Dear Sirs,

I am using a well-known Set which is noted for the way it brings in stations. I recently borrowed a Cossor Metallised Screened Grid Valve to try. I first tried three other makes of S.G. Valves and there was not much difference between them. Then I tried the Cossor. I was amazed—station after station rolled in. I set the dials to a certain station, took out the Cossor and tried the other S.G. Valves, result—flat nothing—only a whisper. I put back the Cossor without touching the dials the Set was returning the place down. You cannot give a better test than this.

Yours faithfully,
Signed

THE simplest and most economical way to increase the efficiency of your Receiver is to replace your old Screened Grid Valves with Cossor. The right type of Cossor Screened Valve will make your Set like new again—restore its vigour. Thousands of Wireless Users are rejuvenating their Sets with Cossor—Britain’s most efficient Screened Grid Valves. You should too.

To A. C. COSSOR, LTD., Melody Department, Highbury Grove, London, N.5.

Please send me, free of charge, a copy of the Cossor 72-page Wireless Book B.V. 33.

Name

Address

Cossor
SCREENED GRID VALVES


To all Dealers at Home and Abroad.
INSIDE! BUILDING THE NUCLEON CLASS B FOUR

Practical Wireless

ROUND THE WORLD OF WIRELESS

The Lucerne Plan

It has previously been announced in these columns that the new "Lucerne Plan" would come into operation on January 16th, and many readers have written to ask in what way this would affect them. Briefly, it can be stated that the wavelength changes will have only a very slight effect upon the listening public, and that reception will be no more difficult than before. As a matter of fact, the modified wavelengths will simplify the selectivity problem, but so that every reader may have a thorough understanding of the new position which will be created we have had prepared a special article on this subject. The article appears on page 781 of this issue, and, since it has been written at the last moment, it is right up-to-the-minute, including even those wavelength adjustments which have been called for at the very last moment. This article gives further proof of our policy of keeping all readers well abreast of the latest developments.

Television Is Here

There are still a few sceptics who claim that television is not popular, and even that it cannot be until vast changes have taken place in regard to the method of transmission and reception of light. These sceptics are generally of the "Micawber" type who are "always waiting for something to turn up" instead of helping in the development of new sciences. Whilst such people are dreaming, Practical Wireless is acting, and all readers will welcome the essentially-practical constructional article in this issue which tells you how to make a really efficient portable television receiver. This new piece of apparatus is easy to make, and by no means costly, so that there is no reason why every Practical Wireless reader should not proceed at once to enjoy the full the many television broadcasts which are now made by the B.B.C. It is a true fact that the present television broadcasts are of distinct entertainment value, and any interested person who has lately been "locked-in" with an efficient receiver such as the "Portovisor" will not dispute this fact.

The "Portovisor" is the very first portable television receiver to be offered to the home constructor and it marks a really definite forward step in modern television technique - yet another proof that "PRACTICAL WIRELESS" ALWAYS LEADS!

New KDKA Broadcast Feature

In addition to the special transmissions made for the benefit of trappers, police, and other inhabitants of the Polar circle, the KDKA and W8XK stations of East Pittsburgh broadcast on every fourth Sunday of the month a brief sacred service and special messages to foreign missions.

France's High-Power Stations

The seven high-power transmitters which the French State System is erecting have now been given official names in order to distinguish them from other private stations which are operating in the same districts. When reference is made to them they are to be known as follows: Toulouse-Mons, Lyon-Transayes, Nice-La Brague, Paris-Villette, Lille-Camphin, Marseille-Realtor, and Rennes-Thories. Their power varies between 60 and 100 kilowatts.

Germany Nearing Five Million Listeners

In the course of November, 202,600 new registered licences were taken out in Germany, thus bringing up the total to 4,837,539. It is hoped that the five million mark may be reached by the New Year. To beat England's figures Germany still has a long way to go, as we are over one million ahead.

Wireless in Taxis

In the United States, where the idea originated, some 2,000 taxicabs which were equipped with wireless sets for the entertainment of both driver and passengers were ordered by the police to remove the apparatus or to have their licences revoked. The decision was taken following an accident in which a man was knocked down and seriously injured. The New York authorities, in taking their decision, stated that "in addition to distracting the attention of the drivers, radio broadcasts in such vehicles would increase street noises to the extent of making the taxicab a public nuisance. Although they had become popular with the general public, the disadvantages of the innovation far outweighed its benefits.

IN THE UNITED STATES, January 6th, 1934

Practical Wireless

PRACTICAL WIRELESS

INSIDE! No. 2 OF "PRACTICAL TELEVISION"

MAKING A PORTABLE TELEVISION RECEIVER

AMATEUR TELEVISION IS HERE!

Throughout the world this is carried out on the lines adopted by the Vatican station at Rome, except for the fact that the transmissions in this instance are destined to Baptist, Methodist, and Presbyterian denominations. The broadcasts may be picked up in the British Isles at G.M.T. 04.30 (Mondays) on 305 metres (KDKA) and 48.80 metres (W8XK).

France's High-Power Stations

The seven high-power transmitters which the French State System is erecting have now been given official names in order to distinguish them from other private stations which are operating in the same districts. When reference is made to them they are to be known as follows: Toulouse-Mons, Lyon-Transayes, Nice-La Brague, Paris-Villette, Lille-Camphin, Marseille-Realtor, and Rennes-Thories. Their power varies between 60 and 100 kilowatts.

A recent decision taken by the American Radio Commission permits three of the most important U.S.A. stations to increase their power to 50 kilowatts. In these circumstances it is expected that the range of WGN, Chicago (462.2 m.), WBBZ, Boston (305 m.) and WHAM, Rochester, New York (290.9 m.), will be greatly extended, and their broadcasts should be picked up more easily in the British Isles. It is anticipated that a similar licence may be given to them. They are: WMAQ, Chicago (447.8 m.); WHAS, Louisville (362.0 m.); KNX, Hollywood (256.7 m.); and WBT, Charlotte (277.8 m.).
Ecko Bakelite Factory

At the bakelite plant at the Ecko works, fourteen hydraulic presses are in operation at the present time, each having the power of two 1,100-ton and two 1,500-ton machines. Each of these presses weighs over 100 tons, and stands 35ft. high from its base. This base is situated 15ft. below the main floor of the plant. Nearly 2,000 tons of concrete were used in preparing the foundations, which are sunk 13ft. into the ground. The hinged dies used for moulding cabinets weigh over 3 tons each, except on the 1,500-ton press, where the die weighs 15 tons. Two cabinets are produced simultaneously by this machine. The electricity consumed by the power plant amounts to nearly 10,000 units a day, or three and a half months a year. Movement of an electrically worked lever plunges the upper die into the mould. A specially prepared sandagram is used for timing, in preference to a clock or other mechanical device.

When the die is released, the cabinet is lifted out of the mould. Morticed screw sockets and metal inserts are firmly moulded in place, and the only operation needed to complete the cabinet is to break off a thin " flesh " of bakelite, and to give the edges a slight polish.

Concerts of British Music

In addition to the seven new works to be introduced at the Six Concerts of British Music to be held in Queen's Hall, under the auspices of the B.B.C., some fifteen or so major works already well-known to the public are included in the programmes. On January 1st Delius's 'A Song of the High Hills,' for chorus and orchestra, will be given, as well as Constant Lambert's 'The Rio Grande,' for solo piano, chorus, and orchestra. The former is one of Delius's most beautiful works, and the latter is of a much more popular character as Lambert's 'The Rio Grande,' which is undoubtedly one of the most successful attempts yet made to apply the rhythmic idiom of modern dance music to a serious symphonic work.

January 5th brings Arthur Bliss's 'A Colour Symphony,' a work of outstanding merit deriving its name from the fanciful attachment of a colour to each of the four movements. Another important work is Eric Fogg's Bassoon Concerto which is dedicated to the late Charles Goldsmith, the renowned principal bassoon of the B.B.C. Orchestra, who is to be the soloist on this occasion.

Revue Fare from Birmingham

On January 12th, listeners will hear on the Midland wavelength both a comedy, To-day's News, and a revue. The comedy, To-day's News, written by S. T. Keegan, 7, Holton Street, Birmingham, and posted to reach here just before coming to Birmingham University.

INTERESTING AND TOPICAL PARAGRAPHS

Bristoe, who has also written many compositions for the films. Alex Vane and Hugh Morton will be in the cast.

The Power of the Press!

Interesting Talks from Midland Regional

Two talks of special interest to the Midland coalfields will be given in the world's Midland Regional programmes. On January 8th, Robert Tredinnick interviews a Midland miner for the Boyhood in Industry series, and on January 10th Professor S. T. Keegan, the University of Birmingham, gives a talk on the development of mining in the region during the past century. Professor Moss had several years of practical experience in Staffordshire coalfields before coming to Birmingham University.

Solve this!

Problem No. 67

Jenkinson made up a mains receiver employing an S.C. H.F. stage, detector and L.F. stages. When tested results were very poor, and he accordingly connected a milliammeter in the anode circuit of each valve in turn. The detector and output stages were quite in order, but the H.F. stage showed no anode current at all. The H.F. choke was tested and found continuous, and an H.T. reading could be obtained between the anode and the earth line. All connections to the valve holder were found to be adequately made and the valve was tested and found up to standard. What was wrong? Three books will be awarded for the first three correct solutions received. Address your attempt to The Editor, Practical Wireless, Esso, Newman, Ltd., 211, Southampton Street, Strand, London, W.C.2.

SOLUTION TO PROBLEM No. 67

In joining the grid lead of the first valve, Jones overlooked the fact that a condenser was wired across the grid and anode, and that the grid should have been joined between the grid and the top end of the coil.

The following three readers successfully solved Problem No. 67, and books have accordingly been forwarded to them:

K. Goldsmith, 47, Eywood Close, Southend, Essex; J. L. Kedgin, 7, Hadwen Street, Solihull; I. Lane; H. Jones, 67, Tichborne Road, Caricin, Bridgnorth, Shropshire.

Musical Comedy Excerpts

The name of David Wilson (baritone) has become synonymous with the Belfast station's programmes of musical comedy excerpts. He will make another appearance before the microphone on January 8th, in a programme of this type. It includes excerpts from The Duet Song, The Maid of the Mountains, and The Lady of the Rose.

Missing Links

A COMEDY in three scenes by Charles K. Ayre, Missing Links, will be heard by Northern Ireland listeners on January 12th. Charles K. Ayre is one of the most popular of the Ulster playwrights, and a number of his plays have been broadcast, including Leaves and Petals and Tiddledy Winks. Missing Links is a witty story of golf and science intermingled.

Military Band Concerts

There are two band programmes from the Midland Regional studio during the week. One for the Creswell Colliery Band, conducted by David Aspinall, on January 9th, and the other by the Birmingham Military Band, conducted by W. Archer Clarke, on the 11th. Interlude in the two programmes are occupied respectively by Patricia Froshough (soprano) and Harold Pollard (entertainer).

Music for the Mind

Interest for the mind continues with a programme of practical science, to be heard on January 12th, at 7 p.m. An attempt will be made to explain briefly the working of an electrically worked lever mechanism, and to describe the production of a press which produces two Model 74 Cabinets at one stroke.

Television in Italy

ENGINES of the E.I.A.R., the Corporation responsible for the broadcasting service, have installed the first Italian television transmitting and receiving station at the Palace of Electricity at Turin. Broadcasts will be made on short waves, specially between 5 and 8 metres, and will consist of relays of topical events, public performances from theatres, and scenes from streets. A regular service will not be operated until the regular station has been completed at Rome; but in the near future plans are being made for the transmission of sound films on 180 lines and 25 images.

Claim Your Tool Kit without Further Delay!
ANY enthusiast who does a fair amount of experimenting collects so much surplus gear that there is some difficulty in knowing how best to dispose of it. Many of the parts could be used to make up an obsolete set, but that would not interest the keen experimenter in the least. The difficulty is that most of the newer circuit arrangements entail the use of new components of special design and some difficulty in knowing how best to dispose of it. Many of the parts could be used to make up an obsolete set, but that would not interest the keen experimenter in the least. The difficulty is that most of the newer circuit arrangements entail the use of new components of special design and, consequently, a simple means of converting the aerial tuner to a simple band-pass arrangement.

A Simple Band-Pass Scheme

Nearly every set built more than a couple of years ago suffers from comparatively flat tuning, so that anything which will give increased selectivity is to be appreciated. A very simple, yet reliable, method of obtaining really sharp tuning with practically any type of set is shown in diagrammatic form at Fig. 1. In that drawing it is assumed that plug-in coils are employed in the existing set, but it should be mentioned that the very same idea is equally applicable to a receiver in which tuning is carried out by means of a more up-to-date dual-range tuner. It will be seen that the wire which previously joined the aerial terminal to the aerial tuning coil has been removed and another wire taken from the aerial terminal to one end of a second coil, across which is connected another .0006 mfd. tuning condenser. A connection is taken from the "top" end of each coil to the "fixed plate" terminals of a differential condenser, which may be of any capacity between .0001 and .0003 mfd., the centre terminal of the condenser (moving plates) is not used. The arrangement shown and described is that of "top-capacity" band-pass tuning, the differential condenser providing the small capacity coupling. This condenser behaves like two small variable condensers connected in series, with a result that the actual capacity in circuit is only a few microfarads. Capacity is at a maximum when the moving plates are half in mesh with the two sets of fixed ones, and can be reduced almost to zero by fully meshing the moving plates with either set of fixed ones. This method of tuning not only increases selectivity, but makes the degree of selectivity easily variable. Thus the circuits tune most sharply when the capacity is at a minimum, and vice versa.

In trying the band-pass system described the new and old coils (or tuners, as the case may be) should be arranged with their axes at right angles, or else they should be screened from each other. If the two coils are identical the settings of the variable condensers will be practically the same for any particular wavelength, but in any case both condensers should be tuned accurately and with care. The simplest way to tune to any station is first of all to set the capacity of the differential to its maximum and find the rough tuning position; after that the capacity can gradually be reduced and the condensers finely adjusted at the same time.

A.V.C. with a Spare Valve

Every experimenter wants to try automatic volume control, but it is not everyone who feels prepared to buy special apparatus until the efficacy of the scheme has been verified. Provided that a spare valve (of practically any type) as well as two high-tension batteries (which need not be in new condition) and a few odd resistances and condensers are on hand, an excellent form of A.V.C. can be tried out by using the connections given in Fig. 2. The drawing shows that a lead is taken from the "top" end of the detector H.F. choke to the positive socket of the 60-volt G.B. battery, whilst a 50,000 ohm potentiometer is connected between two tappings on the same battery, its slider being joined to the grid of the A.V.C. valve. Low tension for the A.V.C. valve is taken from the common source, but high tension and grid bias are obtained from the new batteries already mentioned. It will be seen that the negative lead from the H.T. battery is taken to the filament of the A.V.C. valve through a .05 megohm resistance, and it is across this that the
to the grid circuit of the V.M. valve, through a 50,000-henrys resistance. In order that the arrangement can be followed more easily, the new parts and wiring are shown in full lines, the normal portion of the receiver being represented by broken lines. The method of adjusting this A.V.C. arrangement is as follows. First remove both G.B. wander plugs and tune in a weak station in the usual way; next insert the plug marked "G.B. -1" and find a position for it at which signal strength is unaffected; finally insert the second G.B. plug into a socket giving about 9 volts less than that occupied by the first plug. If signal strength then becomes less, adjust the potentiometer until it is brought back to the previous level. Should it be decided to retain the A.V.C., as a standard fitting a switch should be included in the lead from the potentiometer to the G.B. battery to prevent the latter from being run down whilst the set is out of use.

**H.T. Current Economizer**

Another interesting use for a spare valve is represented by the arrangement shown in Fig. 3. In this case the valve acts as an H.T. economy device by reducing the current consumption of the output valve, which may be either a tetrode or a pentode. The valve now acts as a half-wave rectifier and therefore the grid and anode may be joined together. The two are then connected to the anode of the output valve through a 1 or 2 mfd. condenser, a 250,000-ohm resistance and a high inductance. The connections are self-explanatory, and it need only be added that the grid-bias wander plug should be inserted in a socket providing about twice the voltage previously employed, after which the potentiometer should be adjusted to a position at which there is no distortion on either weak or loud signals. A certain amount of initial experiment might be called for in order to find the most suitable voltage, but once that has been done the "economy" device is perfectly self-compensating. Try it!

**Q.P.P. with Old Transformers**

Quasi-peak pull amplification is not used very widely now, due to the fact that Class B is cheaper and equally efficient, but it gives a much greater output with a battery can be obtained from an ordinary power or pentode valve. This system of amplification can be tried fairly easily and in a form that will prove reasonably effective by following the connections shown in Fig. 4. Two ordinary L.F. transformers are used, the primary windings of these being connected in parallel and the secondaries in series in order to obtain a high-step-up ratio. Stopping resistances of 20,000 ohms each are included in the grid leads to the push-pull valves, but these will not be essential if the valves have similar characteristics and if the transformers are alike. In any case, however, it is desirable that the valves should be of the same type and that both transformers should have the same ratio. The valves represented are pentodes, although triodes can be used instead, merely by omitting the two leads marked "H.T. 2" and "H.T. 3." For preference, the output choke should be a special Q.P.P. one, but if it is sometimes possible to obtain good results by using an ordinary untapped choke, provided that it has a low D.C. resistance and a high inductance. As an alternative, a pair of plain chokes may be joined in series, the H.T. positive lead being taken from the one junction, of course.
The alleged revolutionary appeal of the broadcasting world due to the coming into force of the new Lucerne Wave Plan on January 15th appears to have aroused some anxiety in the minds of many listeners. From the letters we have received on the subject it would seem that many readers are labouring under the impression that the game of "general pool," played by the European transmitters on that date, is likely to cause considerable inconvenience, inasmuch as such a change in channels will necessitate a complete re-dialling and will render the present condenser scales obsolete.

Let it here be said that however drastic the re-allocation of wavelengths appears at first sight, the practical result of the allotment of new channels to the individual stations will not affect listeners to any appreciable degree. As will be explained later, the actual adoption of the new wave-plan will only restrict the number of broadcasts available to the energetic knob-twiddler; it means that such advertised features as "logo of eighty and one hundred stations" may become a thing of the past. The number of transmissions receivable may be curtailed, it is true, but on the other hand the placing of the transmitters in the wave-band having been carried out in a more judicious manner, this relatively fewer programmes themselves will be less marred by interference and thus a greater proportion of worth-while broadcasts should be available to the ordinary listener.

How the Stations are Divided Up

To understand the reason for which a lesser number of stations will be employable, it is necessary to see that some explanation should be given of the new Lucerne Plan. It must be borne in mind that at present wavelengths have had to be found for over two hundred and thirty different European stations, and this number is still likely to grow. Do not forget that in addition to providing a "place in the sun" for the broadcasting studios, clear channels must exist for wireless transmitters connected with such vital services as shipping, commerce, meteorology (weather forecasts, storm warnings, etc.), fog beacons, and for the police, military and naval authorities of the various States. For this reason the band which can be allocated for the use of wireless education and entertainment is strictly limited, and its boundaries are well defined. To place, therefore, over two hundred and thirty stations in an area which has been necessary to create one hundred and thirty separate channels comprised in three different bands, namely; (a) 1,000-2,500 metres (300-150 kilocycles), (b) 600-1,000 metres (500-200 kilocycles), and (c) 300-600 metres (1,500-500 kilocycles). Of these (a) and (c) may be said to be mainly reserved to broadcasting stations, but (b) is merely "lent" for the purpose on the understanding that the use of it may be withdrawn if it is found that any interference is caused to other services. The reason for which exclusive channels for all stations has not been found possible is attributable to the fact that if mutual interference between two neighbouring stations is to be avoided, a definite separation of at least nine kilocycles must exist between their respective transmissions. It is, consequently, this necessary separation which has restricted the number of available wavelengths throughout the three wave-bands and which, for the same reason, has compelled the authorities to create four different classes of channels. These are (1) exclusive, (2) shared, (3) national common and (4) international common. Let me make this clear. In the first case, we have, without doubt, a channel ceded by, namely, an exclusive one to the station to which it has been allocated: in the second we find a wavelength which must be shared with some other transmitter. In this instance the geographical position plays an important part; where a choice of channels had to be made, the choice has fallen on two stations at the greatest distance possible from each other. The disadvantage of this arrangement as against that of completely separate wavelengths will be seen later. The national and international common waves are self-explanatory; the former are channels reserved to one country for a period of years, and on which a programme may be simultaneously broadcast—it will be mainly used for relays—the latter represents a channel allotted to a number of different countries and, as may be realised, can only be used for low power stations in view of the fact that they may be operating at the same time, and will be broadcasting individual entertainments.

How the Listener is Affected

Now, before going into the question of power, let us see in what way this new plan will affect the listener. If we consider the exclusive channels nothing much has happened as, whether we take in Rouen on 420.8 metres as against its present position on 441 metres, we are not affected in any way. We may change the exclusive channels allotted with the sole result that in the case where dial readings are in degrees we shall have to make a fresh list of the stations. Where the dials of manufacturers' receivers have been made out in station sequence, most of them have taken steps to provide their clients with new readings to conform with the wave plan.

If your neighbour, Mr. Brown, moves from No. 78 to your street to No. 20 in the next, there is nothing to prevent your telephone to him; all that has happened is that his calling number has been changed and you will require a new telephone list to work on 325.6 metres. As there is little chance of your hearing the latter in the British Isles, there is a good possibility that the French conditions will continue to prevail, in which case you will still be picked up fairly free from interference. Most of the trouble which might have arisen through the sharing of channels will be avoided by limiting, in either or both cases, the power of the transmitters.

Allocating the Power

The new wave plan, however, had many snags to contend with, one of the most troublesome lying in the power to be used by transmitters already under construction. The limitation of energy permissible in the different wave-bands in respect of the various classes of waves could not be enforced without exceptions, a matter which increased the difficulty of compiling the plan. Roughly speaking, the power allowed to the stations is as follows: For those working on wavelengths between 1,000 and 1,980 metres, up to 150 kilowatts, with a special dispensation granted to Moscow, already in operation, to use 300 kilowatts; transmitters located on channels between 272.7 and 545 metres, 100 kilowatts (Budapest, Vienna, Prague, Leipzig, Paris P.T.T., Toulouse P.T.T. and Rennes). Changes were exempt from this restriction; 60 kilowatts maximum it working between 210 and 272.7 metres and 30 kilowatts for waves between 200 and 240 metres. For the common waves allotted to stations in one specified country, not more than 5 and 2 kilowatts, and for international waves in the last class 200 watts is not to be exceeded.

(Continued on page 734)
THE construction of a meter for measuring current is not a task that is generally undertaken by the amateur, principally because it is considered to be outside his scope. This might be true so far as instruments of the moving-coil or moving-iron type are concerned, but a hot-wire instrument can easily be made by anyone who is accustomed to using simple tools, especially if he has some knowledge of electricity. A hot-wire ammeter of the kind to be described is illustrated in Fig. 1, and it can be seen from this that there are very few parts required, which none of these are of an intricate or complicated nature.

How It Works

Before dealing with the actual constructional work it will be better to describe briefly the principle upon which the type of meter under discussion operates, so that later remarks will more easily be understood. As the name implies, a hot-wire ammeter reads the intensity of a current due to the heating of length of wire. The wire used has a comparatively high resistance, being made of german silver, nichrome or some similar alloy, and thus as current is passed through it the wire becomes hot, just in the same way as does the element of an electric fire or the filament of an electric lamp. It is well known that when a metal is heated it expands, and it is this property which is made use of in the hot-wire type of meter. The length of resistance wire in the meter is so arranged that when it expands it is caused to sag, due to the tension exerted upon it by a thread attached to a spring. In passing from the wire to the tension spring the thread passes over a small pulley or roller to which is attached a pointer. Thus, as the resistance wire expands (and axial), the thread moves, rotates the pulley, and so drives the pointer over a scale, which may be calibrated in amperes or volts as required.

Parts Required

Rather than give a specific design entailing the use of exact parts, which might in some case make it necessary to employ a lathe in their construction, more general information will be given so that it may be applied in utilizing small parts, as well as odds and ends, that might be on hand. The principal parts are shown in Fig. 2, and in that illustration it is assumed that the reader will have facilities for turning up in a lathe the wooden case. Failing such facilities, it will be found quite possible to employ a rigid cardboard or paxolin tube mounted on a wooden baseboard. Yet another alternative is to use a short length of metal cylinder attached to a baseboard, but in that case insulating washers must be provided for all the terminals and screws. The casework is dimensioned, although the figures given are really arbitrary ones, which may be modified in accordance with the actual component parts which are used.

Assuming the use of a wooden case, the first thing to make is the "bridge" that serves as a mounting for a steel spindle, on which are mounted the pulley and pointer. All dimensions are given, and the most convenient metal is mild steel hoop, but those who prefer to make a rather better-looking job will prefer to use a stout gauge of brass sheet. First make the piece marked "A" by cutting off the metal to length and bending it in a vice. Next drill the necessary holes; three of these are about 1/4 in. diameter, the third being drilled 5/32 in. and tapped out with a 3/16 in. Whitworth tap. After that the piece marked "B" can be cut to length and suitably drilled, using a 1/16 in. bit. It is essential that the holes should be drilled exactly with those of "B," and this can be ensured by using the former part as a template. The final task in connection with the spindle-mounting "bridge" consists of making a small indentation with a centre punch in the centre of the piece marked "B," and also in the centre of the 3/16 in. grub screw marked "C." Here again accuracy is an important feature, so great care should be taken that the two punch marks are exactly opposite to each other. This can be ensured by first making a pointed screw to fit one place of "C," mounting "A" and "B" on a flat piece of wood and tightening down the screw until its point makes a mark on "B"; this mark will then indicate exactly where the point of the centre punch should be placed. Another way is to use the ordinary screw, turn this down until its end touches plate "B," and then carefully scribe round it, afterwards finding the centre of the small circle.

The Spindle and Pointer

The small spindle can next be made from a short length of steel wire. Both ends are pointed, and the points can be formed most satisfactorily in a lathe, but failing that, they can be made with a file, or on a small grindstone or emery wheel. The points should be really hard, and, therefore, if the wire has been filed or ground, it will be best to harden them by heating the wire to redness, allowing it to cool to the point at which it is just changing from yellow to blue and then plunging it in water. A small pulley must next be made to fit tightly on to the spindle, and this can be done most easily in a lathe. On the other hand, a suitable pulley might be found in the junk box, whilst failing that, it can be

(Continued on page 784)
TABLE-TOP
CINEMATOGRAPHY

How interesting Movies can be Taken with Models.

This model looks like "the real thing" in a home cine film.

Studio pictures, whether "stills" or "movies," go on through winter, undeterred by the short days and poor natural light. But you do not need to be a professional to take good indoor shots. It is quite sufficient to use the ordinary lights of the room, together with an inexpensive lamp in a good reflector. One of the simplest forms of indoor photography is the "table-top" picture. Model railway engines and accessories in these days are built with careful regard to detail, therefore a good imitation of the real thing can quite easily be made up and an interesting movie table-top film can then be taken. Amateur photographers are given still more scope for ingenuity in movie table-top pictures which have an increasingly popular future.

Other Features

A HOME-MADE TALKIE APPARATUS
FOR TWELVE SHILLINGS
AND EIGHTPENCE

How a reader solved the cost problem.

SECRETS OF TITLING

By the Editor.

THE JANUARY
HOME MOVIES
AND HOME TALKIES

NOW ON SALE 6d EVERYWHERE

Send for the New Polar Catalogue
PRACTICAL WIRELESS

Assembling the Parts

In assembling the meter, the terminals and zero adjuster should first be fitted. After that a screw should be attached to the inside of the case diametrically opposite to the adjusting screw. One end of a length of resistance wire should then be soldered to the screw, a small glass bead slipped over the end, and the wire then pulled fairly tight and soldered to the flat spring of the zero adjuster. Now mount the pieces “A” and “B,” attach the end of a length of thin thread or silk to the tension spring, wind this once round the pulley, and fit the spindle in place so that it can rotate easily in the centre-punch indentations. Finally, the thread should be pulled tight and tied to the bead. Now set the pointer to a zero (left-hand) position, when the meter will be ready for calibration. Before attempting to wind out a scale, consisting of a strip of paper glued on to a thin strip of wood, must be made as shown in Fig. 3. This should be fitted inside the case by means of two screws which can easily be removed again later on.

Calibration

For calibration purposes the meter should be connected up in series with an ammeter (any type) of known accuracy, a filament rheostat of between 10 and 20 ohms, and an accumulator (see Fig. 4). By turning the knob of the rheostat into various positions a number of current readings can be taken, and the positions of the pointer corresponding to, say, 25, 5, 1, 1.5, and 2 amps can be marked off in pencil on the blank scale. After that the scale can be removed and neatly divided up into suitable parts as shown at Fig. 4. It will be found that the divisions are not proportional to the current passing, but that they are more correctly toward the bottom of the scale: this is due to the fact that the size of the wire is not proportional to the expansion, nor is the expansion proportional to the current passed through the wire. So far as the length of a length of resistance wire needed. As a matter of fact, this depends upon the particular kind of wire employed, and the size of the meter (more correctly, the length of the wire). When using Eureka wire and marking the case to the approximate dimensions shown, the wire should be about 32 s.w.g., when a maximum reading of 1 amp is required, or 26 s.w.g. when the instrument is to read up to 2 amps. If a still lower limit is required, it is called for, such as when measuring the air input current from a transmitter, 36 or 38 s.w.g. wire will prove more suitable. It might be mentioned that it is always best to make the meter so that the full-scale deflection is only slightly greater than the value of current to be measured most frequently. By following this rule the instrument is not only easier to read, but if the resistance wire is of about 32 gauge. In that case it can be calibrated with fair accuracy by connecting it

THE LUCERNE WAVE PLAN

(Continued from page 781)

In addition, stipulations were made as regards direction of aerials and also in some instances transmitters must reduce their medium-frequency broadcast power after sunset. As you will see, in the annexed diagram it is only slightly greater than the value of current to be measured most frequently. By following this rule the instrument is not only easier to read, but if the resistance wire is of about 32 gauge. In that case it can be calibrated with fair accuracy by connecting it

Re-shuffling May Be Necessary

It is to be remembered that of the thirty-six European States interested in the Lucerne discussions, delegates of only twenty-seven countries agreed to the decisions on the day the Convention was signed. As Finland, Luxembourg, Sweden, Poland, Lithuania, Hungary, Holland and Greece refused to recognise the wave-plan— at least in some of its findings—a certain amount of re-shuffling may still take place. As far as can be forecast the failure of the dissenting States will not affect the medium-frequency broadcast, but there is every likelihood that, after the present plan has been in operation for some time, with the results that stations working on the "high" wavelengths may not change over from 15.1 to 15.15, but until further notice will continue in their present positions. The Lucerne Plan was only compiled as a modest experiment, and that if it is to satisfy all interested parties, some alterations must be made. It is supposed to stand good for two years, but revisions are not far, and it forms an excellent basis for negotiations. It will be given a thorough trial when stations take up their allotted channels in January, and as may be seen from the list published, it should go far to alleviate the present congested state of the ether.
A large number of readers have asked for a receiver which embodies the two most recent improvements in battery-receiver design, and also has a wavelength calibrated dial. The great difficulty with this type of tuning device is that it is not always possible to obtain an accurate indication of the exact wavelength to which the receiver is tuned owing to the use of coils and condensers of different makes, or which are not adapted to one another. The condensers which are supplied by Messrs. Wingrove and Rogers are designed to be fitted with full-vision scales having an accurately calibrated wavelength scale, and these are designed for coils having a certain inductance value which must agree on both wave-bands. Thus, in this particular case we find that the scale is suitable for coils which on the medium wave-band have an inductance of 157/4H and on the long wave-band an inductance of 2000pH. The Nucleon coils manufactured by Messrs. Wright and Weaire are found to have these precise figures, and thus it should be possible to combine the two components to provide an accurately tuned receiver. Our experiments have confirmed this point, and we are thus able to introduce to the reader an easily constructed receiver which does not employ an expensive combined tuning pack, but which does, at the same time, enable him to obtain one of the great advantages of the commercial receiver, namely, a calibrated receiver. Station searching is greatly facilitated when this type of receiver is employed, as all that is necessary is to look up the wavelength of the desired station and to set the pointer to that portion of the dial. If the station is within range it will be heard, and there will be no loss of time due to searching for a station which is probably out of range of the receiver.

The Circuit

Having described the principal feature of this circuit, and the reason for its adoption, we may examine the remainder of the receiver, and see in what manner it differs from other sets which we have described in the past. Firstly, it will be seen from the theoretical circuit, Fig. 5, that the tuning of the aerial circuit is carried out by means of one coil, and this is coupled to a second coil in the grid circuit of the variable-mu H.F. valve, namely, a Nucleon Class B Four.
the complete arrangement forming a highly efficient band-pass tuner, giving a high degree of selectivity with good signal strength. The combination of this type of tuner with a variable-mu valve thus gives one of the most efficient types of H.F. amplifier which can be built for battery operation at the present day. The H.F. valve is coupled to the detector valve by means of a similar coil, which is provided with a winding for reaction purposes. This may be used to augment signal strength and also to assist in selectivity where this is found necessary.

The three tuned circuits are tuned by the separate sections of a ganged condenser as already mentioned, and trimmers are provided on this condenser in order to balance out stray capacities when the receiver is first put into commission. The detector valve is transformer-coupled to a valve of the small L.F. type, and this in turn is transformer-coupled to an output valve of the Class B type. A tone modifier is fitted in the output circuit, and this supplies a moving-coil load-speaker. It will be seen, therefore, that the circuit is perfectly straightforward and possesses no "frills" or other stunts which might render it freakish in operation. It may thus be built up in the certain knowledge that it will function straight away, and no time will have to be spent in carrying out intricate circuit balancing.

### The Layout

From the photographs it will be seen that in this instance we have departed from the usual chassis construction. Quite a number of readers have asked for a receiver of this design, as they apparently object to the wiring of a receiver on two sides of a baseboard. They find that they get confused when passing wires from one side to another, and, although we do not think that the majority of readers experience this difficulty, we have arranged this receiver on the older method of construction in order to cater for everyone.

It will be seen that this unfortunately results in a rather crowded layout, many

### LIST OF COMPONENTS FOR THE NUCLEON CLASS B FOUR

<table>
<thead>
<tr>
<th>Component Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>One set Wearite Iron-Core Coils (Types BP. 1, BP. 2 and T.G.). (Wright and Weaire.)</td>
</tr>
<tr>
<td>One Polar Star Minor Three Gang Condenser with Horizontal Drive. (Wingrove and Rogers.)</td>
</tr>
<tr>
<td>One Polar Pre-Set Condenser 0.0003 mfd. (Wingrove and Rogers.)</td>
</tr>
<tr>
<td>One 50,000 ohm Megite Potentiometer. (Graham Farish.)</td>
</tr>
<tr>
<td>One 100,000 ohm Midget Screened H.F. Choke. (Bulgin.)</td>
</tr>
<tr>
<td>One 210 DET valve.</td>
</tr>
<tr>
<td>One 240B valve.</td>
</tr>
<tr>
<td>One 16 volt Lion Grid Bias-Vinces Battery.</td>
</tr>
<tr>
<td>One 2 volt 40 amp Accumulator. (Linen.)</td>
</tr>
<tr>
<td>One Radio F.M.P. Loud-speaker. (Rola.)</td>
</tr>
</tbody>
</table>

![Fig. 6.—Complete wiring plan for the Nucleon Class B Four.](image-url)
The NUCLEON CLASS B FOUR is built around

The SPECIFIED Wearite Components...

One Set Nucleon Iron-Core Coils consisting of

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TG 12/6

One Wearite H.F. Screened Choke with Pigtail

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The very heart of this most modern receiver is its coils—Wearite Nucleon Coils. Their amazing characteristics, giving such a high degree of selectivity—permitting the valves to make the most of the initial signals, has prompted the very design of this set.

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Using Bell System for Speaker Connections

The latter point is more important when using speaker 'extensions. For those who use accumulators for H.T. (and some battery users) usually keep them in a cupboard, bringing the wires through a hole in the top, and taking them either direct to the set, or to a terminal board. Both methods have objections, the former owing to the fact that the leads may short when disconnected, and the latter that in the event of any metallic object falling on the terminals, either the front or the back, the results will again not be advantageous to the battery. The terminal board illustrated will be found to be absolutely fool-proof in spite of its simplicity. The terminals should be of the completely insulated type, and they are formed on a strip of ebonite or wood, the edges of which are chamfered at 45 degrees. This fits into the corner between the top of the cupboard and the wall, and is held in place by two screws driven diagonally into the corner. The leads are taken through a hole drilled as near as possible to the corner, thus the connections at the back of the terminals are totally enclosed, and the lettering on the terminal tops is easily read. For quick connections insulated plugs and sockets could be used, but whatsoever method is adopted the result is a neat and fool-proof terminal board. -E. L. PARKER (London, S.E.15).

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An excellent anti-breakthrough choke, which will effectively prevent medium-wave interference when listening on long waves, can be made from an H.F. transformer of the old-fashioned plug-in type. The transformer must be one intended for medium-wave reception and only one of its windings (either the primary or secondary) is actually made use of. The method of connecting the choke is shown in the accompanying sketch, from which it can be seen that it is inserted between the aerial terminal and the corresponding terminal on the first tuning coil. In order to put the "choke" out of circuit when reception is being carried out on the lower waveband, an ordinary two-point on-off switch is connected in parallel with it. For those who do not happen to have a suitable transformer on hand it might be mentioned that these components can often be picked up for a penny or so from "junk" stores dealing in obsolete wireless apparatus. The pins on the base are arranged in the same order as those on a valve, the "filament" pins being connected to the primary winding, and the "grid" and "anode" pins taking the secondary connections. In using the transformer for the purpose mentioned above wires may be soldered to the pins or a neat job can be made by fitting the component into an ordinary valve holder. They should be no necessity to screw the choke, although it may be found worth while to vary its position in relation to other unscreened coils, etc.

(Continued overleaf)

A method of arranging safe battery connections.
Practical Wireless Technicians have started the New Year well—by specifying the Heayberd 751 Choke for Mr. Barton Chaple's "Portovisor." The reason why Heayberd Mains Apparatus is chosen is because it is the most reliable on the market.

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Building the

Heayberd Choke chosen for "Portovisor"

positive main and A so as to regulate the current passing to the neon lamp. Finally, if the reader does not want to feed the points A and B from mains at all, he can connect a 200-volt battery across.

The First Step

We can now turn to the practical side and see how easy it is to duplicate the design featured in the illustrations. A complete list of the components is included elsewhere, and hence readily obtainable from the makers mentioned.

If the combined wooden case is built up to conform exactly to the dimensions given in Fig. 9, then add the top platform 6in. by 4in. by 6in., and it will be found that the structure is very rigid.

Now comes the wooden block which stands the neon lamp and its holder. This is 4in. by 4in. by 1in. Before screwing on the block by three countersunk wood screws passing right through from the underside of the baseboard, drill three holes. Two of these are 3in. holes centrally displaced and 3in. and 3in. from the bottom, and driven right through. Now drill another 3in. hole in the top so that it meets the top hole. This will then allow the pair of leads from the neon lamp holder to make connection, while the lower hole is for the extension rod to the variable motor resistance to pass through. The block can now be screwed in place, measuring up its position accurately according to the dimensions furnished in Fig. 9.

Changing the Motor Direction

In nearly every disc television receiver described so far, the synchronizing circuit was an inductive one. This is because a mains-driven type is replaced by a mains-driven type, and fed from accumulators.

The First Step

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If the combined wooden case is built up to conform exactly to the dimensions given in Fig. 9, then add the top platform 6in. by 4in. by 6in., and it will be found that the structure is very rigid.

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mechanism is at the front of the motor. The disc at the back and, of course, the neon lamp on the right.

With the "Portovisor" however, I decided to have the disc at the front, and in order to maintain the disc rotation correct, and give the normal appearance of bottom to top and right to left, it became necessary to reverse the motor direction. This was the two-flanged process and is carried out in the following way:

Remove the synchronising gear complete by withdrawing the two screws holding the settings against this movable framework. Take off the cogwheel, and then pull out the brushes, after unscrewing the two caps. The aluminium end casing of the motor at the synchronising gear end may then be pulled off gently, and the motor armature withdrawn at the same time. To reverse the motor direction we must reverse the field winding. At the brush end of the motor casing will be noticed two leads, one at each brush point, which are just sprung into place. Ease off each lead and interchange their positions, then replace the armature, brushes and end plate, and screw back the synchronising mechanism in place and fit the cogwheel once more to the motor shaft. The motor now runs counter-clockwise when viewed from the end remote from the synchronising equipment;

A Question of Space

Being anxious to reduce the cabinet width as much as possible, and to allow the disc to be as close as possible to the front aperture movable framework. The following steps have to be taken. First of all, saw off a piece of the motor shaft at the disc end so that only ½in. remains. Then take the disc which is supplied with a fairly long boss, and has cheese-headed screws holding the disc between the two flanges, and cut off a piece of the cylindrical boss so that the length remaining is 11/32in. This will necessitate drilling and tapping a new grub screw hole, but that is quite an easy matter. Now remove the cheese-headed screws one at a time and replace with countersunk head screws, and quite a substantial saving in depth will be effected, as indicated by the sketch Fig. 2.

Complete Assembly

The constructor can now make a start on the assembly of the apparatus. The pictorial diagram, Fig. 8, the wiring plan, board edge. Fixing dimensions for the feet are given in Fig. 12, and these must be adhered to. Next comes the neon lamp holder, and

(Continued on page IV)
here again we must remove superfluous material. With a hacksaw cut off a segment of the lamp-holder base, so that the flat edge is flush with the circular holder portion.

Next make a small right-angled bracket to hold the 150-ohm variable resistance R7. The position of this bracket on the baseboard is fixed automatically if the motor shaft is in its flat plate parallel with the baseboard edge. Two new screw holes must be drilled before the holder can be held down on its wooden mount.

Next screw down in position both the vertical tapped tubular resistance R6 and the 0.1 mfd. fixed condenser C6.

I have detailed the work up to this point, for this completes the last assembly for those who desire the simple television receiver alone without the enlarger and transformer feed. In addition, the motor may be driven from a six-volt motor to be driven from non-inductive accumulators which will omit the vertical tubular resistance, and replace the 150-ohm variable resistance with a 6-ohm one. If only two or three leads are needed now by these constructors, and the apparatus is complete.

Completing the Work

Naturally, the best course for those with A.C. mains is to carry out the complete design, and then the remainder of the components can be screwed to the baseboard as indicated in the wiring diagram, Fig. 12. When this is done complete the wiring. For convenience this has all been carried out in a single rubber-covered flex. The runs of each wire are shown in Fig. 12 and care should be taken to trace out each connection. The run corresponding to the transformer feed. The runs of each wire are shown in Fig. 12 and care should be taken to trace out each connection. The runs corresponding to the transformer feed.

The back is detachable, having one hole drilled to allow the synchronizing framing shift to pass through, and also a rectangular section cut away at the bottom to allow access to the three terminals and give the mains lead free passage.

A Preliminary Trial

At this juncture it is as well to give the "Portovisor" a preliminary trial to ensure that both the wiring and assembly are free from errors. Place the neon lamp in its holder and the disc on the motor shaft, holding the latter in place by its grub screw. Turn the disc gently by hand to see that it does not foul any of the components.

If the lamp is a trifle too far to the left or right, nearly coming out of its holder, the position can be corrected by gripping the lamp holder to its wooden base, and adjust the lamp position until it is in the correct position. Gain this is done, attach the neon lamp to its bakelite case, and slide the component into its cabinet.

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Enlarging the Image

The television image observed through the periscopic hole in the side of the beam is of the same size as that observed by the eye through the side hole. For certain experimental purposes this size may be too small, but on many other occasions when it must be reduced to suit down the hole, and then fixed in position.

Details of a simple outfit for this purpose are shown in Fig. 10. First of all obtain two lenses, one a 4-in. diameter double convex of 1.5-in. focal length, and a second of 3-in. diameter, single convex, having a 3-in. focal length. Now make up the wooden structure indicated in Fig. 10. When the hole center has been marked off, describe off with dividers or compasses two holes on one side of 3-in. and 4-in. diameter respectively. On the other side two similar concentric circles of 3-in. and 4-in. diameter respectively. Cut out the inner circle of 3-in. with a fret-saw, and then with a snub-nose chisel off sufficient wood until there is a level between the 3-in. diameter hole at the back and the 4-in. diameter circle at the front.

Place the large lens central with the 6-in. diameter side towards the wood, and hold it firmly in position with three small brass clips as shown in Fig. 10. Turn the structure over and mount the smaller lens in place, that is, over with the hole, and fix it securely with three small clips. This can now be painted black, and in use just stands in front of the cabinet back, and in this way magnifies the image considerably. As the cabinet has rubber feet at the bottom, the height of the lens is just corresponds with that of the picture tube.

To house the assembly when not in use make two C-shaped clips and fix these to the inside of one cabinet side, on the right facing back, preferably, to accommodate the feet of the lens stand. Then screw a short length of 3/4-in. wood to the inside top of the cabinet, nearly flush with the top of the lens frame, and old enough to hold it in place with the feet in the holes provided.

The first periscopic hole is then closed, and the terminal is brought through the back of the cabinet. As this is so designed to suit down and watch the programme provided by the B.B.C. transmission, this magnification must be avoided in.

Having connected the earth terminal to the earth point on the set switch, on the 'Photograph' five or ten minutes before the television transmission is due to start, allow the motor to warm up and run steadily. Assuming the London National Station which broadcasts the television programme has been previously tuned in, when started the transmission begins, some form of image, very probably distorted, will start with, will be seen in the right-hand cabinet aperture.

A series of shaped lumps will be noticed sweeping upwards and downwards, depending on whether the motor is running too fast or too slow, the correct speed being 7.5 revolutions per minute. The variable motor resistance must be adjusted carefully until the lumps lie horizontally or being.

A series of plates will be noticed sweeping upwards and downwards, depending on whether the motor is running too fast or too slow, the correct speed being 7.5 revolutions per minute.
The Beginner’s Supplement

Choosing and Using Resistances

In this Article the Author Simply Explains How the Correct Type and Value of a Resistance for any Purpose can be Decided Upon.

With the evolution of new and up-to-date circuits it is necessary that resistances (or more correctly, resistors) are being required in rapidly increasing numbers. A few years ago the only resistors that one could find in standard type of receiver was the grid leak, but nowadays quite an ordinary three-valve battery set might contain a good dozen, whilst more complicated circuits (especially those for mains working) frequently contain a score of resistances of various patterns. There is no doubt that, although many of the resistances are not absolutely essential, they do improve the performance of another type of receiver in addition to simplifying the operation to a considerable extent. That is all well for the advanced experimenter who understands the function of each component, but the beginner is very apt to find himself quite “at sea” in trying to decide upon the correct type and pattern for any particular purpose. It is hoped to remove any such difficulty by explaining the applications of each pattern, and showing how the resistance value can most easily be determined.

Types of Resistances

In the first place let us consider the principal varieties of resistances. First, there is the wire-wound one which is generally employed in positions where a good deal of current has to be carried, and where a certain amount of self-inductance is of no consequence. Then there is the so-called metallized resistance, which usually consists of a thin “lead” 1 of metallized material running through the centre of a porcelain rod which has metal connecting caps or wires at each end. Another type of resistance is the “composition” one in which the resistance element consists of a composition made principally of finely-divided carbon, this being caught up in a bakelite, glass or porcelain tube. Lastly there is the so-called spaghetti resistance in which the element is very thin wire wound in helical fashion on a core of asbestos string. This kind of component is very convenient, since it can generally be connected directly to the terminals of other components; but it is somewhat fragile due to the very thin resistance wire which must be used in making it. Consequently, it cannot carry heavy currents, and is liable to be fractured if it is “kinked” or bent to a sharp angle.

Neglecting the spaghetti resistance for a moment, it can be broadly stated that the wire-wound component is most suitable for carrying heavy currents, partly because the wire has a higher current-carrying capacity than have carbon compositions, and partly because the heat developed can more readily be dissipated. Moreover, this kind of resistance is “permanent” and cannot cause crackling sounds due to its resistance value fluctuating frequently. The carbon composition type, on the other hand, is more liable to introduce crackling sounds, due to the variable contact between the particles of conducting material. In making the statement it should be pointed out that there are a few composition resistances in the market which are practically as reliable as wire-wound ones, especially when they have to deal with comparatively low currents. Metal resistor are either similar in their properties to composition ones, but on the whole they are probably more reliable. The last kind of resistances, those in which a conductive film is deposited on a porcelain or similar rod, can be classed along with metallized ones, since their properties are found to be very similar indeed. It would appear that they would better able to dissipate any heat developed, but this does not seem to be the case in practice.

Variable Resistances

All the above remarks have actually been applied to fixed resistances, but most of them are equally applicable to variable resistances and potentiometers, the only difference being that there are but two general types of variable resistances. One type is wire-wound, and should be used when there is any appreciable current (more than 1 milliamp or so) to be carried, and the other is the carbon composition type, where a layer of film of carbon is traversed by a rotating arm. For illustrations of the various types of resistances mentioned see Fig. 2.

Finding the Correct Value

The first thing that the beginner requires to know about resistances is how the correct value for any particular requirement can easily be determined. This brings us to the old favourite, Ohm’s Law, which states that the current flowing in a circuit is equal to the applied voltage divided by the circuit’s resistance; the three factors must be in amperes, volts, and ohms. As however, it is generally milliamperes, which are dealt with in a wireless set, it is better to modify the law by saying that the current (in milliamperes) is equal to the applied voltage multiplied by a thousand, and divided by the resistance in ohms. By re-arranging the expressions in the formula we can get the equation that the voltage dropped by a resistance is equal to the current (in milliamperes) multiplied by the resistance in ohms and divided by a thousand. Similarly we

(Continued overleaf)

Fig. 1.—The above sketch and circuit show the various resistances referred to in the text.
can obtain the equation that the resistance required for any circuit (in thousands of ohms) is equal to the voltage to be dropped divided by the current in milliamps.

The Wattage Rating

Another factor which must be decided before a resistance is bought is its required wattage rating. The Wattage Rating of a resistance is determined by multiplying voltage by current (in millamps): thus a valve filament which takes 1 amp, at 2 volts consumes .1 multiplied by 2, or 2 watts. On the other hand, a resistance which, when passing 20 milliamps, "drops" 100 volts will consume .02 (20 milliamps, expressed in amperes) multiplied by 100, or 2 watts. Another way of finding the power consumption of a resistance is by squaring the current it passes in milliamps.)

Fig. 2.—Various types of resistances are shown in the above sketch; some of these are sectionalised to indicate the form of construction and multiplying that by the ohmic value of the resistance. For example, a resistance of 5,000 ohms which carries a current of 20 milliamps, must have a power rating of .02 squared multiplied by 5,000, or .0004 times 5,000 which is just 2 watts.

Resistances in H.T. Circuits

The simple calculations which have been explained are applicable to most resistances required in the high and low-tension supply circuits of a wireless set, but are of little value when deciding upon the resistances called for in high-frequency circuits. These latter require rather special consideration, and their functions will best be understood by referring to the more or less standard circuit arrangement for a three-valve variable-mu H.F. detector-pentode receiver such as shown at Fig. 1. All the resistances, both fixed and variable, have been numbered for easy reference.

The purpose of R.1 is to act as a voltage control by varying the amount of signal passed on to the first tuned circuit from the aerial. Its total resistance must be much higher than the (high-frequency) impedance of the first tuned circuit. A value of from 100,000 to 200,000 ohms is generally correct. The resistance element must be entirely non-inductive or else it will create various "resonance peaks" which will affect tuning; it has not to carry any D.C. current, and the correct component of the composition type is to be preferred on every count.

R.2 and R.3 act together as a fixed-potentiometer, their purpose being to apply the correct potential to the screening grid of the first valve. Assuming that the latter grid had to carry no D.C. current, and that its resistance would be in the same ratio as that of the S.G. potential to the total voltage of the H.T. battery. For example, if the screening grid required 50 volts and the battery gave 100 volts, the two components should be of equal value; if the screening grid required 40 volts, and the battery gave 120 volts, R.2 should be half the resistance of R.3, or one-third of the sum of the resistances of R.2 and R.3. Actually, R.2 does carry a small D.C. current, and this fact modifies the calculation slightly, although for most purposes this can safely be ignored. It is generally best to choose R.2 and R.3 so that their combined resistance is approximately 100,000 ohms.

R.4 and R.11 are for the purpose of protecting the passageway of the valve and its circuits although they must offer little impedance to L.F.; values from 25,000 ohms upwards would serve the purpose. Both resistances should be non-inductive, but, as they have to deal with alternating current only, this is not an disadvantage.

R.6 is to prevent the passage of L.F. interference circuit, and may have a value of between 100 and 500 ohms.

R.5 is a potentiometer, the purpose of which is to apply a variable potential to that of the first valve. Progressing it, it could have any value from about 5 to 100,000 ohms, but if the value were so low as the first figure the G.B. battery would rapidly be exhausted, whilst if it were so high as the latter it would not provide the "nicety" of control that is desirable. Thus the value generally chosen is somewhere between 25,000 and 50,000, and it does not matter much which of the component is wire-wound or of the composition type, although the former is generally the cheaper. It is also desirable that R.5 should be "graded" in order that its resistance value should change by a lesser amount for any given movement of the knob when the latter approaches the "positive" position.

R.8 is used to couple the detector valve to the L.F. transformer, and it should have a resistance equal to or less than the total H.T. voltage to a figure suitable for the anode of the detector. Generally its value will require to be between 10,000 and 50,000 ohms, but this can be determined by calculation, as also the necessary voltage rating.
In previous articles of this series I have described in fair detail the construction of practically every type of screened tuning coil normally required, so that some further information in regard to the use of the coils described will prove useful. Different types of single coils have been dealt with and circuits have been given to show how two or more of these could be employed together. The principal difficulty in using a number of the coils, however, has been that a separate wave-changing switch has been required for each, thus complicating matters to a certain extent. Fortunately, a new switch has lately been placed on the market by Messrs. Wilkins and Wright (of "Utility" fame) which is an excellent adjunct to the coils described in this series. Besides giving some useful circuits and other information.

By FRANK PRESTON.

This is the Fifth and Concluding Article of the Series, and in it the Author Describes Some Simple Methods of Ganging Sets of the Coils Previously Described, Besides Giving Some Useful Circuits and Other Information.

Fig. 1.—A flat switch of the type referred to. The particular component illustrated is a 3-pole change-over switch.

Fig. 2.—Different methods of using the flat switch with sets of the coils described in this series.

Fig. 3.—A convenient method of mounting the flat wave-change switch beside a set of coils.

Fig. 4.—A neat way of building up a complete coil and switch assembly.

Making Your Own Screened Coils

All-Wave Tuning

Coils for short waves, as well as for the broadcast bands, have been fully dealt with, but no information has yet been given in regard to employing a combination of broadcast and short-wave coils in an all-wave receiver. This is certainly a combination that is rapidly becoming more popular, and which has been proved (by the "All-Wave Two" and the "All-Wave Unipen," both described in PRACTICAL WIRELESS) to be thoroughly satisfactory and efficient. The circuit of a two-valve detector and low-frequency receiver is given in Fig. 3, where the two coils employed are the second to be described (illustrated on page 684, in Fig. 3) and the short-wave coil described on page 731. A flat switch of the type above referred to is used for shorting out a section of each coil, a separate three-point push-pull switch being employed for cutting out the broadcast coil entirely. This is a very convenient system of wavechanging, since the lower and higher band on either the short or broadcast ranges can be obtained by means of the ganged flat switch, whilst to change from broadcasting to short waves it is only necessary to pull out the knob of the three-point switch.

The circuit is so arranged that the (Continued on page 800)
Points of Interest.
There are a few other practical points which should be dealt with before concluding this series. A reader wrote some days ago from Aberystwyth asking if it would not be better to use silk-covered wire in place of the d.c.e. specified in the previous articles. As reason for this suggestion the reader said that he had been informed that cotton winding should be connected to the anode of the detector-valve, as shown. It will be understood that when receiving on the short waves below some 30 metres, only the side-by-side turns of the choke can be in use, since the others will be virtually short-circuited by their capacity. On moving higher up the wavelength range, greater and greater portion of the total windings will come into use until, on long waves, the whole choke will be in action.

**A Universal Choke**

A "universal," or all-wave low-frequency choke is shown, and most of the components sold under one or other of these names can successfully be used in this position. As an alternative, a short-wave and broadcast choke can be wired into use until, on long waves, the whole choke will be in action.

**CHOOSING & USING RESISTANCES**

(Continued from page 798)

R.10 is an L.F. volume control, and varies the amount of L.F. signal current passed from the transformer secondary to the grid of the or of the pentode. Its function is comparable to that of R.1, although low-frequency, instead of high-frequency, current is being handled. The maximum resistance should be considerably higher than the impedance of the transformer, or else there will be some loss in the way of high-note response. A good value for general use is 250,000 ohms, and the component may be either wire-wound or otherwise; the former type is liable to be a bit "noisy" when the pentode is in use, although this is in many cases reducible — if not of very sound construction — to the fact that the resistance is high. In the case of R.5, it is an advantage to limit its resistance to a low figure, so that the resistance variation near the "full-volume" (grid) end of the element is less than at the other end.

R.12 is for decoupling the priming grid of the pentode, and it also cuts down the voltage to a suitable figure; the method of deciding upon its value is to use a value that will limit the d.c.e. to 0.005 mfd. or less. If any proof of it. In any case, whether using shellac or wax, make quite sure that only the thinnest possible layer is applied, because it will increase the thickness of the finished coil and thereby reduce its efficiency to some extent.

The difficulty just referred to would, of course, be non-existent with enamelled or silk-covered wire. Enamelled wire was given as an alternative in the specifications in respect to all the coils dealt with. However, a suitable provided that care is taken in winding it to prevent adjacent turns rubbing each other and scraping away the insulation, and that the number of turns should, theoretically, be modified slightly, due to the fact that the inductance and self-capacity are changed. In practice, however, the difference is generally so slight that the correction factor need not be taken into consideration. The only point that should be considered is that there must be no increase between the ends of winding. This should be the same as those mentioned and shown in the various drawings. And as enamelled and silk-covered wires are the same as those used, the medium-wave turns occupy a shorter space on the former. The same remarks apply to silk-covered wire as to enamelled, except that in this case there is no danger of the insulation being scratched.

There is a little point in regard to soldered connections that ought to be dealt with. Use of an emulsion of white lead and chloroform was mentioned. This is the best flux of all is resin, because this is not corrosive, but it leaves a protective layer on the joint and is not "messy" in use. Additionally, it is an insulator, so that if any should "splat" when the hot soldering iron is applied, no harm can be done.
THE capacity of a conducting sphere in infinite space is, in electrostatic units, defined as equal to its radius in centimetres. To avoid the use of the term "infinite", it is easy to interpret this by saying that will in the open the capacity of a conducting sphere is somewhat greater than its radius expressed in cm. This enables us in many cases to assess the capacity of a component or part of a component by mere inspection with sufficient accuracy to decide whether it is important, and to compute what its effect will be on the circuit of which it forms a part, but the result being in centimetres means nothing to the ordinary man used to dealing with microfarads. The conversion factor fortunately is simple and easy to remember.

One micro-micro-farad = 0.9 microfarad.

The conversion factor for the capacity in mmf. is solely specified for the NUCLEON CLASS B FOUR.

FR6 - PM - 22 - Class B (39/6)

Whenever the highest quality and the most impressive volume are required, makers and constructor set designers alike turn instantly to Rola to satisfy their requirements. And Rola has never let them down. For realistic reproduction Rola speakers are in fact as well as name the World’s Finest Reproducers.

Rola is fitted in 5 seconds to battery receiver, this remarkable unit will increase its volume and sensitivity at least 5 times. Ask your dealer to demonstrate. PRICE 57/-.

THE BRITISH ROLA CO. LTD., Minerva Road, PARK ROYAL, N.W.10.
Phone: Willesden 4322-3-4-5-6.
Short Wave Section

The Lesser Logged Short Waves

By E. Thurway

31.63 metres (9,485 kc/s). Jodky, which relays the Oslo broadcasts, is now working on 42.92 metres (6,990 kc/s) on which channel it is providing both excellent quality and exceedingly loud signals. You will hear on this wavelength the usual musical-box signal usually associated with the Oslo entertainments in the higher broadcasting-wave band. Vienna (C0H2) on 49.41 metres (6,075 kc/s) has also resumed its work on Tuesdays and Thursdays, and may be picked up at odd hours between G.M.T. 13.30 and 21.00. There is no change to report in the time schedules or frequencies of those British, French, and German transmitters.

The station used by the Technical College of the University of Bucarest, which had been switched off, has been put back on again. It operates now on 31.63 metres (9,485 kc/s) and is on Sundays from G.M.T. 15.00. It may be identified by the fact that the studio possesses a woman announcer and that the call frequently given out is Radio Romania.

In the 49-metre Band

In the 49-metre band we find several, but lesser logged foreigners. In the previous one by the fact that it announces the Radio-Difusora de Guayaquil. A further Venezuelan station, namely, YV3BC, Caracas, on 48.92 metres (6,132 kc/s), the relay of the medium-wave broadcasting station in that city. From G.M.T. 21.00-02.00 on week-days is the Panteon broadcasting station, which gives a fair stage at that time the transmissions are carried out on 31.56 metres (9,510 kc/s). In the call you will hear a reference made to the Radio-Difusora de Guayaquil. A further Venezuelan station, namely, YV11BHO, situated at Maracaibo, operates on 48.95 metres (6,127 kc/s). You may distinguish it from the previous one by the fact that it advertises itself as the Broadcasting Company of Guayaquil - a man presides at the microphone.

Exploring the other with a good short-wave receiver to-day provides a fresh interest in radio; moreover, it permits its owner to hear transmissions which are not announced in the ordinary broadcast band.

THE WIRELESS CONSTRUCTOR'S ENCYCLOPEDIA

(2nd Edition)

By F. J. CAMM

This invaluable encyclopaedia is written in plain language by one of the most accomplished amateurs and is illustrated by over 500 diagrams and over 1,000 photographs. It is a useful book for wireless constructors, designers and writers on wireless construction. The whole subject is fully covered, and the volume is remarkable for the accuracy and value of practical illustrations it contains.

No matter in which branch of radio you are interested, you will find everything you need at a glance.


January 6th, 1934

PRACTICAL WIRELESS
Loosely-Fitting Coil Covers

There is a point regarding tuning coils which is worth mentioning. I refer to the setting of the covers of the "canned" type. Sometimes these do not fit at all tightly. This may not at first appear to be a very serious fault, until we remember that the position of the cover affects the tuning range. This means that, in the case of ganged circuits, any movement of one of the coils causes it to upset the ganging. Of course, some coils have the covers held firmly in place by means of a nut on top. A simple safeguard of this nature is really all that is necessary. Sometimes the covers fit fairly well, but tend to move when operating the wave-clamps switch incorporated in the base of the coils. I came across an example of this in a set of three coils mounted on one base with the switches linked by a rod in the popular manner. Every time the switch knob was turned the three covers wobbled from side to side!

"Intermittent" Rating of Accumulators

I should also like to give two suggestions concerning accessories. The first concerns the rating of accumulators. Could not the out-of-date and misleading "intermittent" rating be discontinued? It was based on the purely arbitrary assumption that an accumulator used to power a trembler coil, as for motor ignition or similar purposes, would last twice as long as when on continuous discharge. Under this system an accumulator capable of delivering 20 ampère-hours of electricity would be marked "20 amp.hrs.int." or "20 a.h.". Often, however, the "int" is omitted and the purchaser is led to believe that he has a 20 amp.hrs. battery whereas, in reality, it is only of 10 amp.hrs. capacity. Of course, if as regards shape and size, actual " there can be no mistake, but, as it is, a rating of 20 ampère-hours without any other qualification may mean either of two figures. If the intercutten system were abolished there would be no possibility of ambiguity.

Battery Cords

The other suggestion I should like to make is that portable and such like receivers are often supplied with what is called a "scratching" cord. This is a braided cord with brass contacts or clips somewhat similar to pocket-lamp batteries. This arrangement would make life extremely difficult! I have several times seen one of these cords plugged into the wrong sockets. It was probably used to vary the potential applied to the detector grid through the grid-leak, but it can now be employed as an automatic grid-bias resistance in the L.F. circuit. The method of connection is perfectly simple, as can be seen from the sketch given at Fig. 6. The lead which was previously connected to the negative H.T. wander plug is now joined to one side of the potentiometer, whilst the other end is taken to the G.B. negative terminal and to the negative wander plug on the high-tension battery. In order to prevent instability a fixed condenser is connected in conjunction with the grid. The condenser shown is a 23 mfd. electrolytic one, this being most suitable, but if such a condenser is not readily available, an alternating current type of 2 mfd. capacitance and 50 volt rating may be used as substitute. A correct value of bias for some types of valves can be obtained by varying the slider of the potentiometer. The maximum bias required will tend to be too low for valves of other types, and in such cases it will be necessary to include fixed resistance in the lead between the potentiometer and the grid-bias resistance in the L.F. circuit; this is shown by broken lines in Fig. 5. In any case the actual resistance value required can be found by dividing the grid-bias voltage required by the valve at maximum anode voltage by the anode current taken under the same conditions, and multiplying by a thousand. All the information required for this calculation can be obtained from the makers' instruction sheet. An example will remove any difficulty in following the above statement. For demonstration purposes I shall use the Cossor 220 P.T., which requires 9 volts G.B. and takes 23 milliamps high-tension current. The bias requirement is therefore 9 divided by 23 and multiplied by 1,000, or 391 ohms. Suppose the valve in use had been a Cossor 210P, which requires a G.B. voltage of 7.5 and consumes 10 milliamps anode current, the bias resistance necessary would be 750 ohms, and therefore a fixed resistance of about 500 ohms could be wired in series with the potentiometer and the optimum setting of the potentiometer slider found under working conditions.

Scratch Filters

It frequently happens when using a pick-up that needle scratch is troublesome and some kind of filter is desirable in order to eliminate it. Some amateurs who have experimented with this, have found that a potentiometer and a variable condenser may be used to advantage. It is easily shown that the pre-set condenser should be adjusted until needle scratch becomes inaudible or is reduced to its lowest volume level.
DUBLIUM SMALL ELECTROLYTIC CAPACITORS

A FURTHER accomplishment of the new small electrolytic condensers marketed by BillTISH Condenser Company has been reported. These are of the type primarily designed for radio work, and are fitted at one end only by a standard terminals, and at the other end by a pair of terminals in the form of a small fixed condenser.

British Radiophone Perfection Seven

British Radiophone, Limited announce the forthcoming of a new model of their successful line of portable receivers. The new model is known as the Type A, and is designed for use with the existing valve stock, and is suitable for plugging into the existing valve holder. This makes it possible to use the new model in conjunction with the old model, and to fit only the valves that are required. The new model is also suitable for use with the old model, and is a good two-valve receiver.

Testing Multi-Pin Valves

Users of the Six-Hundred and Sixty Series valve and set testers have probably found that it is impossible to test the new multi-pin valves with these testers. The same point applies to all users of equipment in which the standard type of holder for a valve is used. The Six-Hundred and Sixty valve testers have a number of interesting features which gives the following table of results:

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Ground Pin</td>
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<tr>
<td>2</td>
<td>Plate Pin</td>
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<td>3</td>
<td>Grid Pin</td>
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<tr>
<td>4</td>
<td>Screen Pin</td>
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<tr>
<td>5</td>
<td>Plate Pin</td>
</tr>
<tr>
<td>6</td>
<td>Ground Pin</td>
</tr>
</tbody>
</table>

The capacities range from 2 microfarads to 60 microfarads, and the price is £2.6d.

The New Peto-Scott Loud-Speaker

A NEW multi-pin loud-speaker of sound design is now offered by the Peto-Scott Company. This loud-speaker is designed for use in the stock of this company and is completely compatible with the old model. The magnet system is of the orthodox type, and a 5-watt amplifier is provided for driving purposes in mains connections. The leads are plugged into the socket of the valveholders, and the fixed condensers may be fitted into the terminal strip at the rear. The leads to the terminal should be fitted, and then the three coils mounted in the space provided.

Building the Nucleon 4

The two-pin condensers should be placed on the rear panel components, and then attached to the valveholders and the fixed condensers. The capacities range from 2 microfarads to 60 microfarads, and the price is £2.6d.

Building the Nucleon 4

The Nucleon 4 is a portable radio receiver, designed for use with the existing valve stock, and is suitable for plugging into the existing valve holder. This makes it possible to use the new model in conjunction with the old model, and to fit only the valves that are required. The new model is also suitable for use with the old model, and is a good two-valve receiver.

The capacitors range from 2 microfarads to 60 microfarads, and the price is £2.6d.

The new model is slightly dearer, and is of more robust design. The magnet system is of the orthodox type, and is larger than the previous model, which is still in production.

The leads to the terminal should be fitted, and then the three coils mounted in the space provided. The leads to the terminal should be fitted, and then the three coils mounted in the space provided. The leads to the terminal should be fitted, and then the three coils mounted in the space provided.
A Very Useful Little Kit

SIR,—I received the PRACTICAL WIRELESS Kit tools safely, with which I am delighted. They are a very useful little set, and are well worth the money. I am a regular reader of your valuable paper, so I shall use a set of spanners and drill gauge. Every success to PRACTICAL WIRELESS,— F. HANCOCK (Burton-on-Trent).

“Time Constant”

SIR,—In the December 2nd issue the term “time factor” is mentioned in PRACTICAL WIRELESS. The Subdividing of Copper.” I would be grateful if you would tell me in plain words:

1. Where the question of time comes in?
2. The importance of the “time factor.”
3. And physical explanation of the term.

In reading an article on electric instruments I came across a Maximum time factor = L/R = R/C, which brings the word LT for resistance of a circuit, but it is also applied to circuits having a capacity and resistance in which the time constant is a R/C.

More generally it applies to any physical change, whether electrical or otherwise, which follows the logarithmic law. For example, when an E.M.F. is applied to a circuit that comprises a resistance only the current rises immediately to a value = V/R.

If there is an inductance also in circuit the current rises logarithmically, ultimately reaching the value V/R, but the initial rate of rise is determined both by the inductance only and the time constant is the time which would elapse if this initial rate of rise were continued till the value V/R is reached. The actual current flowing after that period of time is approximately two-thirds of the full value V/R.—Ed.

A Wonderful Kit

SIR,—I wish to take this opportunity of thanking you for your wonderful Pocket Soldering Kit which arrived O.K. It is the ideal kit for the wireless enthusiast.—J. E. BISHOP (London, W.C.).

“Exactly What Is Required”

SIR,—I should like to take this opportunity of writing to you a few words about your paper every success. I consider that it is about the best weekly wireless periodical that I have read since about 1922. No, I have not been a reader since No. 1, but that I regret. How- ever, I consider that your gift Tool Kit is exactly what is required by a person who spends nearly all his time at the experimental bench.—G. BARTHOLOMEW (Bul- ford).

“The Ideal Tool Kit”

SIR,—I must write and thank you for the really first-class Tool Kit which arrived immediately to a value = V/R. The actual current flowing after that period of time is approximately two-thirds of the full value V/R.—Ed.

DO YOU KNOW?

- THAT whilst indirectly-heated valves are warming up, the primary of an L.F. transformer is very hot, and that when first switching on a mains receiver, it is possible to open the valve cover without difficulty.
- THAT the above point explains the cause of many tuning troubles when the valve cover is cold, and that it is not possible to convert an inductive condenser into a non-inductive condenser by external means.
- THAT, generally speaking, it is not possible to use A.V.O. in a D.C. mains receiver unless a simple inefficient circuit is employed.
- THAT a whistle which accompanies loud- speaker reproduction, and which stops when the grid at the output valve is touched, denotes L.F. instability.
- THAT the simplest cure for the above is to reverse the connections to one of the L.F. transformer windings.
- THAT instability can be caused by the variation of the anode voltage of a tetrode condenser. THAT an H.F. choke may be wound on a taped former to improve its characteristics.
- THAT a receiver, with small sections at either end, acts in a similar manner to the above type.

NOTICE

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. Such articles should be written in one sheet of the paper only, and should contain the name and address of the writer. Whilst the Editor does not hold himself responsible for unsolicited copy, every effort will be made to return to the address of the author of any received contribution.

Correspondence intended for the Editor should be addressed to: PRACTICAL WIRELESS, 9, Wenlock Place, London, W.1.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. Such articles should be written in one sheet of the paper only, and should contain the name and address of the writer. Whilst the Editor does not hold himself responsible for unsolicited copy, every effort will be made to return to the address of the author of any received contribution.

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PRACTICAL WIRELESS

CATALOGUES RECEIVED

In order to render these articles, we undertake to send on ratings of any of our advertisers. Most likely, you are on a prepayment basis, so the new price list will require catalogue numbers, and address to "Catalogue."


MILLARD H.F. PENTODES

CONSTRUCTORS contemplating the use of screened-grid pentodes should obtain a copy of a new National Leaflet on these valves which deals with the properties of the screened plate are fully described, and are followed by charts and characteristic curves of the two pentodes—V.P.4 and V.P.6—and practical operating hints for using these valves in modern circuits.

SEND ONLY $1.5 if posted any further


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The problem of getting a short-wave superhet type converter to work with unskilled receivers has been effectively solved by J. E. Astle and Sons, who have produced a range of compact converters suitable for single- and two-valve types, the two-valve models being intended for an early stage of amplification. The converters are suitable for all types of broadcast receivers, and are obtainable for prices ranging from 8s. to 10s. 6d. The wavelength range of the converters, with the standard condenser fitted, is 450 metres, although this range can be increased to 1200 metres by the use of an additional coil. Booklets containing full particulars of the converters and their uses in various circuits, the hook is well worth while for those who prefer to build their own apparatus, and who wish to include pentodes in their apparatus. All work very well and are a useful addition to the home constructor. Copies of the handbook can be obtained for 3d. each, post free, from the National Automatic Wireless, 56, York Road, King's Cross, N.11.

THE ALL-METAL WAY, 1934.

THE rapid growth of short-wave work has naturally led to the production of a number of handbook dealing with the construction of H.T. battery eliminators and battery converter, and we will be pleased to have a list of the parts you require and the pay-

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High Class "C.A". ADAPTOR

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New Products Offered for Every Order placed on a list of the parts you require and the pay-


EPOCH CLASS B ADAPTOR

The next meeting will be on January 9th, and the members of the club are invited to attend.

Mr. Fielding, who gave a talk on short-

-speakers, and requested that the talk be held on hearing Broadcasting for the first time. Mr. H. B. Holmes, who had enjoyed most interest in this subject. Our new series of meetings will be held at the Loan of the Metropolitan Club, 118, Bunhill Road, London, E.C.1.

INTERNATIONAL SHORT-WAVE CLUB (MANCHESTER)

A large number of short-wave listeners attended the inau- guration of the Manchester Chapter of the International Short-Wave Club, Ltd., held on December 12th, at 75, Long Street, Middleton, near Manchester, 10, C. P. Green, 3, Allied Newsagents, Ltd., and Mr. P. Sharp were present. Mr. H. W. Holmes, who gave a talk on short-wave receivers, and requested that the talk be held on hearing Broadcasting for the first time. Mr. H. B. Holmes, who had enjoyed most interest in this subject. Our new series of meetings will be held at the Loan of the Metropolitan Club, 118, Bunhill Road, London, E.C.1.

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IT was a " Members' Night" at a meeting held

January 6th, 1934


REPLIES TO BROADCAST QUERIES

January 6th, 1934

Mr. Lacy, Madrid, Spain; (49) 11139K, Philip Recordon, "Gold Star," High Hillaries Road, Battersea, S.W.8.

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The address is:
LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES AND ENQUIRIES

by Our Technical Staff

If a postal reply is desired a stamped addressed envelope must be enclosed. Inquiries regarding aerials and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Great cheapest, Ltd., 8-11, Southampton St., Strand, London, W.C.2.

This page must be attached to every query.

If a circuit is made up by you and you cannot detect an increase in volume, there is hardly any necessity to measure it. However, from an instructive point of view, you probably wish to carry out some experiments, and therefore the best way will be to use one of the following apparatus. Obtain a small dial of polished aluminium which can be mounted on a piece of wood in a very thin silk; and stretch the silk between two finely fixed arms. The entire structure should be really rigid, and the length of silk should be adjusted so that any current can rotate at least eight times. This piece of apparatus should be placed in front of your loudspeaker (the optimum distance distance for experiments, for it will be found that the music is directed on the mirror with no signals coming through. When arranged in this way the audible waves will cause the mirror to move about, and you can then arrange the lamp (preferably a small incandescent light) so that its light is directed on to the mirror. The maximum movement will be obtained by the loudest sound, and you should be able to detect with your eyes the slightest change in the position of the mirror. Which produces maximum volume. Of course, the volume and mirror must always be placed exactly in the same position.

ADDITIONAL LOUD-SPEAKER

I was very interested in the recent article on connecting up extra loud-speakers, but in that article the author did not deal with the push-pull circuit. As I am at present using this arrangement, and should like to use an extra speaker, I should be glad of directions for connecting it to my circuit. — W. H. (Bromsgrove).

The conditions of a push-pull circuit are generally similar to a triode employing an output choke. Thus, whilst the push-pull circuit with short-circuit, the two anodes of the push-pull valves are joined together by a choke. The output transformer is connected to the valves in the same way as a triode output transformer. The centre tap of this winding is joined to the anode of the transformer. Therefore, an extra speaker may be joined to the two anodes of the triode, or through a fixed condenser of 2 mils. There is no D.C. flowing in the circuit if it is short-circuited and the condensers are not essential, and they need only be used when the circuit is short-circuited to avoid some trouble. The apparatus. If the present speaker is joined to the anodes of the transformer, or a separate transformer, and to use this for supplying one speaker and the primary to be used as a choke.

STATES

I am rather puzzled by the phenomenon which I receive regularly on my set. If I set the tuning dial to a spot slightly below London there is practically dead quiet. I turn the dial to a spot a little higher than the above, and there is a great deal of noise. However, there comes in a lot of cracking and noises which are stronger and come from the London area. I am in myself unknown with this noise, and would be glad to have any suggestions as to the cause. — R. B. (Pimlico).

It is most probable that the wave-change switch has become faulty, due either to corrosion, or a bad contact caused by a worn spring. There is, however, the remote possibility that one of the long-wave windings may have broken down, although with the majority of commercial coils this should not happen. Examine the switch carefully, and we think you will find that this is the cause of the trouble. The receiver as a set works well on one wave-band and falls on another. In cases like this, the fault can only arise in the part of the circuit which is damaged, and with the majority of broadcast receivers one part of the coil is simply shorted out for receiving waves. The fault is as likely to be in the switch or the portion of the coil which is brought into series.

FUSE SHORTING TO CHASSIS

I am putting up a new set, but am rather puzzled by a peculiar fault which is occurring on it. When I finished and screwed the fuse bulb in it glowed fairly brightly. The switch was "off," and so I pulled it into the "on" position, and was surprised to see the fuse cut out and the valves then lit up and the set worked. Results are really splendid, and I could not wish for a better set, but I cannot understand whether I have made a mistake in the wiring, or whether the fuse should work as it does. It is defined by the fact that the switch is off and goes when the set is on. Is not this right? — W. D. C. (Bromlrove).

The fault is due to the fact that you have received the fuse bulb too hard into its holder, and this has been set to the lowest contact on the insulated switch. If you give the bulb one or two turns upward in the holder, you will find that it is not functioning in the ordinary way. A number of readers seem to have come across this difficulty, and it would therefore, appear to be a good plan to fix a disc of paper or thin card below the fuse holder when mounting this in order to avoid the risk.

THERMAL DELAY SWITCH

"As a new reader of your interesting periodical I have just seen reference to what is called a thermal delay switch. I realize from the name that this operates on a thermorelay basis, but I cannot see its application in a normal receiver. Please could you let me know just what it is, and its general application?" — G. H. (Kettering).

The switch is employed on the mains side of a receiver, which uses a rectifying valve of the indirectly heated type. The heater of such a valve is fed from a heater winding on the mains transformer, and the only heat which travels through the switch is from the same heater winding. Thus, whilst the heater is warming up and only closes when a certain amount of heat (24°C) is reached, the circuit is open until the heater has reached this temperature. Obviously, therefore, when the mains are turned on, the switch is in the "off" position until the heater has heated up to the required temperature. Where the valves in the receiver are of the indirectly heated type the switch is designed to take approximately the same time as the normal I.H. valve. The switch may, of course, be employed in a D.C. mains receiver for the same reason.

WAVE-CHANGE SWITCH FAULTY

"My receiver has been working for quite a long time without any trouble, but I cannot get Davenory or other long-wave stations. When I switch over to long-wave, there is a sort of rustling noise, but there are no signals and reaction also seems dead. Can you give me any idea what is wrong?" — R. B. (Pimlico).

It is most probable that the wave-change switch has become faulty, due either to corrosion, or a bad contact caused by a worn spring. There is, however, the remote possibility that one of the long-wave windings may have broken down, although with the majority of commercial coils this should not happen. Examine the switch carefully, and we think you will find that this is the cause of the trouble. The receiver as a set works well on one wave-band and falls on another. In cases like this, the fault can only arise in the part of the circuit which is damaged, and with the majority of broadcast receivers one part of the coil is simply shorted out for receiving waves. The fault is as likely to be in the switch or the portion of the coil which is brought into series.
PRACTICAL WIRELESS MISCELLANEOUS ADVERTISEMENTS

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SOUTHERN RADIO, 323, Euston S.W.4. THE following valves are guaranteed utilised and manufacturers' guaranteed surplus. BLUE SPOT Cash Waiting. SEND FOR IT ON 7 DAYS' TRIAL. The 362 Radio Valve Co., Ltd. 808, Whitecross St., E.C.4.


PATTERNS & TRADE MARKS


MISCELLANEOUS

January 6th, 1934

ELECTROCHEMICAL INSTITUTE, Tufnell Park, N.7. E.C.

PRACTICAL WIRELESS RACING WIRELESS

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PRACTICAL WIRELESS RACING WIRELESS
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For full particulars for claiming awards and a complete list of numbers see TIT-BITS

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Information covering the engine, breather, valve springing, the lighting system, the carburettor, cooling system, dynamo and alternator, steering gear, brakes, wheels, axles, tracing maps, etc.

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How to make clockwork toys, model aeroplanes, model boats, model-batts, ingenious toys operated by sand, wooden models and toys, electrical toys, steam toys, guns, holdding-ups, etc.

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A Sensible INVESTMENT for everyone in the Wireless business.

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This fully illustrated new work deals with the whole theory of wireless from the very simplest principles up to the most advanced stage. It shows you the most up-to-date practice as exemplified in the fine commercial sets which have been placed on the market recently. It shows you the possibilities of short-wave work, and contains numerous useful designs.

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