F. J. CAMM'S MOMENTOUS ACHIEVEMENT!
In these three Cossor Pentagrids is found the solution to really efficient single-valve frequency changing in Super Het. Receivers.

By reason of their special construction these valves are inherently free from the harmonics usually associated with frequency changers, and the signal-to-noise ratio is particularly favourable.

The Cossor 41 M.P.G. in addition to eliminating the disadvantages associated with previous frequency changing systems, provides an even higher gain than is possible with a separate Oscillator and Detector.

The battery type—210 P.G. also has a very high gain per milliamp of H.T. consumption.

**FREE—NEW WIRELESS BOOK!**

A 40-page book packed with useful and interesting information—latest circuits—technical terms—how a ‘super’ works, etc. Send now.

**PLEASE USE COUPON**

To A.C. Cossor Ltd.,
Melody Dept.,
Highbury Grove, London, N.5

Please send me full particulars of these Cossor Pentagrid valves and also include a copy of the Cossor 30 page Wireless Book.

Name
Address

N.B.: Please refer to Coupon Section.
A THREE-VALVE SUPERHET AT LAST! 

Mr. F. J. Camm's New Receiver!

For many months the problem of selectivity has held the attention of designers of wireless receivers, and on all sides it has been admitted that the only real solution to interference-free reception is to be found in the superheterodyne circuit. Unfortunately, this has hitherto necessitated the employment of multi-valve receivers and tricky circuits, with all the attendant difficulties in station separation. Quality has been maintained at a high level—due to the incorporation of a linear detector (without reaction), and the output is sufficient for all normal requirements.

Mr. F. J. Camm has been experimenting with all existing methods of incorporating the superheterodyne feature in a simple receiver, but until recently he has found no real solution to the problem consistent with low price. We fully realize that the home constructor is not prepared to spend a lot of money in trying out a new receiver, although phenomenal claims for every constructor will be able to take advantage of this new development, and may build a receiver which will end for all time his difficulties in station separation. The price of the receiver is only three!

FREE BLUEPRINT NEXT WEEK

Turn to Pages 170 and 171 and read some more about this wonderful new receiver.

Talk on Welsh Culture

Torbeth C. Peate will deal with the vast amount of work which is necessary to obtain a complete picture of the Welsh rural tradition in a talk in the Welsh Interlude for National listeners on October 20th. He will indicate several aspects of Welsh culture which have been neglected and will suggest ways in which Wales, through preserving her folk material, could give a lead to other countries.

Chamber Music Concerts

The B.B.C. announces a special series of six public Chamber Music Concerts in the Concert Hall, Broadcasting House, on Friday evenings at 8.15. This is the fourth series of these concerts, the first of which took place in 1932.

The concerts this season will be given on October 29th, 1934; November 2nd, 1934; December 7th, 1934; January 25th, 1935; March 1st, 1935; March 29th, 1935. The Ensembles engaged are The New English Singers, the Pro Arte String Quartet, the Kolisch String Quartet, and the Bosa String Quartet. Among the solo artists are Arthur Rubinstein, Ernst von Dohnanyi, Lionel Tertis, Carl Flesch, Thelma Reiss, Conchita Supervia, Margot Himesenberg Lefebre and Jo Vincent.

Concert from West Regional

A CONCERT will be relayed from the Regent Theatre, Truro, on October 22nd, when the artists will be Heddle Nash (tenor), Muriel Kemp (pianoforte), and the Cornwall Symphony Orchestra conducted by Charles Rivers. This orchestra is composed of musicians who come from all parts of Cornwall to Redruth to practise. The day before a big concert other players come from the neighbouring county of Devon, and in addition four or five players come from the British Women's Symphony Orchestra and nine from the Royal Marine Band, Plymouth. Thus is formed an orchestra of seventy-four players. For the last twelve years this orchestra has given annually a short series of concerts in Camborne and in Truro.
ROUND the WORLD of WIRELESS (Continued)

INTERESTING and TOPICAL PARAGRAPHS

Sunday evenings, October 21st, November 4th and 18th, and December 2nd, 10th, and 30th. The following distinguished Americans have been invited to contribute to this symposium, in which they will be at liberty to express their points of view on matters general or particular, according to their choice: Miss Frances Perkins, Senator Borah, Owen D. Young, Sidney Hillman, W illa Cather, and President Lowell. Owing to the difficulty of fitting in each speaker on evenings which are mutually convenient, some of the talks will be arranged at short notice; but they will be given on the dates stated at 9.0 p.m., G.M.T.

B.B.C. Midland Orchestra

COMMENCING during the present week the new B.B.C. Midland Orchestra appears in both Regional and National programmes. On October 21st Leslie Heward conducts an Edward German programme, and the light symphony programme on October 23rd, when Mozart’s Symphony in C is the chief work. Victor Hely-Hutchinson will conduct in a programme of humorous pieces. This last was given a few weeks ago with the Midland Natural Orchestra, but had to be curtailed owing to an electrical breakdown in Birmingham. For the Saint-Saëns suite "Le Carnaval des Animaux," the pianists will be Margaret Abelthorpe and Michael Mulliner. The orchestra consists of thirty-five players, with Alfred Cave as leader. It forms the nucleus of the City of Birmingham Orchestra, whose symphony concert on October 26th will be relayed. That programme includes the Haydn Symphony No. 102 in B flat and, with Ernst Wolff as pianist, the Mozart Pianoforte Concerto in B flat. Leslie Heward will conduct the concert.

"The Black Dog of Hergest"

ACCORDING to a recent report the Black Dog of Hergest, a phantom hound, has been seen in the neighbourhood of Kingston. The legend of its appearance dates from the period of the Wars of the Roses; it inspired fear in generations of Herefordshire people, and has left, to this day, a local saying: "Why so fierce, Mr. Vaughan?" which originally referred to Black Vaughan, owner of this phantom hound, who is said to have kept at Hergest Court. Anyhow, "The Black Dog of Hergest" is the subject of the first of the Midland series of dramatized legends. Hoffmann, who has made a play of it, was born in Herefordshire, and has long been a student of West Midland folk-topics and legend; while as a broadcaster, she is on the eve of her hundredth microphone appearance. Martyn Webster produces the play on October 22nd.

SOLVE THIS!

PROBLEM No. 109

Gregory had a small two-valve receiver which had given good results for some time. He gave it a good clean up one day, removing all dust, etc., and when he next tried it out he found that whilst signals were quite as usual up to the Midland Regional, he could hear nothing on wavelengths higher than this station. He examined the coil and found that this was quite in order, but one thing became noticeable after spending some time endeavouring to trace the fault. As soon as he had passed the tuning point of the Midland Regional the usual rushing noise and other background noises ceased to issue from the loud-speaker. What was wrong? These books will be awarded for the first three correct solutions opened. Address your envelope to The Editor, PRACTICAL WIRELESS, Geo. Newsom, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 109, and must be posted to reach here not later than the first post Monday, October 22nd, 1934.

Solution to Problem No. 105

Owing to the heat in the boiler house, the electrolyte in Smith’s accumulator evaporated rapidly. Thus the accumulator became run down much sooner than expected, and when he put it on charge it was only half full. During the charging period it became completely dry and thus failed to function. The following three readers correctly solved Problem No. 107, and books have accordingly been forwarded to them: W. R. Boot, 29, Stapleton Hall Road, Birkenhead, Wirral; Mr. G. K. Walker, 15, Eberton Road, Pimlico, S.W.1; Mr. G. L. Hutchinson, The Pitsane, Chumpeo Hill, S.E.5.

Prince George at Swansea

The new civic centre at Swansea will be opened by Prince George on October 18th. The proceedings are to be broadcast in the West Region, beginning at 12.10 p.m. and while Prince George is inspecting the new Guildhall and Law Courts a few words of introduction will be given by a commentator. When the Prince has proceeded to the Brangwyn Hall, the Bishop of Swansea and Brecon will deliver a consecration prayer, following which the Mayor will formally welcome the Prince. Prince George has recently, for despatch to France, part of a large order received by The General Electric Co., Ltd., from France, being despatched by aeroplane from Croydon.

MODERN DESPATCH METHODS

British Radio Receivers for France

CRITICAL opinion in France recognizes that so far as technical advance in radio reception is concerned, British-made receivers represent a higher standard than any others. In consequence the General Electric Company is exporting considerable numbers of sets just now to France. Air transport is recommended as offering the best facilities in speed, simplification of packing, and in over-all costs, and it is of interest to learn that by utilizing air transport it is possible to convey the goods from the factory belonging to the Company mentioned above at Coventry in only from five to six hours. The illustration on this page shows the first consignment of G.E.C. receivers being loaded on to an Imperial Airways aeroplane at Croydon recently, for despatch to France.

"American Points of View"

An interesting series of talks entitled "American Points of View" will be given in the Regional programme on October 20th, 1934.
Modern Tuning Scales for the Home Constructor

Some Details which Will Enable the Listener to Modernize the Tuning Device on an Old Receiver

By W. J. DELANEY

There are many listeners who are still using a receiver which has seen service for some considerable time, but which gives such good results that they do not feel disposed to modernize it. They may have obtained certain new items, such as L.F. transformers, but in general it does not conform to modern standard in appearance and operation. A glance at modern commercial receivers reveals the fact that the method of indicating the tuning of each station has been very much improved, and some

very novel schemes are to be seen in the various types of receiver which are available.

In place of the small window behind which a celluloid scale moved, we now have wide, open scales with really substantial pointers which leave no doubt as to the exact tuning point. Furthermore, in place of a few arbitrary figures, we can have the names of the various higher powered stations clearly marked so that all the members of the household may tune to a desired station without hesitation or doubt.

It is possible for the home-constructor to make up quite a number of these indicators for incorporation in an old receiver, but naturally the exact construction will depend upon the particular receiver which is in use, and unfortunately, therefore, we cannot give a particular method which might be modified for any type of receiver.

Various Types Possible

There are many types from which the constructor may choose, varying from a large moving disc to a small metal pointer carried by a travelling cord. The first thing which has to be done is to remove the present dial, and in the majority of cases it will also be necessary to move the condenser also, so that it takes up a position slightly farther back to enable the tuning device to be positioned between the condenser and the panel. With modern baseboard-mounting condensers this will probably be found a simple matter, but with old pattern single-hole mounting condensers some form of support will have to be given. One of the well-known component brackets will probably be found satisfactory, and these require only two small screws to attach to the baseboard, whilst the long slot will enable the condenser to be locked into the most convenient position. Whatever type of mounting is provided for the condenser, there will obviously be a hole left in the panel, and to avoid the least of a new panel this may be utilized for the tuning control. Special one-hole mounting bushes are obtainable from most radio stores, and one of these may be locked into the hole to accommodate the tuning control. One of the simplest dials, which gives a good reduction and provides a clear indication of its setting may be constructed by cutting out a large semi-circular section from the panel, mounting a sheet of paper on a piece of wood situated a short distance behind the panel, and soldering a thin piece of copper wire to the end of the condenser spindle. To turn the spindle with a suitable reduction a large disc of plywood is mounted on the spindle, and a groove is made round the edge of the disc. A short control spindle is mounted low down on the panel, and a small wooden disc or piece of rod is attached to it with a cord passing round the larger disc. The cord should preferably be of a suitable length, and it may be turned over to grip the cord. The pointer will thus be carried along with the cord as the condenser turns and a very clear indication will be afforded. Details of the main parts are shown in Fig. 2. The pulleys are from one of the well-known constructional toys, and are obtainable at any toy shop, or may be made from plywood with the centre grooved out. It will be seen that by adopting this cord and pulley idea the scale may be arranged vertically if desired, whilst it may also cover two scales, one to indicate medium waves and the other for long waves. By arranging the wave-change switch also to control the illumination of these two scales the exact station which is being received may more readily be seen.

A Tensioning Device

Where sufficient length is available it will pay to fit a tensioning device for the cord. This is carried out quite simply by making the join between the ends of the cord through the medium of a small spring. A bell spring, obtainable from a cycle dealer’s for one penny, will prove quite suitable.
SWITCHING DEVICE FOR AN OUTPUT PLUG

A Novel Arrangement for Adapting a Plug for Switching Two Speakers

**Diagram**

The diagram illustrates the construction of the switching device for an output plug. It includes labeled parts such as leads from speakers, terminal, bottom moulding, and a small knob for switching.

**Programme Notes**

Programme under the above title, which has been arranged by Pleten Davies for West Regional listeners, will broadcast a variety of music, including classic and contemporary pieces.

**Minstrels' Concert from North Regional**

Next Tuesday evening (October 23rd) the Minnebaha Amateur (nigger) Minstrels, well known in Manchester district, will broadcast a programme from the North Regional Studios. The programme, which is about sixty strong, consists entirely of male-including a score of young boys. It will feature a variety of music, including classical, folk, and popular songs.

**NOTES**

Variety from Scottish Radio Exhibition

On October 20th, a variety programme will be relayed from the model studio, Scottish National Radio Exhibition, Waverley Market, Edinburgh.

Juvenile Performers

Two "juvenile" artists will broadcast in the North Regional programme on October 27th. They are Muriel Beardley, juvenile pianist from Lytham St. Annes, and Billy Williams, violinist, of Pwllheli, Wales. Both have won many prizes, Williams having distinguished himself particularly at the National Eisteddfod of Wales.

"Friday Morning"

This is the title of a play by Val Gielgud which is to be revived in the Belfast studios on October 19th. The setting of the play is an air liner between London and Paris, and its theme is the drama of the reactions of a number of quite ordinary people to the fact that a crash seems imminent. Actually, for the benefit of nervous listeners, the ending is not as sombre as might be expected. Lance Sieviving will produce.

Good Fare from Birmingham

The late Fanny Davies made some memorable appearances at the Birmingham Town Hall. On October 19th, records of her playing Schumann's "Scenes of Childhood" will be broadcast from the Birmingham studio.

Belfast Philharmonic Society's Concert

The first Subscription Concert of the Belfast Philharmonic Society will be relayed from the Ulster Hall on October 19th. The soloists will be Stuart Robertson (baritone) and Gaspar Cassado (cellist), and the Chorus and Orchestra of 350 performers will be conducted by E. Godfrey Brown. The programme will open with a Fanfare by the late Sir Edward Elgar.
ONE-VALVE LOUD-SPEAKER RECEIVERS

A Few Interesting Experimental Circuit Arrangements are here Suggested.

ELABORATE and comparatively complicated receiver circuits have lately come into such common use that the constructor is rather apt to look upon the simple single-valve set with disdain. Despite this, however, it is a fact that the one-valver has much to recommend it, for it can be made very cheaply and in a very short time, besides which it provides a greater degree of amplification and has a greater signal-handling capacity than the ordinary detector valve. In order to obtain the best possible results from a circuit of this kind, it is best to apply a high-tension voltage of not less than 100, whilst voltages up to 150 are often better, provided that they permit of a steady control of reaction.

The set just referred to proved very successful in the hands of a large number of readers, who found that fair speaker reception was attainable up to twenty miles or so, even on a moderate aerial; when a good aerial is employed and the speaker is of a sensitive pattern (preferably one of the older "cone" types) speaker reception up to thirty miles is not impossible.

D.C. Mains Operation

A circuit on the lines of that given in Fig. 1 is very suitable for operation from D.C. mains, since the very minimum of smoothing equipment is called for. The general arrangement of a very convenient D.C.-operated single-valve loud-speaker circuit is given in Fig. 2, from which it can be seen that two fixed resistances and fixed condensers are used to provide all the smoothing that is generally necessary. Filament current for the 2-volt, 2-amp. pentode is also taken from the mains, a 40-watt lamp acting as the necessary "voltage-dropper." Theoretically, such a lamp is only correct when the mains voltage is 200, but in practice it will be found that it functions quite satisfactorily on any supply voltage up to 230. As soon as the switch is turned on the 40-watt lamp will light up, but it can be placed in any convenient part of the room, so that its light is utilized. For example, the lamp might be used in a table light or standard, or it might simply be used to illuminate the receiver.

It should be noticed in Fig. 2 that fixed condensers are inserted in both the aerial and earth leads to prevent the possibility of shocks being received whilst using the set. The condensers provide a further safeguard when the positive mains lead is earthed.

(Continued overleaf)
ONE-VALVE LOUD-SPEAKER RECEIVERS

(Continued from previous page)

A Set for A.C.

Even when the mains are A.C., a single-valve loud-speaker receiver can be made up fairly conveniently, and without too great an expense, by using an indirectly-heated D.C. pentode (with 16-volt, 25 amp. heater) with a 60-watt electric lamp as "voltage-dropper" and a small metal rectifier for H.T. supply. Smoothing, as in the case of the D.C. circuit, is performed by two fixed resistances, although an I.F. choke, or the primary winding of a good transformer, might be used in place of one of them, when the value of the other would require to be doubled. The choke or transformer would prove somewhat better when the mains supply was very "rough," although the resistances will be perfectly satisfactory in the majority of cases.

A Novel Arrangement

An entirely different type of single-valve loud-speaker receiver can be made by using a Class B valve in a "dual" capacity; that is, as both detector and L.F. amplifier. The simplest circuit of this type is shown in Fig. 4, where it will be seen that one-half of the valve acts as a perfectly normal leaky-grid detector and the other half as a three-electrode low-frequency amplifier. Coupling between the two sections is by means of a resistance-capacity network, and everything except the method of using the valve is standard.

This type of single-valve circuit will give results equivalent to those obtainable from an average two-valve receiver, which it really is. Somewhat greater output could be obtained by employing transformer coupling between the detector and L.F. circuits, but this generally leads to a certain amount of instability, due to the capacity which exists between the two anodes. At the same time, there is no reason why transformer coupling should not be tried by the experimenter, for, if a little care is taken in the choice of components, it is certainly possible to obtain good results.

The principal advantage of a receiver of this type is that it can be built in very compact form, due to the very few components required, and the arrangement lends itself to the construction of a simple portable. When used in that way, and with a temporary aerial, however, it would generally be found necessary to use 'phones instead of a loud-speaker. On the other hand, when used on a good outside aerial, speaker reception of stations up to 100 miles or more is possible. Up to twenty miles the circuit will give really good speaker reception, the output being as great as that obtained from the usual small battery-fed power valve. The principal objection is that the quality is not generally too good, and for this reason it is necessary to experiment with G.B.

A THREE VALVE BATTERY SUPERHET

AT LAST!

THE £5 SUPERHET THREE!

Free Blueprint Next Week


A MOMENTOUS ACHIEVEMENT!

Designed by F. J. CAMM
COMMON MISTAKES

This Account of Some of the Errors which Most Frequently Occur will Serve as a Guide for Avoiding Them in the Future

COMMON errors regarding radio fall into two classes: errors of ideas, which usually do no more harm than produce a sense of confusion, and errors of practice, which certainly affect the performance of a receiver, may put it out of action entirely, and in some instances the performance of a receiver, may put it out of action entirely, and in some instances the performance of a receiver, may put it out of action entirely, and in some instances the performance of a receiver, may put it out of action entirely, and in some instances the performance of a receiver, may put it out of action entirely, and in some instances the performance of a receiver, may put it out of action entirely, and in some instances the performance of a receiver, may put it out of action entirely, and in some instances the performance of a receiver, may put it out of action entirely, and in some instances the performance of a receiver, may put it out of action entirely, and in some instances the performance of a 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receiver, may put it out of action entirely, and in some instances the performance of a receiver, may put it out of action entireThe assumption is when is the output stage employs either a Class B or a quiescent push-pull arrangement. In each of these two devices, owing to the special design of the valves and of the circuit, the mean anode current when no signal is being received is only a few milliamperes, and the anode current consumption rises and falls according to the strength of the signal applied at any moment to the grid of the output valve.

**Practical Errors**

Quite a number of listeners find difficulty in understanding the correct way in which to connect up a grid-bias battery. Now the normal G.B. battery has a clearly marked " plus " sign at one end and an equally clearly marked " minus " sign at the other end, the voltage of the intermediate tappings being marked either on the side of the case or upon the black pitch which seals the top. The correct connections, of course, are G.B. plus to L.T. minus, with the grid return connected to the appropriate tappings. I have seen many cases, however, where G.B. plus has been joined to L.T. plus. This is not a very serious fault; for it usually only means that the actual grid-bias is reduced a volt or so below the nominal setting. The other mistake is where G.B. minus has been connected to L.T. minus. This means that the valves are given a positive grid-bias instead of a negative bias, with the result that the anode current rises to an alarming figure with disastrous effects to the high-tension battery, and upon the valves themselves. Fig. 1 gives the correct connections which should be used.

**Valveholder Points**

Mistakes still arise in connecting up valve holders. Occasionally the grid and anode terminals are confused. It should be remembered that the grid connection is the one nearer to the two filament sockets, as shown in Fig. 2.

**Pentodes**

Pentode connections sometimes cause a little confusion. In the case of a battery pentode it is the auxiliary grid which is connected to either the centre pin or the side terminal (Fig. 3). This is simple enough, but mistakes arise quite frequently in the case of A.C. mains pentodes. If the pentode is of the directly-heated type the auxiliary grid is connected to the centre pin as in Fig. 3. In some cases, however, an indirectly-heated mains pentode has been ruined because the centre pin was mistaken for the auxiliary grid connection, whereas, of course, in this type of valve the centre pin is the cathode contact as shown in Fig. 4, and the auxiliary grid is connected to a side terminal. This confusion is obviated if pentodes with the comparatively new seven-pin base are used, that is as long as care is taken to study the diagram giving the correct connections for this type of valve. In some cases bad performance by

(Continued overleaf)
(Continued from previous page)

pentodes has been due to the auxiliary grid being connected to the anode side of the loud-speaker instead of to the H.T. plus terminal of the set (see Fig. 5). Such a mistake, while not leading to damage, does produce very unsatisfactory performance, as the auxiliary grid, instead of being kept at the requisite steady voltage, is subjected to the widely fluctuating voltage which occurs at the anode of the valve.

Mention of voltage variations is a reminder that quite a large number of pentodes are damaged annually, and many even destroyed, owing to the speaker being inadvertently disconnected while the set is in operation. Such an action does not do any harm if the loud-speaker is joined directly in the anode circuit of the valve, but if a choke filter or output transformer is used, the removal of the speaker does not break the anode circuit, but only causes a very large reduction in the load impedance. Such a sudden change in impedance results in the development of a serious voltage surge, which is quite likely to cause the glass foot of the valve to crack.

It also imposes a severe strain on the insulation of the transformer or choke winding, and this may break down either across the winding or to earth. This risk can be avoided by connecting a small condenser (0.1 mfd.) and a 25,000 ohms resistance in series as a shunt to the output circuit, as in Fig. 6.

Speaking of load impedance reminds another fairly common mistake. Listeners sometimes design a resistance-capacity low-frequency coupling, and use an anode resistance of the order of half a megohm, or even one megohm, under the quite mistaken impression that the higher the resistance the greater the amplification obtained. This statement is true only up to a point, because if the resistance is made too high the D.C. voltage drop across it results in such a low voltage at the anode that valve performance suffers.

The best practical results are obtained when the anode resistance is from three to five times the valve impedance. Even with the old R.C.C. type of valve, which had an impedance of about 40,000 ohms it was not safe to use an anode resistance of more than a quarter megohm, and 100,000 ohms usually gave better results. The modern H.L. type of valve, however, generally has an impedance of the order of 20,000 ohms, and an anode resistance of about 10,000 ohms is normally recommended.

The H.T. battery is regarded by many listeners as an evil, chiefly owing to the expense which it entails. It may often be found, however, that this expense is due to lack of knowledge as to how to choose and use the battery, and a little thought expended when making the purchase will often result in a considerable saving over a period. For instance, the question of capacity of the battery is of vital importance. Think for a moment of the ordinary small flash-lamp battery, such as is obtainable for 4d. or 6d. This is intended for intermittent use on a small low-consumption bulb, and it does not need any tests to know that if left with the bulb burning, or if used with a high-consumption bulb, the battery will only last a very short time. Small capacity cheap batteries sold for H.T. purposes are constructed from a number of the elements used in ordinary flashlamp batteries, and thus will only deliver a very small current for short periods. It is useless, therefore, to expect them to give service on a multi-valve receiver.

For a Small Receiver

For a one-valve receiver employing a modern low-consumption valve, ordinary flash-lamp cells are quite suitable and will give good service. They may be joined in series with small brass clips. A standard capacity H.T. battery will, of course, give slightly longer life, but it will not prove economical to purchase one of the large types of battery as it may deteriorate owing to the length of time which it has to be kept. Most manufacturers now state the load rate of their batteries, and it is thus a simple matter to choose one which suite the receiver with which it is intended to be used.

Precautions

There are certain points to be guarded against when using the battery, and the first is that it must be placed away from heat and damp. Dust also proves troublesome if allowed to cover the top, whilst metal bodies, such as screw-drivers, should not be laid on top in view of the risk of short-circuiting portions of it. Do not short out a defective cell or connect a partially discharged battery in series with a new one. Although these devices appear to work satisfactorily there is an uneconomical drain upon the battery and money is, in fact, wasted by the practice. Open out wander plugs and make certain that they make firm contact in the sockets, and noises will thus be avoided. For testing the condition of the battery do not use a flash-lamp bulb or a low-resistance meter. Remember that the current taken by these two items is probably heavier than the receiver load, and thus an incorrect indication of the battery's condition will be obtained. Use a good high-resistance meter and test the battery on load if possible.

HINTS ON H.T. BATTERIES

FLASH LAMP CELLS CONNECTED IN SERIES MAKE A USEFUL H.T. BATTERY FOR A SIMPLE VALVE SET BUT ARE NOT SUITABLE FOR RECEIVERS EMPLOYING LARGE POWER VALVES

Flash lamp cells are quite suitable and will give good service. They may be joined in series with small brass clips. A standard capacity H.T. battery will, of course, give slightly longer life, but it will not prove economical to purchase one of the large types of battery as it may deteriorate owing to the length of time which it has to be kept. Most manufacturers now state the load rate of their batteries, and it is thus a simple matter to choose one which suite the receiver with which it is intended to be used.

Precautions

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ADDDING REALISM TO THE TRANSMISSIONS

In this Article the Author Describes Some Simple Methods of Obtaining Echo Effects by Electrical Means

PROBABLY everyone knows that the effect we speak of as an echo is produced by the combination of "direct" and reflected sound waves. The reflected sounds reach the ear some time after the direct ones, due to "time lag." This occurs between the sounds leaving after the direct ones, due to "time lag." Reflected sounds reach the ear some time after the direct ones, due to "time lag." Every schoolboy knows that he can produce an echo by shouting down a long narrow passage or even by speaking in a large room which has bare walls, but have you ever tried to make an echo by artificial means, that is without the long passage or empty room?

As a matter of fact, echoes of an artificial character are frequently required in theatrical and broadcast work in order to produce certain "effects." They are also very often necessary for giving a natural tone to the voice on long-distance telephones, where normal methods of tone correction are either impossible or ineffective. Some of the ways of making artificial echoes are very interesting and can be used for providing excellent fun for parties, amateur theatricals, and the like.

Echoes from Gramophone Records

I think the simplest, though by no means the least fascinating, method of producing an echo is by employing two gramophone pick-ups working together on the same record. Both instruments are wired in parallel and joined to the same amplifier (an ordinary wireless set can be used, of course), with loud-speaker connected. The general scheme is simple in the extreme, and is illustrated in Fig. 1. By allowing one pick-up to follow closely behind the other, a most realistic echo can be obtained, and the degree of echo effect can be varied as required by altering the relative positions of the pick-up needles in the record groove. In some cases it might be found even better to allow the second pick-up to "follow" the first by so much as a complete revolution of the record. A slight variation of the method just outlined is to connect each pick-up to a different amplifier and loud-speaker; then by varying the distance between the speakers and between the ear and each speaker all kinds of weird results are possible.

Another very simple way of producing artificial echoes, and one which has been widely employed by the B.B.C., is to connect a microphone to the amplifier in the usual way and to place a speaker (which is joined to the output side of the amplifier) behind the person who is speaking or singing into the microphone. In this system it is necessary to employ a second speaker wired in parallel with the first and placed well away from it—preferably in another room. The sound given out by the second speaker is thus responsible for the resultant echoes heard in conjunction with the original sound from the speaker. This method is not a particularly good one, due to the fact that a very long tube is required to obtain the best results. It is, nevertheless, a very interesting one, and offers plenty of scope for experiment. If you propose to try it you might find it desirable in some cases to insert an amplifier between the first microphone and earpiece to obtain a sufficiently powerful echo.

Fig. 1—Echo effects can be produced on gramophone reproduction by using two pick-ups connected in parallel to the same amplifier.

Fig. 2—A simple way of making echoes: two loud-speakers are used, and these are acoustically screened from each other.

Fig. 3—Another scheme for producing echo effects when using a microphone as the source of "supply."
been made. And since the pick-up is connected to the amplifier, the sound from it is reproduced by the speaker at any desired time after the original sound; the two combine to give a most realistic echo effect.

A More Complicated System

The most satisfactory system of producing echoes is that represented diagrammatically in Fig. 5. Unfortunately this idea cannot be tried out by the amateur, since it depends upon the use of a fair amount of expensive and complicated apparatus. It is, however, extremely interesting for its scientific value and because of the novel schemes involved.

The microphone is again connected to an amplifier, the output from which is divided; one portion is passed on directly to a second amplifier, to which a loud-speaker is connected, and the other portion is impressed upon a steel tape arranged in the form of a moving endless belt. The method of impressing the output on to the tape is precisely the same as that used in the Blattnerphone system of recording used so frequently and successfully by the B.R.C. In the first (microphone) amplifier the tape passes between two electro-magnets on which are high-resistance windings connected to the output terminals of the amplifier. Thus the tape is drawn past these magnets it eventually passes on to the second amplifier, where it is passed between a second pair of electro-magnets, which this time re-convert the magnetic impulses into purely electrical ones. These actuate the loud-speaker in precisely the same manner as the signals supplied to the amplifier directly from the microphone. It can thus be seen that the magnetic tape introduces some delay into the speech applied to it, and as a result the reproduction given by the loud-speaker has a distinct echo. On its "return journey" from the final amplifier to that taking the microphone output, the tape is passed between a pair of exceptionally powerful permanent magnets and the magnetic impressions made upon it are therefore completely "erased," so making the tape ready to receive another "speech record" as it passes through the primary amplifier.

It will be seen that any desired effect or time lag can be produced by the very simple means of altering the length of the tape or by varying its speed of passage between the two amplifiers. Incidentally, it might be observed that the system just described is the best and most that can be provided through the medium of a kit; the method of obtaining maximum results by tuning the two stages and thus the listener will be enabled to obtain a perfect permanent magnet and the magnetic field of the electromagnets is therefore able to be concentrated on the exciting coil of the loud-speaker, and the loud-speaker is therefore connected to the primary amplifier. The cabinet is provided with a cut-out front, and loud-speaker, the makers can supply the kit with valves, and cabinet, or to any desired combination. The complete apparatus, as already described, is obtainable for 3s. 6d. or by instalments for 2s. 6d. down and eleven monthly payments of 2s. 6d.

The Cabinet

For those who desire to complete the receiver with a neat cabinet and loud-speaker the makers also provide a fine walnut-finished cabinet of the vertical type, having a cut-out front portion into which the panel fits. The upper portion is provided with a neat fret backed with silk, and the battery are accommodated on a shelf dividing the cabinet into two. The cabinet will accommodate a moving-coil speaker and the makers can supply the kit with valves, loud-speaker and cabinet, or to any desired combination. The complete apparatus, as already described, is obtainable for 3s. 6d. or by instalments for 2s. 6d. down and eleven monthly payments of 2s. 6d.

THE PETO-SCOTT LUCERNE 3

The conditions which now obtain under the Lucerne Plan have induced Messrs. Peto-Scott, of Lucerne, to produce a kit receiver which will enable the best to be obtained at the present time. They have naturally called it the Lucerne Kit, and it incorporates a well-tried circuit in which many modern methods are used.

The Components

The coils are built on long ebonite blocks equipped with high-resistance 'blank' cores, and the high-frequency wave grid winding is wound solenoid fashion at one end, whilst the long-wave winding is wound in slots at the lower end. Two of these coils are employed, one for the aerial circuit and one for coupling the B.S.O. valve and detector stage. The two coils are arranged vertically on the baseboard, and they are well separated, which fact, coupled with the vertical metal screening, prevents any interference between the two circuits.

Earth return leads are provided through the medium of the metal-clad surface of the baseboard, and the remainder of the circuit details are also of good design. To facilitate connection, all components are provided with terminals, and the instructions supplied with the kit will enable it to be rapidly assembled without difficulty. The panel is walnut-faced and the controls are mounted on to this. Separate condensers are used for tuning the two stages and thus the tuning is enabled to be obtained maximum results by accurately tuning each stage without the use of any form of trimming device. The complete kit, as already described, is obtainable for 3s. 6d. or by instalments for 2s. 6d. down and eleven monthly payments of 2s. 6d.
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Some time ago you gave details in your pages regarding the running of an eliminator from a Ford coil. If the eliminator is connected as shown in the accompanying sketch it will supply up to a four-valve set with ease, and there will be no need to take the coil to pieces. —J. B. Burns (York).

A Handy Blow-lamp

This easily-made blow-lamp is very useful for doing soldering where an ordinary iron could not be used. A length of copper or brass tubing about 3in. diameter by 3in. long is first perforated by drilling holes in it and then fitted to an old bayonet lamp holder, as shown in the sketch. This is then fitted with a wick of several strands to fill the tube. A brass disc is made to fit this after a suitable hole has been made to accommodate the bayonet lamp fixing ring, which is soldered to the disc. The disc is afterwards plugged into the grid-bias battery. To hold the lamp holder top is sealed, and is used as a screwed cap to prevent evaporation of the spirit.—James Morrison (Birtley).

A Viewing Mirror and Inspection Lamp

The accompanying sketches show a combined viewing mirror and inspection lamp which is useful when inspecting the internal fittings of a set, especially in tight corners. The device consists of a strip of wood, about 3in. thick, at one end of which a hole is made to hold the flashlamp bulb which provides the illumination. The hole should be drilled a little smaller than the bulb, so that the end will just screw in. The contact with the side of the bulb is made by driving a screw into the edge of the wood, so that it breaks through the other hole and makes contact with the side of the bulb. The contact with the pip of the bulb is made by fixing a thin strip of brass taken from a flashlamp battery, over the bottom of the hole. Leads can be soldered to the strip of brass and to the screw, and wander-plugs fixed on the ends, so that the lamp may be plugged into the grid-bias battery. To hold the mirrors, two pieces of sheet brass are cut out and bent to form support, as shown. The mirrors themselves are fixed in clips made from narrow strips of light-gauge tinplate soldered together. At each end of one strip a metal pin is pushed through the tinplate and soldered to it, the heads of the pins being against the edge of the mirror. These pins should be a tight fit in the holes in the trunnion supports, thus holding the mirrors firmly in place.

The mirrors are adjusted so that their planes are at right angles to one another, instead of being parallel as in a periscope. No sizes have been given, as these can be adjusted to suit individual requirements. The device is used by lowering into the set so that the light illuminates the interior, whereupon the mirrors will show the undersides and backs of components, etc., as desired.—M. D. Armittage (Goole).

A Next Dial-lighting Arrangement

The accompanying sketch shows an improved dial-lighting device which I recently fitted to my set. Previously, it was provided with two lights, one for each dial, but the bulbs were placed in such an awkward position in the set that when one burnt out one had to partly dismantle the set to put in a new bulb. I therefore contrived the simple lighting system shown in the illustration, which shows a sketch of a single bulb used for effectively illuminating both dials. Two small mirrors are fixed behind the panel in the positions indicated and at angles of 45 degrees, a single bulb being fitted midway between them. The mirrors being opposite the holes in the escutcheons, reflect the light on to strips of the dials as they come opposite the escutcheon openings.—T. Mayo (Swanbourne, W. Australia).
YOUR SET: WHAT IS ITS EFFICIENCY?

THE two terms wattage dissipation and output watts are used in wireless parlance, but they are rarely fully understood by the listener. To refer to the power supplied to the loud-speaker by the last valve as the wattage output is a common practice, although care must be taken to ensure that the figure is correctly given. By way of giving a very general explanation of the difference in meaning between the two expressions and might be said that wattage dissipation (so far as wireless work is concerned) is usually applied to a D.C. circuit, whereas the expression "output watts" is used in connection with circuits in which handle A.C. current of audio, or sound, frequencies.

The Difference

Thus, it is usual to speak of the wattage dissipation of a voltage-dropping or feed resistors as the power supplied to the loud-speaker by the last valve as the wattage output. The chief reason why these figures are often confused, however, is that they may both be applied to the output valve in the set. For example, the maximum wattage dissipation of the output pentode used in the "1934 A.C. Fury-Four Super" is over 6 watts, whilst its rated maximum undistorted output is 3 watts. The difference between the two figures in this case is not very great by comparison with that which applies to many of other less-efficient valves. A popular super-power triode output valve, for instance, has a wattage dissipation of more than 25 watts, although its signal output in the same conditions is only 5 watts.

Undistorted Output

The difference between the two figures as applied to any particular valve is not difficult to explain, and is partly accounted for by the fact that a valve—like any other electrical device—is not 100 per cent. efficient. The wattage dissipation of a valve is easily obtained by the simple process of multiplying the anode current by the anode voltage, although in the case of a pentode the screen voltage and current should also be taken into account. The first valve referred to above has an anode current of 30 milliamperes and a screen current of 7 milliamperes (both at 250 volts), so that the wattage dissipation is 37/1,000 multiplied by 250. It is by no means such a simple matter as this to calculate the signal output in watts, since the usual formula depends upon the use of various graphs which are of little interest to the average experimenter. Other formulas, which do not directly depend upon graphs, are available, but these give results which are only approximately correct.

Fortunately for most of us, it is seldom necessary to calculate the wattage output of a valve, since the figure is generally given by the makers on the various data sheets, and even when they do not publish any figures they are usually pleased to supply details upon request.

Optimum Load and Output

It is generally sufficient to know that the output wattage depends upon the (A.C.) voltage and current developed across the load in the anode circuit of the last valve. This load may take the form of an output choke, a fixed resistance, the primary winding of an output or speaker transformer, or the windings of the speaker itself. An important point to bear in mind is that the maximum signal output can only be obtained when the valve is operated at the anode and grid voltages recommended by the makers, and when the output load is of the correct value. The appropriate value of output load is referred to as the optimum load, and is (for three-electrode valves) approximately equal to twice the A.C. impedance of the valve. For the convenience of readers, the table given below shows the optimum loads and maximum outputs (in milliwatts, or thousandths of a watt) for a few of the more commonly used valves.

<table>
<thead>
<tr>
<th>Valve</th>
<th>Optimum Load (ohms)</th>
<th>Maximum Undistorted Output (milliwatts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cossor 215 P.</td>
<td>3000</td>
<td>150</td>
</tr>
<tr>
<td>Cossor 41 M.P.</td>
<td>2000</td>
<td>1500</td>
</tr>
<tr>
<td>Cossor 41 M.N.</td>
<td>2000</td>
<td>2000</td>
</tr>
<tr>
<td>Cossor 220 H.P.T.</td>
<td>1500</td>
<td>500</td>
</tr>
<tr>
<td>Cossor 41 M.P.</td>
<td>1200</td>
<td>1200</td>
</tr>
<tr>
<td>Mullard P.M.2A</td>
<td>1000</td>
<td>150</td>
</tr>
<tr>
<td>Mullard P.M.2B</td>
<td>5000</td>
<td>250</td>
</tr>
<tr>
<td>Mullard D.O.24</td>
<td>4000</td>
<td>2500</td>
</tr>
<tr>
<td>Mullard P.M.22A</td>
<td>1500</td>
<td>425</td>
</tr>
<tr>
<td>Mullard P.M.22B</td>
<td>2500</td>
<td>3500</td>
</tr>
<tr>
<td>Hiscox P.220</td>
<td>1000</td>
<td>175</td>
</tr>
<tr>
<td>Hiscox P.X.230</td>
<td>1000</td>
<td>450</td>
</tr>
<tr>
<td>Hiscox Y.220</td>
<td>12000</td>
<td>500</td>
</tr>
</tbody>
</table>

L.T. Watts

It will have been observed in reading the foregoing that neither the wattage dissipation nor the wattage output of a valve take into consideration the power consumption of the filament or heater. This can, however, easily be calculated by multiplying the filament or heater voltage by the current. Thus, for a battery valve having a filament rated at 2 volts, 2 amp., the consumption is 2 multiplied by 2, or 4 watts. The consumption of the heater of a standard mains valve taking 1 amp. at 4 volts is 4 watts.

It is a matter of simple calculation to find the wattage dissipation of a voltage-dropping or feed resistance is found by multiplying the voltage which it "drops" by the current passing. It can be found more easily in some instances, however, by multiplying the resistance in ohms by the current squared. Thus, the wattage dissipated by a 2 ohm resistance of 5,000 ohms passing a current of 50 milliamperes is 

\[ \frac{5,000}{50^2} \times 0.05 \times 0.05 = 0.015 \] watts.

Power Consumption of a Receiver

The power consumption of a complete mains receiver may be found by adding together the wattage dissipation of all the valve heaters and the wattage consumed in high tension. If the "A.C. Leader Three" is taken as an example it will be found that the total power consumption is 24 watts. This figure is arrived at by adding together the wattage of the three valve heaters (4 watts each), the wattage of the rectifier filament (4 watts) and the H.T. watts (5.32 milliamperes at 250 volts). It might at first appear that the H.T. voltage should be taken as 200 instead of 250, but it must be remembered that the output from the rectifier is at 250 volts, although approximately 50 volts is "absorbed" by the smoothing choke and feed resistances. The figure obtained in this manner does not represent the total consumption of power from the mains supply, since the efficiency of the mains transformer has not been taken into consideration. An efficiency of 80 per cent. is a fair average for a good instrument like that specified, so that the consumption of mains power can be reckoned at approximately 80 watts. From this it is possible to find the cost of running the set; one unit represents 1,000 watt-hours and, therefore, the cost of running the set for about thirty hours on one unit. Thus, if power costs 6d. per unit (this is a high figure, of course), the cost of running the set for one hour would be one-fifth of a penny.
A sudden noise—or an equally aggravating silence...inefficiency somewhere in your set! Take your Avo Minor and find out at once. The Avo Minor is an investment in permanent security, for it is a precision instrument, accurate to a critical degree, and made to stand up to hard usage and even abuse. It is, in fact, a younger brother of the famous Avometer, the instrument used by all the leading manufacturers and their service engineers. With the Avo Minor you can test circuits, valves, components, batteries and power units with the dependable accuracy of the technical expert.

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By F. J. CAMM

The quality is unimpeachably satisfying, the selectivity is micrometrical, the range world-encompassing, and the output really robust. I am sincere when I say that this receiver is the most momentous in paper will make it.

Our Guarantee

Readers of this paper know that I take a personal interest in every receiver built from my designs, and that I guarantee them when constructed according to my instructions and when the components which I specify are used. So enthusiastic am I about the £5 Superhet Three, which I regard as my greatest success, that I propose to make the guarantee I have formerly issued.

Hear It Yourself

Obviously my time is limited, and it would be impossible for me to visit every reader of this paper, but it will give me great pleasure, as time permit, to demonstrate the £5 Superhet Three in various districts. I suggest that readers in various districts who wish me to demonstrate the receiver should get together, and make such local arrangements as will enable me to demonstrate it to a number of them on a particular evening. I shall, of course, provide my own equipment and merely need an aerial and 210PG. In some cases it may be necessary for me to repeat that I guarantee that the "£5 Superhet Three" will do all that I claim for it, and you may build with the confidence that you may avail yourself of my advice and help, free of charge.

So confident am I of this latest receiver, and so enthusiastic concerning its possibilities, that I am positive that every reader of this paper will make it. I do not overstate the case when I say that this receiver is the most momentous in the history of home construction.

Reserve Your Kit or Parts NOW!

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Circuit Details

Components for the 

£5 SUPERHET THREE

One 4-pin sub-baseboard valveholder, terminal type 200P.
One 5-pin sub-baseboard valveholder, terminal type 210PG. One 3-point on-off switch (Graham Farish+). One .5 mfd. fixed condenser (Graham Farish+). One .002 mfd. Formodenser (Formo). One 210PG, 210VPT, 220PT (Cossor). Two 13,7 the use of a band-pass H.F. tuner, to a frequency transformer and then to a pentode loud-speaker.

The £5 Superhet Three! A Coming Event Casts Its Shadow!

The circuit diagram to be given next week will convey at a glance the utter simplicity of this receiver — unbelievable simplicity. You will want to make it straight away, and so enthusiastic is the trade concerning it (most of the manufacturers concerned have examined and listened to it) that they have been working at high pressure for the past three weeks to ensure that an adequate supply of components is available before "Practical Wireless" is actually published. I insist on it, for it is unfortunately beyond the comprehension of some of my readers in the past that...
A MOMENTOUS ACHIEVEMENT

THE £5 SUPERHET THREE


By F. J. CAMM

I TAKE more than ordinary pleasure in announcing that after more than two years of experiment with all types of circuits and components, I have at last perfected a receiver which I can fairly claim to be the most remarkable ever placed before home constructors. A three-valve superhet with all of the advantages which the superhet conveys, the kit of parts for which may be purchased for less than £5, is at last an accomplished fact. As with so many other important developments, PRACTICAL WIRELESS is the first again! A year ago, my quest for the really simple and cheap three-valve superhet of the best operated type seemed hopeless. It is only within the last six weeks that I have discovered the solution. When the full constructional details are presented, together with a Free £5 Blueprint, next week, I am certain that you will be amazed at the simplicity and so few wires, so little expense, and with such a simple circuit arrangement, it has been possible to bring every home constructor the solution to all his problems. For the £5 Superhet Three has none of the drawbacks usually associated with the superhet, consisting of the fact that only three valves are employed.

Every Desirable Quality

The quality is unimpeachably satisfying, the selectivity is micrometrical, the range world-encompassing, and the output really robust. Quite often we do not sec-eye to eye. I have made the bold move of demonstrating my £5 Superhet Three to some of the most important set designers in the country, and all have agreed, although they serve rival interests, that this is the most remarkable receiver since the inception of home construction as a hobby. Our Guarantee

Readers of this paper know that I take a personal interest in every receiver built from my designs, and that I guarantee them when constructed according to my instructions and when the components which I specify are used. So enthusiastic am I, however, over the £5 Superhet Three, which I regard as my greatest success, that I propose to accentuate its possibilities, that I am positive that every reader of this paper will make it. I do not overstate the case when I say that this receiver is the most momentous in the history of home construction. Reserve Your Kit or Parts NOW!

Write to the Editor and Arrange With Him for a Local Demonstration With Your Friends.

Circuit Details

A few preliminary details regarding the circuit will convey how these results have been achieved. Selectivity is the modern problem, which cannot satisfactorily be solved with "straight" receivers. In the £5 Superhet Three, selectivity is ensured by the use of a band-pass H.F. tuner, which absolutely avoids second channel interference. The output from the second detector is passed to a low-frequency transformer, and then to a pentode output valve.

UterSimplicity

The circuit diagram to be given next week will convey at a glance the utter simplicity of this receiver—unimpeachably simple. You will want to make it straight away, and so enthusiastic is the trade concerning it (most of the manufacturers concerned have examined and listened to it) that they have been working at high pressure for the past three weeks to ensure that an adequate supply of components is available before "Practical Wireless" is actually published. I insisted on it, for it is unfortunately the experience of some of my readers in the past that...
NOT the least of a beginner's difficulties in short-wave reception is that of not knowing exactly to what wavelength his set is tuned; he may be able to guess from the size of his coils whether he is on twenty or fifty metres, but this is much too vague to be useful. The difficulty can be considerably lightened, however, by a rough calibration of the receiver by means of harmonics of an oscillating medium-wave receiver.

If we have an oscillation whose wave form is anything but a perfectly pure sine wave (which can only be obtained under special laboratory conditions), it will give rise to a series of harmonic oscillations having frequencies that are an integral multiple of the original frequency. The main oscillation is called the fundamental frequency, and its second harmonic has a frequency of twice the fundamental (or a wavelength equal to half the fundamental wavelength), the third harmonic is three times the fundamental frequency and so on; the total number of harmonics depends on the wave form of the fundamental and the power of the oscillator producing it, and there may be any number of them. Suppose now we have an ordinary broadcast receiver working on the medium-wave band and tuned to the London Regional on a frequency of 877 kcs (312.1 metres); if we turn the reaction control round to maximum, so that the detector valve oscillates strongly, we may actually be made (I, of course, referring to myself) to hear the detector valve oscillate strongly, we turn the reaction control round to maximum, so that the medium-wave receiver should produce a whistle which will be of a pitch depending on the wavelength of the medium-wave set whose fifth harmonic will also be 5,262 kcs; this new frequency is 5,262 or 1,052.4 kcs. Therefore, if, without touching the short-wave set, we slowly tune the medium-wave receiver (still oscillating) to a higher frequency (shorter wavelength), we should hear another whistle in the short-wave set when we reach 1,052.4 kcs, or 285 metres. Still further reducing the wavelength of the medium-wave receiver we should produce a third whistle in the short-wave receiver, without touching its tuning controls, due to the fourth harmonic of 1,315 kcs or 228 metres. It must be noted that three such check points are needed to avoid error; if only two were used we might be misled. For example, if the receiver was tuned to the twentieth harmonic of 877 kcs it would be on 10,524 kcs and so the tenth harmonic of 1,052.4 kcs would also give rise to a whistle; thus, although the short-wave set is actually tuned to 10,524 kcs, unless the short-wave set is retuned to the local station and left at that frequency to which it was tuned read out from the medium-wave set, the tuning will be at fault.

The tuning is then continued until a third and, if possible a fourth, whistle is heard and in each case the frequency of the long-wave set is slowly tuned to a lower wavelength until another whistle is heard in the short-wave set, the fourth harmonic, etc. The check then continues until one is found that the higher harmonics (fourth, fifth, sixth, seventh, etc.) are not present.

They have been kept awaiting for several days when, owing to the popularity of some of my designs, the supply has been totally inadequate. The manufacturers concerned have co-operated whole-heartedly with me, not only on matters of delivery, important though that is, but also on the question of price. Although the set for purposes of euphony is named the £5 Superhet Three, it can actually be made (I, of course, refer to myself) at a price not normally known to me, but most of all you will really be helping yourself if you drop them a note reserving a set. It is possible, for none of the components is specially designed, that you will have a good many of the components by you. I have kept that point well in mind in laying out the receiver, for it is my desire to save your money. In that case, check over the list of components to be given next week and order those parts immediately. Messrs. Pete-Scott, Ltd., have promised to do their utmost to co-operate with me by speedy dispatch of the parts or by reduction of the prices of the parts so that you can order to the receiver ever placed before home constructors. I do not comment on my own work here. This is the remark made by an important component manufacturer as he listened to the receiver, but is merely a mild variant of the laudatory remarks which have been made by radio amateurs.
AERIAL AND EARTH SYSTEMS

The strength of the received signal depends upon the amount of energy which is picked up, and therefore the aerial and earth system is of vital importance. Although a great deal of care is generally expended upon the choice of a receiver or circuit, it is too often found that the listener simply slings up a length of any type of wire in any position, and connects a lead to any point which might go to earth, and then spends a considerable amount of energy in trying to make the set efficient. It should be remembered that the amount of energy which is radiated from the transmitting station is extremely small, and the farther away the receiver is situated the weaker becomes the signal which is picked up, and therefore the aerial and earth system is of vital importance.

The strength of the received signal depends upon the amount of energy which is picked up, and therefore the aerial and earth system is of vital importance.

Types of Aerial

It is not possible for every listener to erect the same type of aerial, and it must be remembered that the total length of wire which is permissible under the receiving licence is 100ft. This quantity includes also the lead-in wire, so that if two masts are erected having a total height of 30ft., it will only permit of a distance between the masts of 70ft. If the authorized length of wire is not to be exceeded, with modern conditions it is generally preferable to use a much shorter length of wire than this, and in general it will probably be found that a total length of 60ft. provides ample signal strength consistent with good selectivity. Before mentioning the various schemes which may be adopted for the aerial it will be well to state that the type of wire which is employed should provide the largest conducting surface possible, consistent with lightness of weight. It must be remembered that the received impulses are high-frequency currents, and these travel on or near the surface of any conductor. In order, therefore, to restrict the passage of these currents as little as possible we must provide them with a large surface area, and it is obviously impracticable to use a large diameter wire for the purpose of an aerial. Fortunately, there is a simple solution to be found in the employment of a stranded cable, made up from a number of small diameter wires twisted together. This type of wire is known as 7/22s, due to the fact that it is built up from seven strands of 22-gauge wire, but to obtain maximum results from this type of wire each separate strand should be of the enamelled variety. In this manner the full surface of each wire is retained, whereas with bare copper wires, only a portion of each surface is made use of.

The Earth Wire

The earth wire should not be of a thinner gauge than the aerial, although, of course, there is the question of the actual coil which is interposed between aerial and earth. The great thing about the earth lead is that it must be of low resistance. Thus, use a thick wire and make quite certain that there is a sound joint at the earth plate. However, this will be dealt with later. Having decided upon the type of aerial which it is best to erect in your particular situation the problem of support arises. On this page a number of different types of aerial are illustrated, and arrangements should be made to erect the necessary mast or support. Scaffold poles are obtainable at moderate prices from a builder's yard, and before erection should be given a good coat of paint. To prevent moisture entering the end grain at the top of the mast a small tin lid or other cover should...
be fixed in position. There is, of course, some risk of the pulley support coming adrift and we have published numerous wrinkles from readers suggesting ways and means of overcoming the difficulty of taking down the mast in order to re-attach the pulley. Insulators must be interposed between the end of the wire and the pulley and above the method of connecting these insulators is shown. The correct method not only gives higher insulation, but also increases the strength of the wire. At the house-end the lead-in has to be provided, and this should, if possible, be the same piece of wire as is used for the aerial. That is, the wire should not be cut and the lead-in joined to the aerial, unless it is found impossible to carry out the single wire idea. Keep the lead-in well away from walls and other earthed bodies, taking ZF as a minimum distance to allow between the wire and wall. Of course, where it enters the house it must come closer, but do not let it run parallel, but bring the lead-in at an angle to the lead-in tube or aerial-earth switch.

The Safety Switch

In order to enable the aerial to be earthed in the event of a thunderstorm a safety switch is desirable, and the lead should be joined to such a switch, with a separate lead to earth. Protect the switch from rain, or noises will be introduced to the receiver in a rainstorm due to drips of rain passing from the lead-in to the earth contact. A simple sloping piece of tin or wood will suffice as a screen, or if a more workmanlike job is to be made a complete box may be used to enclose the switch. If possible, the switch should be provided with a safety spark-gap, and then, should the aerial not be earthed, there is a provision for any undue static to leak away without damage to the tuning coil or apparatus. It should be pointed out that should the aerial be actually struck by lightning there is every possibility of damage being done in spite of the switch, but the installation of this device acts as a preventive of lightning discharges by enabling static charges to leak away from the atmosphere. Do not handle the lead-in wire during a storm. If possible, use a separate earth for the switch, and do not run a parallel wire to the switch as well as to the earth terminal on the receiver. In this way, full protection is afforded, and the maximum efficiency of the aerial and earth system on radio is afforded.

The Earth

The earth must receive as much attention as the aerial, and at the foot of this page some various types of earth connection are shown. Remember that the great feature is low resistance, and therefore the soil in the neighbourhood of the earth plate must be moist and the connection between plate and wire must be sound. To avoid the ravages of damp and chemical effects set up by the soil the joint should be thoroughly protected by wrapping with waterproof material as well as by painting. Various commercial earth plates are on the market and the choice may be made according to individual preference, whilst one of the commercial chemical earths will assist in maintaining good conductivity. Although the earth lead is joined to the earth, it does not follow that bare wire may be used for the lead, and that this lead may run along the wall or other earthed object. A heavily insulated wire should be employed and it should not make contact with any earth until it comes into contact with the earth plate. In this way parallel effects, leading to instability and other difficulties, will be avoided, and any troubles which arise with the receiver at a later date will be more easily traceable when it is certain that the aerial and earth system is free from blame.

The Counterpoise

Before concluding this brief discussion on earths and aerials some reference must be made to the counterpoise. This type of earth consists of a wire suspended a few feet above the ground, and running parallel with the aerial wire. The counterpoise must be erected as carefully as the aerial proper, and insulators must be fitted at each end in order to prevent the wire from coming into contact with the earth terminal on the receiver. A counterpoise may be regarded as an additional aerial, with the exception that it is joined to the earth terminal on the receiver. A counterpoise effect may be obtained in a 'flat-dweller's' receiver by using a copper plate or sheet of copper gauze for the earth lead.
COSSOR'S NEW FACTORY

More than forty years ago the firm of A.C. Cossor, Limited, began its career with the manufacture of all types of low-voltage lamps. The products manufactured were, of course, extremely varied, ranging from X-ray tubes to tiny surgical lamps measuring but 1/16 in. in diameter. In comparison, however, with the vast range of radio and scientific instruments which they produce to-day, their early efforts pale into insignificance.

For many years the name of Cossor was associated almost exclusively with the manufacture of wireless valves until, in 1927, the firm introduced the first nationally advertised constructor kit—the Cossor Melody-Maker. The success of this pioneer receiver was phenomenal, and the extension of factory and staff became imperative. Throughout the years of depression the House of Cossor has gone from success to success, and their steady growth has continued incessantly, until, with the opening of their fifth factory at Highbury they are one of the largest self-contained radio manufacturing concerns in the British Empire.

The opening of this new factory has a special significance, for another thousand workers are now employed on the production of 1935 models. The factory itself is an example of the high efficiency to which modern mass-production methods can be brought. The sixty thousand feet of floor-space are already occupied by the vast and complicated machinery necessary in the manufacture of the many components which go to the making of a modern radio receiving set. The numerous operations are carried out in an extraordinarily orderly fashion, and the gradual formation of the sets can be watched as they pass, on slowly moving tracks, from one worker to another. It is difficult to believe that this huge enterprise has grown in a few years from a modest factory employing a mere hundred workers, to the five multi-floored buildings which to-day give employment to thousands.

DECOUPLING NOT EFFECTIVE

Motor-Boating can always be cured by decoupling correctly, but it is almost impossible to do so when the trouble occurs on the very low frequencies, simply because the capacities required are so large and can only be dealt with by using the electrolytic type of condensers. The question of those sub-audible frequencies is a very difficult one. A good way of avoiding the trouble they cause is to reduce the amplification on the low notes in such a way that there is no appreciable reduction in the amplification in the audio-frequency range. Perhaps the simplest way to do this is to place a small capacity condenser in the grid lead of the amplifier, and then use a grid leak of about one-quarter microhm resistance.
CONSERVING H.T. VOLTAGE

When Designing a Universal Mains Receiver the Problem of Saving H.T. Voltage Often Arises, and Methods of Solving it are Described Below.

By FRANK PRESTON

When the high-tension voltage is obtained from A.C. mains there is seldom any difficulty in securing a value as high as ever may be required, since it is only necessary to choose a mains transformer and rectifier according to the requirements. In the case of a D.C. receiver, or a circuit of the now popular universal (A.C. or D.C. operation at will) type, however, matters are very different; one is limited to the maximum voltage of the supply. This is because, in the case of A.C., a mains transformer is not used and, in the case of D.C., it is impossible by any simple means to alter the initial supply voltage.

Voltage Drop

Bearing these facts in mind, it is well to consider methods of conserving the available voltage, or of saving as much as possible by preventing voltage-drop across various components. Generally speaking, the greatest source of voltage loss in any type of mains receiver is the smoothing choke. This component is essential and, since it has to carry the whole of the H.T. current, it produces a voltage drop equal to the full current (in amps.) multiplied by its ohmic resistance. It is therefore evident that the voltage drop can be reduced to the greatest extent by using a choke of the lowest available resistance, consistent with a sufficiently high inductance value. This point is more important than might at first be imagined, for one maker lists two smoothing chokes each having an inductance of 40 henries when carrying 30 milliamps., but the D.C. resistance of one is 1,100 ohms and of the other, 160 ohms. When passing their maximum rated currents, 220 volts and incorporating valves rated to take an anode voltage of 200.

Using Two Smoothing Chokes

The difficulty which presents itself, however, is one of cost, for the 160-ohm component costs almost five times as much as that with a resistance of 1,100 ohms. For this reason it is often better (and cheaper) to employ two separate smoothing chokes, one to feed to H.F. and detector valves, and the other to supply the L.F. and output valves. This is often a very satisfactory method, because quite a low-resistance choke can be employed for smoothing the supply to the L.F. valves, due to the fact that it may be of low inductance, since a certain amount of "ripple" will pass unobserved in the L.F. portion of the set, whereas it would probably result in pronounced hum in the case of the H.F. circuits. A low-inductance choke can be bought comparatively cheaply, as also can the second choke needed for use in the supply circuits to the H.F. valves. The latter choke should certainly have a high inductance value, but it is only called upon to carry up to about 10 milliamps., so that, even if it has a resistance of, say, 1,000 ohms, it will produce a voltage drop of only 10 volts. In any case, efficiency is not greatly reduced by cutting down the H.T. voltage to the H.F. valves. Another worth-while advantage of the scheme under consideration (illustrated in Fig. 1) is that the second—high-resistance—smoothing choke provides a measure of decoupling between the H.F. and L.F. valves.
Although it is customary to insert smoothing chokes in the positive high-tension lead, there is often an advantage to be gained by connecting them in the negative circuit instead (see Fig. 2). The efficiency of smoothing is just about the same whether the choke is in the positive or negative circuit, but when in the latter position it can be used to supply the bias voltage required by the output valve. This might readily be anything up to 30 volts and is normally taken from the H.T. voltage, which is thereby reduced. The voltage required by the output valve, however, it may be connected as shown in Fig. 2, so that the inevitable voltage-drop across it is usefully employed for biasing purposes.

If the choke has a resistance equal to that required for biasing the output valve, however, it may be connected as shown in Fig. 2, so that the inevitable voltage-drop across it is usefully employed for bias purposes.

Even if the resistance value is not correct for this purpose (it will generally be too high) it is a simple matter to obtain the correct bias voltage by means of a 100,000-ohm potentiometer connected in parallel with the choke, as shown by broken lines in Fig. 2. This potentiometer will have practically no effect upon the normal efficiency of the choke and makes it possible to choose the correct bias voltage while the receiver is in use.

Bias from Speaker-field Winding

This very same idea applies when a mains-energized moving-coil loud-speaker is employed, since the field winding can be wired in the position indicated by the choke in Fig. 2. Unfortunately, it is seldom possible to employ a standard (2,500 ohm) energized speaker with a universal receiver, because such a high resistance introduces too great a voltage loss. At the same time, however, a speaker with a field resistance of 1,500 or even 1,000 ohms can sometimes be used with complete success, provided that the H.T. current consumption of the set is sufficient to energize it. As the necessary current might be anything up to 60 milliamps, however, the consumption by the valves will probably be insufficient. It is possible to pass sufficient current through the windings by connecting a fixed resistance, as shown in Fig. 3. This method is not always satisfactory, because the greater current passing through the windings produces a greater voltage drop. In fact, if the energizing wattage must be the same in the case of either the 2,500-ohm or 1,000-ohm speaker, nothing will normally be gained by using the arrangement suggested. On the other hand, if H.T. voltage is not at a premium—such as in a receiver operating from A.C. only—and the anode current consumption is too low to energize the speaker field, the idea will be found to be perfectly convenient. In fact, it is frequently very useful as a means of fully loading the rectifier. As an example of what is meant, it might be pointed out that if the rectifier gave an output of, say, 350 volts at 120 milliamps, while the valves only consumed 60 milliamps, the voltage would rise to too high a value if the shunt resistance were not included in the circuit.

The value of the resistance must be chosen so that it passes a current equal in value to the difference between that given by the rectifier and the consumption of the valves. In the example referred to above this "excess" current would be 60 milliamps; assuming the voltage available between the ends of the resistance, to be 300, a value of 5,000 ohms would be required.

It's the same throughout the T.C.C. range; the Type 141 is specified for 2,500v. D.C. Working—and it will—it bears the initials "T.C.C." Look to it that the condensers you bring are rated at the right voltage—then look to it that they carry the T.C.C. initials—then you've got the world's finest condensers—and at no extra cost.

There is a new illustrated price list—just ready. If you have not received a copy from your Dealer a p.c. to us will bring you one.
THE MIDGET SHORT-WAVE TWO

A Few Difficulties Cleared Up Regarding the Construction of This Ingenious Set.

A NUMBER of readers have completed the ingenious short-wave receiver which was described in our September 16th issue, and some interesting accounts of the results obtained have been received from various parts of the country. A few queries have been asked regarding certain points in the construction, and in order to clear up these we are giving details herewith.

Firstly, on page 799 of the issue in question, we gave a wiring diagram which showed only the underside of the metal chassis. The view of the upper surface was not given, as only one wire projects to this side, and a photograph on page 796 was, in our opinion, sufficient for wiring purposes. Certain readers desire to have a complete wiring diagram, and we therefore publish on this page the upper-surface plan of the receiver, from which it will be seen that a single wire passes from the variable condenser down to the grid terminal of V2. The accompanying drawing is to the same scale as that published on page 799.

Coil Data

Certain readers are desirous of constructing coils to cover different ranges from those which were given, and there is, of course, no objection to this, although certain restrictions in the design will have to be made, owing to the fact that there are only four possible connections to the reaction and aerial-grid coils. However, to overcome this difficulty, and to introduce some further selectivity on higher wave ranges, a separate aerial winding may be wound on the coils, the lower end of this extra winding being joined to earth. The "top" end of the extra winding may be soldered to a small length of stiff wire projecting from the former, and the aerial may be joined to this projection by means of a small crocodile clip. This will give added selectivity and also modify the range of a coil. In certain cases, where lack of oscillation is experienced, this method of connecting the aerial may be tried, although the aerial-series condenser should suffice in the majority of cases.

Calibrating the Set

In view of the sharpness of tuning on the short waves, certain constructors have been in doubt as to the stations to which they have so far heard, and in some cases have reported that they cannot receive stations which are known to be well received in their locality. It is obviously desirable, therefore, to calibrate the receiver in order that the exact tuning points for various stations may be accurately located, and constructors of the Midget are therefore advised to refer to the article in the Short-Wave Section of this week's issue, where instructions are given for using a normal broadcast receiver to carry out short-wave calibration.

The Aerial

Results may be disappointing if the aerial is not suitable for use on the wavelengths covered by this receiver. In the issue in question it was shown how a short length of flexible should be connected to the aerial terminal and then twisted round the aerial lead, thus providing a further small capacity condenser in series with that already fitted to the receiver. A special aerial, erected for short-wave work only, will be found a much more satisfactory scheme, and will enable the receiver to give a better performance. In general, a short vertical wire will be found most suitable, and this may hang from an upper window, or be specially erected from stand-off insulators held at a distance from the house walls. On no account should the wire be less than two feet from the wall, and the wire should be as thick as possible. Piping proves very satisfactory, and, moreover, is easy to erect. If wire is employed, it should be held tightly between its upper and lower extremities so that no movement can take place and affect tuning positions and signal strength. Before finally fixing the wire some experimental tests may be carried out in order to ascertain what length of wire gives the best results in your particular locality, and whilst these tests are being made the efficiency of the earth should also receive attention.
You must not fail to hear a "Stentorian" on your set. You will be amazed at the difference.

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PRACTICAL WIRELESS
October 20th, 1934

REVIEW OF THE
LATEST RECORDS

ON THE WAX

ONE of the most popular shows on the comedy stage, Bobby Howe displays his versatility in two Columbia DB1424, singing "Yes sir! I love your Daughter" and "Let's dress for dinner". To-night he introduces his sparkling personality into these two songs, that might well have been written for him. Can't you imagine him in "Yes sir! I love your Daughter"? If you wish for sentiment and comedy from the most popular recording duettists in the world then hear Layton and Johnstone on Columbia DB1422 singing "Happy", from the film of that name, and "Night on the Desert". They are still top-liners after years of success — still home successes. "The King's Own" and "True till Death", sung by Norman Allin on Columbia DB1414, is a record that brings this great basso right into your home. Into these songs Norman Allin has infused his mellow artistry, the first a swinging marching song, the other the relating the story of a boy who throws away his toys and becomes involved in the maddest of real fighting. Another fine vocal record is Columbia DB1417, on which Ina Souzé the sweet-voiced soprano, sings two of the greatest successes of modern songs. "Always", from the film "Paritan Lallaby", and "Love, I give you my All". These recordings will give you a real home treat. A fine pianoforte solo that I can especially recommend is Billy Mayerl's own Savory memories on both sides of Columbia DB1419. This record introduces "Kitten on the Keys"; "UKulele Lady"; "What'll I do"; "Carolina in the Morning"; "Chili-Bom-Bom"; "Dancing Time"; "Keep on Humming"; "April Showers"; "Indian Love Call"; and "I'll build a Stairway to Paradise". Synergisation at its best. Sidney Torch makes a clever record this month on both sides of Columbia DB1420. "I want to be Snappy" is an essay in old tunes as hot organ music, as an exponent of which Sidney Torch is considered supreme. From beginning to end he introduces the most unexpected surprises and emphatic rhythms. You should certainly hear this record, which introduces such old-time popular tunes as "I want to be Happy"; "Honey, I'm in love with you"; "Varsity Drag"; "I got Rhythm"; "My heart ached Still"; and "Bambalina". Another hot number equally good is "Kitten on the Keys" and "12th Street Rag" on Columbia DB1421. Harry Robbins gives two very fine xylophone solos on this record. You should certainly hear it.

His Master's Voice Records

Gracie Fields' new film "Sing as we go" is just as full of fun as its predecessors, and even fuller of catchy tunes. Two records released this month, "Love" and "Just a catchy little tune," B9209, and "Sing as we go" and "In my little bottom drawer," B9210, are the pick of them. "Love", is sentimental and Gracie sings it as only she can when she wants to. "Sing as we go" is a very lively tune, with Gracie playing the part of the Pied Piper of French Bludgeon. "Just a catchy little tune" live ups to its title, and "In my little bottom drawer" is the best comedy number she has had for years. Whatever a versatile artist she is. Most readers have no doubt read of the recent death of Raie da Costa, the famous sym- opuated pianist. One of the last records made by this superb artist appears this month on B9211. On this record she plays two of the hit numbers from the film "Twenty Million Sweethearts", "I'll string Along with you" and "What are you intentions". The above film is the musical film of the year—1934's reply to "42nd Street" of 1933. Raie da Costa plays them with astonishing vivacity and breathing dulcetly.

Sterno Records

The British Homophone Company's lists for this month include a fine record by Pat O'Brien, the famous tenor. Hear him sing "The Isle of Capri" and "Aloma" on Sterno 1486—it is certainly an excellent piece of recording. If you like accordion bands then you will undoubtedly appreciate the great French accordion en-ssemble—The Ten Apaches—playing "Les Apaches en fête" and "Lamentation d'Apacho" on Sterno 1485. The accordion at its best. Billy Merrin and his Com- manders appear again this month with two popular dance numbers in "When a woman loves a man" and "Dearest" on Sterno 1484.

THE WIRELESS
CONSTRUCTOR'S
ENCYCLOPÆDIA

(3rd Edition)

By F. J. CAMM
(Editors of "Practical Wireless")

Obtainable at all Bookellers or by post 5/- from Geo. Newnes, Ltd., 57/58, Newgate Street, Strand, London, W.C.2.
Wireless Time Signals in the Antarctic

WIRELESS time signals are expected to give important assistance in the exploration and survey work to be carried out by the British Graham Land Expedition, which recently left England for the Antarctic under the leadership of Mr. John Rymill. Nearly three years, including two winters of complete darkness, will be spent in this region and the principal objective of exploring the 1,000 miles of almost unknown coastline between Lutjens Land and Charcot Land.

Time signals from Buenos Aires will be received daily, with three Marconi portable short-wave receivers specially designed for the purpose, by the exploring parties, by the party on board the expedition ship Penola, and during the free day, the afloat parties on board the Penola. The range of reception will vary from 2,000 to 3,000 miles.

The Marconi receivers for the British Graham Land Expedition, which have been designed so that they can be carried, with all accessories, in a standard sledge ration case, have a range of 25 to 50 metres. They incorporate one-screen-grid valve for high-frequency amplification, one detector, and one low-frequency amplifier valve; with two high-frequency tuning circuits with condensers calibrated in metres, and adjustable reaction coupling. Portable-type aerials are employed and a wire counterpoise earth. Current for the valves is derived from batteries, both the filament and high-tension batteries being of the dry or nickel type.

DX'er's Fine Bag of Stations

MR. RICHARD RAWLES, of Blackwater, Isle of Wight, is an amateur and has worked stations in every part of the globe. In nearly every case an acknowledgement of his reception has been received with an appreciation of his efforts. Mr. Rawles is a member of the International DX'er's Alliance and uses Marconi-type equipment exclusively. For the reception side of his equipment he uses a Marconi Model "276," the well-known 7-valve amplifier, and receives no fewer than thirty-seven American and Canadian stations with astonishing regularity. In each case the reception has been carried out on the loud-speaker with strength from R4 to 9—average about R7. Mr. Rawles states that the static suppressor fitted to the Model "276" is an inestimable boon in receiving the more distant transmissions. He uses the ordinary standard type of aerial—the inverted L variety—30 ft. high, 7/82 enamelled copper; the earth is the ordinary copper tube. He has also worked South American stations and received programmes from the Near and the Far East.

Sir Edgeworth David

THE Welsh Interlude in the National programme, on October 27th, will be given by Professor Oliver Stephens, Professor of the History and Philosophy of Religion in the Presbyterian College, Carthage. The subject of his talk is Sir Edgeworth David—the famous scientist, who died a few weeks ago. Professor Stephens, recently spent a year in a village on the Blue Mountains of New South Wales where Sir Edgeworth David had a country residence, and he will give his personal impressions of the great geologist and explorer. In a sketch of his romantic career he will refer to his early researches into the geology of the Vale of Glamorgan, his work on the coral islands of the Pacific, his association with Shackleton in the Antarctic, his ascent of Mount Erebus, and his discovery of the South Magnetic Pole.

The new Ferranti Battery Portable, which is a completely self-contained 6-volt of the superhet-type.

The Most Important Receiver for Home Constructors—

F. J. CAMM'S 5 SUPERHET THREE

Free Blueprint Next Week!
AMATEUR TELEVISION

TELEVISION FOR COMMERCIAL PURPOSES

By H. J. Barton Chapple, B.Sc., A.M.I.E.E.

An announcement was made a few days ago concerning the Radio Corporation of America, and the exploitation of television for commercial purposes. This firm furnished a few details dealing with the methods it has evolved for the transmission of pictures and printed matter, and it was hailed in the British press as a means whereby high-speed television transmissions could take place.

Of course, what the R.C.A. has really developed is a method for transmitting still pictures, not television images, this being an improvement on the older schemes which require, in many cases, several minutes for the transmission of one or more pictures to distant points. Various systems of still picture transmissions are used throughout the world, ranging from pictures built up by numbered squares in certain numerical combinations telephoned to the point where the picture is reconstructed to systems embodying an electrically-controlled inked needle tracing pictures on a drum, as illustrated in Fig. 1.

Prime Differences

Although picture telegraphy by line or by radio has certain minor details in common with television, there are vital differences which should be borne in mind. First of all, in picture telegraphy it is unnecessary to obtain a permanent record at the receiving end, whereas with television we are merely concerned with a fleeting impression to the brain, and only in very isolated cases is it necessary to adopt complicated methods in order to procure a permanent record. Another important difference is in the speed of transmission.

To bring about the illusion of continuous movement a minimum of twenty-five complete pictures per second must be transmitted in the case of television, this giving flickerless images at the receiving end. With picture or photo telegraphy, however, the question of speed does not arise, and frequently many minutes are taken in order to transmit completely one isolated picture.

On the other hand, however, if it is not desired to have a permanent record of a picture or, say, a typed message, then high-definition television is immediately applicable to this form of transmission of intelligence. Many months ago the Baird Company, when conducting their demonstrations of 180-line television transmission by ultra-short waves, proved conclusively that they could transmit messages at the very high rate of 30,000 letters per second. This was effected by televising an ordinary typed sheet, and one application of this scheme which comes to mind immediately is in the question of sending stock exchange prices to brokers or clubs instead of these figures coming through slowly, and individually, on a tape machine. A suitable receiving set would enable a considerable number of these prices to be reproduced on a small screen with astonishing rapidity.

Other Applications

While on the subject of commercial applications to television, it will be helpful to review briefly a few other ways in which television processes ultimately can be made applicable to normal commercial working. Perhaps one of the most important of these which may arise is the question of selling wares or merchandise by placing the goods in front of the television transmitter so that the signals can be radiated or transmitted to one or more receiving points. The expert salesman can describe the outstanding features of this own particular product, and the prospect of effecting sales would be considerably brighter than if he had to send catalogues and write letters to prospective clients.

The ability of the young mind to absorb knowledge as the result of appealing to both the senses of sight and hearing is a well-known fact. Here, then, is a method whereby television should ultimately be able to play an important part in teaching school children by line or by radio. Instead of experts on a particular subject having to visit the schools individually, and thus cover a large area, and take up a considerable amount of time, it would be possible to face the television transmitter and give specialist lectures to almost unlimited youthful audiences.

Chemistry, engineering, physics, geology, mathematics, and many other subjects could be covered in this way; and although such schemes are quite embryonic at the present moment, it is well within the realms of possibility that this method of education will find support in the future.

Television and the Telephone

Of recent date considerable attention has been directed in the daily papers towards the question of two-way radio and telephony, and this is certainly another important commercial application. By its use it will be possible to have telephone booths in different towns of the same country which can be linked together by line or directional radio.
BY THE PRACTICAL WIRELESS TECHNICAL STAFF

The "G.M." Turntable

LISTENERS who are in search of a low-priced turntable which is suitable for use with portable receivers, or other apparatus which has to be rotated without difficulty, will find the "G.M." ball-race turntable of great utility. It is made from annealed cast iron, and consists of two plates of thick square, each with a ball-race having a diameter of 2in. The two plates are clamped together by means of a central bolt, and a quantity of one-sixteenth steel balls are employed to fill the race. Thus the two plates turn very smoothly upon each other, and as each plate is furnished with fixing holes at each corner it is possible to attach the device in any desired manner to obtain a perfectly smooth action. It is guaranteed to turn 300,000 revolutions and to cost only 1s. 6d. The makers are G.M. Patents Co., Price Street, Bir- mingham, but the turntable may be obtained from most stores who specialise in the popular constructional toy, as this particular turntable is fitted with holes at such a spacing that it may easily be incorporated in models made up from the perforated strips. In connection with this component the makers are offering some valuable prizes for the best model or apparatus made up to incorporate a turntable. Full details may be obtained from the makers.

New Clix Plug Adaptor

MAINSPopular apparatus is generally fitted with a mains connecting plug which may take the form of either a bayonet plug or a bayonet-socket plug, and, as the average home is usually fitted with both power sockets and lamp-holders, it sometimes becomes convenient if the apparatus can be inserted into either type of connection at will. There are already on the market some interesting types of adaptor which permit of apparatus being used with both types of socket, and we illustrate on this page a new form manufactured by Lectrolinx, Ltd., makers of the popular Clix accessories. This adaptor is moulded in bakelite of substantial thickness, consisting of a hollow "cowl" through which the connect ing wire is passed, and which is fitted with an internal thread. Screwing into this section is another moulded portion which has two pins on one end and an ordinary lamp-socket fitting on the other, the mains leads being joined to small terminals situated in the centre of this part of the complete adaptor. It will thus be seen that the two portions may be screwed together to enable either end to project, whilst the attachment of the lead to the reversible portion prevents this from being lost. The illustration shows the appearance of the adaptor when used for a lamp-socket, and also with the reversible portion removed. It is a very convenient component for the home, and will be of double use in many applications. The price is 1s. 3d.

Lissen Un-screened Coils

FOR the construction of a low-priced receiver where it is not essential to employ screened coils, a most unscreened coil with selectivity of the screened type, the Lissen unscreened coils will be found very useful. As may be seen from the illustration on this page, the method of construction follows orthodox lines, a base with six terminals being fitted to the complete coil, and with the further refinement of a small selectivity device mounted in the upper end of the coil. This consists of a small mica-dielectric variable condenser, with an ebonite adjusting screw, and it provides an extremely low minimum capacity, and a maximum of 4000 mfd. A further advantage in the design of this coil is to be found in the fact that the base is designed to fit the Lissen Triple Wave-change Switch. The coil covers the normal wave-lengths, and the windings are arranged in slots on the iron so that the turns cannot move and vary the calibration of the receiver. The price of the coil is 5s. 6d. with selectivity device, and 4s. 6d. without. The triple wave-change switch costs 3s. 6d.

Ostar-Ganz Price Reductions

THERE are very attractive Ostar-Ganz Universal valves on the market to-day, and in view of the changes which certain valves undergo from time to time, whilst still retaining their original type number, information is of the utmost importance. Each valve is guaranteed for a period of six months. The following list shows the principal types which are obtainable for the battery user, and the prices:

- Starting from the top:

<table>
<thead>
<tr>
<th>Impedance</th>
<th>Amplification Factor</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>H2</td>
<td>92,000</td>
<td>32</td>
</tr>
<tr>
<td>L2</td>
<td>14,000</td>
<td>94</td>
</tr>
<tr>
<td>L3</td>
<td>12,000</td>
<td>15</td>
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<tr>
<td>P2</td>
<td>3,000</td>
<td>1</td>
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<tr>
<td>S2</td>
<td>400,000</td>
<td>67</td>
</tr>
<tr>
<td>S3</td>
<td>400,000</td>
<td>67</td>
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<tr>
<td>M2</td>
<td>70,000 (as 1,000,000)</td>
<td>1</td>
</tr>
</tbody>
</table>

All the above valves are also obtainable at the same price for 4s. and upwards.

A.G. Class B Output (4,000 watts) Price 9s. 6d.
B.G. Class A Output (4,000 watts) Price 9s. 6d.

The 362 Radio Valves

THE range of valves manufactured by the 362 Radio Valve Company is a very exhaustive one, and readers who attended the recent Radio Exhibition will remember the splendid display which the firm made of their products. The principal characteristic of these valves is their low price, a simple triode costing only 3s. 6d., and a Class B valve costing only 9s. Because these valves are low in price, however, it does not follow that they are in any way inferior, and some tests which we have conducted reveal that the valves are very satisfactory, when judged from the point of view of performance, and also on the score of reliability. The method of construction results in great strength and absence of microphony, and the S.G. valves have a very low self-capacity.

A novel feature of the 362 is the metallised H.F. valves, and this consists of an insulating coating covering the metallised surface and thus affords a measure of safety should an H.T. lead come into contact with the valve. A further novelty to be found in these valves, and one which we should like to see on other makes of valves, is the marking of the principal characteristics on the valve base. This is not cut in gold type, as a more readable, and thus does not leave the user in doubt at any time regarding the particular characteristics of the particular valve in use. The information which is given is the type number, the amplification factor, the mutual conductance and the impedance, and in view of the changes which certain valves undergo from time to time, whilst still retaining their original type number, information is of the utmost importance. Each valve is guaranteed for a period of six months.
ANNOUNCEMENT

PRACTICAL LETTERS FROM READERS

An Appreciation from Shanghai

SIR,—Please accept my thanks for the safe receipt of the Wireless Encyclopaedia and Data Sheets. I have just glanced through the Encyclopaedia and it seems to be all that you readers claim. It is a valuable addition to my library, where it will be the standard reference work.

The Radio industry is progressing with amazing rapidity. Only by knowing thoroughly the basic principles can pace be, kept with it. Our instruction includes American broadcasting as well as British wireless practice. It is a modern education, covering every department of the industry.

OUR COURSES

Included in the I.C.S. range are Courses dealing with the Installing of radio sets and, to mastery of operating and transmitting, intimately concerns every wireless dealer and, in particular, with their Servicing, which to-day of the industry.

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The I.C.S. Radio Courses cover every phase of radio work, from the requirements of the youth who wishes to make wireless engineering his career to the man who wants to construct and maintain a broadcasting set for his home.

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

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

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PRACTICAL LETTERS FROM READERS

Unintentional Interference

SIR,—My experience regarding the sensitivity of a modern receiver and of the ease with which it "picks up" unwanted interference may be of interest. Recently I had occasion to examine a receiver belonging to a friend, which failed to operate on testing out the primary of the speaker transformer for continuity with a 2-volt cell (and 600 ohm resistance). In series) I heard a series of "crackles" from the speaker next door (and through a fairly thick wall), every-time contact was made to the transformer winding. I think this is a good example of unintentional interference, which could be caused by anyone testing out wireless components, such as transformers, chokes, etc., as well as by a receiver, who happened to be nearby.—Gio. H. Eaton (Fulham).

Do you know

...-THAT a single wire may be used for an extension speaker lead provided a filter-output circuit is used...

...-THAT in the above case a short earth wire at the speaker end will complete the circuit...

...-THAT where an extension speaker is to be used a considerable resistance on the receiver...

...-THAT generally speaking a speaker with a large cone will give better low tone response...

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. Such articles should be written on one side of the paper only, and should contain the name and address of the sender. When the Editor does not hold himself responsible for correspondence, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor, PRACTICAL WIRELESS, 6-7, Portland Place, London, W.1

* to men who want careers in RADIO

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The regular late evening talks have, with two exceptions, been abandoned in favour of various talks features which will appeal to all classes of radio users, contains a number of designs for modern receivers, including a five-valve superhet, a double S.G. screen grid detector class "B", a three-valve H.F. pentode and octode post...pad. The trainee ICITraZt, 14. about life in general, "On Fridays there will be child tribute. Causes of War" and will give a number of distinguished

There is a Hivac equivalent for practically every type and make of valve in use to-day. Write for the Hivac 1935 Valve Guide "N" and Chart. "When BIG MEN FIDDLED"

CHRONICLE WIRELESS ANNUAL.

BROADCAST TALKS

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CHRONICLE WIRELESS ANNUAL.

BROADCAST TALKS

A PAMPHLET giving the programme of B.B.C. broadcasts and talks for the coming months, December, 1934, is now available. The regular late evening talks have, with two exceptions, been abandoned in favour of various talks features which will appear irregularly in the programme. The series that provides the most impetus of speakers is at 10.45 p.m. on Fridays, and presents one of the two exceptions just referred to. This series will be on "The Green of War" and will give a number of distinguished

There is a Hivac equivalent for practically every type and make of valve in use to-day. Write for the Hivac 1935 Valve Guide "N" and Chart. "When BIG MEN FIDDLED"
PRACTICAL WIRELESS
LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

October 20th, 1934

The coupon on Cover iii must be attached to every query.

A Mains Query

"I have a S.G., detector and power set, but wish to build a pentode three. I am using a commercial 25-milliamp eliminator. Can I make the new set 'all-mains'? If so, how? Or do you think it would be better to make it a battery set and use the eliminator (which has a trickle charger for the L.T.)? If I did the latter would I have good volume?"—F.A. (Kingston-on-Thames).

Probably the battery receiver with the trickle charging arrangement would prove much better than you. You would have to arrange for a much greater H.T. voltage if you desired to get the best from mains valves, as these require 200 to 250 volts on the anode, and your eliminator only delivers a maximum of 150 volts. Thus you would not be working the mains valves on their optimum points and would probably get poorer results than with battery valves at full voltage.

No Reaction

"I have a three-valve set, but I cannot get any reaction at all. The reaction condenser is all right and the reaction winding is intact. Please could you tell me where else I could look for the trouble?"—H.H. (Oldham).

If the reaction circuit is intact the only failure of the set to oscillate will be found in the fact that insufficient H.T. is being applied to the grid. This may be due to too high a value of decoupling or coupling resistance, or to a run-down battery. We presume you have ascertained that the valve is O.K., and that the quantity of wire used for the reaction winding is sufficient to cause oscillation with the particular value of condenser which is in use.

Hissing Noises

"I have a commercial superhet, (battery-operated) which I obtained cheaply from a big store near me. It is an American set, and functions quite well except for one thing. All over the dial there is a loud hissing noise, something like steam escaping from a boiling kettle. Is there any way of preventing this, as it becomes annoying after trying to search for some distant stations?"—H. (Blaenavon).

The noise is probably valve hiss and is due to the particular valves which are in use. There is generally a background of noise in any superhet when a number of highly efficient valves are employed, and the only thing you can do is to fit a large-capacity condenser across the output terminals. Naturally, high notes will be cut, but this may not prove a disadvantage if the background noises are reduced. The actual value will depend upon the speaker and output arrangements, and some trial will thus be necessary to find the most suitable condenser to use.

Faulty Aerial

"My set has worked very well for two years but I have lately been troubled with some intermittent crackling noises. These are very loud and only appear after fade-ins. I have tried various methods of tracing them but so far I can only state that when the aerial lead is removed I can still hear the local station faintly, but there is no crackling. The noises are by no means regular. What can you suggest?"—T. U. A. (Highgate).

The fault is probably to be found in the aerial. It may be a poor joint where the lead-in is joined, and this may have become corroded and loose and is moving when a wind blows. Alternatively, the lead-in may swing against a metal gutter or pipe and thus produce the noise. There is still, however, the possibility that the aerial is not resistant, but that the loud-speaker (if of the M.C. type) is not accurately centred. Thus when a loud signal is received the speech coil shakes against the pole piece, but when signals are reduced by removing the aerial the movement of the cone is not sufficient to cause the noise. This may be verified by reducing by removing the aerial the movement of the cone is not sufficient to cause the noise. This may be verified by reducing the volume and thus producing the noise. If it still persists, you should look to the aerial, whilst if the noise ceases, then the speaker is at fault.

Microphone Difficulty

"I have a small button microphone and have connected it to my set as shown on the attached sketch. I can get no results whatever and would thank you if you could certify my connections as correct. I used no transformer. Would this make any difference?"—J. H. (Hayle).

The connections shown are between grid and grid bias, and whilst this is the correct position for the input arrangement it is necessary to interpose a transformer between the microphone and receiver. Generally speaking, the resistance of these small microphones is in the neighbourhood of 100 ohms, and therefore you must obtain a special transformer in order to use the microphone with your receiver.

A Neon Problem

"I have purchased a television neon lamp but cannot get it to glow when connected across the loud-speaker terminals on my commercial receiver. I tried to connect it across the mains with a resistance in series and it glowed, but although I connected it quickly to my set it still would not light. Can you help me?"—T. H. (Bristol).

The striking voltage has to be continuously applied, and it is useless to apply the voltage and then remove it. The cause of the lamp not glowing with your receiver may be due to the fact that the anode current of the output valve is insufficient, or that an output filter circuit is fitted. You need about 20 milliamperes direct current for the lamp, and if a filter is fitted you will have to arrange to incorporate a separate polarizing source.

THE QUERIES COUPON APPEARS ON COVER III

THE WORLD'S HANDIEST AERIAL
A highly efficient adhesive strip Aerial that gives a wonderful pick-up clear of interference: Fitted in a jiffy without tools. Press it anywhere you want to run it and it sticks. Lightning proof, neat, efficient: just the thing for a modern home. PIX, London, S.E.1.

PIX INVISIBLE AERIAL

THEME AERIAL
| Page 187 | PRACTICAL WIRELESS |

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To get the best possible results, you must electrify your set.

**Toad is simple and interesting. If you have an eliminator supplying the H.T., just scrap your battery valves, replace them with A.C. valves and incorporate a HEAYBERD L.T. Transformer. Below are three popular models:**

<table>
<thead>
<tr>
<th>MODEL</th>
<th>OUTPUT</th>
<th>PRICE</th>
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<tr>
<td>725</td>
<td>2 + 2 volts</td>
<td>3 amps</td>
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<td>2 + 2 volts</td>
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<tr>
<td>723</td>
<td>2 + 10 volts</td>
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- L.E.E.-CELESTION High Quality Condensers, 23 x 0.0009 and 110 mfd. oscillator, complete with knob, drive and escutcheon; 7/6 post free.

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- GEC.-Transformers, 500-600v. diode, 2.5 mfd., 75/- each; 500-600v. triode, 5 mfd., 150/- each.

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- E.M.S.-Condensers, Type K, 1,000 mfd., 1/- each; 10,000 mfd., 2/- each.

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20 haCL.B. III SEALED KITS. 5/11 UTILITY TWIN -GANG Condensers, with S.M. on BLUE INFASTRAIGHT III KITS.

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