FIRST COMBINED ISSUE OF "Practical Wireless" & "Amateur Wireless"

Practical and Amateur Wireless

3D. EVERY WEDNESDAY
Vol. 5. Jan. 26th, 1935. No. 123.

a GEORGE NEWNES Publication

F. J. CAMM'S A.C. HALL-MARK

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BIGGEST AND BEST WIRELESS WEEKLY

Practical and Amateur Wireless

Edited by F. J. CAMM

Technical Staff: W. J. Delaney, H. J. Barton Chapple, Wh.Sch., B.Sc., A.M.I.E.E., Frank Preston.

VOL. V. No. 123. JAN. 26th, 1935.

ROUND *the* WORLD *of* WIRELESS

Two Famous Journals Combine!

THIS issue introduces a development of the greatest interest to every reader, the greatest development, in fact, in the history of radio journalism. As from this issue, those two important weekly journals, "Practical Wireless" and "Amateur Wireless," which in their respective fields have done so much to foster the interests of technical enthusiasts and home constructors, will as from this issue combine forces and be issued as one weekly journal under the title of:—

"Practical and Amateur Wireless."

By this fusion of the two papers, the most comprehensive and best-value technical wireless weekly will be made available to the readers of both. "Practical and Amateur Wireless" will virtually be two papers in one, combining all the favourite features of both papers and giving an unrivalled service in news, designs, technical advice, and information of interest to every listener.

The Short-wave Section will be considerably enlarged, and the reader service by post, which has proved so helpful a feature to readers, will be conducted on even more liberal and comprehensive lines than in the past.

Yet, notwithstanding the remarkable value to be given, there will be no increase in price. "Practical and Amateur Wireless" will remain at 3d. and be published every Wednesday. It will be a complete weekly paper for the experimenter, home-constructor, and even the general reader interested in the technical side of wireless. Alive, authoritative, and up to date, it will provide through its service of expert writers and designers an indispensable opportunity to everyone desiring to keep abreast of the developments, and more particularly the newer developments, in this fascinating field.

Welcome!

THE important amalgamation of *Amateur Wireless* with PRACTICAL WIRELESS will bring into our ranks many thousands of new readers, and to them we extend a cordial welcome. We hope that the readers of both papers will like the blending of features presented in this issue. Readers of *Amateur Wireless* will find that their old favourites will continue to serve the new two-in-one journal. They will find that the features they have liked have been retained and even amplified. We hope they will look upon PRACTICAL AND AMATEUR WIRELESS as being ready to help them when they are in difficulty or in need of advice. Once again, a cordial welcome.

> **Special Note to all Readers!**
>
> This is the first combined issue of "Practical Wireless" and "Amateur Wireless." In future please ask for "Practical and Amateur Wireless," the Two-in-One Journal — same price 3d. Same Publishing Day—Wednesday. All correspondence intended for the Editor should be addressed to The Editor, "Practical and Amateur Wireless," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2

The Moscow Studio Orchestra

MOST radio listeners in the United Kingdom are under the impression that the Moscow station spends all its time in broadcasting propaganda. This is far from the fact, as if the condenser dial is turned to 1,724 metres before 9 p.m. G.M.T., excellent vocal and instrumental concerts can be heard. The Soviet Symphony Orchestra, which plays almost daily, claims to be the world's largest assembly of musicians. Until recently it numbered 120, but it has now been increased to 163 instrumentalists.

The Largest Tuning Fork in the World

THE new Berlin interval signal—the morse letter B—is broadcast to the exact frequency of 435 cycles, or the normal musical note A. By this means, orchestras throughout the country, and especially in the provincial radio studios, are able to take this signal as a means of tuning their instruments. The Prague station has also adopted this method, and puts out this note several times daily as a preliminary warning for the time signal.

French Stations Alter their Call

RADIO-PARIS, since it has been taken over by the State authorities, is acting as the main outlet of the official programmes, and, in consequence, calls itself: *Poste National*, although it has been decided in order to make matters perfectly clear, that the words: *Radio-Paris* are still to be tacked on. Radio-Vitus, a private transmitter in the French capital, now disguises itself as the *Poste de l'Ile de France*. Both Lille and Rennes, in the State network, have adopted Regional names; the former styles itself Radio P.T.T. du Nord, and the latter Radio P.T.T. Ouest. In future, all provincial stations will indicate the district served by their broadcasts.

Readers, Please Note

ON page 577 of our issue dated January 12th we illustrated an aeroplane and stated that it had been chartered by Messrs. Peto-Scott Co., Ltd., for conveying kits of Mr. F. J. Camm's £5 Superhet and the Hall-Mark Three to Ireland. Will readers please note that this aeroplane was not chartered by Messrs. Peto-Scott Co., Ltd., but by Mr. W. B. Kay, of 21, South King Street, Dublin, the well-known electrical contractor and wireless specialist. We congratulate this firm on the enterprise shown in this instance, and which they adopted as the only means of having the goods in stock in order to fulfil their customers' requirements.

ROUND the WORLD of WIRELESS (Continued)

"Carmen"

ACTS I and II of Bizet's Opera, "Carmen," performed by the Royal Carl Rosa Opera Company, will be relayed for Western listeners from the Pavilion, Torquay, on January 29th. The Torquay Municipal Orchestra will be under the direction of Ernest W. Goss.

"At the Langleys"

ON February 2nd a new Midland feature called "At the Langleys" will be broadcast. The idea is that the Langleys (father and son) keep open house at their Birmingham home periodically, and receive and are entertained by people who have something interesting to say or do. The feature will thus have some resemblance to "In Town To-night," although its framework should give it a more intimate character.

"Workaday World"

THE first of a new series of twelve talks for Western listeners under the general heading "Workaday World" will be broadcast on January 30th. This series will survey the field of industry in Wales and the south-west of England, and it will be opened by a discussion between H. A. Marquand and George Knox under the title "As things are." This discussion will serve to cover a statement of the general situation of industry with a very general diagnosis.

London Music Festival

THE B.B.C. London Music Festival will be held in the Queen's Hall on May 10th, 17th, 22nd, 27th, June 3rd, 5th, 12th, 14th. On May 10th, a concert in commemoration of the 250th anniversary of Bach's birth consists of a performance of the B Minor Mass, which Dr. Adrian Boult will conduct. The three concerts on May 17th, 22nd, and 27th are to be conducted by Serge Koussevitzky, and all four concerts in June are to be conducted by Toscanini.

Famous Trials

AN interesting broadcast, the fifth of the "Famous Trials" series, will be given in the Regional programme on January 28th, and in the National programme the following evening. It is the trial of Lady Alice Lisle before Judge Jeffreys. She was arraigned for high treason against King James II a fortnight after the battle of Sedgmoor, her offence being that of sheltering two refugees from the Monmouth Army. The trial has been reconstructed by Whitaker-Wilson from a contemporary account given in the State Trials in the Guildhall.

Geraldo and his Band

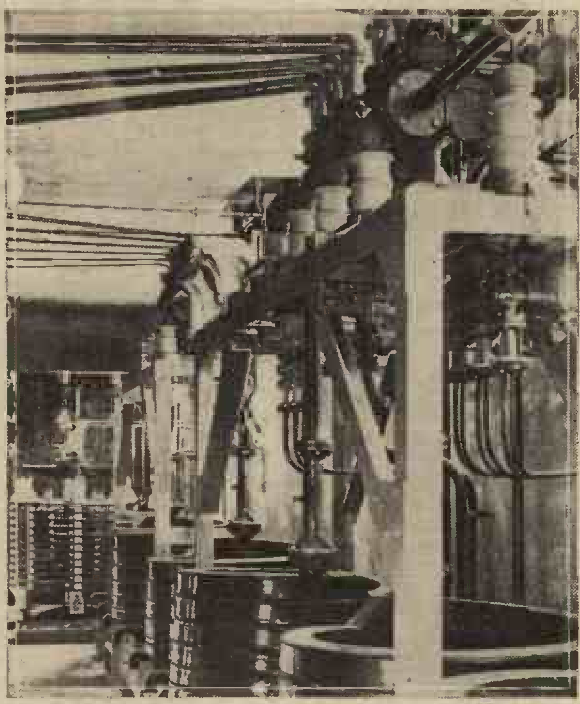
ON February 4th Geraldo and his band are to give another Non-Stop Dance programme which have proved so popular. During the programme listeners will hear Eve Becke, who is well known for her work in "Air-do-Wells" and various musical entertainments, and Peter Burnard, who will sing comedy numbers. Monte Ray is the tenor, and the Review Chorus will be in support.

INTERESTING and TOPICAL PARAGRAPHS

"The Microphone at Large"

AS Owen Reed, who is in charge of "The Microphone at Large" series, is still convalescent after an illness, the Stafford programme in this series will be arranged and produced by Felix Felton from London. Stafford is an example of a very old town which has, of recent years, attracted a number of new industries. In 1913, the town celebrated its millenary. It has been visited by many of the English monarchs, and was the birthplace of Isaak Walton. Something of its past and present life will be reflected in the broadcast on January 24th for Midland Regional listeners.

IN A MODERN RADIO STATION



The switch gear for the valve-cooling water-drums in the new German broadcasting station in the Forest of Tegel.

Entertainment at the Piano

ON January 25th two artists new to broadcasting will appear in England. They are Betty Laidlaw and Bob Liveley. They describe themselves as a team of writers, composers, and lyricists. These two produce a dynamic musical act at the piano. They write their own songs and sketches and, in the American manner, are among the most entertaining syncopated acts which Brian Michie has been able to obtain for one of his feature programmes.

"A Musical Trip Round Europe"

THE Birmingham Hippodrome Orchestra makes "A Musical Trip Round Europe" on January 27th, in the Midland programme. Harry Pell will conduct, and he has chosen musical comedy selections and light orchestral music from Holland, Germany, Russia, Hungary, Austria, Italy, Spain, and France. Mr. Pell was formerly Lieutenant and Musical Director of the Durham Light Infantry, and was, for two years, on the staff of the B.B.C. at Newcastle. He has been Musical Director at Birmingham Hippodrome for five years.

"Something to Talk About"

AT least two of the well-known Eden Phillpotts' Devonshire comedies had their first performance at the Birmingham Repertory Theatre. The one-act play by this author, entitled "Something to Talk About," will be given by the Repertory Company on January 29th, on the Midland wavelength. Herbert M. Prentice is the producer.

"Dick Whittington"

SCENES from Reg Maddox's pantomime, "Dick Whittington and his Cat," are to be relayed for Midland listeners from the Kemble Theatre, Hereford, on February 1st. The book is by E. Byam Wyke and the music by Frederick Humphries. The pantomime has recently had a short resident season at Cheltenham.

Midland Orchestral Concert

PATRICK CORY is the pianist in the Regional programme by the B.B.C. Midland Orchestra on February 1st. H. Foster Clark will conduct, and the programme includes Handel's "Concerto Grosso in E minor" and Haydn's "Drum Roll" symphony. Patrick Cory, who plays two Scarlatti sonatas and (with orchestra) César Franck's "Symphonic Variations," has been Director of Music at Bromsgrove School since September, 1932.

"Pleasure on Parade"

FRANK A. TERRY'S winter concert party, "Pleasure on Parade," will broadcast to Regional listeners on the afternoon of January 31, and to Northern listeners only on the following night. The show is produced and arranged by Frank A. Terry.

SOLVE THIS!

PROBLEM No. 123.

Welbeck had a three-valve receiver comprising a detector valve, followed by two L.F. stages, of which the first was resistance-capacity coupled by means of a complete R.C.C. unit. At first, the set functioned very satisfactorily, but after it had been in use for some time it was noticed that the reaction condenser had no effect, and that signals were considerably weaker than they had been before. The detector valve was proved to be in order by substituting another one, whilst the tuning and reaction coils were continuous, and the tuner worked properly when placed in another set. What was the cause of the trouble?

Three books will be awarded for the first three correct solutions opened. Mark your envelopes Problem No. 123 and address them to: The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Entries must be received not later than first post on Monday, January 28th.

Solution to Problem No. 122.

Bond had overlooked the fact that, when considering the optimum load of valves in push-pull the optimum load of one of the valves must be doubled before the correct transformer ratio can be determined. Thus, he employed a transformer having only half the correct ratio.

The following three readers have correctly solved Problem No. 121 and books are being sent to them: C. M. Beet, 189, Pitsmoor Road, Sheffield, 3; W. Wicks, 68, Millfield Road, Ilkeston, Derby; F. Farrimond, 351, Spring Bank, Wigan, Lancs.

Dr. Fleming with some of his early valves.

The Trend of VALVE DESIGN

by SIR AMBROSE FLEMING
M.A. D.Sc., F.R.S.

An Important Article by the Inventor of the Two-electrode Valve

IN considering the trend of modern valve development the best mode of approach is for the student to understand the defects and limitations of the simple three-electrode valve or triode, as some prefer to call it.

The Triode

In this appliance we have three elements included in a highly evacuated glass or glass and metal bulb. There is first the filament or hot cathode which emits electrons or particles of negative electricity. Then secondly there is the anode or positively charged plate to which the electrons move, and thirdly the control grid which may have a small negative or positive bias given to it, but upon which is superimposed a fluctuating or alternating potential or voltage. When electrons are emitted by the hot cathode they are drawn towards the positively charged anode, but have to pass through the apertures or spaces in the grid to get to the cathode. If the grid has a negative charge the electrons are repelled or hindered from reaching the anode, but if it has a slight positive charge they get a pull towards the anode.

The grid and anode are, however, two conductors near each other, and they form therefore a small condenser said to have "inter-electrode capacity," which may amount to a few micro-microfarads ($\mu\mu$F). The result of this inter-capacity is to tend to make the electron current flowing to the plate from the filament oscillate or fluctuate. The way in which this happens is as follows: Assume the grid to be at zero potential or not charged. Then the electron current flows to the plate and positive electricity must flow from the battery to the plate. This raises the potential of the plate and hence the grid becomes by electrostatic induction negative. This lowers the electron current and hence the plate potential; the grid then becomes less negative or more positive and that again increases the electron current. Accordingly the inter-electrode capacity causes oscillations in the valve current which interferes greatly with its proper action as an amplifier.

The Screen-grid Valve

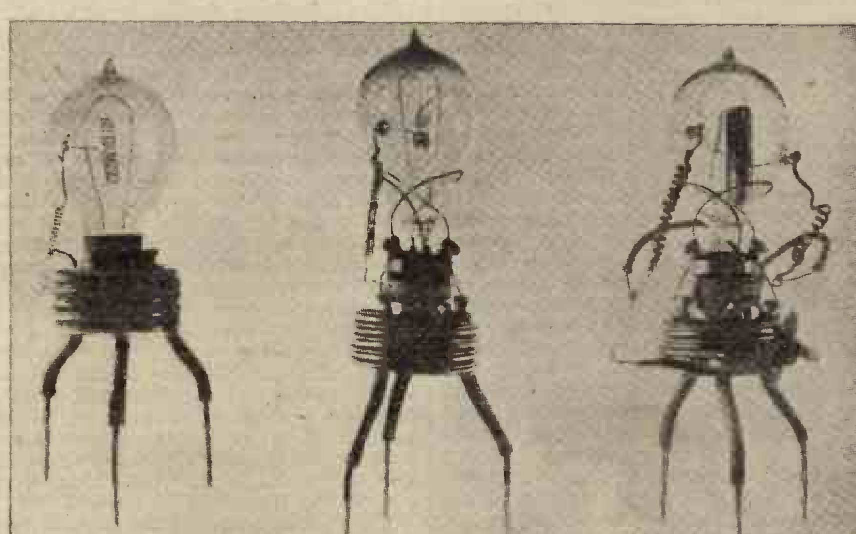
Various remedies were formerly applied, but the complete solution of the problem has been the invention of the so-called shielded or screened four-electrode valve. In this a second grid, called the shield, is placed between the plate and the control grid of the valve, and this shield is connected to a point on the H.T. battery so as to give it a positive potential of about half or two-thirds of that of the plate. The result is to destroy nearly all the capacity between plate and control grid, with all its objectionable results. But the introduction of this shield has another valuable result. If we apply a certain positive voltage to the plate of a triode and keep the grid at zero or at a certain small potential we find that any increase of the positive potential of the grid by a certain small voltage, say 1 volt, increases the electron current, the plate voltage being supposed to be constant. If we keep the grid at constant potential we can make the same increase of electron current by a certain increase of plate voltage. The ratio of the increment of plate voltage to that of grid voltage required to make the same increment in the current is called the *amplification factor*. For an ordinary triode it may be a number such as 5 to 10 or so. We cannot increase this amplification by putting the grid and plate closer or increasing the plate voltage, because then we bring in an aggravation of the grid-plate capacity effects. There are also injurious capacity effects due to proximity of the wires or leads from the plate and grid and also between plate and filament.

These are now overcome by putting the plate terminal on the top of the valve bulb and enclosing the whole valve in an aluminium box. Another valuable improvement is to metallise the whole bulb outside by coating it with a deposit of copper or zinc, leaving an uncoated space round the anode terminal and base cap. With such precautions we can bring the plate and control grid closer and use higher plate voltages and secure an amplification factor of 40 to 50 or even 100 easily, and valves can be made with amplifications up to 500 or 1,000. It is these advances which have made possible the receiving sets of to-day with internal frame aerial and yet capable of picking up far distant foreign stations.

Indirectly-heated Valves

Another important valve advance is the indirect cathode heating, which enables us to employ alternating current, drawn from electric light mains, for the so-called mains receivers. This has been rendered possible by the invention of the dull emitter filament or cathode. One type comprised the now much used thoriated tungsten filament in which thorium was intermingled with the tungsten wire filament. It was found to give a much greater electron emission at a given temperature or conversely to emit adequately at a lower or dull red heat temperature.

Another type consists of a platinum iridium wire coated with barium and strontium oxides. These oxide-coated filaments require only 0.01 watt of power to cause a milliampere of electron emission, whereas the pure tungsten wire required half a watt per milliampere. These improvements render it possible to use a 2-volt accumulator for filament heating. In the indirect emitter or cathode a tungsten cylinder is coated on the outside with barium oxide, and there is a filament of tungsten in the interior, but not touching it, which heated the cylinder by radiation.



Some of the original Fleming valves.

The filament can then be rendered incandescent by an alternating current from a small transformer fed from alternating current circuits of house electric supply. The necessary direct H.T. voltage for the plates is obtained by using a transformer to step-up the house A.C. voltage and then rectifying by a Fleming two-electrode valve having two separate anodes so as to rectify both phases of the A.C. This somewhat pulsating current is fed into a condenser of rather large capacity—about 4 microfarads—and the charge flows out through an iron-core choke or inductance coil shunted by a smaller condenser called a smoothing condenser. The result is to give a steady direct H.T. voltage which can be applied to the plates.

VALVE TYPE A.C.S:2.
An air-cooled anode screen-grid transmitting valve. Thoriated Tungsten filament. Approximate overall dimensions: 460 x 145 mm.
APPROXIMATE DATA.
Filament volts, 15; filament current, 6.5 amps.; anode volts max., 3,000; screen-grid volts max., 750; anode dissipation max., 400 watts. Input 250 milliamperes, mean anode current at 3,000 volts D.C. as an oscillator or high-frequency amplifier in telegraph transmitters, on wavelengths not less than 100 metres.

All-mains Working

The whole receiving set can then be run off the electric house mains for alternating current supply and no bother with H.T. batteries or filament accumulator to charge.

In all the best receiving sets one or two screen-grid valves are used in series as amplifiers for the high - frequency oscillations. These oscillations have then to be rectified or changed into a direct current and then any modulations on it are passed on as low-frequency variations of current. We then require in general to amplify these low-frequency changes in current before we can use them to work a loud-speaker telephone. To do this we require to pass from 10 to 25 milliamperes through the loud-speaker, the resistance of which may be from 2,000 to 4,000 ohms. So that we require to put in power of about 0.2 watt, and it may rise to 0.5 watt for loud sounds. If, however, we try to increase the output of the last low-frequency amplifying valve by raising the H.T. voltage the electrons coming through, the two grids of the screened valve come up against the plate with such velocities that they bounce back into the screening grid and reduce its positive charge or even make it negative. The result is to lower the resultant plate current and it can only be increased again by using very high plate voltage, which is inconvenient or dangerous.

The Pentode

This difficulty is overcome by introducing a third grid between the screen grid and the plate and connecting this third grid to the negative end of the filament or cathode. In this way we make a five-electrode valve or pentode which is a low-frequency amplifier of great power output.

Hence in modern receiving sets we have three kinds of valve—viz., the screen-grid used for high-frequency amplification, the detector or rectifying valve, and the pentode for low-frequency large power amplification.

The Variable-mu

In addition a fourth variety of valve is called the variable-mu valve. The amplificating power of a triode valve depends, amongst other things, on the closeness of the grid wires. If these wires are close so that the spaces are small through which the electrons have to travel, then a small voltage placed on the grid will make a large change in the plate current. In other words, the characteristic curve will be steep and the amplification large. If the grid spaces are large the amplification will be small.

A variable-mu valve is one in which the grid is so wound that the grid spaces are large at one end and gradually get smaller towards the other. If, then, no bias voltage is put on the grid the amplification is large, but if a gradually-increasing negative bias is given to it the electrons are driven through the large grid spaces in preference to passing through the small ones, and the amplification becomes small. Hence it can be varied at pleasure to suit the loudness of the incoming sounds.

Automatic Volume Control

The important use of the variable-mu valve is at present in connection with the so-called automatic volume control. For reasons too long to state here, the loudness of the received speech or music is liable to vary by what is called fading. To render unnecessary voluntary control by the listener by varying the grid bias by hand, manufacturers have introduced what are called multiple valves, which rectify the carrier-wave by means of Fleming valves, and rectification is effected by the use of such valves in place of the so-called "anode bend" mode of detection which was first introduced by the author of this article in 1908.

By employing a double-filament double-anode Fleming valve it is possible to rectify the carrier-wave and employ it to apply a bias to the grid of a mu valve so as to reduce the negative bias when the carrier-wave falls off in amplitude, and thus increase the amplification accordingly. This reversion to the two-electrode valve as a detector has resulted, then, in the practical achievement of efficient automatic volume control. Multiple triode valves are also made to contain in one bulb what amounts to two shielded grid valves. But in many respects no advantage is thus gained.

A very great advance was made several years ago by the discovery that a copper tube with a sharp edge, or a copper-plated nickel tube, could be sealed vacuum-tight to a glass tube. This rendered it possible to make high-power transmitting valves with the metal tube forming part of the bulb acting also as the anode or plate. This then could be water or oil cooled by surrounding the anode with a jacket.

The same constructiou has recently been applied to small receiving valves called "catkin," which have the advantage that they can be thrown about or travel without the risk of breaking which attaches to wholly glass-bulb valves.

Short-wave Transmitting Valves

The most important valve development of late years is in the production of short-wave transmitting valves for short -wave wireless or television transmission. In 1919 Barkhausen and Kurz showed that very high-frequency oscillations could be produced with a three-electrode valve by departing from the usual plan of inductive inter-coupling of the grid and plate circuits. In Barkhaussen's method the grid is kept strongly positive by a battery and the plate at the potential of the filament or even negative. The grid and plate are then connected to a pair of parallel wires called Lecher wires with a sliding bridge condenser across them, the position of which can be shifted.

A.C.A. VALVE TYPE E.472.
An air-cooled-anode transmitting valve suitable for operation as an oscillator or magnifier in short and long-wave transmitters. Oxide coated filament. Approximate overall dimensions: 212 x 52 mm.
APPROXIMATE DATA.
Filament volts, 10; filament current, 1.6 amps.; anode volts max., 1,500; amplification factor, 25; impedance, 5,000 ohms; continous anode dissipation under oscillating conditions, 75 watts. Input as Class C Amplifier. Telegraphy rating: Mean anode current, 120 milliamperes; anode dissipation, 75 watts. The maximum anode voltages at various wavelengths are: At wavelengths exceeding 45 metres, Ea. max. = 1,500 volts; at wavelengths exceeding 15 metres, Ea. max. = 1,000 volts; at wavelengths exceeding 5 metres, Ea. max. = 750 volts.

Under these conditions high-frequency oscillations are set up, the frequency of which depends on the position of the capacity bridge.

G. Marconi and G. A. Mathieu have developed this plan into a very practical method of generating short electric waves of 30 cms. or less in wave-length by setting up suitable oscillations in a Hertzian oscillator placed in the focus of a skeleton parabolic mirror. In such high-frequency valves the electrons emitted by the filament are hurled to and fro between grid and plate like lawn tennis balls and some of them fly back and bombard and soon destroy the filament. Mathieu has, however, developed a type of valve with robust filament or cathode which can last a reasonable time. With the advent of television, however, there will be a call for further improvements.

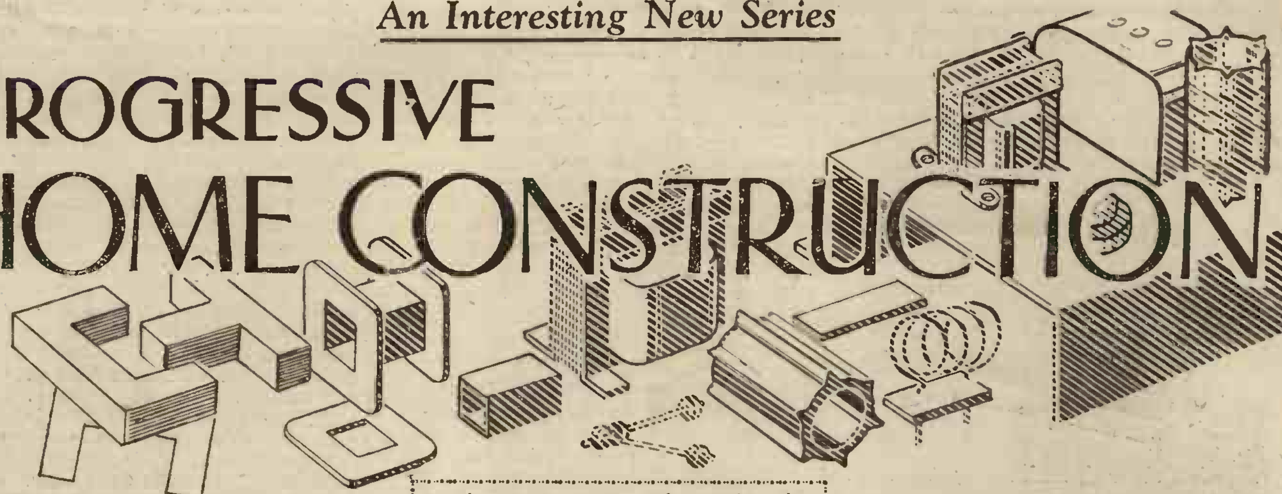
The Magnetron

Another type of high-frequency valve is called a Magnetron. It is a Fleming two-electrode valve with a cylindric anode divided into two parts longitudinally and a strong magnetic field produced by a concentric external spiral wire generated parallel to the axis of the anode.

(Continued on page 644)

An Interesting New Series

PROGRESSIVE HOME CONSTRUCTION



In this New Series of Articles the Authors will Describe the Construction of Various Components Required in Building Complete Receivers

by The Experimenters

THIS being our first article in the new journal, we will commence by expressing the hope that all readers will like this special enlarged issue. We must also point out to all those readers who have been good enough to write to us in the past, making suggestions and giving accounts of their experiences with the circuits that we have described, that we hope that their letters will be even more frequent than before. After all, it is very largely the suggestions contained in these letters which indicate to us the kind of experimental work that you would like us to describe.

Entirely Home Made

Starting with this first issue of PRACTICAL AND AMATEUR WIRELESS we are going to describe a variety of simple sets that can be made almost entirely from raw material. The reason for this series is that so many readers have pointed out that so-called home construction to-day is not true construction but merely a matter of assembly, and that they would like to have details for the construction of practically every component part of the complete receiver. We fully realise, of course, that many articles have been given in past issues of PRACTICAL WIRELESS on the subject of component building, but in this series a rather different line will be followed; instead of describing several different types of the same component in one article, and then dealing with another component in a later article, the idea will be to deal with the construction of each individual part as it happens to be required in making the sets for which circuits will be given. Although practically every component will be dealt with from the constructional point of view, the circuits will so be arranged that any follower of the articles who wishes to employ some particular part that may be on hand, or who wishes to buy a part that requires more than a moderate amount of time or experience to make at home, may buy that part although making the rest. Thus the reader will have details for connecting, as well as making, the parts.

An Efficient Single-valver

It will be seen from the simple circuit on this page that the first set to be considered is a single-valver of really simple, though very efficient, design. The circuit is quite an ordinary one, but nevertheless one that is capable of giving extremely satisfactory results. A dual-range tuner is used, this being wound to cover the two broadcast bands; this is tuned by the customary .0005-mfd. variable condenser, and a .0003-mfd. variable condenser is employed for reaction control. An ordinary three-electrode valve is coupled on the leaky-grid system, and the anode circuit of this contains the 'phones—or a loud-speaker may be used when the set is operated near to a broadcasting station.

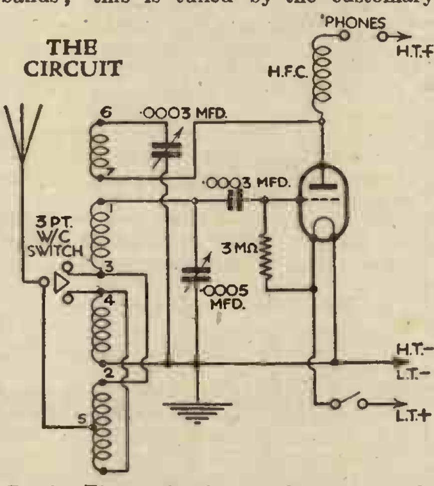


Fig. 1—This is the theoretical circuit of the constructional receiver being described.

Making the Coil

The coil is obviously the first item to be tackled, and the drawing (Fig. 2) gives the principal dimensions and winding data for this. It will be seen that a 4in. length of six-ribbed ebonite tubing is used as a former, and that four slots are formed in the ribs to take the pile-wound reaction and long-wave windings. First of all, after having obtained the length of former, the slots should be marked out and made, preferably by using a strip of cardboard marked as shown inset in Fig. 2 as a template. This can be held against each rib in turn while the required slots are made with a small hand file, or by using two or three short lengths of broken hack-saw blade clamped together. Where the constructor has a lathe available, time can be saved by turning the slots, but there will probably be few who are lucky enough to possess a small machine tool of this nature.

After the slots have been made a couple of 1/16in. holes should be made in one of the ribs just below the end slot. Next pass the end of a reel of 32-gauge enamelled wire through the holes so as to anchor it, leaving about 4in. projecting for the purpose of making the terminal connections later. The wire can then be wound into the first slot, winding 60 turns; pass the wire into the second slot and wind a further 30 turns. Make another pair of small holes in the rib, cut off the wire so that it will just thread through these leaving 4in. for connecting up. In another rib make another pair of holes, anchor the end of the wire on the reel and continue to wind on another 30 turns; pass over into the third slot and wind another 60 turns, thus completing the long-wave section. It is very important that care should be taken that all turns are wound in the same direction, if the two halves are in different directions they will tend to "cancel out" and the coil will not function.

The reaction winding can next be tackled by winding 75 turns of the same kind of wire in the

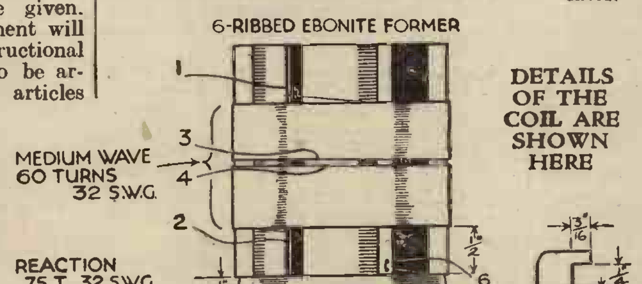


Fig. 2—Constructional details of the tuner and (inset) the template used for marking the slots.

(Continued overleaf)

(*Continued from previous page*

fourth slot, anchoring the two ends of the wire exactly as before. This winding also should be in the same direction as the previous one.

The 60 turns required for the medium-wave winding are wound side by side in

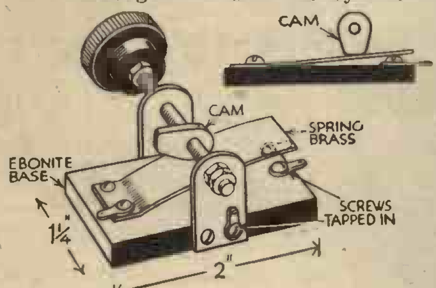


Fig. 4. Details of the easily-made three-point switch.

two halves and in the position shown in Fig. 2, these also being in the same direction. The total amount of wire required for the coil will be less than 1oz., but as similar wire will be called for later it will be advisable, and more economical, to purchase a 4oz. reel in the first place.

Mounting the Tuner

Terminal connections for the finished tuner are made by mounting the former on a 2½in. by 3½in. ebonite baseplate, as shown in Fig. 3. Small angle brackets, which can easily be made from a strip of sheet brass, are used for attaching the coil to the base, and the screws for these are countersunk on the under-side of the base-plate. The terminal heads are similarly countersunk by making 3/16in. holes half-way through the ebonite from the under-side, after making 3/32in. holes right through. This assumes the use of 6 B.A. terminals, but where terminals of different size or type are employed the hole sizes will be slightly changed. If the terminals used are not fitted with headed shanks it will be necessary to raise the ebonite base by fitting collars or washers over the screws used to mount the tuner on the chassis.

Making a Wave-change Switch

The next requirement will be a three-point wave-change switch, and it might be considered more economical to buy this ready made, although a suitable component can be made very easily by following the details shown in Fig. 4. It will be seen that this is made up from several odd pieces of metal and ebonite, a mounting bush from an old component being used to take the spindle. The latter is a short length of 2 B.A. or 4 B.A. (according to the size of the bush) threaded brass rod, a cam for this being made from a piece of heavy-gauge brass. The cam is securely fixed to the spindle with a spot of solder, and the spindle is prevented from moving endways by fitting two pairs of nuts that lock together on each side of the rear brass

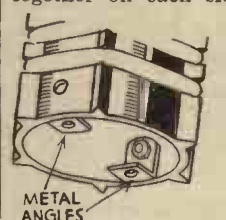
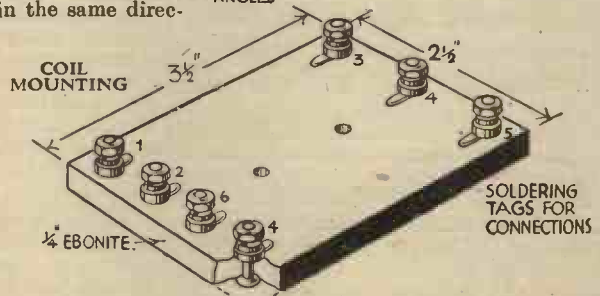


Fig. 3. Showing how the coil former is mounted on an ebonite base.



bracket. An ebonite base is used, and two round-headed 4 B.A. screws are tapped into this, placing a soldering tag under the head of each. The next requirement is a short length of springy brass, and this is fitted in the position shown by means of another pair of 4 B.A. screws again tapped into the ebonite, and a soldering tag is again placed under the head of one of these.

This switch gives very positive contact, and the flat on the brass cam provides a definite "on" position.

The Reaction Condenser

Following the sequence of components in the circuit, the next item is the tuning condenser, and here it is recommended that the part should be bought ready made, because there is no truly satisfactory method of making it without the use of a fair number of tools, and without a rather considerable mechanical ability. The same remarks may be applied to the reaction condenser, but as this component is not so critical as that used for tuning there is no reason why a suitable component should not be made as shown in Fig. 5. There are two fixed plates and one moving plate, these being assembled as shown after attaching two thin sheets of mica to the latter by means of thin glue or shellac varnish. The fixed plates are mounted on the ebonite end piece by means of three lengths of threaded rod tapped into the ebonite and locked by three nuts; the plates are separated by means of two washers threaded over each length of screwed rod. The rotating vane is fixed to the spindle (another length of screwed brass rod) by means of a couple of lock nuts, and operates in a bush similar to that used for the switch described above. This reaction condenser will provide the approximately correct capacity, and will work quite smoothly if care is taken in its construction, and if the moving vane (with mica attached) is made to be a fairly tight fit between the fixed ones. Connection is made to one of the rods used to mount the fixed vanes, and also to a terminal connected to the centre spindle by means of a short length of ordinary flex soldered to the latter. It will be seen that the shape

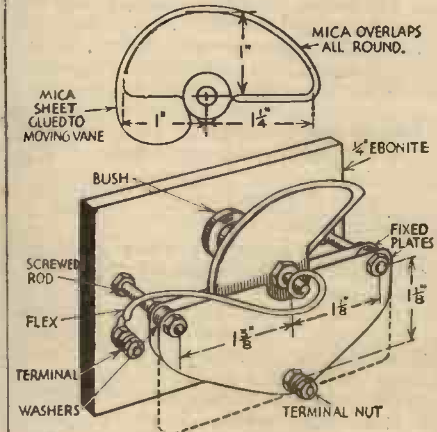


Fig. 5. Constructional details of the reaction condenser described.

of the moving vane prevents rotation through more than 180 degrees, and there is therefore no danger of the flex becoming disconnected.

In the next article we will continue with a description of the few remaining components, and show how they should be wired up, and also describe the assembly of the complete one-valve receiver.

THE TREND OF VALVE DESIGN

(*Continued from page 642*)

Dismountable Valves

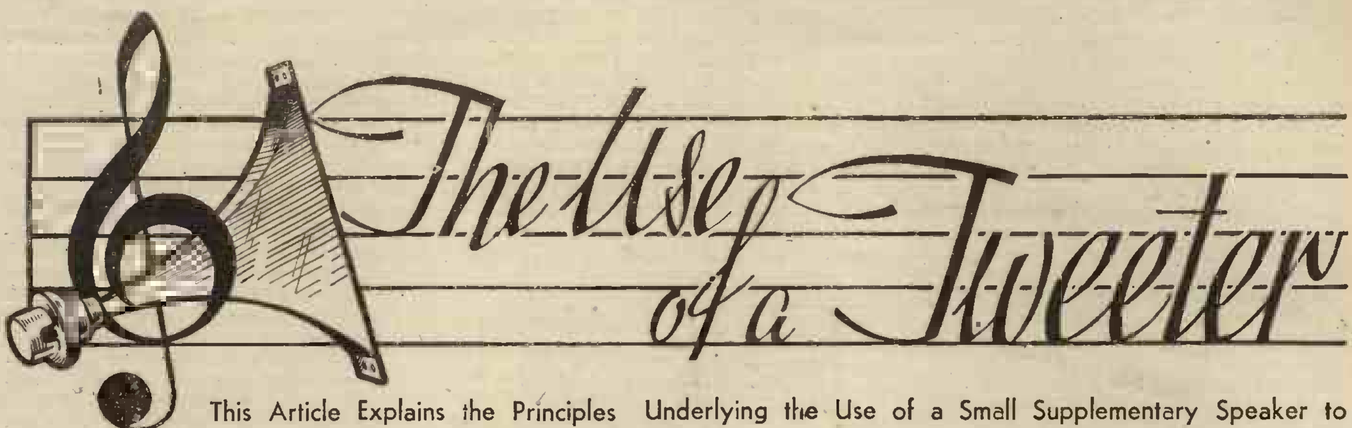
Finally must briefly be mentioned the construction of dismountable valves which can be taken to pieces to renew the filament or cathode.

The glass or glass-and-metal-bulb large power valves are expensive articles, and if the cathode burns out or the grid or plate, the valve is spoilt. Hence attention has been directed to the construction of large high-power transmitting valves in which the "bulb" is entirely a steel tube which can be closed vacuum tight, but also opened up to replace interior parts. As the metal absorbs air molecules, it is necessary to keep a high vacuum pump continually exhausting the "bulb." This has been rendered possible by the discovery of an oil called "Apiezon," which has no sensible vapour pressure at ordinary temperatures and can hence be used in what are called condensation pumps for making high vacua. Such a dismountable valve of 600 horse-power output was exhibited by the Metropolitan Vickers Company at the Albert Hall, London, in 1931. The question whether the dismountable or the metal-glass closed high-power transmitting valve will survive will be determined by initial cost and cost of working, and what unit of power is most convenient. As regards the small receiving valves there does not now seem much room for improvement, but careful attention will be paid in the immediate future to the production of high-power high-frequency or short-wave transmitting valves for Television and receiving valves also for the same purpose.

Metallic "Getters"

An important improvement in valve construction has been the introduction of metallic "getters" to improve the vacuum. Everyone notes that modern receiving valves have a bright appearance as if silvered on the inside of the bulb. This is due to the introduction of a bit of metallic magnesium into the bulb, which is then volatilized by heat after the evacuation by the pumps has been carried as far as possible. The magnesium vapour combines chemically both with the oxygen and nitrogen atoms of the residual air and produces the extremely high vacua necessary with either thoriated or oxide-coated filaments.

Ambrose Fleming



This Article Explains the Principles Underlying the Use of a Small Supplementary Speaker to Assist in the Reproduction of the High Notes.

IT is well known that sound is a wave motion in the same way that wireless radiations, heat, and light are wave motions. But whereas these latter are absolutely independent of any form of matter for their transmission, being disturbances in that intangible medium we call the ether, sound waves can only be propagated through substance. Sound waves are, in fact, mechanical vibrations or movements in the matter itself, so that without the presence of matter there can be no sound.

Producing Sound Electrically

These mechanical vibrations must follow one another fairly quickly to be interpreted by the human ear as sound. If they are slower than this they will not be recognised as sound, but only as movement. For example, if a simple telephone receiver be connected up with a source of electric current as in Fig. 1, the flow of current will cause the diaphragm of the receiver to be attracted towards the magnet; a reversal of the current, on the other hand, will cause a reversal of the movement of the diaphragm as in Fig. 2. Now, if the current while flowing in one direction be gradually reduced in strength to zero, and then slowly increased to its maximum figure in the opposite direction, the diaphragm will gradually move from its position in Fig. 1 to that in Fig. 2. This could be arranged by using an alternating current dynamo as the source of supply and by turning the dynamo slowly. The diaphragm would then oscillate backwards and forwards with each change in the direction and magnitude of the current, but there would be no sound produced. If the speed of the dynamo were now increased until the current changes took place as rapidly as, say, forty times per second then the corresponding vibrations of the diaphragm would produce a low-pitched "burring" sound.

On increasing the speed of the dynamo the vibrations of the telephone diaphragm become correspondingly quicker and the sensation received by our ears is that of a rise in the pitch of the sound being emitted.

Limitations of a Simple Reproducer

By feeding the receiver with alternating current of suitable frequency it will produce any sound from a low "burr" to a high-pitched whistle. It will also, if necessary, produce more than one sound at a time; thus if it is fed with a compound current such as might be found in the output circuit of a radio receiver—one which is, for instance, fluctuating at, say, three distinct frequencies, corresponding to three separate musical notes—it will vibrate in such a manner as to reproduce this compound musical sound. However, no account has been taken of the sensitivity or response of the reproducer. With such a primitive device as that shown here it will be found that the response varies very considerably according to the pitch of the note being reproduced. Thus, if the unit were connected to a wireless set receiving a succession of musical sounds of varying pitch, it would be found that although

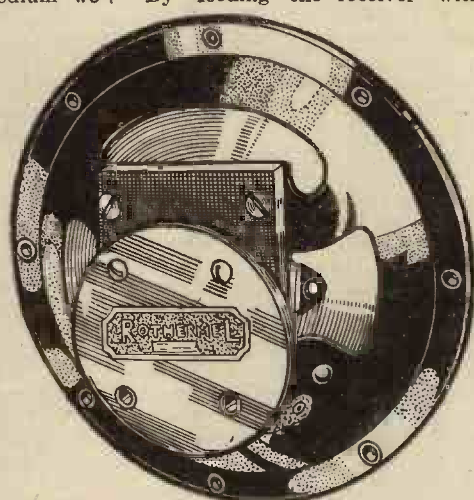
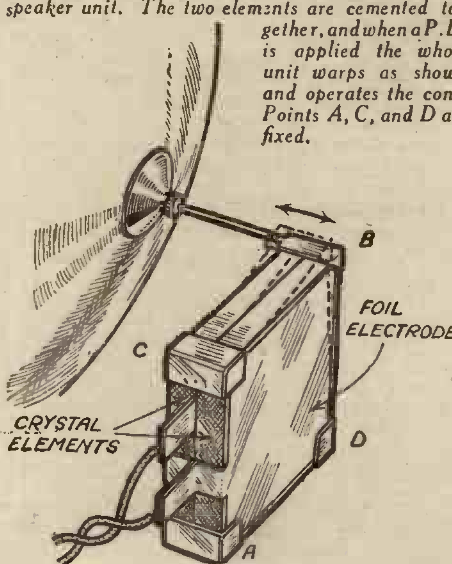
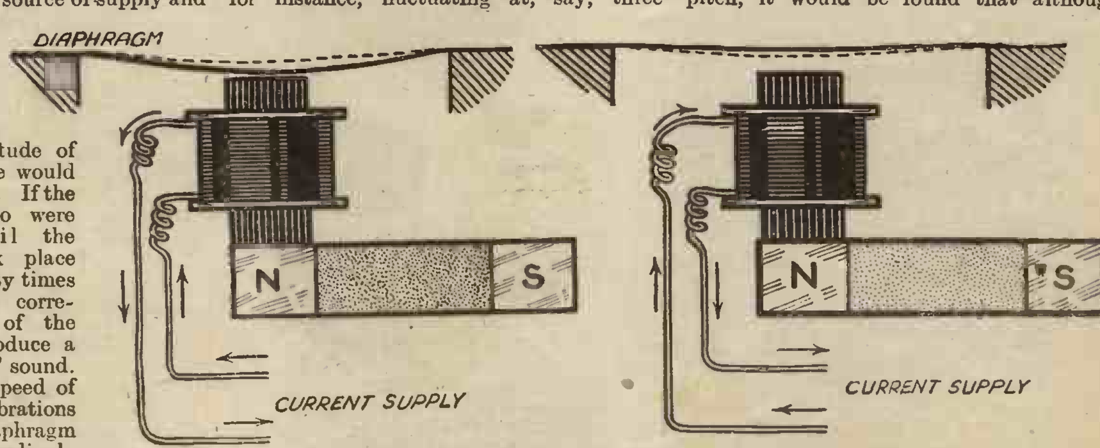


Fig. 4.—A typical "tweeter" or supplementary speaker specially designed to extend the upper frequency limit of the ordinary speaker. The Rothermel piezo-electric unit is shown here.

Fig. 3.—An elementary form of piezo-electric speaker unit. The two elements are cemented together, and when a P.D. is applied the whole unit warps as shown and operates the cone. Points A, C, and D are fixed.





Figs. 1 and 2.—Diagrams illustrating the construction of a very simple form of reproducer.

these sounds were each in turn reproduced by the unit, the relative volume of the different notes would be entirely altered. The middle notes of the musical scale would probably be reproduced in approximately the same relative strengths as the original notes, but the very highest notes, such as the top notes of the piano, would be reproduced comparatively feebly until on reaching the highest audible notes the response would be practically negligible. Coming to the other end of the scale, the very lowest notes would also be reproduced very feebly compared with the middle notes of the scale.

Of course, modern speakers are a great advance over the crude device depicted in Figs. 1 and 2. Resonance, in particular, has been practically eliminated in the best designs. However, the falling off in response towards either the upper or the lower ends of the musical spectrum, or both, is still apparent in the average unit. However, it *is* possible to produce a moving-coil instrument at a popular figure which will give an excellent response from quite low down in the scale up to about 5,000 or 6,000 cycles, and a great many such speakers are at present on the market.

This brings us to the "tweeter." This significant term refers to a class of speaker designed especially for the reproduction of musical notes of the upper register; that is to say, those which correspond to frequencies from about 5,000 cycles to, say, 12,000 cycles.

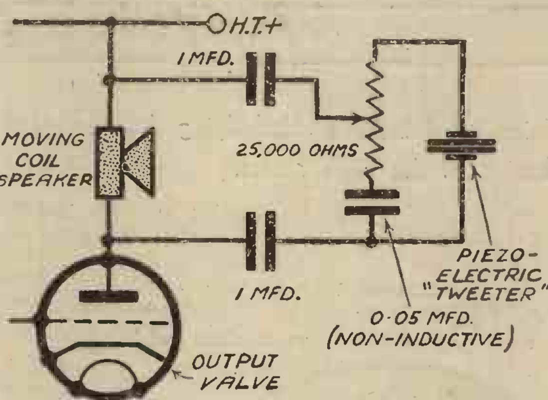


Fig. 5.—Circuit diagram for connection of piezo-electric "tweeter," with volume control.

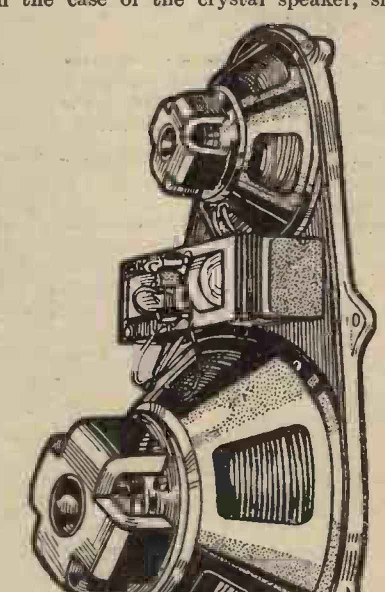


Fig. 6.—A dual speaker arrangement the smaller unit of which acts as a "tweeter" and handles the higher frequencies.

The Piezo-electric Tweeter

The best-known, and probably the most suitable type of tweeter, is a small piezo-electric speaker. An explanation of this type of unit appeared in PRACTICAL WIRELESS dated September 15th, 1934. Briefly, this speaker depends for its operation on the peculiar property of Rochelle salt crystals of distorting when a potential difference is established between opposite faces of the crystal. By making up a small unit consisting of alternate slabs of crystal interleaved with metal foil electrodes, and cementing the whole assembly together, the cone of the speaker can be operated through the medium of suitable levers connecting it to the unit. On connecting the foil electrodes in the output circuit of the receiver the fluctuations of potential due to the speech or music being received are applied to the sides of the crystal slabs with consequent distortion of the unit, and operation of the levers connected to the cone. (See Fig. 3.)

There are several reasons why a piezo-electric speaker makes a good tweeter. Firstly, it is particularly responsive to frequencies between 4,000 and 12,000 cycles—which is what is required. Secondly, it is more sensitive than a moving-coil instrument, and thirdly, the capacity of the piezo-electric unit has a tendency to by-pass the higher frequencies from the main speaker, and so prevent the production of a resonant peak due to the overlapping of the two response curves round about 4,500 cycles.

By using a small diaphragm this type of speaker can be made to give a sharp acoustic cut-off below 3,000 to 4,000 cycles, and thus obviates the necessity for filters to isolate from it those frequencies which it is the job of the main speaker to handle. All that is necessary is to use a simple capacity coupling for the crystal unit. The circuit recommended by the makers of the Rothermel-brush unit shown here is illustrated in Fig. 5. This provides for adjustment of the relative outputs from the main speaker and the crystal unit.

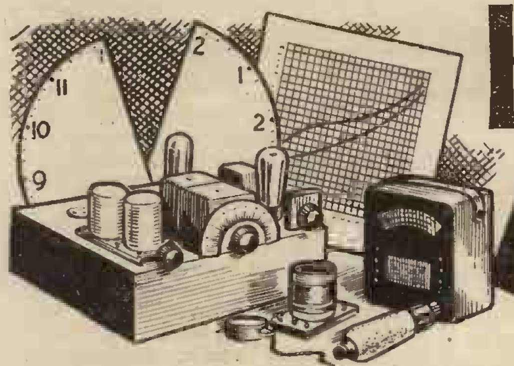
The reality of the reproduction is surprising when a tweeter of this type is used in conjunction with a good moving-coil speaker fed from a quality receiver. Of course, the piezo-electric unit is not the only type of speaker used as a tweeter. Both moving-coil and electrostatic units are adaptable for this purpose. Fig. 6, for instance, shows a matched pair of moving-coil units of the well-known Celestion make, of which the smaller unit acts as a tweeter and takes care of the higher frequencies, while the large speaker responds to the middle and lower frequencies. The small speaker with its lighter cone and diaphragm is able to respond much more readily to the rapid fluctuations of current which represent the higher notes. Because of the light weight of its moving parts the electrostatic speaker is also eminently suitable for the reproduction of the higher frequencies. However, the use of an electrostatic speaker as a tweeter in the accepted sense of the word is not quite so simple as in the case of the crystal speaker, since careful matching with the output and more complicated coupling arrangements are necessary.

A Question of Harmonics

It has already been mentioned that the frequency of the top note of the piano is round about 6,000 cycles, and also that many moving-coil speakers are able to respond to all frequencies from a very low note up to 6,000 cycles with a fairly consistent response. It might be argued, therefore, that a speaker which will handle all notes up to the highest on the piano keyboard without any noticeable resonances or falling off in any part of the scale cannot be far from perfection, at any rate for the reproduction of musical sounds up to a frequency of 6,000 cycles. However, this supposition is fallacious, because it does not take into consideration harmonics and transients.

If you strike a note on the piano you can say right away that it is C or D, or whatever it happens to be, but the sound you hear is not a single tone, but a combination of tones. Naturally, the main note or *fundamental* is the most prominent (in the case of middle C this is a note corresponding to 256 vibrations per second), but it has mixed with it certain harmonics, notably the second, fifth, and seventh. These harmonics are higher notes corresponding respectively to twice, five times, and seven times the frequency of the fundamental. It is largely the number and relative strengths of these harmonics which give the character to different musical instruments, and make it possible to distinguish different instruments playing the same note. Any note played on the violin, for example, has quite a different quality from the same note played on the piano.

You will readily appreciate from what has just been stated that there must be a very large range of tones which if attended by, say, only the second harmonic would be deprived of this if the acoustic response of our speaker cut off above, say, 6,000 cycles. Take the note B, for example, which has a fundamental frequency of 480 cycles and accompanied by a certain percentage of second harmonic (960 cycles). This latter frequency would, of course, be right outside the range of the speaker, and would therefore be absent in the reproduction. Looked at from this angle the necessity for the extension of the useful frequency-range well above the usual upper limit of round about 6,000 cycles is apparent. The higher frequencies which it is the tweeter's function to preserve must be present in the output from the receiver. This may sound rather obvious, but there are many receivers, which in contrast with the majority might be called quality receivers, but which are yet not designed to give an output covering a frequency range above about 5,000 or 6,000 cycles. A tweeter used with such a receiver would obviously not be functioning to its fullest extent. However, it is very unlikely that it would be of no use at all, because the upper notes are very rarely missing altogether from the receiver output, rather are they very feeble in strength compared with those of the middle and lower register. In this case a very sensitive tweeter such as the one shown in Figs. 4 and 5 could be employed, and if adjusted to its maximum output would in some measure compensate for the falling off in the high-note output of the receiver.



HALF-HOUR EXPERIMENTS

The Simple Measurements of Resistance and Capacity are Explained This Week

By FRANK PRESTON

THE testing and measurement of various components lends considerable interest to experimental work, besides being an important necessity when anything "goes wrong." And while it is not possible to take accurate measurements of all the parts of the receiver without the use of comparatively

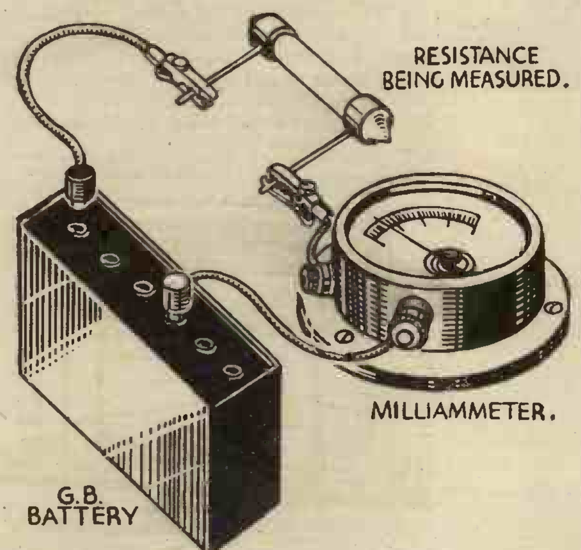


Fig. 1. Resistance values can easily be measured by employing the connections shown here. It will be seen that the resistance to be measured is wired in series with a milliammeter and battery.

expensive and elaborate equipment, reasonably accurate tests can be made of every component by applying a little logic and using nothing more expensive than a good milliammeter. After all, the majority of the tests consist only of checking for circuit continuity, lack of continuity, or the resistance of certain parts.

Easy Resistance Measurement

Simple tests for continuity, etc., were described in a previous article of this series, where it was shown that nearly every measurement required in connection with the complete receiver can be taken by means of a milliammeter, and several of the methods there described can be applied when dealing with individual components. For instance, if it is desired to measure the value of a resistance, it is only necessary to join this in series with a battery and milliammeter, as shown in Fig. 1. From the simple formula: Resistance (in thousands of ohms) equals the voltage divided by the current in milliamps., it is an easy matter to find the resistance value. For example, if it were found that by using a voltage of 6 a current of 2 milliamps. was recorded, it would be known that the resistance had a value of 3,000 ohms. On the other hand, if a voltage of 4½ caused the meter to show a reading of 9 milliamps., the resistance would be known to be one-half of one thousand ohms, or 500 ohms. When one has no idea of the value of the resistance it is better to commence by using a voltage of only about 1½ in order to avoid the possibility of damaging the meter due to the passage of too great a current through it; if necessary the voltage can then gradually be increased until a reading equal to nearly the maximum of the meter is obtained.

In the measurement just described the resistance of the meter itself has not been taken into consideration, but this is unimportant if a moving-coil type of instrument is employed, since the resistance will, in any case, be extremely low by comparison with the resistance itself.

The Resistance "Bridge"

A more accurate method of resistance measurement, however, is by means of a resistance "bridge," a practical example of which is shown in Fig. 2. The only parts required are a 10-ohm variable resistance, a good milliammeter, and a few resistances of known value. Actually, the meter should in this case be of the centre-zero type, but an ordinary one will serve if care is taken. The idea is that when the slider of the variable resistance is set so that the meter gives a zero reading a certain ratio exists between the various parts of the circuit, and the value of the unknown resistance can easily be calculated. The ratio can best be explained by referring to Fig. 3, which shows the idea in theoretical form. Here, we have the ratio: R.1/R.2=R.x/R.3, or R.x (the resistance being measured)=R.1, multiplied by R.3 divided by R.2. Expressed mathematically this becomes:—

$$R.x = \frac{R.1 \times R.3}{R.2}$$

In practice it is unnecessary to consider the actual resistances of the portions of the variable resistance marked R1 and R2, and these may be taken as proportional to the distances of the slider from each end of the resistance. Thus, the value of the unknown resistance can be found by taking a certain fraction of the known resistance, R3. In making the "bridge" a scale should be made to fit the variable resistance, and this should be divided equally round its circumference, and a pointer should be fitted to the knob. If marks are made to indicate the ends of travel of the pointer the distances between it and the ends can easily be observed.

Measuring Higher Resistance Values

This method of resistance measurement is particularly suitable for use in conjunction with components of comparatively low resistance—up to, say, 200 ohms—and can therefore be applied to coils and similar components. When parts of higher resistance are concerned it is necessary to use a potentiometer having a maximum value of about 100,000 ohms and to increase the voltage of the battery to about 100. The potentiometer must not, of course, be of the graded type, and must be suitable for carrying a small current. Especial care

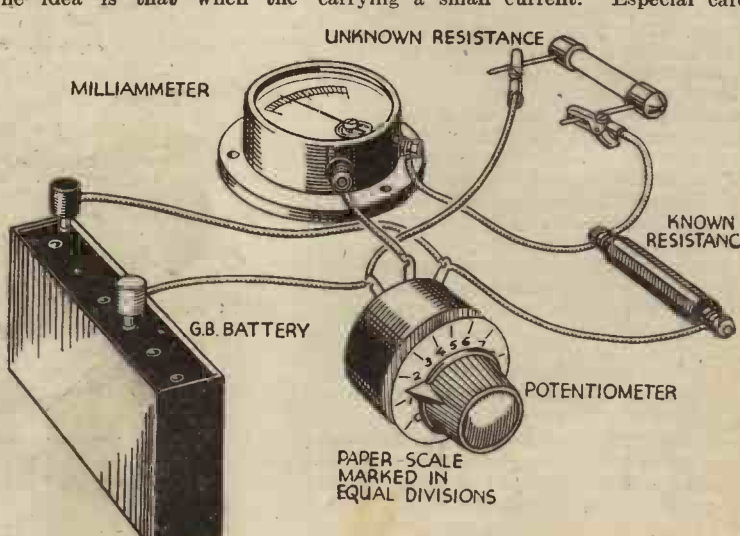


Fig. 2. A practical application of the "bridge" system of resistance measurement; it is described in the text.

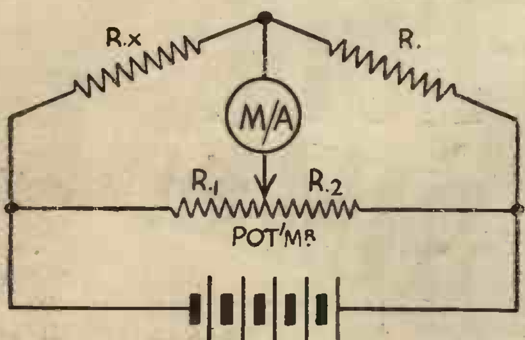


Fig. 3.—Theoretical circuit of the resistance "bridge" from which the principle of measurement can easily be understood.

must be taken when using the higher voltage, because if the slider of the resistance were near to one end, or if the resistance being measured had a value of only a few hundred ohms, there would be a danger of the milliammeter being burnt out. Because of this it is wise to take the precaution of starting with a very low voltage and gradually increasing it until the needle of the meter begins to show some sign of movement. When the slider is on one side of the "balance" point, the needle will move below the zero mark on the scale, and when it is on the other side it will give a positive reading. Careful adjustment of the potentiometer will bring the needle to the exact zero position.

As an example of the simple calculation required, suppose that the slider had to be set to the seventh point on a ten-point scale, and that the value of the known resistance was 5,000 ohms; the value of R.x would be 7/3 x 5,000, or approximately 12,000 ohms. Although, as stated above, a milliammeter can be used, it is much better to use a centre-zero galvanometer, and one of these can be bought quite cheaply from many of the dealers in Government surplus goods. There is also a centre-zero milliammeter made by Bulgin which costs 7s. 6d.

Capacity Measurement

The measurement of capacity can be carried out on similar lines to the method just described in connection with resistances, but an even simpler method for condensers of .0005 mfd. or less is to connect the condenser in parallel with the tuning condenser of a Det.-L.F. type of receiver. The method is as follows: first tune in to a transmission near the top of the condenser scale, then connect the fixed condenser in parallel and alter the tuning condenser until the same transmission is again received. The difference in capacity of the variable condenser at the two positions is the capacity of the fixed condenser. Even so, the matter is by no means easy in the case of modern condensers having vanes shaped to give straight-line-frequency tuning, so it is worth while to obtain an old condenser of the type having semi-circular vanes (if such a component cannot be "fished" out of the junk box). With this type of condenser the capacity is proportional to the scale reading, and so no difficulty exists.

In dealing with condensers of rather more than .0005 mfd., it might be necessary to connect a fixed condenser of known value in parallel with the tuning condenser in order to tune to a station received when the unknown condenser was in circuit. In that case the capacity of the additional condenser would have to be added to the "difference" capacity in determining the value of the unknown component.

A Capacity "Bridge"

Condenser capacities can also be measured by means of a "bridge" circuit similar to that described in connection with resistance measurements, but a calibrated variable condenser is then required and the circuit becomes as shown in Fig. 4. A 10,000-ohm potentiometer is also used, and the ends of the bridge are connected to a high-note buzzer and battery, whilst the galvanometer used for resistance measurement is replaced by a pair of 'phones. The calibrated variable condenser and the potentiometer are adjusted until there is no sound to be heard in the 'phones, or until the buzz is as weak as it can be made. That is, the position is found at which the hum is faint, and such that

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Full Details on Page 692

movement of either the potentiometer or variable condenser in either direction increases the sound intensity. The formula for calculating the value of the unknown condenser (C.x) after making the adjustments referred to is:—

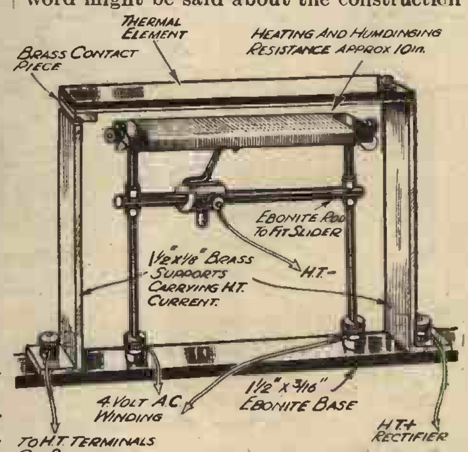
$$C.x = \frac{C \times R}{R.1}$$

The calibrated variable condenser mentioned above might simply be an old, but reliable, condenser of the circular-vane variety, and the capacity can be taken as being proportional to the amount of rotation of the dial. This, of course, is not very accurate, since the minimum capacity of the condenser will not be zero, but a measurable capacity. For most normal requirements, however, this method of reckoning will be good enough.

When more accurate readings are required it will be desirable to obtain a calibrated laboratory condenser, but this is normally an expensive piece of equipment, although sometimes available at a very "cut" price from dealers in surplus gear. It will be appreciated that, as shown, the capacity "bridge" is suitable for values up to about .005 mfd. only, but higher capacities can be dealt with by using a fixed condenser of known value (or two or more condensers in parallel) in place of, or in addition to, the calibrated variable.

COMBINED THERMAL-DELAY SWITCH AND HUMDINGER

THE accompanying sketch illustrates a combined thermal-delay switch and humdinger which has been used for some time with success. The sketch itself is self-explanatory, but a word might be said about the construction



A combined thermal-delay switch and humdinger.

of the thermal element. This is constructed of 1/16in. ebonite and aluminium of similar thickness riveted together. The distance between the heater and the thermal element should be about ¼in., and the contact on the latter should consist of a screw with a pair of lock nuts so that it is adjustable.

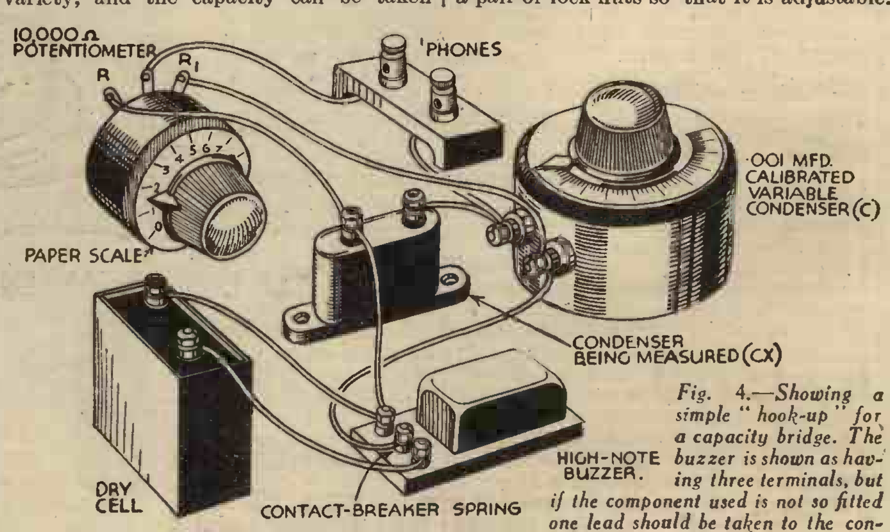


Fig. 4.—Showing a simple "hook-up" for a capacity bridge. The buzzer is shown as having three terminals, but if the component used is not so fitted one lead should be taken to the contact-breaker spring which is internally joined to one end of the windings.

AGAIN CHOSEN by MR. F. J. CAMM

Mr. Camm's increasing following is largely due to his independent and forthright views on questions of technical design. He *guarantees* his sets to operate satisfactorily if the components which he has personally tested and chosen are used.

One thing, however, he has in common with other leading designers of to-day—*he prefers W.B. Speakers, and specifies them exclusively for every important set.*

The amazing new magnetic system and the revolutionary "Whiteley" speech coil will bring to *your* set an additional volume and a new startling realism which you must hear to believe. Ask your dealer for a demonstration *to-day*. You will be astounded.

Stentorian Senior, type PMS1. The largest W.B. "domestic" model. The *exclusive* new magnetic material gives enormous sensitivity. New Whiteley speech coil brings a crispness of attack hitherto unobtainable. 100% dust protection. Oversize cone. "*As near perfection as I believe perfection possible,*" says Mr. Camm. CHASSIS **42/-**

PMS1

Stentorian Standard, type PMS2. Exclusively specified by Mr. Camm for his "1934 Superhet," "All Pentode III" and "Hall-Mark III." Similar to Senior Model but smaller. New "Stentorian" magnet material. New Whiteley speech coil. Like the Senior model, it has the "Microlode" feature for *accurate* matching to *any* output, whether as principal or extension speaker. Now specified *exclusively* for the "Hall-Mark Four" battery model. CHASSIS **32/6**

PMS2

Stentorian Baby Model PMS6. A midget speaker of an amazing performance. Magnet and special coil similar to Senior and Standard models, but smaller. Wonderfully sensitive for its size. Provided with tapped transformer for power, pentode, or Q.P.P. output. CHASSIS **22/6**

PMS6

W.B. "Stentorian" energised speaker, model EM2/PW. Specially designed by W.B. engineers to Mr. F. J. Camm's specification for his amazing new set—the "Hall-Mark Four." Each speaker individually tested in the W.B. laboratory to ensure the particular characteristics required. New Whiteley speech coil. Special transformer accurately matched to the "Hall-Mark Four" output. CHASSIS **29/6**

EM2/PW

Write for the new W.B. Stentorian leaflet.

EXCLUSIVELY SPECIFIED FOR EVERY HALL-MARK FOUR MODEL

Whiteley Electrical Radio Co., Ltd., Technical Department, Radio Works, Mansfield, Notts. Sole Agents in Scotland: Radiovision Ltd., 233 St. Vincent Street, Glasgow, C.2. Sole Agents in I.F.S.: Kelly & Shiel, Ltd., 47 Fleet Street, Dublin.

Presenting F. J. CAMM'S A.C. HALL-MARK

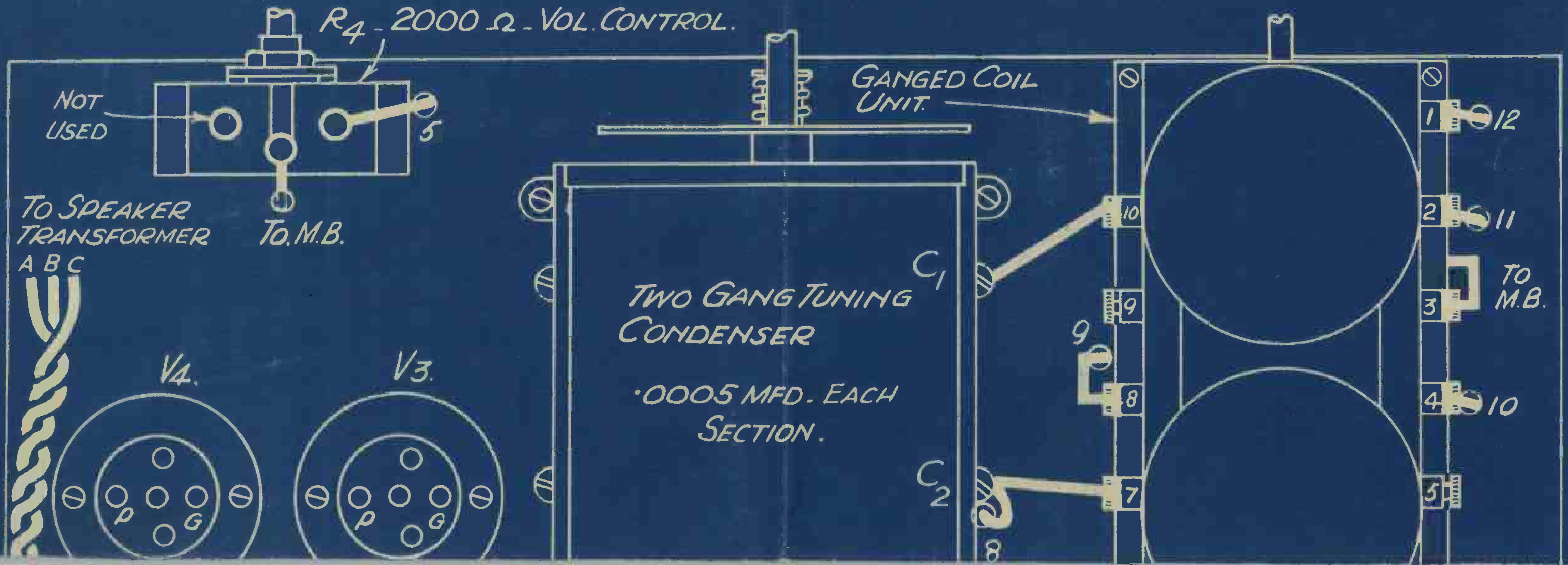
IN response to the many thousands of requests we have received during the past six months for a powerful, high-fidelity, yet simple and cheap receiver, we have great pleasure in illustrating and describing on following pages Mr. F. J. Camm's latest design. Publication of this design synchronises with the completion of the Grid Scheme, which will carry electricity into the remotest parts of the British Isles. Here is a receiver worthy of this latest development, and which is superior to many high-quality commercial receivers costing 30 guineas or more. The Free Blue Print given with this issue shows the position of every wire and every component. Even the beginner can make it. As usual, the A.C. Hall-Mark Four is backed by our Free Advice Guarantee. Readers may thus build it secure in the knowledge that service in the best interpretation of that term exists to help them should difficulties arise.

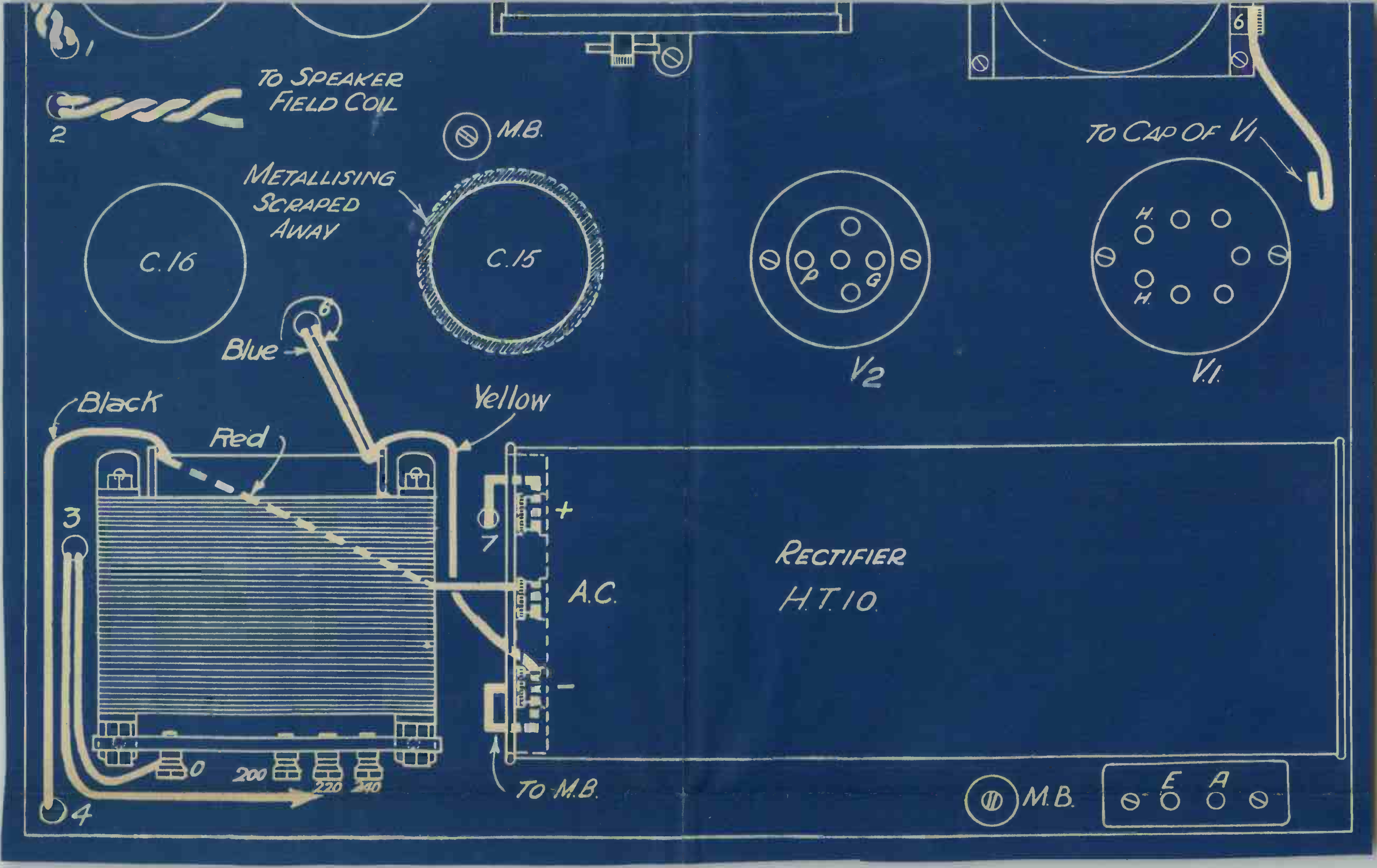
The First of our New "Q" Receivers

BLUEPRINT NO 45
PRESENTED FREE WITH "PRACTICAL & AMATEUR WIRELESS"
DATED JANUARY 26th/35

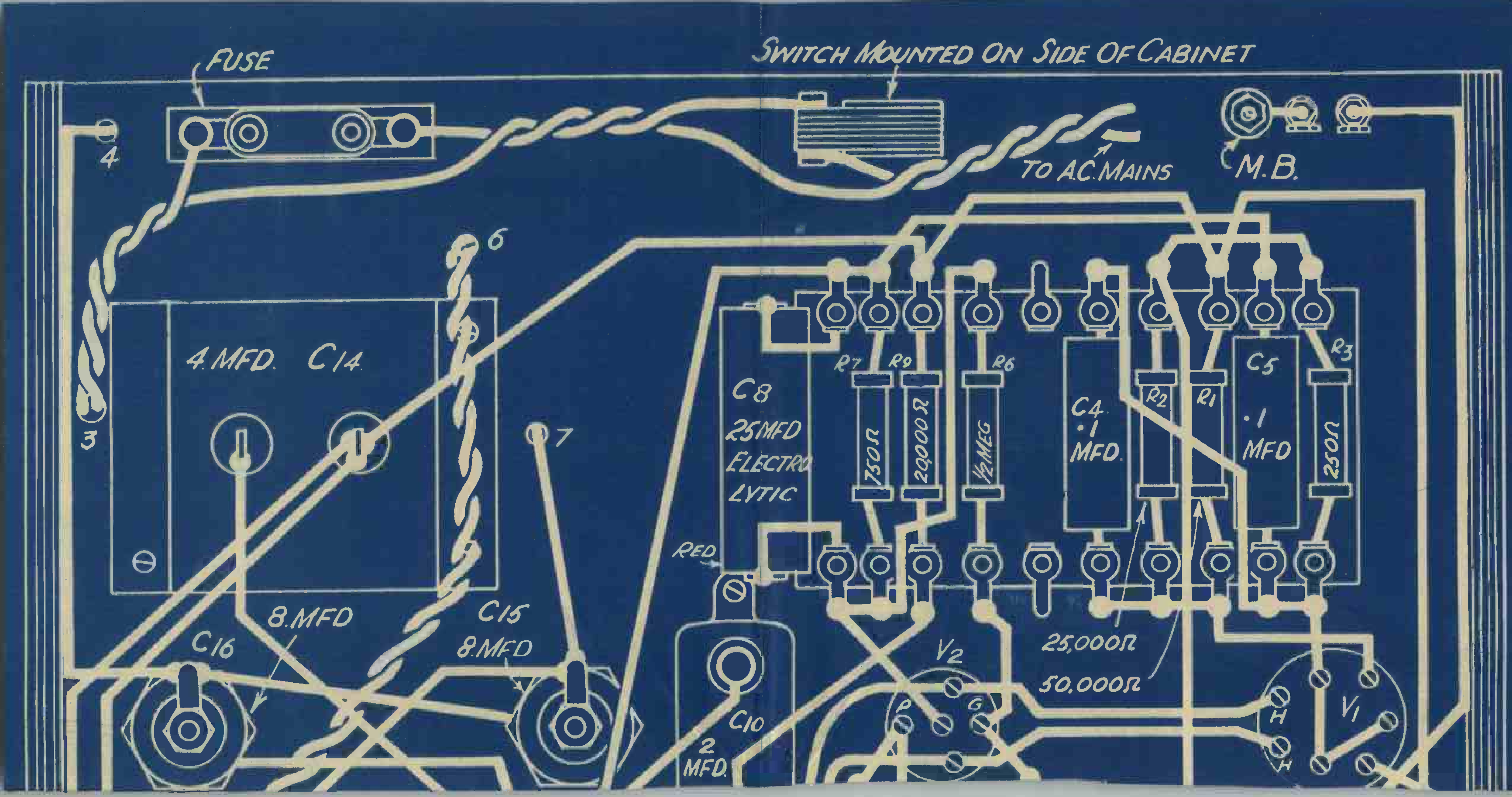
F. J. CAMM'S
A.C. HALL-MARK

PUBLISHED BY
GEO NEWNES LTD
8-11 SOUTHAMPTON ST.
STRAND W.C.2
PRICE 1/-

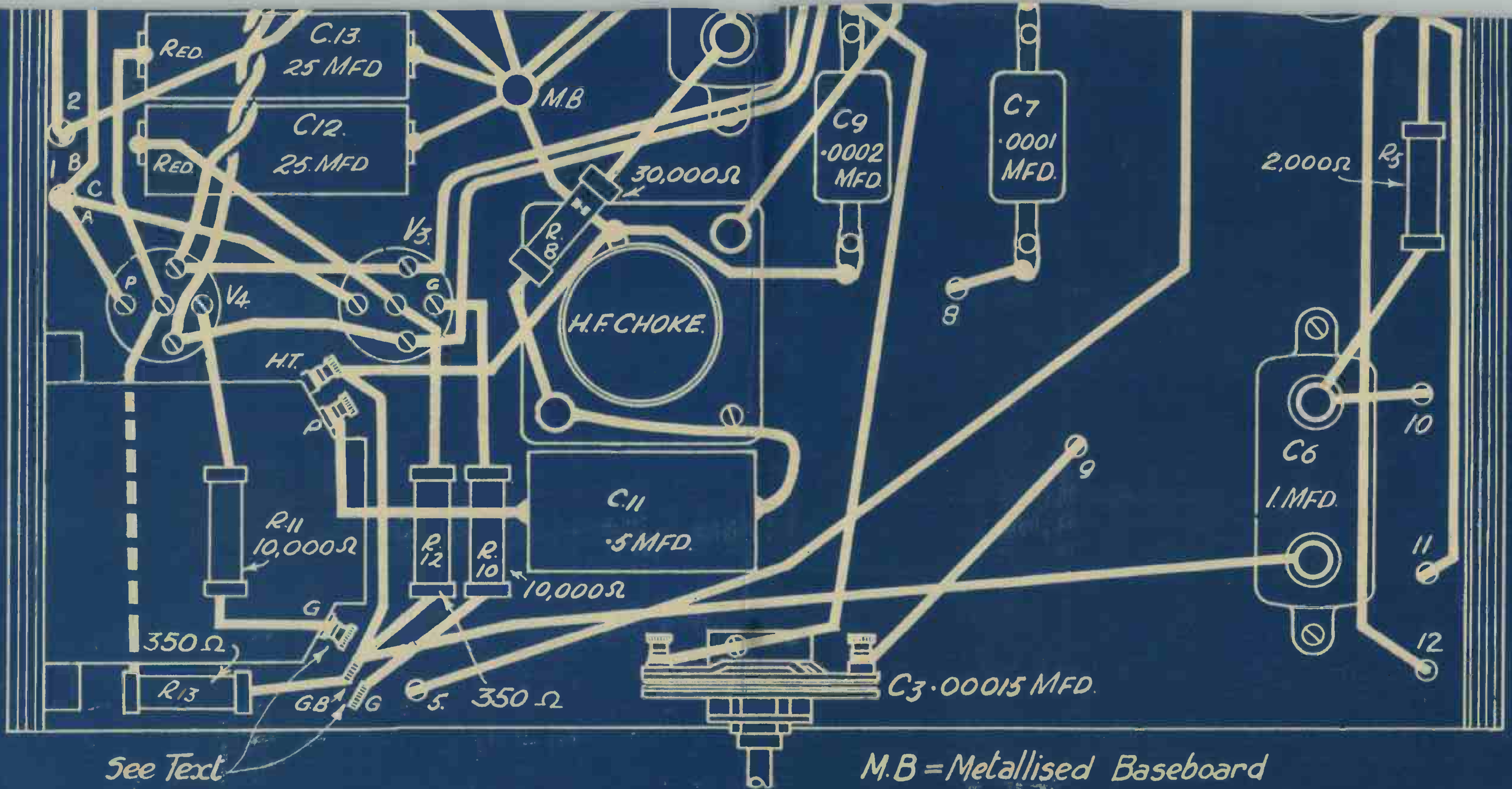




To Speaker Field Coil
1
2
M.B.
Metallising Scraped Away
C.16
C.15
To Cap of V1
H.
H.
P
G
V2
V.1.
6
Blue
Black
Red
Yellow
3
4
0
200
220
240
7
+
A.C.
−
Rectifier H.T.10.
To M.B.
M.B.
E
A



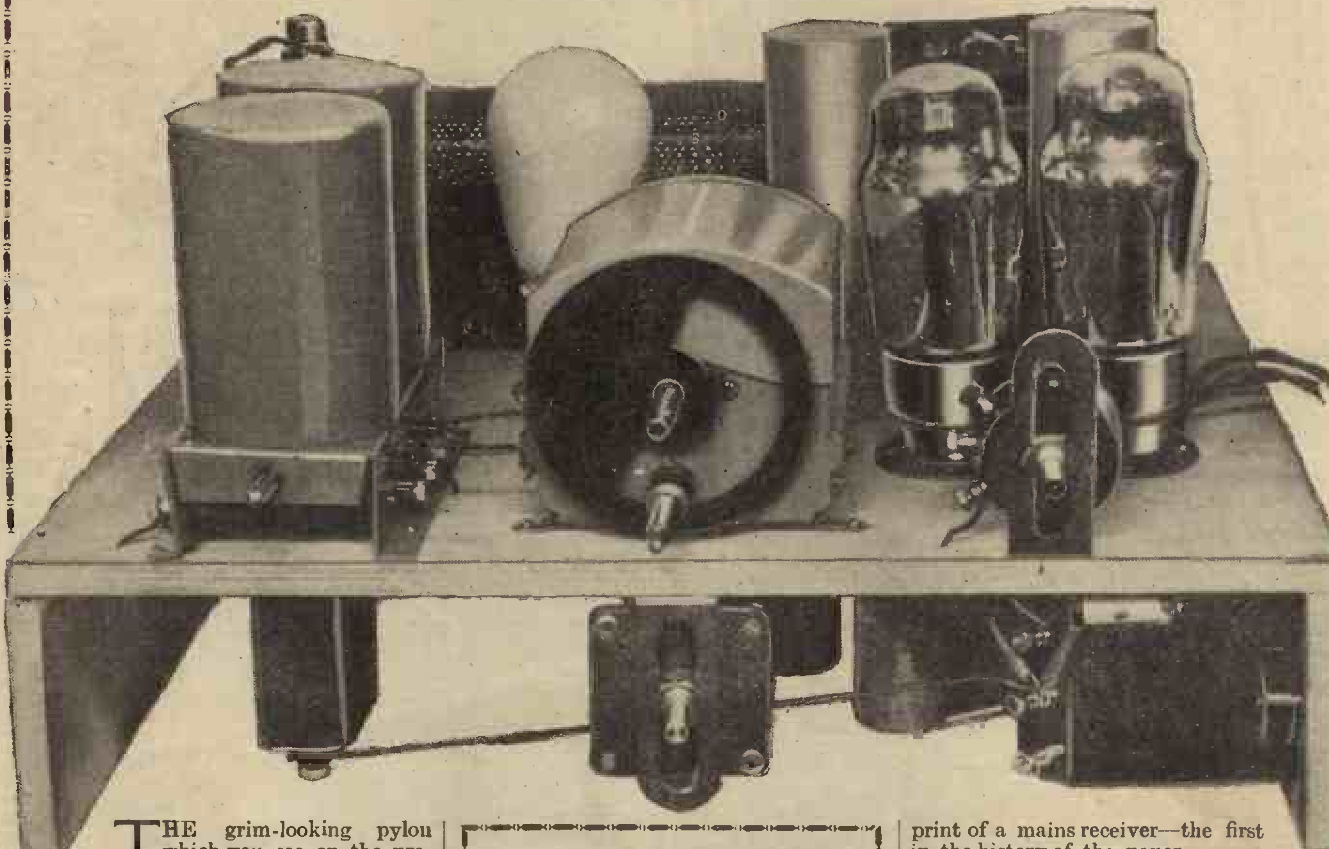
SWITCH MOUNTED ON SIDE OF CABINET
FUSE
4
3
6
7
TO A.C. MAINS
M.B.
4. MFD. C14.
C8
25 MFD
ELECTRO
LYTIC
RED
R7
R9
R6
750Ω
20000Ω
½ MEG
C4
·1
MFD.
R2
R1
C5
·1
MFD
R3
250Ω
25,000Ω
50,000Ω
V2
P
G
V1
H
H
C16
8. MFD
C15
8. MFD
C10
2
MFD.



M.B = Metallised Baseboard

BUILDING the

Our New High-quality Receiver with Many Striking Features. Follow the Blueprint to Ideal Radio and Enjoy the Reliability and Super Performance of a Hand-made Job. Battery and Universal Mains Models to be Produced. For List of Special Features see page 656



By F. J. CAMM

THE grim-looking pylon which you see on the previous page symbolises the network of arteries and veins which thread their way all over the country and feed the remote towns and villages with the form of energy formerly only the prerogative of the few. Thousands of miles of these overhead cables suspended on thousands of pylons feed the whole country with electrical power at the enormous electrical pressure of 166,000 volts. The grid scheme is now virtually complete, and the gradual conversion of the electrical supply system from D.C. to A.C. is now in progress. It would appear from official figures that there are equal proportions of battery users and mains users, and if, as it is expected, the provision of cheap electricity will result in the addition of hundreds of thousands of more homes being supplied with electricity, we may reasonably expect to see the proportion of users of battery-operated wireless sets decline. That is an argument which has been advanced many times during the past five years, but now that the Central Electricity Board has concluded its series of ugly pylons and seemingly provided an excellent means for the paralysis of the country from the power point of view in the time of war, it remains to be seen whether this will, as a fact, be the case.

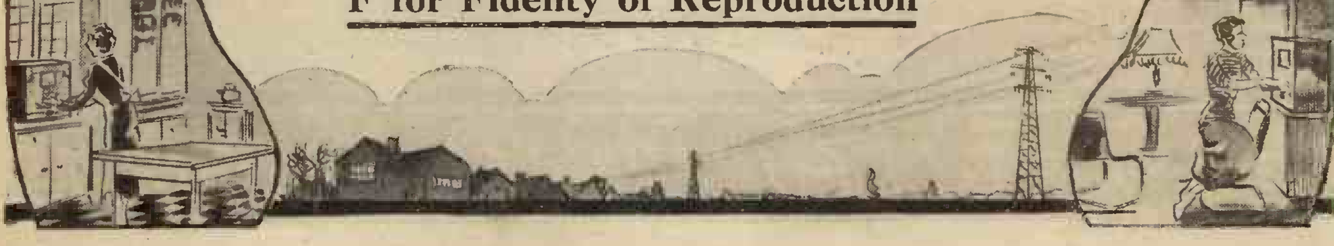
Personally I am inclined to think so, for the correspondence I am receiving asking for mains receivers grows in volume almost daily. PRACTICAL WIRELESS from its commencement has always catered for the battery user when it has issued a blueprint of a new receiver. It seemed to me an opportune time, now that the Grid Scheme is practically complete, to issue a FREE blueprint of a mains receiver—the first in the history of the paper.

Notwithstanding the immediate and continued success of my three-valve Superhet series recently concluded in this paper, I have received many hundreds of letters from mains users who do not want a superhet and have asked for a reasonably-priced quality receiver capable of large undistorted output and capable of receiving the majority of worth-while transmissions. Here, in the A.C. Hall-Mark Four, is the result of my experiments in this direction.

It is perfect. But in order that the battery user may have the advantages which this receiver gives, I am also producing a battery version of it, as well as a model using universal valves. These two latter models are introduced on later pages, and full constructional details will be given in the next two issues of PRACTICAL AND AMATEUR WIRELESS.

A word to the D.C. user. I do not propose to produce a special D.C. version of

F for Fidelity of Reproduction

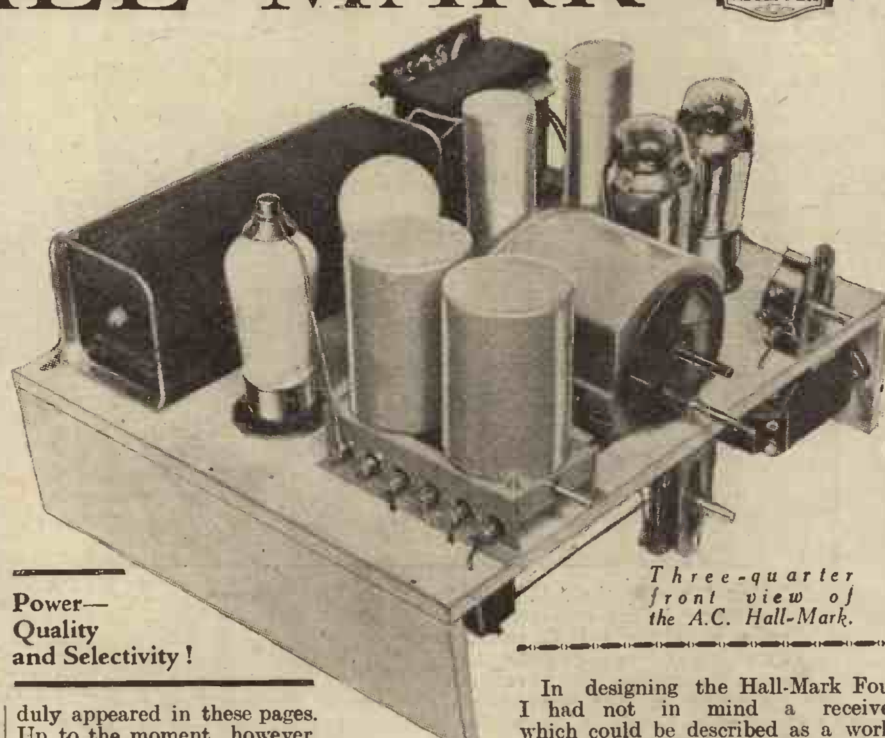


A.C. HALL-MARK

Practical Wireless GUARANTEED RECEIVER

SPECIAL FEATURES

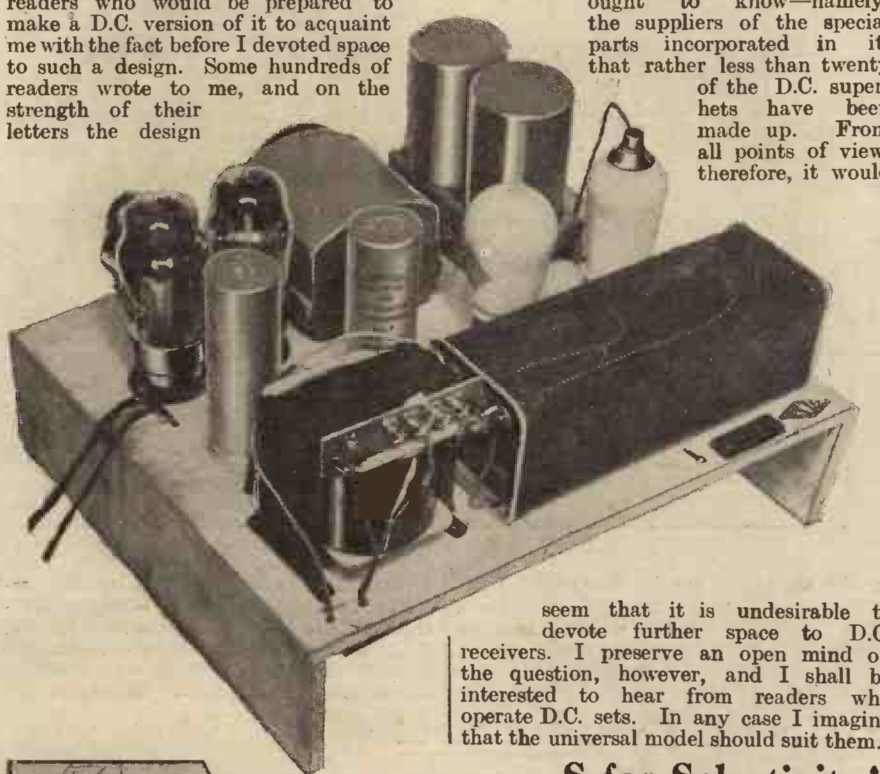
- Quality and Large Undistorted Output at Low Cost—more than 2 watts undistorted output.
- Well-tried Circuit—Variable-mu H.F., Leaky-grid Detection, Push-pull Output.
- Ideal for use as Radio Receiver or Radiogramophone.
- Easy Construction—Coils with self-contained W/C switches. Simple Components and Circuit.
- Ample Selectivity for normal requirements—due to use of aerial coil with loose-coupled winding, and use of efficient H.F. transformer with tuned secondary.
- Smooth Reaction Control which increases selectivity when required.
- Graded Volume Control by Variable-mu Potentiometer.
- Ample Decoupling in all Circuits.
- Absence of Mains Hum because of thorough decoupling, and use of Large-capacity Electrolytic Condensers.



Three-quarter front view of the A.C. Hall-Mark.

Power—Quality and Selectivity!

the A.C. Hall-Mark Four. When I published the design for my £5 Three-valve Superhet I penned a note asking all those readers who would be prepared to make a D.C. version of it to acquaint me with the fact before I devoted space to such a design. Some hundreds of readers wrote to me, and on the strength of their letters the design duly appeared in these pages. Up to the moment, however, I am assured by those who ought to know—namely, the suppliers of the special parts incorporated in it, that rather less than twenty of the D.C. superhets have been made up. From all points of view, therefore, it would seem that it is undesirable to devote further space to D.C. receivers. I preserve an open mind on the question, however, and I shall be interested to hear from readers who operate D.C. sets. In any case I imagine that the universal model should suit them.



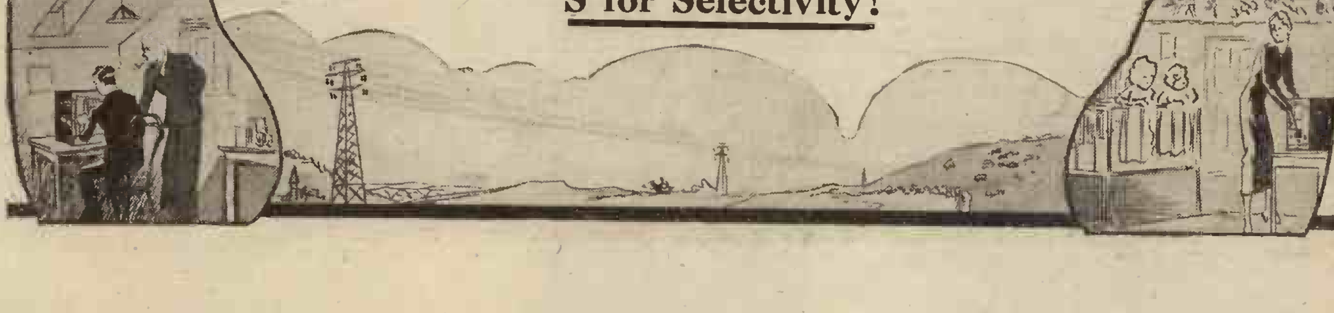
In designing the Hall-Mark Four I had not in mind a receiver which could be described as a world circler, but yet such in fact it has turned out to be, for on a recent evening, when compiling a log of stations received, I found that its performance was superior to that of a well-known commercial receiver costing thirty-five guineas.

Just a word or two about quality receivers. The public has unfortunately taken as its unit of comparative value the cheap commercial receiver which you can buy for 5s. down and so much a week. You cannot expect real radio for a few pounds if you are considering commercial receivers. As I have said many times before, you cannot mass-produce wireless sets to give uniform results, and it is possible that in purchasing the finished product you may be unlucky. The hand-made product, on the other hand, has everything in its favour. To start with it must be cheaper, and it must be better; having built it you know your way about it and even though you may know little of the theory of wireless you will be able to put your finger on any spot which may be giving rise to trouble.

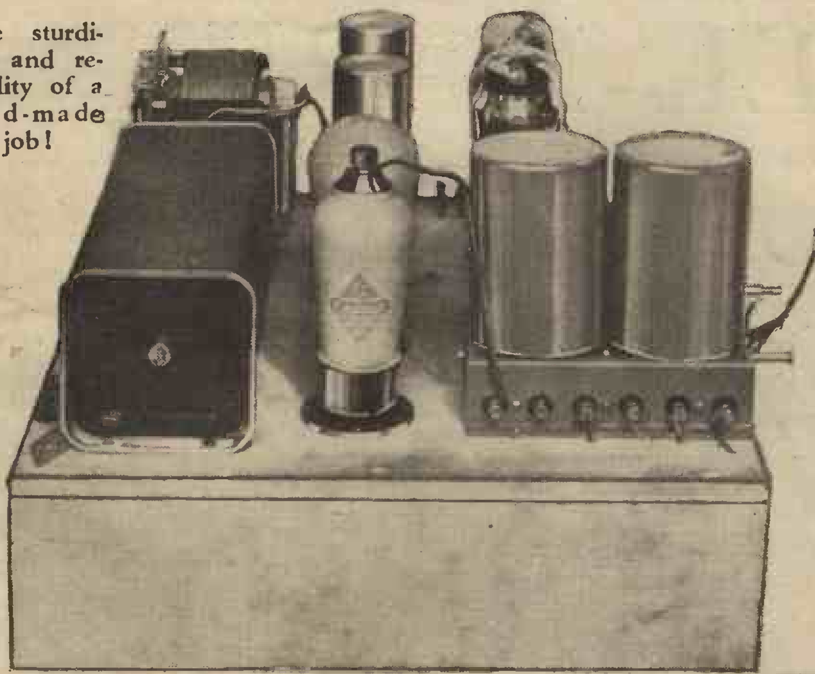
It has been something of an eye-opener to me to learn that so many readers are interested in high-fidelity reproduction, and in my past designs I have concentrated rather on reasonable quality of reproduction to satisfy ordinary needs and have indeed sacrificed a certain amount of the refinements of quality in order to gain selectivity and sensitivity.

A quality receiver of the type which my readers have asked for postulates at once

S for Selectivity!



The sturdiness and reliability of a hand-made job!



Clean, simple lines which give the A.C. Hall-Mark Four a professional finish, with the reliability of a hand-made job.

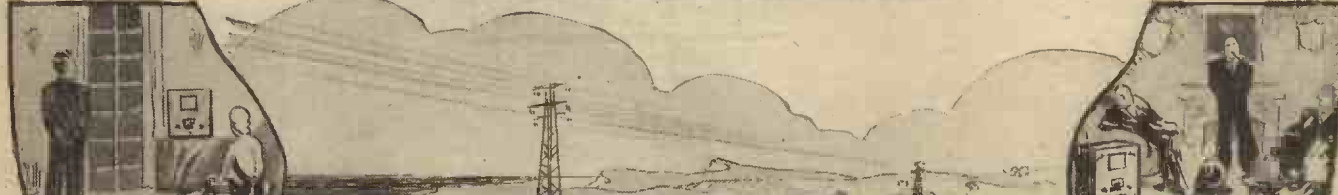
a well-tried circuit, and in the A.C. Hall-Mark Four this may briefly be described as including a variable-mu H.F. stage, leaky-grid detection, and push-pull output. A fair amount of misconception exists regarding push-pull amplification; this receiver is capable of giving 2½ watts undistorted output, but unlike a single output valve capable of fairly high output, which is usually accompanied by blaring, distortion, and lack of quality, with push-pull the high output is there without it being obtrusive. Also, this system of amplification permits of a much finer degree of control, for it is seldom desirable to push the valves to their peak limit. There is always plenty of reserve, so that you can build up the weak stations and "fade" the more powerful ones.

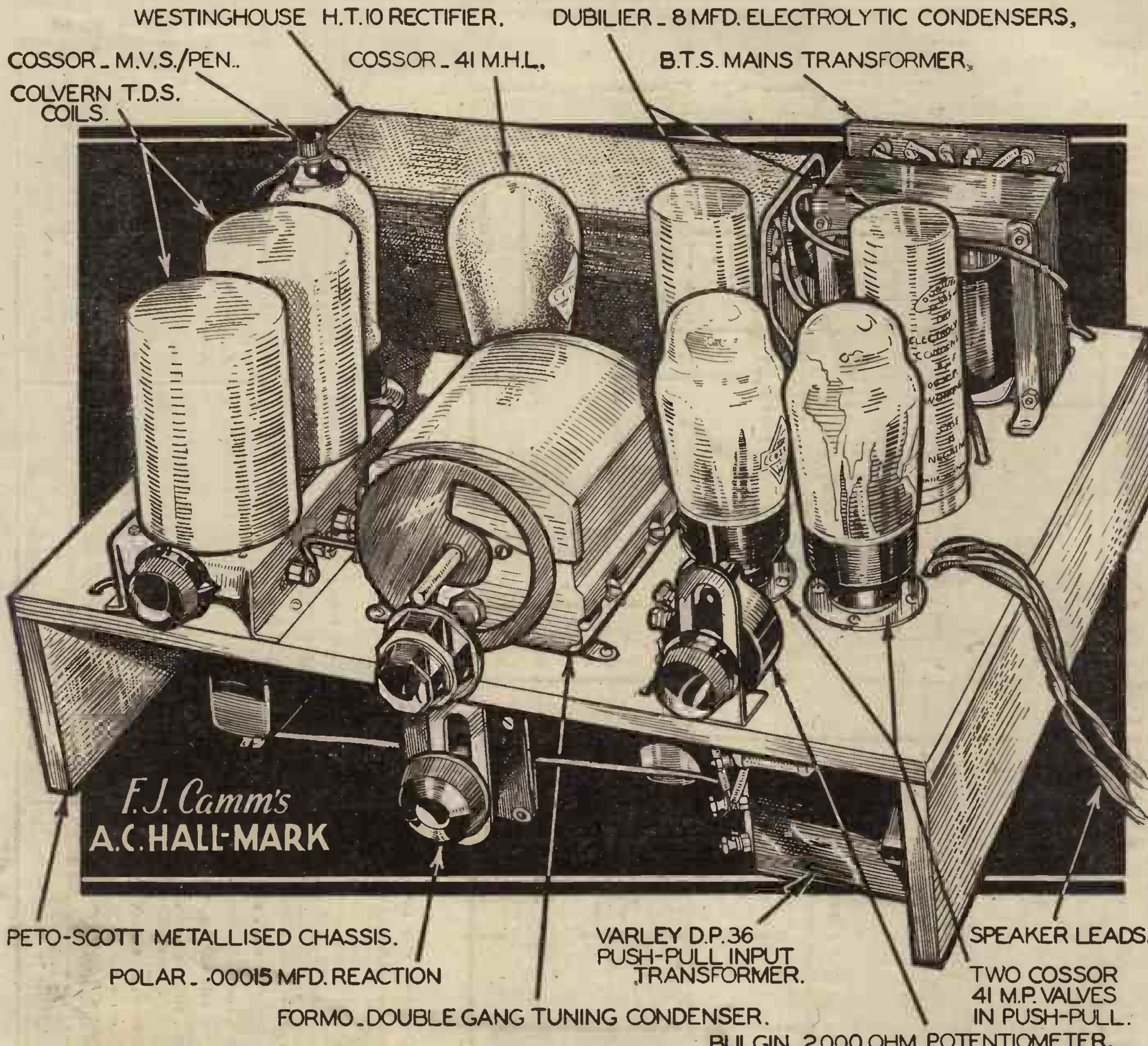
Another great advantage is that it is ideal for use as a radio receiver or radio gramophone, and there seems to be a growing tendency among readers to make the combined instrument.

There is ample selectivity for normal requirements, due to the use of an aerial coil with loose-coupled windings and the use of an efficient H.F. transformer with a tuned secondary. The reaction is delightfully smooth and also functions to increase selectivity when required. The volume control is smooth and graded, and there is ample decoupling in all circuits. Hence, there is no trace of mains hum. The use of large-capacity electrolytic condensers assists towards this end.

Now, whenever one attempts to produce a high-quality receiver, the price question looms large and is likely to have a discouraging effect. It discouraged me, until whilst discussing the design with prominent trade designers I secured their co-operation in the matter of special low-priced components. Hence, in the A.C. Hall-Mark Four you have a receiver which is superior to so-called quality receivers costing thirty guineas or more. An examination of the circuit on later pages reveals no intricacies of design, no stunts, and no components which cannot be obtained at all good wireless shops throughout the country. Any reader experiencing the slightest difficulty in obtaining components should immediately get into touch with me, giving the name of his local dealer. I understand that some readers experienced difficulty in obtaining parts for my last receiver in spite of the precautions I took to see that adequate supplies were available. Investigation shows that in many cases the delay was due more to the local dealer than to anyone else, for whilst a local dealer can make several pounds profit on a complete receiver, he is not likely to be anxious to push the sale of wireless components on some of which his profit may only amount to a few pence. This does not, of course, apply in every case, for I have compiled a list of some hundreds of wireless dealers who carry reasonable stocks of all wireless components. Hence my request that if difficulty is experienced in obtaining parts the reader should get into touch with me forthwith. The construction of the receiver, as will be apparent from the illustration and the free blue print in this issue, really requires very little description, but I desire to draw the reader's attention to one or two special points. In drilling the

P for 2½ watts Power Output!





holes for the valve-holders it must be remembered that the MVS/Pen valve-holder requires a 1¼in. hole, whereas the other three require 1in. holes. Secure the valve-holders centrally in the holes to avoid the possibility of short circuits from the pins to the metallised baseboard. This latter, by the way is supplied already assembled, and Messrs. Peto-Scott Co., Ltd., supply them ready drilled to order.

There is ample space between all of the components to avoid interaction, and therefore each individual part may be mounted before wiring is commenced. The reaction condenser and the potentiometer are mounted on adjustable brackets; the exact dispositions are shown on the blue print. The quickest method of locating the exact position of each component is to lay the blue print over the chassis and prick through, thus marking the position of the screw-hole.

A special warning is necessary in connection with the resistance strip, or group board. This considerably simplifies construction, since most of the resistances and certain of the tubular condensers can be fastened in and soldered at one operation. The warning is that care must be taken to space all resistances to avoid the possibility of their ends touching and thus short circuiting.

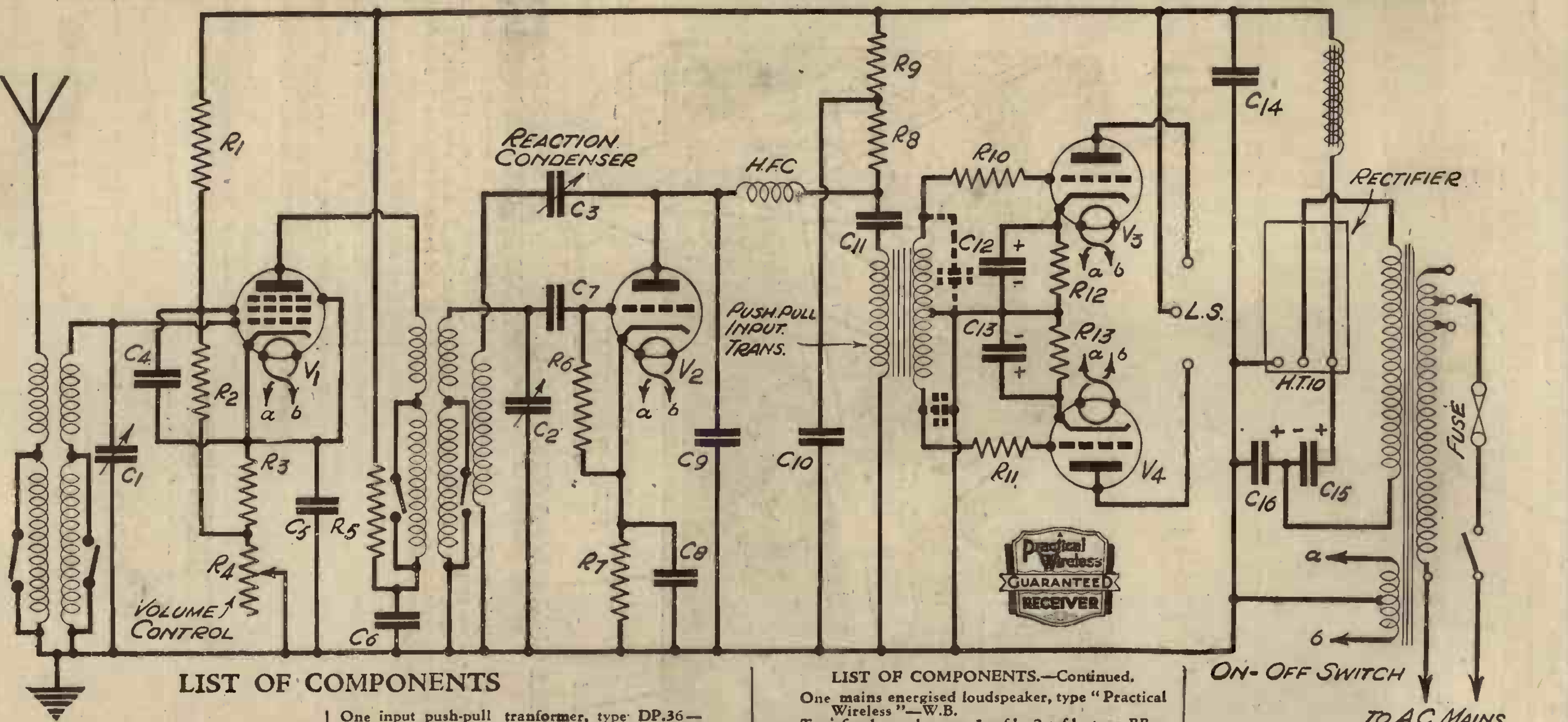
The two twisted leads for the speaker must be connected to the long red and black leads protruding from the speaker. The three twisted leads marked A, B, C, on the blue print must be connected to terminals P, HT, and P respectively of the transformer attached to the speaker.

It will be noted that the two leads which are shown connected to the large fixing nuts of the two 8-mfd. electrolytic condensers must be passed through the upper surface of the baseboard so as to make effective contact with the condenser casing. It is important, however, to see that the casing of C15 does not make contact with the metallised baseboard. An inspection of the blue print reveals that the wiring is quite simple.

I shall, of course, be glad to advise readers who may strike a difficulty, and next week shall give operating instructions.

(Continued on page 659)

CIRCUIT DIAGRAM OF F. J. CAMM'S A.C. HALL-MARK FOUR



LIST OF COMPONENTS

Values of components in the above circuit are as follows: R1, 50,000 *ohms*; R2, 25,000 *ohms*; R3, 250 *ohms*; R4, 2,000 *ohms*; R5, 2,000 *ohms*; R6, 5 *meg*; R7, 750 *ohms*; R8, 30,000 *ohms*; R9, 20,000 *ohms*; R10, 10,000 *ohms*; R11, 10,000 *ohms*; R12, 350 *ohms*; R13, 350 *ohms*; C1, .0005 *mfd.*; C2, .0005 *mfd.*; C3, .00015 *mfd.*; C4, .1 *mfd.*; C5, .1 *mfd*; C6, 1 *mfd.*; C7, .0001 *mfd.*; C8, 25 *mfd.*; C9, .0002 *mfd.*; C10, 2 *mfd.*; C11, .5 *mfd.*; C12, 25 *mfd.*; C13, 25 *mfd.*; C14, 4 *mfd.*; C15, 8 *mfd.*; C16, 8 *mfd.*

One Hall-Mark A.C. Four Console Cabinet—Peto-Scott.
One Metaplex chassis, 12½in.×12in. with 3½in. runners—Peto-Scott.
One 2-gang variable condenser, complete with drive—Formo
One 2-coil assembly, type TDS.—Colvern.
One reaction condenser, .00015 mfd.—Polar.
One input push-pull tranformer, type DP.36—Varley.
Twelve 1 watt fixed resistances, 50,000 ohms, 30,000 ohms, 25,000 ohms, 10,000 ohms, 10,000 ohms, 750 ohms, 250 ohms, 350 ohms, 350 ohms, .5 megohms, 20,000 ohms, and 2,000 ohms.—Amplion.
Three tubular fixed condensers, .1 mfd., .1 mfd. (type 4403), .5 mfd. (type 4406)—Dubilier
Two fixed condensers, .0001 mfd., .0002 mfd. (type 65)—Dubilier.
Three electrolytic condensers, 25 mfd., 25 volt working (type 3046)—Dubilier.
Two electrolytic condensers, 8 mfd. 500 volt working (type 0218)—Dubilier.
One fixed condenser, 500 volt working, 4 mfd. (type LEC)—Dubilier.
One screened H.F. Choke, HFPJ—Wearite.
One QMB. on/off switch, type S.80—Bulgin.
One 10-way group board—Bulgin.
One 2,000 ohm potentiometer, type VC.26—Bulgin.
One mains transformer—B.T.S.
One H.T.10 metal rectifier—Westinghouse.
One .5 amp. fuse and holder—Microfuse.
One twin socket strip, with plugs marked A. and E.—Belling-Lee.
Four valves, MVS/Pen, 41MHL, 41MP, 41MP.—Cossor.

LIST OF COMPONENTS.—Continued.

One mains energised loudspeaker, type "Practical Wireless"—W.B.
Two fixed condensers, 1 mfd., 2 mfd., type BB—Dubilier.
Two component brackets.—Peto-Scott.
Four valve holders, 1 7-pin, 3 5-pin—Clix.

SPECIAL FEATURES OF THE A.C. HALL-MARK FOUR

Quality and Large Undistorted Output at Low Cost—2½ watts undistorted output.

Well-tried Circuit — Variable-mu H.F., Leaky-grid Detection, Push-Pull Output.

Ideal for use as Radio Receiver or Radio-gramophone.

Easy Construction—Coils with self-contained W/C switches. Simple Components and Circuit.

Ample selectivity for normal requirements —due to use of aerial coil with loose-coupled winding, and use of efficient H.F. transformer with tuned secondary.

Smooth Reaction Control which increases selectivity when required.

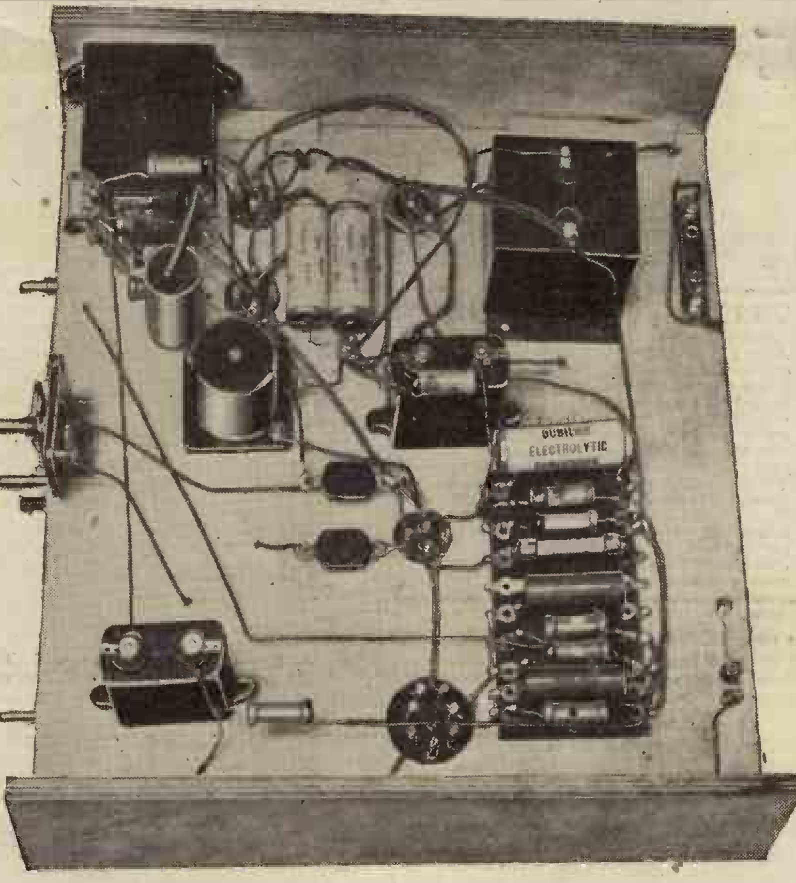
Graded Volume Control by Variable-mu Potentiometer.

Ample Decoupling in all Circuits.

Absence of Mains Hum because of thorough decouping, and use of Large - capacity Electrolytic Condensers.

Ample L.F. amplification due to the use of high-ratio push-pull transformer.

Absence of instability in output stage due to the use of grid anti-oscillation resistances, and grid-circuit by-pass condensers.



(Continued from page 655)

Meantime, it is worth while remembering that with some push-pull valve combinations it may be necessary to fix tone-control condensers between the terminals marked "See Text" on the push-pull transformer.

The value of these condensers should be .0001 mfd. each, and they are connected across the two halves of the push-pull transformer secondary—between G and GB terminals.

Free Assistance

For the benefit of the many thousands of new readers who will be perusing PRACTICAL AND AMATEUR WIRELESS this week for the first time I would stress the point to which I have referred so many times in past issues of the paper, that my advice and assistance are yours for the asking, free of charge, on any matter relating to this set. Such advice and assistance are cheerfully rendered on one understanding only—namely, that you rigidly adhere to the specified parts. There is a very sound reason for this insistence. You cannot expect me to make thirty or forty receivers using the A.C. Hall-Mark Four circuit incorporating in each of them different valves, coils, and condensers. *I know* the performance of my receiver. If you fail to achieve the same results as I have obtained it can only be because you have made a mistake in the wiring, have used a defective component, or have not used the parts I specified. It is in your own interests to use those parts. If for some reason your receiver develops a fault and you write to me explaining the symptoms I am usually able to locate the fault for you straight away. If you have used coils made by "Smiths" when I have specified coils made by "Jones" the fault may be anywhere, and I am unable to help. I am one of the few (probably the only) journalists who freely render advice and assistance in this way, and I devote a considerable amount of time to the analysis of readers' difficulties.

NEXT WEEK!
Constructional Details of the BATTERY PUSH-PULL HALL-MARK FOUR and the UNIVERSAL MAINS HALL-MARK FOUR

New Readers! Make a Note of our Address: "Practical and Amateur Wireless," 8-11, Southampton Street, Strand, London, W.C.2.

Help Yourself

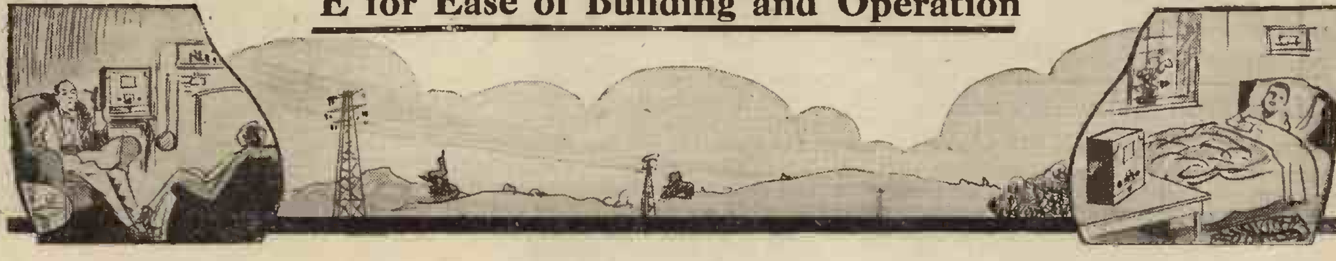
In helping yourself to success by using the parts specified, you are also helping me. I realise that I have a responsibility to my readers when I invite them to spend money in making a receiver of my design. They, in turn, have a duty to themselves to perform. I go to a lot of trouble to make the design right. Don't be one of those who go to a lot of trouble to make it wrong! If you are technically able to vary a design of mine it is fair argument to assume that you should also be able to make it work. If you are unable to locate a fault you are not able to vary a design, and I do not think you will quarrel with the logic of that argument. I stress this point because I received letters from readers who say something like this: "I have built your latest receiver using absolutely the same parts as you did, with the exception of the coils, the valves, and the transformer. These I had by me, and I know they cannot be the cause of the trouble because they worked perfectly in my last receiver." Now a reader who writes to me in this strain is guilty of wrong reasoning; because the Ford gear-box works perfectly well on the Ford, it by no means holds that it is suitable for an Austin or a Morris. In a wireless receiver as with a car you cannot take the units from five different receivers and expect to incorporate them in someone else's design with satisfactory results.

A lot of time is spent in balancing out inefficiencies, in getting rid of stray capacities, in stabilising the receiver, in choosing the best arrangement of the components, and in general polishing-up of the design so that it is reasonably fool-proof. It is for this reason that I have never specified alternatives, with the one exception of my £5 Superhet where readers experienced difficulty in obtaining components.

A Recent Experience

The other evening I visited a reader's house for the purpose of adjusting his Three-Valve Superhet which he said he had made to my design. He had taken every liberty with it, he had not used a Metaplex chassis, he had not used ganged coils, he was using a cheap Pentagrid valve of foreign make, he had altered the layout, the fixed condensers were a collection of odds and ends, and the design looked like an imitation of a Heath Robinson creation. I was able to achieve for him some sort of result. I had taken the precaution of bringing with me my own much-handled model which I connected to his aerial, earth and batteries. A look of keen delight suffused his countenance as he noted the incomparable difference in performance. In building my A.C. Hall-Mark Four, therefore, I hope you will not go and imitate this particular reader's performance.

E for Ease of Building and Operation

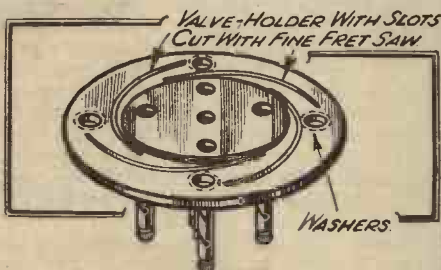


READERS' WRINKLES

THE HALF-GUINEA PAGE

Anti-Microphonic Chassis Valve-holder

TO make an ordinary chassis valve-holder of the bakelite " plate " type anti-microphonic, saw four " slits " in the

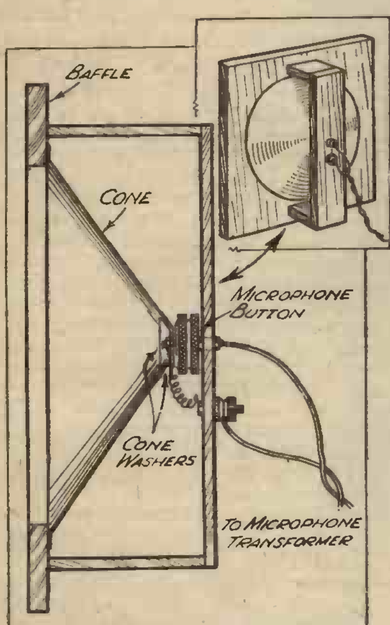


A simple method of making a chassis valve-holder anti-microphonic.

plate, as shown in the accompanying sketch. Although simple, this dodge has a very noticeable effect in " cleaning up " the performance of a set, without being detrimental to the appearance of the valve-holders. A small washer is placed between the valve-holder and the base-board at each screw hole when screwing down.—R. M. ROSS (Alness).

A Super-sensitive Microphone

THE accompanying diagrams show the method of constructing a very sensitive microphone. The materials necessary are: a parchment loud-speaker cone, a



An easily-made super-sensitive microphone.

baffle board, cabinet, or other means of mounting the completed microphone, a small microphone button, two cone washers, and a few odd pieces of wood.

To construct the framework, measure the perpendicular height of the cone from the base to cone washers, add $\frac{1}{4}$in. to this, and cut two pieces of wood about 3in. wide to this measurement. These pieces form the small projecting shelves, as illustrated in diagram. Screw or glue these two pieces to the baffle, just clearing the diameter of the cone.

Next attach the cone to the baffle in the usual way by adhesive tape, etc., and cut a piece of wood to act as a bridge piece for holding the microphone button. In the centre of this piece of wood drill a $\frac{1}{4}$in. hole for the lug of the " mike " button, which should be held firmly in place. About 1in. from this hole drill another one for a terminal, which is connected by a piece of very thin flexible wire to the front electrode of the mike button.

Assemble the button and terminal on to the bridge piece, and then screw the bridge piece across the two projecting shelves, and if the hole for the mike button has been drilled accurately, the front fixing pin of the button should project through the hole in the cone washers. The fixing nuts on the button should now be tightened up on to the cone washers, and the mike is then complete. For the connection to the back electrode a wire should be soldered on to the central lug which projects through the wooden bridge piece. The great feature of this microphone is its non-directional properties, and its sensitivity is remarkable.—V. WALKER (Catford).

THAT DODGE OF YOURS!

Every Reader of "PRACTICAL AND AMATEUR WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL AND AMATEUR WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.

A Dual-purpose Switch

HERE is a suggestion whereby a simple push-pull switch used for the L.T. circuit can also be made to switch on the current from the mains when an H.T. eliminator is used in a set with battery valves.

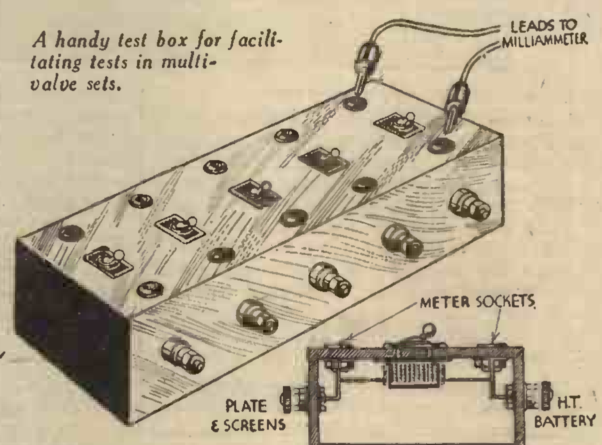
The combined switch is made by the addition of a spring contact mounted in such a position so that it is operated by the rod of the push-pull switch.

A piece of thin strip brass, similar to that used on a $4\frac{1}{2}$-volt flash-lamp battery, is used for the spring contact by bending it to an L shape to form a foot for screwing it on to a base. The other contact strip is made of slightly stronger brass, and is bent in the same manner. This strip is about $\frac{1}{2}$in. shorter than the other one, and at the top it is bent as shown. These strips are mounted on a piece of insulating material, such as ebonite, and are set in such a position so that the end of the rod on the push-pull switch breaks the contact when pushed in, and at the same time cuts off the L.T. supply. The long spring can be insulated from the push-pull switch rod by slipping a rubber sleeve over the end of the spring.—J. W. MATHER (Blackpool).

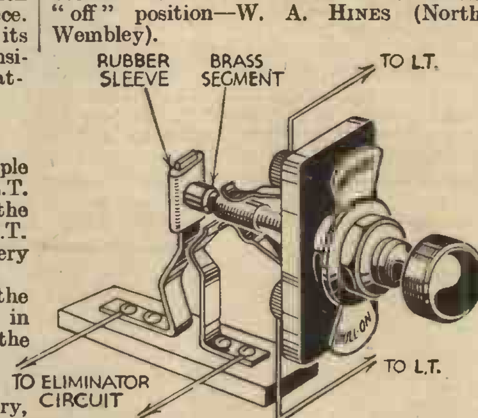
A Convenient Test Box

IT is sometimes difficult for periodic tests to be made in multi-valve sets with regard to plate voltage and current, so the writer made a box on the following lines. A suitable-sized box was constructed to accommodate all necessary tappings to plates and screens of valves used in the

A handy test box for facilitating tests in multi-valve sets.



set, all of which were taken to one row of sockets in the box, and the H.T. leads to the other, as shown in the sketch. A switch connecting the two sockets together was mounted between them. The simplicity of testing with this arrangement will be obvious, the meter being inserted between the sockets with the switch in the " off " position—W. A. HINES (North Wembley).



A combined L.T. and eliminator switch.

PILOT AUTHOR KIT
EXACT TO SPECIFICATION

WARNING DON'T BE MISLED. PILOT AUTHOR KITS CONTAIN THE IDENTICAL PRODUCTS AS USED BY Mr. F. J. CAMM IN BRAND NAMES AS WELL AS VALUES. THAT'S WHY IT IS THE ONLY KIT BACKED BY Mr. F. J. CAMM'S PERSONAL GUARANTEE

AT LAST! The PERFECT GRAMOPHONE MOTOR

SIMPSON'S 1935 ELECTRIC TURNTABLE

5/- DOWN

CONSTANT SPEED
SILENT, SAFE and STRONG.
NOTHING TO WEAR OUT.
NOTHING TO GO WRONG.

A more efficient or quieter running unit is not obtainable . . . synchronous motor, no sparks, no brushes, no electrical interference or wear, no complicated mechanisms, nothing to understand, and nothing to go wrong. **Low consumption, constant speed, 1-hole fixing. Darwin's Magnets. 12 in. Brown felt covered Turntable. All metal parts bronze finished.** A.C. Mains only. 100/150 or 200/250 volts. 50 cycles. Cash or C.O.D. Carriage Paid. **Or yours for 5/- and 9 monthly payments of 4/6.** **42/-**

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Light gauge aluminium. Centre boss is an 8-ribbed black bakelite moulding, faced white to give true stroboscopic effect, and thereby visual speed indication. Scanning holes perfectly punched to secure uniform scanning without preventable lines. Made in 2 sizes and ready for immediate use. 16in. diam. **7/6**

20in. diam. 12/6. Postage, 9d. extra.

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ATLAS ELIMINATOR

Model T10/30. A.C. 200/250 volts 40/120 cycles. Three tappings: 10, 20 or 30 m.a. at 120/150 volts. Trickle charger incorporated 2 volts .5 amp. Send only 5/-, balance in 12 monthly payments of 6/-. Cash or C.O.D. Carr. Paid, £3/9/6, Model C.A.25, Cash or C.O.D. Carriage Paid. £2/19/6, or 5/- down and 11 monthly payments of 5/6.

5/- DOWN

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KIT "A" Cash or C.O.D. *Carriage Paid.* **£8 : 1 : 6**

Author's Kit of first specified parts, including ready drilled Metaplex chassis, less valves, cabinet and speaker.

or Yours for **15/-** and 11 monthly payments of 15/-.

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KIT-BITS You pay the Postman. We pay post charges on all orders over 10/-. GREAT BRITAIN ONLY.

	£	s.	d.
1 Peto-Scott Ready Drilled Metaplex Chassis, 12½in. by 12in. by 3½in.		4	0
1 B.T.S. Mains Transformer	1	2	6
1 Westinghouse Metal Rectifier, type H.T.10	1	1	0
1 Varley Input Push-Pull Transformer, type D.P.36		15	0
1 Colvern 2-coil Assembly, type T.D.S		15	6
1 Set of 4 Specified Valves	2	19	0
Peto-Scott De Luxe Walnut A.C. Hall-Mark 4 Consolette Cabinet	1	15	0
Carriage and Packing 2/6 extra.			
W.B. EM2 P.W. Speaker or 2/9 deposit and 11 monthly payments of 2/9.	1	9	6

BATTERY HALL-MARK 4

KIT "A" Cash or C.O.D. *Carriage Paid.* **£4 : 5 : 0**

Author's Kit of first specified parts, including ready drilled Metaplex chassis, less valves, cabinet and speaker.

or Yours for **7/9** and 11 monthly payments of 7/9.

KIT "B" As for Kit "A," but including set of 4 specified valves, less cabinet and speaker. Cash or C.O.D. Carriage Paid, £6/11/0, or 12 monthly payments of 12/-.

KIT "C" As for Kit "A," but including valves and Peto-Scott Battery Hall-Mark 4 Cabinet, less speaker Cash or C.O.D Carriage Paid, £7/10/6, or 12 monthly payments of 13/9.

KIT-BITS You pay the Postman. We pay post charges on all orders over 10/-. GREAT BRITAIN ONLY.

	£	s.	d.
1 Peto-Scott Ready Drilled Metaplex Chassis, 11x8x3in.		3	6
1 J.B. 2-gang Baby condenser, with Straight Line dial		17	0
1 Colvern 2 coil assembly, type T.D.5.		15	6
1 Varley Input Push-Pull transformer, type DP36		15	0
1 Set of 4 specified valves	2	6	0
Peto-Scott De Luxe Walnut Battery Hall-Mark 4 Consolette Cabinet		19	6
Carriage and Packing 2/6 extra.			
W.B. Speaker, Cash or C.O.D. Carriage Paid, or 2/6 Deposit and 11 monthly payments of 4/-	2	2	0

UNIVERSAL HALL-MARK 4

KIT "A" CASH or C.O.D. *Carriage Paid.* **£7 : 6 : 6**

Author's Kit of first specified parts, including Ready Drilled Metaplex Chassis, less valves, cabinet and speaker.

Or Yours for **13/6** and 11 monthly payments of 13/6.

KIT "B" As for Kit "A," but including set of 5 specified valves, less cabinet and speaker. Cash or C.O.D. Carriage Paid, £10.10.6, or 12 monthly payments of 19/6

KIT "C" As for Kit "A," but including valves and cabinet, less speaker. Cash or C.O.D. Carriage Paid, £12.10.6, or 12 monthly payments of 23/-.

KIT-BITS You pay the Postman. We pay post charges on all orders over 10/-. GREAT BRITAIN ONLY.

	£.	s.	d.
1 Peto-Scott Ready drilled Metaplex Chassis, 12½x10x3½in.		4	0
1 B.T.S. Mains Dropping Resistance		3	6
1 Wearite set of 2 gang coils, types Q and T		15	0
1 Polar 2 gang Midget condenser, with V.P. dial		17	6
1 Varley Input Push-Pull transformer, type D.P.36		15	0
1 Set of 5 Specified valves	3	4	0
Peto-Scott De Luxe Walnut Universal Hall-Mark 4 Consolette Cabinet	2	0	0
Carriage and Packing 2/6 extra.			
Rola FR7 Speaker or 4/6 Deposit and 11 monthly payments of 4/6.	2	9	6

W/B STENTORIAN

YOURS FOR 2/6 DOWN

ANY MODEL

BRITAIN'S FINEST MOVING-COIL SPEAKERS—BRITAIN'S LOWEST EASY TERMS!

Peto-Scott offer you the lowest terms and fairest dealing in the Country. Strict Privacy guaranteed. Immediate Delivery from stock to approved accounts.

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W.B. STENTORIAN BABY. Yours for 2/6; balance in 9 monthly payments of 2/6. Cash or C.O.D. Carriage Paid, £1/2/6.

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B.T.S. 4-VALVE SHORT-WAVE BATTERY RECEIVER KIT

Tunes with a double reduction slow-motion dial, providing either 7 : 1 or 100 : 1. KIT comprises ready-drilled aluminium chassis with handsomely walnut-grained bakelite panel overlay, and all valveholders, terminal socket strips and coil-holder already eyeletted in position on chassis. Complete kit of B.T.S. Tropical specification components, each tested and matched, and set of 4 coils covering 13 to 195 metres, Excluding 4 valves. Cash or C.O.D. Carriage Paid, £5 : 17 : 6. Set of valves, £2 : 1 : 0. Or add 3/9 to Deposit and 3/9 to each monthly payment.

WITH FREE FULL SIZE BLUEPRINT, WIRING AND ASSEMBLY INSTRUCTIONS.

20/- DOWN And 11 monthly payments of 9/9.

1935 EDDYSTONE KILODYNE 4

BATTERY MODEL.—Kit of Eddystone 1935 Kilodyne 4 (battery model) components, including ready-drilled die-cast Aluminium Chassis and four Coils to cover wavebands between 13.5-85 and 260-510 metres, less Valves and Cabinet. Cash or C.O.D. Carriage Paid, £6 19/6

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ADDITIONAL COILS.—76-170 metres, 5/-; 150-325, 5/6; 490-1,000, 6/-; 1,000-2,000, 6/-.

We also supply the B.T.S. SHORT-WAVE KITS for Cash, C.O.D. or H.P. Send for NEW two-colour art folder of all models.

B.T.S. HALL-MARK 3 COILS

Specified and used by Mr. F. J. Camm for the Hall-Mark 3.

None genuine without his signature. THERE ARE NO SUBSTITUTES. With coloured Leads for easy identification.

THE PAIR **7/6** Postage 9d. extra.

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COMPONENTS FOR THE "HALL-MARK" RECEIVERS

THE "A.C. HALL-MARK FOUR"

The SPECIFIED

WEARITE H.F. CHOKE

Type H.F.P.J.

Totally screened.
Small overall dimensions.
Effective impedance, 100-2,000 m.
Self Capacity, 7 mmfds. (approx.)
Inductance, 220,000 m.h.
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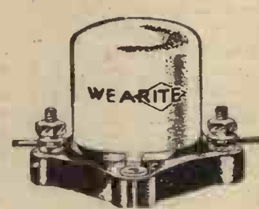
Size: 1⅜in. x 1⅜in. x 1⅝in. high.



The H.F.P.J.

PRICE 2/-

THE WEARITE Q.V.C. VOLUME CONTROL

Perfect contact, silence in operation. Element completely enclosed. One 2,500 ohms required.

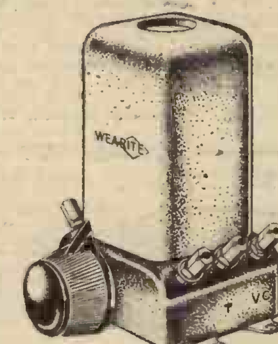
Price **4/6**

"THE UNIVERSAL HALL-MARK FOUR"

The SPECIFIED

WEARITE "Q" x "T" AIR-CORE COILS

Medium-wave secondary coils wound with special stranded wire into low-loss bobbins. Long-wave winding in special wave form to minimise losses.



Type "Q" complete with switch 7/6
Type "T" complete with switch 7/6

The SPECIFIED **WEARITE L.F. CHOKE**

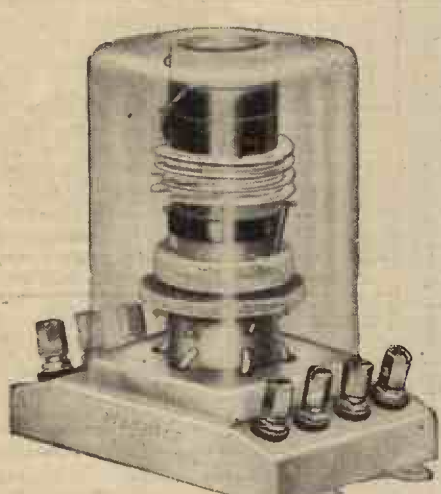
A *constant inductance* Choke 40h., 100 m.a. soundly constructed throughout.

Type H.T.410 Price **17/6**

THE WEARITE Q.V.C. VOLUME CONTROLS

One 2,000 ohms and One 5,000 ohms required

Price **4/6** Each.



The Famous

WEARITE SCREENED Universal Coil

Tunes 180—550 and 850—1950 metres

Whatever the set you are contemplating — remember the "Universal" is designed for use for *Aerial*, *H.F.*, and *Band Passing*. Send for circuits.

5/- per coil.

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The tube requires no tools—no screwdriver or spanner.

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Please send me a copy of Catalogue G.N.834 together with constructional details, Blue Prints, etc., of Wearite (L.P.) Teamster series of receivers and Power Packs, etc.

To Wright & Weaire, Ltd., 740, High Road, Tottenham, N.17.

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6333

On Your Wavelength

by Thermion

—And Still They Come

I HAVE just been trying out a *triple-diode-triode* valve of the very latest pattern. It is made by Mazda, and does about half a dozen jobs all at once. It also has nine pins on the base, as well as a cap mounted on top of the bulb. Although the connections appear rather formidable at first, they are not so complicated once the wiring has been taken in hand; nevertheless, I am not greatly in favour of these multi-pin affairs. All the same I must confess a very strong liking for the Mazda ACHL/DDD—to give it its full title—for it behaves in a most remarkable manner, giving not only second detection (or first if you like), but also delayed automatic volume control, inter-channel noise suppression, and first L.F. amplification. Even this is not all, for, by a very ingenious arrangement, it gives apparently sharper tuning than is normally obtained in connection with A.V.C., and so makes it quite unnecessary to use a visual-tuning indicator.

[*The valve referred to above will shortly be described in our pages.*—ED.]

Very Practicable

THE triple-diode-triode, although comparatively new to the constructor, has been in use since last Show by R.I., who have proved its value in modern superhets. From this it is evident that it is a really practicable job, and that there is no loss in efficiency in this instance by combining what really amounts to at least four valves in a single glass jacket.

Single or Multiple

DESPITE the obvious efficiency of practically all of the multiple valves, I am still very much in favour of using one valve for one function in the set. When you have one valve performing several functions any slight falling-off in efficiency (such as might be noticed when the valve is becoming old and the cathode losing its emission) causes the performance to suffer considerably. On the other hand, if a single-purpose valve starts to feel rather "wonky" the impaired performance is by no means so noticeable. Again, if small diodes and other single-purpose valves were to be widely used it should be possible to make them quite cheaply, so that a replacement would cost a very few shillings, instead of something like 16s. 6d., as at present.

What is "Home-made"?

I WAS talking to a young wireless enthusiast the other day, and he proudly showed me a new—and very elaborate—five-valve superhet. that he said he had just made. The sight of this expensive-looking instrument reminded me very forcibly of the early wireless days—or at least, some twelve years ago—when I made my very first five-valver. But what a difference! I actually *made* mine, condensers, coils, transformers and all, but this young chap had only assembled a few beautifully-made parts that he had bought ready-made. And he had paid just about as much for the whole lot as I had paid for the raw materials for making a couple of variable condensers, a set of coils, and two L.F. transformers.

I tried to console myself with the thought that I probably gained far more pleasure from my home construction than did the owner of the "posh" five-valver to-day. Yes, perhaps they were "good old days"—and perhaps they weren't. I believe I get as much fun out of wireless now as I did fifteen years ago.

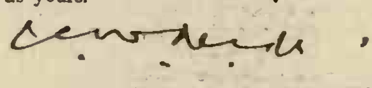
Real Construction

I WOULD not make my own components to-day for anything, but I always recommend all budding enthusiasts to do so. You can never know sufficient about the construction and behaviour of the parts if you have not at least attempted to make them yourself. It is not always a very great saving in the way of cash—in fact, it sometimes works out even slightly more expensive—but it affords a considerable amount of inexpensive experimenting, besides teaching a great deal.

A message from
SIR JOHN REITH,
Director-General of the B.B.C.,
to PRACTICAL AND AMATEUR WIRELESS

"I have followed the progress of PRACTICAL WIRELESS and AMATEUR WIRELESS, and I hope that their amalgamation will result in the renewed interest of readers.

"The B.B.C. is not unmindful of the help it gets from wireless journals such as yours."



Undistorted Output

WHY is it that folk nowadays always seem to be clamouring for more and more volume? Perhaps it is because they have found that great output does not involve distortion, or perhaps they have become so accustomed to hearing music without listening to it that they want it forcing into their ears before they can appreciate the stuff. Four watts undistorted (I mean *undistorted*) in an average-sized room is enough to drive me crazy, but I know people who say that they cannot tolerate anything less than this. Give me about half a watt from a well-designed receiver which gives real quality and I will not thank you for any more. If someone does "turn up the wick" beyond this the sound becomes annoying.

It seems to me that the only way to enjoy a programme of either music, speech, or anything else is to *listen* to the loud-speaker; when the volume level is too high there is a tendency not to listen, and merely to allow the matter to percolate into the skull. Before "heaping coals of fire" upon my head, I would ask those who have strong disagreement with my views to try the experiment of reducing the volume level, at the same time being quite sure that they are not losing the bass by so doing, and to listen to a full evening's programme.

English as She Should be Spoke!

NOW that we have an excellent means of making speech visible I suggest that all this pother about pronunciation can be stopped forthwith. I am sure that it will generally be admitted that the best English is spoken in the south of England, and I suggest that the language as there spoken should form the standard for the rest of the country.

When television arrives, as it may do very soon, I hope the B.B.C. will *transmit* correct pronunciation by means of standard images of words so that schools may, by means of their own cathode ray apparatus, teach scholars how to pronounce King's English. Thus would radio help to rid us of our own Tower of Babel—Welsh, Scotch, Cockney, Yorkshire, and Lancashire. Provided that the scheme were carried through without a strong bias towards the Scottish dialect, such a scheme would be to the benefit of all, and, incidentally, help our Continental friends to pronounce our language and who, in spite of our maps, prefer to call our island Angleterre—why, I have never been able to discover, for France is France to us.

It would also solve a problem which has puzzled me from youth. If school teachers speak correct English (and, presumably, when they attend college pronunciation and enunciation form part of their training), why should people resident in Yorkshire, Lancashire, Dorsetshire, and Scotland pronounce English words different from us?

Volume Controls

THERE are many volume controls which merely act as auxiliary on-off switches, for the angular movement which actually can be said to affect volume is so small that the word *control* is misapplied. A good graded potentiometer by means of which one can gradually *fade* the volume is an exception. Most of them belie the law of Ohm which postulates that the resistance of a wire is proportional to its length.

Nearly all of them are noisy in action; you can "hear" the moving contact as it passes over each successive convolution of wire. I hope that the next exhibition will reveal marked improvement in this direction. A good volume control should have a too-weak and a *too-strong* position—like a good carburetter.

Shortage of Components?

I HAVE received many bitter complaints during the past few months from readers who have experienced difficulty in obtaining components, and have been kept waiting for six weeks or more. The chief offenders seem to be the valve and coil manufacturers, although the complaints I have received cover most of the parts used for a receiver—speakers, variable condensers, and transformers. Some readers have even

(*Continued overleaf*)

(*Continued from previous page*)

sent me cheques and postal orders in the presumption that *Thermion* merely has to issue the order and it is so.

In this way I have been able to help many readers, but I hope I shall not have too many calls of this nature. One reader even sent me the amount less 33⅓ per cent. discount because, he thought, I should be able to obtain the parts cheaper! Nor did he enclose postage! This reader wanted me to save him some money, as well as to go to a certain amount of trouble on his behalf. I, of course, returned his money.

A New Unit?

I NOTICED a reference the other day in my morning paper to a message which had been transmitted by *radiogramme*. Is this a new metric unit, intended to denote some musical measure? Does it denote what the Yanks call "a basinful of volume"? Any reader who understands these things is invited to explain it to me in easy stages.

A New Platform

THIS week I am addressing the largest audience since this feature started, for I am also addressing the readers of PRACTICAL WIRELESS. I am in the happy position of having served both papers, and experience therefore no strangeness in occupying a new platform under a new editor. The editors of both papers I know very well indeed, and I appreciate that in PRACTICAL AND AMATEUR WIRELESS I shall not be a prophet without honour.

This journal is now the most powerful in the country, and without waggling the old school tie too much it pleases me to know that I have played a part in the successes of both journals which have led to this important amalgamation.

Radio and Spiritualism

I HAVE every respect for the religious beliefs of others, but when I read that radio and spiritualism are allied, I kick. The fact that we know no more about the "other side" to-day than when the world began seems to indicate that it is not a matter which will yield to scientific investigation. Personally, I have always felt sorry for so-called scientists who turn spiritualist—they strike such a pathetic spectacle and really show an amazing lack of scientific knowledge. Spiritualism will always, I suppose, be the plaything of the charlatan and the third-class philosopher who like to call themselves scientists, but let us keep radio—an exact science—out of it.

What is Efficiency?

A CORRESPONDENT with a technical kink, but lacking the necessary technical training, sent me an eight-page letter bristling with sticky questions which I spent a couple of hours in answering. His final query, however, made me ponder. He wanted to know how to measure the efficiency of a wireless set. Of course, there is the text-book method of expressing the ratio between watts input and watts output. But is that correct? Suppose you have two four-valve sets operated from the mains each of which takes 40 watts input and gives 2 watts output. Suppose, further, that one was capable of receiving thirty stations free from interference, and of entertainment value from the point of view of volume, while the other receives only half that quantity; obviously the latter receiver, from the point of view of the receiver, is only 50 per cent. as efficient as the former, although from an electrical point of view their efficiencies are equal. Now take the case of two other receivers one of which gives only 1 watt output for a 40-watt input, whilst the second gives 2 watts output for a 40-watt input. Again, according to electrical theory, the latter is the more efficient receiver, and yet it is quite possible for the first to be far more efficient from the point of view of quality, reach, and number of stations received. To make a receiver efficient from an electrical point of view quite often it will destroy its efficiency from the truly wireless point of view. I leave my correspondents to wrestle with these opposing doctrines. You strike the same snags when endeavouring to measure up the efficiency of a motor-car. You will soon be tied up with miles per gallon miles per hour, and loading per horse power, and in some cases you will find a 7 h.p. motor-car doing forty-five miles an hour and forty miles to the gallon giving better efficiency figures than a 20 h.p. sports car doing twenty miles to the gallon and eighty miles an hour. Don't write and tell me the answer; I know it.

The Price Problem

I LEARN that the prices of all high-tension batteries are now considerably reduced. All home constructors will welcome this latest move which, coupled with the recent reduction in the prices of valves, speakers, condensers, and cabinets, should result in a considerable uplift in interest in home-constructed receivers, which are always vastly superior to the average cheap commercial job. There is all the difference between a sound hand-made job and the commercial mass-produced competitor.

PRACTICAL WIRELESS was the only paper to make a stand for a reduction in the prices of components, and the Leader Three series of receivers was inaugurated to place home construction on a price-competitive basis. As a result of these price reductions the sales of components for the home-constructor market have increased during the past year by no less than 20 per cent.

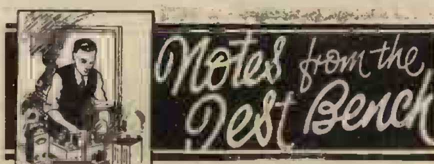
Keltic or *Seltic*?

THE B.B.C. have recently issued a booklet prepared by one of their committees which tells you that the word *combat* is to be pronounced *cumbat* (surely a Scottish pronunciation!) and that *Celtic* is *Seltic*, not *Keltic*. Personally, I prefer, and shall use, the more correct English pronunciation! Meantime, of what use are our dictionaries, all of which are supposed to define meanings and give pronunciations according to common usage? Would not a committee composed of Englishmen, Welshmen, and Scots (equal proportions), under an English chairman, save a lot of argument?

[*We have never heard* cumbat *in England.* —ED.]

British Broadcasting Monopoly in Greece

FOLLOWING many attempts to establish a broadcasting system, the Greek Government has finally conceded the sole right to install and exploit such stations to the Marconi Company, for a period of twenty-five years. The Lucerne Conference allotted three channels to Greece, namely, 499.2 metres (Athens), 373.1 metres (Salonica), and 233.5 metres for some town in the Southern portion of the country. The first station—a 50 kilowatter—will be built in the neighbourhood of the capital and should be in operation towards the autumn months; relays or stations of lower power will follow later.



A P.W. receiver was brought to our laboratory last week, its owner claiming that he could get no response whatever from the speaker, although all components had been tested and found to be in order, and wiring had been carefully checked. He was very upset about it, and even hinted that the design must be at fault. On inspecting the receiver, however, it was discovered that the constructor had not followed the designer's instructions. Several terminals on the blueprint were marked MB, indicating that they should be in contact with the metallised surface of the baseboard. Instead of taking these leads to the actual points marked on the blueprint, this reader had connected them to screws fastened to the underside of the baseboard, and one to the side runner, thinking that any surface that was metallised would provide a satisfactory contact. MB is the top metallised surface of the baseboard, and although with most chassis the underside of the baseboard and the runners are metallised, this metal surface is seldom making electrical contact with the top surface of the chassis.

Ganged Condensers

SOME commercial ganged tuning condensers have tapped holes in their chassis and are supplied with screws for metal chassis assembly. These screws are usually too short for use with wooden baseboards, however, unless the board is countersunk on the underside. It is therefore common practice to use longer screws, and a serious fault often occurs owing to the use of these substitutes. There is a clearance of only about ⅛ inch between the fixed vanes and the condenser chassis, and if the screws are ⅛ inch too long they touch the fixed vanes when screwed in tightly, and consequently the fixed and moving vanes are short circuited.

Wiring Electrolytic Condensers

WHEN testing receivers incorporating electrolytic condensers, it is often found that constructors connect these components the wrong way round, with damaging results to the condensers themselves and to other components in the receiver. When electrolytics are used to by-pass bias resistances, the method of connection is fairly obvious, as one end of the resistance is connected to the common negative lead, and therefore the negative of the electrolytic must be connected to this. When these condensers are used for smoothing purposes in conjunction with a voltage-doubler rectifier, however, the method of connection is more confusing. The positive terminal of one condenser should be connected to the negative terminal of the other, and the juncture joined to one end of the H.T. winding of the mains transformer. The free terminals (+ of one, and — of the other) should then be joined to + and — of the metal rectifier respectively, and the other end of the H.T. winding to the A.C. terminal of the rectifier.

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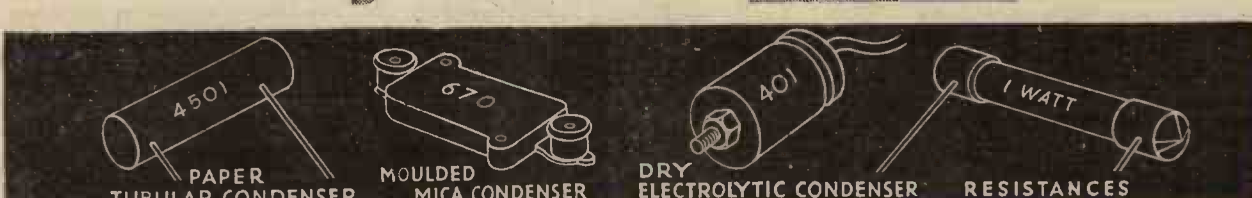

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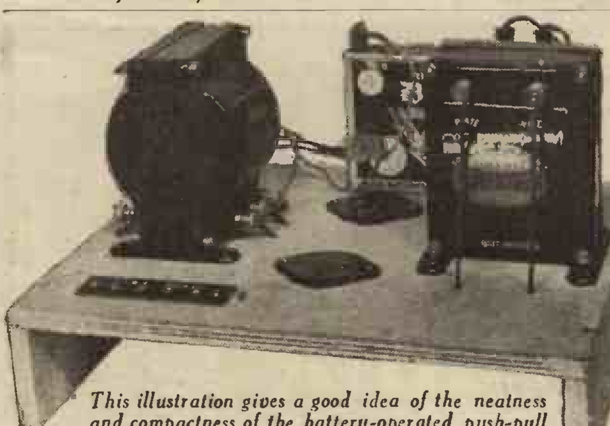


This illustration gives a good idea of the neatness and compactness of the battery-operated push-pull amplifier described.

THE TWO-IN-ONE PUSH-PULL AMPLIFIER

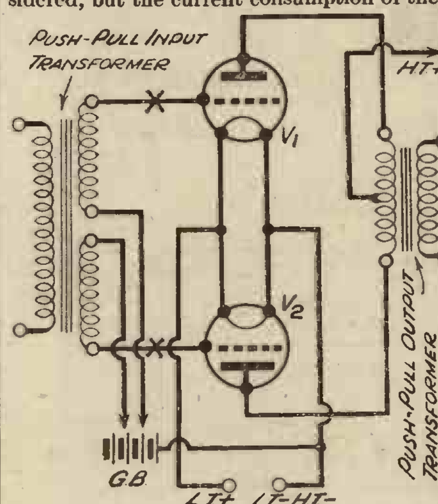
A Simple Battery-operated Amplifier that can be Used with any Type of Battery Receiver when a Large, Undistorted Output is Required

WE believe that the interest that will be shown in the various versions of the Hall-Mark Four will be so great that many readers who already have a good battery-operated receiver will wish to construct an amplifier for increasing the output. It is partly for this reason, and partly because the demands of readers for a really good and simple amplifier have been so insistent, that the unit illustrated on this page has been developed. There is no doubt that push-pull amplification is in many respects better than any other arrangement, and we are quite sure that those readers who have not yet tried this system will wish to do so immediately they realise the popularity that the Hall-Mark series is sure to attain.

Simple Construction

The unit illustrated is obviously extremely simple, and it is certainly not very expensive to build, although the parts used are of the highest possible quality. Those whose experience of wireless goes back a number of years will remember that Ferranti were one of the pioneers of push-pull in this country, and it is therefore fitting that their input and output push-pull transformers should be specified in this instance. These components are the result of a considerable amount of research work in L.F. amplifier technique, and there is no doubt that they are as good as money can buy.

The advantages of push-pull amplification have been set out in these pages on more than one occasion, but during t he last few years the attention of the constructor has been focused on class B and Q.P.P. to the detriment of ordinary push-pull. In some respects this is a pity, for there is no doubt that push-pull in its "straight" form is better than either of the two "economy" modifications when real quality is of paramount importance. We fully realise that economy must be considered, but the current consumption of the push-pull amplifier in question is so low (largely due to the use of efficient modern valves), and the price of H.T. batteries has been so much reduced, that we feel fully justified in reviving interest in push-pull.



The circuit of the amplifier.

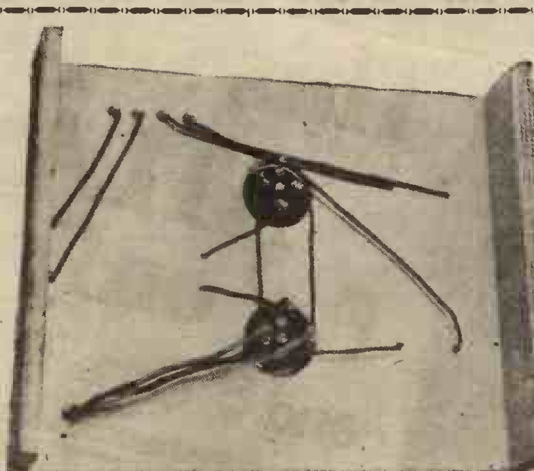
A push-pull arrangement is inherently good from the point of view of quality, and for this reason it makes quite unnecessary the use of various tone-compensating and tone-control systems.

The Construction

It will be seen from the list of components accompanying this article that very few parts are required, whilst the photographs give testimony to the utter simplicity of construction of the amplifier. It can also be seen from the wiring plans that very few connections indeed are called for, and those that are used are short, straight, and easily followed, even by the tyro in home construction. The first requirement is the metallised chassis, and this should be drilled to receive the two chassis-mounting valve-holders as well as the terminal-socket strip that is used for the input and output connections. The holes for the valve-holders are 1in. in diameter and can easily be made by means of a centre bit and a brace; there are four holes for the terminal-socket strip, these being ½in. in diameter, and they can be made with a twist bit or a shell bit as desired.

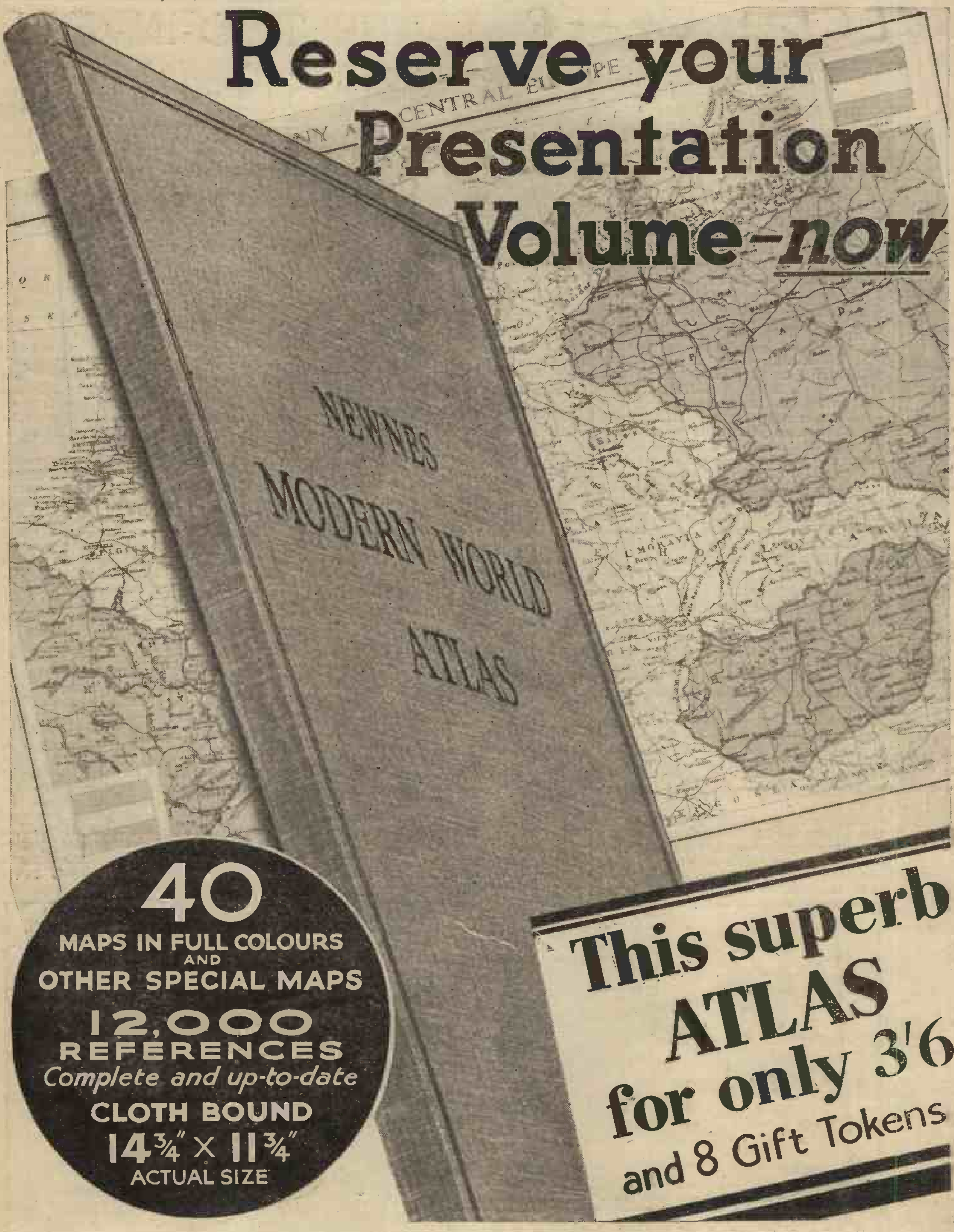
There are a few other holes for the connecting wires, but these are only about ⅛in. in diameter and can be made with a mechanic's brace and twist drill, or even with a large bradawl. These holes should not, however, be made until the components have been mounted on the chassis. With regard to the placing of the parts, it should be explained that the exact positions are not critical, although it is desirable that the two transformers should be mounted with their axes at right angles in order to avoid any possibility of interaction; this would be most unlikely in any event, since both transformers are thoroughly shrouded. It should also be made clear that it is not always necessary to employ the output transformer specified, provided that the speaker employed is fitted with a push-pull transformer designed to match a pair of small battery power

(Continued on page 670)



A view of the underside of the amplifier chassis, showing the few wires required.

Another view of the amplifier, showing the battery leads.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(*Continued from page 667*)

valves. When the speaker is not fitted with a push-pull transformer, however, the Ferranti output transformer should certainly be used.

Wiring Connections

The method of connecting the various parts is made quite clear by the large-size drawings, and it need only be explained that the letters on the drawing, near to the various holes, are only for identification purposes, and show the corresponding holes on the under-side and on top of the chassis. The connecting wire may be of the insulated "push-back" variety or of any other kind intended for set wiring.

The terminal-socket strip is marked L.S. and Pick-up, but the two sockets with the latter designation are for the input from the receiver, and should therefore be connected to the speaker terminals on the set. The other two—marked L.S.—should be connected to two of the three speaker terminals provided on the output transformer, the terminals giving the appropriate ratio being chosen. With regard to the ratio, it may be explained that the most suitable one depends upon the loud-speaker employed. When this is intended for use with a small power-output valve it will be found best to use the two terminals marked 1.6:1, but if the speaker is intended for use with a pentode it will generally be found best to use the terminals giving a ratio of 1:1. The third ratio (2.7:1) will not generally be required, but it can always be tried in order to choose the most efficient matching in practice.

Battery Connections

The amplifier is provided with its own G.B. battery, and there are three G.B. leads. Of the latter one is the positive connection, and should thus be connected to the positive socket of the battery; the other two are from the two halves of the secondary winding on the input transformer, and will normally require a voltage of minus 6. By having two leads, however, it is possible to match the two valves exactly, and the negative wander plugs should therefore be moved about from the 4½-volt to the 7½-volt sockets until best results are obtained. It might even be found best to apply the same voltage to both, in which case one plug can be removed and the two leads connected together. Generally, however, it will be rather better to bias both valves separately, so as to secure exactly correct matching.

It might in some instances be noticed that slight instability occurs, and this will be evidenced by a slight, high-pitched whistle. Should this be experienced, fixed resistances of 10,000 ohms each should be included in the grid leads to the two valves at the points marked with crosses in the circuit diagram.

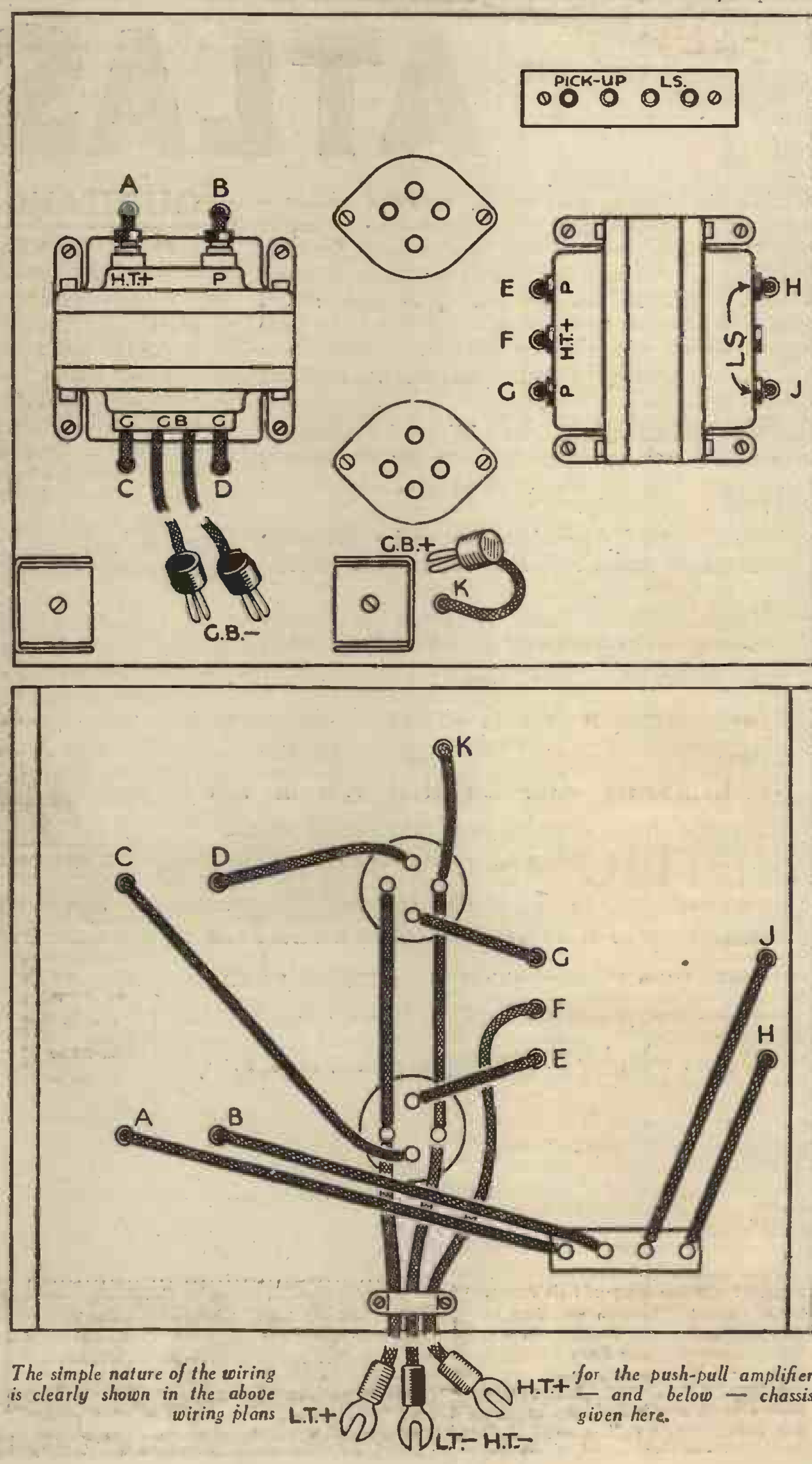
When connecting the amplifier to the receiver, the two spade terminals marked L.T.+ and L.T.— H.T.— should be joined to the corresponding terminals on one of the valve-holders in the receiver, the terminal marked H.T.+ being connected to the high-tension positive terminal on the receiver. When these connections are employed the receiver switch will be operative on the amplifier as well.

The amplifier can readily be detached from the receiver without modifying the wiring of the latter, and is therefore valuable in that it can quickly be brought into operation when additional volume is required. It need scarcely be added that the unit is equally suitable for use on either "radio" or "gram.," but it is not intended to be operated directly from a pick-up. The reason for this is that the voltage output from a pick-up is not sufficiently high to load the push-pull stage. Nevertheless, the amplifier may be used in this manner when only a comparatively small output volume is required.

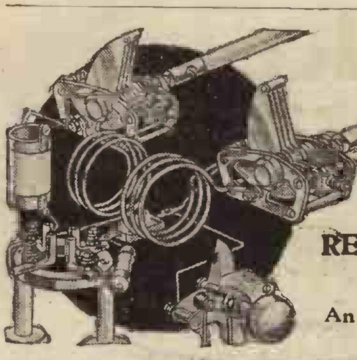
LIST OF COMPONENTS

- 1 Metaplex Chassis, 11in. by 8in. with 2in. runners.
- 2 Ferranti 4-pin Chassis-mounting Valve-holders.
- 1 Ferranti Push-Pull Input Transformer, type AF5cs.
- 1 Ferranti Push-Pull Output Transformer, type OPM1c (not required if speaker is fitted with suitable transformer).
- 1 Pair Bulgin No. 1 G.B. Battery Clips.
- 1 Clix Terminal Socket Strip, marked P.U. and L.S.
- 3 Clix Wander Plugs, marked G.B.+, G.B.—1 and G.B.—2.
- 3 Clix Spade Terminals, marked L.T.— L.T.+ and H.T.+. Connecting wire, flex, and screws.
- 2 Ferranti Valves, type L2.
- 1 9-volt G.B. Battery (Exide).

LAY-OUT & WIRING PLANS FOR THE TWO-IN-ONE PUSH-PULL AMPLIFIER



The simple nature of the wiring is clearly shown in the above wiring plans for the push-pull amplifier — and below — chassis given here.



Short Wave Section

REACTION ARRANGEMENTS FOR SHORT WAVES

An Article Describing the More Uncommon Forms of Reaction Circuits. By G. W. DAVEY

WHEN using a set other than a superhet the success of short-wave reception depends upon easily-controlled, smooth reaction, which should gradually build up a signal in volume, the valve finally going gently into oscillation without any sign of "ploppiness." In view of this, "swinging-coil" reaction has naturally fallen into disfavour, and in this article are described some of the other forms of reaction circuits which work well and which are worth trying out.

A Popular Circuit

The most popular form of short-wave circuit is probably that known as "throttle control." This is shown in Fig. 1, and Fig. 2 shows a modified form giving a very stable and efficient form of control. In order to be able to stop reaction effects, the value of the reaction condenser must be high, compared with that of the .0001 mfd. by-pass condenser, hence the specified value of .0005 mfd. It will also be found that the capacity of the reaction condenser must be increased to stop oscillation, and not decreased, as is usually the case. Throttle control owed much of its popularity at one time to the fact that an H.F. choke could be dispensed with, but now that these components are obtainable so well-made and reliable it is recommended that one be used. Another form of throttle control is shown in Fig. 3. In this case an H.F. choke is used, but the main, and probably the only, disadvantage of the circuit is that hand-capacity effects are likely to be troublesome, as neither side of the reaction condenser can be earthed. The great advantage of this arrangement is that reaction has little effect on tuning, and once a signal has been found, reaction can be brought right up to oscillation point without any need for carefully "following" the signal at the same time.

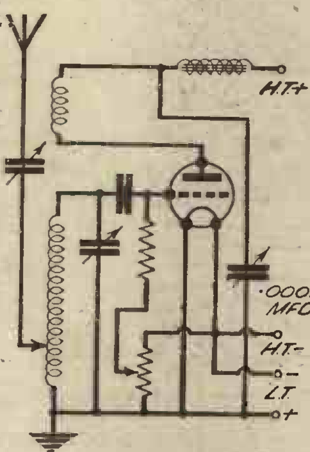


Fig. 1.—A "throttle-control" circuit.

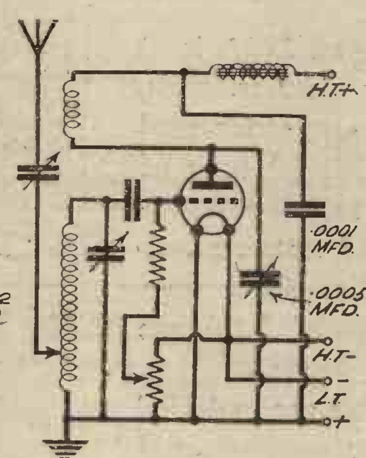


Fig. 2.—A modified form of the circuit shown in Fig. 1.

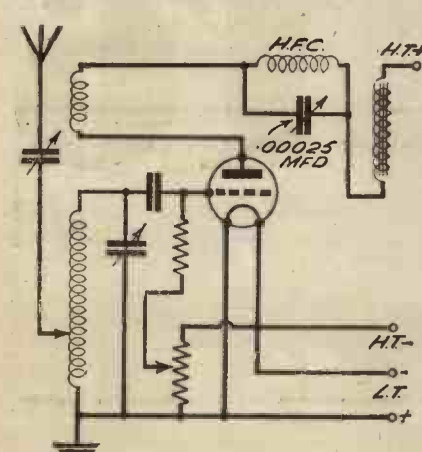


Fig. 3.—A circuit with another form of "throttle control."

This circuit should therefore be of use provided an extension spindle is used on the reaction condenser and preferably also an earthed screen interposed between the condenser and the tuning dial. Once again modifying the circuit, we arrive at that shown in Fig. 4, an arrangement where the aerial input is fed into the anode circuit. This has not been tried by the writer as a short-waver, but again it suffers from the defect that, in this case, neither condenser is at earth potential, and extension spindles and screening will be required on both tuning and reaction controls.

The "Armstrong" Circuit

It is felt that in an article of this nature some mention should be made of the "Armstrong" circuit. This is a super-regenerative receiver designed to make the very most of reaction effects. It is well known that a set bursts into oscillation just before the maximum use has been made of reaction in building up the volume of a signal. The design of the "Armstrong" circuit is such that use can be made of the regenerative effect right up to oscillation point, and hence greatly increased volume and, furthermore, sensitivity obtained. This circuit is shown in Fig. 5. L1 and L2 are the "quench" coils, and large-size plug-in coils may be tried here. C1 and C2 are .001 mfd. each. This circuit gives very fine results on short waves, but owing to its inherent sensitivity is very liable to bring in atmospherics and other interfering background noises. It has been revived lately for more especial use on the ultra-short (5-7 m.) wavebands, where it has been found to give extremely good results.

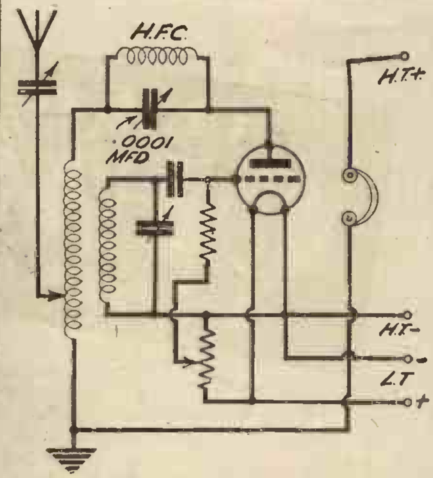


Fig. 4.—A further modification of the circuit.

Resistance Control

As an alternative to capacity-controlled reaction it is possible to use resistance control. Experimenters are naturally familiar with the fact that altering the value of the H.T. applied to the detector valve alters the amount of reaction effects obtainable—the higher the H.T. the readier and fiercer reaction, whilst if H.T. is too low no reaction at all is obtainable. Of this fact use may be made to provide a simple and finely-controllable reaction system, two forms of which are shown in Figs. 6 and 7. It is naturally most important to use good reliable variable resistances, as otherwise poor contact will be the cause of many troublesome noises. The circuit in Fig. 7 is a somewhat better arrangement that at 6, as a finer control of H.T. is obtained, and hence a finer control of reaction. Both these systems have the advantages that hand-capacity effects are

(Continued on page 674)

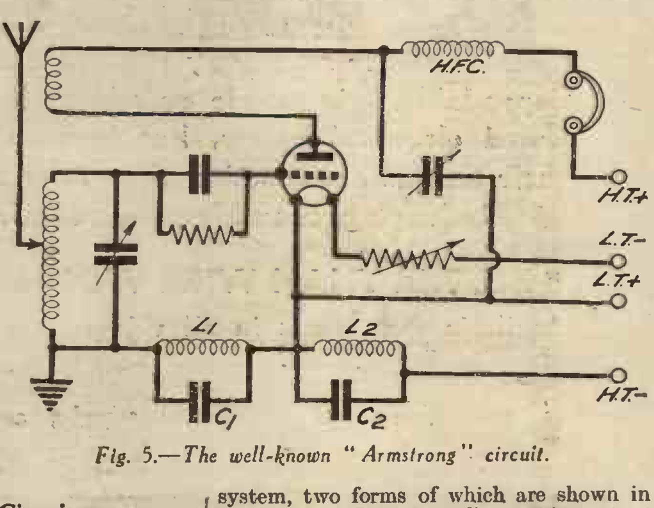


Fig. 5.—The well-known "Armstrong" circuit.

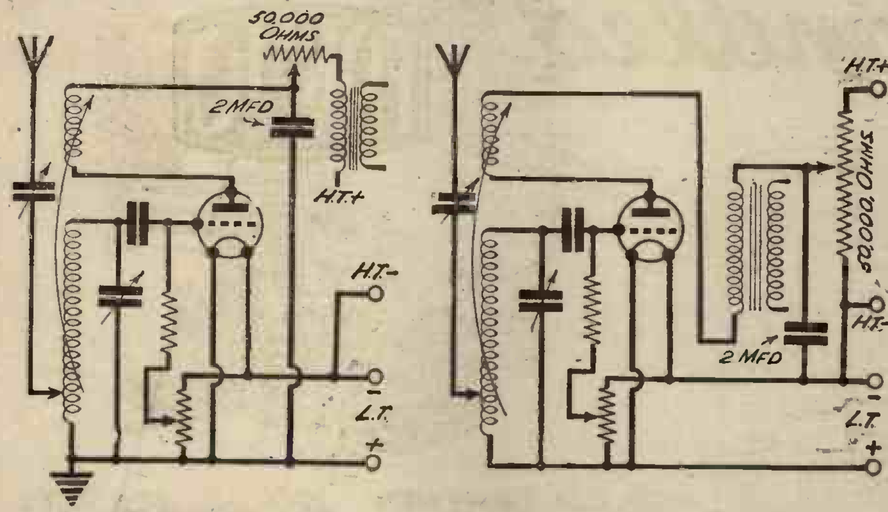
SHORT-WAVE SECTION

(Continued from page 672)

negligible, as also is the effect of reaction on tuning. Neither form seems, however, to have found a great deal of favour among short-wave "fans," but once, after a little experimenting, the best size of reaction control together with the best value of H.T. voltage have been found, the resistance-control system should be found a useful and stable form of reaction circuit.

Smoothness of Reaction

As was mentioned earlier in the article, the success of reaction on short waves depends upon its "smoothness." As an aid to obtaining this it is recommended that the system of grid-leak return shown in all the diagrams be used. It is to connect the L.T. end of the grid-leak to the slider of a 400-ohm potentiometer, the two ends of which are connected to the respective L.T. terminals. The slider is adjusted to the best position giving the easiest control of reaction. As an alternative to this two grid-leaks may be used as shown in the sketch—Fig. 8. The size of grid-leak and of the grid condenser both have an effect on reaction smoothness, and in the event of "ploppiness" in its control it would be as well to experiment with different values of these components. In conclusion, it may be mentioned that if any results of value are to be obtained with a short-waver a little time and trouble spent on the reaction circuit will be well repaid.



Figs. 6 and 7.—Two forms of a short-wave circuit with finely controlled reaction.

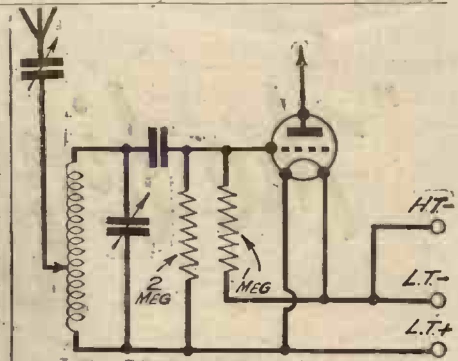


Fig 8.—A circuit in which two grid leaks are used

SHORT-WAVE GOSSIP

IF anything, to-day there is more excitement to be derived from listening on the short waves than to the ordinary medium waveband, for much activity now prevails. Most of the Continentals are developing their systems for the benefit of nationals overseas; new transmitters are being erected and new channels tried out, with the result that the listener who turns to his one- or two-valver nightly is rarely disappointed. On most days he will make fresh captures, and if a log is carefully kept its growth will be rapid.

* * *

ONE need not go far afield for new-comers to the ether; the "fan" who starts by tackling Europe alone will find much to interest him. But it is often when searching for the nearer broadcasts that some of these pleasant DX captures are made. The fact that you possess a modest one- or two-valver as against your neighbour's superhet does not put you out of the running. Just one word of warning, however, if you do not want to be discouraged at the outset: try for the more powerful stations. These are not difficult to tune in and they will greatly assist you in getting the "feel" of the condensers and put you in the right way of tuning your receiver.

* * *

THERE are plenty of these transmissions at your disposal, such as the Zeesen, Daventry, Skamlebaek, Jeloy, Moscow, Madrid, and other short-wavers. Budapest is a newcomer on the air, although experimental broadcasts on the higher frequencies from this city were made some months ago. There now appears to be a regular schedule. HAS3, Szekesfehervar, on 19.52 metres (15,370 k/cs.) is to be heard on Sundays at G.M.T. 1.0 a.m., and on 55.56 metres (5,400 k/cs.). HAT, in the same locality, sends out a programme daily between G.M.T. 1.0 and 2.0 a.m. As these are both 20 kilowatters, expect powerful signals.

There is no difficulty in logging, when you come across them, as the call is put out in several languages, including English.

THE new Portuguese short-wave station which has been reported as answering to the letters CSL is, I am convinced, CT1GO, Lisbon, on 48.4 metres (6,198 k/cs.). The misreading of the call is due, probably, to the fact that it is operated by the Radio Club da Costa *do Sol*, which, as CT1GL, also runs the Parede medium-wave broadcasting station on 291 metres. On 48.4 metres CT1GO may be heard daily (except Tuesday) between G.M.T. 12.30-1.30 a.m., and on Sundays between G.M.T. 4.30-6 p.m. Another channel—namely 24.2 metres—is also being used on Sundays from G.M.T. 3-4.30 p.m., and on Tuesdays, Thursdays, and Fridays from G.M.T. 6-7.15 p.m. It should be remembered that Portugal still possesses our old friend CT1AA, Lisbon, on 31.25 metres (9,600 kc/s.), whose cuckoo interval signal is so useful for identification purposes. Although I have not logged it personally, I understand that CT1CT, also in the Portuguese capital, is still transmitting on 31 metres (9,677 k/cs.) on Sundays at midday G.M.T., and on Thursdays between G.M.T. 9 and 11 p.m.; but I believe that the schedule is not strictly adhered to.

* * *

ANOTHER strong set of signals to be picked up regularly is that given out by the new Rome (Prato Smeraldo) short-wavers. The 25.4-metre channel seems to have been definitely abandoned for 49.3 metres (6,085 k/cs.), on which channel transmissions are made every Monday, Wednesday, and Friday from 11 p.m. G.M.T., and for 30.67 metres (9,780 k/cs.), which is used on Thursdays and Saturdays between 12.45-2.15 a.m., and on Sundays between 4 and 6.30 p.m. G.M.T. In the former case, as the broadcasts are destined to the United States, announcements are made in both Italian and English. Do not mistake this broadcast with one you may hear from Zeesen DJM, which is only 6 kilocycles lower, or on 49.35 metres. In this case, as a rule, the programme is relayed from DJC, and announcements are made in German, English, and sometimes Spanish.

* * *

MANY of the South Americans have chosen channels above 50 metres, or above Moscow RW59. One that has been heard in the United Kingdom is OA4XD, Lima (Peru), on 51.87 metres (5,780 k/cs.). Calls are given out in Spanish and English; in the former case the station calls itself: *La Voz de Peru*; in the latter, *Radio Dusa*. For programmes it relays entertainments from the capital broadcast by the medium-wave station on Thursdays between G.M.T. 2.0 and 4.30 a.m.

HJ4ABE, Medellin (Colombia), which for some time varied its wavelength, seems to have settled down on 50.85 metres (5,900 k/cs.). The power is—or was—only 50 watts, but on occasion it has been picked up between G.M.T. 3.0 and 5.0 a.m.

* * *

ON 48.78 metres (6,150 k/cs.), YV3RC, Caracas (Venezuela), calling: *Radiodifusora Venezolana* (phon) *yay vay trez erray say en Caracas*, is a worth-while search. The interval signal consists of three gongs of different pitch. Try at any time between midnight and 3 a.m.

Finally, XEBT, Mexico City, and COC, Havana (Cuba), both of which work within a kilocycle or so of each other—namely, roughly on 49.92 metres (6,010 k/cs.), are regular and enthusiastic broadcasters. XEBT is the short-wave outlet of the medium-wave XEB, Mexico City. Here you will hear, as a warning and interval signal, the wail of a siren, followed by three cuckoo calls. Times of transmission: nightly from G.M.T. 11 p.m.-5 a.m. COC, on the other hand, may be recognised by its bugle call; is on the ether from G.M.T. 9-11 p.m., and again from 3-4 a.m. As a closing-down melody it takes a well-known air from Suppé's opera "Light Cavalry." The call is always given in Spanish followed by an English translation.

THE EASY ROAD TO RADIO.

THE BEGINNER'S SUPPLEMENT

EFFICIENT AERIAL SYSTEMS.

By H. BEAT HEAVYCHURCH.

THE object of an aerial system is to collect the electrical impulses which ultimately will be reproduced as sound in the speaker. So much even the veriest radio novice understands. But the design and installation of an efficient aerial system is not quite the simple matter which it is so often considered. So many listeners erect a sketchy aerial of very conventional type, and as a result have to content themselves with but mediocre reception, whereas if they had spent a little time in a careful review of the situation, and in deciding upon the most satisfactory arrangement for their particular working conditions, the result might have been almost incredibly better.

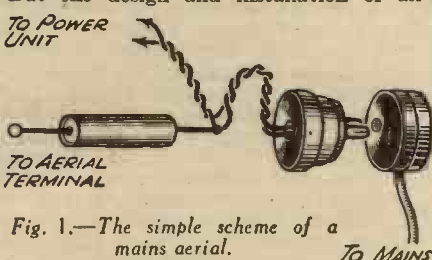


Fig. 1.—The simple scheme of a mains aerial.

Of the many points to be considered in connection with the design of aerial systems, the first can be dismissed in a very few words, although it is of prime importance. It is this—*the earth connection is definitely a part of the aerial system.*

It used to be said that a good aerial was equal to adding an extra valve to the set. I would prefer to say that a good aerial in conjunction with an efficient earth is worth something more than an extra high-frequency valve, so ensure that your earth connection is as good as circumstances will allow. It is scarcely necessary to remind readers that a buried earth plate or tube is the best arrangement, while the incoming water main is second best. Further, as one method of reducing interference from electrical sources, see that your radio earth is retained solely for radio, and that no other apparatus, such as electric light conduits, telephone installations, etc., shares the earth.

Points to Watch

Considering the main part of the aerial from the signal-collecting point of view, remember that an outside aerial is the most efficient from this angle; that it should be as high as possible; while a horizontal length of from 50ft. to 70ft. is recommended.

Just a passing reminder that good insulation is essential—two porcelain insulators at least should be used in series at each end. If you are fortunate enough to be able to erect an efficient outside aerial, do not waste the good signals which it can pick up by using a badly designed down-lead. Points to watch in this connection are first, that this wire must be kept away from the building, and especially from metal gutters, rainwater pipes, and similar objects. In order to ensure this, "stand-off insulators" or brackets are of particular value. Second, the down-lead must be so located that it is not likely to be chafed against such objects as roofs, trees, sheds, etc. Third, it should be kept taut so that it will not swing to and fro in the wind. For one thing, a swinging down-lead eventually leads to a broken joint and, possibly more important, as it gradually approaches and recedes from the side of the building a kind of spurious fading in signal strength is produced.

Fig. 3.—The W.B. Droitwich suppressor.

In large numbers of cases, however, an outdoor aerial is out of the question. Loft aerials must be considered second best to outdoor aerials, but they are a very poor second best in many cases.

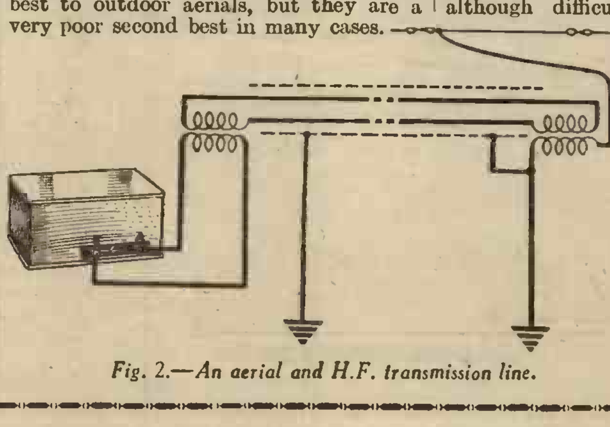


Fig. 2.—An aerial and H.F. transmission line.

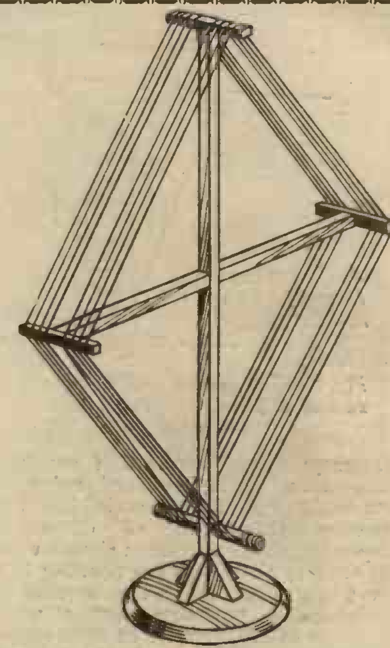


Fig. 4.—An efficient type of frame aerial that will give very good results.

In installing a loft aerial care should be taken to see that they are just as efficiently insulated as outdoor aerials. Their actual location should be selected carefully to ensure optimum results, but usually this can be achieved only by trial and error experiments. It is, however, well worth while conducting these experiments, as the difference between the best position and the worst is usually quite considerable. The down-lead from a loft aerial should be very carefully run, for owing to the smaller collecting power of this type of aerial there is all the more reason for conserving every millivolt. Technically speaking, the ideal system is to bring the down-lead out under the eaves and down the side of the wall supported on hold-off insulators.

Special Aerials

Sometimes, however, especially in flats, even a loft aerial is not possible and then recourse must be made to a small aerial in the room containing the receiver. Picture-rail aerials are even less efficient collectors than loft aerials, although reasonably good results are sometimes obtainable, particularly when the receiver is of a really sensitive type; that is to say, one employing at least a single efficient high-frequency stage for local station reception. Good spacing away from walls is again a desideratum, although difficult to achieve without making the aerial conspicuous and unsightly. Here, again, a little experiment is usually necessary to discover the most efficient arrangement.

Finally, there is the frame aerial which is a still less efficient collector of signals. A really sensitive set is necessary to obtain good results with a frame, at least two radio-frequency stages or a superhet. ar-

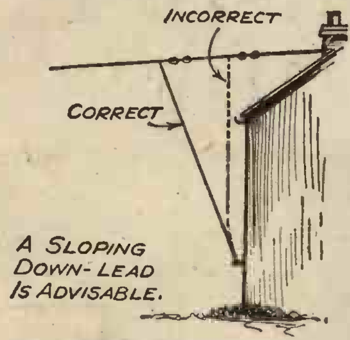


Fig. 5.—The correct and incorrect method of fixing the down lead of the aerial

rangement being essential if anything more than local station reception is to be obtained. A frame aerial, however, possesses the merit of directional properties, giving maximum signals when the arms of the frame are pointing in a direct line to the station it is required to receive, and minimum signals when the plane of the frame is at right angles to this position. By swinging a frame aerial, therefore, the effective selectivity of the receiver can be very considerably augmented, unless, of course, the wanted station and the interfering station are approximately in the same line from the point of reception.

Many of the more sensitive modern sets give reasonably good results with a mains aerial, such as the arrangement shown in Fig. 1, or with a small plate aerial fitted inside the top of the cabinet. With such aerials, however, listening will usually be restricted to a comparatively small number of the more powerful programmes.

So much, then, for the signal-collecting properties of various types of aerial. It may be objected that the more efficient aerials result in increased interference from stations on adjacent wavelengths. This is really a fallacy. A properly designed receiver will have sufficiently good selectivity to separate stations with the loss of only one or two channels on each side of the more powerful programmes. If, however, the selectivity problem is really acute in any particular installation, the high-efficiency aerial should still be retained and a small coupling condenser inserted between the aerial and the receiver in the well-known manner.

The Chief Problem

We now come to what is really the biggest problem in aerial design at the present time; namely, the fact that an aerial system not only collects radio signals, but is also a good collector of interferences radiated from electrical machinery and apparatus of all kinds. These interferences may be due to the electrical installation in the listener's own home, in neighbouring houses, business premises, factories, by electric trains, trams, trolley buses, signs, lifts, and so on.

As has been mentioned on previous occasions, the correct way to tackle interference of this kind is to suppress it at the point of generation, but no law for compelling this exists, and in most cases listeners have to solve the problem for themselves. Interference carried into the set *via* the mains connections to the receiver or power unit do not come within the scope of the present article, but quite a large proportion of the interference is actually radiated. The only method of avoiding this form of interference, apart from preventing its propagation, is to locate the aerial system outside the interference field. How does this suggestion affect various types of aerials?

Fig. 7.—A frame aerial having separate windings for medium and long waves. The change-over is effected by means of a multi-pole switch.

In the case of outside aerials it can usually be taken that if the aerial does not come within 20ft. of a building, or, if erected on masts attached to the chimney, is raised 20ft. above the roof, it will be practically clear of interference radiated from domestic apparatus. Any interference then experienced is probably picked up by the down-lead which passes through the interference field, and may be avoided by using a screened down-lead consisting of an insulated wire, air spaced inside a metallic tube.

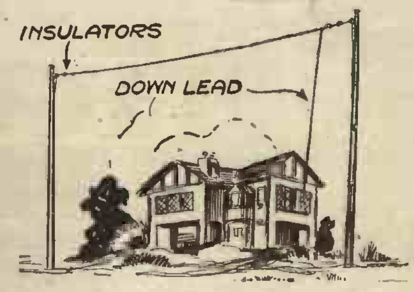


Fig. 8.—An inverted L-Type aerial.

Transmission Lines

If, owing to excessive interference, it is necessary to remove an outdoor aerial to a considerable distance from the house, it will also be necessary to connect it to the set by a "transmission line." This is effected by connecting aerial and earth to the primary winding of a step-down high-frequency transformer and by running screened leads from the secondary winding to a corresponding step-up transformer at the receiver, as shown in Fig. 2. Distances up to several hundred yards can be dealt with in this way without serious loss of signals.

A loft aerial is, of course, more susceptible to radiated interference generated inside the building, but it is usually possible to locate it so that direct pick-up from the mains is avoided. Then, with a careful overhaul of switches, plugs, lampholders, and other equipment to avoid loose contacts, and with spark suppressors fitted to refrigerators and other small motors, the installation should be reasonably free from interference. If trouble is still experienced a shielded down-lead should be employed.

Similar remarks apply, but with added force, to picture-rail aerials; for it is still more difficult to find a position for an aerial of this type which is well removed from electric light wiring and other apparatus. A little experiment, however, will usually reveal the best position. Frame aerials are also very prone to "shock excitation" from electrical interference, although in this case, swinging the aerial will often permit major interferences, such as tram or trolley-bus radiations, to be avoided. Mains aerials, while usually fairly free from radiated interference, are very prone to mains-borne interference, and no remedy can be found, because the fitting of a mains filter would also result in by-passing also the wanted signals to earth.

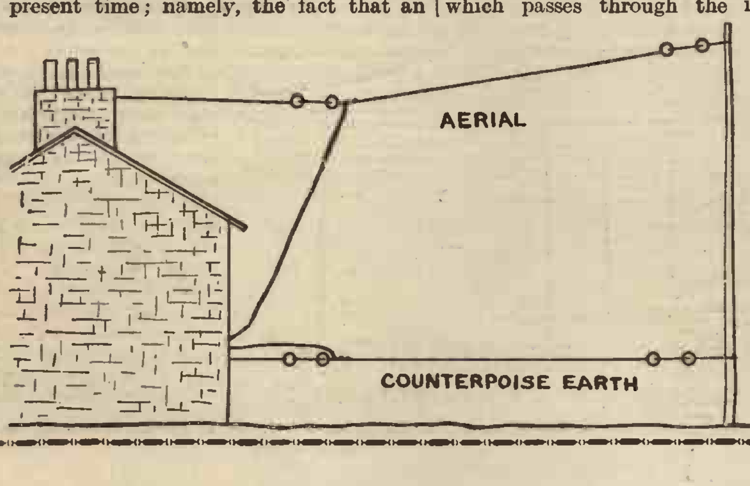


Fig. 6.—An aerial system with a counterpoise earth. With this arrangement improved results are often obtained.

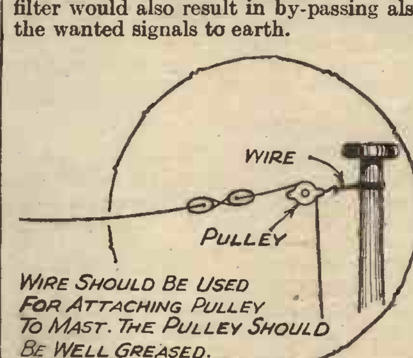
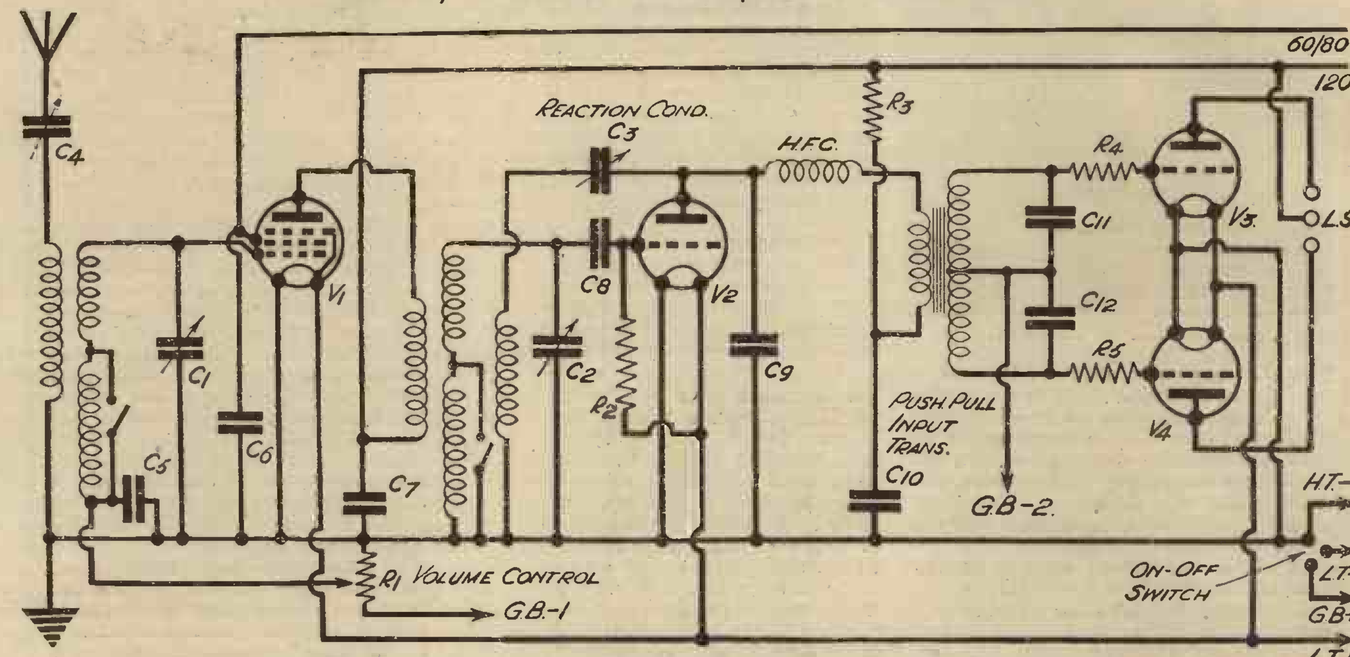


Fig. 9.—Details of the aerial insulators and the method of fixing the aerial to the pole.

THE BATTERY MODEL HALL-MARK FOUR

An Astoundingly Good Battery-operated Receiver with "Mains" Output, Ample Range, and a Degree of Selectivity Sufficient for Most Purposes—All at Low Cost



This circuit of the battery model Hall-Mark Four shows the simplicity of the arrangement.

FOR various reasons, push-pull amplification of the "straight" kind, as opposed to Q.P.P. and Class B, has been very much neglected during the past couple of years, and constant inquiries have been received from readers for a really up-to-date set of comparatively simple type with push-pull output. Push-pull is certainly very desirable when a really large output is required, and particularly when quality reproduction is of prime importance. It is to meet the requirements of many correspondents that we are being so bold as to revive push-pull amplification, and to prove that it is ideal for modern conditions.

A Modern Circuit

The Hall-Mark Four (battery version) of which a circuit diagram is given at the top of this page, is in every respect a modern receiver, and provides exactly the type of reception that is being demanded by more and more listeners, who fully realise that quality and punch are of even greater importance than long range and the ability to separate two transmissions emanating from stations situated many thousands of miles away. We know full well that reception of this kind is not always asked for by every listener, and those who are interested in real DX work were well catered for by the £5 Superhet. But we are also aware that every listener at some time or other likes to have by him a powerful receiver ideally suited to the reception at perfect quality of the nearer stations. There are many constructors, moreover, who find it worth while to have two separate receivers, one with which to go "globe-trotting" and the other for local work and for the benefit of the "family," who place ease of control and quality of reproduction before everything else. The Hall-Mark Four forms an excellent "second" receiver for those who come within the latter category.

It will be seen from the circuit that the arrangement is on very straightforward lines, and that it is entirely devoid of any "extras" that make a circuit look complicated, but which do nothing to improve performance. Air-core coils of sound design and of a type providing good selectivity are used both in the aerial and in the inter-valve circuits. Both coils are of the H.F. transformer type of which the primary is untuned, and both are fitted with built-in wave-change switching so that the number of external connections is reduced to a minimum.

LIST OF COMPONENTS

One Metaplex chassis, 10in. x 8in. with 3in. runners—Peto Scott.
One 2-gang condenser, Baby type with dial—J.B.
One 2-coil assembly, type T.D.S.—Colvern.
One reaction condenser, .0003 mfd. (C3)—Graham Farish.
One pre-set condenser, .0003 mfd. (C4)—Formo.
Four fixed condensers, two .5 tubular (C7 and C10), two .1 tubular types 250 (C5 and C6)—T.C.C.
Four .0002 fixed condensers, type "M" (C8, C9, C11, C12).—T.C.C.
One 50,000 ohm potentiometer (R1)—B.T.S.
Four ohmite resistances, 1 meg. (R2), 30,000 (R3), two 10,000 ohms (R4 and R5)—Graham Farish.
One input push-pull transformer, type DP36—Varley.
One H.F. choke, type H.F.8—Bulgin.
Three potentiometer brackets—Peto Scott.
Two terminal strips, A., E. and L.S./P.U.—Clix.
Six plugs, G.B.-1, G.B.-2, G.B.+, H.T.—, H.T.+1, H.T.+2—Clix.
Two spade terminals, L.T.+ and L.T.— —Clix.
Four valves, 210 VPT, 210Det., and two 220HPT—Cossor.
Loudspeaker—W.B.
One on off switch (three point)—Graham Farish.
Two five-pin valveholders—Clix.
Two four-pin valveholders—Clix.
One Hall-Mark cabinet—Peto Scott.
One 120-volt H.T. battery.
One 9-volt G.B. battery.
One 2-volt accumulator.

Distortionless Volume Control

The first valve is a variable-mu H.F. pentode, and this provides a really large measure of amplification besides forming an ideal distortionless volume control. The detector circuit follows conventional lines, and includes a reaction condenser that gives a smooth control of volume and also enables selectivity to be increased when desired. It is also amply decoupled, with a result that there is no danger of instability or L.F. oscillation, whether the set is used with an eliminator or with an H.T. battery that is past its prime.

It is the output stage, however, that merits most attention, since this includes two modern valves in a modern push-pull circuit. As we have pointed out in recent articles, the degree of amplification given by a push-pull stage is more than double that of a single valve, the output actually being something like two and a half times that of a single L.F. valve. Push-pull has the further advantage that it is practically distortionless, due to the fact that the two valves tend to cancel out any distortion that might otherwise exist.

A Balanced Output Stage

In designing the push-pull output stage of the battery model Hall-Mark Four very great care has been taken to avoid any possibility of instability, and it is for this reason that stopper resistances have been included in the grid leads to the two valves. Still further to ensure perfect stability, however, the two halves of the

(Continued on page 685)

Mr. PERCY W. HARRIS.

TELEVISION THEORIES DISPROVED

This Article by Percy W. Harris Points Out Important Discoveries Made by Amateurs

"No flowers by request!" might be an alternative title to this article, for once more we have to attend the funeral of a wireless theory which has failed to stand the test of time—and a very short time at that! "Short-wave television is not really a practical proposition," we have heard on every side, "everyone knows that these ultra-short waves are like light waves and travel only in straight lines, so that they have a very short range! You can't transmit more than about twenty-five miles with them."

Notice the "everyone knows." I have heard this tag attached to more unbaked and half-cooked theories than I care to remember, and have long since come to suspect anything with that label. There are more than enough scientific Hitlers in these days, who are much too ready to collect a bare handful of facts and deduce a world-encircling theory from them. Just plain impatience is the real cause of this trouble, and it *is* a trouble diligently to assemble enough facts, drawn from practical experience, to justify any serious theorising.

"Quasi-optical" Characteristics

Did you observe how quickly, after the first experiences with ultra-short waves had been obtained, the theorists announced the quasi-optical nature of these waves? A little quiet thought would have persuaded them that it would be wise to wait for a few thousand more tests in all kinds of conditions, with a variety of ultra-short waves, before making such a drastic and sweeping statement. Unfortunately, theories are much more welcome than facts, and are such comforting and relieving things. A good fat, all-embracing theory of this kind saves so much thought and worry, and prevents one wasting time.

If you accept it, that is. I didn't, as I explained two or three months ago in the columns of a contemporary, giving at the same time plenty of reasons why not. Fortunately, a few thousand amateur transmitters and receivers preserved their mental independence also. While all the technical "experts" who unquestioningly accept one another's theories as gospel have been working out a technique entirely dependent upon the optical nature of these ultra-short waves, and while those charming, if slightly inconsequent, gentlemen known as wireless correspondents, in the daily Press, have been explaining it to the public at large, the amateurs have been working their transmitters on 5 metres or so with such success that they have been read over distances as great as five hundred miles. And the dogmatists cannot very well laugh *that* off with nonchalance.

I think you will find—and here am I theorising myself—that this optical effect, as well as the problems of fading, long-and-short-wave interference and interaction, and indeed much else, is largely a matter of aerial design. We have heard a lot about "beam wireless" and how the waves travel along certain paths, but if careful measurements were made it would not be surprising to find that the efficiency of the beam system is due to other causes than those to which it is attributed. I am sure that a great deal of energy is radiated from the *back* of the reflecting system as well as the front, which is rather awkward for the diagrams!

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It is remarkable how the amateurs have been pushed here and there in the spectrum, being first given a waveband because it seems useless, and then being dispossessed of it when they have proved its special value and efficiency. At the beginning, all waves below 300 metres were considered useless for commerce because they were believed to have such poor carrying power. The amateurs were given them for a time. Later they were taken away and the "really useless" range of 180 to 200 metres substituted. I was one of the first to convey to the Marconi Company the news that the Atlantic had been spanned by amateurs using this waveband with a ridiculously low power as well, and I shall never forget the incredulity and patronising amusement with which the statement was received by some of the engineers. Later, when the news was confirmed beyond doubt, it was put down as a "freak," although still later when such transmissions became almost a daily routine, plenty of theories were devised to account for them, and so the band was taken from us.

So it goes on, and in all directions attempts are made to block up possible paths of progress by soporific theories. I do not want you to imagine for a minute that I do not use and value theories, but they have to be much sounder than many of the newer ones to be of any real value.

If you want a good thought-provoking example of how stereotyped we get, let me suggest to you the way attempts are made to get rid of second-channel interference in superheterodynes. You know what happens. The oscillator beats with two fairly widely separated frequencies, the distance between them being twice the beat frequency, so that both are converted into the intermediate frequency. The first signal circuit, being tuned to one of them, gets that one most strongly, and the more sharply the first circuit is tuned, the less of the second frequency there is to get beaten up into the intermediate frequency. If you get this clearly in mind, you will see why pre-selector stages and bandpass circuits are used, with their attendant complications and expense.

The Real Problem

But think a little deeper. What is the real problem? For quality we want the first circuit as flat as possible. The supersonic principle itself can take care of selectivity between adjacent stations, as the intermediates can be made as sharp as we like. What we really want to do is to remove, as sharply as possible, *one particular frequency* which happens to be a good way away from the desired one. What is really needed then is a wavetrap for the *unwanted* frequency, *not* the sharpening and possible attenuation of the one we *want*. Many a superheterodyne of to-day is unnecessarily losing its quality of reproduction in pre-selector circuits (whose only real use is to remove second-channel interference.

In passing, it may be pointed out that the sole reason for using the superheterodyne in the first place has long since ceased to have any importance! It was, at first, the only way to obtain stable high-frequency amplification, for it preceded the neutrodyne and the screen-grid valve in time. Now we have no difficulty in getting H.F. amplification without it, although it is not easy to gang the same number of tuned circuits as we often use in a "super." Yet, just because of this pre-selection, many supers now have no fewer than four ganged condensers, and *that* number of ganged condensers in a "straight" set enables us to use three H.F. stages before the detector.

ALTERNATIVE COILS FOR THE £5 SUPERHET THREE.

Full Point-to-Point Wiring Instructions for Using Varley, Ward and Goldstone, or Colvern Coils in the £5 Superhet Three.

IN view of the difficulty which readers have been experiencing in obtaining the specified coils for the £5 Superhet, we have conducted exhaustive tests with other makes of coils, and find that Colvern G1, G2, G8, Varley BP50, BP50, BP53, or Ward and Goldstone GIC5, GIC6, GIC7 may be satisfactorily substituted.

Theoretical diagrams of the H.F. and oscillator circuits of the three sets of coils mentioned above are shown in Figs. 1, 2, and 3, but for the sake of readers who are not conversant with theoreticals, we will give point-to-point wiring instructions.

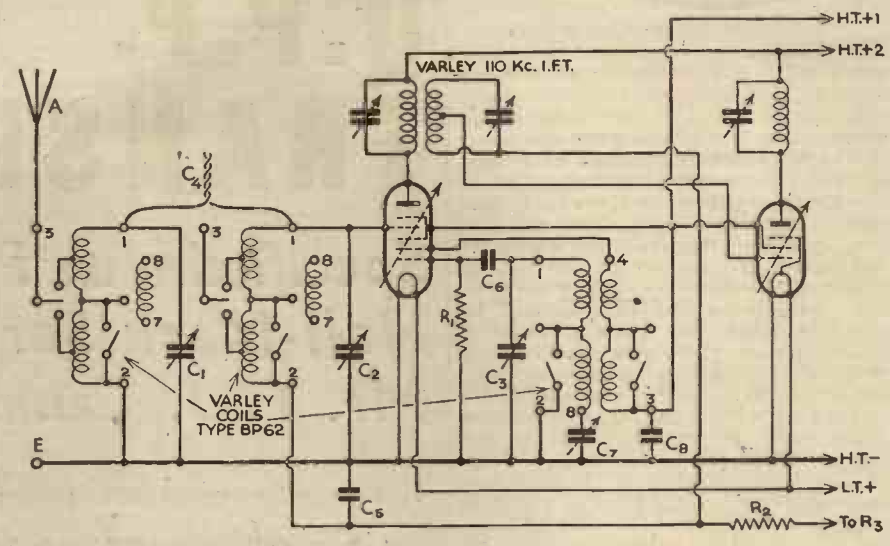

Fig. 1.—This diagram gives the connections for the Varley coils.

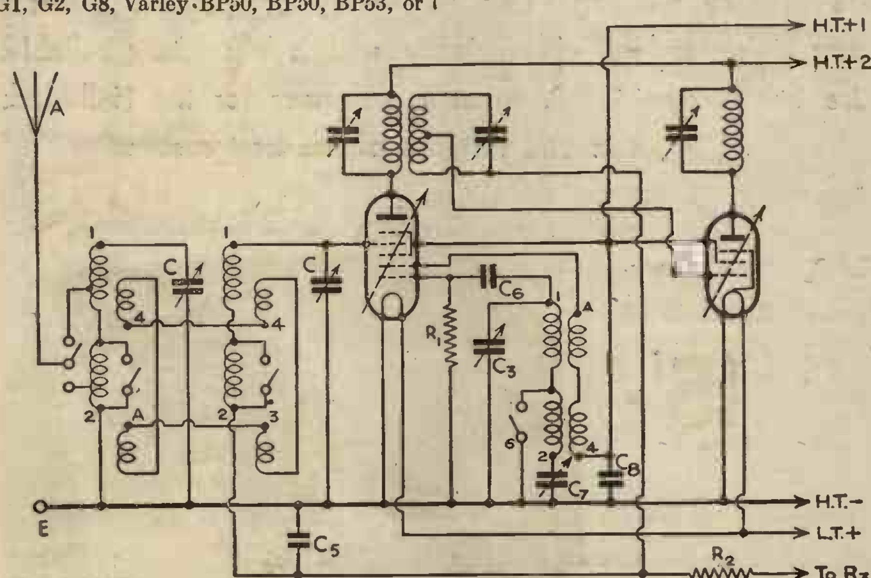

Fig. 2.—Connections for the Ward and Goldstone coils are shown above.

Colvern Coils

The Colvern G1 and G2 coils constitute an inductively-coupled H.F. band-pass unit and, therefore, the home-made condenser C4 used with the Telsen coils will not be necessary. The end of the grid winding of G2 is connected internally to the coupling winding and thence to the chassis, and, therefore, in order not to upset the ganging of the band-pass units it will be advisable to bias the first valve by a different method from that used with the Telsen coils. Terminal 1 of coil G2 should be connected to the fixed vane terminal of C2 and also to one terminal of an extra .0005 fixed condenser. The other terminal of this condenser should be connected to the cap lead of the first valve (210 P.G.) and also to one end of a .5 meg. resistance, the other end of this resistance being then connected to the juncture of R2 and C5. The other connections should be made as follows: G1—7 to aerial lead, 1 to fixed vane terminal of C1, 8 to MB. G2—1 to fixed vane terminal of C2 and to the extra .0005 condenser, as mentioned above. G8—2 to C6 and to one terminal of C7 (pre-set), 7 to the other terminal of C7 and to the fixed vane terminal of C3 (oscillator section, marked superhet underneath the condenser chassis), 5 to MB, 8 to the oscillator anode of the PG210 (pin No. 1), and 6 to C8 and H.T.+1 lead.

Varley Coils

These coils are also of the inductively-coupled band-pass type, but the home-made condenser C4 may be retained if desired and the connections made as follows: BB50—3 to aerial lead, 2 to MB, 1 to fixed vane terminal of C1 and to one lead of C4. BP50 (No. 2)—1 to fixed vane terminal of C2 and to the other lead of C4, 2 to the juncture of C5 and R2. BP53—1 to C6 and fixed vane terminal of C3, 2 to MB, 8 to one terminal of C7, and the other terminal of C7 to MB, 4 to the oscillator anode of the PG210 (pin No. 1), 3 to C8 and H.T.+1 lead.

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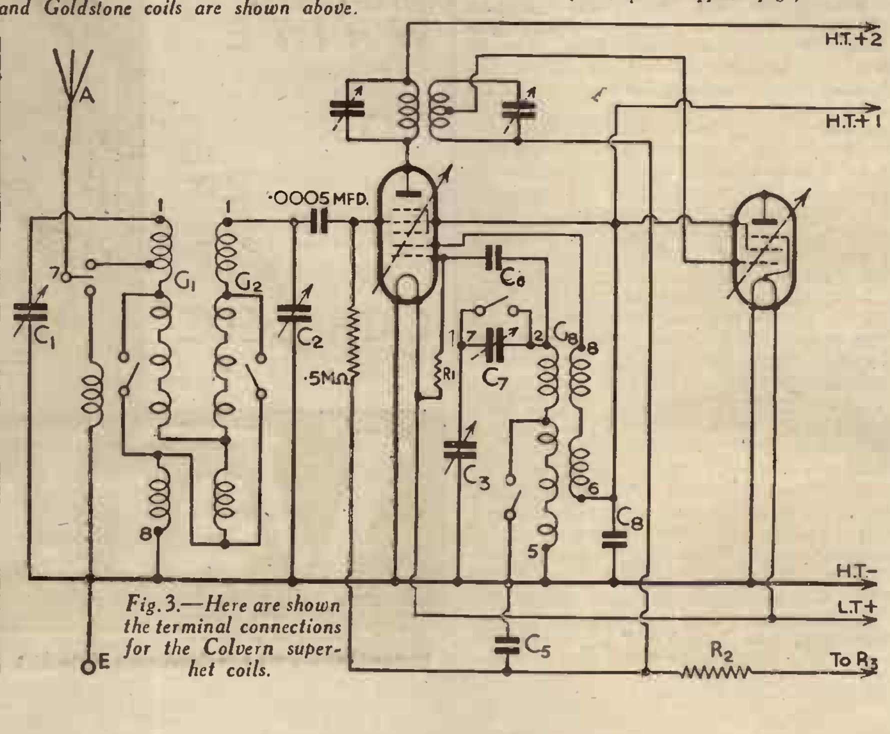

Fig. 3.—Here are shown the terminal connections for the Colvern superhet coils.

ALTERNATIVE COILS FOR THE £5 SUPERHET

(Continued from previous page)

Connection may also be tried to terminal 6 instead of to terminal 3, and the results compared.

Ward and Goldstone Coil Unit

This incorporates inductively-coupled band-pass coils and an oscillator coil. The home-made coupling condenser C4 should be omitted and the wiring made as follows: GIC5—Aerial terminal to the insulated lead protruding from the back of the unit, 1 to fixed vane terminal of C1, 2 to MB, 4 to 4 of coil GIC6, A to 3 of coil GIC6. GIC6—1 to fixed vane terminal of C2, 2 to the juncture of C5 and R2, 4 and 3 to 4 and A of GIC5, as mentioned above. GIC7—1 to C6 and to the fixed vane terminal of C3, 2 to one terminal of C7 and the other terminal of C7 to MB, 6 to MB, A to the oscillator anode of the PG210 (pin No. 1), 4 to C8 and H.T.+1 lead.

The Superhet Gang Condenser

Some of these condensers have their oscillator section at the front end, whilst others have it at the back. Care should, therefore, be taken to connect the oscillator coil (G8, BP53, or GIC7) to the correct section. This has been referred to as C3 in the text, and may be differentiated from the other two sections by its specially shaped fixed vanes.

The Tracking Condenser

In some cases it has been found that the capacity of the pre-set condenser does not reach .002, and, therefore, if results are not entirely satisfactory on the long-wave band, it is suggested that a .001 fixed condenser be connected across the terminals of C7.

RECEIVING EXTRA EUROPEAN STATIONS

THE reception of Australian broadcasting stations in this country is extremely rare, but Manchurian and Chinese stations can be heard fairly frequently if care is taken in tuning the receiver.

Within the last few weeks Shinkyo, Manchuria, has been heard fairly frequently upon 536 metres. The best time to search for this station, as for other Eastern stations, is between 4 and 8 a.m. This station is the most powerful Eastern station, employing a power of 100 kw. XGOA, Nanking, China, is also heard in England from time to time and, owing to its employing English for many of its announcements, is readily identified when heard. It operates upon 439.5 metres with a power of 50 kws. China has several stations which announce in English, and they are all worth listening for. Their calls are XMHA (499.7 m.); XHHX (325.9 m.); XNPP (320 m.); and XGOD, which operates upon 302 metres.

Leaving China we turn to the third most powerful station in the East, KZRM (it is pronounced KZeeRM), Mila's 50 kw. station. Operating upon 482 metres, this station is occasionally heard in this country.

Most listeners to America have heard Latin-American broadcasting, although many are unaware of the fact owing to announcements being made in Spanish.

Mexican Stations

Nevertheless, a comparatively large number of Mexican stations announce in English and Spanish. This is because, being a neighbour to the United States, the fact that the two languages are employed makes them attractive to advertisers who broadcast their programmes from them. One might imagine that the same would apply so far as Cuba is concerned, but it does not because Cuba has no high-powered stations, and is not consistently heard in the United States. CMC, at Havana, however, announces in English and Spanish upon 361.2 metres.

XER, Reynosa, is possibly the most renowned Mexican station which employs two languages. Operating upon 410 metres with a power in the neighbourhood of 100 kW., this station is regularly heard in this country. Lesser heard stations are XEW, Mexico City, which operates upon 385 m.; XETY, 357 m.; XEFE, 300 m.; XEJ, also 300 m.; XENT, 270 metres. Last, but not least, XEB, Mexico City which, despite its low power (it is a 10 kw. station) is one of the most regularly heard Mexican stations. It operates upon 291.1 metres.

Transmissions from the Argentine

From Mexico we turn south to South America and Brazil—the country where Portuguese is largely spoken. When conditions are favourable numerous Brazilian stations can be heard in England, and the best to search for are PRAP (425 m.); PRAC (425 m.); PRAS (335 m.); PRAE (368 m.); and PRAA on 400 metres. The latter is located in Rio de Janeiro. But, although you will hear many stations from the above countries, it is not until you come to the Argentine Republic that you find stations which come in with the consistency of United States stations.

LR4, on 303 metres, is frequently heard as early as 10.30 p.m., despite the European stations which are its neighbours. LR5 (368 m.); and LR9, 281 metres, are two other Buenos Aires stations which are also heard almost nightly in this country.

SUPPLEMENT TO "PRACTICAL AND AMATEUR WIRELESS"

AMATEUR TELEVISION

CHANGING SCANNING BEAM DIRECTION

By H. J. BARTON CHAPPLE, B.Sc., A.M.I.E.E.

WHEN using a spot light television transmitter for the purpose of scanning any scene or artist, the best results can be obtained only by "panning" the beam to follow movement. That is to say, the rapidly-moving light spot produced through the medium of the light source and individual scanner, which, of course, are fixed relative to one another, must be turned bodily by the operating engineer so that the subject is never out of the beam.

This is done quite effectively in the Baird mirror-drum transmitter installed in the B.B.C. television studio by moving the gun-like apparatus on runners for right and left lateral movement, or on curved channelling for angular movement. This is seen very clearly in Fig. 1 which shows the machine in question, together with the curved channelling. With certain programmes, however, it is desirable to move the light beam vertically up or down, otherwise the top part of the picture is cut off. Some time ago a proposal was put forward to remedy this, but so far the improvement has not materialised.

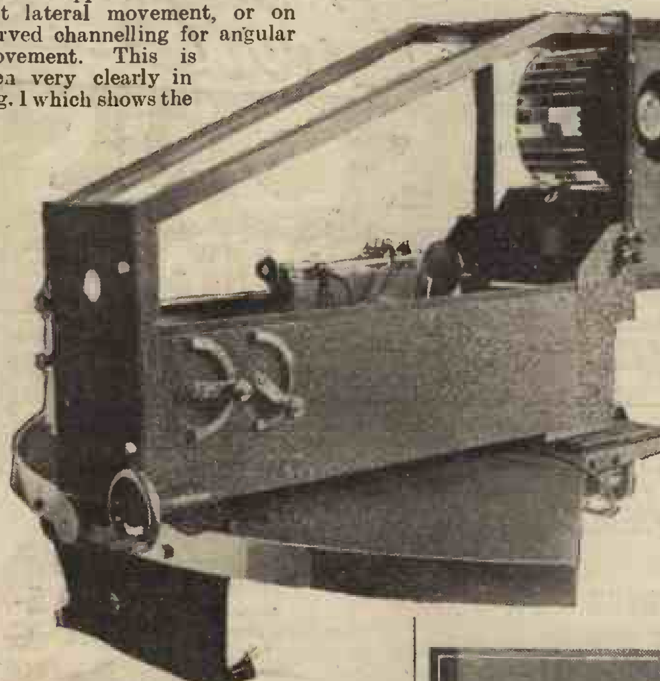

Fig. 1.—The Baird mirror-drum transmitter (cover removed) now installed in Broadcasting House.

The adaptation should not be of a serious character, and one method which could be tried is to use the scheme employed in some of the early disc-scanner transmitters. These first machines did not give any beam movement at all, and it was necessary for the artist to keep strictly to the limited light area when carrying out any performance. Subsequently, a double-mirror reflector device was employed, as shown in Fig. 2. The individual light spots of the scanning beam after emerging from the focusing lens met an inclined mirror surface. This reflected the light vertically where another inclined mirror changed the direction once more to a forward position. The two inclined mirrors were interlinked, and by altering slightly their relative tilt or inclination on site, it was possible to make the light beam move up and down vertically in a most effective manner. Although the amount of movement was rather limited, owing to a possible loss of focus, the scheme met the needs at that period, one of the prime recommendations being the extreme simplicity. If a somewhat similar method could be used by the B.B.C., the work of the producer for certain scenes would be simplified considerably.

Fig. 2.—Using a double-mirror reflector device to vertically "pan" the light spot.

USING ULTRA-SHORT WAVES

THE almost inevitable conclusion that a high definition television service will necessitate the use of ultra-short waves has caused considerable attention to be directed to this form of radio transmission. It has been imagined in many quarters that their use for this purpose dates back about twelve months. This is not correct, however, for, although the new radio technique developed is of very recent rapid growth, the first public demonstration of their valuable properties took place early in 1932.

Fig. 3.—Showing the high situation of the first dipole aerial erected for an ultra-short-wave demonstration in 1932.

After months of intense research an ultra-short-wave radio transmitter was built and accommodated in a brick hut on the flat roof of the Baird Co.'s premises at Long Acre, London. Bearing in mind the peculiar nature of the waves and their essential requirement of a high transmitting site (so that even with a very low aerial power, good signal strength would be received at any situation where the receiving aerial was in sight of the transmitting aerial), this location of the transmitter proved a very valuable one. An idea of its height in relation to surrounding roof tops is shown very clearly by a reference to Fig. 3, which shows the well-stayed dipole aerial (half wavelength) erected on the roof of the radio transmitter hut.

Transmitter Details

At that period a wavelength of 6.1 metres was used and the two copper rods, joined at the centre by a delicate meter to register aerial current (needle position being observed through powerful field-glasses), had a total length of 3.05 metres, so that they acted as a true dipole aerial having an approximate equal signal radiation in all directions.

The wire feed from the radio transmitter to the aerial proper for the first experiments consisted of a pair of parallel wires, whose distance of separation was maintained constant. Inductively coupled to the main oscillator drive at one end, connection to the aerial was made electrically at two points in the aerial length, so that the complete copper rod was divided into three equal parts.

Now, although high definition television scanners were being developed at this period, for the purpose of the public demonstration given in April, 1932, signal modulation was provided by the standard thirty-line mirror-drum transmitter machine then

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USING ULTRA-SHORT WAVES

(Continued from facing page)

installed in a studio on the first floor of the same building. (It will be recalled that the B.B.C. took over the low definition television service in August of that same year, but up to that time all the television programmes emanated from the Long Acre studio.)

The roof of an Oxford Street store was the receiving site and the occasion had a two-fold importance as it signalised the first display of a mirror-drum receiver, whereby television images of considerable brilliance were seen on a translucent screen by the large company present. The radio receiver used was of the super regenerative type, while only a short dipole receiving aerial was used.

A New Aerial

The success of this occasion stimulated considerable research work on ultra-short-wave problems, and one of the first results of this was a marked improvement in the aerial arrangements. Quite apart from the form of signal modulation, it is essential to provide an absolutely steady carrier wave condition at the scheduled wave-length, and although the first aerial arrangements were promising, a great improvement was effected as soon as a new aerial replaced the old one. Apart from the improved rigidity the greatest difference was in the nature of the aerial feed. It is essential to prevent the aerial-feed wires from radiating, and this was done by arranging a pair of half-inch burnished copper tubes to pass from the radio transmitter hut through long porcelain insulators (seen at the foot of Fig. 3). These were maintained at a fixed distance apart of 4ins. by insulator separators up to the bottom of the dipole aerial rod. One tube then made metallic contact with the aerial, while the second feed was left free. In this way the free feed neutralised very completely any tendency of the main tubular feed to radiate electro-magnetic signals. The arrangement is particularly suitable to those locations where the aerial is on the roof of the transmitter building.

THE BATTERY MODEL HALL-MARK FOUR

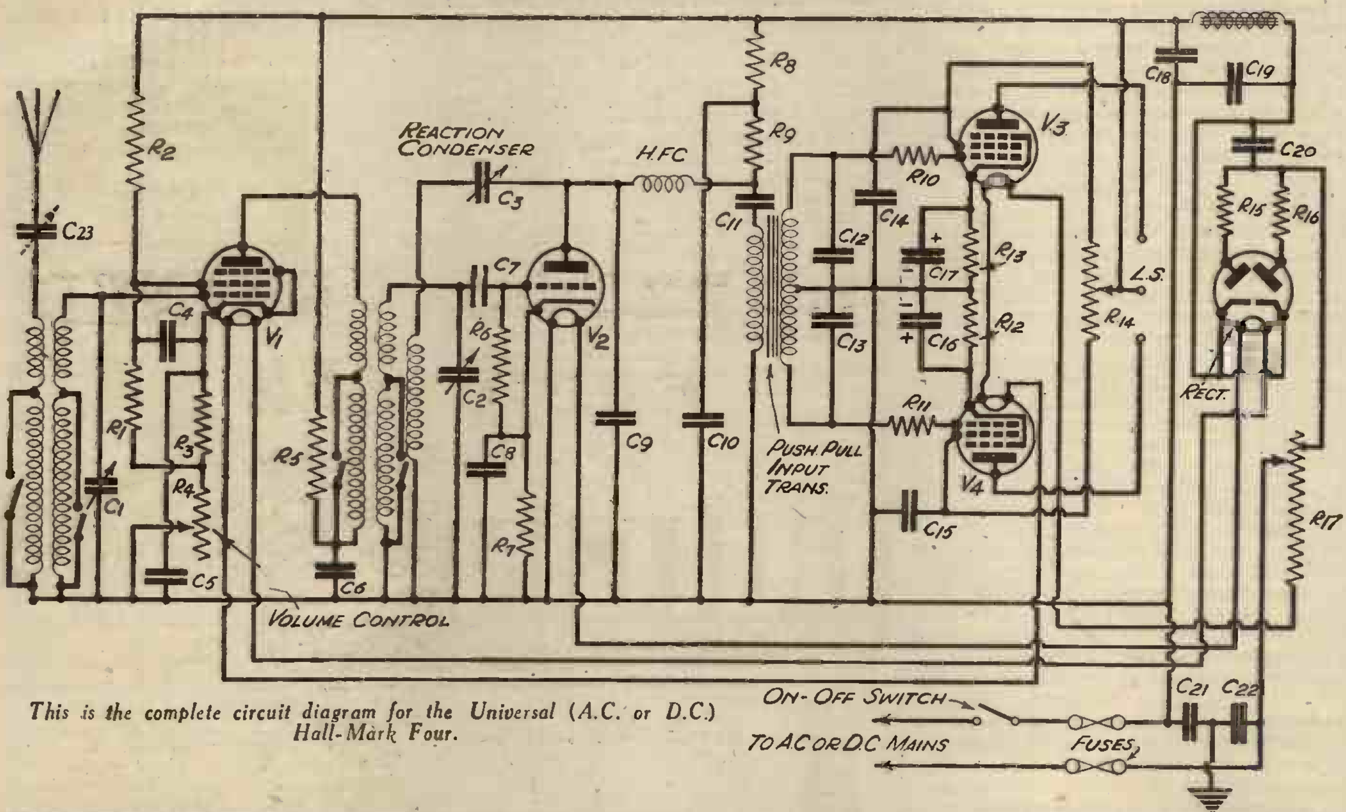
(Continued from page 679)

secondary winding of the input push-pull transformer are shunted by means of small fixed condensers. It might at first appear that these precautions against instability are unnecessarily complete, but this is not the case. Theoretically, two valves used together in a push-pull circuit should be perfectly matched, which means that they should be chosen from the makers' stock with great care. There is generally an extra charge made for accurately-matched pairs of valves, however, and besides this, they cannot be obtained from the local dealer. In saying this we realise that modern valves of the same type have almost identical characteristics—but there are slight variations. But by using the decoupling arrangements referred to above the valves for the Hall-Mark Four need not be perfectly matched, and thus ordinary ones can be bought direct from stock without results being impaired in the slightest degree. Triode output valves are indicated in the theoretical diagram, but pentodes may be used if greater efficiency is desired.

Full constructional details of the battery model Hall-Mark Four will be given in next week's issue of PRACTICAL AND AMATEUR WIRELESS.

THE UNIVERSAL HALL-MARK FOUR

A Preliminary Description of a New Four-Valve Receiver for A.C. or D.C. Mains Working. Full Constructional Details will be Given Next Week



This is the complete circuit diagram for the Universal (A.C. or D.C.) Hall-Mark Four.

DESPITE the fact that most D.C. mains supplies are gradually being replaced by A.C. mains, there are thousands of listeners whose homes are still wired for D.C. only. These listeners do not wish to go to the expense of a D.C. receiver, since they know that it would become useless to them in a year or two—or perhaps a couple of months. It is to such people that a universal receiver has a special appeal, for it will be just as efficient and valuable after the mains supply has been changed as it is at the present time.

The universal model of the Hall-Mark Four is very similar in general principles to the battery and A.C. versions, but it has a few points of especial interest. For one thing, the output stage (push-pull as in the other versions) comprises a pair of high-amplification pentodes and is capable of providing an undistorted output of 6 watts. This is even greater than the output from the A.C. model, and on this score the universal circuit might be preferred by many readers whose homes are already wired for A.C. current.

As in the case of the battery and A.C. models, a variable-mu H.F. pentode is used in the first stage, and this feeds into a leaky-grid detector which, in turn, is followed by the push-pull output stage. To avoid the possibility of the primary winding of the input push-pull transformer becoming saturated due to the anode current of the detector valve, and also to enable the highest possible step-up ratio (consistent with quality reproduction) to be obtained, the transformer is coupled by means of a resistance-capacity circuit, a further resistance being used for decoupling purposes.

Ample Decoupling

It will be seen from the circuit given above that the grid circuits of the pentodes in the output stage are amply decoupled by means of 10,000-ohm stopper resistances, whilst any tendency towards L.F. instability, due to slight differences between the pentode valves, is removed by connecting a fixed condenser in parallel with each half of the secondary winding on the input transformer. A point of rather special interest, because it is unusual, is the provision of a potentiometer for controlling the voltages applied to the auxiliary grids of the pentodes. This potentiometer (R14 in the circuit) has its two ends joined to the auxiliary-grid terminals, whilst the slider is connected to H.T. positive. Thus, when the slider is exactly in the centre of the resistance element both grids receive precisely the same H.T. voltage. On the other hand, by moving the slider to either side of the centre point the voltage on one grid is increased, and on the other, reduced. This enables perfect balance to be obtained in the simplest possible manner.

LIST OF COMPONENTS

One 2-gang set coils, types Q and T.—Wearite.
One 2-gang .0005 mfd. midget condenser with type V.P. drive with wavelength scale (C1, C2).—Polar.
One .00015 mfd. reaction condenser (C3).—Graham Farish.
Four .5 mfd. fixed tubular condensers (C6, C11, C14, C15).—T.M.C.
Two .1 mfd. fixed tubular condensers (C4, C5)—T.M.C.
Three .05 mfd. fixed tubular condensers (C20, C21, C22)—T.M.C.
One .0001 mfd. fixed tubular condenser (C7)—T.M.C.
Three .0002 mfd. fixed tubular condensers (C9, C12, C13)—T.M.C.
One 2 mfd. fixed condenser (C10)—T.M.C.
Three 25 mfd. electrolytic condensers (C8, C16, C17)—Dubilier.
Two 8 mfd. electrolytic condensers (C18, C 19)—Dubilier.
One .0003 mfd. pre-set condenser (C23)—Formo.
Fourteen fixed resistances, 30,000 (R2), 25,000 (R1), 2,000 (R5), 500,000 (R6), 20,000 (R8), 30,000 (R9), 1,000 (R7), 250 (R12), 250 (R13), 50 (R15), 50 (R16), 10,000 (R10), 10,000 (R11), 200 (R3).—Graham Farish.
Two potentiometers 2,000 ohms type V.C.26 (R4) and 5,000 ohms, type V.C.29 (R14)—Bulgin.
One Mains dropping resistance (R17)—B.T.S.
One snap H.F. choke—Graham Farish.
One L.F. choke H.T.11—Wright and Weaire.
One Input push-pull transformer type D.P.36—Varley.
Three potentiometer brackets—Peto Scott.
One Mains on/off switch, type S.80—Bulgin.
Five valveholders, 4, 7-pin, 1, 5-pin—Clix.
Two .5 amp mains fuses—Microfuse.
One mains lead and plug—Belling and Lee.
Five valves, types H.P.2118, R.2018, P.P.4118, P.P.4113, PV3018—Tungsram.
One loudspeaker, type F.R.7. P.M.24—Rola.
One Metaplex chassis —Peto Scott (12 x 10 x 3½ins.).
A.E. strip and plugs—Belling Lee.
One Hall-Mark Four cabinet.

No Mains Hum

The valve rectifier is connected on the half-wave principle and functions as such only when the receiver is connected to an A.C. supply; on D.C. it merely serves as a ballast resistance. The valve heaters are wired in series, and also in series with a voltage-control resistance (R17) which functions on both A.C. and D.C.

Due to the provision of ample smoothing, by means of the 40-henry choke, and also by the use of large-capacity condensers.

VALVE TYPES AND USES—5

Rectifying Valves form the Subject of this Fifth Article of the Series

IF any excuse is necessary for including rectifying valves in this series of valve articles, let it be that the rectifier is nowadays nearly always included when stating the number of valves which any particular receiver contains. Actually, we believe that the rectifier should not be included in that number, since it is likely to lead to confusion when comparing a receiver with valve H.T. rectification with a similar one employing a metal rectifier. Nevertheless, the valve rectifier is an extremely important component, and its correct choice calls for a good deal of consideration. The truth of this statement will be well understood when it is pointed out that there are at least five *standard* types of rectifying valve for outputs of between 250 volts at 60 milliamps. and 500 volts at 120 milliamps. There are, of course, very many rectifiers of other ratings, but these will not be considered here since, so far as the H.T. section of the modern wireless set is concerned, they cannot be considered as standard types.

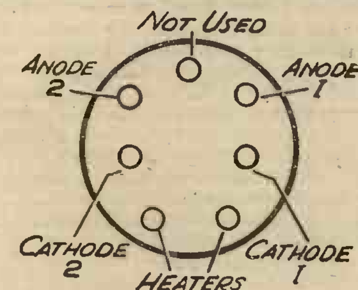


Fig. 3.—Showing the connections to a seven-pin rectifier. The illustration shows the valve base—not the holder.

Three Main Types

The three main types of H.T. rectifier are all of the full-wave pattern, having a directly heated filament and two anodes, and are intended to be fed from a mains transformer having a centre-tapped H.T. secondary and a 4-volt filament winding. The method of connection is well known and is shown in Fig. 1 to avoid any misunderstanding. One small point that is often overlooked by the inexperienced constructor is that the H.T. secondary must give the rated anode voltage for the rectifier on each side of the centre tap. That is, for a valve requiring an input voltage of 250 the transformer must give what is generally referred to as (250-0-250 volts)," or "250 + 250 volts."

Output Voltage

Another point that often worries the amateur, and which may appear to be "all wrong," is that the actual rated output of the valve is sometimes greater than the input voltage from the transformer. For example, the Osram U.10 valve gives 260 volts at 60 milliamps, when fed from a transformer giving 250-0-250 volts. It would be impossible to explain this matter fully without going into mathematics, but it can briefly be explained that the condenser connected across the output leads, and marked C in Fig. 1, has some bearing on this. In fact, the maximum rated voltage would not be obtained if the condenser were omitted or reduced in value below the standard capacity of 4 mfds.; further, if the capacity is increased an even greater voltage is obtained in many cases. The condenser "stores" a certain amount of the output, and helps to "combine" the rectified voltage of the two anodes.

The three standard rectifiers are rated to give approximately 250 volts, 60 milliamps., 350 volts, 120 milliamps., and 500 volts, 120 milliamps. We say "approximately" because the figures vary slightly according to the valves by different manufacturers. Although these figures relate to the maximum output, it is sometimes rather confusing to learn that the voltage output of, say, the first valve mentioned might rise to 300 if the current load were reduced to 30 milliamps. It is for this reason that the outputs of the rectifiers listed in the tables on the next page are given at full and half load. This matter will also be understood more readily by referring to the graph given in Fig. 2, which shows the voltage output of a typical "250-volt" rectifier at different output currents.

The three types of rectifier referred to are often styled A, B and C (not to be confused with methods of L.F. amplification), and these letters provide a convenient means of reference. It will be seen that the filament requirements of the A rectifier is 4 volts at 1 amp. (A.C.), and of the B and C, 4 volts at 2.5 amps. (also A.C.), and thus the L.T. winding of the mains transformer, as well as the H.T. winding, must be chosen to suit the particular type of rectifier to be employed.

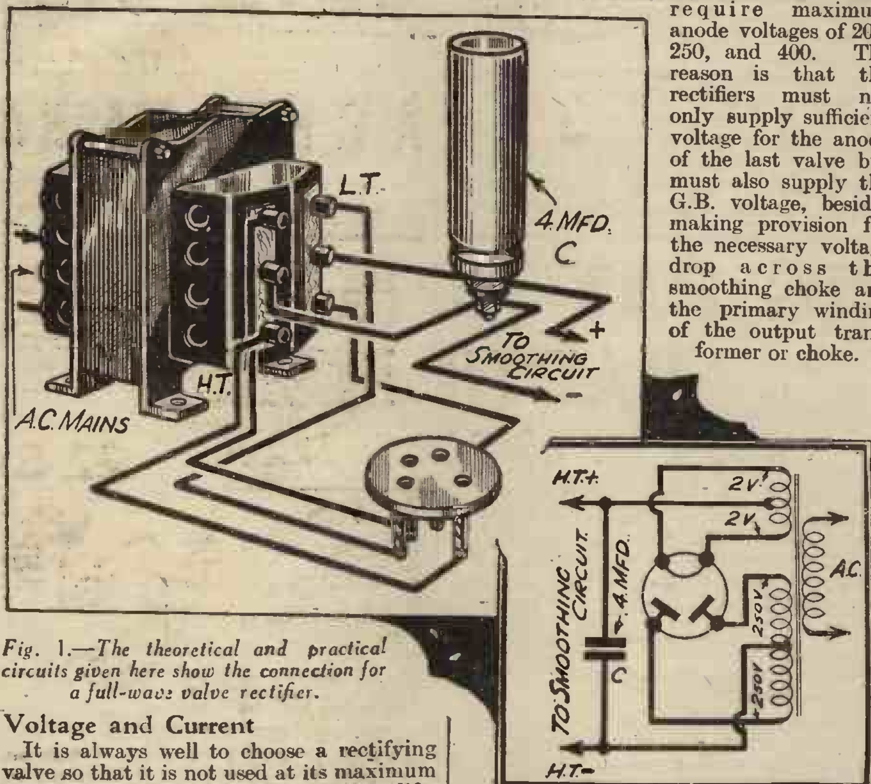


Fig. 1.—The theoretical and practical circuits given here show the connection for a full-wave valve rectifier.

Voltage and Current

It is always well to choose a rectifying valve so that it is not used at its maximum output, since this makes for longer life, and if the maximum rated current is not to be used it is a good plan to obtain a transformer supplying an H.T. voltage of such a value that no more than the rated maximum voltage is delivered by the rectifier. Thus, if 250 volts at 30 milliamps. were required from the U.10 valve mentioned above the transformer should have an H.T. secondary designed to give about 210 volts.

It might be asked why the standard types of rectifier are designed to give approximately 250, 350, and 500 volts when the average output valves require maximum anode voltages of 200, 250, and 400. The reason is that the rectifiers must not only supply sufficient voltage for the anode of the last valve but must also supply the G.B. voltage, besides making provision for the necessary voltage drop across the smoothing choke and the primary winding of the output transformer or choke. It will be seen that voltages of 50 and 100 are allowed for this purpose.

RECTIFIER CHARACTERISTICS

OSRAM U.10 (Directly Heated)	
Filament volts	4
Filament current ..	1 amp
Maximum anode volts ..	250–0–250
Maximum D.C. output ..	260 volts, 60 m.a.
Output at half load ..	300 volts, 30 m.a.
OSRAM U.12 (Directly Heated)	
Filament voltage ..	4
Filament current ..	2.5 amps
Maximum anode volts ..	350–0–350
Maximum D.C. output ..	325 volts, 120 m.a.
Output at half load ..	380 volts, 60 m.a.
OSRAM U.14 (Directly Heated)	
Filament voltage ..	4
Filament current ..	2.5 amps.
Maximum anode volts ..	500–0–500
Maximum D.C. output ..	540 volts, 120 m.a.
Output at half load ..	620 volts, 60 m.a.
OSRAM MU12 (Indirectly Heated)	
Heater voltage	4
Heater current	2.5 amps.
Maximum anode volts ..	350–0–350
Maximum D.C. output ..	340 volts, 120 m.a.
Output at half load ..	410 volts, 60 m.a.
OSRAM MU.14 (Indirectly Heated)	
Heater voltage	4
Heater current	2.5 amps.
Maximum anode voltage	500–0–500
Maximum D.C. output ..	540 volts, 120 m.a.
Output at half load ..	600 volts, 60 m.a.
OSRAM U.30 (7-pin Universal; Indirectly Heated)	
Heater voltage	26
Heater current	.3 amp.
Maximum anode volts (half-wave)	180
Maximum anode volts (voltage doubler) ..	220
Maximum D.C. output (half-wave)	136 volts, 120 m.a.
Maximum D.C. output (voltage doubler) ..	425 volts, 75 m.a.

Indirectly-heated Rectifiers

Mention has not yet been made of the two indirectly-heated types of full-wave rectifier detailed in the accompanying panel. These are the MU.12 and MU.14, and they are similar in nearly all respects to the U.12 and U.14, the only real difference being that they have a cathode in addition to the filament. The cathode is heated by the filament, and is connected to the latter at one end. This means that the rectifier cannot commence to function until the cathode has attained the correct working temperature. The time taken for this is just about the same as that required by the indirectly heated cathode of the average receiving valve, with a result that output from the rectifier commences at the same time as the valves begin to pass an anode current.

The advantage of the indirectly-heated rectifiers is that a sudden increase in voltage when the receiver is first switched on is avoided, and thus the fixed condensers used for smoothing, decoupling, etc., do not need to have so high a working voltage as when ordinary directly heated rectifiers are employed. This advantage is chiefly confined to sets in which the receiving valves are of the indirectly-heated-cathode type, since if the output valve were directly heated there would be no appreciable rise in voltage in any case. It should be mentioned in passing that an indirectly-heated rectifier can generally be substituted for one of the directly-heated type, since in most cases both have four pins only, of which the "grid" and "anode" pins are in contact with the two anodes.

For Universal Receivers

Despite what has been written above, mention should be made in this article to the special type of rectifier that has been developed for use in universal receivers; in the Osram range this is the U.30. This valve has an indirectly heated cathode, the heater of which takes 26 volts at .3 amp. There are actually two cathodes and two anodes, so that the valve can be used in one of two ways; as a half-wave rectifier or in a voltage-doubler circuit. When used in the former manner the maximum output is 136 volts at 120 milliamps., and in the latter, 425 volts at 75 milliamps. It will be seen from these figures that the valve is adaptable for use in nearly any average type of universal mains receiver, or in an A.C. set which is fed directly from the A.C. mains. The U.30 has a seven-pin base, of which the connections are shown in Fig. 3. When used as a half-wave rectifier the two anodes and the two cathodes are joined together, so connecting the two halves of the valve in parallel, but when used as a voltage-doubler the two halves are placed in series, the connections then being similar to those of a metal rectifier; that is, one A.C. lead is taken to the series connection, the other being joined to the junction of the two fixed condensers wired in series across the output. The "free" anode and cathode provide the negative and positive output terminals respectively.

Non-standard Rectifiers

In addition to the rectifiers described above there is a number of others of non-standard type. These are mainly of the half-wave pattern, and although they were used fairly extensively a few years ago they are gradually falling into disuse. The valves are still available for replacement purposes, but their use is not recommended in new receivers. In any case, half-wave valves are not so efficient as are the full-wave types, and it is largely for this reason that their use has been discontinued.

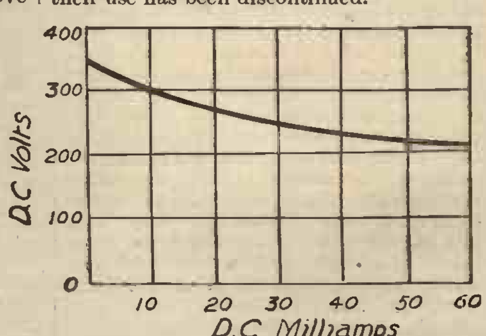
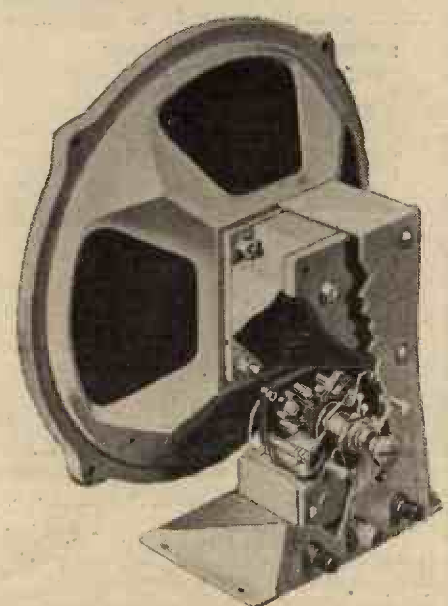


Fig. 2.—This graph shows how the output of a typical rectifier varies with the current load.

Stentorian Loud-speaker Details

THE accompanying illustration showing a cut-away "Stentorian" "Senior" model speaker, P.M.S.1, will prove interesting to many readers, since it shows details of the magnet, the microlode unit, and the throw-over switch for switching from high impedance to low impedance for extension purposes. It is not possible in this illustration to show details of the Whiteley speech coil, but a photograph of this unit will be published in a forthcoming issue.



The "Stentorian" "Senior" Model P.M.S.1 in part section showing the ingenious switch mechanism.

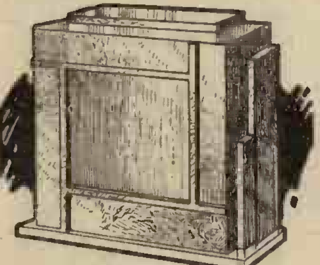
Two New Valves

NOT yet on the market but having come to our notice at the Physical Society Exhibition as an experimental development, the new "Osram" N.40 output tetrode valve has many points of interest. The advantages of a pentode are maintained together with the essential feature of a tetrode, and, as such, avoidance is made of the necessity for a suppressor grid. The restrictions of the secondary electrons are brought about by making use of the "space charge" of electrons which always exists, consisting of electrons in transit from the cathode to the anode. These will, if allowed, form a negative charge between the screen and the anode, and, possessing a negative charge, will tend to repel the secondaries produced at the anode and prevent their return to other electrodes. Owing to the presence of the wires which support the grid and screen, additional electrodes are added to restrain the charge and keep it of the right size and shape to bring about the required suppression. This new development will be of importance to the industry, particularly for firms engaged in export business, as it provides a relief for certain foreign patent restrictions. Provisional characteristics are as follow: heater volts, 4; heater current, 1 amp.; anode volts, 250 max.; screen volts, 250 max.; and mutual conductance, 3 ma/volt. Type N.40 will be fitted with the standard British 7-pin base.

Another new "Osram" valve, the N.41, is a high-slope output pentode in the four-volt A.C. range. This valve is fitted with an indirectly-heated cathode, taking 2 amps. Principal features are its comparatively high undistorted power output, and the small input grid voltage required. It is thus suitable for the output stage of A.C. mains receivers. Characteristics are similar to those given in the case of the type N.40 valve in so far as they apply, except that mutual conductance is 10 ma/volt. Anode and screen currents are 32 m.a. and 8 m.a. respectively, and anode dissipation is 8 watts. The amplification factor is 210. Impedance and optimum load impedance for conditions: anode volts, 250; screen volts, 200; and grid bias, — 3.5; are respectively 21,000 and 7,800 ohms. Automatic bias resistance is 90 ohms. The list price of this valve is 18s. 6d.

Compact and Efficient Speaker

THE new "Fydelitone" speaker, as illustrated, is a product of the well-known firm of Baker's Selhurst Radio, Ltd., of Croydon, pioneer manufacturers of moving-coil reproducers, and has been specially designed for the convenience of those who like to have their radio in several rooms. Complete with a sturdily-built multi-radio transformer to enable it to be correctly matched to the existing receiver, it combines good appearance, compactness, and efficiency. Two models are obtainable, the "Major" at £2 5s., and the "Minor" at £1 15s. The cabinet is of modern design, moulded in bakelite, and is obtainable in walnut or black and chromium. The overall dimensions are only 8⅜in. by 8in. by 4in., and a new type of permanent magnet gives very high efficiency in a minimum of space. If it is wished to use the speaker with an existing output transformer, it may be obtained without the transformer for 37s. 6d. and 29s. 6d. respectively.



The very efficient Baker Fydelitone speaker referred to on this page.

PRACTICAL LETTERS FROM READERS

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

Two-valve Amplifier

SIR,—Referring to the letter on p. 524 of your issue dated December 22nd, *re* "Two-valve amplifier," I have recently made up such a set. It embodies 2 HL valves, R.C. coupled, 60-volt ordinary H.T. battery, 20 a. h. jelly acid L.T., 65 : 1 input transformer, and the microphone (carbon), and single plug-in earpiece, and packs away in the case for carrying. It is, of course, rather heavy owing to the batteries, but is contained in a case about 12in. long x 9in. high x 4in. wide. There is no volume control or tone control.—E. B. (Croydon).

A Satisfied Reader

SIR,—May I congratulate you upon the new series "Circuits and Sets for All."

The "Odd Parts III" is the type of article to find favour with thousands of readers who, like myself, cannot afford fine sets even as cheap as the £5 superhet.

I hope in the future we may look forward to many more such circuits. May I suggest one of 2 H.F. det. and pen. output with A.V.C. and to keep absolute economy in mind but not to sacrifice tone quality?—A. M. (Glasgow).

Our Short-wave Section

SIR,—May I voice an opinion regarding the short-wave page of your invaluable weekly? However good a circuit is set out I am afraid that amateurs, especially novices, will have the utmost difficulty in guessing the values of components correctly. Especially have I in mind a circuit which appeared in your journal dated November 10th, 1934, where only three condenser values were given.

I feel sure many amateurs would try out many more S.W. circuits if they were sure of the component values; these are often critical.—J. C. COLEMAN (Sliema, Malta).

[*The component values very often vary according to the type of valves used, but where the components are not affected by the valves, or other considerations, the values are always given.*—ED.]

A Quality Receiver

SIR,—I should be very interested in a high-class A.C. receiver of the type asked for in PRACTICAL WIRELESS dated Jan. 5. I want to rebuild my own radio-gram, which is out of date now.

May I suggest two PX4s in push-pull or a single PP5/400 output with a good variable tone control? Something really worth while on records and radio!—A. G. BURR (Birmingham).

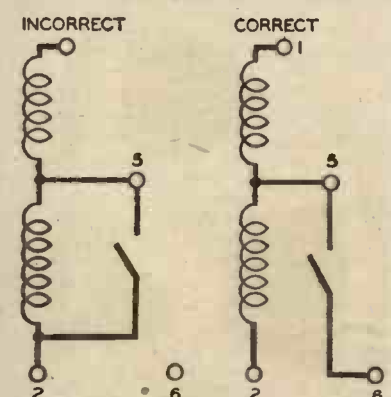
A Colonial Set

SIR,—With reference to Mr. C. A. Rumball's letter in the December 8th issue, I should very much like to see a "Colonial Set" designed by your staff, as, being in the Far East myself, I am on the look out for a really good "all-wave" set. The ordinary medium- and long-wave circuits are practically useless out here. An A.C./D.C. version would be best, as supplies of batteries, etc., are very poor overseas; in my case power can be obtained on board at 220 v. D.C., but on returning home to England my supply would, of course, be A.C.

I am pleased to say I get my PRACTICAL WIRELESS copies regularly, and when I get "right into them" I feel at home again.—H. E. SYMONS (At sea, China Station.)

£5 Superhet Connections for Ward and Goldstone Coils

SIR,—The accompanying sketches may prove of assistance in connection with any queries relating to the operation of the 3-Valve Superhet, incorporating our coil units. It would appear that unfortunately a number of these units have accidentally gone out with a slightly incorrect connection to the wave changing of the G.I.C.7 Oscillator Coil. About 27 of these units



Wave changing connections for G.I.C.7 oscillator coil of £5 Superhet.

were sent out with the wave change switch directly across the terminals 5 and 2 of the G.I.C.7, whereas in fact the bottom end of the switch should go to the No. 6 terminal on the coil. The error is not serious enough for any of the constructors to return the coil, as we can put them right. Actually, to correct the coils it is only necessary to break the connection between the terminal No. 2 and the switch on the underside and merely take the same side of the switch to the metal frame of the coil and switch chassis. The No. 2 terminal will then connect to the preset condenser as already shown on the diagram. All further chassis will of course be correct on this point, and we have already received one or two very good testimonials.—G. V. COLLE, for WARD & GOLDSTONE LTD.

Connections for Deemark Coil

SIR,—Noticing a query from one of your correspondents *re* connections for a Deemark coil, I have fitted one into a receiver and the connections are as follow:—

1. Grid.
2. Earth.
3. Switch (Wave-change).
4. Aerial.
5. } Reaction.
6. }

A .0001 fixed condenser is recommended in between aerial and No. 4 connection. I personally have found that a .0003 condenser gives better results.—J. V. MAGNALL (Blackpool).

(*Continued on page 691*)

PRACTICAL LETTERS

(Continued from page 690)

"A Wonderful Library"

SIR,—The Television and Short-wave Handbook, The Wireless Encyclopedia, and Everyman's Wireless Book, are of great use to the radio enthusiast as they make a wonderful library, which is worth much more than it costs.

I, like many other readers, am in favour of an extra page devoted to Short Waves, in the form of experiments with various types of receivers and aerials, for different wave bands.—G. WALKER (Bradford).

Overloading and its Remedies

SIR,—In your issue of PRACTICAL WIRELESS for January 5th, on page 556, in an article on overloading, cures are suggested which would cause just the opposite effect, making the remedy worse than the disease. I expect a good many who insert milliameters in the output stages and then adjust the G.B. as you suggest will wonder why the needle kicks still higher, and still lower by the method of correction adopted. When the needle kicks upward it shows G.B. to be too high, and when it kicks down G.B. is too low. The remedy is obvious; lowering the G.B. increases anode current and *vice-versa*. When the needle, after alteration of G.B. kicks upward the output transformer ratio is too low, and when it kicks down the transformer ratio is too high again. When the needle kicks wildly from low to high on the scale the output valve is hopelessly overloaded. The remedy is, of course, to use a valve capable of handling larger input.—CROMPTON (Ashtead).

"Mines of Information"

SIR,—I wish to express my thanks for the prize awarded to me, in connection with Problem 117 in PRACTICAL WIRELESS. I wish to congratulate you and your staff for the way in which the designs of modern receivers are put forward in your splendid weekly. Having been a regular reader since its inception, I can truthfully say that your efforts to keep it the leading wireless weekly are being maintained. Also, the presentation books, which have been offered by you, and for which I qualified, are literally "mines of information."—C. R. SHAW (Preston).

CUT THIS OUT EACH WEEK.

Do you know

—THAT a simple transmitting circuit is very similar to a one-valve receiver circuit?
—THAT the inductance of a choke varies with the amount of D.C. current passing through its windings?
—THAT the impedance of a choke varies with the frequency of the alternating current passing through it?
—THAT the impedance of a condenser increases in proportion to the H.F. current passing through the circuit in which it is connected?
—THAT copper tubing is an ideal material for making efficient coils for ultra-short wavelengths?
—THAT indirectly-heated rectifying valves have only a four-pin base, the cathode being joined directly to one end of the heater?

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL AND AMATEUR WIRELESS. Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

The PRACTICAL AND AMATEUR WIRELESS Blueprint Service

These blueprints are full-size. Copies of appropriate issues of "Practical Wireless," "Amateur Wireless" and of "Wireless Magazine" containing descriptions of most of these sets can be obtained at 4d. and 1s. 3d. each, respectively, post paid. Index letters "P.W." refer to "Practical Wireless" sets, "A.W." refer to "Amateur Wireless" sets and "W.M." to "Wireless Magazine" sets. Send, preferably, a postal order (stamps over sixpence unacceptable) to "Practical and Amateur Wireless" Blueprint Dept., Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.

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Argus Three	12.11.32	PW6
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Empire Short-Wave Three	3.12.32	PW7
Solo Knob Three	10.12.32	PW8
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All-Wave Two	19.8.33	PW28
A.C. Three	16.9.33	PW29
Premier Super	23.9.33	PW30
Experimenter's Short-Wave Three	23.9.33	PW30A
A.C.-D.C. Two	7.10.33	PW31
All-Wave Unipen	14.10.33	PW31A
Orbit (Transfer Print)	4.11.33	PW32
Luxus A.C. Superhet	14.10.33	PW33
A.C. Quadpak	2.12.33	PW34
Sixty-Shilling Three	2.12.33	PW34A
Nucleon Class B. Four	6.1.34	PW34B
Fury Four Super	27.1.34	PW34C
A.C. Fury Four Super	10.2.34	PW34D
Leader Three	10.3.34	PW35
Pocket Portable	10.3.34	PW35A
D.C. Premier	31.3.34	PW35B
A.C. Leader	7.4.34	PW35C
Prima Mains Three	5.4.34	PW35D
Master Midget Two	12.5.34	PW35E
Atom Lightweight Portable	2.6.34	PW36
Ubique	28.7.34	PW36A
Four-Range Super-Mag. Two	11.8.34	PW36B
Summit Three	18.8.34	PW37
Armada Mains Three	18.8.34	PW38
Midget Short-Wave Two	15.9.34	PW38A
All-Pentode Three	22.9.34	PW39
£5 Superhet Three	27.10.34	PW40
A.C. £5 Superhet Three	24.11.34	PW41
D.C. £5 Superhet Three	1.12.34	PW42
Hall-Mark Three	8.12.34	PW43
Universal £5 Superhet	15.12.34	PW44
A.C. Hall Mark	26.1.35	PW45

AMATEUR WIRELESS AND WIRELESS MAGAZINE.

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Blueprints, 6d. each.

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1934 Crystal Set	4.8.34	AW444
150-mile Crystal Set	27.9.34	AW450

STRAIGHT SETS. Battery Operated.

One-valvers : Blueprints, 1s. each.

B.B.C. One-valver	28.5.32	AW344
B.B.C. Special One-valver	6.5.33	AW387
Twenty-station Loud-speaker One-valver (Class B)	27.9.33	AW449

Two-valvers : Blueprints, 1s. each.

Melody Ranger Two (D, Trans)	13.5.33	AW388
Full-volume Two (SG, Det, Pen)	17.6.33	AW392
Iron-core Two (D, Trans)	29.7.33	AW395
Iron-core Two (D, QPP)	12.8.33	AW396
B.B.C. National Two with Lucerne Coil (D. Trans)	17.2.34	AW377A
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Lucerne Minor (D, Pen)	24.3.34	AW426
Family Two (D, Trans)	*Apr.* '32	WM278

Three-valvers : Blueprints, 1s. each.

£8 Radiogram (D, RC, Trans)	21.5.32	AW343
New Regional Three (D, RC, Trans)	25.6.32	AW349
Class-B Three (D. Trans, Class B)	22.4.33	AW386
New Britain's Favourite Three (D, Trans, Class B)	15.7.33	AW394
Home-built Coil Three (SG, D, Trans)	14.10.33	AW404
Fan and Family Three (D, Trans, Class B)	25.11.33	AW410
£5 5s. S.G.3 (SG, D, Trans)	2.12.33	AW412
1934 Ether Searcher: Baseboard Model (SG, D, Pen)	20.1.34	AW417
1934 Ether Searcher: Chassis Model (SG, D, Pen)	3.2.34	AW419
Lucerne Ranger (SG, D, Trans)	3.3.34	AW422
Cossor Melody Maker with Lucerne Coils	17.3.34	AW423
P.W.H. Mascot with Lucerne Coils (Det, R.C., Trans)	17.3.34	AW337A
Mullard Master Three with Lucerne Coils	24.3.34	AW424
Pentaquester (HF. Pen, D, Pen)	14.4.34	AW431
£5 5s. Three: De-luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	9.6.34	AW437
All-Britain Three (HF Pen, D, Pen)	6.9.34	AW448
"Wireless League" Three (HF Pen, D, Pen)	3.10.34	AW451
Transportable Three (SG, D, Pen)	*Feb.* '32	WM271
Multi-Mag Three (D, 2 Trans)	*June* '32	WM288
Percy Harris Radiogram (HF, D, Trans)	*Aug.* '32	WM294
£6 6s. Radiogram (D, RC, Trans)	*Apr.* '33	WM318
Simple-tune Three (SG, D, Pen)	*June* '33	WM327
Tyers Iron-core Three (SG, D, Pen)	*July* '33	WM330
C.-B. Three (D, LF, Class B)	*Sep.* '33	WM333
Economy-pentode Three (SG, D, Pen)	*Oct.* '33	WM337
All-wave Three (D, 2LF)	*Jan.* '34	WM348
"W.M." 1934 Standard Three (SG, D, Pen)	*Feb.* '34	WM351
£3 3s. Three (SG, D, Trans)	*Mar.* '34	WM354
Iron-core Band-pass Three (SG, D, QP21)	*June* '34	WM362
1935 £6 6s. Battery Three (SG, D, Pen)	*Oct.* '34	WM371

Four-valvers : Blueprints, 1s. 6d. each.

65/- Four (SG, D, RC, Trans)	17.12.32	AW370
"A.W." Ideal Four (2SG, D, Pen)	16.9.33	AW402
2 H.F. Four (2SG, D, Pen)	17.2.34	AW421
Crusaders' A.V.C. 4 (2 HF, D, QP21)	18.8.34	AW445
(Pentode and Class-B outputs for above; blueprints 6d. each)	25.8.34	AW445A
Quadradyne (2SG, D, Pen)	*Feb.* '32	WM273
Calibrator (SG, D, RC, Trans)	*Oct.* '32	WM300
Table Quad (SG, D, RC, Trans)	*Nov.* '32	WM303
Calibrator de Luxe (SG, D, RC, Trans)	*Apr.* '33	WM316
Self-contained Four (SG, D, LF, Class-B)	*Aug.* '33	WM331
Lucerne Straight Four (SG, D, LF, Trans)	*Feb.* '34	WM350

Five-valvers : Blueprints, 1s. 6d. each.

Super-quality Five (2 HF, D, RC, Trans)	*May* '33	WM320
New Class-B Five (SG, D, LF, Class B)	*Nov.* '33	WM340
Class-B Quadradyne (2 SG, D, LF, Class B)	*Dec.* '33	WM344

Mains Operated.

Two-valvers : Blueprints, 1s. each.

Consolectric Two (D, Pen) A.C.	23.9.33	AW403
Economy A.C. Two (D, Trans) A.C.	*June* '32	WM286

Three-valvers : Blueprints, 1s. each.

Home-lover's New All-electric Three (SG, D, Trans) A.C.	25.3.33	AW383
S.G. Three (SG, D, Pen) A.C.	3.6.33	AW390
A.C. Triodyne (SG, D, Pen) A.C.	19.8.33	AW399
A.C. Pentaquester (HF Pen, D, Pen) A.C.	26.6.34	AW439
D.C. Calibrator (SG, D, Push-pull Pen) D.C.	*July* '33	WM328
Simplicity A.C. Radiogram (SG, D, Pen) A.C.	*Oct.* '33	WM333
Six-guinea AC/DC Three (HF, Pen, D, Trans) A.C./D.C.	*July* '34	WM364
Mantovani A.C. Three (HF, Pen, D, Pen) A.C.	*Nov.* '34	WM374

Four-valvers : Blueprints, 1s. 6d. each.

A.C. Melody Ranger (SG, DC, RC, Trans) A.C.	4.3.33	AW380
AC/DC Straight A.V.C.4 (2 HF, D, Pen) A.C./D.C.	8.9.34	AW446
A.C. Quadradyne (2SG, D, Trans) A.C.	*Apr.* '32	WM279
All Metal Four (2SG, D, Pen) A.C.	*July* '33	WM329

SUPER-HETS.

Battery Sets : Blueprints, 1s. 6d. each.

1934 Century Super	9.12.33	AW413
Super Senior	*Oct.* '31	WM256
1932 Super 60	*Jan.* '32	WM269
Q.P.P. Super 60	*Apr.* '33	WM319
"W.M." Stenode	*Oct.* '34	WM373
Modern Super Senior	*Nov.* '34	WM375

Mains Sets : Blueprints, 1s. 6d. each.

1934 A.C. Century Super, A.C.	10.3.34	AW425
1932 A.C. Super 60, A.C.	*Feb.* '32	WM272
Seventy-seven Super, A.C.	*Dec.* '32	WM305
"W.M." D.C. Super, D.C.	*May* '33	WM321
Merrymaker Super, A.C.	*Dec.* '33	WM345
Heptode Super Three, A.C.	*May* '34	WM359
"W.M." Radiogram Super, A.C.	*July* '34	WM366
"W.M." Stenode, A.C.	*Sep.* '34	WM370

PORTABLES.

Four-valvers : Blueprints, 1s. 6d. each.

General-purpose Portable (SG, D, RC, Trans)	9.7.32	AW351
Midget Class-B Portable (SG, D, LF, Class B)	20.5.33	AW389
Holiday Portable (SG, D, LF, Class B)	1.7.33	AW393
Family Portable (HF, D, RC, Trans)	22.9.34	AW447
Town and Country Four (SG, D, RC, Trans)	*May* '32	WM287
Two H.F. Portable, (2 SG, D, QP21)	*June* '34	WM362
Tyers Portable (SG, D, 2 Trans)	*Aug.* '34	WM363

SHORT-WAVERS. Battery Operated.

One-valvers : Blueprints, 1s. each.

S.W. One-valve	23.1.32	AW329
S.W. One-valver for America	31.3.34	AW427
Roma Short-waver	10.10.34	AW452

Two-valvers : Blueprints, 1s. each.

Home-made Coil Two (D, Pen)	14.7.34	AW440

Three-valvers : Blueprints, 1s. each.

World-ranger Short-wave 3 (D, RC, Trans)	20.8.32	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438

Four-valvers : Blueprints, 1s. 6d. each.

"A.W." Short-wave World Beater (HF Pen, D, RC, Trans)	2.6.34	AW436
Empire Short-waver (SG, D, RC, Trans)	*Mar.* '33	WM318

Super-hets : Blueprints, 1s. 6d. each.

Quartz-crystal Super	*Oct.* '34	WM372

Mains Operated.

Two-valvers : Blueprints, 1s. each.

Two-valve Mains Short-waver (D, Pen) A.C.	10.10.34	AW453
"W.M." Band-spread Short-waver (D, Pen) A.C./D.C.	*Aug.* '34	WM368

Three-valvers : Blueprints, 1s. each.

Emigrator (SG, D, Pen), A.C.	*Feb.* '34	WM352

Four-valvers : Blueprints, 1s. 6d. each.

Gold Coaster (SG, D, RC, Trans) A.C.	*Aug.* '32	WM292

IMPRESSIONS ON THE WAX

By T. ONEARM.

ALBERT SANDLER is such a fine violinist that notable musicians are glad to write compositions specially for him to play. As a mark of his appreciation for Sandler's art, Reginald King, the composer-pianist of wireless fame, wrote two charming little songs, "Daybreak" and "Melody at Dusk," for the violinist to play, and the compliment was returned when Albert Sandler arranged for the composer to accompany him in his recordings of them. Thus, we have a happy combination of artists supreme in their class, and we have, too, for the first time, Sandler announcing his titles. This enjoyable record has just been issued and is a *Columbia DB*1480.

Layton and Johnstone break fresh ground this month in the song "I'm Lonesome for You, Caroline" on *Columbia DB*1482. In this record there is a remarkable quartet chorus in which Layton and Johnstone sing with Layton on Johnstone, a clever technical feat in double recording. "June in January" is on the other side, sung with studied refinement and charm by Turner Layton. You should certainly hear this record.

In "Stars Fell on Alabama" and "Judy" Carroll Gibbons provides delights such as no other pianist can give in the same way. His tone is warm and friendly, and his playing a model of clarity and rhythm. These "best-selling hits" are on *Columbia DB*1487.

Family Harmony

You met little Norman and Mrs. Allen with Les Allen in "Little Man, You've Had a Busy Day." Now hear them again—family harmony happily expressed in "Pal o' Mine" on *Columbia DB*1476. This tune is coupled with "Who Made Little Boy Blue," sung by Les Allen and accompanied by his melody four.

Topical in his numbers, Henry Hall offers the cream of the new hits featured by the B.B.C. Dance Orchestra over the air. "Dust on the Moon" is a beautiful slow melody, while a rapidly-growing hit is "Somewhere in the Blue Ridge Mountains" number. These two tunes appear on *Columbia CB*810. In "Radio Times" (a dedication to wireless and its national service) we have the big dance tune, featured as a special supplement to the *Radio Times* Xmas number. This tune is coupled with "The Phantom of a Song" on *Columbia CB*806.

Geraldo maintains his reputation for melody on *Columbia CB*812. On this record he plays two of the tunes from the new Jack Buchanan film "Brewster's Millions"—"I Think I Can" and "One Good Tune Deserves Another."

A Syncopated Piano Medley

Encouraged, no doubt, by the success of his "Streamline" selection, Vivian Ellis has elected to play a medley incorporating fifteen of his most popular tunes. "Spread a Little Happiness," "Flies Crawled Up the Window," and "Sweep" are samples of the delights contained in this generous Columbia selection, and no fewer than eleven different revue, musical comedy and film productions are represented by the melodies. Mr. Ellis sings one or two of the choruses. Hear this record which is *Columbia DX*663.

The innumerable admirers of Billy Mayerl's advance piano playing will revel in the latest compositions from his nimble pen, which he plays on *Columbia DB*1488, this month.

CATALOGUES RECEIVED

To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue," PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2. Where advertisers make a charge, or require postage, this should be enclosed with applications for catalogues. No other correspondence whatsoever should be enclosed.

A MARCONI ACHIEVEMENT

IN a large and strikingly-produced leaflet the Marconiphone Company give details of what they claim to be the outstanding radio achievement of the year—the new Marconiphone de Luxe, Model 292. Nothing has been spared to make it as satisfying in performance as it is luxurious in appearance. The nine-valve, twelve-stage, band-pass superhet circuit is provided with quiet and delayed A.V.C., variable selectivity, and many other refinements. The new multi-functional moving-coil speaker is a definite step forward in sound reproduction, while the auto-compensated volume control maintains a perfect balance of tone at any volume. The eight-record automatic mechanism has also been brought to a very high degree of efficiency. The circuit consists of a two-stage band-pass aerial filter feeding into a variable-mu signal frequency stage which is followed by a heptode detector-oscillator. Two I.F. stages are used before the double-diode-triode which functions as second detector and first L.F., while a further double-diode-triode supplies A.V.C. In the final stage there are two push-pull super-power triodes, while an indirectly heated heavy-duty rectifier supplies H.T. There are thus nine valves and twelve stages in all. The undistorted output is 6 watts. Power consumption is: radio, 110 watts; gramophone, 145 watts. The cabinet is of figured walnut in an attractive modern style. Height 33in., width 31in. and depth 20in. The price is 48 guineas.

LATEST LISSEN RANGE

DESCRIPTIONS of seven attractive models are described and illustrated in the new Lissen catalogue varying in price from £4 10s. for the "Popular" three-valve, two L.F. and pentode receiver, to £9 15s. for the all-mains A.C. band-pass four-valve receiver. The appearance of the all-mains D.C. four-valve receiver at £9 9s. is particularly attractive and unusual in design, being of satin-polished, figured walnut with dark overlays. There is a model to suit every room, every home, and every pocket. Every Lissen receiver is sent out complete.

RADIO CLUBS AND SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

THE CROYDON RADIO SOCIETY

MUSIC CRITIC of *The Croydon Advertiser*, "Amphion" gave an interesting lecture for the Croydon Radio Society's meeting on Jan. 8th in St. Peter's Hut. He considered that the Society's meetings, particularly its loud-speaker nights, were doing much good in the continual fight for good quality reproduction. Even as it was, a large section of the public were content with inferior apparatus. In discussing musical education, he said that helpful as, of course, the B.B.C. was, it would be several generations before we became a musical nation. He deplored indiscriminate listening, as some people simply had to have a background of loud-speaker noise to their conversations and meals. Radio listening to a concert had advantages over actually being present at it, for irritating mannerisms of the conductor and even more irritating tapping on the floor by the person behind us, were avoided.

Dealing with the construction or "form" of music, he explained why the popular Strauss waltzes had perfect form and the fox-trot of to-day departed from the form rule, which meant that when music was written, the first subject came first, then the second subject, development and recapitulation. Among other topics, he dealt in no uncertain manner with the musical snob, who paid half a guinea to hear a famous violinist and ignored an unknown one when only one and sixpence was wanted. Moreover, he deplored that "Scruffinoff" should be chosen as one's professional name, instead of good old honest and British "Jones."

The Chairman, in concluding, announced that on Tuesday, January 29th, the Society was holding a Dual Loud-speaker Night, and he hoped that "Amphion" would be able to attend it. The New Year Fixture Cards are now ready.—Hon. Secretary, E. L. Cumbers, Maycourt, Campden Road, S. Croydon.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES *and* ENQUIRIES *by Our Technical Staff*

The coupon on Page 700 must be attached to every query.

If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor. PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2.

SPECIAL NOTE

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.

Please note also that all sketches and drawings which are sent to us should bear the name and address of the sender.

Making a Multi-purpose Meter

"I have read with great interest the articles in the series of 'Half-Hour Experiments' in 'Practical Wireless,' and have been particularly interested in the matter of measuring voltages by means of a milliammeter. Could you please tell me the values of the shunt resistances required for use in conjunction with a 0—.5-milliamp. moving-coil meter to enable me to read up to, say, 0—100 milliamps. and 0—150 volts? I should be greatly obliged if you could supply information which would enable me to construct a complete test meter of the type referred to at a total cost of not more than about £2."—W. A. (Co. Sligo).

We are pleased to know that you find the articles of interest, and it may be possible to include the information you require in a later article of this series. It should be pointed out, however, that the values of shunt and series resistances can only be calculated when the resistance of the meter itself is known; as you do not state any figure in connection with your own meter we regret that we cannot supply the information required. We would add, however, that an article dealing with the construction of a multi-purpose test meter appeared in the issue of PRACTICAL WIRELESS, dated December 30th, 1933, and you will probably find a good deal of information in that article.

Short-circuiting Components

"Referring to the article in the series 'What is Wrong?' ('Practical Wireless' dated March 4th, 1933), dealing with testing by short circuit, I would like to ask if these tests can be made when the set is switched on. The reason for asking this is that I tried short-circuiting the primary winding of the L.F. transformer in my set and found that the fuse 'blew.' I also tried short-circuiting the secondary when the set, which had previously been inoperative, commenced to function correctly again. I am puzzled to know the cause for these two apparently peculiar happenings."—"Strongbow" (Riverstown).

The tests by short circuit should be carried out when the receiver is switched on, care being taken, of course, that the short circuit is applied at the correct points and not across the H.T. or L.T. leads. It would appear from your remarks that when you thought the transformer primary was shorted you were actually shorting the primary to the secondary, since this would account for the burning-out of the fuse. From the details you give we are afraid that we cannot account for the change brought about by short-circuiting the secondary winding.

The Leader Three

"I propose to build the Leader Three as described some time ago in 'Practical Wireless,' but as I have a perfectly good and new two-gang condenser and a reliable L.F. transformer of well-known make I should like to know if these could be substituted for those components specified."—D. W. G. (Newcastle-on-Tyne).

Whilst it is probable that the components you have would prove quite satisfactory, we cannot recommend alterations to our specification, nor can we guarantee the receiver when made from parts other than those listed in the constructional articles. In your case, however, we have little doubt that good results would be obtained, although perhaps not quite so good as with the original receiver.

Electrical Interference?

"We have recently installed a three-valve battery receiver, but find that only about two stations on each waveband can be received. It should be added that there are electric pylons near the house, and we wonder if these have any ill effect, especially since we are troubled by interference (presumably) which takes the form of continuous 'crackles and bangs.' Any assistance that you may give will be very much appreciated."—C. K. (Bridgend, Glam.).

It is rather difficult to advise you without having a circuit diagram of your receiver, but we should imagine that your trouble is more probably due to a loose connection or faulty component in the receiver than to the electric pylons near the house. You could check this by disconnecting the aerial and earth—if the noises still persist it can be taken that the set is at fault. If, on the other hand, there is then a silent background it may be assumed that you are suffering from electrical interference and the engineering department of the nearest general post-office should be notified: they will arrange for tests to be made and advise you of the best course to follow.

An Extension-speaker Problem

"I have built the portable crystal set recently described in your pages, but I am unable to receive any signals. Can you please tell me where to look for faults? Another question: When using an extension speaker it was noticed that reception could still be obtained—at much reduced strength—when only one lead was connected. What is the reason for this, please?"—L. W. S. (S.E.3).

There is really very little to go wrong with the crystal set you mention, and we can only suggest that you test the coil and headphones by substituting them in your other receiver.

The extension speaker functions with only one lead attached due to a capacity effect between the second lead and earth. The lead being long and probably running near to a wall, the earth capacity will be fairly high, so that you have almost the equivalent of a choke-capacity output system between the speaker and the penultimate valve.

A Signal Generator

"With regard to the signal generator described in a recent issue of 'Practical Wireless,' I would like a little information on the two following points: Does the 4.5-ohm stud give a reading of ten times the value of the .5-ohm stud for the same meter reading? Are the connections shown on the enclosed sketch (*not reproduced—Ed.*) correct?"—G. H. (Birmingham, 7).

(1) The .5-ohm stud gives one-fifth of the output obtained from the second stud.
(2) Your sketch is quite correct.

Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word. Words in black face type and/or capitals are charged double this rate (minimum charge 3/- per paragraph). Display lines are charged at 6/- per line. All advertisements must be prepaid. Radio components advertised at below list price do not carry manufacturers' guarantee. All communications should be addressed to the Advertisement Manager, "Practical and Amateur Wireless," 8, Southampton Street, Strand, London.

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BIRMINGHAM RADIOMART

BRAND new components by quality makers, immediate despatch, guaranteed satisfaction.

RADIOMART. British Radiophone, fully screened 2-gang .0005 top trimmers, latest compact type, 5/11.

RADIOMART. Radiophone 3-gang, as above, 8/6; Radiophone 4-gang superhet, 9/6.

RADIOMART. Radiophone I.F. transformers, top trimmers, 2/6; also few 117 and 126 k.c.

RADIOMART Utility super 2-gang .0005 ball-bearing, fully screened with trimmers, 5/11; with disc dial, 6/11.

RADIOMART. Utility 3-gang, as above, straight or superhet, 7/11; with dial, 8/11.

RADIOMART. Famous 8 mfd. dry electrolytics, 500v., 2/11; NSF., ditto, 8 x 8 mfd., 500v., 3/6.

RADIOMART. BTH 7in. latest 2,500 ohm. moving coils, humbucker, 4 watt model, 12/6.

RADIOMART. Sonochorde super sensitive PMs. "Class B" or Universal (ideal battery sets), 16/6.

RADIOMART. Centralab potentiometers, every size from 200 ohms to $\frac{1}{2}$-meg (list 12/6), 1/6.

RADIOMART. Genuine 30 ohm Clarostat humdingers; remove hum; brand new (list, 2/6), 9d.

RADIOMART. Pushback—the wire used by setmakers; ready tinned and sleeved, 6yds, 9d.

RADIOMART. Screened flex, H.F. or pick-up; single, 6d. yd.; twin, 9d. yd.

RADIOMART. Resin-cored solder, 10d. per ft.; Bulgin lamp fuses, 2d.; Bulgin twin fuseholders, 4d.

RADIOMART. Non-inductive tubulars, 1,500vt. .0003, .002, 4d.; .01, .02, .04, .05, 0.1, 6d.; .2, .25, 8d.; .5, 9d.

RADIOMART. Differentials; Telsen .0001, .00015, 1/-; Polar .0003, 1/3; Ebonite panels, 16 x 8, 1/6.

RADIOMART. Telsen 1-watt wire-ended resistors, 6d.; Telsen cartridge resistances, tubular condensers, 6d.

RADIOMART. Telsen latest reaction, .0001, .00015, 10d.; Lotus, .0003, 1/-; Utility .0005, 1/3.

RADIOMART. Special offer dozen famous assorted wire-ended resistances, all different, NSF, etc., our selection only, 2/6.

RADIOMART. Triotron "Blass B" units, complete driver transformers, new BVA valve (list 64/-), 32/-; Less valve, 25/-.

RADIOMART. Regentone latest 30ma. A.C. eliminators (list £3/7/6), 39/6; Telsen 28ma., with 4VAC (list £3/7/6), 37/6.

RADIOMART. Lissen 12/6 chokes, 25 hy., 70ma., 4/6; 32 hy. output, 4/6; 3-1 pentode output transformers, 4/6.

RADIOMART. Brand new condensers, eminent makers, 500v. working, 4 mfd., 3/6; 2 mfd., 1/10; 1 mfd., 1/6.

RADIOMART. 350v. working, 4 mfd., 2/9; 2 mfd., 1/8; 1 mfd., 1/4; 250v. working, 4 mfd., 2/3; 1 mfd., 1/2; 0.5 mfd., 9d.; 0.1 x 0.1 mfd., 9d.

RADIOMART. Supremus battery economisers, incorporating Westinghouse rectifier: halves consumption (list 27/6), 7/6.

RADIOMART. Triotron "Class B" 7in. cone PM. unit, with driver transformer, valveholder (list 40/6), 25/-.

RADIOMART. Staltapped "Class B" chokes (list 9/6), 3/6; Igranic driver transformers, 1/11.

RADIOMART. Transformers: Igranic, 8/6; Parvo, 3/6; 3$\frac{1}{2}$-1 Ericsson (15/-), 1/3; Microphone, 2/6.

RADIOMART. Air-spaced variable condensers, .0005, 1/9; bakelite, 1/3; Philips tubular .0001, .001, 2d.

RADIOMART. Screened iron-cored dual-range coils with reaction circuit, 2/11; Igranic short-wave iron-core dual-range, 3/3.

RADIOMART. Telsen, Radiophone, dolly toggle switches, 8d.; Lotus radiogram switches, 9d.

RADIOMART. Radiophone H.F. chokes (manufacturers), honeycomb wound, 1/-; Metvick, 9d.

RADIOMART. Years of transmitting experience makes possible a specialised service in short-wave material which can be relied upon.

RADIOMART. G.E.C. all brass .0003 condensers, with real slow-motion; Ideal short-wave (listed over £1), 2/9.

RADIOMART, Limited, number as above, but double spaced, .00015, 3/9; The finest condensers ever made.

RADIOMART. Brass ball-bearing 100 mmfd. short-wave, pigtail, noiseless, 1/6; brass band-spread or neutralising micro-variables, 1/-; extension brackets, 3d.

RADIOMART. Government £6/6/0 polarised relays, beautiful instruments, perfect, 8/6; Morse practice key, 3/6.

RADIOMART. Pye loloss short-wave valveholders, 4d.; 1$\frac{1}{4}$in. coil forms, 4-prong, 1/3; 6-prong, 1/6.

RADIOMART. Western Electric 21/- microphones, 2/9; transformer, 2/6; Telsen dual-range short-wave coils, 3/6.

RADIOMART. Milliammeters flush, 2$\frac{3}{8}$in., 5/9; 2$\frac{3}{4}$in., 6/9. All ranges above 25ma.

RADIOMART. Fintglass aerial insulators, 3$\frac{1}{2}$in., 6d.; Beehive stand-off insulators, 8d.

RADIOMART. American stand-off insulators, "Tinymite," 6d.; "Midget," 7d.; "Standard," 8d.; Frequentite English valveholders, 8d.

RADIOMART. Black 3in. slow-motion dials, similar Indigraph, 1/-; Lissen coil-mounts, 2d.

RADIOMART. Purchase over-produced stock leading Continental valvemaker; Super valves; sensational prices.

(*Continued at top of column three*)

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RADIOMART. A.C. types at 4/6; H.F. Pen., MH, MHL, VMSG., PT4, SGLA, SGHA, 2 volt, from 2/11.

RADIOMART. American types at 4/6; UX250, UX245, UX210, UY35, UY24, UY27, 46, 2A7, 6A7, 80, 81, 56, 43.

RADIOMART Catalogue gives full characteristics, hundreds other bargains. Goods over 6/- post free.

RADIOMART sends Catalogue or answers enquiries only when stamp enclosed.

THE SQUARE DEALERS

RADIOMART, 19, John Bright Street, Birmingham.

SOUTHERN RADIO'S WIRELESS BARGAINS.

RECEIVERS.—Osram 4-Valves (Actual) Sets. Complete with Four Osram Valves, Moving-Coil Speakers. Pedestal Cabinet. Ready for use on all Voltages A.C. In sealed cartons, £6/0/0 (List £15/15/-).

BURGOYNE Class "B" Sets. With Three Mullard Valves. Exide Batteries and Accumulators. Moving Coil Speakers. In modern Cabinet beautifully finished in Chromium plate. Ready for use. In sealed cartons. £3/18/6 (List £6/10/-).

LISSEN 2-Valve D.C. Sets. Complete with Valves, Speakers in attractive Bakelite Cabinet. Ready for use, on all Voltages D.C. £2/15/- (List £7/7/-).

FERGUSON Radio Midget Sets. 4-Valves (Actual) T.R.F. Complete with Moving Coil Speaker. Valves. Ready for use on all Voltages A/C or D/C. In sealed cartons. £3/12/- (List £8/8/-).

COILS.—Igranic Superhet Four Coils (1 OSC, 2 I.F., with pigtails, 1 I.F. plain). 9/- per set (50/- List).

VARLEY Constant Square Peak Coils B.P.5, with all accessories, 2/3.

PICK-UPS.—Marconi Model K25 (1935 Issue), 21/- (List 32/6).

CONDENSERS.—Plessy Four-Gang Condensers with Oscillator Section for Superhet. Fully Screened with trimmers, 7/3 each (List 45/-). LOTUS Three-Gang, 12/6; 2-Gang 8/6. All Lotus Condensers are complete with Dials, Escutcheons, fully screened with trimmers. Dubilier 4-mfd. (2+1+1) 1,000 Volt, 2/9 each; 4.5 mfd. (2.25+2.25) 3/-. T.C.C. 0.1+0.1, 1/3. Dubilier 0.1, 9d.

SPEAKERS.—Blue Spot 66R Units, 10/6. Mounted on Blue Spot Chassis, 16/6 (List 45/-). Blue Spot Permanent Magnet Moving Coil Speakers. Universal Transformers for Power, Super-Power, Pentode and Class "B." All Brand New 1935 Series in sealed cartons. Type 99P.M., 30/- (List 59/6); 45P.M., 24/- (List 45/-); 62P.M. (in Cabinet), 38/- (List 67/6); 32 P.M. in magnificent cabinet, 45/- (List 87/6). W.B. Stentorian Permanent Magnet Speakers with universal Transformers, 21/- each (List 32/6).

ELIMINATORS. — Regentone Eliminators W.5a. Complete with Trickle Charger for 200/250 volts, 39/6 (List £3/17/6). A small Quantity only of Ekco Eliminators for 100/125 volts only, Type K25 with Trickle Charger, Output 25 m.a., 35/- (List £4/12/6). Type K.18 with Trickle Charger output 18 m.a., 32/6 (List £4/7/6). All Brand New in original sealed cartons.

MISCELLANEOUS.—Westinghouse Metal Rectifiers. H.T.6, 7, 8, 9/3 each. Morse Tapping Keys with flash signal and buzzer. Complete with Battery and bulb, 2/-. Biflo Static Cut-outs, definitely eliminates noise and interference, 2/3 (12/6 List). Telsen Binocular H.F. Chokes, 2/4 (List 4/6). Variable Volume Controls, all capacities, 2/- each. Lewcos Spaghetti Resistances, all capacities. New and boxed, 1/6 dozen assorted.

Many More Bargains at our various Branches.

Every Article Guaranteed and sent Post Paid.

BRANCHES at 46, Lisle Street, W.C.2; 271-275, High Road, Willesden Green, N.W.10. All Mail orders to 323, Euston Road, N.W.1.

SOUTHERN RADIO, 323, EUSTON ROAD, LONDON, N.W.1 (near Warren Street Tube). 'Phone: Museum 6324.

RADIALADDIN (Disposals), Ltd. Exchange your old set for any new model, balance cash or H.P. Write for free quotation to largest radio exchange in U.K. Also clearance sale of reconditioned sets and radiograms at gift prices £1 to £10. Write for list.—46, Brewer Street, Piccadilly Circus, W.1. Gerrard 4055.

ALL REPAIRS to Moving Coil Speakers, prices quoted. Loud-speakers, L.F. and Speech Transformers, 4/- each. Post free. Satisfaction guaranteed. Prompt service.—L.S. Repair Service, 5, Balham Grove, London. Battersea 1321.

MAINS Transformers, chokes, etc., to specification, repairs promptly executed. Guaranteed satisfaction. Prices on request. Henry Peace, Ltd., Wednesbury, Staffs.

HALL-MARK THREE, Superhet Three, ST600 Guaranteed First Specified Kits—Lowest Prices —Easiest Terms—Lists Free—Melfo-rad, Queen's Place, Hove. (Trade Supplied.)

DEMONSTRATION MODELS.—All as new. Climax A.C. Radiogram, listed £18/18/0; Atlas A.C. Console, listed £16/16/0; Decca A.C. Portable Radiogram, listed £15/15/0; Alba Battery Radiogram, listed £12/12/0; Philips D.C. Mains, listed £12/12/0; M.B.3., listed £8/8/0; Burgoyne Battery Three, listed £4/4/0; All less 25%. Carriage Free.—Hay, Winchester Road, Alton, Hants.

RADIO CLEARANCE, 280, HIGH HOLBORN, W.C.1, offers the following stupendous bargains limited quantities only. To orders over 5/- post free. 'Phone : Holborn 4631.

7 VALVE Superhet Plessy Chassis made for proprietary firm whose name we are not allowed to mention; 7 tuned stages; delayed A.V.C.; local distance switch; 7 kc/s separation; Mullard valves; A.C. 200-250 volts. Demonstrations daily. Chassis complete with valves, brand new, less speaker and cabinet, £7/10/0.

RADIO CLEARANCE offers Dorchester 3 Valve Screen Grid Detector, Power, or Pentode Battery Chassis, including all first-class Components, brand new, completely wired, at 35/-, less Valves.

RADIO CLEARANCE makes special offer of a limited quantity S.T. 600 Dorchester Kits to designer's specification, including Colvern Coils, Polar Condensers, T.C.C. Fixed Condensers, R.I. Hypermite Transformer, Metallised Baseboard, Ready drilled Panel and Terminal Strip, list price, £5/17/0; our price, £3/10/0.

RADIO CLEARANCE offers 1 Watt Resistances, well-known make, all sizes, 6d. each.

RADIO CLEARANCE offers Wego 2 mfd. Condensers, canned type, 1s. each.

RADIO CLEARANCE offers 8 mfd. Dry Electrolytic 500 volt working, well-known make, 2/6 each.

RADIO CLEARANCE offers White Sleeving, 1½ m.m., 9d. doz. lengths.

RADIO CLEARANCE offers Telsen 0001-00015 Reaction Condensers and 0003 Tuning Condensers 7d. each.

RADIO CLEARANCE offers British Radiophone 3-gang Condensers with 3 .0005 sections, complete with Dial, Escutcheon, and Pilot Holder, 7/6 each.

RADIO CLEARANCE offers 1/25 H.P. Motors (Gilbert) 100-115 volts A.C. for Television, suitable for 200-250 Volts for use with 700 Ohm Resistances or 30 Watt Lamps, price 10/6.

RADIO CLEARANCE offers Variable Power Resistances by well-known maker, 0-100 Ohms; price 3/- each, exceptional value.

RADIO CLEARANCE offers British Radiophone Triple Gang Condensers, 2XO .0005 and 110 kc/s oscillator section complete with knob, drive, escutcheon; 7/6 post free.

RADIO CLEARANCE offers British Radiophone 110 kc/s Intermediate Frequency Transformers, 3/-.

RADIO CLEARANCE offers 8,000 Ohm Volume Controls, Log. type, with Q.M.B. switch, by G.E.C., 2/6.

RADIO CLEARANCE offers Set of Band-Pass Coils, manufacturer's type, with circuit diagram, suitable for tuned grid or tuned anode; set of 3 coils, 4/6.

RADIO CLEARANCE offers Mains Transformers, unshrouded, manufacturer's type, primary 200-250, secondary 320-0-320v. at 70 m.a., 2-0-2v. at 3 amps, 6/6 post free.

RADIO CLEARANCE offers L.F. Transformers, 3 : 1 and 5 : 1 manufacturer's type, 1/6 each.

RADIO CLEARANCE offers L.F. Transformers, shrouded, 3 : 1 and 5 : 1, price 1/9 each.

RADIO CLEARANCE offers Steel Chassis, cadmium plated, drilled ready for use, 3 Valve, 1/-; 4 Valve type, 1/6.

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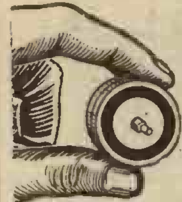

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