic condensers are of two types—"wet" and "dry." They are both much the same in appearance, as will be seen from the two typical examples illustrated in Fig. 48, but whereas the former contains a liquid as the electrolyte, the latter employs a paste, jelly, or some absorbent material soaked in a solution.

The construction of an electrolytic condenser is somewhat similar to that of a dry cell. Fig. 49 represents it diagrammatically. It consists of a centre electrode of aluminium surrounded by the electrolyte (liquid or paste) and an outer metal case. The centre electrode forms one "plate" of the condenser and the liquid (or paste) the other. How a liquid can take the place of a plate is more easily understood if you remember that the liquid employed is a conductor of electricity—it is it not an insulator like oil. Now, if the aluminium rod in the centre is one plate and the liquid surrounding it is the other, where does the dielectric come in? Well, actually when the unit is first assembled there is no dielectric. This has to be "formed." This is done by connecting the centre electrode to the positive pole of a battery or other source of current and the outer case to the negative pole. The current from the battery flows from one electrode to the other through the electrolyte, and in doing so gradually deposits a very thin film of aluminium oxide on the centre electrode. This film has a very high resistance, and the thicker it gets the more the current is reduced until a point is reached when only the smallest current passes; in other words, the film is to all intents and purposes an insulator. The condenser is now "formed" and consists of two plates (the centre aluminium rod and the electrolyte) separated by a dielectric consisting of the newly-formed film of oxide.

In practice the centre electrode is not a simple aluminium rod, but assumes more complex shapes. This is in order to increase its effective area. Two typical anodes are shown in Fig. 50. In each case a sheet of aluminium foil supported by an aluminium rod is used.

D.C. Only

You notice that I mentioned the *centre* electrode as being connected to the positive pole when the condenser is formed. This polarity must also be observed when it is connected in circuit. If it is connected the wrong way round, so that the centre electrode becomes negative and the container positive, then the film will pass into solution and the condenser will cease to function. Of course, this fact limits the use of the condenser to direct current circuits. It cannot

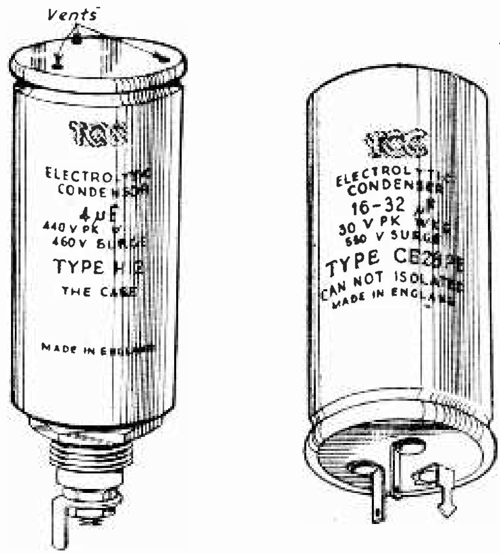

Fig. 48.—A standard type "wet" and a "dry" electrolytic condenser.

be used in alternating or high-frequency circuits, for in such cases each electrode becomes alternatively positive and negative. Any degree of ripple can be imposed on the D.C., providing it is not great enough to cause a reversal of polarity, that is to say, that so long as there is a polarising D.C. voltage it does not matter what form the current takes.

In mains receivers where condensers are used for smoothing, filter and decoupling circuits, the electrolytic condenser is ideal. It is easy to arrange for the anode to be connected to the positive line. In fact, with the many types of electrolytic condenser the container is fitted with a locking nut for securing the condenser to the chassis by the one-hole-fixing method, and so if a metal chassis is used, connection is automatically made between the negative electrode and the earthed chassis. The positive connection is then taken to the centre terminal, which is screwed on the end of the anode and is, of course, below the chassis. In others, a soldering tag takes the place of the screwed end, and the condenser is mounted by means of a special clip.

With electrolytic condensers the insulation properties are not quite so good as with the ordinary type, as there is always a very slight leakage of current owing to the film of oxide not being such a good insulator as some substances. In the circuits mentioned above, however, this is of small consequence.

One great advantage of the electrolytic condenser is that it is "self healing." Should the film puncture owing to a sudden increase in voltage, the condenser will not be rendered useless. When the voltage drops again the puncture will seal up. This property is, naturally, of great importance in mains sets where the breakdown of a smoothing or filter condenser would put the whole set out of commission. (A punctured dielectric with an ordinary condenser means the destruction of the condenser.)

Since this basic electrolytic condenser was produced there have been many improvements. As an example, the production of really efficient "dry" and "semi-dry" types is very noticeable. With these types much ingenuity has been shown in the matter of the electrolyte and the design of the electrodes. Of course, the advantages of the dry type over the aqueous are obvious when it is remembered that with wet types a small vent hole is necessary. However carefully this is designed, there is always the possibility of some of the electrolyte being spilt if it is of a liquid nature. The advantages of the latest electrolytic condensers are: small leakage current (a fraction of a milliampere in most cases), quick recovery after a period of rest (when first used after standing idle for some time all electrolytic condensers take a larger current than normal for some seconds), and low internal resistance. This means a low power factor. The power factor is really a measure of the efficiency of a condenser. An ideal condenser would have a power factor of zero. Modern electrolytic condensers can be brought down to about 5 or 6 per cent.

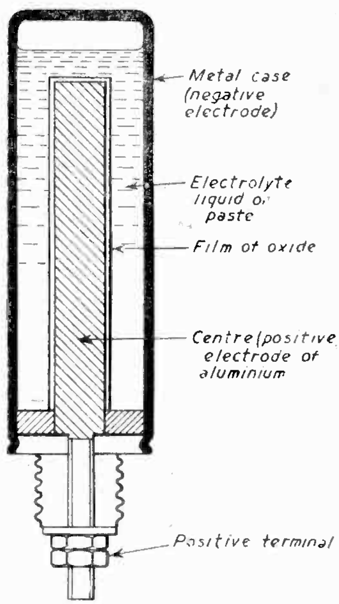

Fig. 49.—Details of construction of a typical "wet" electrolytic condenser.

The Superhet

The word "superhet" is an abbreviation of the more cumbrous *superheterodyne*. Most receivers today are superhets and it is a system of circuitry concerned with selectivity. In the older style of tuning circuits, with which we have been concerned up to the present, sharp tuning is not possible and it will be found in some cases that two or more stations can be heard

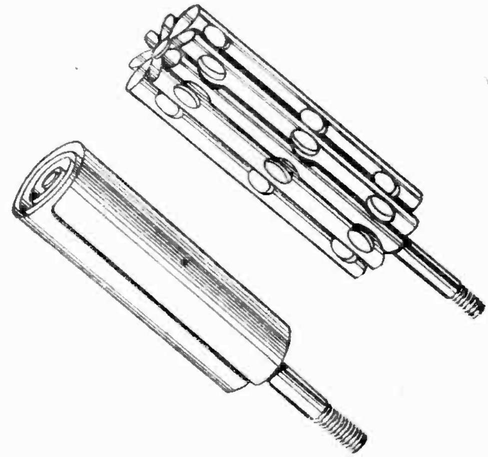

Fig. 50.—Two typical anode designs used in electrolytics.

at the same time, due to the closeness of their wavelengths. In the early days of radio when comparatively few stations were operating, the problem did not occur; but now that the broadcast band is crowded with stations having wavelengths only a few metres apart, it is necessary to design the tuning circuit so that overlapping does not occur. The superhet principle provides the solution. In brief, it consists of receiving a station at one particular wavelength or frequency and changing it to another by means of a frequency changer stage and an intermediate-frequency transformer. In brief, the superhet is a method of obtaining high selectivity by converting a received signal into a different and lower frequency and then amplifying this new frequency. The signal is detected, the frequency changed, amplified by two or more high-frequency stages, again detected and then passed to the I.F. stage or stages.

The intermediate-frequency transformer consists of two coils of wire coupled together and tuned, by pre-set condensers or metal cores, to the intermediate frequency, and connected between the intermediate frequency valves.

In the ordinary tuned radio frequency or "straight" receiver each tuned H.F. circuit operates at the carrier (original) frequency of the signal being received. If, for example, a 300 metre or 1,000 kc/s station is received in the aerial circuit, the oscillations will remain at 1,000 kc/s in every circuit right up to the detector. It is, of course, necessary for every H.F. circuit in the receiver to be variably tuned to allow for the reception of signals of various carrier frequencies. In a superhet, however, only a certain number of the tuned H.F. circuits are variably tuned, and operate at the carrier frequency of the signal. These circuits (there may be only one, of course) come first, counting from the aerial.

(To be continued)

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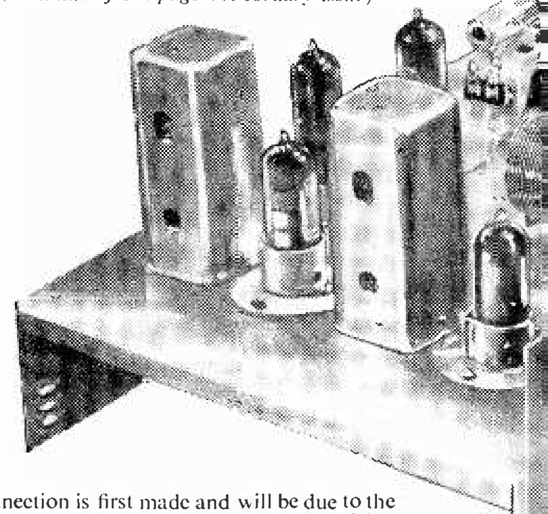
(*Continued from page 77 February issue*)



LAST month attention was drawn to the fact that the actual wires shown in the wiring diagram were "squared up" by the artist in order to make the layout and wiring clear. In actual practice some wires and even some components will come above each other and in such a condition the wiring would be impossible to follow. The main point to watch is that the components should be as near as possible to the positions actually shown, whilst the wiring should be made as direct as possible, cutting wire-ended components down as required to reduce the length of the lead. For instance, the .05 μF condenser seen immediately below the coil unit and above the .1 μF condenser has one lead cut to about $\frac{3}{8}$in. and is soldered direct to the earthing bus-bar, whilst the other lead is cut to a similar length, and to it are attached one lead from a 1 MΩ resistor and the brown lead from the coil unit. The lead from the 1 MΩ resistor should be twisted round the lead on the .05μF condenser, and the brown coil lead soldered when the coil unit is placed in position. Wherever two or more leads are found at one point the correct procedure, to avoid damaging a component by the application of excessive heat, is to twist the leads together temporarily as the various parts are placed in position and finally, when all the wires at a given point are in position to undo them, loop them neatly, all through a single-loop formed in one of the leads, and then apply solder and a hot iron, when all will be joined in the same time as it would normally take to make a single connection. The loop should be permitted to fill with the molten solder and a good, sound connection will result.

Instability

Reverting to the question of the position of actual wires, it is possible, due to running leads in some positions, to introduce instability into almost any receiver. Grid and anode leads of each stage, as well as the anode lead of one stage and the grid lead of another stage, should never run close together or parallel. One model which has been constructed from the details given last month did, in fact, have this trouble and it was found to be due to the run of the yellow lead from I.F.T.2 to the anode tag of V2. The artist has shown this, for clarity, running round on the left-hand side of the valveholder, and if this is followed and it is found that the receiver does suffer from instability (which may not necessarily arise) the lead should be shortened and run round the other side of the valveholder—beneath the 1 MΩ resistor and 680 kΩ resistor, which incidentally was not mentioned in the list of parts given last month. This is also a $\frac{1}{2}$ watt component.

Testing

When the wiring has been completed it should be very carefully checked against the wiring plan or blueprint, one of the most important checks being that made with a resistance meter between chassis and the H.T. positive line. If you do not have a resistance meter a simple meter, say reading to 1 mA., in series with a 1.5 volt cell, will serve, and there should be no indication of any current reading from any point on the H.T. line to chassis, nor from any point on the H.T. line to the heater circuit. An upward flick of the needle may occur when the connection is first made and will be due to the electrolytic condensers, but it should quickly drop to zero. When satisfied that there is no short-circuit at these points make one final test between the aerial and the earth sockets and each of the pins on the input mains socket. Again there should be no connection, or in other words a zero reading on the meter, and the valves may then be inserted in their appropriate valveholders.

If your mains are between 200 and 230 volts, the 200Ω resistor joined in series with the 1,000Ω resistor may be omitted, or alternatively a short length of wire may be connected between the switch and the junction of these two resistors—short-circuiting the 200Ω resistor. On mains from 230 to 250 volts the 200Ω resistor must be included. Leaving the chassis inverted the mains lead may now be plugged in and the set switched on. With the centre knob in its mid-way position (this has three positions, short, medium and long) the tuning knob should be turned until the local station is heard, the volume control being adjusted to keep a suitable level of sound. At this stage a voltage test may be made to make certain that everything is satisfactory, and the table on the right shows the readings obtained on the prototype when connected to 240 volts A.C. mains. The tests were made with a meter having a resistance of 10,000Ω per volt, and thus if a meter with a lower resistance is employed the readings will differ slightly. They give an indication, however, as to the approximate voltages which should be found. One of the most important readings is that across the 1,000Ω series heater resistor. The current taken by

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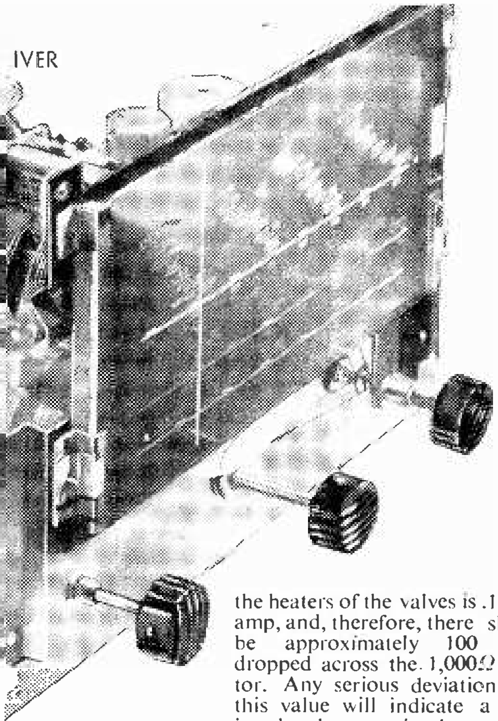


the heaters of the valves is .1 of an amp, and, therefore, there should be approximately 100 volts dropped across the 1,000Ω resistor. Any serious deviation from this value will indicate a fault in the heater circuits and an attempt should be made to correct it. The shunting of the resistor by the meter will affect its value, and again a high-resistance meter must be used.

Tonal Quality

It will be noted that a .01μF condenser is shown connected by broken lines across the loudspeaker connections. This may be added by the constructor according to taste. If, without it, it is found that the tone is rather too shrill the condenser will lower it, and various values may be tried to suit the type of cabinet or room acoustics. The condenser may be joined direct across the transformer connections on the loudspeaker.

Warning

Remember that on no account should any direct earth connection come into contact with the chassis. Also, as the chassis is in direct connection with one side of the mains the greatest care must be taken in handling the receiver and the knobs which have been specified have deeply recessed grub-screws, and therefore if alternatives are used care should be taken to see that the grub-screws are well sunk below the surface of the knob, and if not they should be covered with wax (Chatterton's Compound) to avoid contact being made.

Components and Adjustments

With every design which we publish a number of queries arise from readers who wish to use different parts, or make amendments to the published circuit. We cannot, of course, give instructions for making any modifications to the design as published, but there are certain small points which arose in the A.C. version and which are also applicable to this model which can be dealt with at this stage. First, with regard to the specified parts. The whole feature in this particular design is the removal of the necessity for trimming or lining up, and therefore the heart of the set is the tuning pack, the ganged condenser, the I.F. transformers and the tuning dial. All of these items are "matched" and pre-aligned, so that not only is the necessity for lining-up abolished, but the tuning dial will record correctly the various stations which may be tuned in. At one time all coil manufacturers made coils to a given inductance value, and it was thus possible to produce a tuning scale which would suit any coil, provided that you used a standard condenser with plates of a certain pattern. Modern coils differ, however, and the use of the iron core, which is now so common, varies the inductance, so that the user may adjust the core and obtain a different inductance value, the result of which will be to vary the frequency at different settings of the tuning condenser.

This difficulty is accentuated in the case of a multi-coil unit, and in a superhet a further complication arises due to the setting of the oscillator section. The particular coil specified, however, is tested by the manufacturers in a circuit, and the various trimmers and cores adjusted so that it lines up on the dial mentioned, and also gives maximum performance at all settings of the condenser on the three wavebands. If, therefore, you use any other coil unit, alternative variable condenser or dial, the combination will have to be separately lined up, and unless you have a good signal generator this is not a simple matter.

Stray Capacities

The coil unit is provided with coloured leads, and the layout has been arranged to accommodate these leads without lengthening and to provide the minimum of stray capacities which could affect the tuning. Therefore, an alternative layout should not be adopted, unless this fact is borne in mind. The I.F. trans-

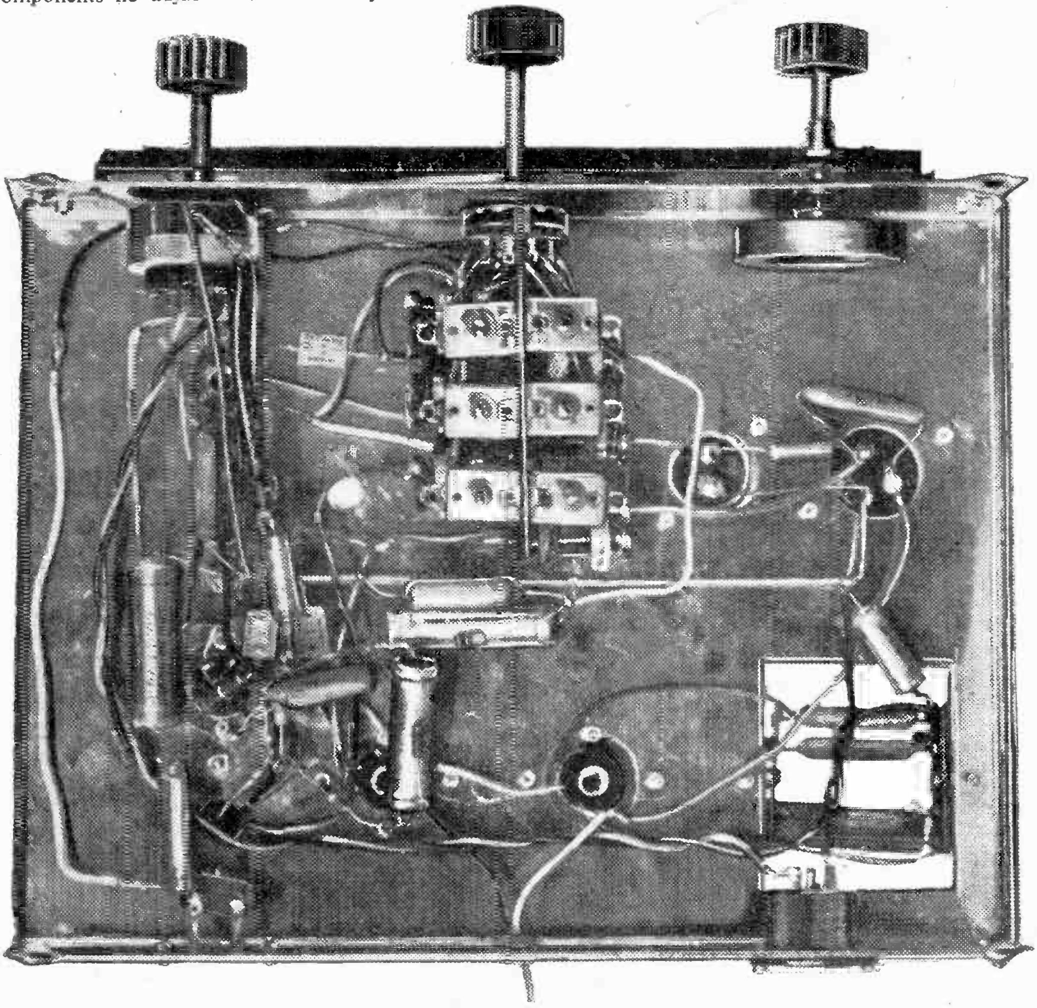
V1	A	210 v.
	S.G.	125 v.
	Triode A	210 v.
V2	A	210 v.
	S.G.	125 v.
V3	A	220 v.
	S.G.	210 v.
	C	14 v. (25 v. range)
Across 1,000Ω series heater resistor = 100 v.		

formers specified for this model are known as type "U" and differ from those used in the A.C. version in that the latter has a top grid lead to suit the different type of valve which was employed. The type "U" components have all leads projecting from the bottom, but the original transformers may be used, provided that they are modified as mentioned on page 76 of last month's issue. This modification will affect the stray capacities in this part of the circuit and will call for a slight readjustment of the lower trimmer to even things up, and it should be carried out on a station somewhere about the centre of the dial on the medium-waveband. Keep the signal very weak by means of the volume control and adjust the trimmer very slightly. Remember that the A.V.C. action will tend to mask the adjustments and a little care is necessary ; rechecking on two or three stations will, however, serve to confirm the adjustment which is made. On the type "U" components no adjustment is necessary.

Components

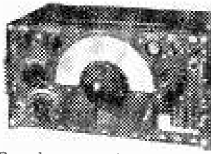
With regard to the remaining components, alternatives are permissible, provided they are of suitable or equivalent types. For instance, the resistors may be of any make, provided they are of similar working voltages and more or less similar physical dimensions. With regard to the 20 MΩ resistor which is specified it will probably be found that in certain makes this is not available as a standard —perhaps only in a higher tolerance rating. It is, of course, quite permissible to use two standard 10 MΩ components connected in series to obtain this value, which is not so critical that the tolerance variation of two components will not affect results.

With regard to the loudspeaker, the model specified when used in a cabinet of the type illustrated gives a very good standard of reproduction, bearing in mind the output volume which is delivered. A better loudspeaker or a larger one will not necessarily give better reproduction unless the audio circuit is modified.



This view of the underside of chassis shows the actual wiring positions and may be compared with the wiring diagram given last month.

EX-A.M. RECEIVER TYPE R1155.



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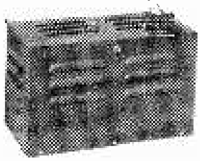

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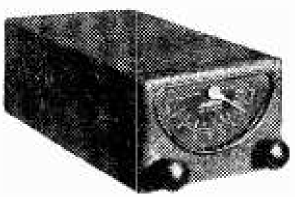

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WRITE FOR FULLER DETAILS. Other chassis in various conditions of completion are available for personal callers only.
CIRCUIT for 5-valve car radio, using above chassis. PRICE 1/6.
We can supply a set of valves that will suit this car radio. All either GT. or metal. One each as follows: 6SA7; 6R7; 6V6; OZ4; 6K7. PRICE 32/6 THE SET.

HEARING AIDS
By well-known Manufacturer. In metal case, size: 2¼in. x 4¼in. x 1in. Complete with batteries and 3 sub-miniature valves, earpiece and cord. Only two controls; volume and on/off. Fitted with internal crystal micr phone.
MADE TO SELL FOR 22 GNS.
LASKY'S PRICE, 99/6
Postage 3/6 extra.
Ready for use. Perfect working order. Slightly soiled but new and unused.
A few hearing aids available, less earpiece, cord and batteries PRICE 50/-. Carriage 2/6 extra.

CONDENSERS
Electrolytic Cans.

16 mfd. 500 v.w.	3/6
24 mfd. 450 v.w.	3/11
32 mfd. 500 v.w.	5/11
60 mfd. 350 v.w.	3/6
64 mfd. 450 v.w.	4/11
8+8 mfd. 450 v.w.	3/11
8+16 mfd 450 v.w.	3/11
8+24 mfd. 450 v.w.	3/11
16+8 mfd. 500 v.w.	4/6
16+24 mfd. 450 v.w.	4/11
16+32 mfd. 450 v.w.	4/9
20+20 mfd. 275 v.w.	2/-
32+32 mfd. 350 v.w.	3/11
60+100 mfd. 350 v.w.	7/6
250 mfd. 350 v.w.	4/11

MANY OTHER TYPES IN STOCK
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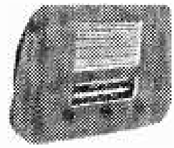
LASKY'S RADIO

Lasky's (Harrow Road), Ltd.,
370, Harrow Road, Paddington, London, W.9
Telephones: CUNningham 1979-7214. All Depts.
MAIL ORDER AND DESPATCH DEPARTMENTS: 485-487, HARROW ROAD, PADDINGTON, LONDON, W.10.
Hours: Mon. to Sat. 9.30 a.m. to 6 p.m.; Thurs., half day, 1 p.m.
Postage and packing charges (unless otherwise stated) on orders value £1—1s. 0d. extra; £5—2s. 0d. extra; £10—3s. 6d. extra; over £10 carriage free unless specifically stated otherwise. All goods fully insured in transit.

LASKY'S RADIO

BAFFLE RADIO CABINETS



Pleasing design, complete with drilled chassis, dial, drum drive and back. Finished in satin mahogany veneer, natural polish. Outside dimensions: 17¼in. wide, 11¼in. high, 5in. deep.
LASKY'S PRICE, 36/-.
Carriage 2/- extra.
Circuit and component list for 4 valve T.R.F. set available.

METAL RECTIFIERS
6 and 12 volt F.W. Bridge.

2 a.	9/-
3 a.	9/11
4 a.	12/-
6 a.	19/6

S.T.C. SENTERCELL RECTIFIERS

RM.1	3/10
R.M.2	4/3
RM.3	5/-
RM.4	18/-

LOUDSPEAKERS
First Quality. All 3 ohm speech coil. Less output trans.

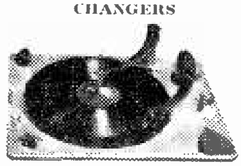
3in.	14/6	6½in.	15/-
4in.	10/6	8in.	15/-
5in.	13/6	10in.	17/6

Now available. 12in. Goodmans heavy duty. 15 watts. 15 ohms.
LASKY'S PRICE, £5/19/6.
Carriage 3/6 extra.

SPECIAL PURCHASE STAINLESS STEEL RECORDING WIRE

¼hr. Reels	6/11.
½hr. Reels	12/6.
1hr. Reels	25/-.

COLLARO 3-SPEED AUTO CHANGERS



Brand new and unused, in maker's original carton. Finished in cream. Fitted with high fidelity studio pick-up (turnover crystal), type GP 29.
LASKY'S PRICE, £9/19/6.
Carriage Free.

I.F. TRANSFORMERS
465 Kc/s Iron dust cores in cans, midget type. Size: 1in. x1¼in.x2¼in. Price 8/6 per pair.
WEARITE TYPE 550. 445-520 Kc/s. 8/6 per pair.
WEARITE TYPE 500. 450-470 Kc/s. 8/6 per pair.

GRAM MOTORS.—Shaded pole, synchronous. For 200/250 v. 50 c.p.s. mains. Rim drive. Many Uses. 9/6 each.

A Condenser Analyser

A COMPACT AND VERSATILE INSTRUMENT FOR TESTING THE INSULATION PROPERTIES OF ALL KINDS OF PAPER AND MICA CONDENSERS, AND RE-AGEING ELECTROLYTICS

By H. R. Singh

The Electrolytic Condenser

IN an electrolytic condenser the dielectric consists of a very thin layer of oxide on an aluminium foil electrode, created by passing direct current from aluminium to the solution. Contact with the solution is made by another piece of aluminium foil or the outer case of the condenser. The oxide layer is not too stable and tends to de-form if the condenser is stored for any length of time. Thus, if an electrolytic is taken from stock and put straight into a receiver, the excessive leakage current may overload the rectifier section. Even if that section withstands the additional load, the heat produced in the electrolytic may, after a time, cause breakdown and damage. With the very high capacitors used in A.C./D.C. type television receivers, these risks are present in even greater degree. It can be said that whereas re-formings of electrolytics before insertion into radio sets is highly desirable, where television receivers are concerned it is an essential safeguard.

Mode of Operation

The instrument is designed to operate from A.C. mains supplies and provides a range of D.C. voltages which are coupled through current limiting resistors to the condenser under test. The current is thereby limited to a safe value which can be maintained until the electrolytic has re-aged, should it be necessary. At the same time, the voltage drop across the charging resistor is applied to a neon lamp. When the current is high, the voltage causes the neon to glow. As the current and voltage fall, the neon begins to flash and, finally, when leakage has reached the normal amount, the neon goes out.

Circuit

The circuit (Fig. 1) consists basically of a half-wave rectifier with switch-selected input voltages from a tapped mains transformer secondary, together with switches for selecting rectified input voltage, rectifier load resistor, reservoir capacitor and the various series charging resistors. A neon capacitor circuit gives visual indication of operation of the instrument.

The rectifier consists of a series of selenium half-wave rectifiers MR_1, MR_2, MR_3, and MR_4. Its input A.C. voltage, obtained from the mains transformer "T," is adjusted in steps between 125 and 550 volts by means of taps on the secondary selected by SW.1. Rectified output is developed across load resistors R_1, R_2, R_3, and R_4 selected by SW.3 across which is connected the reservoir capacitor C_1 selected by SW.4. Switch SW.2 selects half-wave D.C. output and delivers it through the neon indicator network comprising R_5, C_2 and 110 volt neon N, and the series charging resistors R_7, R_8, and R_9 selected by SW.5 to the test condenser. Switch SW.5 in position 1 connects R_6 across the test capacitor to discharge it.

Fig. 2 "A" shows the discharge resistor in circuit and "B" the simplified circuit of the whole system and corresponds to switch positions 2 to 8. Circuit diagram Fig. 2 "B" without discharge resistor R corresponds to switch position 9. Switches 1 to 5 are ganged together and termed the "Selector Switch."

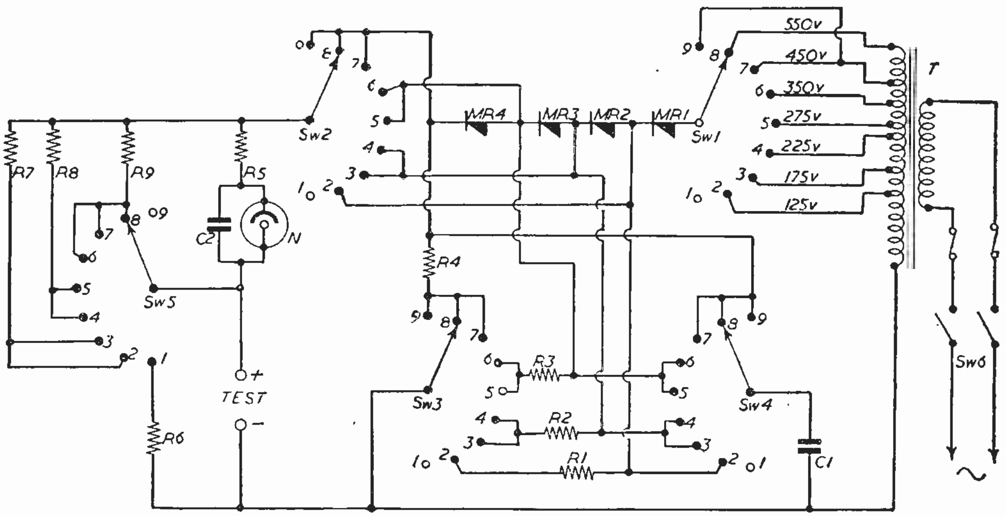


Fig. 1.—Theoretical circuit of the instrument.

Operating the Instrument

The instrument is quite straightforward to use. A pair of test leads should be made up terminating in crocodile clips at one end and red and black banana plugs at the other. These leads should be inserted into their respective sockets on the instrument panel, the selector switch set to position 1, and the unit switched on. In this position the discharge resistor R_6 is brought into circuit and removes the danger of receiving a shock when the clips are used to make connection. In all other positions a voltage is impressed on the clips between 100 and 550 volts depending on the setting of the switch arm.

Checking Insulation

(Applicable to mica and paper condensers only.)

Connect the test leads across the terminals of a condenser whose insulation is desired to be tested and rotate the selector switch to position 9. A good condenser or one with a high insulation should retain its charge for a long period, and the neon indicator which is in series with this condenser and the 450 volt high tension system, should glow only once for a very brief period. This glow is due to the stress or initial charging current of the condenser. A deep momentary glow indicates a condenser of high capacity, and a weak glow a condenser of low capacity. A condenser having poor insulation will be indicated by frequent flashing of the neon, the rate of flashing depending on the loss insulation. Quantitavely, the insulation properties of the condenser can be determined from the formula R=100.N. Where

R=insulation resistance in megohms.

N=number of seconds per flash.

Immediately a test has been made the selector switch should be returned to position 1 to allow the condenser to discharge.

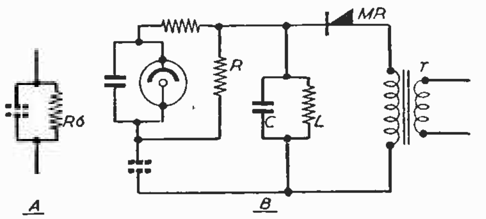


Fig. 2.—" A " shows the discharge resistor in circuit and " B " the simplified circuit of the whole system.

Re-ageing Test

To re-age electrolytic condensers that have been in store for any length of time, the procedure is to connect the condenser to the instrument test leads with due regard to polarity. Select the lowest voltage range and switch the instrument on. In most cases, particularly if the condenser is an old one, the neon indicator will be found to flash quite frequently. After a short period the flashing will have completely ceased and the insulation improved considerably. Select the next higher voltage and allow the flashing to subside. Continue in this way until the working voltage of the component is reached. Here the condenser is left to stand for at least an hour after the flashing has ceased or prolonged itself considerably. It is then discharged and taken out of circuit.

It may sometimes be found that a condenser will not reform satisfactorily at its correct working voltage. In such a case nothing else can be done and the component either rejected as a bad specimen or incorporated into a circuit where the working voltage is low and considered satisfactory for its working.

Construction

The layout of components in the construction of this unit is not critical, and as most constructors will have quite a number of spare parts it was decided not to give constructional details of the metalwork. It is stressed, however, that the panel layout should be so arranged as to present an all-round symmetrical appearance.

A dial should be made out of white Bristol board and fitted to the selector switch. Position 1 should be marked " DIS " to indicate discharge, while positions 2 to 8 should indicate the appropriate voltages present at those switch settings. This can best be done by connecting a multirange voltmeter to the test terminals and rotating the selector arm. Indian ink should be used to mark the dial which can afterwards be protected with a piece of 1/16in. thick clear Perspex. Position 9 should be marked " INS " to indicate insulation.

In concluding it must be pointed out that three components need special consideration and these are:

(1) The neon lamp, which must be either a Phillips or Mazda type 110 volt S.B.C.

(2) The mains transformer, which will have to be ordered specially and have good insulation.

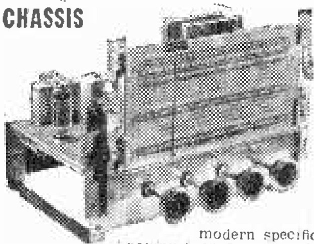
(3) The selector switch; this must be a robust component for the contacts to withstand the range of voltages specified under continuous use.

COMPONENT LIST

R_1 = 25k. 1 watt.	R_6 = 5k. 1 watt.
R_2 = 47k. 2 watt.	R_7 = 247k. 2 watt.
R_3 = 70k. 2 watt.	R_8 = 100k. 2 watt.
R_4 = 100k. 3 watt.	R_9 = 47k. 3 watt.
R_5 = 247k. ½ watt.	

C_1 = 2 μF. 600 volt.
C_2 = 0.25 μF. 350 volt.
1 Mazda 110 volt S.B.C. Neon Lamp.
2 Banana plugs, black and red.
2 Sockets to suit above.
2 Crocodile clips.
SW.1, SW.2, SW.3, SW.4, SW.5 — Yaxley type, single pole—9 way each section. All ganged together.
SW.6 = D.P. on/off Toggle Switch.
MR.1, MR.2, MR.3, MR.4 = S.T.C. Type RM.1.
2 Fuses 1 amp., with holders.
1 Neon lamp holder.
1 Mains transformer, with Secondary tapped at 125 v., 175 v., 225 v., 275 v., 350 v., 450 v., 550 v., at 15 MA.
1 Small pointer knob.

A COMPLETELY ASSEMBLED "ALL-WAVE" SUPERHET CHASSIS



MODERNISE YOUR OLD RADIOGRAM FOR £23

We offer this Autochanger complete with Model B.3 3-waveband as advertised together with 10in. p.m. Speaker for £23 plus 10/- carr. and ins., or with B3PP Model for £26/-/-, plus 10/- carr. and ins.

MODEL B.3.—A 5-valve 3 waveband Superhet Receiver for operation on A.C. mains 100-120 volts and 200-250 volts employing the very latest miniature valves. It is designed to the most modern specification, great attention having been given to the quality of reproduction which gives excellent clarity of speech and music on both Gram and Radio, making it the ideal replacement Chassis for that "old Radiogram," etc.

Brief specifications :—Model B.3.—Valve line up, 6BE6, 6BA6, 6AT6, 6B6, W3X4. Waveband Coverage. Short 16-50. Medium 187-550. Long 900-2,000 metres. Controls (1) Volume with on/off ; (2) Tuning (flywheel type) ; (3) Wave change and Gram ; (4) Tone (3 position switch operative on Gram and Radio).

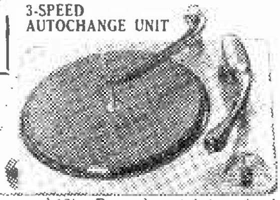
Negative Feedback is employed over the entire audio stages. Chassis size, 11in. x 7½in. x 8½in. high. Dial size, 9½in. x 4½in. Price, complete and READY FOR USE, excluding speaker, **£12/12/-**. (Carr. and Pkg. 7/6 extra.)

MODEL B.3. P.P.—This model is the B.3. Receiver but incorporates two 6BW6 VALVES in PUSH PULL, resulting in really excellent quality reproduction up to approximately 6 watts. Price **£15/15/-**. (Plus 7/6 carr. and ins.).

A GENUINE SPECIAL OFFER!

The COLLARO 3RC/521

3-SPEED AUTOCHANGE UNIT



£9/17/6

(plus 7/6 carr. and Ins.)

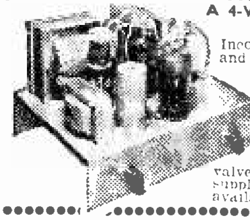
Normal price £13/10/0

- With separate Crystal-heads for STANDARD and L.P. Records.
- Incorporating Pick-up Weight Adjustment.
- Will autochange on 7in., 10in. and 12in. Records not intermixed.
- Minimum baseplate size 15in. x 12½in. with height above 4½in. and below baseplate 3in.
- Brand new in maker's cartons, complete with mounting instructions.

"PERSONAL SET" BATTERY ELIMINATOR

A complete kit of parts to build a Midget "All-dry" Battery Eliminator, giving approx. 69 volts and 1.4 volts. This Eliminator is for use on A.C. mains and is suitable for any 4-valve Superhet receiver requiring H.T. and L.T. voltage as above or approx. to 69 volts. The kit is quite easily and quickly assembled and is housed in a light aluminium case, size 4¼in. x 1½in. x 3½in. Price of complete kit with easy-to-follow assembly instructions, 42/6. In addition we can offer a similar COMPLETE KIT to provide approx. 90 volts and 1.4 volts. Size of assembled Unit 7in. x 2½in. x 1½in. Price 47/6.

A 4-VALVE QUALITY "PUSH-PULL" 6-8 watt AMPLIFIER for A.C. mains.



Incorporating Negative Feedback, Filter Input Circuit and employing 6V6s in Push-Pull. A simple arrangement is provided to enable either a magnetic-crystal or lightweight pick-up to be used, and is suitable for use with Standard or long-playing records. A tone control is incorporated, and the 10-watt output transformer is designed to match 2 to 15 ohm speakers. The overall size of the assembled chassis is 10in. x 8in. x 7½in. high, and full practical diagrams are supplied. Price, including drilled chassis and valves, of complete kit, **£6/17/6**. Price of assembled chassis, supplied ready for use, **£8/12/6**. Full descriptive leaflets are available separately for 1/-.

We have a large selection of AUTOMATIC RECORD CHANGERS AT GREATLY REDUCED PRICES ! !

These units are all by the leading manufacturers and include MIXER and NON-MIXER types. All are brand new in Makers' original cartons.

Send S.A.E. for full particulars.

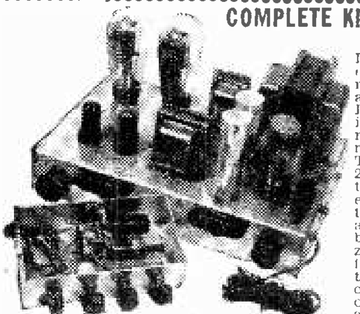
! ! SPECIAL OFFERS ! !

BAKER'S 12in. P.M. 15 ohm 15 watt speaker, **£4/12/6**

TRUVOX 12in. P.M. 2-3 ohm 10 watt speaker, **£2/9/6**

(Plus 1/3 carriage and insurance.)

COMPLETE KIT for 12 WATT HIGH FIDELITY "Push-Pull" AMPLIFIER

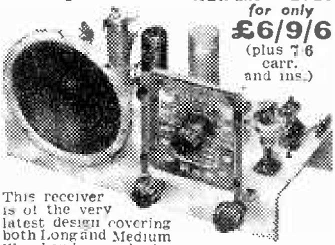


Designed for A.C. mains 200 to 250 volts, employs 6 valves plus rectifier, with negative feed-back, and comprises a main amplifier chassis and a remote controlled Pre-amplifier and Tone Control Unit, incorporating four controls—bass, treble, main volume or mixing control, and a radio, gram. microphone selector switch. This control unit measures only 7 x 4 x 2in. The measured frequency range of the amplifier with this unit shows an excellent response from 14,000 cycles down to 20 cycles, the bass and treble controls allowing independent control of gain at both ends of the frequency range from zero to a gain of 50. It can be seen, therefore, that ample correction is provided to suit any type of pick-up with any type of recording. Input voltage for maximum output is 70 mV. 6.3 volts at 2 amps. and 30 mA. H.T. is provided for tuning unit, etc. Price of complete kit, Amplifier and Control Unit, including drilled chassis and valves, **£14**. Complete specification and layout, 2/-. We can also supply completely assembled and ready for use at **£17**. Please add 7/6 carr. and insurance.

THIS AMPLIFIER COMPARES WELL WITH THE WILLIAMSON AND SIMILAR DESIGNS AT A FRACTION OF THE COST.

A COMPLETE 4 VALVE T.R.F. CHASSIS

including a 5" P.M. SPEAKER and VALVES for only **£6/9/6** (plus 7/6 carr. and ins.)



This receiver is of the very latest design covering both Long and Medium Wavebands, and includes the modern BVA miniature valves. The line up being 12BA6—12AT6—12A6—35W4. It incorporates Permeability Tuned Coils thus ensuring excellent selectivity and sensitivity. The overall size of the complete chassis including Speaker is 10½in. x 4½in. x 6½in. An attractive Bakelite Ivory finished Cabinet, size 11½in. x 5½in. x 6½in. is available for 16/6 (plus 2/6 carriage and insurance).

A DUAL CHANNEL PRE-AMPLIFIER and TONE CONTROL UNIT

This comprehensive PRE-AMPLIFIER and TONE CONTROL UNIT provides full control of Bass and Treble in conjunction with a main Volume Mixer Control. Can be used with any Amplifier and any Pick-up, the range of frequency control provided by the unit affording ample compensation for all types of Pick-up and all natures of recordings, i.e., English, American and Long-Playing, without recourse to Pick-up correction. The extreme flexibility of the Bass and Treble Controls is such that the level of Bass and Treble can be set to suit any conditions irrespective of the volume output of the Amplifier.

The Unit measures only 7in. x 4in. x 2in., including self-contained Power Supply, and can be accommodated either on or away from the main Amplifier, i.e., in the front panel of a Cabinet or any other position. Price, including drilled chassis, valves (6SN7 and 6J5), **£3/16/9**. Complete assembly data is available separately for 1/3. Completely assembled and ready for use, **£5/5/-**.

The COLLARO Model A.C. 514 Record Player

£3/19/6 (Plus 5/- Carr. and Ins.)

RIM DRIVE 78 r.p.m. complete with the COLLARO Plug in type MAGNETIC HEAD and 10 inch TURNTABLE. These are COMPLETE BRAND NEW UNITS for A.C. Mains 200-250 volts.

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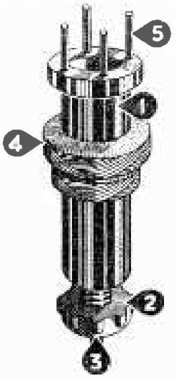
TELEPHONE : CENtral 5812/3/4

IMPROVED "MAXI-Q" CHASSIS MOUNTING COILS



1 & 2. Former Mounting-Bush and Nut completely moulded in coloured polystyrene enables easy identification on both sides of chassis. No corrosion possible as in normal types of metal bush or mounting lugs. Coil can be made vibration proof and locked forever by slight application of polystyrene varnish ("DENFIX") to thread before assembly.
3. Adjustable Iron Dust Core, simplifying receiver alignment.
4. Litz windings on L.F. ranges.
5. The terminal spills are tinned copper and form an integral part of the former.
6. Dimensions: Former length 1⅞in. Dia. ½in., 0 B.A. Fixing.

The following Colour Code identifies the coils:

BLUE: Grid coil with aerial coupling winding. For R.F. or Mixer. Range 1-5, 3/11 each. Range 6-7, 3/9 each.
YELLOW: Grid coil with coupling for reaction or R.F. anode. Straight detector or mixed following R.F. Range 1-5, 3/11 each. Range 6-7, 3/9 each.
GREEN: Grid coil with reaction and coupling winding (6 pin). Range 1-5, 4/9 each.
RED: Superhet Osc. 465 Kc/s. Range 1-5, 3/11 each. R. 6-7, 3/9 each.
WHITE: Superhet Osc. 1.6 Mc/s. Prices as RED.
(Note: Ranges 6 and 7 Red can be used for various I.F.'s: no "White" coils are made for these ranges.)

RANGE	1	2	3
Mc/s	.175 .525	.515 1.545	1.67 5.3
Metres	1700 570	580 194	180 57

RANGE	4	5	6	7
Mc/s	5/15	10.5 31.5	30 50	45/78
Metres	60 20	28 9.5	10/6	6.6/3.8

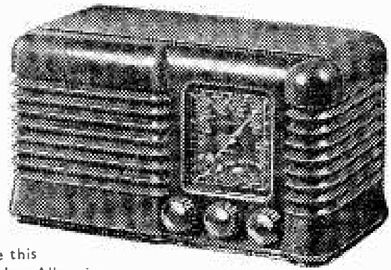
Complete Technical Information on the coils-DTB.1, 1/6. Formers of the above coils complete with core, any colour, 2/2 each.

SEND 9d. FOR GENERAL CATALOGUE.

DENCO (CLACTON) LTD., 357/9, Old Road, Clacton-on-Sea, Essex.

"ATOMIC"

All-Mains Set for 90/-



Using only screwdriver, pliers and soldering iron. YOU can make this attractive 3-Valve All-mains Set (2 Wavebands). Send only 90/-, plus 3/- Carr. & Ins., and Complete Parts including Valves, Ready-to-Use Chassis, Moulded Cabinet and full, illustrated Instructions will be sent by return. YOU CAN MAKE MONEY MAKING THESE SETS FOR FRIENDS—they're simple to CONSTRUCT, astonishing VALUE.

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6F6G	8/9	—	6Q7GT	11/6	9/6	EC31	—	3/6
6H6	4/6	—	6SH7	5/9	—	ECC31	—	8/6
6J5	6/6	—	6SK7	6/9	—	EF80	—	10/6
6J5GT	5/-	—	6SK7GT	—	6/3	EF92	—	7/9
6J6	—	10/6	6V6GT	9/6	—	EF50	—	6/6
6J7G	—	6/6	6V6G	—	7/6	KTZ63	—	6/6
6K6GT	7/6	—	12H6	—	2/9	RK34	2/3	1/9
6K7	7/9	—	80	—	8/9	VU111	3/-	—

Any valve sent C.O.D. at makers' price.

SPECIAL: Metal 6K7, store soiled, 5/-.
COAX 7½d. YD.: Standard TV type (75/80Ω), approx. ¼in. dia., stranded core, limited stock.
JONES PLUGS & SOCKETS, less cover, 10-way, 10d. pair.
SLEEVING: Green, 1 mm. (bore), 1½d. yd. Best quality. (Red and Blue, 2 mm.; Yellow, 1.5 mm.; Black, 1 mm. 2d. yd.)
6 MFD. 2,000v. TEST: Metal block, 3/9, 1/- post.
0.25 MFD. 500V.: Metal tubular, 6 for 2/-.
Post free on orders over £1.

REED & FORD, 2A, BURNLEY ROAD, AINSDALE, SOUTHPORT

MICROGRAM AMPLIFIERS

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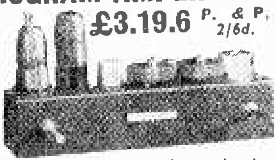

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Unorthodox Anti-fading Receiver

SOME NOVEL CIRCUIT ARRANGEMENTS FOR ISOLATED OR REMOTE AREAS

By Wm. Nimmons

IN the February, 1947, issue of this journal there appeared an article on a "Two-Programme Receiver" by the present writer. To recapitulate, the receiver was something of a compromise: it attempted to do two things at once, (a) to provide the ordinary loudspeaker reception from a number of stations, and (b) to provide an alternative station on headphones so that anyone who wished could concentrate on a serious talk or lecture on the headphones while others in the same room could indulge in jazz or light music.

The method by which this was achieved was as follows: a wavetrap was inserted in the aerial lead, but instead of the energy being allowed to go to waste, the top end of the wavetrap winding was taken to the grid of a detector valve. That is, when the wavetrap was tuned to the desired station (from the point of view of the listener to the lecture) the energy circulating in the wavetrap was utilised for that purpose. At the same time, this did not interfere in the least with the reception of other stations on the loudspeaker, as is customary with the insertion of a wavetrap in the aerial lead of a receiver.

Since then another use for this wavetrap-in-the-aerial method of reception has occurred to the writer. There are areas in the country which do not enjoy uninterrupted continuity of reception. Such an area is the east coast of Co. Down, and there are others. The main obstacle to good reception in Co. Down appears to be the encroachment or "mingling" of the wave from the Northern Ireland station and that from the North region. As these are on the same wavelength there appears little that can be done to counteract the fading.

But in other parts of the country there is fading pure and simple. As several stations carry the same programme it occurred to the writer: why not tune the wavetrap to one station, and what may be described as the main part of the set to another station? The combined outputs of the two stations would (theoretically) emerge as a signal twice as great as any one of them, and could be fed to an amplifying or output valve in the usual way. Since, for distances in this country, the reception would be practically instantaneous, there would be no echo or other untoward effect.

Since the two stations are carrying the same programme, and since it would be unlikely for both stations to fade at the same time, there would appear to be a great advantage in this method of reception. Even if one station faded completely, it would give a ratio of good reception of 1/2: in other words, the strength of the signal would only fade to half of its former value, which is a diminution scarcely to be noticed at loud volume levels and which would ensure continuity of reception.

The Circuit

Accordingly, a set was made up, details of which can be seen in Fig. 1. It will be seen that the first part of the circuit (nearest the aerial) is in reality a wavetrap, but with the difference that instead of ending with a coil and condenser it goes on to include a leaky-grid detector, together with its associated H.T. equipment.

Following on the wavetrap, we have the standard leaky-grid detector consisting of a second coil and condenser feeding a detector valve which has the usual H.T. circuit. Both valves are provided with reaction to sharpen the tuning and increase signal strength, the reaction being provided by a differential condenser together with an H.F. choke in each anode circuit.

The method of coupling to the output valve is simple and effective. Both outputs (of the detector valves) are taken via a .5 μF condenser to the same terminal of the primary of a parallel-feed transformer, the other side of which goes to the earth line. Thus, the combined outputs are fed through the primary of the transformer, the secondary of which behaves in the normal manner.

The circuit is a little tricky to tune at first, since we have no means of knowing which station is "coming through." However, by fitting a switch

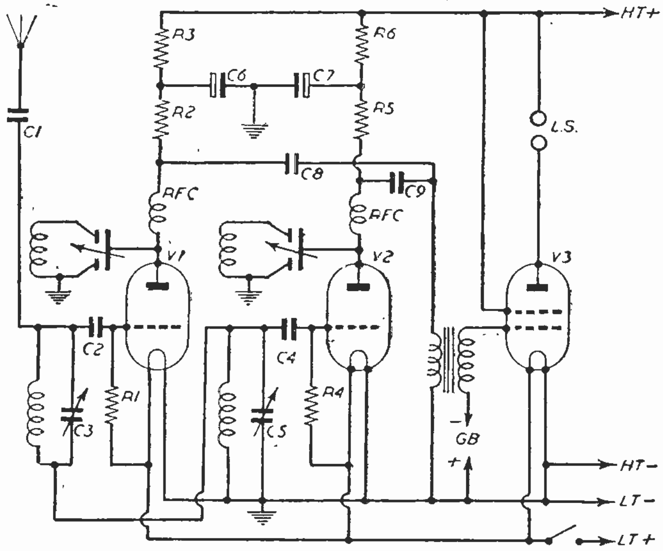

Fig. 1.—A simple dual-channel receiver.

in the filament legs of the two detector valves, and cutting out each in turn, the appropriate station may be tuned in. If one station is stronger than the other, this station should be tuned on the wavetrap, since this will prevent spreading on the other dial.

It was felt, however, that Fig. 1 as it stands was not very satisfactory from the point of view of anyone experiencing fading from a particular station. For one thing, fading occurs at extreme ranges, and the plain detector valve is not much use at such ranges. At least one stage of high-frequency amplification would be necessary.

Adding H.F.

This resulted in Fig. 2. Here we have the wavetrap at A, B being the orthodox main circuit. A is the wavetrap followed by an H.F. valve instead of the plain detector, with the detector following. The coils, L_1 and L_2, behave like a wavetrap, and may be the usual dual-range coil, although the medium-wave winding only is shown. L_3 and L_4 are similar. The two detector valves are provided with reaction, and the method of passing on the signals to the output valve is similar to that of Fig. 1

As an experimental receiver, this set-up presents some curious features. It is as well that we should be clear just what we are trying to do before we start tuning the arrangement. We have to set A (and, of course, its associated tuning condenser in the grid circuit of the following detector valve) so that it absorbs energy from a particular station, this station being one of two we have selected as carrying the same programme. If it carries a different programme from the station selected by B then both will go forward together!

They will, in fact, be conveyed via the two .5 μF condensers to the primary of the transformer, and hence be amplified by the output valve. As such a cacophony is useless from the programme point of view steps should be taken to ensure that the two halves of the set are carrying the same programme.

For this reason, it is nearly always impossible to receive foreign programmes on the dual system. It is, of course, possible to cut out the wavetrap by bridging it with a switch; the set then behaves like any other 3-valver, and it is possible to receive foreign broadcasts.

But for general use, in the manner in which the set is designed, it is usually only possible to receive the Home, Light and Third programmes. This can be done by selecting for, say, the Home Service, two stations as far apart as possible on the dials, and tuning one in on the wavetrap and the other on the main tuner. The Third Programme is the one most likely to be affected by fading, and fortunately the two wavelengths are well separated. As the Light Programme is also transmitted on the long waves it is not so liable to fading; but if a medium and a long-wave station are received the medium-wave station should be received on the wavetrap. The reason for this will become obvious when we see that if the long-wave winding were interposed *before* the medium-wave winding it would seriously interfere with the functioning of the latter.

There are some points worth mentioning with regard to the tuning. The first is that if we tune in the wavetrap to a powerful station and then leave it and transfer our attention to the main tuner, we may get something of a shock. The station *seems* to spread all over the dial! What is happening is that the signal is being carried forward quite independently of the main tuning, but such is the power of habit that we consider the tuning of this section hopelessly inselective. However, by tuning the main section to the same programme on another station we have achieved our object!

The second curious point about the tuning is that all stations are displaced upwards on the main tuner—that is, the tuner nearest the earth in Fig. 2. This is surprising, since the interposition of a wavetrap does not usually displace the position on the dial of stations to which it is not tuned. Be that as it may, the fact remains that all stations are displaced upwards by

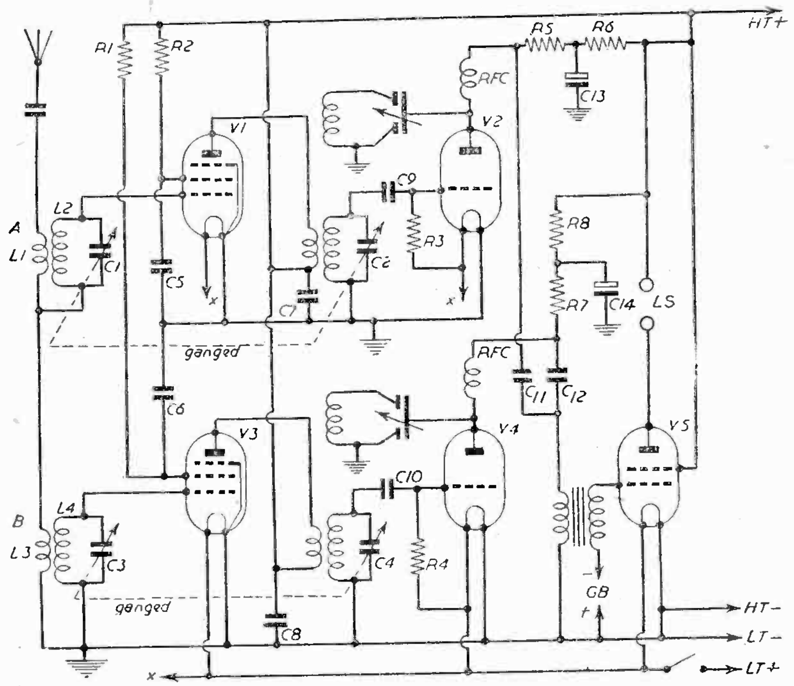

Fig. 2.—A more comprehensive receiver. The wavetrap circuit is associated with V1.

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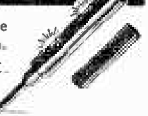

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about 10 degrees on the condenser scale.

The use of an entirely separate L.T. battery to supply V_1 and V_2, with no connection whatever to earth, did not cure this curious fault. Bearing in mind that this is a purely experimental receiver, with a considerable amount of experimental work still to be done on it, it is possible that the application of a bias to valves V_1 and V_3 will materially increase the "normality" of the receiver. This can be done by breaking the connection to earth at the bottom of L_3 and L_4 (in Fig. 2) and connecting the slider of a potentiometer to the bottom of L_3, one side of the potentiometer going to the earth line and the other to a negative bias. The junction of the slider and the earth line should be spanned by a .1 μF condenser.

When this is done the application of bias will be made to valves V_1 and V_3.

Would not an ordinary double-diode-triode with automatic volume control do all that is necessary?

The answer is that on the fringe areas of the transmission the fluctuations in signal strength are so great, and moreover are accompanied by distortion, that the average automatic volume control system is quite inadequate to deal with them. By having the set tuned to a station which is behaving normally, however, the fading station is masked by the overwhelming strength of the sound one.

For those with an itch to experiment, Fig. 2 should give ample scope. Fig. 3 is a rather different type of circuit. In this there is no wavetrap circuit, but the first two valves are duplicated and their outputs fed to the single output valve in the manner with which we are familiar. It will be seen that in this case two separate aerials are required.

As will be seen in Fig. 3, V_1 and V_2 form one part of the receiver, and are intended to tune in one of the stations; while V_3 and V_4 form another part and are intended to tune in the other station. Both stations are combined in the output, and if only one fades at a time the output will be only at most 50 per cent. down.

LIST OF COMPONENTS

Fig. 1.—C1, .0001 μF; C2, .0001 μF; C3, .0005 μF; C4, .0001 μF; C5, .0005 μF; C6, 2 μF; C7, 2 μF; C8, .5 μF; C9, .5 μF. R1, 1 megohm; R2, 30 KΩ; R3, 20 KΩ; R4, 1 megohm; R5, 30 KΩ; R6, 20 KΩ.

Fig. 2.—C1, .0005 μF; C2, .0005 μF; C3, .0005 μF; C4, .0005 μF; C5, .1 μF; C6, .1 μF; C7, .1 μF; C8, .1 μF; C9, .0001 μF; C10, .0001 μF; C11, .5 μF; C12, .5 μF; C13, 2 μF; C14, 2 μF. R1, 100 KΩ; R2, 100 KΩ; R3, 1 megohm; R4, 1 megohm; R5, 30 KΩ; R6, 20 KΩ; R7, 30 KΩ; R8, 20 KΩ.

Fig. 3.—C1, .0001 μF; C2, .0001 μF; C3, .0005 μF; C4, .0005 μF; C5, .0005 μF; C6, .0005 μF; C7, .1 μF; C8, .1 μF; C9, .1 μF; C10, .1 μF; C11, .1 μF; C12, .1 μF; C13, 2 μF; C14, .0001 μF; C15, .0001 μF; C16, .5 μF; C17, .5 μF; C18, 2 μF. R1, 100 KΩ; R2, 100 KΩ; R3, 5 KΩ; R4, 5 KΩ; R5, 1 megohm; R6, 1 megohm; R7, 30 KΩ; R8, 20 KΩ; R9, 30 KΩ; R10, 20 KΩ.

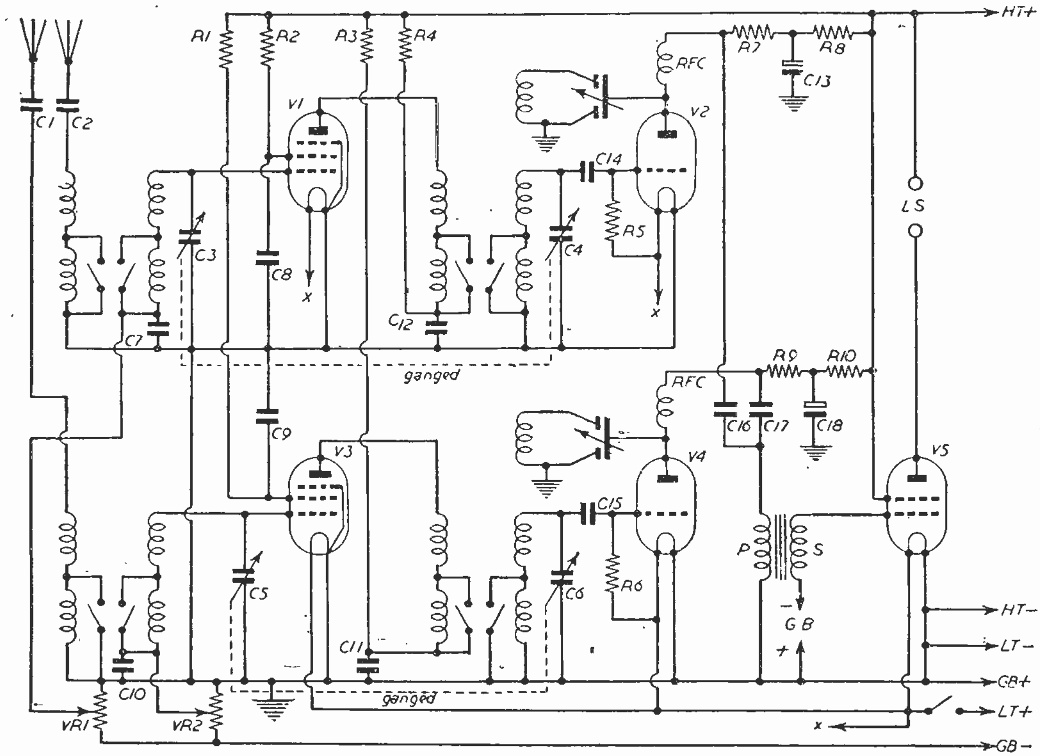
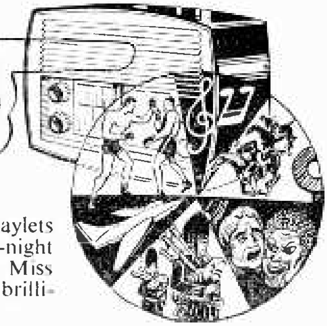


Fig. 3.—Another type of dual-channel receiver.

Programme Pointers



By MAURICE REEVE

Drama

THERE is nothing quite like Shakespeare as radio material, so far as the spoken word is concerned. This is so universal in its embracement, so colourful in its idiom and so powerful in its appeal, that, given first-class delivery —which it invariably gets on the BBC—it is bound to succeed. As with Beethoven's music—which, alas, has usually to carry the heavy cross of annotation and explanation, meticulously and boringly repeated at each performance—no descriptive notes are necessary; the genius of the work is self-evident; its message stands forth four square.

Two notable examples were offered us last month, each from opposite ends of the poet's vision. High tragedy in "Othello" and fairy comedy in "The Dream," the latter being particularly attractive by virtue of Mendelssohn's incomparable incidental music in full, beautifully played by the Royal Philharmonic Orchestra under John Hollingsworth.

Very long casts must receive a general congratulation with special tributes to Joan Hart as Desdemona and Sir Ralph Richardson as Bottom the Weaver.

Marlowe's "Dido, Queen of Carthage" was also well worth doing. Unlike the works of Shakespeare, it must have been new territory to many listeners as it was to their contributor, who had hitherto only read it. Pamela Brown and Sebastian Shaw headed a notable cast, one and all of which vividly portrayed the famous tragedy.

"Anna Christie" was revived—I hardly know why, especially as it was played just before the author's death. Joan Millar was the star who chose it in the Wednesday evening series. She occasionally lost her assumed American veneer in her moments of highest passion of which there are not a few.

"The Hanging Judge" was Boris Karloff's choice in the same series. An exciting piece in which, after sentencing a man to death early on, the "double life" of the judge, Sir Francis Brittain, is gradually revealed. It reminded me of Robert Hitchen's much more exciting novel, "The Paradine Case." "Hanging Judge" is by Raymond Massey, from a novel by Bruce Hamilton. So characteristic is Boris Karloff's voice, and so well known from years of film fame, that I am sure I should have recognised it without the aid of *The Radio Times*. This was the last piece put on by the late Sir Godfrey Tearle.

Comedy

"Once in a Lifetime," a story of the early days of Hollywood by G. S. Kaufman and Moss Hart, is a very clever and witty satire on some of the nit-wits who manage to do well for themselves in such industries as film making, but it lacked snap and sparkle in production. One thought of Harry Green in "Fifty Fifty" with regret.

Diana Churchill broke new ground with her Wednesday night "choice," Noel Coward's brilliant triple bill of playlets with the title "To-night at Eight-thirty." Miss Churchill was most brilliant and versatile.

"What Do You Know?"

The noises which emanate from musical instruments, either solo or in combination, are largely pleasant or unpleasant according to taste, and, sometimes to context. But surely there can only be one opinion of the "musical interpolation" of that very entertaining show, "What Do You Know?", and that is, hideous. Furthermore, it is quite unnecessary.

Success of Buchanan

Jack Buchanan makes a most likeable and entertaining "Master of Ceremonies" in the "Forces Show." His suave and urbane sophistication, helped by his faultless technique and long experience, are most agreeable. Furthermore, each time I have heard this show, he has been provided with a very good script.

Beecham Concerts

Two magnificent Beecham concerts adorned the past month, one with the BBC symphony orchestra and the other with his own Royal Philharmonic. No fewer than three Beethoven symphonies were in the two programmes, the third, sixth and seventh, a feast from Sir Thomas, who doesn't give us too much Beethoven. The finale of the seventh restored our faith in the classic masterpieces and convinced one that, given the right kind of performance, they can never become hackneyed.

This may be the best place to mention "Eugene Onegin," originally a "master" short story of Pushkin, then an opera of Tschaikowsky—one of his best works—and now "dramatised for broadcasting" by Wilfred Grantham. I liked it very much. The sad story of how the dissipated young Onegin turned away from Tatiana when she was literally throwing herself at him, only to find later, to his cost, that, when happily married and with a family, he truly loved her but was spurned for his intrusion, came over very effectively. As with many "operised" stories, "Carmen," for example, nothing quite compensates for a much loved and very familiar score.

"Much Binding"

As I feared, the new "Much Binding" flags a bit and doesn't maintain its original momentum. The idea of a newspaper increasing its circulation from nine to 10 copies stales. Apparently, it stays at 10, an idea that can't last for ever, but the weekly features from Sam Costa, Maurice Denham and Dora Bryan keep up a good average of wit and fun.

COMMUNICATIONS RECEIVER R.1155 The famous ex-Bomber Command Receiver known the world over to be supreme in its class. Covers 5-wave ranges 18.5-7.5 mc/s. 7.5-3.0 mc/s, 1,500-600 kc/s, 500-200 kc/s, 200-75 kc/s, and is easily and simply adapted for normal mains use, full details being supplied. Aerial tested before despatch these are BRAND NEW AND UNUSED IN MAKERS' ORIGINAL TRANSIT CASES. ONLY **£11/19/6.**

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A few of the **R.1155 N** model can also be supplied. This is the latest version which covers the Trawler Bands, and in addition is fitted with ultra slow motion tuning. Used, but tested working before despatch. ONLY **£17/19/6.**

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POWER PACK TYPE 3. Used by the Services with the R.1132A receiver. A standard 19in. rack mounting job to match the receiver, this is for 200/250v. 50 cycle mains with output of 250 v. D.C. 100 ma. and 6.3 v. .4 amps. Is fitted with H.T. current meter and voltmeter, and is a really superb unit, which can be used for a variety of sets. Tested working before despatch. ONLY **90/-** (Carriage, etc., 5/-).

100 MICROAMPS METERS. 2½in. Circular Flush Mounting. Widely calibrated scale of 15 divisions marked "Yards," which can be re-written to suit requirements. These movements are almost unobtainable to-day, and being BRAND NEW IN MAKERS' CARTONS are a snip. ONLY **42/6**

INDICATOR 62A. A two deck chassis job, this contains VCR97 tube with Mu-metal screen, 12 valves EF50, 4 of SP61, 3 of EA50 and 2 of EB34. IN NEW CONDITION IN MAKERS' TRANSIT CASES. ONLY **99/6** (carriage, etc., 10/6).

TRANSFORMERS. — Manufactured to our specifications and fully guaranteed Normal Primaries. 425-0-425 v. 200 ma., 4.3 v. 4 a., 6.3 v. 4 a., 5 v. 3 a. **ONLY 50/-**; 350 v.-0-350 v. 160 ma., 6.3 v. 6 a., 6.3 v. 3 a., 5 v. 3 a. **ONLY 42/6**; 250 v. 0-250 v. 100 ma., 6.3 v. 6 a., 5 v. 3 a., **ONLY 32/6.** 350 v.-0-350 v., 150 ma., 6.3 v. 5 a., 5 v. 3 a. **ONLY 32/6.** The above are fully shrouded, upright mounting. 5.5 kV. E.H.T. with 2 windings of 2 v. 1 a., **ONLY 72/6**; 7 kV. E.H.T. with 4 v. 1 a., **ONLY 82/6.** PLEASE ADD 2/- POSTAGE FOR EACH TRANSFORMER.

E.H.T. TRANSFORMER FOR VCR97 TUBE.—2,500 v. 5 ma., 2-0-2 v. 1-1 a. 2-0.2 v. 2 a. (post 1/6). **37/6.**

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RECEIVER R3118.—A further supply of the very popular unit we sold out of a few months ago. Ideal for conversion to TV having a built-in A.C. Mains Power Pack for 180-240 volts. Is tremendously powerful, employing 7 I.F. stages of 12 mc/s with 4 mc/s band-width, and has 16 valves: 6 of VR65, 4 of VR92, 2 of VR136, and 1 each VR137, P61, 5Z4 and Y63 "Magic Eye." In new condition. ONLY **97/6** (carriage, etc., 7/6).

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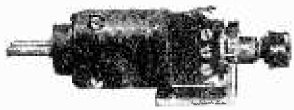

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GERMANIUM DIODES. 1/9 ea.; 2 for 3/-.

YAXLEY TYPE SWITCHES.—2-pole, 6-way, 1-pole 10-way, 11-pole 7-way, all at 2/3; 4-pole, 3-way Midget, 1/6.

HIGH VOLTAGE CONDENSORS.—.01 mfd. 4 kV., .02 mfd., 5 kV., .03 mfd. 2.5 kV., .05 mfd. 3.5 kV., 2/- each

COAXIAL CABLE.—22ft. lengths, with 2 Pye plugs, 3/11.

HEADPHONES suitable for crystal sets, 12/6.

COIL FORMERS. ⅜in. with iron dust cores, 6/6 doz. (9d each).

TRANSFORMERS.—Input 230 v., output 75 v., C.T. 600 mls., 250 v. C.T. 10 mls., 4 v. 3 amp, 4 v. 1.5 amp, 10/-.

½ MEG POTS. with switch, 2/-; 5,000Ω, less switch, 1/6.

SMOOTHING CHOKES.—60-80 mls., 2/-.

RELAYS 765Ω, 4 make 1 break. 2,000Ω 1 make, 2 break, 2/3.

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RECTIFIERS.—12 v. 2 amp., 12/6; 250 v. 75 mls., 7/6.

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The L-C Circuit, "Q" and the Power Factor

A SIMPLE EXPLANATION OF SOME OF THE PRINCIPAL FACTORS IN CIRCUIT DESIGN

By F. E. Apps

IN every radio and television set there are many circuits consisting of a coil or coils and a fixed or variable capacitor, either in parallel with or in series with the coil. For the set to work efficiently it is necessary that these circuits be adjusted or tuned to the correct frequency, but it is not this alone that determines whether the set is efficient. There are other factors that have a great effect upon this efficiency. One of these factors is the "Q" of the coil. This "Q" could be called, and is, in fact, a term that expresses the "goodness" of the coil.

"Q"

The losses that occur in a coil may be due to several causes. One is due to the D.C. resistance of the coil, which will vary greatly, and in some cases—that of a short wave coil, for instance—be very small indeed. There is also the loss occasioned by the coil's proximity to metal objects, such as screening plates or the chassis. This loss is due to the electro-magnetic field set up around the coil by the R.F. in it, inducing current in the adjacent metal and thus losing energy by it.

To refer to the D.C. resistance loss again: it should be noted that in the case of multi-turn coils this resistance is usually kept down by using "Litzendraht" wire, which is a wire made up of many strands of fine wire insulated from each other, offering a much larger surface area for the H.F. currents to travel over than would be the case of a single strand wire of the same cross-sectional area.

Note that H.F. currents do not penetrate the wire as D.C. does but only travel on the surface. Where a coil, such as an I.F. coil, appears to have lost efficiency it may often be traced to the fact that some of these strands have broken away at the soldered joint, thus lowering the amount of surface area and increasing the H.F. resistance of the coil.

Insulation resistance of the coil and the coil-former will naturally affect the coil's efficiency. This may be due to poor or worn insulating material on the wire itself, or poor material of which the former is made, especially if this material is liable to absorb moisture from the atmosphere.

From the foregoing it can be seen that there are quite a few factors that affect a coil, or rather the "Q". Thus we can formulate that the "Q" of a coil is the ratio of the purely reactive impedance of the coil to the HF resistance of the coil, *i.e.*, "Q" $= \frac{\omega L}{R}$. So much for the coil part of an L-C circuit.

The Capacitor and the Power Factor

The losses that occur in a capacitor are fewer than in the coil, but they can have an effect on the efficiency of the circuit that can be serious. This is especially so in the higher frequencies. One, of course, is insulation resistance, meaning the dielectric resistance which should be very high for efficiency, 100 megohms being a reasonable lowest reading allowable. There is also resistance to ground and resistance at points of contact to the plates. All of these resistance tests may be very high and the condenser apparently quite efficient, but this is not always the case. In capacitors whose dielectric is some other substance than air, as in trimmers, padders, etc., another factor arises.

The dielectric of a capacitor is under a state of strain due to the continual charging and discharging of the plates, and should the material of which the dielectric is composed be of a poor or unsuitable composition this strain will affect its atomic structure and loss of energy will occur in the form of heat. This will in turn affect the insulation resistance and eventually cause breakdown. This is the reason why in condensers in a circuit that are subjected to heavy fluctuations of current, as in a television time-base circuit, it is usual to specify mica dielectrics.

These losses, if they occur, will affect the phase relationship between current and voltage which should, in a perfect capacitor with nothing else in the circuit other than capacity, be 90 deg. Thus we classify a condenser by the effect it has on this relationship. This is called the Power Factor and is stated as $\cos\theta$ or as the ratio between true power and the apparent power in the circuit by the phase angle θ between current and voltage. If in a capacitor the phase angle θ between current and voltage is 90 deg. then $\cos\theta$ or the Power Factor is zero.

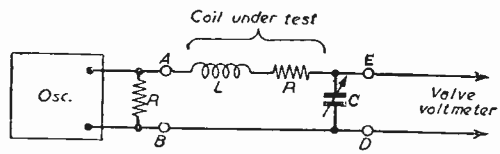

Fig. 1.—Theoretical circuit of an average "Q" meter.

The L-C Circuit

Here we have both inductance and capacity with, maybe, some H.F. resistance, which may occur in either coil, capacitor, or both. We take the complete circuit and estimate its efficiency or goodness, and state that as the "Q" of the circuit. This can be measured accurately and the instrument used is known as a "Q" meter.

Essentially it consists of a means of generating an oscillation that will correspond with the L-C value of the circuit under test, a meter to measure the output of an oscillator across a standard resistor, means of applying same output to the circuit under test, and a valve voltmeter to measure the voltage obtained. If the applied voltage across R be adjusted to, say, .1 volt and the voltage across the coil under test be 10 volts, then as $V_1 = IR$ through the resistor and $V_2 = I\omega L$ through coil,

$$\frac{V_2}{V_1} = \frac{\omega L}{R} = Q$$

Therefore $Q = 100$.

Notice that the voltage applied is kept low and R is also low, so that impedance of output is negligible. The voltage must be taken on a valve voltmeter, as it has a very high input impedance and thus any stray

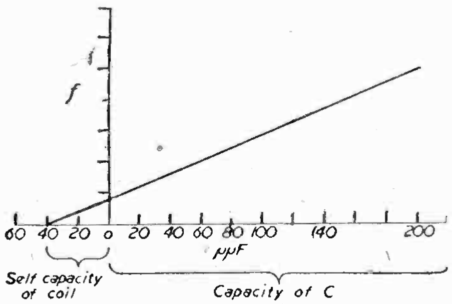

Fig. 2.—A graph of various readings at different frequencies on a "Q" meter in checking the self-capacity of a coil.

capacity, etc., across the test terminals have negligible effects. The oscillator portion of the "Q" meter must have an accurately adjustable attenuator and calibration.

In the theoretical diagram of an average "Q" meter (Fig. 1), L and R represent the coil under test. R_1 is the standard resistor of low value which is purely ohmic; C is adjusted until V_2 is maximum, whose value is observed on the valve voltmeter. Points A and B are points for observing V_1 and points E and D for observing V_2. Output from the oscillator should not be high otherwise the reading of V_2 will be too great for the valve voltmeter if the "Q" is high.

There are other purposes to which a "Q" meter can be put. As C is an air dielectric condenser of very low loss indeed a check may be made on other small condensers such as trimmers, padders, etc., by placing them across C at points C and D and reading the difference in "Q" on the valve voltmeter.

It is sometimes necessary to check the self-capacity of a coil, when it will not tune to a given frequency that should be in its range, with a given trimmer capacity. This can be done on a "Q" meter by taking various readings at different frequencies. One can then plot a curve on graph paper and check the residual capacity of the given coil when capacity of C equals zero (see Fig. 2).

News from the Clubs

COVENTRY AMATEUR RADIO SOCIETY

Hon. Sec.: K. Barber, 1, Charterhouse Road, Coventry.

THE Society have been successful in obtaining accommodation for their exclusive use at 9, Queen's Road, Coventry. The club station has been installed there and operates under call-sign G2ASF on the 160, 80-, 40-, 20- and 10-metre amateur bands.

BRIGHTON AND DISTRICT RADIO CLUB

Hon. Sec.: T. J. Huggett, 15, Waverley Crescent, Brighton.

THE Annual General Meeting of the above club took place on January 5th, 1954.

The following officers were elected:

Hon. Sec.: T. J. Huggett.
Chairman: Mr. R. Langridge.
Vice-Chairman: Mr. E. Bannister.
Hon. Treasurer: Mr. W. Pitfield.

The club transmitter G3EVE is on the air the second Tuesday in every month, on 80 metres.

Meetings are held at 7.30 p.m. every Tuesday at the Eagle Inn, Gloucester Road, Brighton.

CHESTER AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: E. Yates, G3ITY, 38, Durham Road, Blacon, Chester.

THE new year began well with a large attendance at the first meeting of the year—on the 5th January — when an auction sale was held.

On the 12th January a very interesting lecture was given on an all band transmitter portable, by B. O'Brion (G2AMV), Regional Representative.

The sixth Annual General Meeting was held at the Tarron Hut Y.M.C.A., Chester, at 7.45 p.m. on Tuesday, 19th January.

The monthly news letter is available to all interested on application to the club secretary.

SOUTHEND AND DISTRICT RADIO SOCIETY

Hon. Sec.: J. H. Barrance, M.B.E., 49, Swanage Road, Southend-on-Sea, Essex.

THE first of a series of up-to-date lectures by expert experimental researchers in the field of radar, transistors, electro-chemistry etc., was held recently in the Queen's Road Laboratories of the Municipal College, when Mr. T. Gray, of Marconi's, Chelmsford, unfolded the marvels of radar to a large appreciative audience. These were well rewarded for having braved the weather.

The talk was illustrated by epidiascopic projection, operated by Mr. S. T. Smith, M.B.I.R.E., and included a composite radar picture of the Spithead Review.

In pointing out the possibilities and limitations of radar, Mr. Gray explained how, in some respects, in the detection of distant objects, radar was superior to the human eye, while in others it was inferior.

CLIFTON AMATEUR RADIO SOCIETY

Hon. Sec.: C. H. Bullivant, 25, St. Fillans Road, London, S.E.6.

ALTHOUGH no meeting was held on Christmas Day, a net was organised on Top Band by G3DIC and most of the licensed members of the Society had their equipment tuned to 1925 kc/s at 10.30 a.m. Christmas morning. Some of our SWL members visited stations operating in the net whilst others had their own receivers running to listen-in on the proceedings.

On December 18th, D. Reed gave an interesting talk describing his record player and home built amplifier. His talk was illustrated with excerpts from both LP and standard 78 r.p.m. recordings. January 1st again attracted a large gathering for a junk sale when, as usual on these occasions, much equipment changed hands.

Meetings are held every Friday at the Society's H.Q., 225, New Cross Road, S.E.14, and a warm welcome awaits new members both young and old.

STOKE-ON-TRENT AMATEUR RADIO SOCIETY

Hon. Sec.: K. H. Parkes, G3EHM, 159, Belgrave Road, Longton, Stoke-on-Trent, Staffs.

MEETINGS are held each Thursday night in our headquarters, at the rear of the Cottage Inn, Oakhill, Stoke-on-Trent, Staffs.

Lectures are being arranged on tape recorders, modulators, transistors and T.V.I. suppression. Members are asked to make full use of our workshop and refreshment facilities are now adequate.

Prospective members are cordially invited to attend any Thursday night. Application forms can be obtained from the secretary.

B'HAM & DISTRICT SHORT WAVE SOCIETY

Hon. Sec.: Mr. Yates, 67, Regent Road, Handsworth.

AT the Annual General Meeting, the main business of the evening was the electing of officers for the coming year.

In view of the retirement of the society's president, Mr. Burton, G.2.BON, has now been elected to this position, and will also be chairman again for the coming year.

The following members will be officers of the society for the coming year also: vice-chairman, Mr. Frearson; treasurer, Mr. Shirley; hon. secretary, Mr. Yates.

Committee members: Mr. Neal, Mr. Burdett, Mr. Button.

ALPHA — FOR SETS OF VALVES

Ten VR91 (EF50) Valves Ex. Brand new units. 6/- each, 45/- set.
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1R5, 1S5, 1T4, 1S4 or 3V4 or 3S4, 30 - set.
6K8G, 6K7G, 6Q7G, 25A6G, 25Z4G, 37 6 set.
12K8G, 12K7G, 12Q7G, 35Z4GT, 35L6GT or 50L6GT, 37/6 set.
Ten 6AM6 (EF91), 75 - set.

MAINS TRANSFORMERS

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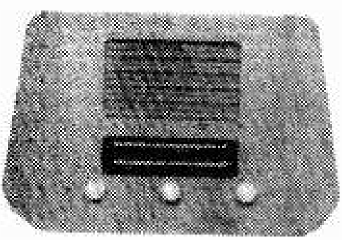

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Surplus Double Diode Pentodes

DETAILS OF EX-SERVICE VALVES, WITH BASE CONNECTIONS

By E. G. Bulley

VALVES belonging to this classification are complex in structure and are similar in construction to the double-diode-triode, with the exception that the amplifier section is a pentode instead of a triode. However, the application of such valves is the same as that of the double-diode-triode, that is to say they are so designed as to perform simultaneously the functions of detection, amplification and automatic volume control.

Now, as in the case of the double-diode-triode the pentode also has a single cathode structure. The emitting surface on the sleeve is in two sections, one for the diodes and the other for the pentode unit. Both sections of the valve are internally screened as in the case of the double-diode-triode.

The diode sections in these valves can be used independently, one for A.V.C. and the other for detection. They can, however, be used in conjunction with each other, either in parallel or in a full-wave rectifier circuit. The former will give nearly twice as much A.V.C. voltage for a given carrier as for the latter type of circuit. Nevertheless the latter does not require so good a carrier frequency filtering as the ,former. Furthermore, by utilising the valves under discussion it is possible to dispense with an intermediate stage, although one can, if one so desires, use them in the conventional R.F. and I.F. pentode circuits.

TABLE 1.

U.S.A. Type	Vh.	Ih	Va	Vs.	Gm.	Impedance KΩ	Remarks
VT189	6.3	.3	250	100	1.3	700	I.H
VT68	6.3	.3	300	125	1.1	600	I.H
VT 93A	6.3	.3	300	125	1.3	600	I.H
VT 169	12.6	.15	300	125	1.3	600	I.H
British NR87	4.0	2.0	250	250	9.0		I.H
VT 162	6.3	.3	250	125	1.1	600	I.H

Typical Circuit

An important feature of these valves is that the pentode section can be used as an output pentode if the valve has a high slope. A typical circuit showing the valve being used as such is shown in Fig. 1. This circuit provides delayed A.V.C. with diode detection feeding a high-slope output pentode.

It is as well to mention, however, that R.F. voltages should be prevented from being fed to the control grid of the pentode. The most satisfactory way of doing this is to include an R.F. choke between the diode load resistor and the diode anode. In

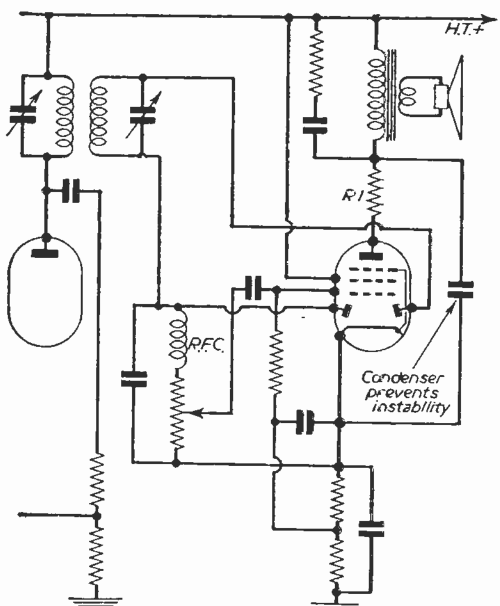


Fig. 1.—Circuit showing how double diode pentode can be used as an output pentode.

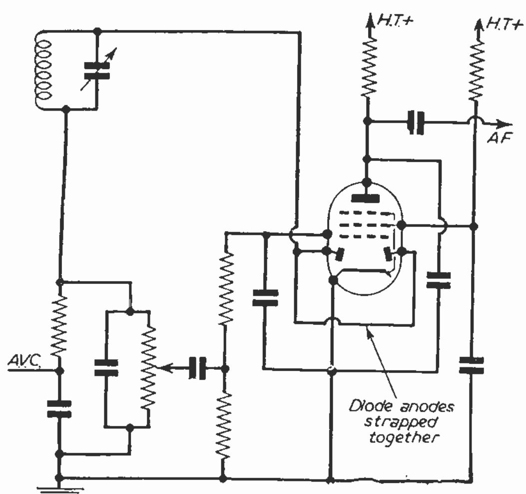


Fig. 2.—Basic circuit showing half-wave detection, A.V.C. and fixed bias amplifier.

addition, one can include a condenser between the anode and the cathode of the pentode.

R1 in Fig. 1 is an anti-parasitic resistor, and should be assembled as near to the anode pin as possible.

When such valves as shown in Fig. 1 are used, it is advisable to keep the anode and screen voltages as high as possible without exceeding the maximum ratings of the valve.

Fig. 2, however, is a basic circuit, wherein the double-diode-pentode is used as a half-wave detector with A.V.C. and an amplifier with fixed bias.

Surplus valves that are available today at very reasonable prices are enumerated in Table 1. These valves should prove extremely useful to the experimenter and newcomer to radio. The basing details of such valves are also shown in Table 2.

TABLE 2.

	1	2	3	4	5	6	7	8	Tc	Remarks
VT189	H	A	D1	D2	G2	G1	K & G3	H	—	Loctal
VT68	H	A	G2	D1	D2	K & G3	H	—	G1	7 Pin Base (U.S.A.)
VT 93A	—	H	A	D1	D2	G2	H	K & G3	G1	Int. Octal
VT169	—	H	A	D1	D2	G2	H	K & G3	G1	Int. Octal
VT162	H	A	G2	D1	D2	K & G3	H	—	G1	American 7 Pin
NR87	D1	A	D2	H	H	K & G3	G2	—	G1	British 7 Pin

New Radar Plotting Device

THE Marconi International Marine Communication Co., Ltd., now has available a new plotting device to assist in the proper appreciation of the radar "picture" observed on the P.P.I. The plotter, known as the Marconi-Harrison "Locatorgraph," has been designed following extensive enquiries (made with the co-operation of shipowners) among navigators as to the desirability of such an adjunct to the marine radar set—enquiries which indicate that a need exists for a simple and handy computor of this nature.

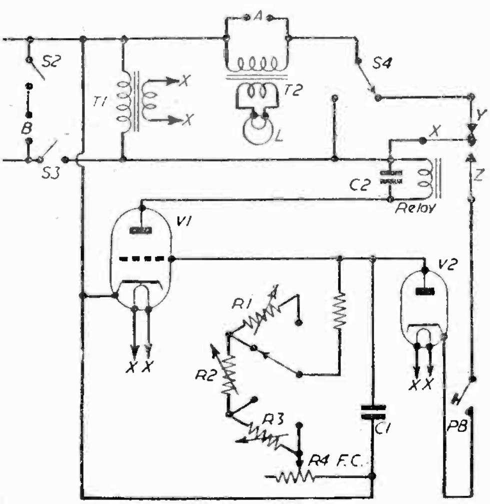
Plotting on the "Locatorgraph" is carried out with an ordinary pencil on a sheet of transparent plastic material about 12in. square. The pencilled marks can be erased by an indiarubber when no longer required. A circular scale graduated from 000 deg. to 359 deg. is engraved on the underside of the transparent plastic to serve as a bearing ring, and beneath this is a rotatable ivorine disc engraved with equally-spaced horizontal and vertical lines, ten concentric circles, and a radial bearing line. The "Locatorgraph" is mounted on a thin duralumin base plate, forming a light yet rigid instrument easily held in the hand and not susceptible to distortion in extremes of temperature or humidity. The entire instrument is completely non-magnetic and may therefore be used in close proximity to compasses; it is also entirely self-contained and can be employed anywhere on the bridge.

In use the "Locatorgraph" enables the navigator to record in fully visual form the changing positions of radar responses from other ships and above-water objects as they appear on the P.P.I., instead of having to rely on memory or on bearings and distances jotted down on paper. By plotting consecutive echo positions he can calculate another vessel's course and speed, estimate her point of nearest approach, and, by observing any departure from her line of relative motion, take any action which may be advisable to avoid any danger of collision.

The advantages of these facilities will be obvious. The plot can be made quickly and accurately without recourse to chart-work, and when made it can be carried away from the radar set and shown anywhere on the bridge if consultation should be necessary.

An Electronic Timer

IN our February issue we gave a description of a useful accessory known as an Electronic Timer. Several readers on examining the circuits given with this article discovered that in the Fig. 4 diagram a short-circuit would arise when the push-button switch was operated. The draughtsman was, unfortunately, responsible for joining up two points, and thereby introducing the offending lead. A corrected diagram is given below, from which it will be seen that the short length of horizontal line between the cathode of V2 and the condenser C1 should be omitted. This was apparent to most readers, but for the benefit of those who are making the instrument and were not clear as to the correction needed, the amended diagram is given. In reply to those readers who wished to have details for modifying the time constant or other modifications we can again only repeat our standard reply to such requests—we are sorry but we cannot give individual modifications.



Corrected diagram of the Timer.

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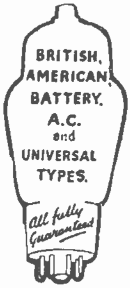

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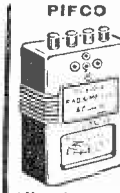

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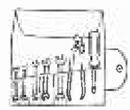

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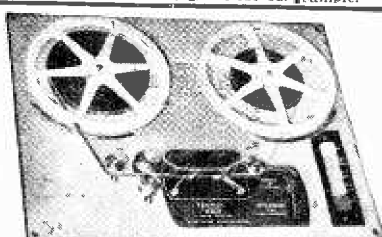

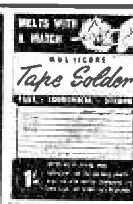

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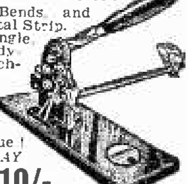

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OPEN TO DISCUSSION

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

TV Interference

SIR,—I have never seen fairer comment than that which appears in your January editorial and I heartily congratulate you.

My only regret is that it will not come to the notice of the many misguided TV owners who seem to have been persuaded that 90 per cent. of their troubles are due to privately-owned motor-cars, though the truth is almost the reverse.

Further to the examples you quote, it is on record that a radio service van was recently driven away from a house, creating a veritable snowstorm on the screen of the receiver which had just been serviced !—C. N. COURTNEY (Barking).

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 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.

Radio-controlled Models

SIR,—How pleased I was to see Mr. G. Paish's letter in your last issue of PRACTICAL WIRELESS asking for a section on radio-control although why only in the summer I do not understand. The summer may be the time for operating the models, but winter evenings are when they are made.

Radio control has so many varied possibilities and is so relatively unexplored except by a few who do not publish their ideas, that I feel it would offer your excellent magazine even more variety, and certainly gain the appreciation of those readers whose interests lie deeper in "applied radio" as opposed to "pure radio." C. L YOUNG (Southampton).

The Amateur Transmitter

SIR,—Here are a few brief replies to points raised by Mr. H. Cole and Mr. C. Roberts in reply to my letter in your October issue.

1. The question of Parliamentary voting is one which concerns the people of this country only; the allocation of radio frequencies affects other countries and is primarily decided by the Atlantic Conference, and not by the British Post Office.

2. Amateur stations *have* been known to interfere with essential service stations; this can easily occur if the service station is listening to a weak signal which the amateur cannot hear.

3. Crystal control is just as liable to cause interference as any other method of control; it is fairly obvious that Mr. Cole is not aware of the different ways interference can arise and this is a very strong reason for not giving him a licence!

4. Radiation from model control transmitters is a matter of yards, not of miles, owing to the low aerial, of an inefficient type, and high frequency.

5. I did not say that a licensed amateur never interferes with other services; my point was that he is less likely to do so than another with no knowledge of transmitter theory, and that if interference is brought to his notice, he will know what to do about it.

6. If Mr. Roberts cannot read morse, how can he possibly distinguish between the Continental commercial stations on 80 metres and British amateurs? It is a comparatively rare thing to hear a British amateur operating badly, but the less said the better about some of the commercial stations. Some of the amateur bands are shared with other services, and amateurs are allowed to use them "subject to non-interference with other services" (terms of licence).

7. I have never yet heard a licensed British amateur operating on an unauthorised frequency, but I *have* heard it done by an operator whom I knew to be a pirate (subsequently caught and heavily fined!). How does Mr. Roberts know that the 4.2 Mc/s. offender was not a pirate, and how did he measure the offender's frequency so accurately?—V. G. P. WILLIAMS, G3FYY (London, N.W.2).

Coastal Radio Beacons

SIR,—I was delighted when I saw the article on "Coastal Radio Beacons" in the December issue.

I suggest you follow up with a small article each month on the other radio navigational aids. Could your technical department issue a set design to cover the following conditions: (1) all dry; (2) cover shipping and radio bands; (3) Long range. It need only be on headphones; (4) minimum of controls; (5) Incorporate a D/F loop aerial, if possible.

The set would then be a very handy set to have at sea. Time checks with the "pips" could be taken for navigational work, weather forecasts, etc., for general safety, and if a D/F loop aerial is possible, radio navigation can be used.—W. A. ANDERTON (Nelson).

Reader's Appeal

SIR,—I should like to appeal to any reader who has any circuit or handbook of the 358 ex-government communications receiver to be kind enough to loan it to me.

I have one of these receivers minus coil units, and I wonder if any of your readers have successfully used other coils?—J. WALWYK (Hounslow).

Radio-controlled Models

SIR,—Your correspondent, G. Paish (Devon) (Feb. issue, p. 122), who is asking for information on audio frequency tone modulated radio controlled models, may find the following to be of interest.

Anon, "Radio-Craft," Jan. 1946, p. 242, Radio Target Planes.

Anon, "Wireless World," Sept. 1951, p. 342, Radio Telearchics.

Bruinsma, A. H., "Remote Control by Radio" (Philips Technical Library).

Chantrill, John J., "Newnes Practical Mechanics," July 1949, p. 299, and Aug. 1949, p. 338, Radio Controlled Model Battleship.

Honnest-Redlich, G., "Radio Control for Models" (Harborough Pub. Co.), pp. 39-46, R.F. Circuits, Modulated Carrier; pp. 73-80, Special Intergear for Modulated Carriers.

Hunt, Peter, "Radio Control for Model Aircraft," (Harborough Pub. Co.), p. 53, Audio Frequency Control.

Osborne and Dunn, "Radio-Craft," Oct. 1947, p. 20, Ploughing by Radio.

Queen, I., "Radio-Craft," Jan. 1945, p. 212, A Radio Robot Convoy.

Rayer, F. G., "Newnes Practical Mechanics," Feb. 1953, p. 86, Radio-Controlled Boat Mechanism.

Safford jnr., Edward L., "Model Control by Radio" (Radcraft Publications, Inc.), p. 22, Resonant Relays and Reeds; p. 30, Bandpass-Band Elimination Filters; p. 32, Band Rejection Filters; p. 33, Discriminators: pp. 59-63, Tone-Operated Receivers; pp. 64-69 Tone Modulated Transmitters.—JACK POTTER (Whitley Bay).

Noise and the R1155

SIR,—Being an owner of a R1155 I feel that all this changing of valves in the receiver to try to cut down the noise level is unnecessary. With a good aerial, cut for the frequency it is receiving on, the noise level will drop considerably. The R1155 which I possess is about a year old and apart from removing the D.F. parts and putting in an output stage the set has never been modified and the signal-to-noise ratio is extremely good. The aerial I use is a 132ft. long wire. Admitted, the bandwidth on the 55 is not very good, but apart from that it is an excellent receiver.—M. KELLETT (Leicester).

D.C. Supplies

SIR,—I learn from statistics supplied by the British Electricity Authority that there are over six million homes supplied with Alternating Current and something less than half a million with Direct Current. Further, it is hoped, economic conditions permitting, to transfer all D.C. supplies to A.C. (240 volts) within the next five years.

I have much sympathy with the "D.C. Brigade" but I feel that with these figures in mind there is little justification for PRACTICAL WIRELESS designers confining themselves to A.C./D.C. type circuits.

My own experience is, and I fancy that it will be generally conceded, that the "Universal" type of receiver does not give the same performance as the A.C. only type. The increased safety factor due to mains isolation and lesser heat dissipation alone must weigh heavily in favour of this type of circuit, apart from the higher voltages available and simpler arrangement of valve heater wiring. I deprecate the trend towards "Universal" television circuits and imagine that these are prompted more by pricing than technical considerations and must ultimately lead to inferior results and more frequent servicing.

Surely your best course is to continue the present policy of designing fundamentally for A.C. and also producing a universal version, as with the recent "Coronet." I would suggest that D.C. only circuits would be rather a waste of time; although cheaper to produce than their A.C. counterparts. Direct Current is on the way out, even if somewhat slowly. PRACTICAL WIRELESS circuits have a reputation for longevity, and conversion of supplies to A.C. might well take place before the useful life of a D.C. receiver was spent!—FRANK H. COWLES (Southall).

SIR,—I am now 59 years of age and my newsagent will confirm you that I have for many years taken your Wireless and Television monthlies. Many times I have found them interesting and helpful, but only when you have catered for D.C. or A.C./D.C. We have a good area with D.C. and many more would welcome more A.C./D.C. circuits.—F. C. MACKIE (Gateshead).

Use of the 6N7G

SIR,—With reference to the letter signed "Dreamer, Manchester," in the January issue of PRACTICAL WIRELESS, it may be of interest to report my own experience.

I modified my existing quality amplifier, which had been using a triode-connected KT63 output valve (driven by an L63) and replaced the KT63 with a 6N7G. Although this was, for myself, an expensive modification, I thought it was worthwhile because I then had 10 watts of very good quality output from the amplifier. Before modification, with only 5 watts, there was an excessive quantity of H.T. current wasted which is now being used by the 6N7G.—A. BLAKEMORE (Derby).

R1132A

SIR,—I should like to contact a reader who has bought and modified an ex-R.A.F. R1132A. My receiver operates well except for a loud hum, not due to smoothing, and the 6V6 output valve gets too hot to hold after about five minutes.

I wonder if any of your readers has experienced the same trouble and if he would write to me?—R. PINCHES (Plymouth).

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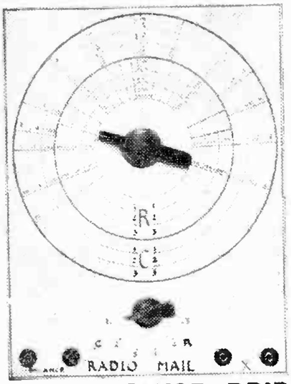

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Ready Punched 5-Valve Chassis. Size 12¼ x 8 x 2½ complete with attractive glass dial 11½ x 4½. Reflector Plates, Pointer and Pulleys. Price 12/6 plus 1/- postage.

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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.

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PRACTICAL WIRELESS, .. Mar 1954

Published on the 7th of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, Strand, London, W.C.2, and printed in England by W. SPEAIGHT & SONS, Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand: GORDON & GOTCH (A sia), LTD. South Africa: CENTRAL NEWS AGENCY, LTD. Subscription rate including postage, for one year: Inland and Abroad 13s. 6d. (Canada 12s.) Registered at the General Post Office for the Canadian Magazine Post.

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As above with Superhet Chassis, **23/6.** P. & P. 3/6.

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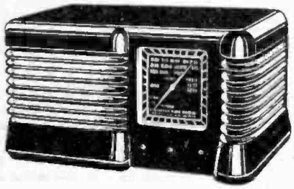


Used metal rectifier, 230 v. 50mA., **4/6** ; gang with trimmers, **6/6** ; M. & L. T.R.F. coils, **5/-** ; 3 obsolete Ex Govt. valves, 3 v/h and circuit, **6/6** ; heater trans., **6/-** ; volume control with switch, **3/6** ; wave-change switch, **2/-** ; 32 x 32 mfd., **4/-** ; bias condenser, **1/-** ; resistor kit, **2/-** ; condenser kit, **4/-**.

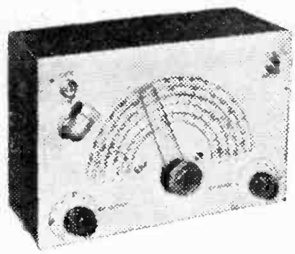
M & L. Superhet Coils with circuit, **6/6** ; iron cored 465 IF's, **7/6** ; min. gang, **5/6** ; volume control with switch, **4/-** ; wave-change switch, **2/6** ; heater trans., **7/6** ; 4 v/h, **1/6** ; 4 obsolete Ex Govt. valves, metal rectifier and Xtal diode with circuit, **14/6** ; 25 x 25 mfd., **1/-** ; 16 x 16 mfd., **3/3** ; condenser kit (17), **7/6** ; resistor kit (14), **3/6.**

Used 4 valve plus metal rec. A.C. mains, 230/250 superhet. Valve line up 6K8, 6K7, 6Q7 and 6F6. Medium wave in mahogany cabinet, size 14½ x 9 x 7¼in. These have been checked and are in first-class working order, and have a first-class performance, 6½in. P.M. speaker. P. & P. 5/-, **£3 19/6.**

Used 5 valve A.C. mains 200/250 3-wave-band superhet. Complete in outstanding walnut cabinet, size 22 x 14 x 10½in. Valve line up, 6K8, 6K7, 6B8G, 6F6 and U50 rec., 8in. P.M. speaker. In first-class working order, **£7 19/6.** P. & P. 12/6. We have a few of these in A.C./D.C., price as above.

All dry A.C. mains battery unit, 200/250 v. Metal case size 8 x 5 x 3in., by famous manufacturer incorporating Westinghouse metal rectifiers, 3 500 mfd., 16 + 24 mfd., mains trans., 3 smoothing chokes, output 90 v. 10 mA., 1.4 v., .25 amp. P. & P. 2/6, **39/6.**

COMPLETELY BUILT SIGNAL GENERATOR. Coverage 110 Kc/s-320 Kc/s., 300 Kc/s-900 Kc/s., 900 Kc/s-2.75 Mc/s., 2.75 Mc/s-8.5 Mc/s., 8.5 Mc/s-25 Mc/s., 17 Mc/s.-50 Mc/s., 25.5 Mc/s.-75 Mc/s. Metal



case 10 x 6¾ x 4½in., size of scale 6½ x 3½in., 2 valves and rectifier. A.C. mains 230/250 v. Internal modulation 400 c.p.s. to a depth of 30%. Frequency calibration accuracy plus or minus 1%. Modulated or unmodulated R.F. output continuously variable 100 milli-volts. Post and packing 4/-. **£4/5/0. 34/-** deposit, three monthly payments of **£1.**

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Amplifier Case, black rexine covered, leather carrying handle, chrome plated corners, rubber feet, felt lined, detachable lid. External dimensions 13½ x 13½ x 9½in. **£1.** P. & P. 2/6.

Pr. 200/250 v., secondary 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24 and 30 volt at 2 amps., **13/-.**

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300-0-300 60 mA. 6.3 v. 1 a., tapped at 4 v. 6.3 v. 2 a. tap 4 v., **13/6.**

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P. & P. on the above transformers 3/-.

32 mfd., 350 wkg.	2/-
16 x 24 350 wkg.	4/-
4 mfd., 200 wkg.	1/3
40 mfd. 450 wkg.	3/6
16 x 8 mfd., 500 wkg.	4/6
16 x 16 mfd., 500 wkg.	5/9
8 x 16 mfd., 450 wkg.	3/9
32 x 32 mfd., 350 wkg.	4/-
32 x 32 mfd., 350 wkg. and 25 mfd., 25 wkg.	6/6
25 mfd., 25 wkg.	11d.
250 mfd., 12 v. wkg.	1/-
16 mfd., 500 wkg., wire ends	3/3
8 mfd., 500 v. wkg., wire ends	2/6
8 mfd., 350 v. wkg., tag ends	1/6
50 mfd., 25 v., wkg., wire ends	1/9
100 mfd. 350 wkg.	4/-
100 + 200 mfd., 350 wkg.	9/6
16 + 16 mfd., 350 wkg.	3/3
Ex Govt. 8 mfd. 500 v. wkg., size 3½ x 1¾, 2 for	2/6
60 + 100 mfd., 280 v. wkg.	7/-
16 + 32 mfd., 350 wkg.	6/-
50 mfd., 180 wkg.	1/9
65 mfd., 220 wkg.	1/6
8 mfd., 150 wkg.	1/6
60 + 100 mfd., 280 wkg.	8/6
50 mfd., 12 wkg.	11d.
32 + 32 mfd., min., 275 wkg.	4/-
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Miniature wire ends moulded 100 pf., 500 pf., and .001 ea.	7d.

Partridge fully shrouded mains transformer, input 200/250 secondary 350-0-350 175 mA. 6.3 v. 7 amp., 5 v. 3 amp., p/p 3/-, **35/-.**

Partridge fully shrouded pushpull transformer, PRI 6,000 ohms, SEC 15 ohms, p/p 2/-, **20/-.**

Partridge fully shrouded choke, 15 Hen. 180 mA., p/p 2/-, **15/-.**

Partridge fully shrouded choke, 5 Hen. 120 mA., p/p 2/-, **8/6.**

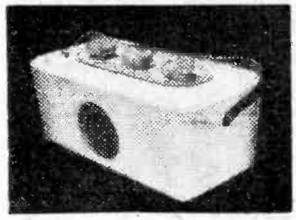
CONSTRUCTOR'S PARCEL, comprising chassis 12½ x 8 x 2 in., cad. plated 18 gauge, v/h., IF and trans. cut-outs, backplate, 2 supporting brackets, 3 waveband scale, new wavelength station names. Size of scale 11½ x 4½in., drive spindle, drum, 2 pulleys, pointer, 2 bulb holders, 5 paxolin international octal valve holders, 4 knobs, and pair of 465 IF's, **16/6.** P. & P. 1/9.

AS ABOVE, but complete with 16 + 16 mfd. 350 wkg. and semi-shrouded drop thro' 250-0-250 60 m/a., 6 v. 3 amp. Pri. 200-250, and twin-gang **31/6.** P. & P. 3/-.

5in. M.E. field coil 750 ohms with O.P. trans., **17/6.** P. & P. 1/-.

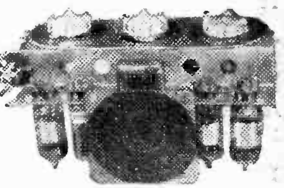
Germanium crystal diode, 2/3. post paid.

BATTERY CHARGER KIT, comprising metal case 5 x 4½ x 4½ trans. 230/250 v. and metal rec. Will charge 6 or 12 v. battery at 1½ amp., **19/6.** P. & P. 2/6.



PERSONAL PORTABLE CABINET in cream-coloured plastic, size 7 x 4½ x 3 in. Complete 4-valve chassis. Scale and 3 knobs. Takes miniature 90 v. and 7½ v. batteries, **9/-.** P. & P. 1/6.

3in. P.M. SPEAKER to fit above, **10/-.** Miniature output transformer, **5/-.** Miniature wave-change switch, **1/6.** Miniature 1-pole 4-way used as Volume and Off, **1/6.** 4 B7G valveholders, **2/4.** Midget twin gang ⅞in. dia., ⅞in. long and pair medium and long-wave T.R.F. coils ⅞in. long x ⅜in. wide ; complete with 4-valve all-dry mains and battery circuit, **8/6.** Condenser Kit, comprising 11 miniature condensers, **3/6.** Resistor Kit, comprising 15 miniature resistors, **4/6.** The above receiver (less valves and batteries) could be built for approximately **51/-.** P. & P. 2/6. Valves to suit above **10/-** ea. Point to Point Wiring Diagram **1/-.**



View of chassis as it would look when assembled with valves inserted.

Extension speaker cabinet, in contrasting walnut veneers, size 15 x 10½in. Will take 6½ or 8in. speaker, **17/6.** P. & P. 2/-.

Volume Controls. Long spindle less switch, 50K, 500K, 1 meg., **2/6** each. P. & P. 3d. each.

Volume Controls. Long spindle and switch, ¼, ½, 1 and 2 meg., **4/-** each ; 10 K. and 50 K., **3/6** each. ¼ and 1 meg., long spindle, double pole switch, miniature **5/-.** P. & P. 3d. each.

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.**

Valveholders. Paxolin octal, **4d.** Moulded octal, **7d.** EF50, **7d.** Moulded B7G, **7d.** Loctal amphenol, **7d.** Loctal pax., **4d.** Mazda Amph., **7d.** Mazda pax., **4d.** B8A, B9A amphenol, **7d.** B7G with screening can, **1/6.** Duodecal paxolin, **9d.**

Trimmers, 5-40 pf., **5d.** ; 10-110, 10-250, 10-450 pf., **10d.**

Twin-gang .0005 Tuning Condensers, 5/-. With trimmers, **7/6.**

Midget .00037 dust cover and trimmers, **8/6.**

P.M. SPEAKERS	with trans.	less trans
3½in.		13/6
5in.	16/6	12/6
6½in.	16/6	12/6
8in.	18/6	15/-
10in.		19/6

Post and packing on each of the above, 1/6 extra.

Truvox BX11 12 in. P.M. 3 ohm speech coil **45/-.** P. & P. 3/6.

Crystal pick-up with Sapphire Trailer Needle, with volume control, **23/-.** P. and P. 1/-.

Terms of business: Cash with order. Dispatch of goods within three days from receipt of order. Where post and packing charge is not stated, please add 1/- up to 10/-, 1/6 up to £1, and 2/- up to £2. All enquiries and list, stamped addressed envelope.

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