Capt. E. H. ROBINSON, the well-known radio expert, author of "Perfect Broadcast Reception," etc., etc., says of British Radiophone Condensers, "This firm still provides the very best variable condensers made. If you want the best there is no alternative."

This splendid testimonial, coming from such an authoritative source, speaks for itself.

MATCHED PERFECTION ENSURES RESULTS

Radiophone Condensers incorporate many patented unique features, such as Radial Wedge assembly of vanes, Springloaded Tapered Bearings with "Keep Plate" Anchorage. The Steel Girder Frame method of assembly and three-point Suspension guarantee freedom from mechanical distortion. Every Radiophone Condenser is matched section by section at six points of the tuning scale to within \( \frac{1}{4} \) per cent. One has only to balance out the stray circuit capacities with the aid of the trimmers conveniently provided at the top of the unit to ensure permanent MATCHED PERFECTION.

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SPECIFIED FOR THE "PREMIER SUPER" British Radiophone Super Hot Three Gang Midget Condenser
Type 693 Price 22/6
With full vision tuning dial 3/- complete
The Igranic Variable "Megostat" High Resistance. Designed and constructed to the highest standards of radio engineering—finish in keeping with the reputation of Igranic—special contact preventing wear and ensuring constant resistance value—can be used as a volume or tone control, as a variable grid leak or as stabilising resistance, etc., in single-hole fixing—at the reduced price of 3'6 in four sizes—another example of that efficiency of performance and reasonableness in price which are typical of every item in the Igranic range. Let Igranic Components be the making of your set.

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PERFECT PUREST POWER TONE

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We stress that word fidelity. No matter how efficient your receiver, its efficiency is of little use unless the reproducer does faithfully recreate the original transmission.

That is just one reason why we are so anxious that you ask your dealer to demonstrate an R. & A. Reproducer. He will gladly do so, and you will have an opportunity—without obligation—of hearing a performance which will prove a revelation to you.

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SIEMENS ELECTRIC LAMPS AND SUPPLIES LIMITED 16/18A, THOMPSON STREET, LONDON, E.C.4
At last the day of All-World Radio has arrived, and you can build with your own hands the first receiver to give you not only England and Europe, but America and Australia direct. The Lissen All-World All-World "Skyscraper" 4 tunes from 12 to 2100 metres. It brings two complete new wavelength ranges within reach of the ordinary listener — stations and programmes which before he was never able to receive — Ultra-Short and Short-Wave transmissions from all parts of the earth. And, remember, you get these stations through Double-Balanced Output giving brilliant reproduction on a Moving-Coil Speaker — as much power as a Mains Set from ordinary, high-tension batteries. Lissen have made this All-Wave All-World Radio available to Home Constructors first, because it brings back the thrill of conquest to hear America and Australia direct on a set you have built yourself, it makes you an enthusiast to realise what a wonderful thing you have created!

And when you see the Great Free Chart of the All-Wave All-World "Skyscraper" 4, which tells you how to build it and how to work it and why it gives such marvellous results, you will agree at once that it will be wise of you to build for yourself rather than buy a factory-assembled receiver which cannot give you these new and intriguing short-wave stations. The FREE CHART simplifies everything; there are pictures of every part, with every wire numbered, every hole lettered, every terminal identified. YOU CAN'T GO WRONG! But get the Chart and see for yourself — then build the Lissen All-Wave All-World "Skyscraper" 4, the SET THAT SPANS THE WORLD!
The New Lisbon Station

TESTS are being carried out by the Daily Mail to ascertain whether a transmitter now nearing completion at Lisbon; the wavelength allotted to this station by Lucerne is 27.69 metres (829 kc/s), but between October 5th, when it is hoped to bring it into operation, and January it will work on 28.22 metres (1,063 kc/s). The call is: BBC Lisbon.

France's New Station:

The high-power transmitters already under construction are those of PIT, Paris (120 kw.), Nice (60 kw.), Lyons Pitt (100 kw.), and Toulouse Pitt (120 kw.). Orders have now been placed with French makers for stations to be erected at Lille (60 kw.), Renens Thourie (100 kw.) and Marseilles (60 kw.). The first four are to be ready by the spring of 1934.

Egyptian Broadcasting System

At the Lucerne Conference the Egyptian Government was granted six channels for the working of broadcasting stations. The 20 kilowatt transmitter now being built at Abo Zabal, near Cairo, will operate on 483.9 metres (620 kc/s), a wavelength shared with Brussels. The programmes will be relayed by Alexandria on 267.4 metres (1,123 kc/s), a channel on which the high-power North Scottish Regional will also work later. Tests by the Cairo station are expected to take place towards the end of November. Further stations will be installed in upper Egypt when required.

To Combat German Propaganda

It is reported that the Polish Authorities intend to erect a station at Gdynia, a port on the Baltic of Danzig; it is to be used as an antidote to the anti-Polish propaganda broadcast through the German Königsberg and Heilsberg studios.

Sundays Only

BOORMENDAL (Holland) owns a small 200-watt transmitter which is only used on Sundays; it relays a sacred service from the local Reform Church at 9.40 a.m. and again at 4.40 p.m. The station has been in existence for the last five years: it works on 245.3 m.

Wireless Picture Transmissions

A s many readers will have noticed, the daily papers frequently contain illustrations which have been telegraphed from foreign countries. In some instances the transmissions are made over landlines and submarine cables, in others by wireless. There are at present established services operating between London, Rome, Lyons PTT (100 kw.), and Toulouse (20 kw.). Orders have now been arranged to supply a limited number of sets of these spanners at 3s. each set, post free. Fill in coupon below and send with 3s. in stamps, addressed to: —

Spanner.
"Practical Wireless."
Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.

There are at present established services operating between London, Rome, Lyons PTT (100 kw.), and Toulouse (20 kw.). Orders have now been arranged to supply a limited number of sets of these spanners at 3s. each set, post free. Fill in coupon below and send with 3s. in stamps, addressed to: —

Spanner.
"Practical Wireless."
Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.

The Highest Transmitter in Europe

DOUBTFUL the record must he held by the small wireless station erected at the summit of the Lée du Midi de Bagneres in the Pyrenees (France), at no great distance from the famous Lourdes Pilgrimage. The transmitter is situated at 3,860 metres (9,842 feet) above sea level, and is used for the broadcast of meteorological observations. During eight months of the year the officials of the Observatory, owing to heavy snowfalls, are completely cut off from the outside world. Transmissions are carried out on 277 metres (1,085 kc/s) and on 77 metres (3,800 kc/s); it is on the short wavelength that the Observatory is in touch with the French National Meteorological Office, to assist in the compilation of weather charts.

Cincinnati's Giant Transmitter

WVLW, the new 500 kilowatt station which is being built at Mason, Ohio, is expected to be ready to test in February. Its wavelength will be that of the present transmitter (429.3 metres). An idea of the size of this plant is given by the fact that to cool the 100 kilowatt valves the daily supply of water required is that used by six thousand average families!

To Assist Foreign Listeners

IT is often very difficult for British listeners to pick up programmes from Belgrade and Ljubljana. So far no alternative channel has been available. In future Czechoslovakia and Jugoslav will exchange a series of evening entertainments, and in this manner the latter's best broadcast will be well heard through Prague.

Classification of Short Waves

In view of the Marchese Marconi's experiments with micro waves, an endeavour is being made to give descriptive names to the higher frequencies now used for transmissions below 200 metres. Down to the 10 metre wave band, it is suggested that the channels be designated as short waves; from 10 metres to 1 metre, “metre” waves; from 0.10 metres to 0.10 centimetres (0.10 metres) “decimetre” waves; 0.09 centimetres to 1 centimetre as “centimetre” waves, and the lower wavelengths down to 0.001 as “millimetre” waves.

Italy possesses two networks for the interchange of programmes, the Northern one comprising the studios of Milan, Turin, Genoa, Trieste and Florence. The Palermo transmitter will be added to the Southern net shortly.
ROUND the WORLD of WIRELESS (Continued)

International Programmes
Arrangements have been made by the U.I.R. (Geneva) for a series of International concerts to be relayed by a number of Continental stations. They are to be contributed by Buenos Aires (September 3rd), Budapest (November 8th), Berlin (December 8th), and to be followed in 1934 by Prague (January 6th), Brussels (February 7th), Belgrade (February 23rd), London (March 29th), and Stockholm (April 4th).

Fail in German Listening Licences
In August, 1933, Germany possessed 4,480,278 licensed listeners, or 37,828 fewer than on the corresponding date in July. Over 351,000 free licences have been distributed by the authorities to unemployed and war invalids.

Radio for Snake Charmers
At the Algerie (Radio Alger) studio, before an invited audience, an air performance made his snakes away rhythmically to the music of a broadcast transmission. It was demonstrated that the conventional reed pipes were not a sine qua non; but that even the relay of a foreign synchronised dance band was able to charm the reptiles!

Luxembourg's Midday Programmes
In addition to the concerts broadcast every evening at 7.0, 8.30 and 10 o'clock, Radio Luxembourg is now on the air daily with a lunch-hour transmission from 12.30 until 1.0. The wavelength is 1,190-5 metres; the power 200 kilowatts.

German Amateur Transmitters
Following a total cancellation of all licences, the German authorities have now granted permits to 184 amateurs to carry out experimental broadcasts. Stringent conditions have been imposed. All licences must be recognized by members of the National Socialist Party, and are required to advertise Nazi aims in all their broadcasts to foreign countries!

Cathored Pentode Output and Moving Coil Speaker

SOLUTION TO PROBLEM No. 54.
Whalever overlooked the fact that there would be a voltage drop due to the current passed through the smoothing choke, and also found that the grid bias voltages had to be added to the total high tension voltage. He therefore required at least 250 volts in order to satisfactorily operate the receiver.

List of Prizewinners for Problem No. 53:
Mr. Wm. Michael, 82, South Road, Bowden, Staffs; Mr. S. W. Salmons, 41, Onufaide Road, Colchester; Mr. E. R. Holings, Blackfenbridge, Croydon, England.

The LATEST COLUMBIA FOUR-VALVE RECEIVER

Is This a Record?
Jean Roy, the Radio Toulouse (France) announcer, in a recent interview, stated that from April 1st, 1925, when he first took up his duties, he has provided listeners with an 'at least one hour of continuous airtime for more than 22,000 hours!'

BERLIN'S DEUTSCHENSNDER
As the Germans are anxious that transmissions from their high-power station should be heard not only throughout Germany but also in neighbouring countries, the power is to be increased to 120 kilowatts. At the same time a new system of aerial towers is to be used to eliminate fading effects in the broadcasts. There also exists the possibility that a more favourable site than Zeven may be found for the new station.

Record Short-wave Transmissions Between Aircraft in Flight
Remarkable instances have been forthcoming lately from the Empire routes of Imperial Airways of long-range wireless communication between aircraft in flight, and also between aircraft and ground stations. The other day, while one of the new "Atlanta" type air-liners was flying near Mpija, on the Africa air-mail, its operator got into touch and maintained communication for several minutes with another aircraft of the same type which was then in the neighbourhood of Victoria West, approximately 22,000 miles away. Even at such a distance—representing a record for communication between aircraft on the Empire routes—both operators found reception excellent, and no general interference. Recently, also, while the air-liner "Astraea" was making an 4000-mile survey along sections of the new more route between India and Australia, a second aircraft on the same route was able to work it and why it agreed at once that it was two-way communication from the air was rather than buy a factor published with Sydney over a distance you three new and interesting more than 3000 miles, and maintained CHART simplifies everywhere difficulty for some time.

The Promenade Concerts Season
The Promenade Concerts end on October 3rd, in which the B.B.C. has announced the opening of its winter season of Public Concerts on October 18th. There will be the season of eighteen Symphony Concerts on Wednesdays, starting on October 18th and continuing weekly until December 13th, after which there will be a break until January 31st. Following this break there will be a series of Six Concerts of British Music on January 3rd, 3rd, 5th, 8th, 10th and 12th. The London Music Festival will be held again on May 4th, 7th, 9th, 11th, 14th and 16th. All these concerts will be at Queen's Hall. A series of twelve Public Chamber Concerts will be given fortnightly at St Paul's Hall, Broadcasting House, the first of which will be heard on October 20th.

(Continued on page 154)
THE arrival on the market of another tuner designed to cover the short waves as well as the normal broadcast band arouses the interest of the home constructor, and to many the question no doubt arises, "Is it worth it?" So far, there are very few of these tuners; and no doubt arises, "Is it worth it?"

As has been repeatedly stated in these pages, losses on the short waves must be reduced to an absolute minimum in view of the very high frequencies which are in use. Perhaps to understand this better it is necessary once again to point out the desirability of having the tuner in frequencies instead of wavelengths. When we refer to the London National station transmitting on a wavelength of 261.6 metres, and then state that Boundbrook, New Jersey, transmits on 46.69 metres, we do not realize the vast difference that exists in the frequency which is used for these stations. The frequency of the London transmitter is 1,147 kc/s, but the frequency of the Boundbrook station is 6,425 kc/s. You will remember, from the various beginner's articles that by frequency is meant the number of vibrations, or changes of direction, per second. Obviously, with the lower frequency variations there is little risk of the signal jumping across small gaps or otherwise finding its way to earth. With the high frequency, however, the slightest capacity will serve to provide a path where it is not wanted, with the result that the signal will either disappear or partly do so before being fully rectified and amplified. In addition to this, another feature of the short waves is the sharpness of tuning, or number of stations which can be heard over a given portion of the tuning dial. On a normal tuning condenser of .0006 mfd. capacity, the London National will tune at approximately 15 degrees on a 100 degree scale, and the Regional will tune at approximately 30 degrees. The difference between these two stations in metres is 94.4, but the difference in kilocycles is 304. In other words, at this part of the wave-band a difference of 94 metres equals 304 kc/s. When, however, we enter the 30 to 100 metre wave-band we find a vastly different state of affairs. Thirty metres equals 10,000 kc/s, and 50 metres equals 6,000 kc/s. We have, therefore, a difference of 4,000 kc/s, equalling 20 metres, and as the separation between stations to permit full reproduction of side-bands is 9 kc/s, we find that many more stations will be obtainable over the same number of degrees on this band.

For the long waves, however, such a value would not enable us to tune from Luxembourgh to Huizen on a single coil, so we must compromise. Careful design, by which is meant careful choice of coil turns and their disposition on the former, will enable a winding to be adopted which may be used for various wave-bands without introducing the unwanted capacities referred to in the opening part of this article, and which at the same time may be tuned by a .0006 mfd. condenser in a fairly satisfactory manner. Obviously, however, a good slow-motion drive will have to be used in order to assist station selection on short waves.

Tuning Arrangements
This introduces our second difficulty. Some form of tuning will have to be adopted which will enable us to select one of these stations, and in a receiver designed especially for short-wave work it is customary to employ a very low capacity tuning condenser (.0001 mfd. usually), and in addition to use a slow-motion dial.

For the long waves, however, such a value would not enable us to tune from Luxembourgh to Huizen on a single coil, so we must compromise. Careful design, by which is meant careful choice of coil turns and their disposition on the former, will enable a winding to be adopted which may be used for various wave-bands without introducing the unwanted capacities referred to in the opening part of this article, and which at the same time may be tuned by a .0006 mfd. condenser in a fairly satisfactory manner. Obviously, however, a good slow-motion drive will have to be used in order to assist station selection on short waves.

Reaction Arrangements
A further point of difficulty arises in arranging reaction windings. For the medium and long-wave windings it is customary on a dual-range coil to use a single reaction winding of such a size that it provides smooth control for the long waves. This is usually too great for the medium waves, so it is disposed on the coil former in a position close to the long-wave winding, in which position it offers greater coupling to that coil than it does to the medium-wave winding, and the result is that smooth control may be obtained with a single

(Continued overleaf)
reaction condenser over both bands without the difficulty of introducing switching. With this wish also include the short waves we find that it is not necessary to dispose a single winding to provide adequate control over three bands. The best means of accomplishing the winding is to split it, and use a few turns for the short waves, coupled to the short wave grid coil, and utilise the remainder of the winding in the usual way. This can give splendid results if the turns ratios are correctly chosen. The design of the H.F. choke affects the reaction control, and although there are several chokes available which will work with efficiency on all waves from 20 metres upwards, I find it preferable to employ two chokes, one especially designed for the short waves, and one standard choke. These are joined in series and they each come into effect on their respective wavebands.

A TREASURESEEKER

If you are thinking of taking a holiday on Cocos Island, or in the land of the Incas, or at any other spot where vast treasure is reported to be accurately hidden; here is your chance to locate it, and return to your native land rich beyond the dreams of avarice. The great idea comes from the land of the allmighty dollar, and consists of a portable wireless apparatus which will indicate the near presence of a secret hoard, or, presumably, any other mineral deposit. As will be seen from the illustration, the treasure seeker after wealth trails a long pole, at either end of which is carried a type of portable set. The forward end is a receiver, and is adjustable as to its angle with the receiver at the rear end of the pole. The transmitter consists of a single-valve Hartley oscillator, the radiating aerial being a "loop" or frame wound around the outside of the containing case. The receiver at the other end has a three-valve straight circuit, with tuned loop, and a tuned coupling between the screened valve straight circuit, with tuned loop, and the detector valves. The latter is coupled by transformer to a pentode output. A variable series resistor controls the H.T. supply to the screening grid as well as oscillation. The theory of operation is simple. Radiated from the transmitter heterodynes the oscillations of the receiver, which is tuned to a wavelength slightly above or below that of the transmitter, so causing a whistle or beat note in the headphones. If the prospector walks over or near a metallic deposit, the deflection of the waves radiated, or the absorption of power by the metal, alters the note to a greater or less extent according to the magnitude and distance of the "find." The receiver may also be worked in a non-oscillating state, but adjusted to be "on the edge." In this condition any disturbance of the surrounding electrical or magnetic conditions causes oscillation and a consequent note in the phones. The wavelength used may be between 100 and 200 metres, that being the band allotted for marine purposes.

Broadband reception and that all the short-wave stations will then be at your finger tips. Nothing is farther from the truth. It is quite possible that you may be lucky in hearing one or two stations, but unless the receiver is well-designed you will probably find that not only will the sensitivity be low but that those stations which can be heard are only obtainable when reaction is pushed so far that it is only in C.W. or a heterodyned carrier which is heard, and that speech and music cannot be satisfactorily resolved. Of course, if the receiver had been designed on sound lines in the first case, and was efficiently wired and arranged, it is quite possible that the addition of the all-wave tuner in place of the existing tuning coil will result in quite a good short-wave selection, but the best will not be obtained from the coil unless the above-mentioned points have been attended to.

Conclusions

Summing up the above remarks, therefore, we find that it is possible to design a really efficient coil which will satisfactorily tune over short, medium and long wave-bands, and that in order to obtain maximum results on all bands it is essential to use a really good tuning condenser operated by means of a good slow-motion dial. For smooth reaction it is preferable to use two H.F. chokes in series. That the lay-out must be very carefully chosen and a certain amount of care and experiment is necessary in order to obtain maximum results. That the receiver must really be designed as though it were a short-wave receiver, when the medium and long-wave stations may be left to look after themselves. It will no doubt interest our readers to know that we have spent a great deal of time and thought on the subject of allwave receivers, and the results of our tests are embodied in a single-valve receiver which employs one of the latest tuners, and it will be described in next week's issue. Although and the normal broadcast bands.

Fig. 4.—A neat commerical tuner which covers short waves. Although and the normal broadcast bands.
A Simple Universal Receiver Which may be Used on either A.C. or D.C. Mains, and Which Gives Results Equal to an Ordinary Three or Four Valve Set

By
W. J. DELANEY

Not so very long ago I described a simple two-valve set which operated entirely from A.C. mains, and which gave results which had hitherto not been obtainable with such a small number of valves. In this case the pentode valve was used as a detector. Many listeners who are in the position of only having the D.C. mains at their disposal asked for a similar type of circuit, and unfortunately this was not a practicable proposition, owing principally to the difficulty of obtaining the large output with the D.C. valves then obtainable. There have been introduced into this country recently some special valves which operate with 200 to 250 volts direct on the heaters, and these valves are of what is known as the universal type. That is to say, they may be used with either A.C. or D.C. on the heaters, and, providing that the circuit is correctly designed, hum is non-existent. In addition to this valuable feature, the valves have most remarkable characteristics. For instance, a detector valve is obtainable which has the remarkable amplification factor of 100, as against the more conventional 20 to 40. After a little experiment I have developed the circuit shown in Fig. 1, which is a great improvement on my previous A.C. Twin, and which may be used on any type of mains without alteration, and which will provide sufficient volume to almost fill a small hall.

Owing to the few components which are required in this receiver, it has been found possible to get all the components on a baseboard measuring only 10ins. long by 8ins. deep. The receiver is also remarkably cheap, and will no doubt prove immensely popular to those who desire an easily-constructed, powerful mains set for use with D.C. or A.C. mains.

The Construction

The construction of the receiver should be a matter of only one evening's work, and will occasion no difficulty even to those who have never before built a wireless receiver. Apart from this place the bakelite disc. Now on top of this place the tin disc, and when all the holes are accurately lined up turn the complete assembly over and bend round the long soldering lug which is to be seen near to the vertical strip of metal running across the valve-holder. There are actually two of these lugs, but only the one nearest the anode terminal should be bent, and the exact position may be seen from the wiring diagram. Bend it right round until it lays flat on the tin disc, and then screw the valveholder to the under side of the baseboard. The other valveholders are screwed on top of the base in the usual manner. The other point requiring mention is the 2 mfd. fixed condenser which is mounted on top of the base. This is coated with green enamel all over, but in order to provide a return earth connection to the chassis the enamel should be scraped off both top and bottom of the projecting lug at one end, and this condenser should then be screwed down with this bared lug nearest the earth terminal. Again, reference to the wiring diagram will make this point quite clear.

Mounting the Components

It will be seen from the wiring diagram that there are very few parts to be screwed down, a saving having been effected by using the special Telsen coupling unit, comprising a resistance, condenser, and condenser, and

(Continued overleaf)
transformer in one housing. The resistance is, however, of too low a value to give maximum results with the particular valve employed for detection, and it is therefore necessary to increase the value by connecting a further resistance in series. This is joined between one terminal on the choke and the H.T. terminal of the coupling unit. To prevent any risk of a short-circuit to the chassis, a small piece of insulated sleeving should be slipped over one of the wire ends of the Dubilier resistance, and then this wire should be passed through the hole in the chassis to make connection with the coupling unit.

To simplify the wiring this is mounted upside down, which means that instead of pushing the dolly down to switch on (as in the majority of ordinary house-lighting switches) it operates in the reverse direction. This should be borne in mind when the receiver is first put into use.

The Wiring

If you have never made a receiver before you may find it preferable to remove one or more of the components when putting the wires into position, as some of the contact points are a little difficult to get at. A little patience, however, will soon help you out of any seeming difficulty, and the wiring should be completed within an hour. Leave the variable condenser until the wiring is practically finished, and fix the two leads for this component before mounting it on its bracket. To ensure a neat appearance the condenser should be held in position whilst the leads are measured, and then it should be removed whilst the wires are fitted. Upon replacing it on the bracket the wires will then reach just to the coupling unit and coil.

(Continued from previous page)

LIST OF COMPONENTS FOR THE A.C.—D.C. TWO.

One Tuning Coil, Type W.216 (Telsen).
One 0.005 mfd. Tuning Condenser with slow motion dial, Type No. 1046 (Jackson Bros.).
One 10/1 Coupling Unit (Telsen).
One .0005 mfd. Reaction Condenser (Graham Farish).
One Smoothing Choke, Type D.Y. 22 (R.I.).
One .002 Condenser, Type 34 (T.C.C.).
One .0001 mfd. Reaction Condenser (Graham Farish).
One Smoothing Choke, Type D.Y. 22 (R.I.).
One .0005 mfd. Reaction Condenser (Graham Farish).
One .002 Condenser, Type 34 (T.C.C.).
One .0001 mfd. Reaction Condenser (Graham Farish).
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One .0005 mfd. Reaction Condenser (Graham Farish).
One .002 Condenser, Type 34 (T.C.C.).
One .0001 mfd. Reaction Condenser (Graham Farish).
One Smoothing Choke, Type D.Y. 22 (R.I.).

Top and Sub-Baseboard Wiring Diagram
WO!ING to the great increase in all kinds of electrical appliances and machinery which has taken place within recent years, interference with radio reception has gradually become more serious.

It is now no longer possible to ignore the problem—it must be recognized and tackled accordingly. Believing that an ounce of practice is worth a ton of precept, we shall attempt here to give some practical hints on overcoming this objectionable form of interruption.

Some of the commoner sources of man-made static include electric signs, trolley buses, accumulator charging plant, electric motors, fans, vacuum cleaners, etc. The effects they produce on reception usually take the form of harsh, irregular cracking noises which are equally persistent on any wavelength.

There are clearly two methods of tackling the problem (1) At the source and (2) At the receiver. Obviously the former is the better method. Not only is it usually more effective, but if successful will benefit other listeners in the neighbourhood. Of course, in some cases this is not possible, and then recourse must be made to devices applied to the receiver itself.

The Cause of the Crackles

The actual cause of electrical interference is the sparking at brushes or contacts of the offending piece of apparatus. Perhaps the most obvious example is that of a motor-car engine. Here each spark, as it jumps across the gap of the sparking plugs, will cause a crackle in a nearby receiver. The faster the engine runs, the more rapid are the crackles until at high "revs" they merge into one continuous roar.

Another example is that of an ordinary house-lighting switch. When the lights are switched on or off a crackle is heard in the loud-speaker. This is due to the slight spark which occurs at the contacts of the switch. The spark radiates damped waves similar to those produced by a spark transmitter with the exception that they are unfinned.

A significant point is that the radiations are helped very largely by the wires carrying the current to the spark gap or contacts. This fact may be illustrated by comparing the interference caused by an ordinary electric bell or buzzer connected to a battery with very short leads with the same instrument when operated by a battery connected by long leads. In the latter case the radiations will be considerably stronger.

Apart from the part played by the mains or leads in propagating these undesirable radiations, it is obvious that their strength depends also on the intensity of the spark. It is only logical, then, that efforts at the elimination of the interference should be directed towards (1) A reduction of the sparking itself and (2) The elimination of the radiation of its energy by means of the wires carrying the current.

Ways and Means of Effectively Dealing with Unwanted Noises

By W. B. RICHARDSON

The interference suppressor which may be fitted to various domestic appliances

Before describing the methods which are used to accomplish this let us consider the source of the interference itself. Although this might be caused by outside agencies, such as transmitters, power stations, charging plant, etc., it is just as well to first ascertain that the trouble does not lie nearer at home. For instance, amongst some of the commoner causes of crackling noises emanating from the domestic supply system are the following: Faulty switch contacts, electric bulbs which have not been properly pushed home in their holders (see Fig. 1), bad contact at terminals of switches, ceiling roses, fuses, etc. The reason for radiations in cases of this sort is due to "arcing" at the offending contact. A wire connected to a binding screw or terminal may be making only intermittent contact owing to, say, a loose grub screw. This will cause an arc to bridge the gap during the periods when there is no direct contact. Walking across the room may provide sufficient vibration to "make" contact and so start the arc. In the case of wall switches, the trouble may be caused by the contacts losing their springiness after some years of use. In these cases the spring may be making only intermittent contact due to arcing at the terminal or by a binding screw or terminal. The arc may be making only intermittent contact due to arcing at the terminal or binding screw. The arc will cause a crackle in a nearby receiver. Another example is the trolley bus. The conductor which is connected to the trolley bus may often cause crackling noises due to sparking which occurs when the conductor and brush are separated at each switching of the trolley. The crackling noises may be due to sparking at the switch contacts, electric bulbs which have not been properly pushed home in their holders, bad contact at terminals of switches, ceiling roses, fuses, etc. The reason for radiations in cases of this sort is due to "arcing" at the offending contact. A wire connected to a binding screw or terminal may be making only intermittent contact owing to, say, a loose grub screw. This will cause an arc to bridge the gap during the periods when there is no direct contact. Walking across the room may provide sufficient vibration to "make" contact and so start the arc. In the case of wall switches, the trouble may be caused by the contacts losing their springiness after some years of use. In these cases the spring may be making only intermittent contact due to arcing at the terminal or binding screw. The arc may be making only intermittent contact due to arcing at the terminal or binding screw. The arc will cause a crackle in a nearby receiver.
by using bare aerial wire and porcelain insulators, or else by using rubber-covered wire. An alternative arrangement, which is quite effective, consists merely of a length of flex laid along the floor of the room in which the receiver is installed. Its position should be varied until the best place is found, when it can be concealed under the carpet.

Screening the Aerial
Sometimes interference may be caused by currents induced in the aerial by nearby gutter piping, metal stove pipes, iron roofs over workshops, etc. Naturally, the aerial and lead-in should be kept as far away from these as possible. Failing that, suitable suppressors themselves or allow you to have them fitted. Often a pair of condensers is all that is necessary to cut out the crackle.

Naturally, without their consent and co-operation nothing can be done. If the source is definitely traceable then the best method of approach is via the Post Office authorities, to whom application should be made. Of course, they have no powers as yet to force the parties concerned to fit suppression apparatus, but many firms will take a reasonable view of the matter, and either install suitable suppressors themselves or allow you to have them fitted. Often a pair of condensers is all that is necessary to cut out the crackle.

Tramways and Flashing Signs

Sometimes interference may be caused by currents induced in the aerial by nearby gutter piping, metal stove pipes, iron roofs over workshops, etc. Naturally, the aerial and lead-in should be kept as far away from these as possible. Failing that, suitable suppressors themselves or allow you to have them fitted. Often a pair of condensers is all that is necessary to cut out the crackle.

The evening broadcasts are destined to foreign countries and follow according to a regular rota, thus:

- Oct. 7th, 1933, Radio Luxembourg is now on the air with a lunch-hour transmission from 12.30 until 2 p.m. The wavelength is 1100.5 metres and the power 200 kilowatts. The evening broadcasts are destined to foreign countries and follow according to a regular rota, namely: Germany (Wednesday), France and Belgium (Saturday and Tuesday), Holland (Friday), Great Britain (Sunday) and Italy (Monday). For these transmissions all announcements have been put out in two or three different languages.
BETTER RADIO RECEPTION

Be a critic for once. Switch on your Set and listen—listen carefully. Is the bass rich and full—is the treble brilliant, clear cut? Can you get the volume you want?

It's a simple matter to make your Set like new again. With the right types of Cossor Valves (your dealer knows them) you can improve its performance out of all recognition.

And, if you use a Battery Receiver, you should find out all about Class "B"—the remarkable new system of Amplification that will give you "Mains" Volume without extravagant H.T. Consumption. Please use the coupon.


Please send me free of charge, a copy of the Cossor 40-page Valve and Wireless Book B.17 and Folder L.93 which tells me all about Class "B" Amplification.

Name

Address

Post 5/995

The only reason for using Class "B" with an eliminator is that one certainly obtains a greater maximum output than could otherwise be obtained with a single battery valve—but no H.T. saving is effected thereby.

**Fuses**

A matter about which I am always receiving inquiries, and upon which a great diversity of opinion seems to exist, is the question of fusing at the rectifier circuit. Listeners as a whole seem to be divided roughly into two main groups—those who are over anxious to be on the safe side and put fuses in their mains and in the H.T. unit, and those happy-go-lucky people who hope for the best and omit fuses altogether. There is, of course, a small minority who form the happy medium.

From an examination of a large number of shop-made mains sets of different designs, and of the rectifying valves employed in them, one forms the opinion that in the case of expensive and high-quality apparatus it is standard practice to incorporate fuses only on the input side, while the less expensive sets have no protection at all. Possibly the argument is that the set will be plugged into the house mains and will therefore be adequately protected by the sub-circuit fuses. This, however, is a fallacy, because a secondary circuit is seldom lighter than five amperes rating, and in the event of a short circuit on the output side of the receiver quite a lot of damage may be done without blowing a five amp. fuse.

**A Special Case**

A very special case of the variation in anode current affecting the performance of the set occurs in receivers where the output stage comprises two valves operated in push-pull, or a single Class "B" output valve. In such cases the "standing current" in the output stage is a matter of a few milliamperes only, while the peak values of the anode current may be ten times as great, or even more.

Such a receiver, operated from an ordinary H.T. eliminator, could not be expected to be capable of obtaining a large maximum output with battery H.T., and there is actually little point in employing an eliminator. Still there are a few people who desire to use an existing H.T. unit with Class "B" output, and it is therefore necessary to show how this may be satisfactorily achieved.

In the case of a musical valve, it is frequently sufficient to feed the Class "B" valve through a separate smoothing system which is particularly generously designed in the matter of choke inductance and condenser capacity. Where a valve rectifier is employed, however, further steps must be taken. The best solution, in addition to providing very efficient smoothing, is to connect across the H.T. positive and H.T. negative terminals a "gas discharge" tube, of which several reliable makes are on the market. (See Fig. 14.) It must be remembered, however, that the effect of such a tube is merely to maintain a constant drain from the eliminator by taking additional current when the anode current of the valve drops. Thus the actual H.T. consumption approximates to the maximum value of the anode current of the valve, and the high-tension economy, which is one of the prime advantages of Class "B", is lost.

**Fig. 14.—Adding a neon tube voltage stabilizer for an eliminator supplying a Class B valve.**

**Fig. 15.—A rectifier unit showing suggested position of fuses.**

This, however, is a fallacy, because of the predominance of sub-circuit fuses. This, however, is a fallacy, because of the predominance of sub-circuit fuses. This, however, is a fallacy, because of the predominance of sub-circuit fuses. This, however, is a fallacy, because of the predominance of sub-circuit fuses.
Wherever wireless terms are understood "Ohmite" means "The Best Resistance"

OHMITE RESISTANCES

The most popular and efficient type of fixed resistance for all general purposes. "Better than wire wound." All values, 50 ohms to 5 meghoms.

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Exide

For wireless H.T. get Drydex — the dry battery by Exide

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TYPE DFG 45 amp. hours . . . 8.6
TYPE DMG 70 amp. hours . . . 11.5
TYPE DHG 100 amp. hours . . . 14.6

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Branches: London, Manchester, Birmingham, Bristol, Glasgow, Dublin, Belfast
In this Article the Writer Describes a Simple and Efficient Instrument Suitable for Use in Conjunction With Modern Short-wave Receivers.  

The fundamental principle of this wave-meter is that it is a variant of the popular absorption wavemeter used by amateurs the world over.  

It is, however, a definite improvement over the aforementioned type, and is universal in application, and can be used with any type of short-wave receiver—masseemed, partly, or totally screened.  

Screening makes absolutely no difference whatever, and providing it is possible to magnetically couple the four turn coupling coil to the detector grid coil, or, in the case of aperiodic coupling being used in the receiver, to the aperiodic coil, this wave-meter will function efficiently.  

The same applies with reference to the various types of tuning coils employed in short-wave receivers, two, four, or six pin, and dual-wave coils.  

The coil screen obviates direct pick-up and windings, and so assists in accurate calibrations being made.  

The angle at which the panel is set makes absolutely no difference whatever, and according to the design and the position of the coil it is desired to couple with.

**Details of Construction**  

It will be noticed that the cabinet is of desk type construction, and if made exactly to the dimensions given, it will be found that the angle at which the panel is set will enable the user to take accurate dial readings, either in daylight or artificial light.  

The cabinet, thus drilling holes for leads in cabinet top is avoided. Fit tuning condenser in centre of panel and make sure the moving vanes clear the sides.  

The components should be next fitted up, also the socket strip. Remove terminals from coil base, also aluminium spigot around which screen fits. Screw base to underside of cabinet (top) with two machine screws (to be used near the centre). The twin flex lead may be of any length, so that the wavemeter can stand close to the set or some distance away, according to the requirements of the individual.

Variation in length does not affect the calibrations, as the coils and coupling flex form a complete untuned link circuit.  

(Continued on page 158)
WE are now approaching the most interesting stage of our discussion on the simple disc television receiver, namely, assembly; but before dealing with that, let me first of all have a word to say on the question of lenses for magnifying the image.

Lenses

The image, as it is built up by rotating the spiral of holes in the disc before the modulated neon glow of the lamp is limited in its size by the dimensions of the disc. For example, with a disc having an external diameter of 20ins., the actual image area size is slightly less than 2ins. high and just over 1in. wide. For most practical purposes this is too small to watch for any length of time without eye strain, so a lens or a pair of lenses must be mounted before the image so as to enlarge it optically.

Do not attempt to magnify the image too much, or with the present thirty-five transmission it will lose definition. A limit of four to five times will, as a general rule, be found ample. Suitable lenses may be obtained at any opticians. An ordinary reading glass will serve, but usually a combination of two lenses will be productive of better results. One very good combination is a 6in. diameter single convex and one 4in. diameter double convex with focal lengths of 17ins. and 11½ins. respectively. These should be clipped or fixed on to a mount 1½in. apart with the smaller or double-convex lens nearer the disc and the larger or single convex lens further from the disc. This is shown in Fig. 1 and the exact distance of the mount from the disc itself can be ascertained by observation, but about 2½ins. will be found to be the approximate distance.

Assembly

The assembly of the various components is quite a straightforward matter, and in view of my previous articles will present no difficulty to the reader. Of course, there are several variants according to the aesthetic taste of the constructor, but in almost every case one or two points must be observed. First of all, screw the motor to a wooden mount so that when the disc is placed on the shaft it will clear the table or bench on which the mount is resting.

One example of this is shown roughly in Fig. 2. The neon lamp must be fitted in the usual type of bayonet-type holder at the back and on the right of the disc so that the centre of the neon glow area is on the same horizontal line as the motor shaft and coincides with No. 13 hole in the disc. This precaution will ensure that the whole light area will be scanned by the disc apertures as they rotate. By the way, see that you have the disc, neon lamp, and lenses mounted the right way round on the motor shaft—that is to say, when facing the front the spiral of holes should progress towards the centre in a clockwise direction. Then, if the motor is made to rotate in an anto-clockwise direction, the scanning movement will be as the B.B.C. standard—namely, hole movement bottom to top and strip movement right to left.

Further Suggestions

If the motor is mains or accumulator-driven it will require both a fixed and variable resistance in series with the leads. These can be mounted as shown, the variable resistance being adjusted to make the motor run at its correct speed of 350 revolutions per minute. The same mount that is used to screw down the motor can be employed to hold the lens or lenses which are positioned immediately in front of the disc and neon.

You will notice that I have not made any mention of synchronizing apparatus at this juncture, as this is a subject which must be treated separately at a later date. I am concerned now only with the simplest of instruments and the correct motor speed must be maintained by a delicate handling of the variable resistance or, alternatively, introducing some form of friction brake on to the motor shaft.

Examples

By referring to Fig. 3 the reader will obtain a very fair impression of how a machine of this character can be built up from relatively crude apparatus and yet made to function quite well and give hours of pleasure. Notice the "tunnel" in front of the lenses so as to screen off any extraneous light, and also the reflector at the back of the neon lamp to concentrate the neon glow. Fig. 4 shows yet another variant, this time a machine made up from commercial parts. The next important point for us to study concerns the various methods of connecting the neon lamp to the output circuit of the wireless receiver, and I am making this the subject of a special article which will appear in a subsequent issue.
NEW—and better than many at double its price

MEGITE POTENTIOMETER VOLUME CONTROL
The element is of the fine nickel-chrome wire embedded in bakelite. The action is through a slipper plate, giving a smooth, positive contact, absolutely silent operation and making broken contacts impossible. Three terminal types. Simple box fixing. Complete with operating knob.
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These Valve Holders have exceptionally low loss moulded bases, the insulating material between sockets being reduced to a minimum. Contacts are of phosphor bronze, sturdy in design.
Four Pin Five Pin Seven Pin
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PIP TRANSFORMER
The PIP transformer is thoroughly sound in construction and design and gives a result equalling and often better than others at a much higher price. In distinctive red case with nickel terminals.
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Modern design... plus unrivalled quality and unequalled performance

The new Dubilier Type 9200 Paper Condenser is a most revolutionary change in Condenser design. It embodies all the features essential to the Constructor and follows the modern 'all-metal' trend of design. Here are its outstanding features which offer conclusive proof of its supremacy.

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4. New method of fixing to chassis.
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Look for the familiar blue and red caricatures in your dealer's shop!
A Valve-holder from Scrap Material

The accompanying sketches show a valve-holder made entirely from scrap material. Old high-tension battery sockets serve as valve sockets, and these are soldered to pieces of springy strip brass. Each socket complete with strip is mounted on a block of ebonite, cut to the shape required, and fastened thereto by a countersunk head screw and lock-nuts in the manner illustrated.—George E. Best (Reddish).

Cutting Out the Aerial Condenser

With the majority of dual-range coils a difficulty presents itself. A fixed condenser of approximately .0001 mfd. is placed directly in aerial lead, but the problem is how can one cut the condenser out when on long waves, as reception on this wave-length proves better without it. The usual method is to have two aerial terminals, or else the lid of the cabinet needs lifting to make an adjustment. By referring to the accompanying diagram it will be seen that the necessary adjustment is done automatically when switching to long waves. Furthermore, there is no financial outlay, owing to the fact that the same switch does the work by making use of the metal tip on end of the switch, which normally is disengaged when switch is set for long wavelengths.

The only materials required are two pieces of tin cut and shaped as shown, and two pieces of wire, and these can be connected up in a few minutes.—T. W. Smith (Chelmsford).

Short-wave Choke from a Crystal Detector

A very efficient short-wave choke can be made from an old crystal detector of the glass tube type, two 4 B.A. nuts and bolts, two soldering tags, and a small quantity of wire (brass or enamelled covered). First remove the cup and the cat's whisker arm and on the glass tube, starting about 3/16 in. from the end, wind a choke of approximately 80-100 turns of 38-46 S.W.G. Put a spot of Chatterton's compound or sealing-wax on the first and last wires to keep them in place. Solder a tag to each end of the wire for connecting purposes. Then take a 4 B.A. bolt, pass it through the end soldering tag, the brass bracket, and the large ebonite washer, put on a nut and tighten. After unscrewing the other brass bracket from the base, repeat the above process at the opposite end, and then slip the glass tube into position between the ebonite washers. Re-fix the bracket on the base, and the choke is complete.—J. Irwin (Blackburn).

An Aerial Earthing Switch

A very efficient aerial earthing switch, which can be fixed outdoors and operated indoors, can be made from a china base single-pole double-throw switch. First remove switch blade from centre of base and it will in all probability be found long enough to fit between the contacts A and B, otherwise a strip of copper or brass will have to be obtained to do so. Next cut a slot about 1/2 in. long and 1/4 in. wide in the centre of the blade, then make a hole in contact B and drill a small hole right through so that contact and blade can be bolted together. Now obtain a length of metal rod, about 1/2 in. diameter, of a sufficient length to pass through door-post or window-frame, and solder or screw to one end a U-shaped piece of metal, as shown in the illustration at C, and drill for a small bolt and nut. The rod is then passed through centre hole in switch base and operating rod attached to the blade with a small bolt and nut. It is essential that this should be a loose fit. It only remains to drill a small hole right through the door-post or window-frame where it is desired to fit the switch and screw knob on the indoor end of the operating rod. The illustration is almost self-explanatory, and no doubt the majority of readers will have sufficient material in their junk boxes to make up one of these switches. It will be found that the switch is "self-cleaning," owing to the spring contacts A and B.—W. J. Davies (Uxbridge).

(Continued overleaf)

A simple aerial earthing switch.
be bolted to the baseboard, and a terminal screwed into the top of the knob, as illustrated. A sound electrical connection is then available and H.T. leads and spaghetti resistances may be joined with ease. -W. H. Mason (Stalybridge).

A Useful Component of Compact Design

THE illustration shows a component which takes up little space, and reduces the number of leads in a set. The scheme consists of an ebolute former which slips over the valve socket with a friction grip. The component contains a former for the choke, and the grid condenser and grid-leak are also contained in the former. The condenser and grid-leak are enclosed in a cap in the form of a ring in which a circular groove is cut. The 'dielectric' and condenser leaves are in the form of a part circle as shown, and the grid-leak is wound on a flat former which fits in the groove, one end being attached to one terminal of the condenser. No difficulty will be experienced in connecting up the grid-leak, either in parallel or in series with the condenser. This arrangement may be made up by any experimenter, and attached to any set, and the space saved allows a better arrangement of the rest of the components. This idea incorporated in the valve-holder is much more convenient than the method shown, but it is easier for the amateur to make and fit to the valve socket as shown. The idea was first carried out by attaching the same arrangement to a valve socket from which the globe had been taken or broken. -W. H. Grayling (Cambridge).

A Cheap Universal Tester

THE following particulars relate to a universal tester which I have made and found reliable. The components required are 1 moving coil milliammeter, reading 1 to 5 milliamperes, 7 resistances, values as shown (strip Colvarestat were used as these are 5-watt type), 31½ ft. 20 D.C.C. wire wound on a card for a 1 ohm resistance, 13 sockets (11 red, 2 black), 1 black and 1 red plug, 41-v. G.B. battery, and a strip of tin for bus bar. The other end of the leads have crocodile clips which may also be clipped on to two prods. The test available are as follows:

- For Voltages use neg. socket with:
  - Socket B for 1 to 5 volts reading is actual
  - C for 2 to 15 volts, D for 10 to 50 volts, E for 50 to 250 volts, F for 100 to 500 volts
  - Across supply

- For Milliamps use neg. socket with:
  - Socket A for 1 to 5 mA, reading is actual
  - Black plug in G, and Socket G for 5 to 50 mA, reading is x 10
  - Black Plug in H, and Socket H for 20 to 100 mA reading is x 20
  - In one of the leads.

For Continuity test use Sockets J and K with:

- For high resistance tests red plug in A
- For low resistance tests red plug in B or C
- Or filament tests

For Ohms (1) Read off exact voltage of battery with red plug in B by shorting J and K
(2) For resistances 1,000Ω to 10,000Ω red plug in A. Place resistance across J and K
(3) The reading is Voltage x 1,000 ohms

A useful component of compact design. For Resistances less than 1,000Ω red plug in B
Then Res. = Voltage x 1,000 Ohms
Reading

-1,000 ohms

Resistances of higher value than 10,000Ω may be placed in series with higher voltages across A and neg. sockets.

Then Res. = Voltage x 1,000 Ohms

Reading

By winding the 1 ohm resistance with 9½ oz. No. 18 S.W.G. Eureka wire, and using black plug in B, 1 to 5 amperes can be read on the meter.
LIST OF TOOLS

IN THE "PRACTICAL WIRELESS" KIT

One 4in. spring steel Chesterman rule No. 3ooD-2.
One special scriber with adjustable chuck for scrib ing point renewal.
One pair of special ebonite test prods with wander plug socket ends and brass test points.
One special 4in. trammel with one fixed and one sliding head enabling circles to be scribbled from 0 up to 3in. in radius. This tool may also be used for cutting holes in ebonite and baseboards too large to be drilled in the ordinary way.
One 60-degree 16-gauge steel set square with finger fret, for easy use.
One special viewing mirror for inspecting obscure parts of the set. This viewing mirror fits into the scriber chuck.
One screwdriver with brass ferruled handle, extremely useful for locking screws, securing components to baseboard, etc.
And the three steel spanners 0-B.A., 2-B.A., 6-B.A., 8-B.A., 10-B.A., given free to every reader of PRACTICAL WIRELESS fit in a special recess beneath the set-square.

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THE MANCHESTER WIRELESS EXHIBITION

OUR STAND No.11—

The Stand-to-Stand Report given here is arranged in alphabetical order of exhibitors' names to facilitate quick reference.

STAND No. 85. Gallery

AERIALITE LTD., Amber Street, Manchester

This firm specializes in aerial materials and accessories, and has on show an interesting display of "Levenstrand" aerial wire, invaluable aerial strip, percolating earth tubes, and complete sets of aerial circuit components. The "Levenstrand" aerial wire is somewhat unique in that a 2500 insurance against lightning is given with every length sold. It can be obtained in lengths 1000', 333', and 50', at 5s. 6d., 2s. 6d. and 1s. 6d., respectively. The price of the complete aerial equipment, which includes every necessary required, from the aerial wire to the earth lead, is only 7s. 6d., and this equipment is attracting a considerable amount of interest.

STAND No. 34, Toonan Hall

AMPLION (1932) LTD., 62-4, Rosoman Street, London, E.C.1

One of the most interesting items on this stand is the new "Sonette" permanent magnet moving-coil speaker—selling at the low figure of 2s. 6d. This is a really excellent line, and is truly one of the best low-priced speakers on the market at the present time. There is also a large E.M. speaker on show, which is named the "Audito." Selling at 20s. 6d., it is an excellent adjunct to a powerful receiver or for small public address amplifiers.

Although in the past Almion have devoted their attention almost entirely to the production of loud-speakers, the position is now somewhat different, for they are making a full range of Class B components which are worthy of the reputation which the name of Almion has attained. There is a three-valve driver transformer, which can be matched to any Class B valve listed at 5s. 6d., as well as a tapped output choke turning at the same price.

Yet another line of outstanding merit is the new screened H.T. choke, priced at 3s. 6d. This is an excellent component, having a low D.C. resistance, combined with extremely high inductance and low self-capacity.

STAND No. 115, New Hall

AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO., LTD., Winder House, Douglas Street, Leeds, A.19

The well-known and very popular "Avometer" is exhibited on this stand in both A.C. and H.T. types, selling at 1s. 6d. and 2s. 6d. respectively. Additionally, there is the "Avoductor," a useful unit for H.T. in conjunction with the multi-range "Avometer" when taking measurements on valve. A combination of these two instruments nowadays forms the full testing equipment of nearly every radio receiver.

Another interesting exhibit is the "small brother" of the "Avometer," namely the "Avotester." This is a very accurate multi-range meter that can be used for measuring three different ranges of currents, three voltage ranges and four resistance ranges. It sells at the very remarkable price of 40s., and is so compact that it can easily be carried in the pocket. Do not miss this stand if you are interested in high-grade measuring instruments.

Meccano, Billing & Lee have produced this miniature instrument which is simply connected to the mains and removes fuses from electric consumers, fans, etc.

A neat modern cabinet, showing how utility is being considered by makers of audio cabinets.

A newidget speaker, one of the interesting Compton range. Priced at 21s., this speaker is only 21c. deep but handles 25 watts without distress.

Three voltage ranges and four resistance ranges. The price of this is 2s. 6d., whilst a three-type cost only 2s.

The "Black" L.T. accumulator is also on show and is attracting a good deal of careful attention. The L.T. uses it is plateless, and therefore virtually immune from the usual life which beset

The Graham Fainish "Pipe" L.T. Transformer, desirable in series 44 and 45 at 3s.

To enable the tone range to be controlled with faders, this device, a British Pic product, will prove of value. Twisted four-core cable is supplied with the control, and the cost is only 3s. 11d.

STAND No. 27, Main Hall

BELLING & LEE, LTD., 62-4, Rosoman Street, London, E.C.1

One of the most interesting exhibits on this stand is the "Levensrand" aerial wire. This is a really excellent line, and is worthy of careful attention. The visitor cannot fail to observe the excellent finish that is shown off to the best advantage.

Another interesting exhibit is the "small brother" of the now well-known Levensrand aerial wire.

A combination of these two instruments nowadays forms the unit for use in conjunction with the multi-moue

Additionally, there is a three-ratio driver transformer, which can be matched to any Class B valve listed at 5s. 6d., as well as a tapped output choke turning at the same price.

The price of the complete aerial equipment, which includes every necessary required, from the aerial wire to the earth lead, is only 7s. 6d., and this equipment is attracting a considerable amount of interest.

STAND No. 115, New Hall

AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO., LTD., Winder House, Douglas Street, Leeds, A.19

The well-known and very popular "Avometer" is exhibited on this stand in both A.C. and H.T. types, selling at 1s. 6d. and 2s. 6d. respectively. Additionally, there is the "Avoductor," a useful unit for H.T. in conjunction with the multi-range "Avometer" when taking measurements on valve. A combination of these two instruments nowadays forms the full testing equipment of nearly every radio receiver.

Another interesting exhibit is the "small brother" of the "Avometer," namely the "Avotester." This is a very accurate multi-range meter that can be used for measuring three different ranges of currents, three voltage ranges and four resistance ranges. It sells at the very remarkable price of 40s., and is so compact that it can easily be carried in the pocket. Do not miss this stand if you are interested in high-grade measuring instruments.

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The "Black" L.T. accumulator is also on show and is attracting a good deal of careful attention. The L.T. uses it is plateless, and therefore virtually immune from the usual life which beset

The Graham Fainish "Pipe" L.T. Transformer, desirable in series 44 and 45 at 3s.
A Universal Distant-Control Relay, manufactured by Messrs Bulgin. This costs £2 5s. and may be used with any type of receiver, D.C., A.C. or battery-operated.

A new type of valveholder, manufactured by Graham Parish. The new idea in terminals enables a number of wires to be accommodated without the trouble of the wires becoming loose owing to the nut untwisting the loop.

A Universal Distant-Control Relay, manufactured by Messrs Bulgin.

A new type of valveholder, manufactured by Graham Parish.

A new type of valveholder, manufactured by Graham Parish.
A feature which is proving of especial interest is the wide range.

Rola speaker can be obtained in either Class B, D, or triode types, and is suitable for all types of modern and conventional receivers.

STAND No. 69, Main Hall

BULGIN, A. F., & CO., LTD., Abbey Road, Barking, Essex

The most extensive range of home-constructor components and gadgets, for which means Buling are so well known, is attractively displayed on this stand. In addition to last year's designs that are being continued there are several new items. Among these special mention should be made of an ingenious unit for fitting to the back of any radio receiver. Known as the Men-Tel vs. Colour-Meter, it is used for testing the receiver's and loudspeaker's output. It is obtainable in single or twin forms, and is suitable for FCC, C.B., and M.S. receivers.

STAND No. 114

CIFEL PRODUCTS, LTD., 134, Pentonville Road, N.C.1

The chief feature of interest here are a number of attractive receivers in both mass and battery-operated types. Perhaps the one which attracts most attention is the four-valve, fitted with two efficient variable-variant tubes, but the smaller sets will also possess a worthy of commendation. Of the components exhibited there are a number of L.P., Class B and Q.P.P. transformers, in addition to a full range of fuses and indifferent.

STAND No. 28, Main Hall


Besides the very complete range of high-tension units shown by Messrs. Clark, there are some very interesting new receivers on view. The most popular of these is the 144, a four-valve superheterodyne receiver giving an undistorted signal output of no less than 2 watts. Another receiver of which is of equal interest to the battery user is the Q.V.G. Class A instrument, which is fitted in a cabinet and has a really good moving-coil speaker.

STAND No. 16, Main Hall

CLIMAX RADIO ELECTRIC, LTD., 59, Parkhill Road, Battersea

A wide range of particularly handsome and modern receivers comprises the Climax exhibit. Their receiving selectivity is so perfect that it is turned from, say, a full 90,000 to the complete null point. The former inel rument is to the completely balanced, tube-valve, and has a battery power supply, while the latter has a full range of tuning assemblies comprising the necessary "Ferranti" coils, tuned tuning condenser and multiple switch. All the components are mounted together on a rigid, aluminium chassis which can be adapted to numerous forms of set construction. None models are provided with a four-way switch which serves for wave-changing, connecting a pick-up, and for switching on and off.

STAND No. 32, Main Hall

CULVERIN, LTD., Mewson Road, Ramford

Not only are Messrs. Culverin showing their extensive range of tuning units of both "Ferranti" and "Fonster" types, but they have now a number of splendid complete tuning assemblies, comprising the necessary "Fonster" coils, tuned tuning condenser and multiple switch. All the components are mounted together on a rigid, aluminium chassis which can be adapted to numerous forms of set construction. None models are provided with a four-way switch which serves for wave-changing, connecting a pick-up, and for switching on and off. Altogether a most interesting display.

STAND No. 14, Main Hall

COSMOGRAPH, LTD., Cambridge Arterial Road, E.3

Something new in cabinet design. This is a Moster Okoon's new season's products, and strikes a new note line which we have noticed recently and which seems to have found a perfectly sound movement and a steady rest-and-reverse operation without the complete wheel which we have noticed recently and which seems to have found a perfectly sound movement and a steady rest-and-reverse operation without the complete wheel.

STAND No. 30, Main Hall

CROWELL (SOUTHAMPTON) LTD., 32, Brinton's Terrace, Pontefract

This firm has already recently devoted its attention to the production of high-end receivers, and is shown in a new line, of which must be suitable for everyone's needs. The prices are attractive and the sets should not be missed.

A Multique M.B. Rotary Switch manufactured by Messrs. Bulgin. This is obtainable in single, double, or tri-polar types, at prices from £3. 6d. upwards. Definitions of terms are given by an ingenious type of contact maker. The multi-ques and switches are shown in various forms, and are extremely useful in connexion with the various models of various types of condenser units which are shown. These models are cut away to show the internal electrode assembly and are an education in themselves.

There is also a really wonderful display of home-constructor kit sets, one of which has a motor-rotating table able to enable the visitor to inspect them with ease. These kit sets, however, are also the complete sets and sets which are representative of the very wonderful value for money which Cosmograph are noting.

STAND No. 104, Gallery Bridge

COSMOGRAPH, LTD., Cambridge Arterial Road, E.3

This is a new display, and extremely useful in connexion with the various models of various types of condenser units which are shown. These models are cut away to show the internal electrode assembly and are an education in themselves.

Something new in cabinet design. This is a Moster Okoon's new season's products, and strikes a new note line which we have noticed recently and which seems to have found a perfectly sound movement and a steady rest-and-reverse operation without the complete wheel.

The new "Universe" pick-up is also given a prominent position, and is of outstanding interest in that it saves the extremely high initial output of 4 watts. It is a well-designed unit, and gives an almost perfect even response to the full range of frequencies.

STAND No. 32, Main Hall

CROWELL (SOUTHAMPTON) LTD., 32, Brinton's Terrace, Pontefract

This firm has already recently devoted its attention to the production of high-end receivers, and is shown in a new line, of which must be suitable for everyone's needs. The prices are attractive and the sets should not be missed.
PRACTICAL WIRELESS

October 7th, 1933

As an extension Intermediate Frequency Transformers for main wire circuits. No trimming or other adjustments have to be carried out, and the coils are preset to the best position.

(Continued from previous page)

STAND NO. 79, Gallery

CITY ACCUMULATOR CO., LTD., 7, Angel Court, London, E.C.2

This stand is notable for the wide variety of high-grade transformers which are shown. These are type-shape kind of receiver, but it is the table, console, or radio-valve type. The appearance and finish is of a very commendable kind.

STAND NO. 90, New Hall

GOODMANS, LTD., 69, St. John's Street, Clerkenwell, London, E.C.1

Clifford Pressland Sales, 92, Victoria Street, London, S.W.1

There are rationally made, and all are housed in most attractive cabinets. A special feature is the ready dust of built into a large cabinet which is fitted with twin gas-pressure transformers, very accurately balanced multiple loud-speakers and very efficient couplings. This is one of the most effective sets on show, and was the centre of some admiring crowds at 10.30 p.m.

STAND NO. 91, Gallery

ECONASIGN CO., LTD., 92, Victoria Street, London, S.W.1

STAND NO. 12, Tomman Hall

EDGE, W. & SONS, LTD., Belton, Lancs

In this exhibit there is a new range of "Intermittent" receivers. These are of modern design, and all are housed in most attractive cabinets. A special feature is the ready dust of built into a large cabinet which is fitted with twin gas-pressure transformers, very accurately balanced multiple loud-speakers and very efficient couplings. This is one of the most effective sets on show, and was the centre of some admiring crowds at 10.30 p.m.

STAND NO. 23, Main Hall

ELECTRO DYNAMIC CONSTRUCTION CO., LTD., 155, Charing Cross Road, London, W.C.2

Intermediate Frequency Transformers for main circuit. No trimming or other adjustments have to be carried out, and the coils are preset to the best position.

STAND NO. 19, Main Hall

GENERAL ELECTRIC CO., LTD., Victoria Bridge, London, S.W.1

All the various types of "Orion" valves can be seen here, as well as the new "G.E.C." super high-frequency battery. The latest kit set, called the "Thrice" series, is a Blue Spot energised speaker which can be obtained in three different voltage ratings.

STAND NO. 20, Main Hall

FERANNOI LTD., Hollywood, L.A.

The latest kit set, called the "Thrice" series, is a Blue Spot energised speaker which can be obtained in three different voltage ratings.

STAND NO. 21, Main Hall

FERANNOI LTD., Hollywood, L.A.

MESSRS. FERRANOI need no introduction to our readers, and their stand is one of the most effective on the floor. The receivers for which they are in search are so highly respected. In addition to the extensive range of transformers, transformers, etc., included, the loud-speakers and super-tension receivers are of outstanding interest. Electric clocks in various patterns are also shown, and these are made in types and sizes for indoor use.

STAND NO. 19, Main Hall

GENERAL ELECTRIC CO., LTD., Victoria Bridge, London, S.W.1

All the various types of "Orion" valves can be seen here, as well as the new "G.E.C." super high-frequency battery. The latest kit set, called the "Thrice" series, is a Blue Spot energised speaker which can be obtained in three different voltage ratings.

STAND NO. 22, Main Hall

GRAMPIAN ELECTRIC CO., LTD., 7, Angel Court, London, E.C.2

The latest kit set, called the "Thrice" series, is a Blue Spot energised speaker which can be obtained in three different voltage ratings.

STAND NO. 23, Main Hall

GRAMPIAN REPRODUCERS, LTD., 31, Station Avenue, New Barnet, Herts.

GRAMPIAN speakers are made in a wide variety of types, and the display on this stand is intended to show the interesting instrument which Gramian is most suitable for his particular requirements. Very complete technical details in regard to every type are given, and there is in attendance a competent staff who are pleased to advise any visitor in regard to the choice of a suitable instrument.

STAND NO. 29, New Hall


It is a Lieven product.

STAND NO. 26, Main Hall

GOODMANS, LTD., 69, St. John's Street, Clerkenwell, London, E.C.1

Although there is shown here a wide variety of speakers, for which Goodmans have become well known, the loud speaker with shallow rate, which is specifically intended for use as car radio equipment, is probably the most interesting. The chassis is an actual part of the motor system, and the form of construction adopted results in the production of a most musical unit.

STAND NO. 62, Tomman Hall

GOODMANS, LTD., Holme Works, Morden Road, London, S.W.

High tension batteries are not a large part of this stand, but there is a complete range of electrostatic condensers in every conceivable type.

(Continued on page 164)
**PILOT AUTHOR KITS**

**D.C.**

**A.C.**

**TWO**

**KIT A**

Author's Kit of FIRST SPECIFIED Parts.

CASH or C.O.D. Carriage Paid, 5/-.

Balance in 11 monthly payments of 4/-.

Send for NEW CATALOGUE.

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**EXCLUSIVELY SPECIFIED**

**PETO-SCOTT**

**B.C.**

**OAK CONSOLE**

In Handsome Figured Oak Hose French Polished.

6/0/6 only.

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**SUPER PREMIER KIT A**

Author's Kit of FIRST SPECIFIED Parts.

CASH or C.O.D. Carriage Paid, 5/-.

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**EXCLUSIVELY SPECIFIED**

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**1934 WADADAPTER**

Bet. 3/1/5 and 9/5.

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**NEW GARRARD MODEL 22A.**


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**B.T.H. MINOR PICK-UP AND TONE ARM**

Cash or C.O.D. Carriage Paid, 1/12/6. Balance in 4 monthly payments of 5/-.

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**NEW MARCONIPHONE MODEL 19 PICK-UP.**

Cash or C.O.D. Carriage Paid, 1/12/6. Balance in 4 monthly payments of 5/-.
PRACTICAL WIRELESS
October 7th, 1933

VARLEY SQUARE PEAK "FOUR"

remaining sockets are for the use of an external loud-speaker, for which purpose one of the toggle switches is provided to disconnect the loud-speaker fitted to the cabinet. The remaining toggle switch is for the normal purpose of switching the set on and off.

The Controls
On the front of the cabinet there are only apparently three controls in addition to the usual switch, the left-hand knob controls the station selection, the right-hand knob is the normal volume control (working on the I.F. valve), whilst the right-hand knob with a "15" knob provides a reaction control for boosting the strength of weak stations. So far no mention has been made of the wave-change switch, and this is apparently, at first sight, absent. An ingenious arrangement is incorporated in the escutcheon by means of which the wave range is changed and at the same time the station identifications are also changed. The tuning dial is engraved with a reaction control also works very well and has no effect on the tuning settings. All exposed leads in the wiring are metal sheathed and earthed, whilst the I.F. valve is also of the metalized type and earthed. These are thus not liable to pick-up on the wiring, the majority of which is carried out inside the cabinet. The mains side of the receiver is furnished by means of a Varley transformer and a variable-mu H.F. pentode, whilst the field of the moving coil loud-speaker is provided for smoothing purposes. Adequate smoothing is provided by about 4 mf. electrolytic condenser, and a pilot light is wired to the heater leads to provide an indication that the receiver is alive, as well as to facilitate tuning by illuminating the dial.

RECEIVER: Varley Square Peak "4", Model AP.46.
MAKERS: VARLEY (OLIVER PELL CONTROL, LTD.).
CIRCUIT: Four-valve superheterodyne. H.F. Pentode as first detector and frequency changer; variable-mu H.F. pentode for intermediate frequency amplification; power rectifier, and pentode output. Class B valve rectification, with mains field and electrolytic condensers for smoothing. Provision for pick-up and external loud-speaker. Reaction control provided.

RESULTS: Selectivity and sensitivity are of more than usual length, is wound round this cleat out of the way. This is the first good point which strikes the eye when the cabinet is standing up, the fingers are easily inserted round the handle through the medium of the hole and it comes up sufficiently far to enable a really firm grip to be obtained and the cabinet transported with comfort. The back of the cabinet is fitted with a neat removable door, with holes cut to prevent the passage of dust, etc. A pair of metal brackets are inserted below to assist in preventing the passage of dust, etc. A pair of metal brackets are fitted at the lower end of this back in the passage of dust, etc. A pair of metal brackets are fitted at the lower end of this back in the passage of dust, etc.

The Circuit
As already mentioned, four valves are employed for the purpose of providing a super-het circuit of modern design. The variable-mu H.F. pentode valve works very efficiently with its associated volume control and enables the set to be tuned to a point just off oscillation, without having any hum or noise. The reaction control also works very well and has no effect on the tuning settings. All exposed leads in the wiring are metal sheathed and earthed, whilst the I.F. valve is also of the metalized type and earthed. The cabinet presents a somewhat unusual appearance and is a really substantial-piece of work. At the top a large hole is cut in the wood, and a small bottle piece is inserted below to assist in preventing the passage of dust, etc. Let into the hole is a small metal handle for carrying purposes. This falls flush when the cabinet is standing up, sufficiently far to enable a really firm grip to be obtained and the cabinet transported with comfort. The back of the cabinet is fitted with a neat removable door, with holes cut to prevent the passage of dust, etc. A pair of metal brackets are inserted below to assist in preventing the passage of dust, etc.

The tone of reproduction is very good indeed, and complete absence of cabinet rattle is the indication of the actual efficiency of the circuit may be obtained when it is stated that Pecann was heard in the particular district mentioned, with the volume control turned to a position less than two-thirds on and with no reaction whatsoever. The only point to mention with regard to tuning is that the markings on the dial do not correspond with the actual stations, unless the short length of flex which the makers provide is used for an aerial. On the full outside aerial, for instance, the actual station settings are two or three degrees off the actual indication. Uppers of fifty stations are readily obtainable on this cabinet, and very few of the good European stations required the volume control full on. Some of the very weak Italian stations were selected in order to test the reaction control, and one was found which was only just audible with the volume control at maximum. The reaction control was then advanced, with only the very slightest alteration in the tuning point and provided a comfortable signal. The tone of reproduction is very good indeed, and complete absence of cabinet rattle is the indication of the actual efficiency of the circuit. Hum can only just be discerned when the receiver is tuned to a point just off oscillation, a condition which, of course, should not occur in normal use.
This Lissen 7-valve Superheterodyne is absolutely UNIQUE!

NO KIT SET
EVER BEFORE HAD
6 STAGE BANDPASS FILTER

NO KIT SET
EVER GAVE EXACT
9/KC TUNING CHANNELS

NO KIT SET
INCLUDED REAL
AUTOMATIC VOLUME CONTROL

NO KIT SET
AT ALL EVER
COULD EMPLOY THIS
DIODE PENTODE VALVE

NO KIT SET
OFFERED LISSEN
CLASS 'B' OUTPUT

SEE the Constructional Chart giving most comprehensive, most detailed instructions and you will want to build the MOST AMBITIOUS Kit Set, ever made available for Home Constructors!

Never before has there been any receiver for home constructors on such an ambitious scale as this new Lissen "Skyscraper" Seven-valve Superhet. It embodies every up-to-the-minute advance and refinement of the most luxurious factory-built superhets—it gives the constructor the opportunity to build a £20 receiver for less than half that price. The circuit of the Lissen "Skyscraper" Seven-valve Superhet incorporates a six-stage bandpass filter, giving exact 9-kilocycle channels and, therefore, providing a standard of selectivity never before achieved by a home constructor's kit and very rarely found except in laboratory apparatus.

Amplified Automatic Volume Control is provided; a special valve for this purpose having been produced by Lissen for use in this receiver. The use of this Amplified Automatic Volume Control constitutes an entirely new experience in listening; no "fading," no "blasting"—you will find yourself enjoying every word of every programme, however near or however distant, without the slightest temptation to interfere with the receiver once you have tuned it. This is radio listening as it should be enjoyed!

Lissen Class "B" Output through a new full-power Lissen Moving-coil Loudspeaker—glorious rich tone and majestic volume, actually more faultless in its reproduction than anything you ever heard from even the most powerful mains receiver, yet working economically in this Lissen "Skyscraper" from H.T. batteries. Lissen have published for this great new "Skyscraper" Seven-valve Superhet a most luxurious Chart, which gives more detailed instructions and more lavish illustrations than have ever before been put into a constructional chart. It makes success certain for everybody who decides to build this set; it shows everybody, even without previous constructional experience, how they can have a luxury receiver and save pounds by building it themselves. A copy of this Chart will be sent FREE in return for coupon on the left, or your radio dealer can supply you. Get your FREE CHART now!
This is the most compact switch we have yet produced, and as efficient as any made. It is the ideal switch for matched coil units or any other components requiring a combined change-over or make-and-break.

Nickel silver contacts engage on silver points, avoiding all risks of corrosion, and the sliding action ensures at all times a perfectly clean contact. There is virtually no inter-capacity between the points, thus avoiding the use of elaborate screening.

Any number of circuits can be controlled by this new switch, from a single make-and-break or change-over upwards.

**Prices**

- 342/1 3 Pole Single Throw ... 1'6
- 342/2 2 Pole Change Over ... 1'6
- 342/3 3 Pole Change Over ... 2'6

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**UTILITY WORKS, HOLYHEAD, BIRMINGHAM**

Write for a copy of our new catalogue; it contains full details of our complete range of switches, condensers and dials.

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**CONVERT YOUR SET INTO AN ALL WAVE SET**

**for 9'6 only**

All wavelengths from 14.5 to 2,000 metres covered by this British General All-Wave Tuner.

Free wiring diagrams showing how you can build or convert your set supplied Free. State circuit when ordering.

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**CRAMMED WITH EXTRA CHEMICALS!**

- and MERCURY Means Enormously Increased LIFE!

Grosvenor Mercury Batteries are made in three grades for every Radio Need:
- Grosvenor Red Line 5/6 to 11/-
- Grosvenor Brown Line 6/- to 15/-
- Grosvenor Blue Line 7/- to 20/-

The life of a battery is the life of its cells. That is where the Grosvenor MERCURY process works such wonders. It guards the cells against corrosion — makes them last so long that they are crammed by hydraulic pressure with extra chemicals to use them up.

Next time you buy a battery, remember the amazingly long life, the extra reserves of power that are packed into Grosvenor. Insist on Grosvenor — and get the most for your money!
In the Concluding Article of this Series, FRANK PRESTON, F.R.A., Explains the Function of the L.F. Amplifying Valve and of the Loud-speaker.

(Continued from page 96, Sept. 30 issue)

Transformer Coupling

THERE is another method of feeding the audio-frequency voltages to the L.F. valve, which is by means of a low-frequency transformer. This latter component, as you well know, consists of two coils of wire placed on an iron core. One coil, called the primary winding, takes the place of the L.F. choke shown in Fig. 21, whilst the other, or secondary, is connected between the grid of the amplifying valve and a tapping on the G.B. battery (see Fig. 22). Audio frequency currents flowing through the primary set up a magnetic field which varies in sympathy with the signal impulses. This field is “concentrated” in the iron core, which offers considerably less resistance to magnetic lines of force than does air. And since the secondary winding is also on the iron core the lines of force pass through it and cause currents similar to those in the primary to flow in it. The currents produce a voltage between the ends of the secondary and this is passed on to the L.F. valve.

Transformer Step-Up

The transformer does much more than merely pass on the signal voltages from one valve to another, though, for it is actually made to increase (or amplify) them. By using a greater number of turns on the secondary than on the primary the voltages are increased in proportion to the ratio of the numbers of turns. For example, if the secondary had twice as many turns as the primary the voltages would be doubled; if three times as many they would be trebled, and so on. Although the latter statement is perfectly true in theory it does not quite hold in practice since there are certain losses in the windings and in the iron core. Nevertheless, the transformer does give an appreciable “step-up” effect, which is of decided advantage.

It might appear, to the reader that the amount of amplification afforded by a transformer cannot be increased to any desired extent by increasing the ratio of secondary to primary turns, but there are definite practical limits; too few primary turns give too low an impedance for satisfactory operation of the detector valve, whilst too many turns on the secondary will produce a loss of top notes due to the increase in capacity of the winding. Generally speaking the secondary contains from two to five times as many turns as the primary winding.

Last week we saw how signals are rectified by the detector valve and how the high-frequency component—or carrier wave—is disposed of. We also considered different methods of feeding the audio-frequency impulses to the L.F. valve so that they may be amplified before being made to operate the loud-speaker. Our present problem, then, concerns the mode of functioning of the low-frequency amplifying valve.

The general principle follows closely on that surrounding the working of an H.F. amplifier, since the object is to apply fluctuating voltages to the grid so that they might produce a corresponding anode current fluctuation. This sounds all very simple, but there are a number of factors to consider, because we require, not merely amplification of the signal, but distortionless amplification. To obtain a thorough understanding as to how the latter may be secured we must perform make a brief study of the valve’s “characteristic curve,” which takes the form of that shown in Fig. 23. The curve is not difficult to understand for, after all, it is merely a line which shows how the anode current of the valve varies in sympathy with the voltages applied to the grid, assuming the anode voltage to be constant (as it is in practice). We can see, for instance, that when the grid potential is zero the anode current is 15 milliamps, whilst when a negative potential of about 9 volts is applied to the grid the anode current falls to only 2 milliamps.

Grid Current Distortion

For a moment let us imagine that the
grid voltages were made to be zero, by connecting the end of our transformer secondary or grid leak (according to the method of interstage coupling employed) to L.T. negative instead of to a grid bias battery. And now let us represent our signal voltages as shown by the line drawn below the curve—it is assumed that the latter voltages attain a maximum of 2 volts on each side of their mean value. The effect of the signal voltages is to vary the grid potential between 2 volts negative and 2 volts positive. In practice the result of this would be hopeless and terrible distortion, because as the grid becomes positive some of the current which should pass from the filament to the anode will flow to the grid instead. Without going fully into the subject, it can be stated that when grid current flows, distortion results, due to a voltage drop being set up across the grid circuit coupling component. Besides this, however, it can be seen that the anode current would reach a very high figure and in consequence a big strain would be put on the high-tension battery and on the valve, with a result that both would be damaged.

**Distortion due to the "Bottom Bend"**

Suppose now we go to the opposite extreme and apply a negative bias voltage of 8 volts. The signal voltage will be added to this, as shown in Fig. 24, so that the grid voltage will vary between minus 10 and minus 6 volts. Here again we should get distortion, due to the "lower bend" in the characteristic curve. To be more explicit, the change from minus 8 to minus 6 volts would produce a variation in anode current of rather more than 2 milliamps, whereas the change from minus 8 to minus 10 would only vary the anode current by about 1 milliamp. Obviously, the amplification of positive and negative halves of the signal voltages would not be uniform and therefore we should get distortion.

**Correct Grid Bias**

I think it will now be clear that the L.F. valve should be negatively biased to a point somewhere between the two extremes which we have considered. The exact point must be chosen so that the signal voltage can never be so great as to make the grid positive, or to make it so negative that the valve will operate on the "bend" of its characteristic curve. This ideal (which is easy of attainment, by the way) is represented in Fig. 25, where the grid bias voltage is minus 6. Under such conditions of operation we can obtain distortionless amplification for a moderate expenditure of high-tension current. We can now understand the common expression that "an L.F. valve should always be operated on the straight portion of its characteristic curve," and we are able to appreciate the value of grid bias.

**Efficiency**

Unfortunately, the "efficiency" of an average three electrode power valve is only about 14 per cent., so that of the total power taken from the high-tension battery, something like 86 per cent. is wasted. There is no way of avoiding this waste, except by employing a pentode, an average sample of which has an efficiency of over 30 per cent. We cannot here go fully into the reasons for the increased efficiency of pentodes, but must dismiss the question by saying that the characteristic curve of a pentode is "steeper," so that any given change in grid voltage produces a larger change in anode current than it does with a triode.

**Large and Small Power Valves**

In the above explanation a fairly typical small power valve has been assumed, but the very same thing applies in the case of any low-frequency amplifier—the valve must always be biased so that it will operate entirely on the straight part of its characteristic. It is for this reason that the valve must be chosen according to the amplitude of the signal voltages which are to be applied to its grid, and it will be clear why we have "large" and "small" power valves. As a further explanation of this point, it might be added that if, for instance, the signal voltages applied to the valve taken as an example were of 8, instead of 4, volts, the valve would be "over-loaded," since the negative half cycles would drive it on to the bend in its curve; for such, comparatively large variations in grid voltage it would be necessary to employ a valve having a characteristic with a longer straight portion, or in more usual parlance, to use a "larger" power valve.

**Turning Anode Current Variations into Sound**

We have now reached the last link in our chain, and are ready to consider how the variations in anode current caused by fluctuations of grid voltage, can be turned into sound. We know that (Continued on page 174)
No two valves — except by coincidence — are precisely and completely identical. The variations are quite small; yet they are often quite enough to ruin the whole performance of your set. What, then, is the safest thing to do when buying valves? Obviously to pick those with the greatest reputation for keeping closely to standard. “Play for Safety” may not be an heroic motto, but who wants to be heroic when they are buying valves?
Radio offers immediate rich rewards to trained men. It is a field with tremendous, unlimited opportunities. Air traffic, broadcasting, television, talkie pictures, cathode ray, and the whole of the electrical field, quite apart from the more accepted radio field, now and in the future, are vitally linked up with some phase of radio science. In less than ten years, over 150,000 jobs have been created. Already there are over 1,000 men earning more than £2,000 per year, and over 25,000 more than £500 per year, and these are doing work that you would call a hobby.

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Thousands are also earning regular incomes for interesting spare time work such as set designing, writing for the press, servicing, inventing, demonstrating, etc., etc. You can do the same. You can turn your evenings into guineas; and if you wish, qualify for highly-paid employment. Trained men are urgently wanted, and we can give you the sort of training that employers demand. The T.C.R.C. Radio Correspondence Courses are prepared and conducted by men who have themselves made good in the Radio Industry and earned four-figured incomes.

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Let a T.C.R.C. Course put you a year ahead with your set designing, and enable you to contribute in a bigger way to the development of Britain’s wonderful Radio Industry.

T.C.R.C. training is intensely interesting—no foreign textbooks, no obsolete theory or dull drudgery, no additional expenses. You will enjoy learning it.

**FATHERS! Prepare your sons for jobs like these**

Radio Manufacturers employ testers, inspectors, foremen, engineers, service men, buyers and managers. Radio Dealers employ service men, salesmen, buyers and managers. Broadcasting Stations use engineers, operators, and station managers. Police Departments use radio and there is a big television field. Students passing our Special Continuation and Practical Training Courses are guaranteed employment on completion.

Our prospectus gives you full information of the opportunities that Radio offers, and explains how we can train you quickly to become a radio expert through practical home-studying. It is free for your asking. Just fill in and send off the coupon below.

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Please send me free, full details of the T.C.R.C. Radio Correspondence Courses and tell me how I can qualify for highly-paid employment, as well as make money in my spare time.

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Address: ____________________________  Occupation: ____________________________
PRACTICAL POINTS ON DECOUPLING

The Correct Values of Resistances and Capacities to Be Used

By ERIC JOHNSON

Broadly speaking, the whole art of decoupling consists of nullifying the effect of a resistance or impedance common to two circuits. This effect is very pronounced when a source of H.T., i.e., mains voltage and other forms of L.F. oscillation are transferred from stage to stage, giving rise to motor-boating and other forms of L.F. oscillation. Fortunately, the cure is a simple one; upon reference to Fig. 1, it will be seen that a high resistance is deliberately inserted in the anode circuit, and a bypass condenser connected from the side remote from the H.T. to earth. The resistance forms a very effective barrier to the varying voltages. On the other hand the condenser offers an easy path to earth. It will be perfectly obvious that efficient decoupling may only be assured if the reactance of the condenser is low as compared with the resistance. Let us enlarge on this somewhat.

Resistance and Capacity Ratios

We will assume that it is necessary to have a decoupling ratio of 20:1. In other words the condenser must not offer a greater reactance than twenty times the value of the resistance. Consider, for example, a case where the decoupling resistance has a value of 20,000 ohms. Our by-pass condenser must therefore offer an equivalent resistance not greater than 1,000 ohms. As, however, the reactance of a condenser rises with a decrease in frequency, we must be sure that our 20:1 ratio holds good at the lowest frequency for which our receiver is designed. It is customary to accept 50 cycles as such. The nearest standard size condenser which fulfills these requirements in this particular example is 2 mfd. (the reactance of a condenser is given by \( X = \frac{1}{2\pi fC} \), where \( C \) is capacity in mfd, and \( f \) is frequency in cycles per second). For a given value of resistance the condenser may be as large as one likes, and, in fact, the larger the more complete is the decoupling. It is equally true that for any given condenser, decoupling will be more effective for an increase in value of resistance over that necessary to achieve the correct ratio. Generally speaking, however, it will be found more economical to keep the resistance fairly low and use a large condenser, because we cannot afford the consequent large voltage drop which must result from using a high resistance. This is especially important in battery sets where every volt of H.T. has to be conserved. On the other hand mains users will often find that their decoupling resistance sets in a dual role, and will replace the usual voltage dropping resistance in the eliminator, for almost invariably the H.T. output is in excess of the requirements for stages prior to the final one. In battery sets it may be found profitable to install some system of decoupling which does not absorb valuable volts.

Bearing in mind the conditions necessary for decoupling, we find that as long as we have an impedance in the anode circuit, the inadmissable by-pass condenser little trouble will be experienced. In cases where the usual voltage drop must be guarded against, therefore, it should be remembered that the resistance may be replaced by an L.F. choke whose reactance to the lowest musical frequency shall be equal to this resistance. Now the reactance of a choke is given by \( X = 2\pi fL \), \( f \) being the frequency in cycles per second and \( L \) the inductance in henrys. Substituting the values given in the previous example, we find that the nearest standard choke is a 60 H. one. As before, the larger this is, the more complete the decoupling, and as the d.c. resistance will in no case be more than 1,000 ohms the voltage drop is negligible. Care must, of course, be taken to see that the choke maintains its rated inductance at the largest anode current likely to be experienced. Although this method of decoupling is likely to find more favour among battery users, it may be found a distinct advantage in mains receivers, for the extra choke will add its quota of smoothing where it is most needed.

Grid-circuit Decoupling

Before concluding, let us discuss the essentials of grid-circuit decoupling. Fig. 2 shows a conventional output stage with automatic bias, the latter being obtained by resistance "R" in the cathode lead, a condenser being fitted to bypass the L.F. component. Now the value of this condenser is commonly quite small, and is often anything larger than 2 mfd. The important point to remember, therefore, is that the L.F. voltage drop across this capacity is quite high at low frequencies, i.e., where its reactance is high. Unfortunately, this voltage is fed back to the grid out of phase with the normal applied voltage. The net result is to very effectively damp out the low frequencies, and thus reduce our bass response. There are two remedies which may be applied. The first, which naturally suggests itself is to replace our bypass condenser with a larger one which would have a low reactance to the bass frequencies. To meet this requirement, we find that anything under 50 mfd. would cause a distinct attenuation to the lower notes. A year or so back this would present an impossible solution, but now that we have electrolytic condensers with capacities of this order in a container as small as the more commonly used sizes, the problem no longer exists.

The second and most effective remedy for the trouble is to thoroughly decouple the grid circuit. The method is identical with anode circuit decoupling; a high resistance is inserted in the grid lead, and a 1 mfd. condenser joined from one end to the cathode. As the resistance carries no appreciable current it may be made quite large, 100,000 ohms being customary. As a consequence there is no point in using a condenser larger than that specified, as these values give very complete decoupling. A wire-wound resistance would be a luxury in this position, but care must be taken to see that one of the reliable metallised type is used, as should the resistance open circuit, the output valve may be seriously damaged by the consequent removal of bias. For this reason the ordinary non-descript grid-lead variety is not recommended.

Reserve Your Pocket Tool Kit
Now! See Page 143.

Fig. 3.—Complete decoupling has been added in this modification of the Fig. 2 arrangement.
ROUND THE WORLD OF WIRELESS

(Continued from page 124)

The New Russian Wavelengths

With the launching into operation of the Lucerne Plan, Moscow's 500-kilowatt station will work on 1,714 metres (175 kc/s) and her second high-power transmitter on 1,107 metres (271 kc/s). Leningrad, Minsk and Kharkov will continue to use the long channels, but will also be heard in the early hours of the afternoon by listeners in most districts of Great Britain. Note the call: Kalundborg-Kjøbenhavnen og为一体的Dansk-Kommandowaffe (short-wave station). Before the news bulletin is broadcast you will hear the announcer say: God aften, hos der Pressens radioavis (Good afternoon, here is the press (news) transmission). The interval signal consists of a musical box melody resembling a small carillon; it plays the theme of an old Danish folk-song of the twelfth century. In the evening, details of the programmes are frequently given out in English and German as well as in the Danish language.

Making an Improved Absorption Wavemeter

(Continued from page 137)

According to a Norwegian report the U.S.S.R. intends to build a number of stations in Siberia and in Asiatic Russia, one of which may be actually planned to radiate some twelve hundred kilowatts, and therefore surpass any other transmitter in the world.

Listen to Copenhagen

With the opening of the new 60-kilowatt transmitter at Kalundborg, the Copenhagen wireless programmes can now be well heard even in the early hours of the afternoon by listeners in most districts of Great Britain. Note the call: Kalundborg-Kjøbenhavnen og为一体的Dansk-Kommandowaffe (short-wave station). Before the news bulletin is broadcast you will hear the announcer say: God aften, hos der Pressens radioavis (Good afternoon, here is the press (news) transmission). The interval signal consists of a musical box melody resembling a small carillon; it plays the theme of an old Danish folk-song of the twelfth century. In the evening, details of the programmes are frequently given out in English and German as well as in the Danish language.
NEVER BEFORE SUCH RANGE . . .
SUCH SELECTIVITY . . . SUCH
TRUE-TO-LIFE TONE AT SUCH
MODEST PRICES

The Cossor MELODY MAKER

Up-to-the-minute in design, incorporating Variable-Mu S.G. stage, fully shielded high-efficiency coils, single dial tuning etc., this remarkable new Cossor Melody Maker is exceptional value. Capable of bringing in a wide choice of programmes this powerful Receiver is, in every way, equal to much more costly Sets. Yet, in spite of its efficiency, it is so simple that you can build it at home. No wireless knowledge necessary. Send at once for Constructional Chart—use the coupon.

SPECIFICATIONS

BATTERY MODEL 341
PENTODE OUTPUT
Balanced Armature Loud Speaker
Complete Kit of Parts for assembling Cossor Melody Maker, Model 341, similar to Illustration, including Variable-Mu Screened Grid, Cossor Detector, and Cossor Pentode valves. Fully screened coils, Double-Gang Condenser, Combined Volume Control and Cut-Off Switch, all the parts for simple home assembly.党组书记 cabinet 12" x 12" x 9", space for batteries and accessories. Balanced Armature Speaker, provision for Gramophone Pick-up Plug and Jack. Wavelength range 260,000 to 400,000 metres.
Price
Hire Purchase Terms: 1½ deposits and 6 monthly payments of £1 16s. or alternatively 2½ deposits and 12 monthly payments of 10s.

BATTERY MODEL 342
MOVING COIL LOUD SPEAKER
Complete Kit of Parts similar to Model 341 described above, except that it is supplied with a Permanent Magnet Moving Coil Loud Speaker.
Price
Hire Purchase Terms: 1½ deposits and 12 monthly payments of 15s.

BATTERY MODEL 344
CLASS "B" OUTPUT
Complete Kit of Parts as Model 341 described above, but with four Cossor Valves, Class "B." Output Stage and Permanent Magnet Moving Coil Speaker.
Price
Hire Purchase Terms: 1½ deposits and 12 monthly payments of 15s.

ALL-ELECTRIC MODEL 347
Complete Kit of Parts, similar to Model 341 described above, but with four Cossor Valves, Class "B." Output Stage and Permanent Magnet Moving Coil Loud Speaker. For A.C. Mains only. Price
Price
Hire Purchase Terms: 1½ deposits and 12 monthly payments of 15s.
Prices do not apply in I.F.

NAME
ADDRESS

Please send me a Constructional Chart which tells me how to build a Cossor Melody Maker Model No.__________________

To A. C. Cossor Ltd., Melody Dept., Highbury Grove, London N.3
ACCURATE MATCHING AT LAST!

- 17 transformer ratios for really accurate matching to ANY power valve or pentode and 4 ratios for Class B or Q.P.P.
- all available on one speaker by a simple switch adjustment.
- Added sensitivity due to the "Mansfield" magnetic system! Better balance through really accurate matching!
- The difference in performance must be heard to be believed.

Write for the "Microlode" folder.

"MICROLODE"

(Regd. Trade Mark)

MOVING-COIL SPEAKERS

With the new "Microlode" feature and the famous "Mansfield" magnetic system.


Invaluable Practical Handbooks

This series covers a wide field and will prove of the greatest value to everyone interested in models and how to make them; woodwork and other crafts. Each book is clearly written and fully illustrated.

Twenty-Five Tested Wireless Circuits

All the sets described have been designed to meet modern needs. They range from simple crystal receivers to a seven-valve superheterodyne, and all the sets have been made and tested before inclusion.

Accumulators

An up-to-date handbook dealing with every type of accumulator, methods of charging them at home, care and maintenance. This little handbook also explains how to erect a charging station.

Motor Car Upkeep and Overhaul

In this handbook will be found information on the engine, decarbonising, valve grinding, the lighting system, the carburettor, cooling system, lubrication, springs and shock absorbers, steering gear, brakes, wheels, axles, tracing noises, etc., etc.

NEWNES HOME MECHANIC BOOKS

1/6 Your Newsagent to Show You Other Titles in This Series.

362 GUARANTEED VALVES

SAVE YOU 50%!

If your dealer does not stock, send for 362 post free direct from the makers. Post Free from 362 are NON-MICROPHONIC and are definitely as good as any, and better than most. FULLY GUARANTEED and BRITISH ALL THROUGH.


COMPLETE 362 "CLASS B" KIT, including "Class B" Valve, 7-pin valveholder, Input Transformer and Output Choke, with full instructions, 28/-.

Ditto, wired complete with Moving Coil Loud-speaker, 5/-.

Cash with order. Cheques and P.O.'s must be crossed and made payable to:- THE 362 RADIO VALVE Co., Ltd. (Dept. W. 21), Stoneham Road, London, E.5.

NEWNES' HOME MECHANIC BOOKS

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The CABINET for MODERN SETS!

The Gamco 'Devonshire' Cabinet expresses the modern trend of radio design. Finished in selected walnut veneer and supported on black polished feet. Complete with back, baseboard and halflinboard, 36/-; see it at our showrooms or write for free booklet.

Carrington Mfg. Co., Ltd.,
Showrooms:-
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GAMCO

1/6 each
Background Sounds for Operatic Records

Radio listeners who have heard the recent B.B.C. transmission of complete operas from gramophone records may have been puzzled by the usual noises of an opera house, including the sounds of the orchestra tuning up, applause, coughing of the audience, etc. It is now revealed that these sounds are reproduced from special “Hit-Master’s Voice” records, which are stored in the great record library at Broadcasting House.

Festival of Radio Drama

One of the first plays to be broadcast by the B.B.C. in the early days at Savoy Hill, will be revived when the Festival of Radio Drama opens in October. This is Richard Hughes’ thriller, Danger, which he wrote specially for broadcasting. Another play in the series will be O. Henry’s The White Chateau, by Reginald Berkeley, which also achieved fame a few years ago.

The author wrote the play for the microphone, and later it was adapted for the films and the stage.

British Batteries for Tibet

Until 1904 no foreigner had ever set foot in Lhasa, the “Forbidden City” and capital of Tibet, and the news that the Chloride Electrical Storage Co., Ltd., has received an order for an Exide battery of 220 cells, for the Palace of the Dalai Lama, Ruler of Tibet, is a tribute to the prestige of British goods. Getting the battery there will be no easy task, since the only means of transport is by mule, yak, or camel, and the 300-mile journey under these primitive conditions will involve special precautions in the packing of the glass boxes; moreover, the passes into Tibet are usually closed by snow from about the end of November, so that the shipments must reach Calcutta not later than the first week in November.

Record G.F. Orders

Busy factories are the usual aftermath of Olympia, but Graham Parish tells me that the orders the firm has received since the Show (set designers have apparently fired every constructor with their own enthusiasm over the new additions to the G.F. range) makes the 50 per cent. factory extension at Bromley look like being quite inadequate.

More new lines at the Manchester Show—a heavy advertising campaign—Graham Parish, seems to be paying off and gathering speed for a record year. They are publishing a new catalogue this month, I hear, and I suggest that you drop them a postcard for this and the G.F. Station Tuning Chart, before you forget it—they’re both worth having.

The New Hellesen Hi-Life High-Tension Batteries

Very interesting tests have recently been made by a famous radio set manufacturer of the new Hellesen Hi-Life high-tension batteries. We understand that they were shown to give no less than 50.2 per cent. longer life than other batteries on the same test. This is the more startling as this unique cell belongs to the Hi-Life range sold at popular prices. All Hellesen batteries are now made entirely in England with British labour, and the big factory at South Wimbledon is filling up with raw pressure. These Hi-Life batteries are packed in attractive cartons in a new design of orange and black.

Selling at rather higher prices, the new Super Range maintains the long-standing reputation enjoyed by this firm for durable heavy-duty batteries. These Hellesen super batteries make use of a new patent which gives them a greatly increased capacity without adding to their weight or overall size.

Background Sounds for Operatic Records

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Controlling Reaction

Before saying anything about the appropriate adjustments to obtain this desirable silkiness of control, let us first discuss the possible methods of controlling reaction. Figure 1 shows the most popular circuit, a modification of Reinartz's arrangement, in which a small variable condenser of about .0002 mfd. is used in series with the reaction coil to control the impedance of the circuit and so vary the feed-back current through the coil. Figure 2 shows a method that is somewhat older and not so much used nowadays, but is still a great favourite with the writer; it is called the "throttle" condenser method because the reaction condenser $C_2$ is used to provide a variable path to earth for high-frequency currents, so that at the minimum setting of the condenser the reactance of this path is high and the H.F. currents are throttled back, as it were, and prevented from flowing through the reaction coil; increasing the capacity then permits more H.F. to flow so that there is a larger current through the reaction coil and the feed-back is increased. Both of these circuits are capable of very smooth control, but it is not easy to eliminate from either of them another fault common to all reaction circuits—their tendency to affect the tuning of the grid circuit so that altering reaction detunes the station being received and thus complicates the tuning process.

The use of a variable resistance in series with the H.T. positive lead to control reaction is an alternative method that suffers far less from this defect, while at the same time being capable of very smooth action. A circuit is given in Figure 3, in which $R_3$ is the reaction control resistance; any good instrument of about 50,000 ohms will be satisfactory provided it is silent in operation, the 2 mfd. condenser $C_4$ helping to ensure this. The amount of reaction obtainable depends on the condenser $C_2$, which is about .0003 to .0005 mfd. capacity; the larger this condenser the stronger the oscillations obtained with a given reaction coil, or conversely, the smaller the reaction coil need to be to obtain sufficient oscillation. This is another point in favour of the arrangement, since a small reaction coil reduces the amount of detuning caused by the control. If a very wide range of frequencies is to be covered with one reaction coil it may be desirable to make $C_2$ variable in case the variation allowed by the resistance is not great enough to give controllable reaction at both ends of the frequency range.

Adjusting H.T. Voltage

In order to obtain the maximum amplification from the valve the H.T. voltage should be as high as possible, but, unfortunately, this often leads to harsh reaction control; the H.T. should therefore be varied until the loudest signals are obtained.

Fig. 1.—A simple reaction arrangement.

Fig. 2.—A modification of Fig. 1.—This is the throttle reaction control.

Fig. 3.—Controlling reaction by means of a resistance ($R_3$).
consistant with smooth movement, and in making this adjustment it is desirable to try the effect of varying the number of turns in the reaction coil, since the increased H.T. volts will make a smaller grid coil possible, and this often leads to greater smoothness and less effect on the tuning of the set. It will be noticed that in all the circuit diagrams the grid leak is not taken direct to the L.T. as usual, but to the slider of a 400-ohm potentiometer R5; this is a refinement that is sometimes helpful in improving reaction by making possible a slight variation of the bias applied to the valve. The knob is rotated until an improvement in reaction control is obtained, but it should not be taken too near the negative L.T., or signal strength will be materially reduced. A higher value of grid leak is desirable in this case, for if smoothness and less effect on tuning are required the slider of a 400-ohm potentiometer R2; this gives an improvement in reaction control is obtained, but it should not be taken too near the negative L.T., or signal strength will be materially reduced.

Trying-out Different Valves

Before settling on one particular valve for the detector in a short-wave receiver it is always worth while to try out all the possibles, even if one class is best for the purpose it often happens that experience of a certain type, even from the same maker, works better than another or is quieter in operation. Quietness is perhaps the greatest virtue in a short-wave set, for it is no use having loud signals if they are made unreadable by hisses or battles in the background arising from noise. Different valves may show excellent variation in response, dust in variable condensers or run-down batteries. Some of the small power valves of the L.P. class of only a few decades ago, having an impedance of 6,000 ohms or so, often make very good, quiet, detectors, although naturally one would expect the response of a detector type on the H.L.2 class to be more efficient. Another possible source of noise is the aerial, especially in picking up mains hum; the method of coupling the aerial by a very small fixed condenser C2 to the grid end of the coil, shown in Figures 1 and 2, while being very convenient and simple, sometimes gives rise to a minor degree of noise, and a change over to the aperiodic coupling coil shown in Figure 3 may improve matters, especially on wavelengths above 50 metres; the number of turns should be about one-half to three-quarters of the number in the grid coil, and it is convenient to make the coupling variable.

50 TESTED WIRELESS CIRCUITS

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

This handbook contains every modern circuit for every type of wireless receiver, with instructions for assembling, component values, and notes on operation. Whatever the circuit you require, it is in this book.
THE MANCHESTER RADIO EXHIBITION

(Continued from page 164)

PRACTICAL WIRELESS

October 7th, 1933

The batteries used no introduction, since they have probably been in the market as long as man can make; if need only be said that the latest types are a mark in advance of contemporary progress in the earlier types were.

The condensers are perhaps not so well known, but they certainly deserve to be. For there is no doubt that they are really excellent components in every way.

STAND No. 10, Main Hall

HERALD R.B. MILNES RADIO CO., Bingley, Yorks.

MULTI-DE. data are now known throughout the conditions of an economical source of high-tension current. They consist of banks of steel-iron accumulators connected in series or in parallel in an instant by the operation of a switch. Mechanical designs are now so sophisticated that they can be charged overnight for the ordinary low-tension accumulator, or anything put in series with them provides the necessary H.T. voltage. The units are shown in various sizes and at most reasonable prices.

STAND No. 17, Main Hall

MULLARD RADIO VALVE CO., LTD., 111, Charing Cross Road, London, W.C.2

THIS stand is in a not surprisingly large area of excellent valves; and "tasteful" arrangement.

The condensers are perhaps not so well known, but they certainly deserve to be. For there is no doubt that they are really excellent components in every way.

STAND No. 23, Main Hall

MULLENS RADIO Co., LTD., Bingley, Yorks.

“Herald” R.B. units are now known throughout the conditions of an economical source of high-tension current. They consist of banks of steel-iron accumulators connected in series or in parallel in an instant by the operation of a switch. Mechanical designs are now so sophisticated that they can be charged overnight for the ordinary low-tension accumulator, or anything put in series with them provides the necessary H.T. voltage. The units are shown in various sizes and at most reasonable prices.

STAND No. 55, Main Hall

PEYER RADIO, LTD., Africa House, King'sway, London, W.C.2

THIS feature of this stand is the new "Sovereign" anti-interference unit which is claimed to prevent electrical and atmospheric interference of any variety. By connecting the unit in different ways it is claimed to produce alternative effects according to the particular kind of interference which is experienced.

STAND No. 66, Main Hall

PORT TAYLOR RADIO LTD., Gorse Road, North Acton, London, W.3

This feature of this stand is the new "Sovereign" anti-interference unit which is claimed to prevent electrical and atmospheric interference of any variety. By connecting the unit in different ways it is claimed to produce alternative effects according to the particular kind of interference which is experienced.

STAND No. 65, Main Hall

PORT TAYLOR INSTRUMENTS LTD., Purley Way, Orpington

"MADRID" receiver, occupies a good deal of the space on this stand, and the outstanding feature in this range is the superhet superheterodyne.

This is fitted with automatic volume control, a noise

(Continued on page 167)
UNIVERSAL "HIGH - VOLTAGE VALVES"

With these valves you can build yourself a "UNIVERSAL." All-mains set—convert battery sets to all-mains—alter present mains set to work off either A.C. or D.C. supply. No transformers or resistances needed. Easy and economical.

Write for latest lists and circuits.

Sole Agent for Great Britain:
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"TUNING COILS" by "Photon"

In the preceding "Photon" article we dealt with the tuning coil in the open, and demonstrated a simple method of calculating the inductance.

We are now ready to consider the question of the "potted" coil. Fig. 1 may be stated that when a coil is "potted" the whole field is virtually confined to the space within the pot. Owing to the high a.C. frequency and the fact that the pot provides what is really a short-circuited secondary very little of the magnetic field can escape from the pot, in fact the amount of field that can escape is negligible; that is what the pot is for—to prevent interference. The form of the field is consequently totally different from when the coil is in the open; it is not as shown in Fig. 1 (as has twice been times represented), but as shown in Fig. 2.

The lines of force must form closed curves passing through the walls of the pot; obviously this restriction of the field in the external field is negligible; that is what the pot is for—to prevent interference. The form of the field is consequently totally different from when the coil is in the open; it is not as shown in Fig. 1 (as has twice been times represented), but as shown in Fig. 2.

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suppressor, full-vision tuning scale, tone control and trimming device.

A master switch having four positions for putting into the past, and Messrs. Radialaddin's in part exchange. THIS firm specialises in speakers of the different types: these models enable constructive feature placed on the market. A Class B valve costing only £32 7s. 6d. High-tension Power "Full o' the system has operated very well.}

The display of sectionally-cut loud-speakers of every type is to be seen on this stand, and the models range from the Type 50, iron-cored transformer up to the latest Type 200. The B.C. valve costing only £210 8s. The display features all the way through the neighborhood is a neat component built into a small box." A Class B valve costing only £20, and the display of sectionally-cut loud-speakers of every type is to be seen on this stand, and the models range from the Type 50, iron-cored transformer up to the latest Type 200. The B.C. valve costing only £210 8s. The display features all the way through the neighborhood is a neat component built into a small box.

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

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Name........................................... Age...........
Address.............................................

October 7th, 1933

PRACTICAL WIRELESS

ANNOUNCEMENT

To men who want careers in RADIO

1. A.V.C.

These letters stand for Automatic Volume Control, a term which is being increasingly used in connection with modern receivers. The term is not strictly correct as the arrangement only comes into effect at certain pre-arranged conditions. In general, the arrangement is carried out by utilising the signal voltages passed on by the detector to vary the bias on the H.F. valves. It is well known that a current passing through a resistance results in a voltage drop across that resistance, and, therefore, we may arrange a signal of a certain value to pass through a resistance of a certain value so as to provide a biasing voltage on a variable H.F. valve. Any reduction of signal strength passed through this resistance will reduce the bias on the H.F. valve and so increase the magnification of that stage, resulting in a louder signal being passed to the detector. Conversely, an increased signal will pass more bias to the valve, and so reduce its sensitivity. Modifications of this basic principle are introduced by utilising special diode valves for biasing purposes, and also by arranging that the controlling effect of the H.F. stages does not operate until a certain signal intensity is reached. In this condition it is known as Delayed Automatic Volume Control.

New Times Sales Class B Speaker Unit

The illustration shows a neat Class B unit and loud-speaker, already mounted on a battle for inclusion in any type of cabinet. The loud-speaker is of the permanent magnet type, with matching transformer fitted to the substantial metal chassis, and this is, in turn, coupled to an efficient Class B output choke. A tone-control condenser is fitted across the primary sections, to eliminate some of the higher frequencies and so give a slightly richer effect to music. The values chosen appear very suitable and certainly avoid the rather high pitched tone which is generally noticeable with Class B working. The three transformers are all at angles with one another to avoid interaction. A high-voltage cord is fitted to it, and this is provided at its end with a combined valve-holder and plug which fits into the output valve of an existing receiver. The present output valve is then plugged into the top of the adaptor and so connects the unit in circuit with the batteries, etc. On test results were very good indeed, full volume being obtained, and all conditions having to be made to the set with which it is used. It is marketed by New Times Sales, 56, Ludgate Hill, E.C.4., at 5s. 6d. with valve.

A Problem Solved

Does the A.C.-D.C. Universal receiver appeal to you? Perhaps you would like to build this receiver, or one of the other interesting designs which have been published in these pages, but are prevented from taking advantage of the improved results which are obtained from these modern receivers because you already have a receiver which is giving good results, and you do not feel like scrapping it. There is, however, no need to go on using your present set for the man who can build an up-to-the-minute receiver, as your position has been considered and our requirements made. Partex Radio, Valeen House, 56, Ludgate Hill, E.C.4. This firm specialises in the part exchange of existing apparatus in order that new receivers, or sets of parts for receivers, may be obtained. It should be unnecessary for us to point out the immense advantages which may be obtained by the scheme. No doubt many readers have already attempted to dispose of an old set to a friend, or perhaps have advertised it in a local paper, but without success. All these difficulties are removed when you can go to a firm and state that you desire the parts for such-and-such a receiver, and that you have a receiver, in good working condition, which you wish to dispose of. A really good allowance is then made for the old set, and you are able to obtain the parts for the new receiver without any further trouble.

We would urge all our readers who are desirous of taking advantage of this scheme to write without delay to Partex Radio at the above address for full details.

BATTERY DOUBLE-DIODE

 USERS of battery receivers will be interested to learn that a double-diode will shortly be available for them. This is a homemade product, and full details and reports will be given when available.

STAND-OFF INSULATOR

From Messrs. Ward and Goldstone comes the announcement of a neat standard insulator listed at 1s. This will enable owners of battery receivers, as well as for arranging an aerial on earth wires, to save them from the experimental approach.

HEAVY DUTY H.F. CHOKE

An ingenious H.F. choke, especially designed for marine use, has been received from Messrs. Ward and Goldstone. Priced at 7s. 6d. This is a most substantial component rated to carry the full mains voltage in D.C. sets, with a minimum voltage drop. Full details to be given later.
A SIMPLE H.T. ELIMINATOR

The diagram shows a simple, safe and effective H.T. unit for D.C. mains 150/250v. Smoothing is adequate, and the H.T. hum-free for sets using up to three valves. The “Fuseplug” rules out accidental short-circuits. R1 and R2 resistances shown for voltage dropping are suitable for 200/250v; for lower voltage mains reduce accordingly. A cover should be provided and the earth wire of set connected to E. terminal.

BULGIN COMPONENTS ILLUSTRATED

<table>
<thead>
<tr>
<th>Resistor</th>
<th>Capacitor</th>
<th>Transformer</th>
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<tbody>
<tr>
<td>Price</td>
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<td>565/13</td>
<td>65/55</td>
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575d, MOSELEY ROAD, BIRMINGHAM, 12.
FILAMENT CIRCUIT IN D.C. MAINS SETS

(Concluded from Page 58, September 30th Issue)

Consequently, the correct value in this case for the mains-resistance is 20 ohms. The next point requiring explanation is the necessity for two shunt resistances which are shown in Fig. 5, connected directly across the filament of a special valve. It will be appreciated that as the anode current of the last valve passes down the filament lead it must also pass through the filament of the other tubes. If the circuit is arranged for it an alternative path. The shunt resistances are this alternative path, allowing the anode current to pass round the circuit, but not through the two valve filaments.

Providing for Grid-bias
Grid-bias must, of course, be provided for, and fortunately this is a simple matter as the voltage drop across any ohmic resistance in the negative side of the filament circuit can be utilized for the purpose. As has already been pointed out, the resistance of the filament causes a potential difference of 4 volts between points A and B in Fig. 3, and, therefore, if the grid return lead is taken to point A, the grid of the output valve will automatically be 4 volts negative in respect to the filament—in other words, 4 volts bias is being applied to the last valve.

As the valve will have to be replaced for any reason, the shunt resistances will be somewhat less, greater current will flow, and the valve will be thrown out of bias. Obviously, if the filament resistance of the replacement valve is less than that of the original valve, the total resistance in circuit will be somewhat less, greater current will be required to flow, and the valve may be over-run, causing it to lose emission much more quickly than it normally would.

In the latter the filament is also the cathode, in the former the cathode is a separate element which encloses a heat element called the "heater." When the heater is connected to an irregular supply, it becomes hot, and transmits heat to the cathode, causing the emission of electrons in a steady stream. Obviously, if the heater-fed from an irregular supply is unsatisfactory, it may be necessary further voltage drop shall be provided in the negative lead, which will give the necessary further voltage drop and consequently Lf more bias, or alternatively, as the negative

choke possesses resistance, a portion of the choke winding can be tapped off and arranged for in circuit in Fig. 5.

Now indirectly-heated D.C. valves differ from the battery valve, in that whereas in the latter the filament is also the cathode, in the former the cathode is a separate element which encloses a heat element called the "heater." When the heater is connected to an irregular supply, it becomes hot, and transmits heat to the cathode, causing the emission of electrons in a steady stream. Obviously, if the heater-fed from an irregular supply is unsatisfactory, it may be necessary further voltage drop shall be provided in the negative lead, which will give the necessary further voltage drop and consequently Lf more bias, or alternatively, as the negative

choke possesses resistance, a portion of the choke winding can be tapped off and arranged for in circuit in Fig. 5.

For instance, the set is used for a three-valve set using indirectly-heated D.C. valves.

As the current in the heater circuit is unsmoothed D.C., stray couplings are likely to be present, the results being particularly unpleasant in view of the fact that the H.F. ripple is made up of a series of sine waves and is usually at a much higher frequency than that found on A.C. mains. The detector stage is always the most troublesome, the only satisfactory method of keeping these out of the set is to use a special high-frequency choke in each mains lead before the L.T. smoothing chokes, as shown in Fig. 4.

Another difficulty frequently encountered in such a set is the presence of H.F. currents superposed on the mains voltage that one may, if allowed to get into the receiver, may cause reduced selectivity, modulation hum, etc. The smoothing chokes are, of course, designed to deal with such frequencies and, consequently, they do not offer much opposition to these unwanted currents. Thus, in a separate screening-box, the set will operate much better with no connection to earth at all.

Finally, it will be appreciated that any fluctuation in the mains voltage will cause a similar fluctuation in the voltages applied to the filaments, which are not, of course, designed to withstand any such fluctuations, and in order to avoid premature deterioration due to this, a variable-selective regulator lamp can be connected in series with the mains resistance, which will take care of any considerable mains-voltage fluctuation permitting only the correct voltage to enter into the filament circuit.

Figure 4. — A circuit using Indirectly-heated D.C. Mains Valves.

Figure 5. — Automatic Bias is obtained by a resistance and condenser in the cathode lead.

Continued on opposite page
range, these whistles being of a nature such as would render the set almost useless.

As in A.C. design, automatic grid-bias can be arranged for by connecting resistances in the cathode leads as shown in Fig. 5. As the anode current of the valve must pass through any resistance in its cathode lead, voltage is developed across the anode current in milliamperes. In order to provide a low-resistance direct current, H.F. or L.F. currents which may be present in the circuit, the formula for calculating cathode resistance values is:

\[ \text{Resistance} = \frac{10,000}{\text{m.a.}} \]

Universal Valve for A.C. or D.C. Mains

The third type of valve, namely, the "universal" or Zart Ganz valve, is a form of indirectly-heated valve, the heater of which is designed to work directly from any supply, whether A.C. or D.C., without the necessity of a mains-transformer or a voltage breakdown resistance, thus permitting the construction of a receiver which will operate from either D.C. or A.C. mains without alteration or adjustment. Such a receiver is, of course, an attractive proposition to a constructor who, although now on D.C., shortly expects to change over to A.C., but it is not possible to use the universal valve—ordinary indirectly heated D.C. valves can be used. The only unconventional point is the supply of the supply for any anode current when the set is connected to A.C. mains. This is, however, quite a simple matter if it is borne in mind that a metal rectifier offers very low resistance to current passing one way, and, consequently, very little voltage drop will occur through this component with direct current passing through it. Under these conditions, the rectifier is naturally only an "ornament," but in any event, it does not prevent the passage of D.C. and does not reduce, to any appreciable extent, the voltage available for the anode circuits. When the set is connected to A.C., however, the rectifier comes into its own and converts the alternating current into direct current which, after smoothing, is suitable for the anodes of the valves. It will be appreciated that in such a circuit the smoothing must be exceptionally comprehensive, partly due to the fact that only half-wave rectification is employed. It is, however, to be noted that a "universal" receiver of this type does not comply with the various electrical regulations when connected to A.C. mains, as in such a circuit, the usual mains-transformer is, of course, connected directly to the mains. This can be overcome quite simply by interposing a 1:1 transformer between the set and mains, removing it, of course, when using the set on D.C.

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WATER DISTANCE SWITCH for Batteries or Transformers. Wire is fitted on all from any room. Cash 6d.

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WATER UNIVERSAL METER. British made, these meters are as good as British, components, etc. Cash 25/-

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15/- down, balance in 6 monthly payments of 2½.

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SOVEREIGN PERMEABILITY TUNER
The first permeability tuner to be received from the Sovereign Factory, and is no doubt the forerunner of many similar tuners. As may be seen, it consists of an electrostatic clamping to which is fitted a number of trimmers and a slow-motion drive. The latter works with a very small deflection, approximately 0.5 to 1. The actual mechanism is simple but very effective, and employs a metal thread screw running through the centre of the assembly, upon which is mounted a bracket holding two separate windings. Cores of the powder iron are arranged on either side of this central screw, and the former upon which the coil are wound are a comfortable sliding fit over these cores. The result of this is that the effect of the initial position of the cores to a position where the core is completely inside the coil, thus giving a complete variation in inductance value. The size of the trimmers, etc., have been chosen with the pitch of the thread to have some effect as we have been used to experiencing when turning a coil through the broadest possible with a normal tuning condenser. The spacing of the pitch stations is quite effective, although our attempt to make a coil of slight crumbling was noticed in one part of the scale. For bottoming purposes, however, the tuner will be found most effective, and will enable a very simple type of receiver to be built up in view of the fact that no tuning condenser is required. The price is 1½.

WATERFEL HYWATT RESISTANCE
A new type of wire resistance has been produced by W.A. Wetherell & Co., and a sample has been received for test. It consists of a wire winding over a tube of heat-resisting material, the completed resistance being coated with an enamel containing blue-grey. The specimen was rated at 5,000 ohms, and on test it was found to be slightly higher than this figure, the error being well under two per cent. A test was arranged to ascertain the current-carrying capacity of the complete resistance, and it was found that it was well below 300 mA. At 50 mA the wire was not warm to touch, but the burn-out took place near the circle mark. The resistance then cut continuously for 5 minutes sub-dived at 50 mA, and although a slight smell was given off the wire stood up to the strain admirably. It would appear from these tests that the material is admirably suited for incorporation in eliminators and mains receivers and will handle quite a considerable wattage without risk of breakdown.

NEW W/B SPEAKER
We have already mentioned the new Microcele radio, and we have now received a smaller edition of this interesting speaker in the form of a permanent-magnet moving-coil speaker with matching device fitted to the base. The speaker and class is of the same size and material as the Microcele type M/4A, but the magnet system is somewhat smaller. The ordinary "U" type is employed, with a central pole piece and pole shoes, the pole shoes being linked to the magnet to accommodate the special tapped transformer. As can be seen in the case of the M/4A, two moving-iron arms are fitted to the base, under which conditions the matching may be carried out for practically any type of receiver. Where, however, push-pull or similar circuits are used, we are connected with a metal terminal fitted between the two black ones, and the armature or two are then adjusted symmetrically, providing only one ratio. The speaker was tested with an orange for positive receiver and gave very good results. Speech was clean and crisp, with no trace of peaking, and that of forward type now associated with W/B speakers. Sensitiveness was quite high for a speaker of this class, and the volume from a two-watt valve was ample, whilst on a four-valve it was possible to push the volume to the limit without any trace of distortion. The new Microcele device was found most effective. As this speaker is only 3½ 1/s, it will no doubt prove immensely popular.

NEW TUBE: "CLASSE B" 1 M.W. Transmitter. The new British Radio valve intermediate frequency transformer with screen removed to show construction.
PRACTICAL LETTERS FROM READERS

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

A Soldering Hint

SIR,—I read your replies to queries each week, and find them not only exhaustive and accurate, but written in an interesting manner.

But this week I noticed a reply which I think could be made a little more helpful to those who, like myself, two months ago could not make a soldered joint. However, I read various instructions for soldering, but very rarely could I manage to get a soldered joint to run evenly. However, one evening I resolved to find out my difficulty.

I was soldering various parts for experiment and I discovered the answer to my problem. I soon found that the solder would only melt where the iron was properly “timed,” and I noticed that a small "blob" of solder adhered on this part. If this "blob" is carefully applied to the part to be soldered, a neat job will result.—H. RATCLIFFE (Manchester).

Class B Eliminator

SIR,—I have taken your weekly book since its introduction, and think it good value for a modest threepence.

Some months ago you promised us a H.T. Eliminator using a neon tube. I have been using it for three months now, and find it is the only method waiting to see that, but I have been using it with the greatest of success for three months ago you promised us a H.T. Eliminator using a neon tube. I think could be made a little more helpful in the manner. Thank you for giving us so much useful advice in your paper only, and should contain the name and address of our sender (not necessarily for publication).

Ephoc Radio—a Correction

SIR,—We have seen your interesting article in reference to our speakers in the edition of September 30th, and highly appreciate same. I would like a little correction to be made here, however. In the second column you state, “Ephoc were pioneers of point-magnet moving-coil speakers and produced the first efficient instrument of this kind in Great Britain.” I would like to point out that the mention is correct so far as development research is concerned, the first of our efficient instruments that we actually put on the market dates back only about six years ago.—Ephoc Radio Manufacturing Co., Ltd.

Circuit diagram of Mr. E. C. Hobday’s eliminator.

properly, dry batteries proving unsatisfactory. The accompanying diagram shows the circuit. All materials are Ferroli, with the exception of the neon tube, which is a Cossor. This is absolutely no hum on my mains, which are very dirty and difficult.

What I should like to see in PRACTICAL WIRELESS is a battery-operated set with an Ignispan or similar unit with two variable-mu detector and Class B output with A.V.C. and tone control. I believe this could be done, and for one would welcome any attempts made in that direction. Wishing you the best of success.—EDGAR C. HOBBAY (East Finchley).

The Fury Four

SIR,—I have built your Fury Four, and it is the set I have just constructed. Mr. Cumm is to be congratulated as the Editor of PRACTICAL WIRELESS, and the Wireless Constructor’s Encyclopaedia, and I extend to him and his staff the best of good wishes. Hoping the new superhet, the Premier Super, is as good as the Fury Four.—H. WILLIAMS (Linlithgow).

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At last the day of All-World Radio has arrived, and you can build with your own hands the first receiver to give you not only England and Europe, but America and Australia direct. The Lissen All-Wave All-World "Skyscraper" 4 tunes from 12 to 2,100 metres. It brings two complete new wavelength ranges within reach of the ordinary listener—stations and programmes which before he was never able to receive—Ultra Short and Short-Wave transmissions from the ends of the earth. And remember you get these stations through Double-Balanced Pentode Output giving brilliant reproduction on a Moving-Coil Speaker—as much power as a Mains Set from ordinary high-tension batteries.

Lissen have made this All-Wave All-World Radio available to Home Constructors first, because it brings back the thrill of conquest to hear America and Australia direct on a set you have built yourself, it makes you an enthusiast to realize what a wonderful thing you have created!

When you see the Great Free Chart of the All-Wave All-World "Skyscraper" 4, which tells you how to build it and how to work it and why it gives such marvellous results, you will agree at once that it will be wise of you to build for yourself rather than buy a factory-assembled receiver which cannot give you these new and intriguing short-wave stations. The FREE CHART simplifies everything; there are pictures of every part, with every wire numbered, every hole lettered, every terminal identified. YOU CAN'T GO WRONG! But get the Chart and see for yourself—then build the Lissen All-Wave All-World "Skyscraper" 4, the SET THAT SPANS THE WORLD!
Your Radio Tool Kit

If you have not yet reserved your Radio Tool Kit, every tool of which has been specially designed by the Editor of Practical Wireless, and cannot be obtained in any other way, you should do so at once. You should hear in mind that the tools are high-class instruments which in the ordinary course would cost you at least 12s. 6d. Make up your mind to possess the tools are high-class instruments which are mended only by them! Don’t use tools designed for schoolboys and usually recommended only by them! Every reader of Practical Wireless knows good tools when he sees them—see page 187!

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Our Pocket Tool Kit—specially designed for those who take pride in building sets correctly—is further evidence of our experience in every branch of radio.

PRACTICAL WIRELESS is the LEADING CONSTRUCTOR’S ENCYCLOPEDIA-and to supply it for a purely nominal subscription of 3s. 6d. per annum (and most worthwhile in every respect) is further evidence of our experience in every branch of radio.

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Forthcoming events in Practical Wireless will prove of the greatest possible interest to home constructors. We have many original and far-reaching ideas to place before our readers.

This series will mark a new departure in wireless construction since they will describe in detail the construction, so that you study design (as you build) of an eminently modern battery receiver, which can be built up in easy stages. We shall commence by describing the construction of an ultra simple two-valve set, and in later articles it will be explained how additions and modifications can gradually be made until a de-luxe four-valve is eventually completed. At every stage of the constructional work an interesting technical stall will be presented.

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This paper, which is world renowned for the originality of its policy and ideas, and the energy and enthusiasm with which it caters for the home constructor, has become accepted standard by which others are judged.

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broadcasting station. It has now been decided to close down its entertainment broadcasts on January 1, 1934. It will be retained by the military authorities for official work only. To Replace Witzleben

The 100-kilowatt Berlin station, which is being erected on the old artillery ranges near the German capital, is now nearing completion. It will be testing towards the middle of November. It is hoped to have it ready for the regular daily broadcast programmes in time for Christmas.

Winter Time

With the return from British Summer Time to Greenwich Mean Time (winter time), we must remember the differences which exist between our clock readings and those used on the Continent. Most of the European countries, such as Germany, Scandinavia, Italy, Austria, Switzerland, and so on, which adopt Central European Time (coinciding with B.S.T.), do not make any summer alteration, and consequently now one hour ahead of us. Eastern European time, which covers part of Russia (Leningrad, Estonia, Latvia, Finland, Bulgaria, Romania, and Turkey), represents two hours ahead of G.M.T. Moscow, further east, again one hour, so the midnight chimes must be tuned in at 9 p.m. G.M.T. Spain, Portugal, Algeria, and Morocco make no alteration and adopt G.M.T. throughout the year. Holland will still be twenty minutes in front of us and Reykjavik (Iceland) one hour behind. This change over, as the days grow shorter, must also be borne in mind by short-wave listeners in their search for transatlantic broadcasts.

Radio Tamanarive

The Madagascar Posts and Telegraphs have increased the power of the F.I.U.2 (Antananarivo) transmitter to 300 watts. Most of the short-wave broadcasts are now made daily on 32.7 metres (6,093 k/c). The best time to search for this station is between 5,693 k/c and 7,670 k/c, hours, so the midnight chimes must be tuned in at 9 p.m. G.M.T. Spain, Portugal, Algeria, and Morocco make no alteration and adopt G.M.T. throughout the year. Holland will still be twenty minutes in front of us and Reykjavik (Iceland) one hour behind. This change over, as the days grow shorter, must also be borne in mind by short-wave listeners in their search for transatlantic broadcasts.

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A Simple Explanation of the Superheterodyne Circuit which will Enable even the Beginner to Understand its Apparent Complications. By W. J. DELANEY

WHY has the superhet lost the popularity which it once enjoyed? There are two reasons. Firstly, the use of terms such as frequency changer, intermediate frequency amplifier, separate oscillator, and similar names frightened the ordinary amateur. Secondly, many experts said that the superhet was only for the advanced technician, and consequently he did not trouble to examine it. It made the ordinary amateur think that the superhet was inferior. Good loud-speaker results could not be obtained, they said. Therefore, the superhet was relegated to the background because manufacturers could not sell the necessary coils, etc., and very few amateurs were interested in it. It spite of this, however, it was definitely employed in many research laboratories, and even by the B.B.C. for certain relay purposes. The improvement in valves and coil design has led to a revival of the circuit, and it can now be quite definitely stated that the quality of a superhet can be equal, even if not better than the majority of ordinary circuits, and it is even simpler to handle than many two-valve sets. This latter feature is due to the fact that a superhet can be "one-knob tuning," and a volume-control is the only other fixture apart from the necessary on-off and wave-change switches. Actually there is nothing out of the ordinary in the circuit, and I propose to show in this article just how the superhet follows standard practice, and how the mysterious terms which are given to its different functions are really no more complicated than the circuit arrangement. I hope that this will lead many to take up the circuit, because it is certainly the circuit of the future, as it is the only one which will give perfect separation to stations working with the allotted wavelength separation.

The Circuit
To commence with I will take a complete superhet circuit, and not one wherein one valve is employed for dual purposes. This will make the working clearer and avoid complicated terms. In Fig. 1 is a diagrammatic representation of a seven-valve superheterodyne, with each separate stage represented by a box. The first point to impress upon the reader is that some of these boxes carry names familiar to you in ordinary receivers, namely H.F. amplifier, detector, L.F. amplifier and output stage. These are exactly the same as are used in any ordinary receiver and consequently need no explaining. They do not differ in the slightest degree, either in construction or the manner in which they function. These stages are shaded in the sketch, and it will be seen that there are only three stages left, and that is the one which I will explain. Before going on with the explanation I would like once again to stress that the shaded portions may be taken from any circuit of normal design and would be replaceable in the superheterodyne. This, the H.F. stage is employed as an amplifier for very weak or distant signals; the second detector operates on the normal grid leak or anode bend arrangement, and the L.F. stage is used to enable a sufficiently loud signal to be passed to the output stage for the satisfactory operation of the loud-speaker. There is thus left the I.F. stage and the first detector and oscillator. To simplify matters I will take the L.F. stage first.

The Intermediate Frequency Amplifier
Its name should enable its function to be understood, but for the non-technical it may be described simply as a standard H.F. amplifier. The tuned circuits of which are fixed to work at one wavelength only (Fig. 2). There are no tuning condensers to be manipulated, and the H.F. transformer which is included in its grid circuit is designed to work at a wavelength of usually just over 2,000 metres (or 110 to 125 kilocycles). Now, as we wish to receive stations working on all sorts of different wavelengths, how can we use such a fixed amplifier? Obviously, we could not, all our stations equivalent to 2,000 metres or so, and this is where the first part of the superhet circuit comes in. To enable us fully to understand the principle it is essential to work in kilocycles (or frequency) in place of the customary wavelengths (in metres), and the reason for this will be seen as we go along. The London Regional station works on a wave-length of 356 metres, which is a frequency of 843 kilocycles. Now, as we must turn this to 110 or 125 kilocycles to enable our I.F. stage to work on it, we must obviously change the frequency to that figure. This is the function of the first detector and oscillator, and the combination is known as the "frequency changer." I shall deal with this in the next article.

Fig. 1.—Diagrammatic representation of a 7-valve superhet circuit.

Fig. 2.—The circuit arrangement of a typical I.F. stage.

Fig. 3.—How the intermediate frequency transformers are built up. The small semi-variable condensers are adjusted to provide accurate tuning of both primary and secondary. In some cases this is done at the factory, and in others a small adjustment is allowed for.
---Making Your Own---

Intermediate Transformers

In This Article the Author Explains How the Constructor Can Build Efficient Components at Little Cost

---By N. A. KAYER---

The keen constructor likes his set to be as far as possible his own work, and experiences pleasure from building up his own components before assembling them to form the complete receiver. One component which is usually regarded as one to be bought ready-made is the intermediate frequency transformer of a superheterodyne receiver, and although the very best results are required in the way of true band-pass selectivity it pays to use a factory-constructed article, it is quite a simple job to build an I.F. transformer which will give satisfactory results. Since two or more transformers are required in a complete receiver, considerable economy can also be effected by making them at home. The instructions given here show how to make an I.F. transformer for the standard frequency of 110 kc/s, and by making up transformers to this specification, any experimenter who has wanted to try out a superhet circuit, but has been deterred by the cost of the transformers, can be assured of success.

Details of Construction

The transformer is shown mounted on a wooden base by the use of a 4 B.A. screw rod through the centre of each. This will give a pair of formers, each consisting of a bobbin provided with two slots /in. wide and fin. deep, in which we have to wind the transformer coils. A fine copper or aluminium can about 4 in. high may be used; these should be as far as possible his own work, in order to keep the sides of the tin well away from the transformer windings.

The lid of the screening box should be bolted to the central hole and nuts placed above and below the holes drilled right through both, one in the baseboard, and three 5/32in. windings. The other holes are for leading wires to the can from below, for making connection to the windings. (See Fig. 1.) We now have to make up two wooden formers—one to take the primary and one the secondary. Each former is built up from discs cut out from 3/16in. plywood; for the complete transformer, six discs of 1 in. diameter and four of 1 1/2 in. are needed; a 5/32in. hole has to be drilled exactly through the centre of each, and the discs are then carefully smoothed off on a piece of sandpaper, after which they can be assembled and glued together in the manner shown in Fig. 2. To clamp them together in their proper positions while the glue is setting, a 4 B.A. screw should be passed through the central hole, and a nut threaded on it and tightened up.

Winding the Coils

This will give a pair of formers, each consisting of a bobbin provided with two slots 1 in. wide and 1 in. deep, in which we have to wind the transformer coils. A fine copper wire connections would obviously be unsuitable. This completes the transformer; in use, the two terminals of one trimmer condenser (it is immaterial which) become the primary terminals, and those of the other trimmer condenser the secondary.

Stiff wire connections would obviously be unsuitable. This completes the transformer; in use, the two terminals of one trimmer condenser (it is immaterial which) become the primary terminals, and those of the other condenser the secondary.

50 TESTED WIRELESS CIRCUITS

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

This handbook contains every modern circuit, complete with instructions for assembling, component values, and notes on operation. Whatever the circuit you require, it is in this book.

The VISOR-TELEDRUM

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

Television, as a subject, has been very much in the news, and although many of the stories which have got abroad appear to clothe some of the immediate developments in a shroud of mystery, this is really far from being the case.

The Facts

What are the facts as we know them today? Well, first of all, there is the present television service provided by the B.B.C., using the standard Baird apparatus, the vision signals being broadcast by the London National station on a wavelength of 281 metres, while the accompanying sound emanates from the Midland Regional station on a wavelength of 398 metres. The transmissions are of half an hour's duration and take place on Monday, Tuesday, Wednesday, and Friday nights, starting at 11 p.m. Now these programmes have a definite entertainment value, and the interested amateur will be amply repaid for any time and money he expends in building apparatus so that he can look in.

If there is any further incentive needed by the reader who cannot quite make up his mind, then here are the other facts.

Although the images which can be seen by the reader who cannot quite make up his mind, then here are the other facts.

The Ultra-Short Waves

Fully cognisant of these facts, the television authorities have been developing both transmitting and receiving apparatus which will give flickerless images (25 pictures per second) complete with a wealth of detail, this last-named resulting from the use of 120-line and in many cases 180 or even 240-line scanning. Details of apparatus of this character were furnished in a Tele-Talkie article of mine which appeared in PRACTICAL WIRELESS dated September 30th.

I continued to hold that which images of this character can be transmitted is via the ultra-short waves, and the B.B.C. are conducting experiments on these very short wavebands, but no time schedule of the transmissions or official statement has been published so far concerning this work or the firm or firms involved.

Completely independent of B.B.C. activities, however, the Baird Company have rented one of the Towers of the Crystal Palace for a period of four years, and work is already well advanced for ultra-short-wave experiments from this ideal situation. I mentioned this in the article referred to above, but I now learn that to start with, the wavelength of 6.05 metres will be used for the transmission of the television signals, and occasionally for sound, while at other times the accompanying sound will be transmitted on 165 metres. When the installation is complete vision signals will be seen on 6.05 metres and the associated sound on 6.20 metres. The important point I am leading up to, however, is that the first television signals should be on the air early in October, and these, to start with, will be of the standard 30-line, vertical scanning 7 by 3 ratio, 121 pictures per second.

All amateurs possessing ordinary thirty-line television receivers can therefore participate in this wonderful pioneer work provided they have a radio receiver which will tune on the ultra-short waveband and are within the range of the signals. This last-named factor is a very doubtful quantity at the moment, and here the amateur can help by making known whether he can receive and synchronize the television signals on his receiver.

The Visor-Teledrum

First of all, then, the reader will want a reliable piece of television apparatus, either of the disc or mirror drum type. I have dealt with the former in my Tele-Talkie series, and this article is to serve the purpose of introducing the mirror drum design, to which I have been devoting a great deal of time recently so as to be sure (Continued overleaf).
that readers would have a piece of trouble-
free apparatus. In addition, I am now
testing out a special ultra-short-wave
adaptor, which I can present to readers and
thus enable them to be in the van of pro-
gress as far as television is concerned.
I shall have more to say about this adaptor
in an early issue, so let me now deal with
the piece of television apparatus which I
have called the Visor-Teledrum.
The only complete mirror drum equip-
ment which is on the market is the Baird
apparatus shown in Fig. 1. This is the
projector which is included in the complete
"television" marketed by that company,
and in consequence is a factory-built job
designed for housing in a cabinet top of
relatively narrow compass. The optical
path and angles between some of the com-
ponents has therefore had to be made to
conform to certain limits, and a jig-drilled
baseplate becomes necessary.
Flexible Apparatus
To give the amateur a little more scope,
and also to make the apparatus more
flexible, I have therefore made the optical
side of my machine keep to a prescribed
centre line. This will perhaps be made
clearer by a reference to Fig. 2, which
shows an elevation of the bare essentials
which have been included, and to Fig. 3,
which is a plan view of the Fig. 2
apparatus.
The "signal analyzer," projection lamp,
 lenses, reflecting mirror, rotating thirty-
mirrored drum are all lined up optically to
be vertically over A B, while the dotted
line in Fig. 2 indicates the path of the
mean light ray beam at any one instant
of the complete operation.
Now what are the main items which
are being included in this new piece
of apparatus? First of all, we
shall have the "signal analyzer,"
projection lamp, and one lens

mounted as a complete unit, called the
Baird Grid Cell unit. Readers will no
doubt recall that I dealt at length with
light modulation devices for television in
PRAC TICAL WIRELESS dated September 2nd,
so there will be no need to go over the
ground again.

An Important Point
In Fig. 4, however, is seen a photo-
graph of the latest form of the Grid Cell
(or light valve) alone, and in Fig. 6 is a
view of the special type of bunched filament,
100 watt projection lamp which I am using
in conjunction with the unit. These two
components, together with the Nodal prism
combination, have the important property
that when the incoming radio television
signals are passed on from the wireless set
to the pair of grid cell leads, the steady
beam of light from the projection lamp is
modulated in such a manner that the
resultant light variation is almost propor-
tional to the light scanning analysis which
produced the signal originally at the trans-

Fig. 5.—The spiral type of 100-watt bunched
filament projection lamp used in the Visor-
Teledrum.
(Continued from previous page)

light, which is now varying in intensity,
passes in a straight line to an inclined mirror
set at such an angle that rays are reflected
slightly upwards and focused on to the
mirrors of the drum. As each mirror picks
up the light area thrown on to it, it in turn
reflects the beam and throws it parallel down the
resultant small area traverse vertically upwards
across a front screen as shown. Each mirror on the drum, instead of being parallel
with the axis about which it revolves, has a
slight " cant," the angle difference between
such successive mirrors being of the order of
one-sixth of a degree for a thirty-mirrored

This accurate positioning of the mirrors is
essential in order to build up the image area in thirty vertical strips of light, each
strip being transmitted on the screen to the
immediate left of its neighbour.

The action is a little difficult to show diagram-
atically, but perhaps Fig. 6 will help matters.
Imagine a beam of light emanat-
ing from the point X which runs through
the mirror I, 6, which we will suppose is mounted
at the angle shown. The light will be
reflected in the path OY, striking a screen
ABCD placed in its path, and if the drum
is turned slightly we can imagine the light
spots travelling upwards and getting to the
strip of light against the edge CPB. A
similar state of affairs exists for mirror 2, 5,
which can be parallel to the drum axis YZ,
and places the vertical strip of light through Q
as a result of drum movement.
Finally, we have the scheme repeated for
mirror 7, 4, giving the strip of light against
the edge DRA. Of course, the angles of
the mirrors with reference to the drum
axis XZ have been exaggerated when compared
with the actual apparatus, but this is really how the image area is built
up on the vertical front screen shown in Fig.

Correct Speed
Another very important feature with this
apparatus is the motor which is driving the
drum at its prescribed speed of 780 revolu-
tions per minute. It is of the universal
type, that is to say it does not matter
whether it is fed from D.C. or A.C. mains.
It must be of a type designed to run
at constant speed. To assist the motor
in maintaining its correct speed, automatic
synchronizing gear is included as part of
the equipment. When the appropriate
cells are fed with signals of the correct
strength, the whole apparatus will be main-
tained in synchronism, and beyond a slight
tendency to float occasionally, that is move
up or down slightly when certain changes
are taking place at the transmitting end,
principally during the transition stage from
close-up images to extended, or vice versa,
the image will be steady for the period of use.

Framing and phasing of the image so that
it is centrally disposed in the screen is
done very simply by moving round a
single knob at the side of the instrument.
The motor is mounted in special trunnions,
and the knob movement revolves the motor
in its cradle, thus altering the relative
position of the synchronizing gear and the
drum so as to move them bodily either up or down, as the case may be.

In its final design I am sure the amateur
will find that he has a piece of apparatus
which will provide him with endless hours of
interesting work, quite apart from the enter-
tainment derived from the programmes now
broadcast. Obviously, to obtain the best
results it must be worked in conjunction
with a first-class wireless receiver, and I
shall deal with this side of the question at
the same time.
1,000 Degrees Centigrade

There's more—much more—in the manufacture of Cossor Valves than meets the eye. Consider for a moment the nickel anodes. Any impurities in the metal—even minute traces of gaseous matter—might, at a later date, impair the efficiency of the valve. Each one, therefore, is subjected to intense heat in an electric furnace, in an atmosphere of hydrogen, to drive off all impurities. Here is a process which is unseen by the public. Many in fact might consider it an elaborate—and rather unnecessary precaution. Yet it is but one of many similar processes devised by Cossor engineers to safeguard a reputation of which they are justifiably proud. When you buy a Cossor Valve you can be certain that no expense has been spared—that nothing has been left undone—to make sure that it will give you long and dependable service.


Name...
Address...

The Little Dog in "His Master's Voice" trademark carries a graphic message to all intending purchasers of radio. He listens—and cannot believe that what he hears is not reality. Apply the same test to any "His Master's Voice" radio instrument... LISTEN; just listen—for it is by that test that every "His Master's Voice" instrument has been made for a quarter of a century.

Listen!


An outstanding example of " His Master's Voice" range of 'true-to-life' radio instruments is the Superhet Lowboy Seven, Model 470. This instrument, employing a seven-valve superhet circuit and band-pass tuning, picks out every worth-while home and European station with satisfying ease. There is no 'overlap,' and the background, thanks to the use of variable mu valves, is practically silent. This razor-edged selectivity and remarkable station-getting power are allied to a tone perfectly balanced from top to bottom of the register. The 'true-to-life' tone is further enhanced by a walnut cabinet acoustically matched with a mains-excited moving coil speaker. Provision is made for the attachment of a pick-up which makes possible the electrical reproduction of gramophone records, and the instrument has sufficient power to operate two or more additional loudspeakers. Take the first opportunity of calling at your nearest "His Master's Voice" dealer for a demonstration. The price of this instrument is 25 gns.—or by hire purchase.

"His Master's Voice"

"TRUE-TO-LIFE"

RADIO

To the Gramophone Co., Ltd., (Dept. P.W.), 100 Clerkenwell Road, London, E.C.1.
Send me full details of Model 470 and complete list of "His Master's Voice" Radio.

Name
Address

(Prices do not include P.I.T.)
Theoretical circuit of the Unipen.

(Continued from page 188)
given elsewhere. Remember that you must get the exact parts; alternatives will only lead to trouble and will invalidate the guarantee.

You can now make the 1in. hole in the 10in. plywood strip, to receive the valve-holder. Next assemble the three pieces of five-ply which form the chassis, and mount the necessary components on it. The panel calls for attention next, and this should be drilled according to the drawing reproduced on the next page. After drilling, attach the tuner, condensers, and switch, and then screw the panel to the chassis.

Point-to-Point Wiring Instructions

After the parts are all assembled the wiring can be commenced. As was mentioned before, there are only fifteen wires, and these can be traced on the wiring plan. Still further to simplify matters, though, I will give you, in words, the point-to-point connections. They are:

- Connect terminal "1" on the valve-holder to the right-hand (looking from the back) terminal of the on-off switch; terminal "2" on the valve-holder to the lower terminal on the S.W. choke; terminal "4" on valve-holder to .0003 mfd. fixed grid condenser; top terminal on S.W. choke to one terminal on the "Midget" choke; second terminal on "Midget" choke to "L.S.-" terminal; terminal on tuner marked "Reaction Fixed" to upper terminal on reaction condenser; terminal "Reaction Moving" to lower terminal on reaction condenser; "Earth" terminal on tuner to end terminal on tuning condenser; end terminal on tuning condenser to terminal "E," and also to right-hand terminal on switch; terminal "Anode" on tuner to lower terminal on S.W. choke; terminal "Grid" to side terminal on variable condenser; side terminal on variable condenser to fixed grid condenser; "Aerial" terminal on tuner to left-hand terminal on preset condenser; other terminal on preset through a hole in the chassis to terminal "A." That completes the normal wiring, which is carried out in "Quickwyre," and it only remains to connect up the grid leak and the flexible battery leads. The former is joined by its own wire ends between terminal "4" on the valve-holder and that terminal on the grid condenser which connects to terminal "4" on the valve-holder. Of the battery leads, those with "H.T.+" and "L.T.-" attached are twisted together and connected to the left-hand terminal on the switch, the "H.T.+" lead goes to the "L.S.+" terminal, the "H.T.+1" lead is joined to terminal "5" on the valve-holder, and lead "L.T.+" is taken to terminal "3" on the valve-holder.

It should be mentioned that the valve holder terminals are numbered from "1" to "4" in clockwise order, starting with the filament terminals nearest to the panel; the centre terminal is number "5."

For the sake of neatness the flexible leads are all twisted together and secured to the underside of the chassis by means of a small wooden "bridge."

Now that you have completed the constructional work, the receiver can be connected up to the batteries and given its first trial. Put plug "H.T.-" into the negative socket on the high-tension battery, (Continued overleaf)
be taken that the set is not allowed to
by increasing the reaction, but care should
condenser the local station will soon be heard.
switch on.
reaction knob to its central position and
turn the lower pointer to " AG." Turn the
to the " M " (medium wave) position and
denser, set the upper pointer on the tuner
leads should be connected to the positive
or not, the set should first be tried with
whether you intend to use a loud-speaker
accumulator, and connect the aerial and
plug " H.T.+ " into the 36-volt socket.
unwired about four turns, the lower tuner pointer set to
" S " and the upper one turned to either
" S1 " or " S2 " according to whether the 14.5 to 40 or 32 to 50 metre range is re-
required. Tuning will then be the same as for
broadcasts bands, except that it must be
carried out much more slowly, using the slow-
oscillation tuning condenser knob only. It is
more important than ever on the short waves
that the reaction control should be adjusted
until the faint " breathing " sound is heard.
set is most sensitive in this condition
and stations can easily be brought in which
otherwise would never be heard. If it is
found that oscillation cannot be obtained
on any particular part of the tuning scale,
or if oscillation starts with a sudden
" plop," the pre-set condenser should care-

The Unipen as a Short-Wave Adaptor
To use the " Unipen " as a short-wave
adaptor in conjunction with a broadcast
set of any type, all that you need do is to

THE UNIPEN
(Continued from previous page)
plug " H.T.+" into the 60-volt socket and
plug " H.T.+1 " into the 30-volt socket.
Join the L.T. leads to the negative and
positive terminals respectively on the
accumulator, and connect the aerial and
earth leads to the appropriate terminals.

Tuning Instructions—The Selectivity Control
Screw down the knob of the pre-set con-
denser, set the upper pointer on the tuner
to the " M " (medium wave) position and
turn the lower pointer to " AG." Turn the
reaction knob to its central position and
switch on. If you now rotate the tuning
condenser the local station will soon be heard.
It can be brought up to maximum strength
by increasing the reaction, but care should
be taken that the set is not allowed to
oscillate, since it can cause interference
with nearby receivers if used carelessly.
If a whistle is heard the reaction condenser
should immediately be slackened off.
If your aerial is fairly near to a trans-
mitter you will probably find that selec-
tivity is poor and signals can be heard over
several degrees of the tuning dial. In that
case the lower pointer on the tuning unit
should be turned to the
" M " position. This
will make signals slightly
weaker, but they should
still be quite loud enough
for the phones. A number
of other stations can be
tuned in by rotating
the tuning dial slowly
and occasionally altering
the reaction setting so
that a faint " breathing "

The attractive panel
lay-out of the Unipen.

phones can be heard several feet away,
the set will not give satisfactory
on a speaker, but when they are sufficiently
loud a sensitive speaker of the balanced
armature type (that mentioned in the
specification has been found to be the best
for this set) will afford pleasing reproduction.

The unipen
October 14th, 1933

Next Week
Next week I will give a test report on the
set and tell you the positions of the tuning
condenser at which the more important
stations are to be heard. In the meantime
you set will not give satisfactory
work in the knowledge that the set cannot
fail to give really splendid results.
It is very unlikely that you will experience
any difficulty in making the " Unipen," or
in operating it either, but if you do, re-
member that the set is Guaranteed, and
you are entitled to our Free Advice in
regard to it. Simply address your letter in
the usual way to the Editor, and remember
to enclose the " Free Advice Bureau "
Coupon, which you will find on the
" Queries and Enquiries " page of this issue.
Superior at every point

H.M.S. Single Screen H.F. CHoke
A small but efficient screened choke which will be found satisfactory in use in all types of circuits where the extra high efficiency of the L.M.S. Twin Screened Choke is an unnecessary extravagance. Suitable for long, medium and short wavelengths. PRICE 2/6

Ensure a safe and efficient Aerial and Earth. The new AEROCINIENT KIT provides all you need. Complete, 6d.

Send a postcard for our new catalogue, which describes all our products.

Graham Farish Products

Advertisement of GRAHAM FARISH LTD., Masons Hill, BROMLEY, Kent.
From every point of view

the 'Alpha' leads

With ordinary speakers, chassis distortion or damage affects the diaphragm, and may cause the speech coil to foul the gap.

In the 'Alpha' the unique and patented method of mounting the diaphragm independently of the chassis ensures complete freedom from the effects of chassis distortion. Diaphragm and speech coil are mounted to a pressed steel member which is secured to the centre pole piece of the magnet by a single nut. Accurate centring of the speech coil in the gap is thus assured, resulting in permanent and trouble-free operation.

Two models are available, viz.: STANDARD, with 6 ratio Transformer, and MODEL "B," with Universal Transformer for Class B operation.

Ask your dealer to demonstrate, and write us for new 1934 Leaflet.

P. M. MOVING COIL REPRODUCER DE-LUXE
REPRODUCERS & AMPLIFIERS LTD., WOLVERHAMPTON

Cure crackling in your radio with a

'REJECTOSTAT'

You can clear your radio reception of most of the interfering noises caused by trams, signs, sweepers and other electrical machinery, without any alteration to your set. Ask your local KB Authorised Dealer about the KB "Rejectostat." He will explain how to fix it to your aerial.

KB "REJECTOSTAT" UNITS—£1 5s. 0d.
Special shielded lead-in cable — 4d. a yard

FOR RADIO AT ITS BEST—you must hear KB—the new Radio

CUT OUT AND POST THIS COUPON to Kolster-Brandes Ltd., Cray Works, Sidcup, Kent.
Please send me full particulars of KB "Rejectostat"

Name
Address

Post in an unvalued envelope using 1d. stamp.
It has already been explained how an H.T. battery is made, so we can now consider how it functions. When it is in circuit chemical action between the carbon, sal-ammoniac and zinc causes a voltage to be developed between the positive and negative elements. But as current is drawn from the cell the same chemical action produces a certain amount of hydrogen gas which attaches itself to the manganese dioxide which absorbs the gas. Hydrogen is an insulator and so the cell would soon cease to operate were it not for the manganese dioxide which absorbs the gas.

Provided that the current does not exceed a certain amount, the hydrogen will be absorbed as quickly as it forms and consequently the cell will continue to operate until the sal-ammoniac electrolyte is spent, or the zinc container corroded away. But if the current load were too great the hydrogen would not be absorbed quickly enough and the cell would either cease entirely to function or would deliver only a small voltage due to the "internal resistance" created by the hydrogen. This explanation should make clear the reason for the different capacities of H.T. batteries obtainable. When a higher current is required for a big set the cells must be larger so that sufficient manganese dioxide can be accommodated to absorb the hydrogen gas which is produced by the chemical action between the positive and negative elements.

Three Sizes of H.T. Batteries

It should now be clear why we have three sizes—standard, double and triple capacity—of high-tension batteries. The first type is capable of giving a steady output of 6 to 7 milliamperes, the second of 12 milliamperes and the third, of some 20 milliamperes. Quite naturally, the larger city batteries are more costly but when the H.T. consumption is in excess of about 7 milliamperes their much longer life might not appeal to you as much as tests under normal working conditions. Just over a year ago a friend who had made a three-valve S.O. receiver told me that his 100-volt standard capacity batteries had lasted no more than eleven weeks each on an average. He had tried three different makes and had paid approximately ten shillings for each battery. We measured the H.T. current consumption of the set and found it to be exactly 9 milliamperes, whereupon I advised the use of a triple-capacity (some makers refer to them as super-capacity) battery of similar voltage and costing a guinea. He was somewhat reluctant to act on my advice but did so eventually, and the larger battery lasted just short of nine months! I leave it for you to calculate the saving. Please bear in mind that I am not financially interested in the sale of batteries, and I recommend the larger types because I know that they are a definite economy for any except the smallest set. If you are in doubt as to the type of battery most suitable for your set, just measure the current consumption when using a battery which is up to full voltage by connecting a milliammeter in series with the negative lead as shown in Fig. 4.

Using Two Batteries in Series

With a receiver in which there is more than one H.T. + tapping, and where one or two of them require only 60 volts or so, the lower half of the battery is subject to a higher load than the other and so runs down more quickly. This is wasteful, because it becomes necessary to replace the battery before a portion of it has become exhausted. In such cases as this it is more economical to use two 60 or 60-volt batteries connected in series in stead of a single one of higher voltage since one of them can be replaced separately.
and the other kept in service until it becomes properly exhausted. A sketch of the connections required is given in Fig. 6.

**Shell** "Life"

There are not many more points to be observed in regard to the use of a high-tension battery, but it should be mentioned that moisture and humidity are both conducive to longer life. If the battery is allowed to get too warm, the electrolyte evaporates to a certain extent, while dampness or extreme cold have a deleterious effect. These things are not of great importance in this country, where we enjoy temperate climatic conditions, but in the interests of economy they should not be entirely overlooked. It should also be remembered that all types of dry battery run down after a certain length of time (probably a year to eighteen months) even if they are not used at all. The deterioration is due to evaporation of the electrolyte and corrosion of the zinc cell containers. For this reason it will be unfair to say that it is unwise to buy batteries from a small shop where they may have been in stock for a long time.

**Other Forms of H.T. Supply**

High-tension accumulators are not used exclusively, but they do provide an economical source of supply when using a large set having a consumption in excess of 20 milliamperes or so. No special mention need be made of their correct use since the same rules apply as in the case of low-tension accumulators, except that the construction is of such a form that recharging is not necessary at intervals of less than two months, always provided that the cells do not run down more quickly than this. As the usual capacity is 2,500 milliamperes hours, they will supply a current of 25 milliamperes for 100 hours.

Another type of H.T. accumulator is built up from a number of nickel and steel plates and uses an electrolyte of caustic potash which will permit of the normal accumulator and does not require so much attention. The cells are all connected to a switch so that they may be put in parallel and charged from a 6-volt accumulator of the normal type. The current taken from the accumulator is quite small and tappings can be taken from a 2-volt section to provide the normal L.T. supply.

A kind of H.T. supply unit which dispenses with the need for a dry battery or mains supply is known as a Battery Suppressor. This is a form of eliminator which can be fed from the L.T. accumulator whilst the latter is being employed for its normal purpose of heating the valve filaments. The principle upon which the instrument operates will be understood by reference to Fig. 6. Low-tension current (of say 10 to 20 milliamperes) is passed through the winding of a high-tension step-up transformer through a make-and-break. This results in a voltage of 110 or so and this alternating current being obtained across the secondary winding and the current is rectified and smoothed in just the same way as from the lighting mains. When using an eliminator of this type its current consumption must be added to that of the valve filaments when deciding on the most suitable capacity for the low-tension accumulator.

**Mains Eliminators—Choosing a Suitable Type**

High-tension eliminators for use from the lighting mains can be obtained in innumerable different types, so the beginner will often be at a loss to know how to make a choice. The principal deciding factors are the maximum voltage and current required by the set, and these items naturally affect the price as well as the cost of the unit very appreciably.

Assuming that the set is of the most popular three-valve S.G.-Det.-Pen. type, it will require at least 120 volts at a minimum of 15 milliamperes, but it always pays to obtain a unit which will have a little "reserve." By so doing it will never be overloaded, and consequently it should last for ever (or nearly so). In addition, there will be "power in hand" for the time when you wish to add another valve, as you most certainly will if you are of an experimental turn of mind. So long as you are going to use battery valves, a maximum voltage of 150 is all that is required, and the appropriate maximum current rating for two-, three-, four-, and five-valve sets can be taken as 12, 15, 25 and 30 milliams respectively. Next you must decide on the number of tappings required. Personally, I prefer to have only two, one giving the maximum voltage, and another a variable zero to 80 volts supply, which is suitable for feeding the screening grids of S.G. and V.-M. valves.

When using an eliminator of this type it is, of course, necessary to employ de-coupling in the set itself. I consider this the neatest and most satisfactory system, but if you already have a set fitted with two or three H.T. terminals it is best to obtain an eliminator with, say, one fixed and two variable tappings, so that the optimum voltages can be obtained under any circumstances.

**Screening Grid Potential**

At this juncture it ought to be pointed out that the H.T. for the screening grids should always be taken from a potential transformer, and not from a variable resistance. This is always arranged for in eliminators specified as having an S.G. tapping, but where a different type of instrument is in use, the screening grid potential can be provided by connecting a 100,000 ohm wire-wound potentiometer between the negative and one positive eliminator terminals, as shown in the sketch of Fig. 7. Conne-

**Trouble Shooting**

When buying an eliminator for a battery set, it is always well worth while to obtain one fitted with a trickle charger so that the accumulator can be charged at practically no cost. The extra expense of the trickle charger is very slight, and it will soon pay for itself. On the other hand, if there is some likelihood of eventually changing over to A.C. valves, an eliminator should be bought which contains, in addition to the H.T. supply, terminals giving 4 volts, 6 and A.C. The latter will not be required whilst battery valves are in use, but may be left disconnected until they are needed.

**Voltage of "Fixed" Tappings**

A point which often confuses the beginner is that the "fixed" voltage tappings on eliminators are usually specified as giving, for example, 100-120 volts at 5-3 milliams. This means that the voltage will be the lower figure when the load is 5 milliamperes, or the higher one when the current is only 3 milliamperes. Intermediate voltages will obtain when the current consumption is between the maximum and minimum values. In such cases it will be fairly safe to assume an average voltage (110 in the example quoted) if the actual current consumption of the set is not known, but it can be found as shown in Fig. 4, by connecting a milliammeter in series with the tapping concerned.

**Switching On the Eliminator**

When using an A.C. eliminator with a battery set it is very important that the L.T. should be switched on before the eliminator, and switched off after the eliminator. This is to ensure that there will always be a current load on the H.T. supply, which will prevent the voltage rising to a high figure and causing damage to receiver components.

**Grid Bias**

The grid bias supply is just as important as the H.T. and L.T., in fact, from the point of view of economical running it can be even more so. G.B. batteries are cheap but, used correctly, they can considerably increase the life of both the H.T. battery and the valves. As an example, I give the following figures which show the high-tension current consumption of a typical small power valve when receiving an anode voltage of 120 and various values of grid bias voltage.

**Anode Voltage=120**

<table>
<thead>
<tr>
<th>G.B. Voltage</th>
<th>Anode Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 m.a.</td>
<td>10 m.a.</td>
</tr>
<tr>
<td>6 m.a.</td>
<td>15 m.a.</td>
</tr>
<tr>
<td>12 m.a.</td>
<td>18 m.a.</td>
</tr>
<tr>
<td>15 m.a.</td>
<td>20 m.a.</td>
</tr>
<tr>
<td>18 m.a.</td>
<td>22 m.a.</td>
</tr>
<tr>
<td>24 m.a.</td>
<td>26 m.a.</td>
</tr>
</tbody>
</table>

The G.B. voltage recommended by the makers for this valve is twelve, but it works quite well at 15 volts and an economy can be effected by operating it at the latter value. When the power is turned on, the current consumption goes up rapidly, and results are not improved.
NEW—and better than many at double its price

**DRIVER TRANSFORMER**


Ratios: 1:1, 1.2:1, 1.5:1.

Price: 12/6

**VALVE HOLDERS**

Three Valve Holders have exceptionally low loss moulded bases, the insulating material between sockets being reduced to a minimum. Contacts are of phosphor bronze, sturdy in design.

Four Pin Four Pin Seven Pin
Type, 6d. Type, 8d. Type 1/3

**PIP TRANSFORMER**

The PIP transformer is thoroughly sound in construction and design and gives a result equalling and often better than others at a much higher price.

In distinctive red case with nickel terminals.

Made in 3:1 and 5:1 ratios.

Price: 6/6

**GRAHAM FARISH PRODUCTS**

Ensure a safe and efficient Aerial and Earth. The new AEROFICIENT KIT provides all you need. Complete 6/6

Send a postcard for our new Catalogue, which describes all our products.
WHEN you try one of these handsome Cossor Receivers in your own home (your Dealer will gladly arrange it) you will realise that you can have up-to-date Radio for a surprisingly modest outlay. In performance, appearance and ease of operation these Cossor Console Models are equal to much more expensive Receivers. Send the coupon for full particulars.

SCREENED GRID CIRCUIT
MOVING COIL SPEAKER
SINGLE-DIAL TUNING

COSSOR CLASS "B" BATTERY CONSOLE
Model 3456
Complete Receiver, as illustrated, with Cossor 230 VS Variable-Mu Screened Grid, Cossor 210 H.L. Detector, Cossor 215 P Driver and Cossor 210 Class "B" Output Valves. Single-dial tuning, selectivity control and combined volume control and "on-off" switch. Wavechange switch for 30, 50 and 850-1000 meters. Handcrafte valve finished Console Cabinet, 2 ft. 11 in. high, 1 ft. 2 in. wide, 11 in. deep, giving ample accommodation for batteries. Permanent Magnet Moving Coil Loud Speaker of the latest type.

Please send me free of charge, Folder No. 199 which gives full particulars of Cossor Console Receivers.

NAME
ADDRESS

PRICE

COSSOR ALL-ELECTRIC CONSOLE (for A.C. Mains) Model 3468
Specification similar to Battery Model 3456, but operating from Electric Light Supply. Complete with three Cossor A.C. Mains Valves viz: M.V.S.G. (Met.) Variable-Mu S.G., 41 M.H. (Met.) Detector, 41 M.P. Output, 41 M.P. (Met.) Rectifier. Mains Energised Moving Coil Speaker. Illuminated tuning-dial (Model 3468 only) For A.C. Mains only. 200/250 volts adjustable. £10.15.0

COSSOR ALL-ELECTRIC CONSOLE (for D.C. Mains) Model 3469
As Model 3468, but for operation on D.C. Mains. Supplied complete with three Cossor D.C. Mains Valves viz: D.V.S.G. (Met.) Variable-Mu S.G., D.H.L. (Met.) Detector and D.P. Power Output. For D.C. Mains only. 200/250 volts adjustable. £10.15.0

Legs are detachable on all Console Models and the receivers can be used as table models with legs detached.
Mullard Master Valves are chosen by discriminating radio enthusiasts in greater numbers than any other type of valve. That is because previous results have shown them superior in design, construction and performance. Today three million aerials lead down to Mullard Master Valves—and three million aerials can’t be wrong.

ASK T.S.D. Whenever you want advice about your set or about your valves—ask T.S.D.—Mullard Technical Service Department—always at your service. You’re under no obligation whatsoever. We help ourselves by helping you. When writing, whether your problem is big or small, give every detail, and address your envelope to T.S.D., Ref. D.P.R.

Mullard

THE MASTER VALVE

In the past, all the receivers which have been produced by Practical Wireless have been built at the very minimum of expense, consistent with efficiency. That is to say, when the design has been considered, the various components have been chosen so that the essentials of the particular design could be incorporated with as small an outlay as possible. In no case has efficiency been sacrificed in order to cheapen the cost of a receiver. On the other hand, no expensive component has been chosen if a cheaper one was available which would give the same results. Many letters have been received from readers asking for cheaper receivers, and, on the other hand, many readers have asked for what might be termed a luxury receiver. That is, one which employs really up-to-date ideas and gives practically the very best that can so far be obtained in a home-constructed receiver, expense being no object. For these the present receiver has been produced. It is not cheap. It does, however, employ principles which can be said to be really modern, and although only four valves are employed, these are the very latest valves which have been released. The circuit, too, is absolutely new, and there will be seen to be many novel features in it. Apart from the fact that the circuit is of the superhet type, automatic volume control is incorporated, and two of the latest high-frequency pentodes are employed together with a duo-diode-triode.

The Circuit

Before going any further, perhaps the circuit should be explained for the benefit of those to whom such details appeal. Band-pass tuning circuits are employed between aerial and first valve, which is an H.F. pentode acting in the double capacity of first detector and oscillator. The band-pass coils and the oscillator coil are built up on a single unit with the three-gang condenser, the whole being obtainable with tracking condenser, etc., included. This is a British Radiophone product, and the efficiency is of the very highest order owing to the fact that the three separate circuits are factory matched and already adjusted when built into the set. On the same assembly is a potentiometer for volume control purposes, ganged with an on-off switch. I.F. transformers manufactured by the same firm are employed to couple this first valve to the I.F. valve and also in the next stage. The I.F. valve is a variable-mu H.F. pentode, and the bias is set to a pre-arranged value and then acted upon by the A.V.C. circuit. There is thus no manual volume control on the H.F. side. The third valve is a duo-diode-triode connected in a very unconventional manner. It will be seen that one diode acts as a rectifier whilst the other diode performs the function of A.V.C. The anode is kept at a constant potential, whilst the cathode performs the functions usually devoted to an anode. It is coupled, via a fixed condenser, to the volume control potentiometer which forms one part of the resistance-capacity coupling between the duo-diode-triode and the output pentode. Included in the cathode lead is a special hum stopper, and it will be seen from the circuit diagram that the voltage is obtained independently. The output valve, a Mullard Pen. 4 V., gives an output of approximately 2 watts. The mains unit is built up on a separate chassis, and this is coupled to the receiver chassis through the medium of a multi-way lead and a plug. The speaker is of the energized type, the field winding serving as a smoothing choke. So much for the circuit.

Construction

As the coils, condensers, etc., are already assembled as a complete unit, the construction is reduced to a very simple operation. The valve-holders should be mounted first, then all the sub-baseboard components.

Note very particularly the position of the

The mains portion will be dealt with next week.
With Next Week

small .25 mfd. electrolytic condenser. It is essential that the negative terminal of this is joined to the common earthing lead. Although the chassis is of the metatized type it is provided with a separate earthing lead so that it is absolutely certain that a good earth return is obtainable. For this purpose two bolts will be seen in the chassis, and connections are made to these through the medium of soldering tags. There are a number of soldered connections, and in order to prevent trouble at a later stage, care should be taken to ensure that these connections are soundly made. As each joint is soldered, pull at it in various directions in order to make sure that it is not "dry soldered." Leave the band-pass unit until last in order to avoid the extra weight when turning the chassis about to make various connections. There are very few wires, and the wiring diagram will make all points quite clear. There are no difficult points in any part of the circuit.

The Mains Unit

The mains unit should next be made up, this may be carried out from the theoretical, or you may wait for full details next week. There are one or two special points to be attended to, and, therefore, you should only undertake this if you are fully capable. Particular care should be paid to the connections to the pins of the connecting plug in order to ensure that the correct potentials will be applied to the receiver when the chassis is connected. The flex from the on-off switch should be joined to the input sockets on the mains transformer in accordance with the voltage of the mains. It will be noted that a mains aerial socket strip is fitted to the experimental receiver, and the connections for this device will be described at a later date.

Testing Out

Plug the valves into the sockets in accordance with the markings shown on the wiring diagram, and test out the receiver before inserting it into the cabinet. Make certain that the switch is in the "off" position, and then connect to the mains. Switch on, and after an interval of about thirty seconds a faint hum should be heard from the speaker. Turn the volume control farther towards the right (clockwise) and then rotate the tuning dial until the local station is heard. On the original receiver it was found that the trimmers on the band-pass unit and the I.F. transformers required no adjustment whatsoever, but this may have been due to a lucky setting of the various parts, and each receiver should be tried in order to make certain that no adjustment is required. On no account rotate the trimmers as though you were winding up a clockwork mechanism. Only the slightest turn should be required in either direction, and it is best to set the volume control to a position where the station can only just be heard, and then adjust the trimmers to maximum volume. If any increase is obtained, reduce volume again on the volume control. Practically every worthwhile European station may be heard on this receiver, and the A.V.C. device will take care of any fading.
LIST OF COMPONENTS FOR THE LUXUS A.C. SUPERHET.

1. One Superhet Radiopak with 500,000 ohm Potentiometer (British Radiophone).
2. Two I.F. Transformers (110 kc/s) (British Radiophone).
3. One Screened H.F. Choke (Amplion).
4. Three 5-pin, one 4-pin, two seven-pin chassis type Valves (Clix).
5. One 3 watt Rectifier (E.G.50) (British Radiophone).
6. One Aerial-Earth Socket Strip (Clix).
8. A Simple Universal Receiver Which May Be Used on Either A.C. or D.C. Mains

Further Notes on THE A.C.-D.C. TWO

A Simple Universal Receiver Which May Be Used on Either A.C. or D.C. Mains

Full constructional details were given last week.

The theoretical circuit of the Luxus A.C. Superhet.

The earth connection in this receiver runs from the condenser bracket, via the chassis, and a simple junction is thus made. Connection to the mains is obtained direct from the fuse-holder. For this purpose obtain a length of flex long enough to reach from the receiver to the nearest mains point, and fit a plug to the end. The opposite end should be bared for no more than a quarter of an inch, and these short bared portions should be inserted into the connecting terminals on the fuse-holder. Tighten up the screws well to avoid all risk of their being pulled out and so blowing the house fuse, and make certain that the switch on the receiver is "off." Flexible leads are provided for connection to the loud-speaker, and these are brought through a small hole in the rear of the chassis. A further short length of flex must be fitted to the positive supply for connection to the side terminal on the pentode valve-base.

Testing Out

Plug the special detector valve (D.130) in its holder, and the pentode (P.T.9) in the centre socket. The special half-wave rectifier (E.G.50) is then inserted in the remaining socket, and the aerial and earth joined to the two terminals bearing these markings. Connect the aerial flex to Terminal No. 8 on the coil, set the wave-change switch to medium waves, reaction at zero, and switch on the mains switch. Switch on the receiver, but do not be disappointed if you hear nothing from the speaker. The valves which are used take a further short length of flex should be obtained direct from the bared end, and fit a plug to the end.

For this purpose obtain a length of flex long enough to reach from the house fuse, and make certain that the switch on the receiver is "off." Flexible leads are provided for connection to the loud-speaker, and these are brought through a small hole in the rear of the chassis. A further short length of flex must be fitted to the positive supply for connection to the side terminal on the pentode valve-base.

Testing Out

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HE writer was recently asked to advise a friend on the purchase of a radio-gram. His advice was—

Don't. This may come as a shock to those who have recently indulged their fancy to the tune of fifty guineas—perhaps more or perhaps less—in the acquisition of a large and imposing piece of furniture capable of "all the music," and which so far as the gramophone is concerned may be just as useful ten years hence as it is to-day, but which for so long as concerns the radio side may be obsolete in twelve months time.

Speaking without a tinge of exaggeration, it is a mystery to the writer why the combined instrument has acquired such a vogue; one may pardon the nouveaux riches for buying the latest and most expensive instrument with self-changing mechanism, the magazine of which his butler loads for him daily! He knows that if there should be something better next season, he has only to put his hand in his pocket and have that, passing the previous year's model—on to one of his dependants or poor relations; it may even do duty as a wedding present. But many of these expensive combination instruments are bought by those who can ill afford the money and even make their purchase on the deferred payment system, or, as it is sometimes called, the "never-never." The main disadvantage of the combined instrument has already been stated; a few changes in the broadcasting system—as, for example, one or two new giant stations, or technical improvements in the components that go to make up a wireless receiver—may render the radio reception part of the instrument obsolete. On the other hand, if instead of a single combined instrument the purchaser elects to go in

for an electric gramophone as an entirely separate instrument, and keep his radio receiver for radio reception, he not only has two strings to his bow—that is to say neither instruments being temporarily indisposed will deprive him of entertainment—but also he can change or remodel his radio receiver to keep up to date at comparatively small expense. Also the instruments can be made to do duty in different rooms; or the electric gramophone may be taken away on a holiday, without occupying too much space in a small car.

It may be argued that any intelligent amateur could make the necessary modifications to the radio part of the combined instrument to bring it up to date; but these remarks are not directed to the intelligent amateur; he is rarely at sea or in the wrong, he can usually look after himself. The writer would, by choice, subdivide the "electrical entertainment equipment" more completely. Namely, in his opinion, the "radio" function is as capable of "all the stunts," and which so far as its production, it seems a mistake to do away with the possibility of using the gramophone in the old-fashioned way; it is quite useful when trying a record over or listening to a linguistic record, and it saves "juice." A cabinet gramophone or good portable with a pick-up added makes a perfectly good job, and more often than not is there awaiting conversion without a penny being spent. The writer has a gramophone dating from about 1912, with a pick-up added a few years ago, which so far as its function is concerned is doing as well as the most up-to-date and extravagant instrument; the records do not change themselves, it is true, but there are two aspects of that. The writer recently called on a friend who had just purchased a 100-guinea instrument; it was turned on, and it went on and on, record after record; an operatic selection was followed by a Beethoven sonata, and after that a "slap-stick" entertainment or a comic song. To put a self-changing record radiogram in cabinet complete into the hands of the average man who would buy such an article is in its results very like putting a Webley and Scott automatic into the hands of a small boy.

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The Moving-coil Speaker

The function of a moving-coil loud-speaker is somewhat different and can best be understood by making reference to the sectional sketch of Fig. 28. A powerful cylindrical magnet (which may be of either the permanent or energised type) is surrounded at one end by a coil of wire attached to a cone. The anode current is passed through the latter coil, which thus becomes what might be termed an air-core electro-magnet. Variations in current cause the coil's magnetic field to be strengthened and weakened in turn, with a result that the coil is attached towards, or repelled from, the permanent magnet. In this way the cone is set into vibration and creates sound waves corresponding exactly with the fluctuating currents passing through the coil.

Matching the Speaker and Valve

There is yet another point to consider. We saw in regard to the preceding valves that the impedance in their anode circuit must bear a definite relationship to the impedance of the valve, if maximum efficiency were to be obtained. The same thing applies to the output valve and, generally speaking, the loud-speaker should have an impedance equal to twice that of the valve in the case of a triode, or something like one quarter in the case of a pentode. It is customary nowadays, however, for valve manufacturers to state the most suitable anode impedance under the heading of "optimum load." A little difficulty arises here, though, because the impedance of a speaker varies a good deal according to the audio frequencies with which it is being fed. For example, a fairly typical moving-coil loud speaker might have an impedance of 2,000 ohms at 100 cycles, and of so much as 5,000 ohms at 2,000 cycles; we must therefore assess the impedance at an average frequency such as 250 cycles (corresponding to middle C). This is obviously a compromise, but it is the best we can do, and as a result we are bound to sacrifice a little efficiency at frequencies higher and lower than the average. In practice, it is found that the losses introduced in this way are not very great and are usually less than those arising from other sources. Fortunately, the impedance of a moving-coil speaker does not vary by any great extent with changes in frequency, and thus its response to the whole of the musical scale is more uniform.

Avoiding "Saturation" of the Speaker Magnet

There are objections to connecting a speaker directly in the anode circuit in the manner shown in Fig. 26, and it is becoming more and more usual to feed it in some other way. The main objection in so far as moving-iron speakers are concerned is that the steady anode current is often so great as to "saturate" the permanent magnet, making it incapable of responding properly to current fluctuations. When this occurs the speaker becomes less sensitive and also produces serious distortion.

Choke-capacity Coupling

The simplest way of overcoming the latter difficulty is to connect the speaker on the "choke-capacity" system illustrated in Fig. 30. The primary of the transformer has a larger number of turns on its primary than on its secondary winding, and as a result the primary impedance is much greater than that of the secondary. For example, suppose the secondary were made to have an impedance of 10 ohms and were connected to a moving-coil speaker of similar impedance, the primary could be made to match the output valve by suitably proportioning its number of turns. Actually the primary impedance is proportional to the square of the turns ratio, so that if the above transformer had 20 times as many turns on its primary as on the secondary, its primary impedance would be equal to 20 squared, or 400, or 4,000 ohms. It can thus be seen that any loud-speaker may be matched to an output valve by means of a suitable transformer. By reversing the above calculations we get the equation:

$$ \text{Ratio} = \sqrt{\frac{\text{Optimum Load}}{\text{Speaker Impedance}}} $$

For example, suppose they were placed in either of the positions shown in the diagram; the speakers would then have practically no response to the signals. This difficulty is found in the employment of an output step-down transformer wired up as indicated in Fig. 30. The transformer has a larger number of turns on its primary than on its secondary winding, and as a result the primary impedance is much greater than that of the secondary. For example, suppose the secondary were made to have an impedance of 10 ohms and were connected to a moving-coil speaker of similar impedance, the primary could be made to match the output valve by suitably proportioning its number of turns. Actually the primary impedance is proportional to the square of the turns ratio, so that if the above transformer had 20 times as many turns on its primary as on the secondary, its primary impedance would be equal to 20 squared, or 400, or 4,000 ohms. It can thus be seen that any loud-speaker may be matched to an output valve by means of a suitable transformer. By reversing the above calculations we get the equation:

$$ \text{Ratio} = \sqrt{\frac{\text{Optimum Load}}{\text{Speaker Impedance}}} $$

This particular subject was fully dealt with on page 332 of Practical Wireless, No. 7, under the heading, "The Loud-Speaker and the Output Stage," so there is no need to pursue it further in this article.

We have now followed the path of a signal from the time it reaches the receiving aerial until it emerges from the loud-speaker in the form of sound, and I hope that the explanations given will have been of assistance in cure, but they form a starting point for a further study of the principles upon which our receivers work. Even though the subject has been treated as briefly as possible it has required the expenditure of some seven thousand words to express in a simple wireless receiver during the tiniest fraction of a second.
For the Short Wave Enthusiast

Points to be Borne in Mind in Order to Ensure Maximum Results

By K. E. Brian Jay

**The screen-grid valve as a detector** has become increasingly popular in broadcast receivers lately, not only in superhet but also in simpler arrangements, as several excellent designs which have appeared in this paper have testified, but its merits in this position have been less widely acclaimed for short-wave receivers. Actually, the screen-grid valve makes a very sensitive short-wave regenerative detector, where it has several advantages over the orthodox triode. The main difficulty in putting this type of valve to work is the necessity for a very high impedance load in the anode circuit, in order to obtain maximum amplification from any valve the load in the plate circuit must have an impedance several times greater than the internal impedance (anode impedance) of the valve, but the internal resistance of the screen-grid valve is so high (anything from 300,000 to 1,000,000 ohms) that it is difficult to contrive a load of sufficiently high impedance to get the theoretical maximum output without at the same time greatly reducing the H.T. voltage available at the anode owing to the voltage drop across the load. Choke coupling offers the best solution, since a very high impedance can be obtained with a small D.C. resistance, provided the inductance of the choke is high enough; a 300-henry choke, for example, has an impedance to currents of 5,000 cycles frequency of about 940,000 ohms. However, this form of coupling has the disadvantages of high cost of the choke and no voltage step up obtainable, as with a transformer. Unfortunately, transformer coupling in its simplest form cannot be used efficiently because even the best transformers have too low a primary inductance; the only way of overcoming this defect is to use either choke or resistance feed of the transformer. Choke feed is best, because of the small voltage drop across the choke, but it is, of course, expensive; however, for those who would like to try it, a circuit diagram is given in Fig. 1. Ch is the choke, coupled to the transformer by the 0.1 mfd mica condenser C6; R3 is a 10,000 ohm decoupling resistance, and C3 a 1 to 2 mfd decoupling condenser.

Quite good results are obtainable by using an ordinary L.F. transformer as a choke, the two windings being joined in series; it is necessary to ensure that the windings are in the right sense or their inductances will cancel instead of augmenting each other; the terminals P and GB are joined together, and the remaining two regarded as the terminals of the choke; if the amplification is not satisfactory, the connections to one of the windings should be reversed. Fig. 2 shows the resistance-fed circuit in which the choke Ch is replaced by the resistance R5; a slight modification to the transformer arrangement is also suggested in this circuit, which gives an increased step-up ratio over the Fig. 1 arrangement; this connection is applicable to either method of coupling. The higher the resistance of R5, the nearer the load impedance approaches the theoretical best, but its value is limited by the H.T. voltage available; with 120 volts no great advantage was noticed by going beyond 100,000 ohms, although some people may prefer to use as much as 250,000 ohms; actually very good signals have been obtained with as little as 50,000 ohms. Either of the foregoing circuits may be modified to simple choke or resistance coupling by removing the transformer and connecting C5 straight to the grid of the L.F. valve, the bias being applied by a variable source of screen-grid voltage, since the performance depends very largely on the nice adjustment of this potential. Note that a three-point filament switch was used. The screen-grid volts should be kept low, especially if resistance coupling is used, because it will be found that as they approach the same value as the plate the tendency to threshold howl; but this may be merely an idiosyncrasy of the particular valves used.

**Voltage Adjustment**

Turning now to the detector itself, the connections are seen to be the same as for a triode detector, except for the screen grid, this is supplied by a potentiometer consisting of a 50,000 ohm fixed resistance R4 and the 50,000 ohm variable potentiometer R6, the latter being bypassed by the mica or non-inductive condenser C2.

---

**Fig. 1.** A very good short-wave circuit using choke fed L.F. coupling.

**Fig. 2.** A similar circuit in which resistance fed L.F. transformer coupling is used.
hold bowl will be accentuated, until a point is reached where the valve refuses to oscillate. The voltage needed will be between 20 and 50, depending on the H.T. voltage and the value of the resistance, a 100,000 ohm resistance limiting the screen volts to about 30 and a 250,000 resistance to about 20.

Reaction Control
The method of reaction control shown in Fig. 1 is the usual modified Reinartz arrangement, while Fig. 2 shows the slight alterations needed to try out throttle control. Either method is very satisfactory, a suitable value for C3 being 0.0002 mfd.; it will be noticed that there is very little detuning caused by the reaction control on wavelengths above about 35 metres, and probably careful screening would give similar immunity on very much shorter waves. Variation of the screen-grid potential offers another very smooth adjustment of reaction; in this case R4 becomes the reaction control, and C3 is replaced by a fixed condenser of from 0.0002 to 0.0003 mfd. capacity. Resistance control of reaction by a variable resistance in the H.T. lead to the plate has also been tried, by making R4 a 50,000 ohm variable component, but it was not found easy to obtain good control over a large wavelength range without frequent adjustment of the screen-grid potential; smoothest control by this method was obtained with a coupling resistance of 250,000 ohms, but the method was not at all well behaved when choke coupling was used.

Coil Sizes
With regard to the coil sizes it will probably be found that an extra turn is necessary on the reaction coil compared with the coil used with a triode detector, and that the longest wavelength obtainable with a given grid-coil will be slightly reduced owing to the smaller grid-filament capacity of the screen-grid valve. Reaction control will be found very smooth, and probably the 400-ohm potentiometer R3 will not be needed to obtain good results, but it is just as well to have it "in case." If back lash shows up in the reaction adjustment a slight reduction of the screen-grid potential will remove it. Any screen-grid valve should be satisfactory, preference being given to metized types; if instability is experienced with valves of high mutual conductance, increasing the value of the decoupling resistance R3, and possibly the condensers C2 and C3 should eliminate it.

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The Telegraph Condenser Co. Limited
In view of the almost universal adoption of the superhet circuit by makers of modern high-class receivers, we found the experience of submitting the Philips "Superinductance" receiver to a thorough test most refreshing. This set is definitely in the de-luxe category, and we would say right away that it is one of the best we have had in our laboratories. So far as the sequence of valve stages is concerned, the circuit is perfectly "straight," but the results are at least equal to those given by any superhet we know having the same number of valves.

It is often imagined that a superhet is essential if one is to obtain the extreme degree of selectivity demanded by the present broadcasting conditions - the results obtained from the set under review completely and entirely disprove this idea. Although the "Superinductance" set has been in use for some weeks and has been tested on aerials of various types and lengths, we have not at any time found a single station which could not effectively be eliminated by a movement of the tuning dial equivalent to the recognised separation of 9 kilocycles.

Great Sensitivity

But that is not the only feature of the set, for its sensitivity and station-getting powers are more than remarkable; even when used on a 15ft indoor aerial we found not the slightest difficulty in bringing in twenty odd stations at real "full out," with only one exception. In some cases, the peculiar effects of fading and wave-shuffles might be made by the broadcasting authorities. To facilitate the location of stations, the earphone is connected in such a way that there is no need to change the control when the tone control is in the "treble" position, but on reducing volume to a minimum, the整个separate position, with the IPSE control in the "bass" position, it will be quite clear from this that the tone control is a very useful fitting and one which will be appreciated by users of the set.

Simple Control

As can be seen from the illustration on this page, the arrangement of the tuning controls is very neat, and there are only two knobs on the front of the cabinet; the tone control, which is only required occasionally, is at the back. The right-hand knob operates the condenser scale when rotated, and by pulling it out or pushing it in, the long or medium wavebands are brought into use.

Novel Tuning Scale

The tuning scale is one of the most important features of Philips receivers and is quite unique. Actually, it consists of two separate scales which rotate together, but at different speeds. The inner scale is marked off on the outer edge into sections marked from "A" to "L." On a concentric circle wavelengths from 200 to 2,000 metres are indicated in every hundred metres. On a second concentric circle the wavelengths from 200 to 600 metres are shown, in this case 50-metre divisions being used. A mark, which is operated by pushing or pulling the tuning knob, covers the range of wavelengths in use. The outer scale serves as a micrometer and is graduated in 20-metre steps. In this it succeeds entirely, and we found that such receivers are to be highly recommended.

The Philips Type 634A Superinductance Receiver

The Philips Type 634A Superinductance Receiver

In view of the almost universal adoption of the superhet circuit by makers of modern high-class receivers, we found the experience of submitting the Philips "Superinductance" receiver to a thorough test most refreshing. This set is definitely in the de-luxe category, and we would say right away that it is one of the best we have had in our laboratories. So far as the sequence of valve stages is concerned, the circuit is perfectly "straight," but the results are at least equal to those given by any superhet we know having the same number of valves.

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The tuning scale is one of the most important features of Philips receivers and is quite unique. Actually, it consists of two separate scales which rotate together, but at different speeds. The inner scale is marked off on the outer edge into sections marked from "A" to "L." On a concentric circle wavelengths from 200 to 2,000 metres are indicated in every hundred metres. On a second concentric circle the wavelengths from 200 to 600 metres are shown, in this case 50-metre divisions being used. A mark, which is operated by pushing or pulling the tuning knob, covers the range of wavelengths in use. The outer scale serves as a micrometer and is graduated in 20-metre steps. In this it succeeds entirely, and we found that such receivers are to be highly recommended.
An Interesting Circuit

To the more technically-inclined reader, the circuit arrangement will be of especial interest, due to the fact that it is right up to date and incorporates several novel features. Briefly, it comprises four valves and a rectifier; the first two are Mullard S.A.V. screen grids, and they are followed by Mullard's D.S.4 single diode-tetrode detector-amplifier, and a Mullard PM24A power pentode. A Philips type 1821 valve is employed as a full-wave rectifier. A power pentode;-- A Philips type 1821 valve detector-amplifier, and a Mullard PM24A by a Mullard S.D.4 single S.4VB screen grids, and they are followed and a rectifier; the first two are Mullard interest, due to the fact that it is right up the circuit arrangement will be of especial

An Interesting Circuit

A D.C. Version

It should be mentioned that Messrs. Philips produce a D.C. version of the same receiver, styled the 634A, and this is claimed to be the finest receiver ever produced for use on direct current mains. The same general circuit arrangement is followed as in the A.C. model, but to enable the same signal output to be secured two power pentodes are used in parallel for the output stage.

A guinea extra is charged for the D.C. set, to cover the additional cost of the second output valve and the necessary coupling components.

Automatic Fading Compensation

Automatic fading compensation (actually a form of A.V.C.) is obtained by applying the bias voltage developed by the diode-tetrode detector to the grids of the preceding valves. This scheme works very well in practice, and we found that fading was almost entirely overcome.

Provision is made for connecting a pick-up in the detector circuit, and sockets for this purpose are provided on the back of the receiver. The normal volume control operates just the same, whether gramophone reproduction or radio reception is being enjoyed.

Uniform Sensitivity

One very important feature of the Philips "Superinductance" circuit is that the receiver is designed to be equally sensitive at every point on the tuning range. This unusual but laudable result is achieved by gauging the potentialmeter with the tuning condenser; it is so arranged that the stage gain of the H.F. stages is gradually and automatically reduced as the wavelength is decreased.

Another unusual point that strikes one on examination of the circuit is that there is not a single smoothing choke in the power supply system; the smoothing—which is as efficient as anyone could wish for—is effected entirely by a carefully arranged network of resistances and condensers. The method is certainly ideal, although it has to be scientifically worked out to enable it to function so satisfactorily as it does in the case in question.

We would conclude this report by emphasizing that the Philips 634A "Superinductance" receiver is perfectly safe, of handsome appearance, and gives astonishingly good results. Moreover, at the price of 16 gns., it represents as good value as any instrument of comparable quality on the British market.

A.D.C. Version

It should be mentioned that Messrs. Phillips produce a D.C. version of the same receiver, styled the 634C, and this is claimed to be the finest receiver ever produced for use on direct current mains. The same general circuit arrangement is followed as in the A.C. model, but to enable the same signal output to be secured two power pentodes are used in parallel for the output stage.

A guinea extra is charged for the D.C. set, to cover the additional cost of the second output valve and the necessary coupling components.
Efficiency the Keynote

Primarily, of course, the object of class B is to provide as generous a volume from a battery set for a modest consumption of H.T. current. "Mains volume" at battery costs is a slogan which describes the system very aptly.

In order to answer some of the queries just referred to let us consider a typical three-valve battery receiver with one screen-grid, valve, detector, and a power or pentode output valve, and see what difference it would make to add Class B. As it is, a set of this description will consume about 10 to 20 milliamps depending on the type of output valve used. This consumption will be to all intents and purposes constant. That is to say, the set will use the same amount of current whether the signals received are loud or quiet. The output of such a receiver may be something like 100 or 200 milliwatts according to the type of output valve used. This will give quite sufficient volume for a system very aptly.

H.T. Current Proportional to Signal Strength

With Class B, this wastefulness is largely overcome because the anode current of the most extravagant of all the valves in the set, namely the output valve, is proportional to the signal strength. In place of the super-power valve, we use a special Class B valve which consists of two complete valve elements mounted in one bulb. It is really two valves in one. They are high amplification triodes. Being connected thus in opposition means that when an alternating current is applied to their grids, one valve operates during one half-cycle of the programme and the other during the other half-cycle. Before any signal arrives, the anode current through each valve element is zero. When a signal is received, the anode current begins to flow and reaches a maximum value for a period corresponding to a strong signal, it rises to a very high figure. Whereas for a large grid swing (corresponding to a strong signal), it rises to a very high figure. During the loud passages the anode current of the Class B valve may rise to 40 or 60 milliamps, but owing to the fact that the anode current of the Class B valve varies in proportion to the signal strength, the average consumption of the set will be about 15 milliamps. The total consumption of the set, therefore, will be of the order of 15 milliamps, a figure which is well within the capacity of the ordinary car battery. Using the larger output Class B valve with its appropriate driver, so as to obtain a 2 watts output, the average anode current will increase to about 20 milliamps, but the increase in volume will be about 20 to 35 milliamps.

Battery Eliminators and Class B

From the above it will be seen that as regards H.T. consumption the Class B arrangement compares very favourably with the old S.G. Det., and 2 L.F. arrangement, while as regards output it is definitely superior. In other words the efficiency of Class B is greater.

That this efficiency is due to the fact that the anode current of the Class B valve varies in proportion to the signal strength immediately brings us to the question of using battery eliminators with this class of output. Many constructors
having battery sets working from eliminators have asked if it is possible to change over to Class B and still use their eliminators. In some cases (not all) the answer is "No!" Since the anode current fluctuates over such a wide range the voltage of the elimination transformer may rise and fall. It is a simple case of the working of Ohm's law. The greater the current, the greater is the voltage drop. The average small eliminator is rated to supply about 25 milliamps, whereas the current taken by a Class B receiver may rise to 60 or 70 milliamps. During these periods the voltage of the eliminator would drop very considerably and frightful distortion would result. It might be thought that the use of a larger eliminator, one rated at say 60 milliamps, might solve the problem, but here again it is seen that the system is economic, but at the same time we must not overlook the fact that the fullest advantage is only to be obtained when the system is fully extended. If only moderate volume is required there is no objection to using Class B. In fact, a single L.F. stage employing a high efficiency pentode will probably give all that is desired. A change to Class B would mean the scrapping of the pentode and the purchasing of both a driver and a Class B valve besides a driver transformer and output transformer. If mains volume is required then Class B is the best proposition, but on the other hand it will not bring up very weak stations. It does not take the place of an extra H.F. stage.

Regarding quality of reproduction. This is of a high order especially when the system is fully extended, but some distortion is noticeable on weak signals or during periods of only slight modulation. In this connection it is to be noted that a run-down H.T. battery can cause considerable distortion owing to its high internal resistance. This causes a large voltage drop during the quiet passages and loud passages.

Matching the Speaker

One point affecting quality is the correct load for the output. The majority of designs for Class B receivers include an output transformer or choke for matching the output valve and the speaker, but in some cases circuits are published which do not include any of these components, the valve being connected direct to the speaker. In this case the receiver is intended to be used with a speaker with special tappings for Class B transformers or chokes.

One reason why a speaker with a high resistance (not high inductance) should not be connected directly across the output is because the variations in anode current and voltage with Class B are much greater than with ordinary circuits. A high resistance in the anode circuit means a large voltage drop during the heavy current or loud passages compared with a small drop during quiet passages. This naturally tends to reduce the anode current during the loud parts and increase it during the quiet parts, so tending to bring the volume for one modulation level. This is why output chokes and transformers for Class B are designed with low resistance windings.
WHEATSTONE'S BRIDGE SIMPLY EXPLAINED

By O. C. UHTHOFF

The Why and the Wherefore of Measuring Resistances.

The circuit XYZ, as the extremities of these two circuits are in electrical contact of negligible resistance. A current will flow between two points if there is a difference of potential between them; thus we see that since no current flows through G at the setting Y, the latter point must be at the same potential as the point O.

Using the Bridge
Now this is where the mathematics comes in, but it is quite simple to follow. Let the current flowing through \( R_1 \) and \( R_3 \) be \( I \); and let the current flowing through \( R_2 \) and \( R_4 \) be \( I \).

We have seen that \( O \) and \( Y \) are at the same potential, thus the voltage drop along \( R_1 \) — the voltage drop along \( R_2 \) because the other ends of \( R_1 \) and \( R_2 \) are at the same potential.

\[ \text{From Ohm's law: } R_1 I = E_1 \]
\[ \text{and } R_2 I = E_2 \]

where \( E_1 \) is the voltage drop in question. Since both the left-hand sides are equal to \( E_1 \), they are equal to each other.

\[ R_1 I = R_2 I \]

Dividing both sides by \( I R_1 \), we get

\[ \frac{R_1}{R_2} = \frac{I}{I} \]

By exactly similar reasoning, we also get the result

\[ \frac{R_2}{R_3} = \frac{I}{I} \]

Since both the left-hand sides are equal to \( I \), \( I_1 \), we get

\[ \frac{R_1}{R_3} = \frac{I}{I} \]

or, multiplying both sides of the equation by \( R_1 \)

\[ R_2 \left( \frac{1}{R_1} : \frac{1}{R_2} \right) = \frac{I}{I} \]

(Continued on page 224)
RADIO CLUBS
AND SOCIETIES

Club reports should not exceed 200 words in length and should be received first post each Monday morning for publication in the following week's issue.

AMATEUR TELEPHONY TRANSMISSION ON 5 METRES

Amateur stations G6KA and G5NC are conducting nightly telephony transmissions on the 5 -metre wave band, with inputs of 15 and 10 watts respectively. The times of the transmissions are as follows:

G6KA—23.30 to 24.00 G.M.T.
G5NC—23.30 to 24.00 G.M.T.

Reports on these transmissions will be extremely welcome, particularly as they are being carried out after dark. Would anyone listening to the above stations kindly report to G6KA, c/o The Incorporated Radio Society of Great Britain, 58, Victoria Street, London, S.W.1, and in respect of G5NC, to H. Osborne, 77, Fairfield Road, Walthamstow, London, E.17. All reports will be duly acknowledged.

THE BEC RADIO SOCIETY

The Society holds its meetings on the first and third Tuesdays of each month, and anyone interested is assured of a cordial welcome at the above address.

SLADE RADIO

A lecture on "Modern Amateur Phonographs," with its application to radio circuits, was given by Mr. G. F. Clark at the meeting held last week. The lecture was given covering all the points of the lecture and it was seen how film on the plates was used to control the tone. A.C. and D.C. wave forms were seen and both were rectified. Also speech frequency by means of a microphone and a radio receiver. The lecturer spoke on the considerations which must be given to a circuit when designing a receiver for use throughout the country. This talk was followed by a general outline of the function of each stage in a super-heterodyne receiver.

INTERNATIONAL SHORT-WAVE CLUB (LONDON)

This Society commenced a new session on Thursday, September 29th, 1933, and extends a cordial welcome to all new technical and non-technical members. The syllabus for the coming session includes instructive and interesting weekly lectures, demonstrations, debates, and reviews on new apparatus, etc., by qualified radio engineers and representatives of various radio houses, experiments in television, and the formation of a short-wave receiving and transmission section, and visits to places of appropriate interest.

BURLINGTON-ON-TRENT AMATEUR RADIO SOCIETY

At the meeting held on Tuesday, September 28th, at the Wheatsheaf Hotel, Station Street, Mr. C. A. Bradbury, BRS 1066, gave a very interesting talk on television, which was given by Messrs. L. F. Reading, 2A TI, and J. E. Hunter, 2BJN, Secretary, Arthur E. Bear, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

INTERNATIONAL SHORT-WAVE CLUB (LONDON)

The London Chapter of the International Short-Wave Club celebrated its first anniversary at its meeting, held on Friday, September 29th, at the R.A.C. Hall, Wandsworth Road, S.W.2. The first half of the evening was given to short waves, Mr. A. F. Rogerson, A.M.I.R.E., giving a lecture, in which he described and demonstrated several receivers, including his own short-wave station, on which many short-wave stations were heard. Particular mention must be made of the extraordinary reception of Wave 1630, which filled the hall. The second half of the meeting was given to the ultra-short- and long-waves, with the members being highly interested in a demonstration of 2-metre apparatus, which was given by Morsa E. Y. Binding, 2AYT, H. Bruce, 2AXA, and J. E. Hunter, 2BJN, Secretary, Arthur E. Bear, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

HACKNEY RADIO AND PHYSICAL SOCIETY

At our opening meeting of the Winter Session, which was exceptionally well attended, Mr. E. A. Bradbury gave a lecture on "Modern Radio Heterodynes." In opening his talk he first spoke on the considerations which must be given to a circuit when designing a receiver for use throughout the country. This part of the talk was followed by a general outline of the function of each stage in a super heterodyne or quasi-optical waves, the members being highly interested in a demonstration of 5-metre apparatus, which was given by Morsa E. Y. Binding, 2AYT, H. Bruce, 2AXA, and J. E. Hunter, 2BJN, Secretary, Arthur E. Bear, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

SLADE RADIO

A lecture on "Modern Phonographs," with its application to radio circuits, was given by Mr. G. F. Clark at the meeting held last week. The lecture was given covering all the points of the lecture and it was seen how film on the plates was used to control the tone. A.C. and D.C. wave forms were seen and both were rectified. Also speech frequency by means of a microphone and a radio receiver. The lecturer spoke on the considerations which must be given to a circuit when designing a receiver for use throughout the country. This talk was followed by a general outline of the function of each stage in a super-heterodyne receiver.
Cheap Cabinet Finishing

By F. H. HOUGHTON

An Economical and Effective Method of Covering a Radio Cabinet with Grained Cloth

THERE are, no doubt, many readers who may be contemplating the construction of a radio cabinets but are at a loss with regard to a suitable finish. Even with the ready-made French polish, which is so obtainable it is a difficult job for the amateur to obtain a really first-class finish. Hence this article, which explains a method of finishing a cabinet in a cheap but effective manner by covering it with Rexine or similar grained cloth.

It is not my intention to describe the actual construction of the cabinet, except to say that deal is an easy wood to work in, besides being cheap and easily replaced if mistakes are made; it is well dovetailed at the angles and at least 6in. thick, it should be quite suitable for covering, and will make a very strong job, especially where batteries are contained in the cabinet.

Tools Required

The only tools required for covering the cabinet are a sharp pointed knife, scissors, a large, flat brush for glue and a large, flat board to work on. A word about the Rexine—choose a cloth that is firm but yet of good quality. Endeavour to cut the cloth in one piece to cover the whole cabinet, as indicated in Fig. 1, allowing about 1in. larger than the cabinet where marked X, and 1in. larger where marked O. Set the measurements out with a soft pencil on the back of the cloth using a tee-square, if possible so as to get the angles correct.

Cutting Out and Glueing

When making your cabinet do not fix the front fret yet, but having cut out the cloth, prepare the glue in the usual way in a glue-pot, or, failing that, in a saucepan of water, and when it is melted add hot water until it is about the consistence of milk. Now cover the front fret with a thin coating of glue all over except for about 1in. all round the edges, and place it down on the back of the cloth, which has previously been laid on a flat surface, being careful to get it in its correct position on the portion marked Front in Fig. 1, and well flatten it out with a pad. When it is dry it is a simple matter to take your sharp pointed knife and cut around the edges of the fret whilst it is laying flat on the table. After cutting round the fret apply a little stain on the edges of the wood to match the cloth and to cover the cut edges of the cloth as well. Now fix the fret into place in the cabinet with small nails or screws fixed in the 1in. margin left round the edges, after which the remainder of the cabinet can be glued. The 1in. strips will be found to come at the back, where they can be turned over the edge of the cabinet and secured. After gluing the cloth down an overlap of 1in. will be seen, as in Fig. 2, and the best way to treat these corners is to bend down the overlap flat to the side and cut through the two thicknesses with a sharp knife, using a straight edge about 1in. from the edge, as in Fig. 3. Remove the two strips A and B and glue and stick down the flap, when a perfectly matched joint should result.

Treat the four corners the same.
TELSEN
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At the new reduced prices, the wonderful Telsen range of components represents more than ever radio's finest value. Whatever your coil requirements, be sure and insist on Telsen for lasting efficiency at the lowest cost consistent with quality.

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No. W.349 Single Coil 8/6
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TELSEN H.F. TRANSFORMER COIL

May be used for H.F. amplification with Screened Grid Valve, either as an H.F. Transformer, or, alternatively as a tuned grid or tuned anode coil. It also makes a highly efficient Aerial Coil where the adjustable selectivity feature is required.

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For Superhets which do not employ band-pass tuning in their pre-detector H.F. stages, Mechanical construction and wave-change switch assembly almost identical with standard Telsen Screened Coils. Price 21/6

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Comprises two accurately matched Screened Band-Pass Coils, on a single rigid plinth base. The Coils are independent of each other and can be wired for any of the three types of Band-Pass Filter to give exceptional quality with variable selectivity. Price 14/6

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With separate coupling coils for medium and long waves. Highly suitable for use as aerial-coils or as anode-coils following a screened grid valve, giving selectivity equal to that of a well-designed band-pass filter. Price 7/-

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TELSEN BAND-PASS COIL UNIT

Comprises two accurately matched Screened Band-Pass Coils, on a single rigid plinth base. The Coils are independent of each other and can be wired for any of the three types of Band-Pass Filter to give exceptional quality with variable selectivity. Price 14/6

TELSEN FOR EVERYTHING IN RADIO

ANNOUNCEMENT OF THE TELSEN ELECTRIC CO., LTD., ASTON, BIRMINGHAM
A USEFUL TEST APPARATUS

For Quickly Determining the Value of Resistance or Capacity for Any Particular Purpose.

THERE are many instances when the constructor wishes to connect a resistance or condenser in circuit temporarily, and this is usually achieved by the crude expedient of connecting two pieces of wire to the condenser or resistance, leaving same to dangle nowhere in particular, with possible danger to the valves or H.T. battery. The object of the apparatus described is to provide a ready means of determining the most suitable value of resistance or capacity required for some particular function, so that the correct component can be purchased and fitted permanently in the set.

Construcctional Details

Obtain a small wooden box, such as an instrument case, or crystal-set box, a panel to fit, a sufficient quantity of sockets, a plug for same, three terminals, and, if you plan is to mount the sockets opposite the corresponding studs and mark the resistance values against them.

Capacity Test

And now to deal with the capacity test. You will note that on the right-hand side of the diagram the same switch arm is capable of being moved to the various studs, in series with which are condensers of different capacities. The capacity, according to which stud the switch arm is moved, is placed across the terminals B.C. By moving the switch arm from one stud to another, the resultant capacity across the terminals will be the sum of the capacities indicated, a pair of leads with spring clips, of course, making the necessary external connections.

If desired, a plug and set of sockets can be used as the rear plug in lieu of the switch arm and studs, but the actual lay-out, number of resistances and condensers, or a variety of capacities can be applied to any particular circuit, it is best to have the correct resistance, not that which might appear on the surface to be the most suitable.

This is done by dividing the difference between the H.T. voltage required by the valve and the available H.T. voltage by the normal anode current flowing at the correct voltage, the result being multiplied by 1,000. In the case of bias resistances, divide the bias voltage required by the valve by the current flowing in the anode circuit of the valve in question and multiply by 1,000.

Diagram of connections for a simple test apparatus, and table of resistance and capacity values.

do not happen to possess a discarded switch arm complete with studs, a visit to the local junk shop will no doubt result in one being obtained cheaply.

The actual lay-out, number of resistances and condensers, and choice of values, can be left to individual requirements, but a handy combination is depicted in the diagram. Referring to this you will observe that on the left-hand side the switch arm is capable of selecting any resistance from 2,000 ohms up to 100,000 ohms—the sum total of all the resistances—with the plug in the bottom "dead" socket, the value of resistance being across the terminals A.B. Any individual or consecutive series of resistances can be obtained by inserting the plug in a suitable socket relative to the switch arm, i.e., the resistance across the terminals will be the sum of the resistances remaining between the studs the switch arm is on and whatever socket the plug is inserted. The beat

E R I E

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1, Golden Square, Piccadilly Circus, London, W.1.
**BAD QUALITY—ITS CAUSE AND CURE**

By EVANS

A Practical Article Which Deals With This Subject in Simple Terms.

DISTORTION caused by defective components has been fully dealt with in recent issues of PRACTICAL WIRELESS, but we call for further discussion. Bad quality is, however, often due to a haphazard choice of components, or to inaccurate circuit design. It is surprising the number of details that have to be considered when designing even the simplest of receivers; unless a constructor has a thorough knowledge of his work, it is therefore very much wiser for him to strictly adhere to the specification of reputable make or outsource his labour. The receiver average home-designed receiver is of the two or three-valve variety, having a detector followed by one or two L.F. stages, either transformer or resistance coupled. This type of receiver will therefore be dealt with in detail, and a final word of advice will be added concerning H.F. amplifiers.

Detector Distortion

The leaky grid detector, which is commonly used nowadays, although very sensitive to weak signals, is rather easily overloaded. The type of overload is of two kinds: accentuation of the top notes, and sometimes (more especially when an H.F. stage is used) double peak tuning. The latter is indicated by a weakening of the signal strength when the condenser is tuned exactly to the transmitter's wavelength, with comparatively louder signals on each side of this position. To avoid overloading, the detector should be preceded by a volume control (a 30003 variable condenser, connected between the aerial and aerial terminal of the set, will prove satisfactory), and the voltage actually applied to the plate of the valve should be at least 40 volts. If there is a resistance -capacity coupling, the grid-leak resistance must not have too low a value, the low-notes will not be able to pass to the grid of the H.F. valve. The values indicated in the accompanying table are therefore recommended: these will provide approximately 90 per cent. amplification at 50 cycles. An experienced designer may, however, vary them to suit the frequency response desired, and therefore the reader should not condemn the receiver because the component values do not exactly coincide with those given in the table.

Transformer Coupling

The coupling between the L.F. valve and the power valve will probably be a transformer having a ratio between 3 and 5/1 (a higher ratio is not recommended). Transformers usually have a bad inductance regulation, or in other words, their inductance is considerably reduced as the direct current passing through the primary windings increases. This inductance must be high, preferably 50 henries or more, otherwise the bass notes will be attenuated and reproduction will sound tinny. This is the reason for the fairly general adoption of the parallel feed method of transformer coupling; with this system the direct current passes through the parallel feed anode resistance, whereas the signal current finds the path through the coupling condenser to the transformer primary easier—direct current cannot pass through a condenser. The anode resistance must not have too high a value, otherwise, as in the case of the detector, the voltage actually applied to the valve plate will be greatly reduced. On the other hand it must not be too low, or the base notes will be passed to earth via the battery. A resistance having a value of approximately one and a half times the valve impedance is recommended.

Output Stage

If a small power valve is used in the output stage (e.g., 219P), from the writer's experience, best results will be obtained by using a choke filter output. This may be connected directly in the anode circuit, between the valve plate and the H.T. lead, but the author advises attaching a choke filter output transformer having a ratio between 3 and 4 to the speaker should be connected to the output transformer, however, to use a choke filter output arrangement. Transformer coupling may be used, but no one can separate the effect of the transformer from the speaker, and apart from the fact that the windings are liable to burn out, the voltage drop across them will be so great that the actual voltage applied to the plate of the output valve will be too low.

When a super-power valve (or a large pentode) is used in the last stage, a moving-coil speaker will give better quality than the cone type, provided the preceding stages are well designed. The primary terminals of the output transformer should be attached to the speaker, so that quality is quite satisfactory on moderate strength stations, but deteriorates considerably when volume increases beyond a certain level. This form of distortion is due, in practically all cases, to valve overload. If careful adjustr
 trabajando con la tensión de alimentación de acuerdo con el manual de instrucciones de la válvula. El resultado de esta tensión no es tan importante como la tensión de alimentación que sigue.

Para evitar que el receptor se mueva, se debe evitar que la tensión de alimentación sea demasiado alta. Si la tensión de alimentación es demasiado alta, se producirá interferencia en el receptor. La tensión de alimentación debe ser regulada para que sea lo suficientemente alta como para evitar interferencia, pero no tan alta como para dañar el receptor.

**Back Coupling**

El receptor debe estar bien conectado para evitar interferencia. Si el receptor no está bien conectado, se producirá interferencia en el receptor. Para evitar interferencia, se debe asegurar que el receptor esté bien conectado.

**Erasable**

Para evitar que el receptor se mueva, se debe evitar que la tensión de alimentación sea demasiado alta. Si la tensión de alimentación es demasiado alta, se producirá interferencia en el receptor. La tensión de alimentación debe ser regulada para que sea lo suficientemente alta como para evitar interferencia, pero no tan alta como para dañar el receptor.

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**Eliminators**

Numerosas preguntas son recibidas de constructores que no tienen experiencia en la construcción de receptores. Además, los receptores de hilo están siendo utilizados para algunos de los receptores de los que se habla anteriormente. Cuando un receptor de hilo es utilizado con un receptor de hilo, la tensión de alimentación se producirá en el receptor de hilo. Cuando el receptor de hilo se utiliza para alimentar el receptor de hilo, se producirá interferencia en el receptor de hilo. Para evitar interferencia, el receptor de hilo debe estar bien conectado para evitar interferencia en el receptor de hilo. Para evitar interferencia, el receptor de hilo debe estar bien conectado para evitar interferencia en el receptor de hilo.
R. & A. REPRODUCERS

A mong the many ingenious features which form part of the make-up of the well-known R. & A. loud-speakers, the novel form of assembly included in the Alpha model is illustrated below. This particular model costs $10.50, and has an overall diameter of just over 10in. As with all types of R. & A. speakers, a correctly-designed and accurately-built input transformer is fitted. The design of the speech coil, diaphragm, and method of centring is such that adequate response is obtainable over all parts of the musical scale, and, in addition to rich bass notes, the highest treble on the piccolo, for instance, are reproduced with a remarkable clarity and forwardness. The particular model which is illustrated will be seen to have a next device for ensuring that the speech coil is accurately centred, and that it cannot move in any direction but the correct "piston-like" backwards and forwards action, which is essential if all damping and distortion is to be avoided. Great rigidity is employed in the method of assembly which is employed.

HELLESENS BATTERIES

These two illustrations show the ingenious methods of assembly which are incorporated in the R. & A. "Alpha" Reproducer. Each battery produced by Messrs. Hello-sens has a voltage of .5 to .6 volts. Maximum plate voltage is constant, the audio-frequency modulation varies in accordance with the programme. It is important, therefore, that the output valve in a radio set should be able to handle these extra loud passages without noticeable distortion. For this purpose the usual triode or pentode output valves provide ample "overload capacity" for normal reception, but those listeners who require super-excellent quality, combined, perhaps, with rather more volume than that given by the average sets, can use in the output stage of a.o. mains receiver or radio-gram one of the larger valves giving maximum undistorted output of 5 watts and upwards. These valves, it should be noted, require anode voltages ranging from 400 to 700 volts. A popular valve of this type was the Mullard D.O. 25, which has been a firm favourite with many. This valve, however, requires a low tension supply of 5 volts, which is often inconvenient in view of the fact that most mains transformers give only a 4½-volt L.T. supply. The Mullard Company have now brought out a new large output valve, D.O. 30, which may be regarded as a 4½-volt version of the D.O. 25. Its published data are as under:

<table>
<thead>
<tr>
<th>Parameter</th>
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</tr>
</thead>
<tbody>
<tr>
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<td>4.0 v.</td>
</tr>
<tr>
<td>Filament Current</td>
<td>2.5 a.</td>
</tr>
<tr>
<td>Max. Anode Voltage</td>
<td>400 v.</td>
</tr>
<tr>
<td>Optimum Load</td>
<td>4,000 ohms.</td>
</tr>
<tr>
<td><em>Anode</em> Impedance</td>
<td>60 ohms.</td>
</tr>
<tr>
<td><em>Amplification Factor</em></td>
<td>30.0</td>
</tr>
<tr>
<td>Multiaxial Conductance</td>
<td>0.03 m/Volt</td>
</tr>
</tbody>
</table>

The new Mullard high-voltage output valve is manufactured in two types, A and B. Both are similar in design and are intended for use with the usual triode or pentode output valves. In the A type, the plate voltage is limited to 400 volts, while the B type will handle 700 volts. The current rating is 150 mA for the A type and 75 mA for the B type. The Mullah Company have now brought out a new 5-volt version of this valve, the D.O. 30, which has been a firm favourite with many. This valve, however, requires a low tension supply of 5 volts, which is often inconvenient in view of the fact that most mains transformers give only a 4½-volt L.T. supply. The Mullard Company have now brought out a new large output valve, D.O. 30, which may be regarded as a 4½-volt version of the D.O. 25. Its published data are as under:

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</tr>
</tbody>
</table>

UNIVERSAL H.F. PENTODES

M ICROMESH TUNOGRAPH

LEDLY, the vacuum tube manufacturers are now making the exhaustive range of tube hi-voltage condensers with wire ends may be internally screened, thus doing away with the possibility of cylinder non-inductive condensers in metal cases, which are not very convenient when being used in multiple circuits. The base is provided with two screw holes so that it can be mounted and inclined at any angle. The range is also available using Tungsrn automobile valves. These valves are H.F. Pentodes similar to types 51 and 68 of the stand A.C. American range, having 4 volt 3 amp. heaters. The electrodes are anode, covered, thus doing away with the necessity of screening the valve. The grid connection is brought out through the terminals to the usual American fashion.

V.M. C. MAINS UNITS

W HEN reporting details of some interesting Mains Units which are guaranteed against breakdown under fair usage for two years from date of purchase. Prices and ratings are very satisfactory and we hope to give a test report on one of these in an early issue.

NEW DUBLIR VALVES

IMPROVEMENTS in the well-known Dubilier condensers are announced by the Mullard factory is specially manufactured for tubular high-voltage condensers with wire ends may be internally screened, thus doing away with the possibility of cylinder non-inductive condensers in metal cases, which are not very convenient when being used in multiple circuits. The base is provided with two screw holes so that it can be mounted and inclined at any angle. The range is also available using Tungsrn automobile valves. These valves are H.F. Pentodes similar to types 51 and 68 of the stand A.C. American range, having 4 volt 3 amp. heaters. The electrodes are anode, covered, thus doing away with the necessity of screening the valve. The grid connection is brought out through the terminals to the usual American fashion.

TUNGSRN AUTOMOBILE VALVES

This new automobile valve is now available in the Tungsrn range. These are H.F. Pentodes similar to types B1 and B5 of the stand A.C. American range, having 4 volt 3 amp. heaters. The electrodes are anode, covered, thus doing away with the necessity of screening the valve. The grid connection is brought out through the terminals to the usual American fashion.

MICROMESH TUNOGRAPH

The Standard Telephone Company have introduced new ideas in the Microsous Tube. This is, in effect, a miniature cathode-ray oscillograph, and is used in order to show when a receiver is accurately tuned to a station. The filament current is 25 to 30 microamperes, with a voltage of 3 to 5 volts. Maximum plate voltage is 350.
YOUR set
can get
AUSTRALIA

Fit an Eelex Short-Wave Con-verter to your present set. You can receive America, Russia, Australia, South Africa, etc.

Bringing your set up to date. Sample the joys of short-wave reception by fitting an Eelex Short-Wave Converter to your present set and add 70 extra stations to your log. Only a moment to fit. This remarkable invention enables you to receive stations between 16 and 190 metres. You can double the enjoyment of your wireless with an Eelex Short-Wave Converter to your present set.

J. J. EASTICK & SONS,
118, Bunhill Row, London, E.C.1
Phone: Metropolitan 0314/5/6.

PRACTICAL WIRELESS

(Continued from page 215)

If \( ZX \) is a uniform resistance graduated in suitable units, it is only necessary to know the ratio of the lengths \( XY \) and \( YZ \). Thus if \( XY \) is 4 units and \( YZ \) is 8 units, the ratio of the resistances \( R_1 \) and \( R_2 \) will be \( \frac{1}{2} \).

Hence \( R_2 \) = \( \frac{1}{2} \) and we know the value of \( R_2 \) but not the value of our unknown resistance \( R_1 \).

Lastly, as the formula was unfortunately omitted from the original article, I will say that \( R_1 \) and \( R_2 \) are equal to \( B \), \( E \), and \( F \) respectively, taking the terminal of the battery in direct contact with \( B \) as the negative one. It does not, however, matter which way round the circuit.

Making Granular Cored L.F. Transformers

An extremely efficient substitute for stallow laminated cores for L.F. transformers and chokes may be made from material obtainable from practically any engineering workshop or service garage, and sometimes from a chemist; namely, soft iron filings. The construction of such a transformer or choke is extremely simple, the usual requirements being a tin-plate or other metal container, sufficient iron filings to fill it, and suitable winding. The primary being two and three thousand turns, wound on a card former with an internal diameter of about \( \pi \) or \( \pi \) in., of suitable gauge wire, the secondary being made in the correct proportion with respect to the transformer ratio. The primary and secondary are wound side by side, and the ends brought out with thicker wire and labelled, the completed winding then being well taped all over. It is essential that this should be well done, otherwise iron filings might enter and upset the insulation. A layer of iron filings should then be put in the tin and slightly tampered down. A wooden block, about an inch square, is placed over this layer, the coil supported on top of this block, and the whole filled in with filings under moderate pressure. It is essential for the efficient working of the component that the filings should be soft. If any doubt is felt on this point, the filings should be heated to a red heat, and allowed to cool very slowly. A choke or transformer constructed in this manner will be found to have a practically constant inductance through a large range of variation of current through its primary, provided that a reasonable amount of fillings, about jib, is used.—NORMAN ROLLASON (Canterbury).

October 14th, 1933

battery is connected. The formula therefore becomes:

\[ B = \frac{E F}{D P} \]

Actually either \( A \) or \( B \) may be the unknown resistance, provided the other is known. The accuracy of the results will largely depend on the type of galvanometer used. Probably a voltmeter or ammeter will be more convenient if set hand than head-phones, as in the former case the circuit is kept closed all the time, and the continual making and breaking as in the case of head-phones is not part of the procedure. As, however, resistances of critical value are seldom needed in wireless sets, the greater accuracy obtained by using a meter instead of head-phones is perhaps unnecessary.

Fig. 2 shows the complete apparatus.

THE LEADING CLASS B COMBINATION SPEAKER

(Adaptors & Unit Combined)

GET MAINS VOLUME from YOUR BATTERY SET

Enjoy the same perfect performance, colossal volume and increased sensitivity as you would get in a good-quality all-mains set, by connecting the superb EPOCH "Class B" Combination Speaker to your battery set. The EPOCH, which combines a complete "Class B" adaptor and high-class Cobalt P.M. Unit, can be easily fitted without any alteration being made to your present set and at very little extra H.T. cost.

ONLY 5/-

To Try the

EPOCH

for 7 days

THE FAMOUS EPOCH "CLASS B" ADAPTOR

If you already have a moving-coil receiver and wish to incorporate Class B construction, the EPOCH "Class B" Adaptor is designed for this purpose. It converts your set to "Class B" without any alteration whatever. Supplied complete with "Class B" Valve and full instructions.

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E. EBERHARD, L.t., Dept. F.27, NUMBER ONE, EDINBURGH, LONDON, N.18.
Branches : 70/72, Port St., Edinburgh, 71; West Green Rd., Tottenham, 34, St. James St., Walthamstow, and 139, Hertford Rd., Enfield West.
All letters must be accompanied by the name and address of the sender (not necessarily for publication).

From a Reader in Singapore

Sir,—I have been a local subscriber to PRACTICAL WIRELESS for less than three months. I am following the example of many others by dropping a line to wish this periodical the success which it richly deserves.

From a Reader in England

SIR,—I have been a reader of PRACTICAL WIRELESS for less than three months. I am following the example of many others by dropping a line to wish this periodical the success which it richly deserves.

An Australian Reader's Thanks and Suggestions

Sir,—Although I have been a reader of PRACTICAL WIRELESS for less than three months I am following the example of many others by dropping a line to wish this periodical the success which it so richly deserves.

I have, however, one small grumble, and that is the consistent manner in which you neglect this part of the world in your news columns. Of course, I realize that the overwhelming majority of your readers reside in England, but surely they would not mind so much as to be able to assemble the material in such a way that it would interest most of them.

I think the average reader would be amused to hear that a friend asked me if I took my set with me when I go abroad! I think it is safe to say that wireless has a firm hold on the majority of the English people by now.

As an instance of our divergence from English practice I may mention that in Australia the "all-electric" is the rule rather than the exception. I think the average reader would be amused to hear that a friend asked me if I took my set with me when I go abroad! I think it is safe to say that wireless has a firm hold on the majority of the English people by now.

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In conclusion, I really think that if you continue to be heard through the wireless receiver when the bell is situated some distance away. THAT a short length of wire running parallel with the bell wires will provide a ready alarm system. THAT the extra wire should be twisted round to be heard through the wireless receiver when the bell is situated some distance away.

There are many other ways in which the wireless can be used to advantage. One is the use of the wireless as a telephone. Another is the use of the wireless as a bell system. Yet another is the use of the wireless as a signalling system. The possibilities of the wireless are almost endless.

In passing you will be interested to hear that a friend asked me if I took my set with me when I go abroad! I think it is safe to say that wireless has a firm hold on the majority of the English people by now.

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In conclusion, I really think that if you continue to be heard through the wireless receiver when the bell is situated some distance away. THAT a short length of wire running parallel with the bell wires will provide a ready alarm system. THAT the extra wire should be twisted round to be heard through the wireless receiver when the bell is situated some distance away. THAT an electric-bell wiring system will often provide a very good temporary aerial. THAT a glass valve which is turning black, or a silvered bulb which is developing a rainbow effect, is probably nearing the end of its useful life. THAT resistances should not be permitted to make contact with the terminals of other components, as some types of resistances are " alive " on the outside.

The Editor does not necessarily agree with opinions expressed by his correspondents.
Get 5 times the Volume from your present Battery Set

In 5 seconds any battery set owner can get about 5 times the present volume from his existing receiver simply by connecting a Rola Class B Speaker Amplifier Unit. No alteration to the set is necessary.

ROLA Class B Speaker Amplifier Unit...

Mr. R. H. Bradley, Director of Studies, Technical and Commercial Radio College.

A MONG the many thousands of letters I receive there is always a large number from readers (and the fathers of younger readers) asking for my opinion and advice as to the opportunities in radio as a profession.

The radio profession can be likened to a very large tree with many branches, well laden with an abundance of rich fruit. But it is seldom that the plums are to be had for the asking, or merely as a result of a keen interest in radio. Some men have reached the fruit by laboriously climbing the tree; the majority who have picked the plums have used a ladder. And the name of the ladder is "Knowledge."

The radio industry is not simply a business in which commercial ability alone is sufficient. It was created by men with a sound knowledge of electrical engineering, and its phenomenal progress has been made possible by the efforts of men who have studied radio thoroughly, and have never ceased to add to their knowledge. It is doubtful whether any other industry has progressed so rapidly or has been so dependent on technical knowledge and research.

The importance of a thorough knowledge, and the difficulties of obtaining trained men with the right sort of knowledge, have been responsible for the formation of the Technical and Commercial Radio College.

The College has been founded by men who are more than technicians. They not only know radio as a technical subject, but they also know what sort of training is necessary to the man who would succeed. Their activities have covered a remarkably wide range of technical and commercial subjects and they are certainly very well equipped to undertake the responsibility of training others.

The fees are most reasonable and can, if desired, be paid by monthly instalments.
If a postal reply is desired, a stamped address plate must be enclosed.

Every answer and correspondence which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Grosvenor, Lid, S.W.11, Southwark St., Strand, London, W.C.2.

This subject that have occurred in 'Practical Wireless' and also in another wireless periodical. In so doing I have found what appears to be a contradiction, and as one paper might be wrong, I would like to know which it is. In 'Practical Wireless' it is explained that the value of the bias voltage required to obtain the grid bias voltage required by the amperes of current in the grid circuit. In the other paper, a statement is made that the resistance value is obtained by dividing the bias voltage by the amperes of current of the valve to be biased. Can you give me any advice on this ruling on matter? So as to avoid any misunderstanding, I enclose a few pages from articles printed in 'Practical Wireless' and in the other paper concerned.

M. L. (Bath).

You have rather "tripped up" in recalling the two articles to which you refer. Since an article for a battery receiver and the other in a mains set. The 'Practical Wireless' article you mention is perfectly correct, and refers to any type of battery receiver. The idea is that since the bias resistance is in series with the high-tension negative lead and the voltage drop is that which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Grosvenor, Lid, S.W.11, Southwark St., Strand, London, W.C.2.

I wish to make clear the position of the two rotary switch arms.

Wait All Stations

End of Message

Erase (or Error)

Underline

Inverted Commas

Brackets

Interrogation

Comma

Semi-colon

Exclamation

其余的句子和段落内容被截断了，无法完整阅读。
To some readers trouble, we undertake to send on completion of 50 of our advertisers.

GILBERT, J. C.

Fluxite Ltd.

CROSS, A. C., Ltd.

COVERN, LTD.

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CARRINGTON MFG. CO., LTD.

BULGIN, A. F., & CO., LTD.

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BRITISH GENERAL MFG. CO., LTD.

BRITISH RADIOPHONE, LTD.

BRITISH EBONITE CO., LTD.

BRITISH BLUE SPOT CO., LTD.

New Advertisements received.

ELEOTRADIX PRODUCTS

CONSTRUCTORS and experimenters will find much interest in the 32-page catalogue issued by Claude Lyon, Ltd., of 76, Oldhall Street, Liverpool, 3, containing the latest forms of the well-known " Claro-Kite" variable resistances and experimented with in an improved range of continuous wire-wound potentiometers, and also some ultra-high resistance graphite potentiometers. Both are suitable for volume central circuits where currents of the order of 1 milliamp or so are carried. Another useful component is a range of balancing out 'horns' in A.C.-operated receivers. A full range of " B.A.T. " fixed resistors are also listed. Although small, they are of particularly robust construction, non-inductive, non-capacitive, and are proof against burning out by overloads even up to 500 per cent. Full ranges of switches and ganged condensers are listed and also a new range of mains transformers and chokes.

HUGHES SUPERGAMERS

The highest standard of excellence to which modern receivers are well dimed is well illustrated by a new season's booklet issued by Hughes (Great Britain), Ltd., Hove, Sussex. The new range of automatic record-changers and radiograms listed embody all the most recent developments, including a new automatic variable control which prevents the second detector overloading, and overcomes fading to a great extent without impairing sensitivity to any appreciable degree. The Super-8 is a five-valve superhet receiver for operation on A.C. mains, while the Super-D is a six-valve class B receiver for battery operation. The Super-O is a five-valve superhet receiver for operation on either A.C. or D.C. mains, while the Super-P is a five-valve model for operation on D.C. mains only. In the radiogram section there are the Console and the Pedestal models, the latter being fitted with an automatic record-changer. The prices of the receivers range from 18/- to 22/-, and the radiogram from 25/- to 31/-.

A CITY OF SOUND

A very interesting little booklet, bearing the above title and written by H. L. Johnson, has been reached to us from The Marconiphone Co., Ltd. It begins with a simple story of the Romantic beginnings of radio, the Marconiphone experiments, and a fascinating account of its progress up to the present day. Following in its last part are details of the Marconophone Works at Hayen, Middlesbrough. The reader is taken through a modern power house, he is introduced to the big 800-ton presses, coil-winding machines, the intricate recording machines, and many of the interesting operations carried out in these busy works. In the last few pages of the book full particular attention is given to the new 1934 models of Marconiphone radios and record-changers, with a price-list ranging from 18/- to 22/-, and the radiograms range from 25/- to 30/-.

ELEOTRADIX MICROPHONES

The original ECOLEBONITE low loss formers are thoroughly reliable. They are used in all parts of the world. Look for the ECOLEBONITE mark. Ask for it. It is supplied direct by ELEOTRADIX. SEND 6d. (post free) for third edition up-to-date handbook of tuning coils for DUAL RANGE, BAND-PASS, and SUPER-HET circuits. Fully illustrated with data. A very interesting handbook.

RODS, SHEET, TUBES, PANELS

THE BRITISH EBONITE CO., LTD.,


PRACTICAL WIRELESS

October 14th, 1933

228
This most fascinating journal deals with every practical interest—television, wireless, microscopy, astronomy, money making ideas, photography, cinematography, home broadcasting, engine driven model aircraft, chemical and electrical experiments, lathe work, model locomotives, the stratosphere, new tools, gadgets and accessories, ray control of mechanism, etc. Lavishly illustrated, it covers every practical mechanical and scientific interest. All Readers' queries are answered free. It is the journal without a rival.

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Practical Wireless

Encyclopedia of Popular Mechanics

October 14th, 1933

Newnes
NEW MAGAZINE

FOR EVERY READER
TRIUMPH OF NEW IGRANIC SPEAKER

EFFICIENT REPRODUCTION FROM THE SMALL OUTPUT RECEIVER AS WELL AS HEAVY VOLUME WITHOUT DISTORTION

29/6

IGRANIC DUAL TRANSFORMER

PATENTED MAGNET CONSTRUCTION

- The patented magnet construction overcomes all amplitude distortion.
- Every frequency in its true proportion, perfect maintenance of tonal balance.
- The Igranic D.9, thanks chiefly to the patented magnet construction, has earned the preference of the experts. In quality of reproduction and price it fears no rival.


HEAR IT AT YOUR DEALERS NOW
THE ORBIT—THE STAR SET OF THE SEASON!

Something Entirely New for the Home Constructor!

The PROGRESSIVE Experimenter

* Starts this Week!

ESSENTIAL TO GOOD RECEPTION

The AEROFICIENT KIT 66

Contains every component needed to make an efficient and permanently safe Aerial and Earth, complete with full instructions, Tuning Chart, etc. Sold by all dealers.

A GRAHAM FARISH PRODUCT

ADVERTISEMENT OF GRAHAM FARISH LIMITED, ROMLEY KENT
Whenever a well-known designer brings out a successful set you can be almost certain that one or another of the Radiophone Matched Perfection range of components is exclusively specified. Such preference is a sure indication of superiority of results that are far ahead of rivals, of absolute reliability and scientific accuracy.

The Superhet Radiopak specified for the "LUXUS A.C. Super FOUR" is a precision unit of the highest quality. Its selectivity is decidedly in the "super" class, accuracy being assured to within 1/2 of 1 per cent. You have only to balance out the stray capacities with the aid of the trimmers conveniently provided at the top of the unit to ensure permanent "matched perfection."

SPECIFIED EXCLUSIVELY for the "Practical Wireless"

"LUXUS A.C. SUPER FOUR"

Band Pass Super-het Radiopak
Type 533/110 K.C. Price 75/-

Radiophone I.F. Transformers
Type 633/110 K.C. Price 10/- each

BRITISH RADIOPHONE LTD.
ALDWYCH HOUSE, LONDON, W.C. 2

TELEPHONE HOLBORN 6744
If you have money to burn, try what valves you like. Some cost less than Mazda, some claim more. A great many people have discovered that actually not one of them does more, that most don’t do so much!

Of course, you don’t have to believe this. You can prove for yourself—with your own money. Or you can listen to experienced people, like set manufacturers or first-rate wireless dealers. They’ll give you an opinion of Mazda. And if you like to take it, you’ll get a lot more pleasure from your wireless at far less cost.
The Magnavox Permanent Magnet Range fitted with multi-ratio transformer to suit any set.

<table>
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<tr>
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<tr>
<td>Senior</td>
<td>£3 3 0</td>
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YOU CAN PUT YOUR TRUST IN BENJAMIN!

Benjamin British made components and Benjamin British made Magnavox Speakers—together your assurance of absolute reliability and your guarantee of faultless reproduction. Make it Benjamin every time and be SURE.

"Standard" Series (Mains Energised)

Magnavox speakers are standard equipment in the best selling sets.

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<tr>
<td>Standard D.C. 152</td>
<td>£2 5 0</td>
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"Magna" Series (Mains Energised), the finest speakers we have yet produced.

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The Benjamin Transfeeda, the most efficient and inexpensive alternative to costly L.F. Transformers. Price 11'6.

Illustrated is the new 7-pin. Price 2'6.

In addition anti-microphonic 4-pin and new designed 5-pin are available at popular prices.

Write for complete lists and data sheets on all Benjamin and Magnavox products.

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For full particulars of a special Autumn offer, whereby students enrolling soon can obtain tuition at considerably reduced fees—see special note in the prospectus. Write for your copy to-day.

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Whatever the circuit, the experienced constructor will always choose "J.B." For tuning iron-cored coils, in particular, the accurate matching found in J.B. Gangs becomes imperative; and the mechanical rigidity of "J.B." ensures the permanence of this matching.

Illustrated is the new J.B. "DILECON CONDENSER" with fitted terminals, soldering tags and one-hole fixing. This is of the solid dielectric type, the vanes being interleaved with bakelite. The J.B. model is shakeproof and rigid to a degree seldom attained, and yet is no more expensive and is as small as any. If economy or space demands solid dielectric condensers, the Dilecon will ensure best possible results. Write for complete new catalogue.

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Design is of paramount importance, the foundation on which depends the ultimate performance of a reproducer. For this reason the R. & A. research department is constantly studying the problems of sound reproduction, and the result is to be found in the uniform high quality of performance inherent in every R. & A. Reproducer. Ask your dealer to demonstrate any R. & A. model. Compare its performance with that of any similarly priced instrument and you will appreciate a superiority which is acknowledged by the leading Set manufacturers who are fitting them as standard in their 1934 models.

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- TYPE '60' Differential Armature ... $21.00
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PRACTICAL WIRELESS

October 21st, 1933
**APOLGY**

You may be disappointed by a little delay in obtaining your AvoMinor, but we ask your indulgence. It is entirely due to the overwhelming rush of orders for the first accurate combination testing instrument that has ever been put on the market at a reasonable price.

We anticipated, and made provision for, an exceptional demand, but the success of the AvoMinor has surpassed our highest expectations. Orders are being filled in strict rotation, whilst energetic measures are being adopted to increase production.

We would like to point out that as the whole world has waited so long for an instrument capable of accurately carrying out so many tests as the AvoMinor, it is surely better to wait a little longer for the perfect, than to purchase a less reliable product.

**THE AVOMINOR**

Trade Mark.

It is an ACCURATE moving coil combination testing instrument giving ten different ranges of readings in millamps, volts and ohms. It tests everything. It means quick, accurate, easy detection of every possible fault. No other similar instrument makes so many tests with such accuracy. Ask your dealer about the AvoMinor, or write direct for descriptive literature.

At last the day of All-World Radio has arrived, and you can build with your own hands the first receiver to give you not only England and Europe, but America and Australia direct. The Lissen All-Wave All-World "Skyscraper" 4 tunes from 12 to 2,100 metres. It brings two complete new wavelength ranges within reach of the ordinary listener—stations and programmes which before he was never able to receive—Ultra Short and Short-Wave transmissions from the ends of the earth. And remember you get these stations through Double-Balanced Pentode Output giving brilliant reproduction on a Moving-Coil Speaker—as much power as a Mains Set from ordinary high-tension batteries.

Lissen have made this All-Wave All-World Radio available to Home Constructors first, because it brings back the thrill of conquest to hear America and Australia direct on a set you have built yourself, it makes you an enthusiast to realise what a wonderful thing you have created!

When you see the Great Free Chart of the All-Wave All-World "Skyscraper" 4, which tells you how to build it and how to work it and why it gives such marvellous results, you will agree at once that it will be wise of you to build for yourself rather than buy a factory-assembled receiver which cannot give you these new and intriguing short-wave stations. The FREE CHART simplifies everything; there are pictures of every part, with every wire numbered, every hole lettered, every terminal identified. YOU CAN'T GO WRONG! But get the Chart and see for yourself—then build the Lissen All-Wave All-World "Skyscraper" 4, the SET THAT SPANS THE WORLD!
October 21st, 1933

PRACTICAL WIRELESS

READ ABOUT THE "ORBIT" ON PAGE 249.

R O U N D  t h e  W O R L D  o f  W I R E L E S S

The FIRST Two-Pentode Set

We trust that regular readers will again excuse the use of our valuable space in order to point out that the FIRST HOME-CONSTRUCTED RECEIVER EMPLOYING AN H.F. PENTODE AS A DETECTOR, followed by a pentode output valve, was designed in our laboratories and described in this journal in April last (The A.C. Twin). We mention this for the benefit of new readers, and also in reply to a statement in a contemporary which claimed the honour when describing such a circuit in September! As we have so often mentioned—PRACTICAL WIRELESS loses no time in placing details of recent developments before its readers!

Home Construction Holding Its Own

There are many amateurs who believe that the art of home-construction is dying out. A recent census was taken by a well-known weekly, and it shows that no less than 25 per cent. of the receivers in use in 25,000 homes are home-constructed. A further illuminating fact was that over 50 per cent. of the receivers in use were not more than two years old, which means to say that home-construction is still being pursued with great interest. The advantages of making your own set have often been set out in these pages, and it is very gratifying to see that so many listeners take such a keen interest in the hobby, and we take great pride in the fact that we have played no small part in the fostering of this interest.

Queries and Enquiries

Many readers are omitting to send stamped addressed envelopes for postal replies. In every case where a postal reply is desired a stamped addressed envelope must be enclosed.

B.B.C. Chamber Concerts

The B.B.C. announces three series of Chamber Concerts, to be given in the Concert Hall of Broadcasting House at 8.30 p.m. on alternate Fridays, from October 20th to December 15th, and again from January 19th to April 20th. Series A comprises the four concerts on October 20th, November 17th, December 1st, February 2nd, and March 16th. The concerts of Series B and Series C follow these at intervals of a fortnight each.

The Busch String Quartet plays quartets by Haydn, Reger, and Beethoven at the first concert; in the second Lionel Tertis and Solomon give a programme of viola and pianoforte music, which includes the first performance of Bliss’s new Viola Sonata and Violin Sonatas by Mozart and Delius, which Tertis has transcribed for viola.

In the third concert, on November 17th, the London String Quartet play quartets by Brahms and Beethoven, and the Hugo Wolf Serenade. Continuing Series A on December 1st, February 2nd, and March 16th, the concerts of Series B and Series C follow these at intervals of a fortnight each.

The Bush String Quartet plays quartets by Haydn, Reger, and Beethoven at the first concert; in the second Lionel Tertis and Solomon give a programme of viola and pianoforte music, which includes the first performance of Bliss’s new Viola Sonata and Violin Sonatas by Mozart and Delius, which Tertis has transcribed for viola.

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A FURTHER programme of favourites from the Oratorios, under the title "In Quires and Places where they Sing," will be given for West Regional listeners on October 22nd, by Mary Hamlin (soprano), Kenneth Ellis (bass), the Choir of the Cardiff Musical Society and the Western Studio Orchestras. Mary Hamlin has ancestors on both sides of the Channel. She was born at Exeter of Devonshire parentage and descended from the Welsh Princes of Powys on her mother’s side.

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THE ORBIT

EMPLOYS AUTOMATIC FADING COMPENSATION

Reliability—Quality—Station-Getting—All at Low Cost!

Read about our New Transfer Print System

(Proc. Patent No. 24584/33)

SEE PAGE 249
Broadcasting in Greece

The construction of a wireless station in the neighbourhood of Athens has been definitely decided upon by the Greek Government; the transmitter will at first be used mainly for aviation services, but outside these hours will be placed at the disposal of the authorities for the broadcast of programmes.

The Future Power of Radio Alger

Following the example set by France, Algeria has passed a broadcasting law by which in future listeners to Radio Alger will contribute towards the upkeep of the station and cost of programmes. This annual revenue will permit the authorities to install a high-power transmitter, of which the construction is to be begun without further delay. Although not yet definitely fixed, it is expected that the station will be working on 75 kilowatts in March or April, 1934. Three million French francs have been voted to defray the cost of the new plant.

A Little-known Broadcaster

Although Antwerp (Belgium) has had a station for six years, it is seldom that any reference is made to it. In the near future, however, we may hear more about it, as the power, hitherto only 300 watts, is being increased. Answers Radio broadcasts on 229 metres (1,344.6 kc/s), and for most of the transmissions the Flemish language only is used. The call is Hier Antwerpen, with a Fresnous translation: Ici Radio Ansers.

On British Lines

Apparently when the new Abu Zabal (Cairo) station is brought into operation the service will be run on much the same lines as ours, as the programmes are to be solely of an entertaining and educational character. All publicity will be barred.

Forbidden to Broadcast

Radio Vitus, Paris, which has recently completed the building of a high-power station at no great distance from the French capital, has been forbidden to broadcast through it. As he was anxious to obtain a fairly high degree of selectivity, Parker decided that he would use the receiver with a frame aerial. He therefore paid a visit to the local radio store and purchased a five valve set and a frame aerial. On his return to his apartment he joined the frame aerial across terminals A and B, and switched on. He found, however, that instead of sharp tuning the results were just the opposite, the local station spreading over many degrees. Furthermore, he soon found that the aerial had no directional properties at all. Why was this?

Alternate Programmes for Denmark

Towards January, 1934, we may expect to hear two programmes from Copenhagen, namely, one of a national character through the Kalandborg high-power station, and a regional entertainment from a new 25-kilowatt transmitter which is being erected upon the cliffs of Roskilde. The latter will be broadcast on 250.1 metres (1,158 kc/s). The site of the new station has been selected, insomuch as it will provide good reception to Copenhagen listeners, it will be placed at a sufficient distance to prevent any interference with the capture of foreign programmes. In a recent census taken regarding the class of entertainment preferred by subscribers to the system, some 90 per cent. of the replies made it clear that the relay, or the direct reception of entertainments from neighbouring states, were greatly appreciated.

All Above 100 Kilowatts

Of the South American States Mexico is likely to prove a severe competitor, at least, in respect to broadcasts of her northern neighbour, and the Texas stations anticipate considerable interference with their transmissions. At Matamoros, on the border of the Gulf of Mexico, three high-power stations are being erected, namely, XEM, 500 kilowatts (422.3 metres), XEL, 150 kilowatts (454.6 metres), and XEMT, 150 kilowatts (356 metres); these may be used for publicity, and the greater part of the broadcasts will be in the English language. Two big plants are being installed at Villa Acuna, on the Texas frontier: XEF and XER, working respectively on 459.9 metres and 407.9 metres; both rated at 500 kilowatts. It is also stated that a similar transmitter will be built at Monterey (XET, 434.8 metres), and that XENT, already operating at Nueva Laredo on 270.1 metres, will boost its power to 150 kilowatts. Surely a nation of giants! There should be little difficulty during the coming winter of placing Mexico on our log as easily as we do other transatlantic broadcasts from Canada and other parts of the North American continent.

Midland Composers' Concerts

There will be two Midland Composers' concerts in the near future—Joseph Engelman on October 31st, and Sir Herbert Brewer on November 4th. Joseph Engelman, a Birmingham native, is a self-taught composer, whose best-known works are light suites for orchestras. He had a ballet performed a few years ago, Dr. Adrian Boult conducting. His son, who is the pianist at a Birmingham theatre, and a frequent broadcaster, gives a recital of his works. The Brewer concert is by the Midland States chorus, conducted by Edgar Morean, and consists of seven of this famous composer's part songs.

"Kaleidoscope"

One of the most haunting plays ever broadcast was "Kaleidoscope," representing the life of a man from the cradle to the grave. Listeners to the National programme will have heard "Kaleidoscope" on October 27th, and it will be heard by Regional listeners on the following evening. Selected pieces of prose and verse are read aloud on the dialogue of the play, and music is used as an actual character.
This is the First of an Entirely New Series of Articles which will Show how Every Reader can Obtain a Thorough Understanding of the Working of a Receiver by Actual Experiment. Theory has been Ignored and the Complete Scheme is Essentially Practical.

By FRANK PRESTON, F.R.A.

Progressive Experimenter

There is an old saying that "experience is the best tutor," and this is particularly true in regard to wireless. One could read every handbook published on the subject and still acquire far less practical and useful knowledge than by spending but a fraction of the time building and experimenting with a simple receiver. I have for a long time had in mind a scheme by which any interested constructor, be he a beginner or not, could build for himself a wireless set rather on the idea of an expanding bookcase. The main point was that at every stage of the experiments the apparatus should be capable of providing good broadcast reception. It was also decided that, if possible, not a single component should at any stage of the progressive constructional experiments have to be discarded. I have thus devised what is, I think, a new system of wireless self-instruction which will not only prove entertaining, but will be inexpensive and never-ending. The final object is the production of a perfectly up-to-date and really efficient receiver.

The initial cost of parts will be only about thirty-six shillings, and the extra components required from time to time will be bought in easy stages, so that the whole scheme will be of particular attraction to those many readers who have not a great deal of cash to spare on their hobby. It was at first considered that several readers might prefer to make all their own components, but after carefully considering this question it was decided that it would be cheaper to buy most of them. At the same time it was felt that the constructor who wished to carry out all the many experiments which I shall describe would not be able to find time to make the components as well. As a result I shall only ask you to make the tuning coils. This work will not occupy too much time and will facilitate the carrying out of a few of the most important tests in regard to selectivity.

Modern Constructional Methods

A good idea of the appearance of the experimental receiver in its initial form can be gathered from the photographic illustration on this page, whilst the draw-

Fig. 2.—A view of the receiver as seen from the back; you can see the positions of all the components mounted on the chassis.

ings and sketches will make the constructional details quite clear. It will be at once apparent that a metallized wooden chassis (of the kind popularized by PRACTICAL WIRELESS) is employed and that the design throughout is thoroughly modern. At first glance it would seem that the chassis is much larger than is required, but it must be remembered that it was chosen to accommodate the constructor who wished to carry out all the many experiments which I shall describe. The chassis is thoroughly modern.

No Circuit Diagrams to Worry You

Another feature of this "course" (if that name does not sound too scholastic) is that circuit diagrams will in most cases be dispensed with, their place being taken by easily-read sketches and attractive drawings. It is my sincere hope that every PRACTICAL WIRELESS reader who is new to the science, or who has not previously been given thought to the "whys and where-
TUNING COND'R.

ON-OFF SWITCH

FUSE

METALLISED WOODEN CHASSIS.

LEADS TO BATTERIES.

Fig. 3.—This is our artist's impression of the original receiver. The names will enable you to recognize the components.

PRACTICAL WIRELESS

DUAL RANGE TUNING COIL

DETECTOR VALVE

PRE-SET AERIAL CONDR.

A1 A2 E

L.F.OUTPUT VALVE

Fig. 4.—All constructional details for the tuning coil may be obtained from the above sketch.

Fig. 5.—Here you have a pictorial circuit diagram, whilst the corresponding theoretical circuit is shown inset. By comparing the two you will be able to improve your knowledge of circuit diagrams.

October 21st, 1933

Simplicity of Wiring

Up to this stage we have assembled everything except the tuning coil, and we shall find it easier to wire up before making that component. There are really very few wires to deal with, so it is unlikely that any difficulty will be met with here. To simplify matters, however, you might find it worth while to cross out with a pencil line each wire as it is dealt with. The wire specified is insulated, but the covering can be pushed back with the fingers to leave a sufficient length of bare material for making into a loop to fit the appropriate terminal. It will be clear from the illustrations that the grid leak is supported by the wiring, not being fastened to the chassis in any way. The battery leads consist of suitable lengths of single flex, to the ends of which are attached the appropriate wander plugs and spade terminals. For the sake of neatness, all these leads are passed through a quarter-inch hole made through the back of the chassis.

There is one little point which should be clearly explained in connection with the wiring: that is, that there is no wire connection between the on-off switch and the filament terminals of the valve-holders. This connection is, however, made through the metallized chassis and a 1/4 in. 4BA bolt which is passed through it. The bolts and also the wires going to it are shown quite clearly in the wiring plan.
The use of a screen-grid H.F. stage is not common in short-wave receivers for several reasons, the chief being the belief that the advantages to be obtained are not as great as the extra complications, especially as a second tuning control would be introduced and most people find one quite enough! This is a perfectly sound argument, of course, but the additional tuning control can be eliminated by leaving the H.F. stage untuned, and the extra valve will still be worth while even although its full capabilities are not exploited. The chief advantages of an untuned screen-grid stage are the removal from the tuning mug of dead spots, due to aerial loading, and a certain amount of amplification, resulting in louder signals; it may seem that this is not much to get for the extra cost of a valve, but, unless economy of battery current is very important, it is well worth while.

A suitable circuit is shown in Fig. 1. The grid circuit of the screen-grid valve consists simply of the high-frequency choke Ch1, the aerial being connected directly to the grid end of this choke, while the high-frequency valve is coupled to the detector by means of the second H.F. choke Ch2, and the coupling condenser C1; the rest of the circuit is standard. The sizes of the first two chokes are rather important: Ch1 is smaller than the average short-wave H.F. choke, only about 50 turns or so of number 36 d.c.e. wire on a 1 in. diameter ebonite tube. A larger choke than this results in bad interference, of the kind called cross-modulation, from the nearest medium-wave broadcasting station, which makes itself heard all over the dial of the short-wave, at any rate in the vicinity of 40 to 50 metres. If the receiver is used so close to a medium-wave station that interference cannot be removed even by cutting the choke down to 50 turns, the insertion of a preset variable condenser in series with the aerial (at the point marked X) should cure the trouble. It is sometimes recommended that a resistance of from 100,000 to 250,000 ohms is used in place of the choke Ch1.

The capacity of the coupling condenser C1 is not critical but should not be too large; .0001 mfd. is a very good value, and it should certainly not exceed .0003 mfd. The condenser C2, the screen-grid by-pass condenser, must be a mica component, or at least non-inductive, of from .01 to .1 mfd. capacity. The condenser C3 and coil L1 are the usual detector tuned grid circuit and standard values will suit this position. Incidentally, another of the advantages of the screen-grid valve is that the tuning of the detector circuit is not affected by the aerial at all, and consequently it is possible to note the dial reading of any station and be confident of always finding it at that setting and not five degrees away, because the aerial has sagged on to the apple trees or something, as often happens with simple direct coupled detector circuits.

Using an Auto Transformer

A variation of the circuit that is popular in America is shown in Fig. 2. In this arrangement the choke coupling is discarded for an arrangement that is best described as an auto-transformer, the tuned grid coil L1 being included in the plate circuit of the screen-grid valve in such a way that it forms both the primary and, regarded as the detector grid coil, the secondary of an H.F. transformer with a turns ratio of 1:1. There is no coupling condenser in this arrangement, the plate of the screen-grid valve going straight to the grid end of the detector coil. The H.T. positive is connected to the other end of L1 via a H.F. choke Ch1, and in order to bring this end of the coil to earth potential as far as high-frequency currents go, it is connected to the earthed plates of C2 through a large fixed condenser C1. Since C1 is in the tuned circuit L1-C1, any losses in it will reduce the efficiency of the circuit; it must therefore be a really good quality mica component, between .004 and .01 mfd. The grid condenser C3 must also be a good quality instrument because it has to stand the full H.T. voltage to the screen-grid valve; the usual capacity is suitable. In this circuit the H.T. grid does not play such an important part as in Fig. 1, and may be an ordinary short-wave reaction choke such as Ch2. The unimportance of Ch2 is really the only advantage of this circuit over Fig. 1, and in spite of the possibility of trouble with this component in the future it is none.

(Continued on page 256)
DURING the last two years, the progress made in receiver design has been so rapid that an outside aerial is by no means so essential to good reception as was thought formerly; coupled with this fact, we must remember the general increase in power of the principal broadcast stations has done much to make the set independent of the large and unsightly aerial. In spite of this, few receivers are sensitive enough to dispense with this entirely by relying on the relatively small pick-up of the frame. Apart from this, the only alternative is an indoor aerial system. Whilst such an arrangement can be extremely satisfactory from a sensitivity point of view, it rarely happens that the wires can be erected without causing some inconvenience to the rest of the household. If the coupling condenser is at all large, the mains ripple will be passed on to the detector and subsequently amplified; even a quite small condenser can cause this trouble if the voltage ripple is of the high-frequency commutator type; admittedly the reactance of a capacity of the order of .001 mfd. is very high to audio-frequencies, but it must be remembered that a powerful mains receiver will give a good account of a tiny input to the detector. Bearing this in mind it will be appreciated that we are compelled to use a condenser which is of such a value to seriously limit the effectiveness of our aerial; the coupling condenser may therefore be increased to about .01 mfd. with advantage. There is no point in increasing it beyond this value, as the reactance to broadcast frequencies is but 15 or 20 ohms or so. It must be emphasized that it is quite useless to take all these precautions to keep the circuit resistance low if we neglect our earth connection; so be sure to see that this is above reproach.

An Alternative Arrangement

Perhaps a better system than that described above is shown in Fig. 3. Here we have a coupling coil in series with the mains lead. This may be of the so-called aperiodic type or tuned. As a general rule, no trouble will be experienced with hum—the effective coupling for audio-frequencies is far too weak. Should it be desired to tune the coil, it will be found advisable to “tie” down one end to earth potential, otherwise hand-capacity effects will prove troublesome; a condenser for this purpose is shown in broken lines.

A mains aerial constructed on the several lines suggested above should be very effective as the range of frequencies is far too weak. Should it be desired to tune the coil, it will be found advisable to “tie” down one end to earth potential.

Rectifier Aerials

An Efficient Alternative to the Frame.

By ERIC JOHNSON

has a very effective resistance. This would be unimportant if our aerial were of the small high resistance type—a little extra resistance would be but a small part of the whole. We cannot increase the size of this capacity without introducing that mains hum will be apparent with the tapping point well down to the low potential end. In these circumstances it may be found that the series condenser may be increased to about .01 mfd. with advantage. There is no point in increasing it beyond this value, as the reactance to broadcast frequencies is but 15 ohms or so. It must be emphasized that it is quite useless to take all these precautions to keep the circuit resistance low if we neglect our earth connection; so be sure to see that this is above reproach.

An Alternative Arrangement

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A mains aerial constructed on the several lines suggested above should be very effective as the more conventional indoor variety, and should, in fact, bear comparison with a small outside one. It is definitely not recommended for short-wave work, however. The high capacity to earth makes it totally unsuitable for the job; even if the pick-up were good we should find that the interwinding capacity of the mains transformer would make a very effective short to earth. As a point of fact, the greatest efficiency will generally be obtained from the mains lead. On the long waves it is always found that stronger aerial coupling is necessary. For reasons outlined above, this may bring in its train heavy damping and mains ripple. The small loss in efficiency is hardly likely to be very noticeable on these frequencies, however, and certainly should not act as a deterrent to an effective solution to the aerial problem.

THE GOOD COMPANIONS!

The Wireless Constructor’s Encyclopaedia and our Pocket Tool Kit! Have you reserved yours? See page 187, October 14th issue.
Fingerprints!

If you could watch Cossor Valves being made you would be surprised to see every one of the hundreds of girls engaged in assembly wearing thumb- and finger-stalls. There's a special reason for this. Even in the driest atmosphere the skin exudes moisture. Pick up a tumbler and you'll leave finger-prints behind—an almost invisible film of grease. But finger-prints in valve assembly mean impurities deposited on the metal parts. And impurities mean trouble—poor quality of radio reception—distortion—fewer stations—and, maybe, a shorter life.

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ACCURATE MATCHING AT LAST!

- 17 transformer ratios for really accurate matching to ANY power valve or pentode and 4 ratios for Class B or Q.P.P. all available on one speaker by a simple switch adjustment.

- Added sensitivity due to the "Mansfield" magnetic system! Better balance through really accurate matching! The difference in performance must be heard to be believed.

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With the new "Microlode" feature and the famous "Mansfield" magnetic system.

PM4A 42'- Complete


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...IT IS OBVIOUS THE VALVE HAS GONE..."

"It took me only a very short time to discover that—thanks to the 'All-in-One' Radiometer. With this invaluable instrument to help me I'll guarantee to track down any trouble in a few minutes."

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Standard Model "All-in-One" Radiometer, for Battery Sets only, as shown here. Price £12.6

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EXTRACT FROM A TESTIMONIAL.
Crouch End, N.B.
24th April, 1933,
Dear Sirs,
You will be interested to learn that I shall shortly be discarding one of your H.T. batteries. The H.T. Battery in question is a "Siemens Power" 100 volt and was purchased by me in November 1931, and has been in use in conjunction with a 3 valve set since that date—a matter of 17 months.
I am,
Yours faithfully,
(Signed) C.H.

With the new developments now available Battery Sets can be made as sensitive and as powerful as their equivalent types in 'all mains' and with a purity of reproduction which cannot be surpassed.
YOU CAN BE ABSOLUTELY SURE OF THE BEST RESULTS IF YOU USE

SIEMENS
FULL O'POWER
RADIO BATTERIES
THEY COST NO MORE THAN ORDINARY BATTERIES

Write for Free Booklet 667 of up-to-date Battery Information

Columbia’s amazing radiogram offer!

A FOUR-VALVE ALL-ELECTRIC RADIO-GRAMOPHONE WITH MOVING COIL SPEAKER AT 23 GNS.

SPECIAL FEATURES:
2. Flood-lit scale calibrated in wave-lengths with station finder.
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4. Provision for additional speaker.
5. Universal automatic brake.
6. Volume control common to both radio and gramophone.
8. One knob tuning with reduction gear.
10. Mains aerial device.
11. Low running costs.

THE FINEST VALUE EVER PRODUCED BY THE GREAT COLUMBIA FACTORY

Here is the chance of a lifetime to buy a luxury radio-gramophone at an amazingly low figure. For 23 GNS. you are offered an instrument that embraces every material advancement of radio and gramophone science—combined in an instrument which needs but plugging into your electric light supply to bring you the finest programmes that modern broadcasting has to offer, and superb rendering of gramophone music—both with an amazing fidelity of tone.

Columbia have never had more confidence in an instrument than they have in this—representing as it does the greatest value for money to-day—an instrument that might reasonably be priced at many pounds more. This radio-gramophone is a standard product of the great Columbia factory—the largest in Europe—and like all Columbia instruments has undergone nearly eleven hundred tests as part of the routine of manufacture—which explains Columbia’s confidence in this product. Read the brief specification given—then take the first opportunity of seeing and hearing it at any Columbia dealer’s. Remember, this is a chance not to be missed!

COUPON: To the Columbia Graphophone Co., Ltd., 98 Clerkenwell Road, E.C.1.

Please send me particulars of the new Columbia all-electric Radiograph-Four, Model 620, without obligation.

NAME
ADDRESS

Columbia
RADIO AND RADIO-GRAFOPHONES
PRACTICAL WIRELESS

A MOST IMPORTANT ANNOUNCEMENT

Here You Are Given Preliminary Details of an Entirely New Receiver, Designed by Mr. F. J. Camm, Which Will be Fully Described Next Week.

Read About Our New Transfer Print System

(Proc. Pat. No. 24584/33)

purpose is solely to enable PRACTICAL WIRELESS to give absolutely unrivalled service to its readers.

Absolute Accuracy

In addition to the laboratory, our workshop also has been newly equipped with new tools and equipment. This enables us, if and when necessary, to design new components and accessories which could be made up by the various manufacturers for supplying to readers. All our equipment is British Made and is accurate to the n'th degree. As a result you can make full use of the selectivity and sensitivity properties in a manner that has hitherto been impossible with any but the most expensive and elaborate receiver.

A Brief Preliminary Description of the Latest Set

No doubt our readers are by now wondering just what kind of instrument this latest receiver is. Briefly, it is distinctly modern, and although having but three valves, IT GIVES AT LEAST "FOUR-VALVE" RESULTS. It is intended for battery operation because we know perfectly well that the majority of our constructor readers prefer a battery set. At the same time, however, the set is eminently suitable for use with an eliminator of simple, practically any pattern, so main working can easily be provided if desired.

Low cost, compatible with unmatchable performance has also been secured.

A WONDERFUL INSTRUMENT WITH AUTOMATIC FADING COMPENSATION

Selectivity and Anti-Fading

The latest type of ferrite core coils are used to ensure ample selectivity for any and every requirement, and the carefully designed "Anti-Fading" circuit makes long-distance reception a matter of utter simplicity.

Of course, we all know perfectly well that long range and selectivity combined are of little use in the normal course of events for receiving stations that are subject to fading. CONSEQUENTLY THIS NEWEST STANDARD SET IS PROVIDED WITH AN AUTOMATIC ANTI-FADING DEVICE WHICH WORKS. As a result you can make full use of the selectivity and sensitivity properties in a manner that has hitherto been impossible with any but the most expensive and elaborate receiver.

The high-amplification pentode valve is used in the output stage and this enables an ample output of excellent quality reproduced to be obtained from a really great number of stations. Following our usual practice we do not wish to boast of the great number of stations we have heard, or how many on one receiver; we know, as you do, that such figures mean little and depend almost entirely upon the location of the receiver. The receiver system employed and innumerable other varying factors. We will merely say then, that you can depend upon results of this kind, you have never before dreamed of in connection with a receiver having but three valves and costing so little.

Entirely New Form of Construction

But that is not all, the method of construction is quite different to any ever employed before for a home-constructor's set—not only is it different, but it is better. All the components are mounted on the underside of a metallised wooden chassis, so that no wiring is visible on top. This arrangement has made it possible considerably to simplify the constructional work, and at the very same time to attain higher efficiency combined with a particularly "clean" and "neat" appearance.

Another advantage which accrues from this method of construction is that it enables the receiver to be mounted in its rightful place—on the chassis with the rest of the components. Thus, the complete receiver can be removed from, or replaced into, its cabinet in a matter of seconds, and it can be tested with ease before it is fitted into the cabinet and whilst it is perfectly accessible.

Simple Controls—Handsome Appearance

The number of controls has been reduced to the minimum without making any sacrifice of efficiency, and they consist of a single tuning knob which drives a slow-motion condenser dial, a wavechange switch and a reaction control. There is also an on-off switch, but this is so positioned that the symmetrical arrangement of the main controls is not interfered with.

When fitted into its cabinet the receiver is sufficiently handsome to grace any room.

A Revolutionary Development—The Transfer Print

Every PRACTICAL WIRELESS Receiver is guaranteed to perform in the manner claimed. We undertake to induce every reader free of charge should anything go wrong in the construction, operation or operation of any of our receivers provided that the parts we specify are used. We specify only the parts used by our designers. You are thus enabled to guarantee our receivers to perform in the manner claimed. There cannot be a standard of performance unless the reader uses the parts specified by the designer.

PRACTICAL WIRELESS exists to serve its readers!
A Test Report and Some Additional Operating Notes

Of the greatest difficulties with a battery are caused by a large amount of low-frequency amplification, that is, feed-back, low-frequency oscillation, and so-called medium-wave feed-back. Actually, all these forms.

800 feet from the London stations were easily eliminated. As a matter of fact, none of the three stations was found to occupy more than twenty or thirty degrees on the condenser scale. By reducing the capacity of the pre-set condenser, unscrewing the adjusting knob until the two turns, any of the stations could be entirely cut out in something less than five degrees. When the set was operated rather more carefully, making full and careful use of the dial, two or three other stations could be brought in at good phone strength. Of these, Fécamp, Bordeaux-LaFayette, North Regional, Radio Paris, and Hilversum provided good signals. The positions on the condenser scale for the stations mentioned above were as follows:

Fécamp, 2 degrees; London National, 21 degrees; North National, 30 degrees; Bordeaux, 11 degrees; London National, 120 degrees; Daventry National, 130 degrees; Radio Paris, 143 degrees, and Hilversum, 157 degrees. These figures may not apply exactly in your case, but they will help you in locating the different stations.

On the Short Waves

Later on, a change over to the short-wave bands was made, and on the lower one (14.4 to 40 metres) a number of continuous wave stations were picked up at once. The only telephony station that could be well received was Zeezen, on 19.73 metres, and this was tuned by a decoder setting of approximately 34 degrees. On changing to the 32 to 90 metre band, Rome (48.2 metres) was received at 12 degrees, and Zeezen (49.83 metres) was just over 14 degrees. Since this first test was carried out under such adverse conditions and during day-light hours, it gives some idea of what may be expected from the set in the worst localities for reception in the country. In fairness to the set, however, it was felt that it ought to be tested under more average conditions, so I took it out to my own private laboratory, which is situated some twelve miles north-west of London and a similar distance from Brokum.

A still further effort was made to increase the volume by using a higher H.T. voltage. When the voltage was doubled there was undoubtedly a slight improvement, but this was not considered to be sufficient to justify the installation of a larger battery, especially since the current consumption was increased to about eight milliamperes from a little over one-third of a milliamperes. After I had given the set a thorough test on the broadcast wavebands, I turned my attention to the short waves. Incidentally, this was about 11 p.m., and it did not take more than a few seconds to bring in quite a number of amateur transmitters on the 40-metre band; these were best received between about 5 and 12 degrees on the condenser, with the wavechange switch in the "S2" position. Tuning was extremely sharp, so that it was found to be perfectly feasible to turn the condenser as slowly as ever possible by means of the smaller knob. Care had also to be taken in maintaining the valve in the "just oscillating" condition which I mentioned last week. It was very interesting to follow these amateur stations, and I was amazed to find that they could be received almost as well with the "Unipen" as with a very "hot-stuff" single-wave short-waver.

There were not very many short-wave broadcasting stations to be found on the 32-90-metre band at the time of these tests, but Radio Nations (Switzerland), working on 40.3 metres, provided a steady signal at slightly over 10 degrees. Upon turning to the lowest waveband, (Continued on page 272)
Because results have proved them the most reliable valves in the world; because performance has proved them the finest design in the world; because public choice has proved them the most popular valve in the radio industry, three million aerials today lead down to Mullard Master Valves. **And three million aerials can't be wrong.**

ASK T.S.D. Whenever you want advice about your set or about your valves—ask T.S.D.—Mullard Technical Service Department—always at your service. You're under no obligation whatsoever. We help ourselves by helping you. When writing, whether your problem is big or small, give every detail, and address your envelope to T.S.D., Ref. O.Y.R.

Mullard
THE MASTER VALVE

A well-known British set-maker was placing large orders for Hellesen Hi-Life batteries. First he put them on test. The result of his test showed that their life was no less than 50.2% longer than any other battery working under identical conditions—a figure even greater than that shown by our own tests in the factory.

That is the result of over 40 years experience in the manufacture of dry batteries. Since 1887 Hellesen batteries have been the best in the world. Now the new Hi-Life batteries, the latest addition to the Hellesen range, have reached an even higher standard of performance than before, and are offered to you at a price competitive with any other quality battery.

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HOW CLEAR IT IS!

GET THIS FOR NOTHING

50.2% EXTRA LIFE

WIRELESS BATTERIES ARE POWERING YOUR SET

HAVE YOU A MARCONI 551

Then you need Ever Ready Batteries:
H.T. Port. 17; G.B. 4; L.T. 2169—all made specially for it. Or simply ask your dealer for the Ever Ready List, showing all popular makes with their special Ever Ready Batteries. Your set will be powered perfectly by its appropriate Ever Ready Batteries.

Because it incorporates every worth-while radio development, the new Cossor Melody Maker has "All Europe" range and adequate selectivity—it will bring you the best Continental programmes free from local or other interference. Its reproduction is rich, full and true-to-life. This remarkable set will give you everything—performance, appearance, ease of operation—that you'd expect from a costly Receiver. Yet, despite its remarkable efficiency, the Cossor Melody Maker is so simple that you can assemble it—Meccano-fashion—at home. No wireless knowledge is necessary. Send the coupon below for a Constructional Chart which tells you how you own this powerful Receiver for the bare price of the parts.


Please send me a Constructional Chart which tells me how to build a Cossor Melody Maker.

Model

Name

Address

Please note a Constructional Chart which tells me how to build a Cossor Melody Maker.

FOUR MAGNIFICENT NEW MODELS

BATTERY MODEL KIT 342

Balanced Armature Loud Speaker

Complete Kit of Parts for assembling Cossor Melody Maker, Model 342, similar to illustration, including Cossor Variable-Mu Screened Grid, Cossor Detector, and Cossor Variable Valve. Fully wired and ready for immediate connection. Complete Kit of Parts for assembling Cossor Melody Maker, Model 342, similar to illustration, including Cossor Variable-Mu Screened Grid, Cossor Detector, and Cossor Variable Valve. Fully wired and ready for immediate connection.

PENTODE OUTPUT

Complete Kit of Parts for assembling Cossor Melody Maker, Model 342, similar to illustration, including Cossor Variable-Mu Screened Grid, Cossor Detector, and Cossor Variable Valve. Fully wired and ready for immediate connection.

BATTERY MODEL KIT 344

Class "B" OUTPUT

Complete Kit of Parts similar to Model 342 described above, but with four Cossor Values, Class "B" Output Stage and Permanent Magnet Moving Coil Speaker.

ALL-ELECTRIC MODEL KIT 347

Complete Kit of Parts similar to Model 342 described above, but with four Cossor A.C. Values, Main Values (10,000), Power Line and A.C. Mains Energised Moving Coil Speaker.

Prices do not include Mains or accumulator.

BALLOON MODEL KIT 343

MOVING COIL LOUD SPEAKER

Complete Kit of Parts similar to Model 342 described above, but with four Cossor Values, Class "B" Output Stage and Permanent Magnet Moving Coil Speaker.

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ALL-ELECTRIC MODEL KIT 347

Complete Kit of Parts similar to Model 342 described above, but with four Cossor A.C. Values, Main Values (10,000), Power Line and A.C. Mains Energised Moving Coil Speaker.

Prices do not include Mains or accumulator.

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Prices do not include Mains or accumulator.

Prices do not include Mains or accumulator.
ENGINEERS recognize two methods of testing, namely qualitative and quantitative. The two terms are almost self-explanatory, but a simple example will serve to show the real difference between the two. Suppose that you find that your radio receiver is not giving the volume to which you are accustomed; for some reason or another you suspect that all is not well with the output stage. You remove the output valve from its holder and replace it temporarily with one borrowed from a confiding friend. It operates perfectly; volume is restored; you had hit upon the faulty spot first time.

Apt To Be Slow

But it does not always work out thus. Suppose that when you fitted the substitute valve things were no better than before. Then you would have to suspect some other part of the equipment and examine or replace each in turn until at last you found the seat of the trouble. Or, worse still, what if the original trouble was that your valve had been ruined by some wrong connection or short circuit within the set, and that when you experimented with your friend’s valve you ruined that too? No, except for a few simple and obvious faults, qualitative testing is too slow, too uncertain, and sometimes too dangerous.

On the other hand, imagine that you possess some simple and cheap measuring instruments—a milliammeter, say, and a voltmeter. When your set showed symptoms of trouble you could have measured the anode current of the output valve. If you found the reading was below normal, you would know at once that one of a certain number of things had occurred. Either the valve had lost a part of its emission, or the high-tension voltage had fallen considerably, or the grid-bias voltage was too high, and so on. Then you could make further tests in order to discover the exact cause of the poor performance. Quantitative testing is quick, simple, and final.

In the early days of radio, when sets and circuits were comparatively simple and the average standard of performance low, qualitative testing was sufficiently speedy and accurate for most amateur needs. To-day, however, circuits are relatively complicated, and components have a high order of efficiency. Mathematically accurate adjustment is the order of the day, and very small errors in adjustment bring serious consequences in loss of selectivity, sensitivity, stability, and quality.

A Mistaken Impression

It is often thought that testing instruments are an expensive luxury, and this accounts for the fact that only a very small proportion of those who call themselves serious radio amateurs possess even the simplest gear for carrying out accurate tests. This is, however, quite a mistaken notion, for quite valuable results can be obtained by means of most inexpensive and simple equipment.

Before describing the various types of instruments available and the quickest methods of conducting tests with their aid, it may be of assistance to outline briefly what quantities are most suitable for measurement, and the principles involved in the process.

In the first place it is necessary to realize that all the happenings in a radio set are, in effect, the passage of electric currents of different kinds, some constant in value, and some of varying strength. It is upon the correct values and behaviour of these currents that the set operates.

Like all electric currents, those occurring in a radio receiver are primarily due to the existence of electric pressure—voltage—applied by some apparatus capable of developing that pressure. This may be an electric battery, as in the case of an accumulator for low-tension supply, or a dry high-tension battery; or again, it may be the electric light mains, the pressure of which is generated by a dynamo at the power station. In any case, there must be a voltage before an electric current can pass.

Two Factors

Further, however great the voltage, no current can exist unless there is a complete circuit along which it can pass. The breakage of a wire, the disconnection of some component, or the fracture of a soldered joint will interrupt the path along which a current should travel, and the current will no longer exist.

The strength of the current depends upon two factors, first the amount of the voltage and second the extent to which the circuit offers opposition to the passing of the current. This opposition is termed resistance.

In this Article the Author Describes the Principle of Working of the Various Types of Meters used in Radio Work. By H. BEAT HEAVYCHURCH

Fig. 1.—Simple diagram explaining the principle of a moving iron instrument. This illustration does not show the actual form of movement.

Fig. 2.—Two very good examples of moving-coil instruments included in a wireless receiver.

Fig. 3.—Illustrating the elementary principles of a moving-coil instrument.

Fig. 4.—Comparison between scale of moving-iron and moving-coil instruments. A. Moving iron (crooked at bottom). B. Moving coil (equally divided).
To Listen Efficiently Should be the Aim of Everyone Using Radio in their Home. Study this Article to find the Best Way of Bringing this to a Successful fruition.

Deciding the Position
To begin with, then, I should first decide upon the position of the receiver itself. It would, of course, be placed in the room in which the family would normally require to listen—usually the lounge or living-room, depending upon the habits of the family. The actual position would be selected as the result of considering four points: (1) the position of the loud-speaker relative to the normal family circle, (2) ease of manipulation of controls from my armchair, (3) possibilities of good aerial and earth connection, and (4) appearance.

These four points are, of course, not of equal importance, nor does it follow that their relative importance is the same in every case. For example, a set having a self-contained speaker must be located having greater regard to (1) than (2), whereas, if a separate speaker is used, this instrument can be located where it will give the best acoustic effect, the receiver proper being positioned where it is most convenient from the control point of view.

Again, although, in general, arrangements for a good aerial and earth are very important, sets of the transportable and portable types are practically independent of these conditions, and even with a set designed for external aerial and earth, provided it has a speaker at least one high-frequency stage and the listener is not too exacting in his requirements by way of distant reception, aerial efficiency is not a matter of very vital importance.

A Conviction
I know I shall be criticised for this statement, but it is my firm conviction that, for the majority of listeners, a radio set should be a reliable source of entertainment rather than a highly efficient scientific instrument. Efficiency is, of course, highly desirable, but it should take second place to comfort and convenience. Therefore, I say, for the average listener, place your set where it sounds best, is most convenient to operate, and looks best—provided you can, at the same time, obtain the programme service you desire. If, on the other hand, you want to get every ounce out of your set, you may have to sacrifice something in

(Continued overleaf)
which water may be poured occasionally to keep the earth connection moist and of high conductivity.

Alternatives

Regarding the aerial, much depends as I have already pointed out, upon whether you want maximum efficiency or maximum comfort and visual appearance. If your set is in the former, you will have chosen a spot close to a window as the location of your receiver, and will proceed to erect a good outside aerial. Note that the effective height is of greater importance than the horizontal span, and an aerial stretched between short masts clamped to the chimney is usually quite good, if not better, than a long aerial running the length of the garden. With a set of fair sensitivity, a loft aerial is very little inferior to an outdoor aerial — provided the down wire is spaced out from the wall. But so much has been written already about these two conventional forms of aerial that I do not propose to add to it.

From the aesthetic point of view, any aerial running outside the house has objections, and if you have decided to sacrifice a little in aerial efficiency in order to place your set in the most convenient position, there are several alternatives from which you may choose. A very sensitive set, say a circuit including only one high-frequency stage, may be necessary to run a wire round the walls of the room. But so much has been written already about these two conventional forms of aerial that I do not propose to add to it.

Fig. 3.—High aerial masts between two chimney stacks, with down wire held well away from the wall.

Continued from previous page

comfort and appearance in order to locate the set in the most favourable position for a good aerial and a good earth.

A word or two may be said about the selection of apparatus if a new set is to be bought or made for the new home. If you are definitely planning for listening—and not, for experimental work —several alternatives suggest themselves. There is, of course, the ordinary receiver with a built-in loud-speaker. Its position will be decided upon the lines already laid down. Next, and possibly an improvement from the convenience and aesthetic point of view, is the receiver with separate speaker.

Most listeners also require a gramophone operation, and the choice then lies between a pick-up on a separate gramophone turntable and a complete radiogram. In the latter case, the position will probably be fixed once and for all from aesthetic considerations —there are usually only one or two positions in an average room where a large radiogram can be comfortably, and it is usually a spot which necessitates long journeys back and forth from your chair for record changing.

Now let us consider the question of aerial and earth. Even if a high-efficiency aerial is not considered essential, a perfect earth is very desirable, and not difficult to achieve. Especially is this the case if you 'ave access to a new house in the process of building, and before the floorboards are laid. Knowing roughly where your set is to be, you can sink a good earth plate, tube or bowl in your garden, as near to the set as possible, but some three or four feet from the wall of the house, bringing the earth wire through the nearest underfloor ventilator or "air-brick." Get the builder to drill a hole in the floorboard close to where your set will stand, and bring your earth wire up through this hole. By the way, when sinking your earth plate, it is not a bad idea to drive in a piece of metal tube—old gas pipe will do admirably—through it. The earth plate must remain the same. Within certain limits reception may be just as good at quiet drawing-room strength as when run all out in a small hall, the point to be emphasized is the necessity for maintaining correct proportion over the frequency spectrum. The third requirement of the loud-speaker is the ability to deal faithfully with transients.

In order to reproduce an exact impression of the original transmission, a loud-speaker has to fulfil three requirements; the most obvious is that it must be of a frequency range, although it may be in no way altered, and, furthermore, the over-tones or harmonics must be present in their true proportions. This implies immediately that the relative strengths of fundamental and harmonics must remain the same. Within certain limits reception may be just as good at quiet drawing-room strength as when run all out in a small hall, the point to be emphasized is the necessity for maintaining correct proportion over the frequency spectrum. The third requirement of the loud-speaker is the ability to deal faithfully with transients.

We will assume, therefore, that our receiver is above reproach from the quality standpoint, and that the虢d in question is near perfect as can be at the present stage. In spite of all this there is an uncomfortable feeling that this perfection has not been achieved. Notwithstanding that both amplifier and speaker give a straight-line response. We may be listening to a concert from Queen's Hall, but with no stretch of the imagination (if we are honest) can we believe that we are actually there. This feeling is related, at least in part, to the fact that the music comes from a point source. We cannot hope to achieve audiophonic reproduction without stereophonic reproduction.

Using Two Loud-speakers

The secret is the possession of two loud-speakars. We will assume that one is incorporated in the receiver as usual, and the other is installed in a remote part of the house. The distant speaker should be run at full volume; a general rule the best effect will be obtained with our set-speaker running at quite moderate strength. Each speaker should be equipped with an independent tone-control. A balance can now be made between the two which will give the impression of an orchestra playing in a large hall. The stereo effect of course, achieved by the slight echo effect caused by the sound waves from the distant speaker lagging behind the other. This echo effect may not be acceptable on speech; it is quite simple therefore to cut the distant speaker out altogether by use of the volume-control.

It must be realized that the above is an illusion pure and simple, and is not true stereophonic reproduction, although the latter could be easily realized with the co-operation of the B.B.C. To illustrate the method let us imagine that a play is in progress with a microphone on one side of the stage and another on the opposite side. One is connected to the London National transmitter, and the other to the Daventry National. At the receiving end we must, of course, have two receivers, one tuned to each station with its own loud-speaker. As before, one speaker is built in the set, and the other installed in a distant part of the house. It can be easily seen what the effect of an artist moving from one side of the stage to the other would be reproduced in all its original realism with the transmission of the sound from one speaker to the other.

Oct. 21st, 1933

STEREOPHONIC REPRODUCTION
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BLUE SPOT 100U Speaker and Chassis. For high or low powered sets. Original Price £4/17/6. Our Price (for a limited period only), Cash or C.O.D. ONLY. £2/10/0 deposit and 11 monthly payments of 15/6.


BAKER CLASS "B" MOVING-COIL SPEAKER, complete with driver, Cash or C.O.D. Carriage Paid, £3/17/6. Balance in 11 monthly payments of 7/- only.


NEW ROLA "CLASS B" PERMANENT MAGNET MOVING-COIL SPEAKER, complete with input transformer. Send 6/6 only. Balance in 12 monthly payments of 5/6.


NEW ROLA CLASS "B" PERMANENT MAGNET MOVING-COIL SPEAKER and AMPLIFIER. Complete with driver and input transformer. Two models: A for PM2B, Send 5/- only, 20/- for 10/0B and 30/- (octave which when ordering). Cash or C.O.D. Carriage Paid, £3/11/0. Balance in 11 monthly payments of 6/0.

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NEW LISSEN SKYSCRAPER FOUR ALL-TRANSISTOR CONSOLE CABINET MODEL, comprising all components, including set of Interferential Valves and Cabinet. Cash or C.O.D. £11/15/0. Balance in 11 monthly payments of 10/-.

NEW LISSEN 7-VALVE AUTOMATIC SUPER-HEATED CONSOLE MODEL, comprising all components, including set of Interferential Valves. Cash or C.O.D. £17/15/0. Balance in 11 monthly payments of 14/6.

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SEE the Constructional Chart giving most comprehensive, most
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Never before has there been any receiver for Home Constructors on such an ambitious scale as this new Lisseen "Skyscraper" Seven Valve Superhet. It embodies every up-to-the-minute advance and refinement of the most luxurious factory-built superhets—it gives the constructor the opportunity to build a £20 receiver for less than half that price.

The circuit of the Lisseen "Skyscraper" Seven Valve Superhet incorporates a 6-stage bandpass filter giving exact 9-kilocycle channels and therefore providing a standard of selectivity never before achieved by a home constructor's kit set, and frequently found except in laboratory apparatus. Amplified Automatic Volume Control is provided, a special valve for this purpose having been produced by Lisseen for use in this receiver. The use of this Amplified Automatic Volume Control constitutes an entirely new experience in listening: no "fading," no "blasting"—you will find yourself enjoying every word of every programme, however near or however distant, without the slightest temptation to interfere with the receiver once you have tuned it. This is radio listening as it should be enjoyed! Lisseen Class 'B' Output through a new full-power Lisseen Moving-coil Loudspeaker—glorious rich tone and majestic volume, actually more faultless in its reproduction than anything you ever heard from even the most powerful mains receiver, yet working economically in this Lisseen "Skyscraper" from H.T. batteries. Tuning is something new in single-knob control—in fact, not only single-knob control but single station tuning. You never hear two stations together, you never need to think about separation. The 9-kilocycle tuning peak of the circuit ensures "one station at a time" all round the dial, and the Amplified Automatic Volume Control adjusts the receiver automatically to provide the same volume from each transmission. This simplicity is the true luxury of listening—and this is the Luxury Receiver for Home Constructors.

Lisseen have published for this great new "Skyscraper" Seven Valve Superhet a most luxurious Chart which gives more detailed instructions and more lavish illustrations than have ever before been put into a constructional chart. It makes success certain for everybody who decides to build this set; it shows everybody, even without previous constructional experience, how they can have a luxury receiver and save pounds by building it themselves. A copy of this Chart will be sent FREE in return for coupon on the left or your radio dealer can supply you. Get your FREE CHART now!

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Publicity Dept., Isleworth.
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Name
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Electric pressure is measured in volts. Very small voltages may be expressed in millivolts (thousandths of a volt) or even micro-volts (millionths of a volt) but such delicate measurements need very expensive instruments usually beyond the reach of amateur listeners.

Finally, resistance is measured in ohms, very high resistances being sometimes expressed in megohms. A megohm is, of course, one million ohms.

**Following a Law**

Next, it is important to remember that there is an exact and never varying relation between the direct current flowing in a circuit, the voltage producing it, and the resistance which limits its value. This relation is contained in a formula, commonly known as Ohm’s law, which states that the current in amperes is equal to the pressure in volts, divided by the resistance in ohms.

The simplest form of measuring instrument, and that upon which all other indicating meters are based, is the ammeter or milliammeter (the name depends upon whether it will measure currents of large or small intensity). Of the many types of these instruments, only two are likely to be handled by the amateur, namely, moving-iron instruments and moving-coil instruments.

In the moving-iron instrument the current to be measured is passed through a fixed coil of wire within which are two pieces of iron, one fixed in position and the other capable of moving about a central pivot, see Fig. 3. With the current to be measured passes through the coil it produces a magnetic field, and both pieces of iron are magnetized in the same direction. They consequently repel each other, with the result that the piece which is pivoted moves away from the fixed piece. The movement of this piece is opposed by a spiral spring, and the amount of movement depends upon the magnetizing force which, in its turn, depends upon the strength of the current. A pointer attached to the pivot moves over a scale, thus indicating the amount of deflection of the iron and hence the strength of the current.

The second type of instrument is known as the moving-coil instrument, two good examples of which are shown in Fig. 2. It consists of a permanent magnet, usually of the horse-shoe type, between the poles of which is pivoted a coil of wire as indicated in Fig. 3. The current to be measured passes through the coil of wire which is, of course, magnetized. Mutual attraction and repulsion between the poles of the magnet and the poles of the coil takes place, and the coil, being free to move against the pressure of a spiral spring, is deflected to an extent depending upon the current strength, its deflection being indicated by a pointer which passes over a graduated scale.

In practice the moving-coil instrument is preferred to the moving iron, chiefly because it is more accurate, and because the scale is more “open,” that is to say, the divisions are equally spaced. With a moving-coil instrument, the scale divisions are cramped at the lower end and spread out at the top, making readings of small values very difficult and inaccurate, the comparison between the scales of the two instruments being shown in Fig. 4.

It must be remembered, however, that moving-coil instruments are only serviceable for direct current measurements, while moving-iron instruments may be used for either direct or alternating currents.
THE Lissen "Skyscraper Superhet Seven" is probably the most ambitious kit set ever offered to the home-constructor, but despite this it has been so well designed that the versed beginner in wireless construction finds no difficulty in building it up in a very short space of time. As the name implies, this receiver has seven valves, which are arranged to form a particularly efficient battery-operated superheterodyne. The mere name "superheterodyne" often confuses the mind of the beginner visions of complications and wonderful circuits well beyond his ken. He pictures wired-on wires, tightly adjusted, and difficult operation, but none of these are to be found in the set under review. In fact, extreme simplicity is the keynote and is one of the salient features throughout.

Very Modern Refinements

That the "Skyscraper Seven" is really up to the minute can be seen at once when but a few of the refinements are mentioned. For example, the tuning scales for both long and medium waves are marked off in metres; efficient automatic volume control is provided by means of the very latest valve development in the Lissen type of CS battery-operated diode-pentode; a three-way loud-speaker tone control is provided; the output stage employs two special S.G. valves instead of triodes; and the three extra valves arranged as an excellent Class B amplifier.

An Easily-assembled Kit

But let us start at the beginning, by dealing with the kit of parts which are supplied in a strong partitioned box with every one marked for easy identification. There is a strong aluminium chassis, completely drilled to receive every component and connecting wire, and all the parts are supplied with screws so that they can be mounted in a minimum of time. There is also an ample length of wire and a supply of insulating sleeving, not to mention a very well-prepared chart showing the entire construction in easy stages. This latter is a wonderful piece of work, and its extremely well-prepared chart showing the entire construction in easy stages. When the constructional work is commenced one quickly appreciates the full-scale drawings and the clarity with which the wiring procedure is explained. Every wire shown on the plans is numbered, and a key index gives the exact length of each wire, tells which terminals it is to be connected to, and the number of the hole (where the wire goes through the chassis) through which it must be passed. The battery leads and also the flexible which connect up the anodes of the S.G. valves are colour coded so that they can be identified at once.

Neat and Compact Cabinet

The walnut cabinet, whether of the console type or table model type, is supplied in sections which can be assembled in next to no time without the use of glue. Both types are, of course, polished and have a distinctly handsome appearance, which is much better than that of many factory-made ones that are used to house commercial sets. They are extremely compact, and the console one, which is large enough to accommodate all the batteries, measures only 20ins. long by 11ins. high and 11ins. wide. This is supplied with a Lissen permanent magnet moving-coil speaker which really does justice to the set. There is a considerable amount of fascination to be had from building the receiver, but to handle the finished instrument is no less interesting. The first thing is to adjust the trimmers on the three-gang condenser and to find the optimum setting for a long-wave padding pre-set. This operation is delightfully simple, thanks to the detailed instructions which are given, and we found that it could be carried out entirely in about ten minutes. Once it has been done the trimmers never need any further alteration and their settings "hold" accurately over both wavebands.

Simple Controls—and a Criticism

There are only three controls on the whole instrument; two of these are on the front of the cabinet, and the third is at the side. One of these is the on-off switch. It has a rotary movement, and when in its central position the set is "off"; rotating it to the left or right connects the batteries and gives medium or long-wave reception respectively. If we may be allowed to make one small criticism, it is that this switch is not quite so "positive" in action as we should like. As a result, it is sometimes a little difficult to know whether the set is "on" or "off". This is, of course, a very small point, and were it not for the excellence of the set in every other direction it would scarcely have called for any mention. We have no doubt that the makers could overcome this little difficulty quite easily by fitting slightly stronger contact springs.

We gave the "Skyscraper Seven" a prolonged test on a short aerial of less than average efficiency and have nothing but praise for the performance it gave. The wavelength-calibrated dial was found to be very accurately made, so that we had no trouble in finding any desired transmission whose wavelength was known. It would be impossible to mention by name even half the number of stations that were well received, for they simply tumbled in all round the dial. Not only were they brought in at strong strength, but the quality was in all cases distinctly above the average for a battery receiver. By making use of the loud-speaker tone control, reproduction could be varied from very "brilliant" to "deep mellow." The advantage of automatic volume control was very evident, and stations which normally fade badly could be held at practically constant strength for hours on end. Additionally, the blasting which one usually gets when tuning to the local station was entirely absent, and it was found impossible to overload the detector even when listening to Brookmans Park, less than twenty miles from the receiving aerial.

Real Selectivity—Silent Background

Selectivity was all that could be desired, but at the same time there were no signs of "sideband cutting" provided that tuning was accurately carried out. What rather surprised us was the entire absence of those background noises which one is liable to hear at night. The entire set is "on" and yet there is no "hum" whatever. There is nothing noticeable in the control box, and there is no "blasting" when the aerial is changed; the former is no less interesting.

This illustration shows the attractive lines of the Lissen "Skyscraper Superhet Seven": cabinet and controls.

(Continued on next page)
associate with super-heterodynes. Second, changes, so far as I could judge, entirely absent; if there was any it was too slight to be noticed. It would rather seem that these excellent results are due to no small measure to the use of the 126 k/c intermediate frequency which Messrs. Lissen have standardized in their superhet equipment, as well as to the use of three complete band-pass filter circuits.

Novel Circuit Arrangement

The novel circuit arrangement of this receiver with its interesting to a more technically minded reader in view of the many outstanding features incorporated. A capacity-coupled band-pass serial tuning circuit precedes the first detector and the aerial coil has a loose coupled winding which is connected to a tapping on the long-wave portion; this effectively prevents medium wave "breakthrough" and removes aerial damping from the first tuned coil. A Lissen S.G.2 pentode, one valve acts as first detector, operating on the anode bend principle. Its bias voltage is varied by the A.V.C. valve acting as second detector, and this makes the receiver independent of voltage. A separate oscillator (a Lissen H.L2) is used and is tuned by a shaped oscillator section on the printed circuit. Next comes another variable-mu valve acting as I.F. amplifier and having its bias voltage controlled by the second detector. The latter valve, as mentioned before, is a production of Messers. Lissen and is not as yet made by any other firm. It is a six-electrode valve, having the usual three grids and plate, plus an auxiliary anode which functions in conjunction with the filament as a diode rectifier. It is coupled to the Lissen L2 driver valve through a resistance fed in the pitch required for individual tastes.

Newly Circulated

A capacity-coupled band-pass aerial tuning condenser is connected between the anode of the Class B driver valve through a resistance fed in conjunction with the filament as a diode rectifier.

A.T. consumption.

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A capacity-coupled band-pass aerial tuning condenser is connected between the anode of the Class B driver valve through a resistance fed in conjunction with the filament as a diode rectifier.
Completing the Luxus A.C. Superhet

Details Regarding the Construction of the Mains Unit, and Operation of Our Latest Luxury Super-heterodyne Receiver

By W. J. Delaney

Those readers who endeavoured to complete the construction of this receiver from the theoretical circuit will no doubt have met a rather difficult point. This concerns the method of mounting the two electrolytic condensers. It will be seen from the theoretical circuit that the field winding is joined between the negative poles of the two electrolytic condensers. This has certain advantages in this particular circuit, but renders it necessary to carry out a little unusual method of mounting.

Mounting the Electrolytic:

Two brackets will have to be constructed from stout gauge aluminium or brass, and a terminal mounted on the side, as shown in the sketch, Fig. 1. In addition, two squares of stout cardboard should be cut, slightly larger than the foot of the brackets. As a further safeguard—in view of the fact that it may be possible to develop a short circuit across the high-voltage section of the mains unit—when the positions of the two brackets have been marked on the chassis from the illustration, Fig. 2, the metal coating should be scraped away with a penknife. All risk of short circuits is then obviated.

Mounting the Speaker:

To mount the speaker in position before assembling the two units in the cabinet, a small baffle should be cut from ordinary thin plywood, and this should be screwed to the front of the mains unit chassis with a hole sufficiently large to clear the diaphragm, but with room enough for holding down bolts or screws.

Mount the valve-holder first, then the two electrolytic condensers. Do not omit the special locking ring which is included on these components, and when the condenser is fitted to the bracket, lock the nut up as tight as possible, when the pentode valve will sink slightly into the metal and avoid all risk of the condenser coming loose at a later period. Next, mount the mains transformer, and then commence the wiring of this unit. The 01 condenser should be screwed in the position shown, and a small bracket should be made from strip brass or aluminium to hold the connecting cable. Great care should be exercised, when connecting this cable, in order to get the correct pins wired to provide the proper voltages in the receiver.

Final Details:

In other words, do not get mixed between the grid and anode pins of the plug. When the wiring is completed, the speaker should be fitted to the baffle and the field winding joined to the two terminals on the electrolytic condenser brackets. It does not matter which way round the field is connected. That is to say, there is no positive marked 0 on the transformer on the speaker chassis, whilst the remaining terminal on the condenser is connected to the terminal marked 75, as well as to the positive poles of the two electrolytic condensers. The connection to the speaker is made by means of a flexible lead joined to the anode terminal of the pentode valve, and this should be passed through a hole in the receiver chassis, and cut off just long enough to reach the speaker transformer. When the wiring is quite complete, the two chassis should be stood side by side and the set tested before putting it into the cabinet. Connect a length of flex to the 01 Belkin mains socket, and plug this into the nearest mains socket. Plug in the special 5-pin plug to the valve-holder on the rear of the receiver chassis, and insert the valves in the respective sockets. These are marked on the wiring diagram given last week.

There should not be the slightest hum or trace of instability when the receiver is switched on, and the local stations should be heard at quite good strength without any adjustment of the I.F. transformers or the trimmers. In order to carry out the necessary trimming adjustments a weak station at the bottom of the tuning dial should be selected, and the volume control turned until the station is practically inaudible.

If the station is known the wavelength should be checked with the markings on the tuning scale, and the trimmer nearest the panel adjusted to bring the tuning point to the correct dial reading. When this has been done the remaining trimmers should be adjusted for maximum response, any improvement in signal strength being compensated for by reducing the volume control. It should not be difficult to find the best settings, the correct position, of course, being that where a reduction in strength results when the trimmers are turned in either direction.

The All-wave Unipen

(Continued from page 250)

However, things were quite different, and a really good "bag" of stations was soon obtained. Brook Bound (call sign announced W9XAL) came in well at 11 degrees and gave a nice steady signal with practically no signs of fading. Another American, Schenectady (W3XAD), was also quite good at a condenser setting slightly above that of Brook Bound; Pittsburgh (W8XK) was another good station, coming in at 104 degrees. Zeeen, Rome, and other Continental stations could be received without the slightest difficulty, and were often as loud as Midland Regional. Practically all the stations that were received on "phones could be brought up to full loud-speaker strength by using the set as an adaptor in conjunction with a standard Det. 3 L.F. receiver.
CLASS B DRIVER TRANSFORMER


Ratings:
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VALVE HOLDERS

These Valve Holders have exceptionally low lead moulded bases, with insulating material between sockets being reduced to a minimum. Contacts are of phosphor bronze, sturdy in design.

Four Pin
Five Pin
Seven Pin

Graham Farish Ltd., Bromley, Kent.

PRACTICAL WIRELESS

October 21st, 1933

THE PROGRESSIVE EXPERIMENTER

(Continued from page 239)

...stouter wire by winding it once round. Now proceed to put on the next twenty turns and make a second tapping, wind another twenty turns, make a third tapping, and then complete the last ten turns. The end of the wire should be anchored just as the beginning was, again leaving Sine or so for connecting purposes. In order to keep the winding more even it is best to arrange the tapping points on different ribs, as in the original coil which you can see in one of the photographs.

The coil is attached to the top surface of the chassis in a very simple manner by screwing down a short length of wooden rod or a cork over which the hollow ebonite former will fit tightly. Connect the top end of the winding to the terminal on the tuning condenser which is in contact with the fixed vanes, and join the lower end to the other condenser terminal. The crocodile clip on the flexible lead from the pre-set condenser will be attached to the different tappings of the coil.

You are now quite ready for giving the set a preliminary trial and to commence your experiments. Fit the nine-volt grid bias battery in the clips attached to the chassis and put plug "G.B. -" into the positive socket and plug "G.B.+" into the "4.5 volt" socket. Join up the two- volt accumulator, and then connect the high tension battery. The "H.T.+" plug should be put into the negative socket, then plugs "H.T.+1" and "H.T.+2" should be fitted into the "120-volt" and "60-volt" sockets respectively.

Connect up the loud-speaker (using the two black terminals only) and set the contact arms to positions "A" and "E" respectively, in order to obtain the correct ratio for the power valve specified.

Attach the "E" winder plug to the earth lead and that marked "A" to the aerial lead-in, and insert these in the terminal sockets marked "E" and "A1."

The First Experiment—Selectivity

The first experiment can now be tackled. Fit the crocodile clip on to the first tapping (thirty turns) on the tuning coil and rotate the condenser dial until a station is received. You will find that the station can be heard over a fairly wide "band" on the condenser dial until a station is received.

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Every component gives up its secrets to an EMICOL Test Meter.

No component can hold anything back from an EMICOL Test Meter. In a twinkling you can test the efficiency of every part of your set.

Why waste time and money looking for faults when the regular use of an EMICOL Test Meter will enable you to prevent them?

Write for free descriptive literature giving full details of the range of EMICOL Testing Meters.

October 21st, 1933

BEGINNER'S SUPPLEMENT
(Continued from page 262)

seen, very feeble and are therefore very often amplified by one or more valves before being rectified. The first valves are called high-frequency (H.F.) valves, and their business is to produce currents similar in every respect to those in the aerial circuit, but much stronger; the extra energy comes from the batteries or the mains which supply them with current.

The next process, namely rectification, is carried out by the detector valve. This valve also amplifies to some extent, but its chief function is to convert the high-frequency currents, which, as we have seen, are currents which move quickly in the same direction as the wave from which they are derived, into direct current, i.e., a current which flows in one direction only. The next process is amplification. This is carried out by the detector valve.

The next process is amplification. This is carried out by the detector valve.
RESISTANCE MEASUREMENT

An Article Dealing with the Method Used, and the Construction of a Simple Bridge.

RESISTANCES are used in any radio set, and are not infrequently the cause of breakdowns. Yet how many people would be able to test a resistance in the case of a breakdown? The first test to be applied would probably be with a pair of 'phones and small battery, which shows if there is a definite disconnection inside the component concerned. But the simple test with the 'phones will not show if a resistance has changed from 10 to 1,000 ohms or from 1,000 to 10 ohms. Such a change might easily take place, due to the winding breaking down. A breakdown of the winding, or due to the insulation, is very inconvenient. There is also the danger that should the resistance be lower than was at first supposed, the current will be large and will do considerable damage to the meter.

The Bridge Method

There is, fortunately, a very good method of comparing resistances by the bridge method, which is used in most laboratories and is very accurate. The circuit of the bridge is shown in Fig. 1. If the values of the four resistances in the circuit are in a certain ratio, there will be no difference of voltage between the ends of the galvanometer. When this is so, the bridge is said to be balanced.

From this, if we know three resistances, we can calculate the fourth. It may at first be thought that the bridge would have no application for the radio man, since three resistances must be used, of which the values must accurately be known, and one of these must be variable, in order to obtain balance. Fortunately, however, there is quite a simple way out of the difficulty in which only one known resistance is necessary. This is how it is done.

The resistances $R_3$ and $R_4$ are replaced by a wire $AB$ (Fig. 2) which has a sliding contact running over it at $C$. The wire $AB$ is of such a high resistance as to be consistent with good mechanical strength and is usually of 22 or 24 gauge manganine wire which may be obtained from any scientific instrument makers. The wire is stretched over a scale which is divided into 100 divisions and 1,000 sub-divisions, a meter rule of the usual wooden type being suitable. Now the values of the resistances $R_3$ and $R_4$ are proportional to the lengths of wire $AC$ and $BC$ in each case. So that the ratio $R_3/R_4$ is equal to the ratio of the lengths $AC/BC$. The lengths are easily measured on the rule, and according to the law for balance, $R_1/R_2$ is equal to $R_3/R_4$, which in turn is equal to the ratio of the lengths. So if $R_1$ is known the value of the unknown resistance is easily found.

Constructing a Simple Bridge

As much for the theory. Now let us consider the construction and range of a simple bridge. The main detail is the slide wire which comprises the two lower resistance arms of the bridge. It must be absolutely uniform, otherwise the resistance will not be proportional to the length in the circuit. Furthermore, it must be exactly the correct length. Fig. 3 shows the simple construction employed, the whole apparatus being mounted on a piece of wood about 3ft. 9in. long and 6in. wide. The metre rule is screwed down on to the wood, and at each end of the rule, and touching it, is a flat strip of copper, which is screwed down to the baseboard. Two terminals are fitted to the copper strip as shown, and another similar strip on which there are three terminals is mounted at the back of the baseboard. The important point in the whole construction is the fixing of the slide wire, which must be so soldered that it is exactly the metre in length to the point where the solder commences. This is because the resistance of the solder and the copper strip is negligible compared to that of even a small portion of the slide wire. So a good blob of solder should be put on at the edge of the end of the rule. The sliding contact is a small piece of copper strip, screwed to a piece of wood as a handle. It must be pressed firmly on the slide wire. The battery is connected to the terminals $B$, the resistances $R_1$ and $R_2$ to the terminals so marked, and the galvanometer between $G$ and the sliding contact.
DURING the past few weeks conditions of the ether have so improved that it has again been a pleasure to bring the short-wave receiver into operation. As most nations are now realizing the value of GSG, Daventry Empire, having suffered losses in the ether has now well heard on 49.26 m. (6,090 kc/s) with a wave-length, is now well heard on 15.00 (Mondays, Tuesdays, and Fridays) with an extension until 15.30 on Saturday and Sunday. The announcements are made in six different languages.

Transatlantic Broadcasts
Of the most frequently reported has been YV1BC, Caracas, which on 49.08 m. (6,112 kc/s) has been working on weekdays between G.M.T. 16.00—15.30, 22.45—03.30, and on Saturdays on 19.30—03.30. The interval signal is easily recognized: it consists of four chimes on a gong every fifteen minutes, and usually precedes the call. If you can prove reception of a broadcast by giving details of some items heard, and write to YV1BC, Radio Broadcasting, Caracas, Venezuela, you may be rewarded, as confirmation, with a booklet on the call.

Another station for which it is worth trying is XETE, Mexico City, on 424.3 m. On most evenings they are twce each half hour between G.M.T. 21.00—01.00 (Thursdays and Tuesdays); 21.00—00.00 (Fridays and Saturdays); 21.00—05.00 (Saturdays) and 16.00—02.00 (Sundays). According to an official report broadcasts hitherto carried out on 25.42 m. have been discontinued. VESHERX, of the Maritime Broadcasting Company, Halifax (Nova Scotia), working on 49.26 m. (6,110 kc/s) may be often picked up between G.M.T. 22.00—03.00. Here again a gong signal is used; there are four notes every half-hour, preceding the call and announcements. VESJR, Winnipeg (Canada) on 29.6 m. (11,175 kc/s) appears to work in sparses between G.M.T. 14.30 and 03.00 daily. Strokes on a gong are also used as an interval signal, and the station operates by a gramophone record, O Canada.

In respect to stations in the United States, the following changes should be noted: W8XF, Chicago, short-wave relay of W8NR, of the N.B.C. network on 49.18 m. (6,100 kc/s) does not broadcast on Saturdays. On Sundays it operates from G.M.T. 20.30—23.00 and from 01.00—05.00; on other weekdays from G.M.T. 01.30—05.00. Also another station for which it is worth trying is W9XF, Chicago, short-wave relay of W9ZP, of the Midwest Empire, which broadcast on 49.22 m. (609 kc/s) as a relay of the Trades Unions' studio (RCY) working on 1,304 m. or, alternatively, ROZ, 1,000 m. and 424.5 m. On most evenings they are two distinct programmes.

Notes on the Most Important Broadcasts Below 50 metres
By E. THURWAY

PRACTICAL SHORT-WAVE NOTES

SOMETIMES when a new short-wave receiver is bought for the first time it is found that the receiver does not possess the prescribed wave-range, zero on the dial tuning the receiver to a wavelength far above that of the intended minimum. A receiver may behave itself in this manner according to either one of two defects—in the first, the minimum wavelength is not low enough, but the maximum is correct, and the second in which the whole wave-range from zero to 180 degrees on the dial is either lower or higher than the intended original.

Unfortunately, there are no coil standards in common use for short-wave tuning, and beyond the figures published by manufacturers for use with their own coils and a given capacity, we are more or less in the dark when it comes to a question of estimating the wave-range of a short-wave coil. If a metal chassis construction is used, special steps must be taken to ensure that the tuning coils themselves do not come too near the panel. If plug-in coils are used, some provision must be made to mount the coils at a distance
from the chassis. To achieve this, the best plan is to use a piece of inch-thick wood, measuring about 2ins. by 2ins., mounting this on top of the chassis plate, and on top of the wood mounting an ordinary bush-

The chassis is to be limited, that is, a correct maximum coil as well. If the tuning range is found to be too high—that is, if both ends of the dial tune too high a wavelength, the best method of reducing the wavelength is, of course, to reduce possibly one whole turn from the tuning coil, which may also require a little attention being given to the reaction of the coil as well. If the tuning range is found to be limited, the tuning coil, which may also require a

...effect described above may be experienced.

Also, do not make the mistake of running any of the wiring in the tuning circuits too near the metal chassis merely in order to secure neatness. Extra capacities can be formed in this manner in a number of places which have a rather disadvantageous effect on the efficiency of a short-wave set.

Actually, the chassis system of construction, if employed sensibly, is very excellent for short-waves. We can, for instance, make use of chassis-type valve sockets which have considerably lower capacities than some examples of other types, and the wiring can be kept very short, with a minimum of actual connecting wires. These amateurs who do not object to the use of solder can take advantage of some of the very small fixed condensers and resistances now available with wire ends, and wire these directly into the circuit. These will be found particularly advantageous for the grid circuits as the condenser and leak in the detector circuit can be practically wired on to the detector valve socket itself, thus reducing considerably the length of wire in use.

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On sale at all Newsagents, Stationers and Bookstalls for 1/1.
BAKER'S CLASS B CONVERTER

The illustration below shows the latest type of Class B unit which is manufactured by Baker's Selhurst Radio. This consists of a heavy metal case finished in a very neat black grained effect, with the name Baker clearly embossed on the upper surface. In practice the device works very well indeed, the tone being quite pleasing. The tone control works admirably and enables quite a good high-note cut off to be obtained when required. The volume is fully up to Class B standards, and the coupling of the output valve to the receiver is simplicity itself. The price of the unit is 37s. 6d.

SOLON "EMPIRE" SOLDERING IRON

This consists of a heavy metal case finished in a very neat black grained effect, with the name Baker clearly embossed on the upper surface. It is thus intended primarily for connection to a three-point power switch, but it may be used on an ordinary lighting circuit by having back the earth wire out of the way (and preferably insulating it in some way) and fitting an ordinary lamp socket adapter. The handle fits with a patent bakelite terminal connecting lead and cord grip which keeps the wire away from the element and at the same time ensures that the leads cannot be inadvertently pulled off. The iron takes approximately four minutes to reach the necessary temperature for soldering purposes, and it is thus a very satisfactory accessory for the experimenter or the service man.

BULGIN SPIROHM RESISTANCES

Bulgin Bulgin Resistances have been very impressed with this particular component. A neat porcelain former (5in. long by 1in. diameter) is provided with a spiral turned-in wire and round this is wound a resistance element consisting of a heat-resisting core surrounded by a winding of bare resistance wire. A threaded metal rod passes through the former and, and small holding-down brackets are fitted at each end. Connection is made by means of a clip fastened round the ends of the element. In a terminal is mounted at the top of the clips, with the addition of a small hole for soldering purposes, which is a great advantage of this type of resistance. -part from the valuable cooling properties which it possesses - the fact that the resistance may be varied in quite small steps by sliding the clip along. For instance, we took a Spirohm which was rated at 6,000 ohms, and in order to test its adaptability we cut off (quite at random) 600 ohms. One clip was loosened and passed along the bare wire while the instrument was made to carry 1,000 ohms. One clip was loosened and passed along the bare wire while the instrument was made to carry 1,000 ohms. One clip was loosened and passed along the bare wire while the instrument was made to carry 1,000 ohms. One clip was loosened and passed along the bare wire while the instrument was made to carry 1,000 ohms. One clip was loosened and passed along the bare wire while the instrument was made to carry 1,000 ohms. One clip was loosened and passed along the bare wire while the instrument was made to carry 1,000 ohms. One clip was loosened and passed along the bare wire while the instrument was made to carry 1,000 ohms. One clip was loosened and passed along the bare wire while the instrument was made to carry 1,000 ohms. One clip was loosened and passed along the bare wire while the instrument was made to carry 1,000 ohms.
ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY

This Society is pleased to announce the formation of a department to obtain work for its unemployed members. There are no charges for this service, or for the society, to the unemployed. Representatives dedicated to the society will shortly be broadcasts regularly from American stations. Christchurch, New Zealand, is organizing a branch of the society.

Hon. President, Leslie W. Orton.

SLADE RADIO (AFFILIATED TO THE R.S.G.B.)

A branch of PRACTICAL WIRELESS. Wireless enthusiasts are cordially invited to attend a meeting of the above Society on any Thursday, at 8 p.m., at their headquarters: Porcelain Hall, Bromfield Road, Kettering.

The following is a programme of future events:

Oct. 2nd — “Gas filled relays.”
Nov. 2nd — “Gas filled relays.”
Dec. 7th — Annual Dinner.
Jan. 11th — Annual General Meeting.
Feb. 23rd — Lecture and demonstration “A.C.V.” by Mr. F. J. Collins.
March 9th — Lecture on “From Nelson’s day to the present,” by Lieut. Commander Hillaries Scarlett, R.N.,“U.S.11, A.M.I.E.E.

THE THAMES VALLEY AMATEUR SHORT-WAVE AND TELEVISION SOCIETY

The first meeting of this Society was held at Teddington on Wednesday, October 4th. A large gathering, including many unknown transmitters, the host being Mr. Crocker, G2SS (Sunbury), and during the evening discussions on the season’s programme were given. Mr. E. Shepherd, G6BS (Sheppton), gave an outline of the phases of short-wave work to be followed during the season, and an enthusiastic television group was formed. A very interesting talk, given by Mr. V. J. Wadman, G8X (Waltham-on-Thames), on “Stadium Arrangement,” followed by Station Description No. 1, was well received. Mr. Wilkins, G6WYN (District Representative No. 11, R.S.G.B.), spoke on matters concerning all Radio Societies and aroused much enthusiasm. The meeting closed with inspection of apparatus exhibited. Intending members should write to :
Hon. Secretary, Mr. R. Sheargold (G6R8), “Glenmore,” Manygate Lane, Shepperton, Middx.

GOLDERS GREEN AND HENDON RADIO SCIENTIFIC SOCIETY

Thursday, November 9th, at 8.15 p.m. in the lecture hall of the Hampstead Public Library (at the corner of Finchley Road and Arkwright Road, N.W.3), a lecture and demonstration is to be given, entitled “Music from the Air,” when the new Valve Electronic Musical instrument will be played for the first time in Hampstead by Mr. Martin Taubman, A.M.I.E.E., to whom seats are free.

Other Contents:

SIMPLE HOME-MADE TALKIES

THE ART OF SPICING

HOW REVERSAL MICKEY MOUSE FILM IS PROCESSED

ENLARGED ISSUE

THE OCTOBER

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PRACTICAL WIRELESS

October 21st, 1933

PRACTICAL LETTERS FROM READERS

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

Accumulator Charging Arrangement

Sir,—About two months ago I pointed out that I had found plug and socket working preferable to switch gear. It is this point that has again aroused my interest. I have taken a part of the diagram by A. Bingham, Liverpool, in No. 53, page 28, to make clear this preference. You will admit, I am sure, that it is by a strange coincidence that this is the very circuit I abandoned, and sent in the plug and socket arrangement for preference. A glance at Fig. 1 shows that the accumulator

Fig. 1 & 2.—Diagrams accompanying Mr. Cole’s letter.

Before the arrangement mentioned was in use we were on one occasion treated to a silent night,—owing to the failure of two accumulators. The hook-up, shown in Fig. 2, saved the situation. The two accumulators were connected in series, and the trickle charger tapping raised to 4 volts and connected across two accumulators. Two volts only were tapped off to the set, and the programme which had begun came in as usual. There was a slight hum between items, and for this reason it was not regarded as a permanent arrangement. It was, however, continued successfully for the whole evening.—P. C. H. Cole, Harlowden.

Facilities for Binding Vol. II

Sir,—As a reader of your weekly from the time of its inception, may I offer the same facilities for binding Vol. II will be offered as were given in the case of Vol. I.

May I take this opportunity of congratulating you upon keeping the standard up to the high level at which it was introduced. It is my high opinion of the value of this periodical which prompts my inquiries as to binding facilities.—H. Thurston (Stratford).

(This is being prepared and an announcement will be made in the near future.—Sr.)

CUT THIS OUT EACH WEEK.

DO YOU KNOW?

-THAT the metallicized coating of some mains lights is joined to one of the pins and not to the cathode.
-THAT the suppressor grid is connected to one of the pins in some mains pentodes, and is not joined to the cathode.
-THAT the normal tuned-anode arrangement gives greater amplification than any other form of M.F. coupling, but is more difficult to stabilize.
-THAT removal of the earth connection should result in a reduction of signal strength, because the earth is imperfect.
-THAT signals from a powerful local station may often be obtained by holding the aerial terminal instead of joining up the correct aerial lead.
-THAT an electrolytic condenser must be chosen with care regarding the voltage rating to which it is subjected.
-THAT trimming adjustments in a receiver on the H.F. side should be carried out with a wooden instrument, and not an ordinary long-handled brassdriver.
-THAT it is possible to hear the American medium wave stations in England with a single H.F. stage on favourable occasions.

NOTICE.

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

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Printed by NEWNES & PEARSON PRINTING CO., LTD., Exmouth Street, Ladbroke Grove, W.10, and published by GEOVJE NEWNEE, LTD., 811, Southampton Street, Strand, W.C.2.

Sole Agents for Australia and New Zealand: GORDON & GOW, LTD.
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Practical Wireless, October 28th, 1933.

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The circuit of the Lissen "Skyscraper" Seven Valve Superhet incorporates a 6-stage bandpass filter giving exact 9-kilocycle channels and therefore providing a standard of selectivity never before achieved by a home constructor's kit set and very rarely found except in laboratory apparatus. Amplified Automatic Volume Control is provided, a special valve for this purpose having been produced by Lissen for use in this receiver. The use of this Amplified Automatic Volume Control constitutes an entirely new experience in listening: no "fading," no "blasting"—you will find yourself enjoying every word of every programme, however near or however distant, without the slightest temptation to interfere with the receiver once you have tuned it. This is radio listening as it should be enjoyed! Lissen Class "B" Output through a new full-power Lissen Moving-Coil Loudspeaker—glorious rich tone and majestic volume, actually more faultless in its reproduction than anything you ever heard from even the most powerful mains receivers yet working economically in this Lissen "Skyscraper" from H.T. batteries.

Lissen have published for this great new "Skyscraper" Seven Valve Superhet a most luxurious Chart which gives more detailed instructions and more lavish illustrations than have ever before been put into a constructional chart. It makes success certain for everybody who decides to build this set; it shows everybody, even without previous constructional experience, how they can have a luxury receiver and save pounds by building it themselves. A copy of this Chart will be sent FREE in return for coupon on the left, or your radio dealer can supply you. Get your FREE CHART now!
In the first article of this series, which was given last week, I suggested a few simple experiments that you could try in relation to selectivity. No doubt you have gone through all these and learned a good deal about the simplest methods of making a receiver able to reject unwanted transmissions. You will also have found that some methods of sharpening the tuning cause a loss in signal strength, whilst others do not have this effect. It all depends upon the aerial-earth system in use, and quite often it so happens that by making a careful choice of both the coil tapping and the capacity of the pre-set series aerial condenser a combination can be found which gives not only more selectivity, but also louder signals.

The Results of My Selectivity Experiments

Perhaps it will help you if I briefly describe the results that I obtained from the experiments that were described. In the first place, however, I must state that I used a 30ft. indoor aerial situated some eleven miles from Brookmans Park, and a long earth lead taken to a water pipe. This system is, of course, distinctly bad, but served my purpose quite well. When the lead-in was plugged into socket "A.1." and the crocodile clip attached to the highest tapping (thirty turns down the coil), London National was tuned in at about 5 degrees on the condenser dial and London Regional was loudest at about 30 degrees. I say "loudest" because tuning was very "flat," and it was not possible to separate completely the two London transmitters. Both stations provided moderate loud-speaker signals and were extremely loud on the phones.

After transferring the lead-in to terminal "A.2" and leaving the crocodile clip on the lowest tapping, even the London stations were very weak on the phones unless the pre-set condenser knob was screwed right down. But when the clip was moved to the highest tapping perfectly good speaker signals could be obtained from the locals, and with the pre-set adjusted to about half its maximum

(Continued overleaf)
capacity there was ample selectivity for local station reception. It was concluded that this particular setting was most suitable for use with the aerial-earth system employed.

A Name For the Receiver

Note that we have gained a good deal of useful information regarding the best form of aerial coupling, we are ready to add a few more parts to our receiver. By the way, it has been suggested by several readers that this experimental set should be given some name. I agree with them and have decided that we will call it the “Progressor”; this name will apply right from the commencement of our simple experiments until the time that the complete four-valve receiver has been finished off.

“Swinging Coil” Reaction

In order that the set may be made considerably more powerful without even spending a single penny, we shall next add reaction. The very simple method of doing this is illustrated by a sketch printed on page 295, and you will see that the reaction coil is wound on a narrow bobbin made up from three strips of stiff card. One of these is shaped rather like a tennis racket, one end being circular and of 1½ ins diameter; the second is a disc 1½ ins. diameter, and the third is another disc, this time 1½ ins diameter. The three pieces of card are glued together to form the bobbin in which about 100 turns of the 24-gauge d.c.c. wire left over from the tuning coil are wound. The beginning and end of the winding is anchored by passing the wire through a pair of small holes made with a pricker or compass point. Leave about 10 ins. of wire spare at each end for making connection later on. A small angle bracket must now be attached to the top of the ebonite coil former by means of a short bolt and nut. This bracket can be made from a thin strip of brass, or may be an angle bracket from a set of Meecans or Trix.

The reaction coil is next fastened to the bracket with another bolt and nut, and is so arranged that it can be rotated over the end of the tuner. Now we must connect the reaction winding in circuit, and to do this the wire from the plate terminal of the first (detector) valve-holder to the terminal marked “P” on the low-frequency transformer must be removed; the two ends of the reaction coil are then passed through small holes made in the chassis and connected to the terminals from which the wire has just been removed.

We are now in a position to observe the effect of reaction. Rotate the reaction coil until it is as far away as possible from the tuned winding and then tune in the local station. After that, to try altering the position of the tuning dial slightly whilst reaction is being adjusted.

Increased Signal Strength and Greater Selectivity

Once the reaction control is functioning properly, you will find that signals are considerably stronger, that tuning is quite sharp, and that the number of stations that can be received is at least ten times as great as before. The only point to watch—and you really must watch it very carefully—is that your set is not allowed to oscillate. This can always be prevented if the proper sequence of operations is followed when tuning in. It is as follows: advance the reaction setting to the point where a faint “breathing” sound is heard in the speaker (the detector is then just off the point of oscillation, and is in its most sensitive condition); rotate the tuning dial slowly, occasionally modifying the reaction setting, so as to maintain the detector valve in the “nearly-oscillating” condition. You will find that by following this method a large number of stations can be received with ease.

After you have become quite “at home” with the reaction adjustment, you should repeat the selectivity experiments described last week, because you might find that conditions are now a good deal different. Settings which were previously useless from the point of view of selectivity may now be entirely satisfactory.

Changing Over to Capacity Reaction

The system of reaction control which I have just dealt with is that known as “swinging coil” reaction, and is the kind which was used universally a few years ago. It is not in very great favour at the present time, however, because it cannot be adjusted with quite sufficient delicacy, and it has rather too great an effect upon the tuning. The system which is to-day used in the majority of receivers is known as capacity reaction (due to the fact that it is varied by means of a condenser), or more popularly, “Rotating” reaction (because it was invented by a radio experimenter of that name).

In order to experiment with capacity reaction, we shall require a high-frequency choke, a .0003 mfd. reaction condenser, and a small bracket on which to mount the former component. For ease of reference the exact types and makes of these components are given in tabular form in another place on page 325. The positions in which the parts are to be mounted

(Continued from page 295)
"I was amazed... station after station rolled in..."

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 and without touching the dials the Set was roaring the place down. You cannot give a better test than this.

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The long, dark autumn and winter evenings are, of course, the broadcast band D.X. man's paradise. For, as we all know, wireless waves travel further in the darkness than in the light. With the increase in power that so many stations have had, it looks as though D.X. ("radioese" for "distance getting") will be better than ever this winter provided the set is selective enough to separate the many stations it is sure to pick up. We had a foretaste of this difficulty towards the latter end of last winter, and on "running round the dials" recently, although early in the autumn, I could see that the selectivity problem was going to be a real one for many this season; for despite the fact that my set is selective, the local National and Regional stations, I find, have a background of interference soon after dark—not enough to interfere with reception of the programmes, but definitely there during an interval. In view of this, I feel a few hints and tips on improving selectivity in general would be of use to some who think theirs inadequate for the coming season.

Look to Your Aerial
To begin with, I think we should take a look at the aerial. The full 1000ft. allowed by the P.M.G. is, of course, rarely used elsewhere than in the heart of the country, because the high power of most stations and the need for selectivity has made it unnecessary. The longer the aerial, the stronger the signal, the greater the damping on the aerial circuit, and the less the selectivity, and vice versa. Therefore, if you find you are getting a goodly number of stations at good strength, but that you need a little more selectivity, even at the expense of some of your power, try cutting down the length of the aerial somewhat. In any case, 50ft. should be ample. If you do not want to go to the trouble of cutting a piece out of the aerial wire, you can "shorten" it artificially by connecting a condenser in the lead-in to the aerial terminal (Fig. 1). Try .0005, .0002 or .0001 fixed condensers if you have them by you, using whichever proves best; if not buy a .0005 pre-set type and try that.

Better still, buy a mica-dielectric .0005 variable condenser and mount it on the panel; you then have a variable selectivity adjuster, and also a volume control in a handy position. Many of the special devices sold serve the same purpose. While discussing the aerial circuit, if it is made up of a plug-in coil, either plain or centre-tapped, try an X coil; this should appreciably improve selectivity (Fig. 4).

Tapping the Aerial
If it is not an ordinary solenoid coil, a tap may also help here to improve selectivity. A good way to find a suitable spot for the tap is to connect the aerial lead to a pin or needle, either by soldering or tightly binding with a piece of wire, and just try sticking it through the cotton covering of the wire on the coil so as to make contact with the bare wire beneath. When you have found a spot that gives you good volume and sufficient selectivity, just bare the wire by scraping off the covering with a penknife or razor-blade; now disconnect the wire from the aerial terminal to the coil, connecting instead to the aerial terminal a piece of flex, terminating in a crocodile clip. Just slightly raise the turn of wire you have bared, and connect on to it the crocodile clip. Now take the needle or pin off your aerial lead-in wire and connect it to the aerial terminal. Your tapping is now complete.

Aperiodic Tuning
Another good plan is an aperiodic aerial circuit. This can be arranged by connecting an aperiodic coil to the present coil in the aerial circuit (Fig. 5). In the case of a plug-in coil, if you have some others handy—such as Nos. 25 or 35—you can mount another coil holder beside your present aerial coil connecting as follows:—One to aerial, other side to earth terminal (or that side of the present coil which is earthed) and just plug in a coil which (Continued overleaf)
gives good selectivity and volume. With an ordinary solenoid you can wind ten to twenty turns (the exact amount can be found by experiment) around the outside of the short-wave winding, again connecting as above. If you have no other plug-in coils handy, or no room to mount one, the following is a good scheme. Wind a bank coil of about twenty turns, roughly, the same diameter as your plug-in coil. This is done by just winding the turns round a tin or tube of correct size. Slide them off and tie the coil in about three places with cotton to prevent it coming round a tin or tube of correct size. This is done by just winding the turns the same diameter as your plug-in coil. If you have no other plug-in coil, the following is a good scheme. Wind a hank coil of about twenty turns, roughly, the following is a good scheme. Wind a hank coil of about twenty turns, roughly, the following is a good scheme. Wind a hank coil of about twenty turns, roughly, the following is a good scheme. Wind a hank coil of about twenty turns, roughly, the following is a good scheme. Wind a hank coil of about twenty turns, roughly, the following is a good scheme. Wind a hank coil of about twenty turns, roughly, the following is a good scheme. Wind a hank coil of about twenty turns, roughly, the following is a good scheme. Wind a hank coil of about twenty turns, roughly, the following is a good scheme. Wind a hank coil of about twenty turns, roughly, the following is a good scheme. Wind a hank coil of about twenty turns, roughly, the following is a good scheme. Wind a hank coil of about twenty turns, roughly, the following is a good scheme. Wind a hank coil of about twenty turns, roughly, the following is a good scheme. Wind a hank coil of about twenty turns, roughly, the following is a good scheme. Wind a hank coil of about twenty turns, roughly, the following is a good scheme. Wind a hank coil of about twenty turns, roughly, the following is a good scheme. With an ordinary solenoid you can wind ten to twenty turns (the exact amount can be found by experiment) around the outside of the short-wave winding, again connecting as above. If you have no other plug-in coils handy, or no room to mount one, the following is a good scheme. Wind a hank coil of about twenty turns, roughly, the same diameter as your plug-in coil. This is done by just winding the turns round a tin or tube of correct size. Slide them off and tie the coil in about three places with cotton to prevent it coming round a tin or tube of correct size. This is done by just winding the turns the same diameter as your plug-in coil.

**Band-Pass Tuning**

Band-pass tuning is another possibility which would increase selectivity, but this, I feel, is best carried out by entirely scrapping the present circuit arrangements and fitting a properly designed band-pass unit. In any case, this somewhat lengthy subject has been often dealt with in the pages of this journal, and the interested reader is advised to refer to previous articles on the subject.

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**THE EXPERIMENT has been made to broadcast the same programme from two stations distant from one another accurately synchronized.**

The first difficulty is one of obtaining perfect synchronization, but even when this is done the difficulties of the problem are only just beginning. Firstly, the whole area served by two stations whose carrier waves are of the same frequency would be covered or mapped out by a whole system of nodes and loops, the nodes being situated where the waves neutralize and the loops where the waves reinforce one another. If, for example, the wavelength radiated be 400 metres, on the direct line between the two stations, there would be a zero and a maximum alternating at every 200 metres distance, and throughout the areas served there would be a maximum at every point situated at exact number of wavelengths from both stations, and a minimum where the distances differ by half a wavelength. It is not difficult to see that reception under these conditions must suffer greatly.

Then the question of modulation arises. If we were to assume the side-bands as well as the carrier waves as strictly synchronous, it is difficult to forecast what kind of interference effect would be experienced. There would be areas where certain side-band frequencies were missing and perhaps where the carrier wave is minimum, and others where the carrier wave may be a minimum and other side-bands maximum, etc., and if, by way of exploring the region, a set were moved from one place to another, no results would differ at every change of position. As stated, however, it would be hardly possible for the side-bands to be synchronous with exactitude; the velocity of the propagation of a change of E.M.F. in a land line is far slower than in the ether, where it approximates to the velocity of light, and although the acoustic lag between one station and another might be no more than sound experiences in passing through two or three feet of air, the extent of the resultant dephasing would be sufficient to invalidate any argument based on exact synchronization of side-bands.

Let us think what would happen if it were possible to emit actual sound-waves from two stations ninety-five miles apart, and examine the interferences taking place between them over the intervening region on the supposition that sound could travel as fast as light: we should find that a note emitted by one station having a frequency of 2,000 would reach the other station approximately one wavelength out of phase, and an observer situated half-way between the two stations would receive a given signal simultaneously from both stations. Observers situated between the two stations at a quarter distance, that is twenty-four miles away from each, would receive nothing: they would be situated at nodes where the waves cancel out. For other frequencies the modulated nodes and loops would be differently distributed, but wherever the observer might find himself there would be, potential, actual acoustic frequencies which he would be able to pick up at full strength and others which would be weak or absent. The conception of sound-waves travelling with the velocity of light, and being directly audible in a region hundreds of miles in extent is, of course, imaginary, but the facts realised on this supposition are substantially the same as those consequent on the distribution of a modulated radio signal.

The position can be summarised as follows:—

1. Difficulty will be experienced in accurately synchronizing two carrier waves from widely separated sources, in which failure involves powerful beats or surges in any receiver tuned in to the carrier frequency. This difficulty can be overcome by accurate crystal control.

2. With perfectly-tuned and synchronous carrier waves there will be a distribution of maxima and minima of interference. At such points as where the carrier waves are of equal strength, the minimum will have a zero value.

3. Apart from distortions or defects of reception due to (2) above, waves of acoustic frequency will be subject to interference.

---

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MORE ABOUT
THE ORBIT—F. J. Camm's Latest Success

ONLY FOUR KNOBS! NEW TRANSFER PRINT WIRING SYSTEM!
AUTOMATIC FADING COMPENSATION AT LAST!

LAST week you were given some preliminary particulars of the "Orbit," and you were reminded that the reader simply must build—and next week very complete constructional details will be given by Mr. F. J. Camm himself. An additional feature of next week's issue of PRACTICAL WIRELESS will be the FREE PRESENTATION of a "TRANSFER-PRINT," (Provisional Patent No. 24,884/33), by means of which any and every reader can build the set himself in a minimum of time and with the definite assurance that it will function correctly as soon as the parts have been assembled and the wiring completed. Further to satisfy the interests of readers, Mr. Camm gives a PERSONAL GUARANTEE OF SATISFACTION to every constructor, and in case of difficulty he will give FREE ADVICE in regard to the cause of trouble.

In the meantime, however, all readers are naturally interested to know something about the set which has been evolved after a considerable amount of research and experimental work in the PRACTICAL WIRELESS laboratories. Briefly, the set has three valves, arranged in the most popular combination of Variable-Mu High Frequency Amplifier, High-Efficiency Detector, and Pentode. At the request of thousands of readers of the "Orbit," it has been designed for battery operation, but the high-tension circuits are so arranged that an eliminator of any type can be used with every satisfaction where desired.

Selectivity in Plenitude
To ensure an ample degree of selectivity for all requirements, iron-core coils have been employed, and the combination specified has been proved to give a sufficiently generous degree of selectivity to enable the local station to be tuned out in a fraction of a degree on the tuning dial. In addition to this, medium-wave break-through is non-existent, and thus the bugbear of unsatisfactory long-wave reception has entirely been overcome.

Automatic Fading Compensation
A really new and up-to-date feature of the "Orbit," which is bound to be much appreciated, is the provision of an automatic fading compensator device. The fitting of this is perfectly straightforward and does not complicate the constructional work in the slightest degree. What is still more important is that the device definitely does fulfil the purpose for which it is intended. The latter statement might appear superfluous, but readers who have had experience with some of the home-constructed receivers having the refinement of so-called automatic volume control will know that it is not. Despite the utter simplicity of the "Orbit," this new receiver is a real station-getter; not only does it bring in stations, but it enables them to be listened to in comfort and without the usual fading which takes all the enjoyment out of long-distance listening. The automatic compensator gives an ample output and the volume provided is more than adequate for even a large drawing-room. Combined with the generous output, however, the "Orbit" gives really life-like reproduction.

Simplicity of Operation
Simplicity of operation has been carefully considered by Mr. Camm, and as a result the "Orbit" HAS ONLY FOUR KNOBS, which are symmetrically disposed. The single knob for tuning occupies a central position; to the left of this is the wave-change switch, and on the right is the reaction control. An on-off switch is situated away from the other knobs, where it is both unobstrusive and convenient.

The two-gang tuning condenser is provided with an accessible trimming adjustment so that perfect matching and optimum results can be secured in the simplest possible manner.

New Form of Construction
An entirely new form of construction is employed for the "Orbit," the loudspeaker unit being mounted in its rightful place on the receiver chassis. Thus one can see if the set is to be tested with ease when it is removed from the cabinet and makes the whole instrument particularly neat and compact. The cabinet specified is of unusual style and has been specially designed for the "Orbit"—it certainly makes the receiver look as good as it really is.

In reading through the above remarks you might have come to the conclusion that the "Orbit" must be an expensive set. IT IS NOT. In fact, the total cost of all the components (exclusive of the speaker) is only five guineas. Running expenses are proportionately low, since the H.T. battery current consumption is between 10 and 12 milliamperes, and the L.T. consumption only half an amperes.

You will be pleasantly surprised when you obtain your next week's issue of PRACTICAL WIRELESS and examine the illustrations of the "Orbit." It is just the set you want. In fact, if you wish to have the best, cheapest and most advanced type of receiver, you cannot afford not to build the "Orbit."
A Link in the Chain

Of course, we all know that there are quite a number of different components in a receiver—all links in the chain—all performing their respective functions—all contributing to the final result—the reproduction of the sounds heard in the transmitting station more or less faithfully. Now one of the important links in the chain is the output valve, to which the loud-speaker is connected. No matter how excellent the circuit or loud-speaker, if they are not correctly linked together results will be unsatisfactory. We are going to discuss this linking together of the output valve and the loud-speaker.

As a start, let us consider the output circuit as shown in Fig. 1. This is in its simplest form, and is generally employed with a moving-iron loud-speaker.

Will this arrangement give the best results? Will it do justice to a really good balance of components? Let us now look at Fig. 2! Anything wrong? Have you ever seen a moving-coil loud-speaker connected to the output valve in this fashion? No. Of course not. You ask why, and your informant says it simply isn’t done. Quite true! But why?

When Employed

When should an output device be employed? It is desirable in practically any receiver when the output valve takes an anode current of more than 10 milliamperes, or when exceptionally long leads are employed which would cause a relatively large voltage drop. It is also necessary to match the output valve to that of the loud-speaker; this generally applies to a moving-coil loud-speaker, and is absolutely essential for reasons which will be discussed later. Sometimes a tapped output choke is employed, but in this case it becomes, in effect, an auto-transformer.

There is another rather important reason for the employment of an output filter, and that is the prevention of shocks. When an H.T. eliminator or all electric receiver is employed, it is really essential to employ some form of output filter if immunity from shocks across the loud-speaker terminals is to be obtained.

Choke and Condenser Values

The value of the choke should not be less than 20/30 henrys and the usual capacity of the condenser is 2 mfd. A capacity of 4 mfd. is theoretically more desirable, but in actual practice the improvement in reception is not perceptibly appreciable. Now look at Fig. 3. The dotted line indicates the path of the fluctuating current, while the straight line indicates the path of the direct current to the anode of the valve, the condenser blocking the path of the direct current, but allowing the passage of alternating current. The condenser should offer a low impedance compared with that of the loud-speaker to earth through the loud-speaker do not pass through the source of H.T. supply, and set up voltages across it which might cause motor boating.

This is why we all find radio so intensely interesting. It is not necessary to have a knowledge of either science, engineering, or physics to construct a radio set. Before you can start right away, and definitely get results, you wish to know why it isn’t done, so we now get down to our subject, output devices.

Output Devices

This is an extremely simple arrangement, and there are two principal methods employed to couple the output valve to the loud-speaker, namely, choke capacity and transformer coupling. The former method is shown in Fig. 3, and this diagram will serve to illustrate the principles involved. Transformer coupling will be discussed later. Its purpose is twofold. First of all, it keeps the plate current of the last valve from passing through the winding of the loud-speaker and, secondly, reduces the voltage drop which occurs when direct currents pass through the winding of a high-resistance loud-speaker. These are not the only uses of a choke filter. The speech currents being diverted to earth through the loud-speaker do not pass through the source of H.T. supply, and set up voltages across it which might cause motor boating.
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Every section is the work of an acknowledged expert in his particular sphere, and the contents are entirely up to date. No reader of PRACTICAL WIRELESS can afford to be without this unique volume, which is available only to regular readers of this journal who comply with the simple conditions given at foot of other page.

N.B.—A few of the diagrams and illustrations are reproduced in miniature in this announcement.

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currents of even the lowest audible frequency. Values lower than 2 mfd should not be used, otherwise the response to the lower notes will be reduced.

There is another aspect to this question which applies to either transformer or choke output circuits, and that is the drop in voltage in the inductance due to the passage of current through the windings of the loudspeaker. Take a concrete example; your receiver is battery-operated and employs the 120 volts (new) H.T. battery. Assume that the last valve takes 20 milliamperes, rather a big drain on H.T. batteries, but it will serve to illustrate our argument more easily.

If the resistance of the loud-speaker winding be 2,000 ohms, then there will obviously be a voltage drop across the windings. We will calculate this according to the following formula:

$$\text{Voltage drop} = \frac{20/1,000 \times 20/1,000 \times 2,000}{20/1,000 \times 2,000} = \frac{4}{5} \text{ or } 0.8$$

Now let us give a concrete example and see what results we shall obtain, assuming the same 120-volt H.T. battery. This time the anode current of the output valve will be 10 milliamperes with the same resistance of the loud-speaker windings. Here the voltage drop will be: $\frac{20/1,000 \times 2,000}{20/1,000 \times 2,000} = 0.2$ volts. Can you afford to throw away 20 volts?

In this case, any further problem to this effect is the problem of no output filter being employed on the output valve, the plate voltage of the latter because of the low D.C. resistance of the loud-speaker windings being. Therefore this winding should be treated as a heat a certain amount of power. The value of the energy lost, in watts, is ascertained by multiplying the resistance of the winding by the current squared, i.e., $R \times I^2$. Again, we take the value of the resistance of the loud-speaker, and if the anode current of the output valve be 20 milliamperes, which is quite likely if a super power or pentode valve be employed, then the calculation would be:

$$\text{Power dissipated} = \frac{20/1,000 \times 20/1,000 \times 2,000}{20/1,000 \times 2,000} = \frac{4}{5} \text{ or } 0.8$$

This power is transferred to the loud-speaker, and it is evident that in heat depending upon whether the winding was designed to pass a current of 20 milliamperes (the loud-speaker winding) or 200 milliamperes, the answer is the same, and so will be the heat effect. This is not a graceful result. The current will be more than that of the loud-speaker winding, will, of course, pass a greater current with safety. If the speaker winding will not pass this amount of current (dissipate this energy in heat) then the windings will become excessively hot and eventually burn out. We might now consider Fig. 3 a little further. It is obvious that the fluctuating currents will pass direct from the loud-speaker to earth, therefore neither of the loud-speaker terminals are at high D.C. potential with respect to earth. One terminal connects to H.T. negative which is at earth potential, while the other terminal is connected to the condenser and is consequently insulated from the high potential point. The condenser employed should be capable of withstanding the voltage of the plate supply, otherwise it will break down and the high-tension voltage will be put across the loud-speaker windings, with probably disastrous results to the loud-speaker.

The other method of connection is shown in Fig. 4. In this case one of the loud-speaker terminals is at high potential, since it is connected to the positive side of the plate supply, which is above earth potential, in this case. The voltage across the condenser in this case is lower than that of Fig. 3, since there is no steady voltage due to plate supply but only the audio-frequency voltages, and these will be small owing to the low impedance of the condenser.

A tapped output choke is very useful in matching a loud-speaker to a valve, particularly one of the pentodes, Fig. 5, shows the circuit arrangement. It was previously mentioned that the inductance of the choke should not be less than 20,000 henrys, therefore there is an important reason for this. This choke is in parallel with the loud-speaker and the impedance of both varies with frequency. At the higher speech frequencies the impedance of the choke will be very high compared to that of the loud-speaker and therefore it is of little importance considered from the point of view of fidelity of reproduction. As we get down to the lower frequencies, however, the position is very different. If the inductance of the choke were, say, 5 henrys, its impedance may be equal to or even less than that of the loud-speaker. If the impedance is low the voice load will be reduced, and consequently there will be a reduction in efficiency, the power output falling off. In calculating the value of the low-frequency choke, do not forget that the inductance must be that obtained under working conditions. If the inductance were 50 henrys with no D.C. flowing it might be very much lower when the plate current was flowing, and as the amplitude of the current increases the inductance of the choke, and the lower notes would not be reproduced in correct proportions.

PRACTICAL WIRELESS

October 28th, 1933

(Continued from page 308)
Peto-Scott are pioneers in Radio and Television. Our service to the British public was introduced in 1919, and during fourteen years of solid service and satisfaction we have established a reputation for fair dealing that defies competition. Each of our shops in all parts of the globe come to us regularly for all their radio requirements—kits, all descriptions. Part Kits, Miscellaneous Component, Speakers, Eliminators, and Accessories. Purchases can be made for cash, C.O.D., or on Easy Payments. WE DEAL WITH YOU DIRECT. Peto-Scott's Easy Way System with its strict privacy and no third-party collections, will bring radio to your home by convenient monthly payment. Send list for quotation; no obligation. Easy Terms on Orders over £2.

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NOW that the excitement caused by Class B amplification has turned into a solid appreciation of its value, it would therefore seem an opportune time to review the present types of valves available, carefully ignoring those that are obsolete and of no practical value. Consequently, the screened-grid valve will be our starting-point, it not being our intention to bother the reader with a résumé from the time of Maxwell and Hertz, the true but often overlooked, pioneers of radio. It is not intended to adhere too closely to the valves themselves, but rather to touch on subjects that are closely linked and consequently often overlooked, being overshadowed by the valve itself.

The valve is the driving-force of a radio receiver, and over-all efficiency must largely depend upon it. Too frequently an unsuitable valve is called upon to fulfil a duty that it was never intended to perform, and consequently becomes a square peg in a round hole. It is not always fully realized that the amplification developed by each stage is equally dependent upon the valve and the circuit. Consequently, if a good valve is provided with a totally unsuitable coupling, it may give results inferior to another valve when the latter is less efficient when compared on a fair basis.

When designing a receiver for a definite purpose, an effort is made to examine a lot of components on a baseboard anyhow, a logical method is to work upwards from the output valve, first of all deciding the output required and then arranging for preceding stages to magnify the incoming signal until the output valve can be adequately loaded to supply the desired output. Even though it is contended that the output valve is the place to start when designing a set, it does not necessarily follow that this is the best starting-point for our present purpose. It is probably safe to say that the screen-grid valve in its ordinary form has not got many months to live as far as genuine selectivity rather than control of the local station. This remark is particularly applicable to listeners in Cornwall and Devonshire, and those parts of Northern Ireland that are well outside the Swamp area of Belfast and Athlone.

H.F. Pentodes

The present vogue of the indirectly-heated variable-mu is somewhat overshadowed by the H.F. pentodes that are making their appearance. The ordinary and variable-mu types will both be available, the latter giving all the advantages of the variable-mu valve, together with an unprecedented degree of amplification. The H.F. pentode has been so ably dealt with by Mr. Barton Chapple in a recent issue of PRACTICAL WIRELESS that further remarks will be out of place.

The development of the H.F. pentode is closely connected with automatic volume control, partly owing to the requirements of the latter being very considerable H.F. or I.F. gain. In the first place, the arrival of automatic volume control was heralded with considerable enthusiasm, and it seemed that the whole system was relatively simple until special valves were introduced, starting with a diode-triode, being a two and a three electrode valve in one bulb. This was quickly followed by other types, including a double diode-triode, being two diode valves and a four electrode valve in one bulb with a common cathode, culminating at the time of writing in the Cossor A.V.C. valve, which takes the form of a double diode-pentode, the whole assembly being contained in one bulb with a previously unheard-of number of external connections. None of these developments will benefit the battery user of modest spending power, owing to the very high gain required to overcome the loss due to A.V.C. We

(Continued on page 316)
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Indispensable to everybody who wants to understand the working of wireless receivers. The Author starts with elementary principles, covers the whole field of wireless reception, both from the theoretical and practical points of view, and finishes with a complete survey of a four-valve wireless receiver, explaining its working from the aerial terminal to the loud-speaker. 3/6

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A SMALL TESTER

THE tester shown in the accompanying illustrations may interest readers who like to know the condition of their batteries, etc. The materials required are as follows:

A polished recessed switch block 6f in. by 6j in.; one meter (the one shown is a Wates triple reading instrument, costing 8s. 6d.); nine sockets (Gb11s); three miniature screw bulb holders (metal holders, not china); and three 4i-volt flashlamp bulbs. Also a .25 mfd. fixed condenser may be required across the milliamp section. The method of construction is as follows:—

Drill nine holes, five at the top and four at the bottom of the polished block for the sockets (see Fig. 1). Cut out a hole in the centre of the block large enough for the meter face to slip through. Mount the miniature screw holders on the inside of the rim at the bottom of the block, then screw a bulb in and mark where the bulb rests on the inside of block. Make three marks, one for each bulb and then drill the holes about .1 in. diameter. The lighted bulbs will show through the holes, at the front of block.

Wire the meter up to the five sockets at the top of the blocks (see Fig. 1). Look at the illustrations below. The greatly enlarged photograph shows Superial with its seven strands completely encased from end to end with extra heavy vulcanized rubber insulation, so thick, it is actually like a rubber tubing. This insulation is then protected with heavy braiding and finally compounded and waxed to resist every condition of weather—hot or cold, all the year round for many years to come.

The AERIAL WHICH MADE BROADCASTING POPULAR

Superial is too costly to IMITATE

in every way Superial is superior to all other Aerials. It has longer range, super selectivity and crystal clear reception. It is simple to fix—no insulators are necessary and no separate lead-in is required.

Compare any other Aerial with Superial and you will realize the poor quality of the ordinary outer covering—examine more closely and you will discover that the imitation is made up entirely without the essential rubber vulcanization—therefore without protection. Get Superial and be safe—it costs only a little more, but it is worth more than double. Then, of course, there is the extraordinary efficiency of the scientific combination of ferrous and non-ferrous metals (including copper) far superior to the copper only Aerial.

Look at the illustrations below. The greatly enlarged photograph shows Superial with its seven strands completely encased from end to end with extra heavy vulcanized rubber insulation, so thick, it is actually like a rubber tubing. This insulation is then protected with heavy braiding and finally compounded and waxed to resist every condition of weather—hot or cold, all the year round for many years to come.

From Dealers everywhere.

BEWARE OF IMITATIONS

LOOK AT THE NAME AND THE BOX

£500 FREE LIGHTNING INSURANCE FOR 2 YEARS

Look at this poor imitation. A piece of ordinary covered Aerial. The cheap cotton covering is not true insulation, neither is it a protection against corrosion or lightning. It quickly perishes on exposure, becomes unravelled and serves no useful purpose. Do not confuse it with vulcanized rubber insulation, which is a perfect protection.

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IMPROVE YOUR SHORT WAVE RESULTS

Short-wave Enthusiasts will welcome this "EDDYSTONE" high efficiency lead-in device. It makes sure that weak short-wave signals from thousands of miles away, are carried safely to the set without loss at the point of lead-in—usually the weakest link of any aerial system.

"EDDYSTONE" Low Loss Lead In

CAT. No. 946, Price 2/6.

The lead-in of "EDDYSTONE" short wave sets are used, fixed or portable.

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We will be pleased to send you details of any or all of these subjects. Just fill in, and post the coupon, or write in any other way, stating which branch of Wireless interests you. The information you require will be forwarded at once.

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OF THE W.B.
‘MICROLODE’

Not only “great” but overwhelming. The astonishing “Microlode” has altered the whole aspect of moving-coil speaker matching. A superlative speaker accurately matched to the set is better than a good speaker approximately matched. Brilliance, attack and sensitivity depend largely on magnet, speech coil and cone design. Even balance of reproduction depends on the matching. That is why the W.B. “Microlode” is specified by the designers of nearly every constructor set this year. Hear one at your dealer’s and realize the difference. Meanwhile write for the new W.B. folder.

‘MICROLODE’ type
P.M.4a - 42/-

With the new “Microlode” feature and this famous “Mansfield” magnet: system.


IMPRESSIONS ON THE WAX
(Continued from previous page)

music of pomp and real magnificence. But the triumph is arrested by a lovely passage to recall the simple things of life.

Now all that is probably far away from the thoughts which inspired Beethoven when he wrote the fifth, but I prefer to translate it into something which may appeal to ordinary folk. Your interpretation may be different, but the music is unmistakably great, and this stirring work has here been faithfully handled by the London Philharmonic under Weingartner in the finest recording of this work ever made. You can get the records in an album, by the way, with a leaflet, all for 26s. If you prefer it, and I don’t know any set of better value or more lasting worth.

Plato—Organ

Another important addition to outstanding piano performances is the Liszt Sonatas in B Minor (H. Moll)—H.M.V. DB1855-1857. Horowitz treats us to some wonderful playing. He belongs to that type of genius who can strike a single note and convey volumes. This piece contains not only examples of this, but much of the “brilliant” music Liszt often wrote. A valuable work for the student.

An eminently suitable suite—so it turns out—for the organ is the Peer Gynt. G. Thalben Ball has done it most pleasantly at the Kingsway Hall on two H.M.V. records—B4484-85. I am quite sure of its popularity: he interprets it all perfectly, especially In the Hall of the Mountain King.

Various Vocals

It is some time since a record of a male voice quartette appeared, but one on this month’s Columbia list is well worth while. The McGowan Male Quartette (well known to Midlands Regional listeners) have done Kingsley’s Farewell and two funny things called Little Tommy and A Catastrophe (DB1176). The first is a little known setting by Colman and is most attractive. Their singing is really good, and, with the right stuff, they may be the English combination to give the reigning monarchs (The German “Comedy Harmonists”) a run for their money. I heartily recommend this record to you.

You all know Teresa Del Riego’s beautiful song Homing. Two performances have recently been issued, one by Derek Oldham on H.M.V. 4481 backed by Still as the Night) and the other by Eva Turner on Columbia LD11 (with I Love Thee). It’s up to you. Tenor or soprano? Eva Turner’s rendering is an improvement on that of Alvarez, and, whilst a good performance, I don’t think it is quite suited to her. I like Derek Oldham’s better: it means more to me, and his other side is better than the second song of Miss Turner. This is a record which is a success because the singer has stuck to his natural bent—opera. Joseph Schmidt is not nearly so good in his recent frivollities as in Meyerbeer’s O Paradiso (L’Africana) on Parlaphone R1893. Really, this is a very fine performance, and the reverse side Piano (Tosti) illustrates his ability with the rhythm usually associated with Naples. It would be unforgivable to pass over a Melchior Wagnerian record. We have the Prelude from the Meistersinger (H.M.V. BD1858) in which this famous star shows to considerabe advantage. I prefer the Prize Song in every way to Richard Crook’s recent record, and the Siegfried Forging Song is a striking effort. If you are a Wagner enthusiast, hear this.
Learn at home

Big Pay for Trained men!

Thousands of men are earning regular incomes for interesting spare time work such as Set Designing, Writing for the Press, Servicing, Inventing, Demonstrating, etc., etc. You can do the same. You can turn your evenings into golden eggs, and, if you wish, qualify for hoighly-paid full-time employment. Trained men are urgently wanted and we can give you the sort of training that employers demand.

T.C.R.C. Radio Correspondence Courses are prepared and conducted by men who have themselves made good in the Radio Industry and earned four-figure incomes.

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Fathers! Prepare your sons for jobs like these.

Radio offers immediate rich rewards to trained men. It is a field of tremendous and unlimited opportunities. Traffic, broadcasting, television, telephone, telegraphy, telephony, research, inventions, demonstrating, etc., etc., are all closely linked up with radio science. There is no doubt that the Courses have been prepared and conducted by men who have themselves made good in the Radio Industry and earned four-figure incomes.

Read what "Practical Wireless" says:

"There is no doubt that the Courses have been prepared to a very high quality by men who know what they are writing about. The Principals of the College and a great number of lecturers and radio experts are up to date and are the leaders in the radio industry and the College has received entries from all parts of the country."—Signed: W. S. VERRELLS, Managing Director of E. R. COLE, Ltd. (Manufacturers of the famous EKCO RADIO).

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Widen your radio knowledge. T.C.R.C. Training is intensely interesting—in foreign test-books, no obsolete theory or dull drudgery, no additional expenses. You will enjoy learning. Our Prospectus gives you full information of the opportunity that radio offers and explains how you can train yourself quickly to become a radio expert through practical study. It is free for your asking. Just fill in and post coupon now.

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October 28th, 1933

PRACTICAL WIRELESS

A SMALL TESTER

(Continued from page 318)

A duplex aerial for Long and Short Waves

Here is a useful aerial arrangement used for listening on widely differing wave bands. The original idea was used for the long waveband (600 to 4,000 metres), and short waves (10 to 100 metres). The aerial consists of a twin wire inverted "L" type, 49ft. in length (from free end to aerial switch), each limb being spaced by 6 foot spreaders. Good results are obtained on short-waves using one limb, long-wave reception being carried out by throwing over the double-pole double-throw switch to the opposite position, when both limbs are paralleled. The improvement noticed on the longer waves was very marked, yet short-wave reception was not marred. The accompanying sketch makes the arrangement clear and, when erected, apart from being of symmetrical appearance, it avoids the necessity of aeronial unsightly. —ROBB. E. GREENE (Fawdon).

A SMALL TESTER

(Continued from page 318)

A duplex aerial for long and short waves.
SHORT-WAVE transmissions are so readily picked up on simple apparatus that a small portable receiver to cover the 13 to 80-metre wave band is quite a practical proposition. If the listener is prepared to be content with headphones, then two valves are usually sufficient for normal working. A stage of high frequency before the detector has not been included because the cost, weight, and space taken up by the extra components has to be considered, and a larger H.T. battery would be required. Such a stage has certain advantages, and would provide a certain amount of amplification and easy reaction control also, if the receiver is to be used on various holiday trips the aerial arrangement is likely to be different each time the set is used. The height and length of aerial would depend on local conditions, and in connection with such aerials it is worth noting that a supply of spare wire should be taken; the writer has often been compelled to abandon quite a good length of wire on packing up for the day, after getting the free end placed nice and high in a convenient tall tree. Readers must not conclude that it is a common practice to leave the country-side festooned with odd lengths of wire, but there are times when there is no alternative. If conditions only allow for a very short aerial, it should be tried connected to the grid end (terminal No. 6) of the tuning coil, with or without an intervening series condenser. The latter may not be necessary, as the damping should not be sufficient to prevent the receiver oscillating. With the particular type of dual range coil used in the receiver described here, an aerial loading inductance winding has been incorporated with the aerial coupling coil, and by shorting terminal No. 3 to No. 2 either with a piece of wire or another switch, this coil can be cut out and only the usual small aerial coupling winding used. The wave-change switch used in the receiver shorts terminals No. 8 and 5, so that only part of the tuning coil is used. This is just an ordinary "on and off" push-pull switch, and when closed the range covered by the coil is about 12 to 30 metres, and when open 25 to 80 metres. It may also be noted that the high-frequency choke has not been connected in the circuit exactly as specified on the instruction sheet sent with each dual-range coil; both methods have been tried and the one shown, which includes a fixed condenser of .001 mfd., has been retained. Constructors can use the other method if a .001 mfd. condenser is not available. Experiments with the aerial connected to the grid coil resulted in "head capacity"; the receiver oscillated smoothly before, but touching the 'phone cords always upset reception. Another short-wave choke and fixed condenser connected to the grid, or any part of the headphones upset reception. Another short-wave choke and fixed condenser connected to the grid...

LIST OF COMPONENTS FOR PORTABLE

One Wood Case with Plywood Panels and Divisions

One Metal Panel.

One Antinodal Short-wave Coil Unit (Radio Instruments, Ltd.)

Two Valve-holders (one short-wave and one ordinary), or two short-wave types.

One .00025 mfd. Variable Tuning Condenser (Utility).

One Slow Motion Dial, Type No. 1181, for above (Utility).

One .00025 mfd. Slow Motion Reaction Condenser (Eddystone).

One Short-wave High-frequency Choke (Eddystone).

One .001 mfd. Grid Condenser (Lissen).

One .001 mfd. Condenser (Lissen).

One Grid Leak, 3 to 5 meg. (Lissen).

One L.F. Transformer, Ratio 1 to 4 or 5 to 1 (Telsen).

Two .001 mfd. Push-Pull Type Switches.

Four Terminals, Phones, Aerial, Earth (Bellings-Lea).

1.5-Volt non-pull Accumulator and 100-Volt H.T. Battery.

Extra to prevent band-capacity effects as per circuit diagram, Fig. 3.

One Short-wave High-frequency Choke and .001 mfd. Condenser, is required. The Eddystone taper type H.F. choke is suitable for both positions.
AN EVENT OF IMPORTANCE

NEW BLUE SPOT

CLASS B

OUTPUT STAGE

The most efficient and adaptable
Class B Unit Available

FOR ALL CONSTRUCTORS

FOR ALL STANDARD & ALL RECENT TYPES
BLUE SPOT MOVING COILS
66 R UNITS & CABINET MODELS

Literally thousands of listeners who own Blue Spot Speakers, and thousands more besides, will welcome the introduction of this new Blue Spot Class B Unit. It is so essentially adaptable, so simple to fit, so completely efficient, as thoroughly representative of Blue Spot quality and value. The addition of this unit enables any Battery set owner to enjoy Class B output at little expense.

The unit can be fitted in a few seconds and in the case of Blue Spot Speakers simply by means of bolts which bind unit and speaker together as a complete rigid unit. The assembly is then ready for fitting to the Speaker baffle, to the baseboard, or fitting inside any Blue Spot Speaker cabinet. The unit can be fitted in a few seconds and in the case of Blue Spot Speakers simply by means of bolts which bind unit and speaker together as a complete rigid unit. The assembly is then ready for fitting to the Speaker baffle, to the baseboard, or fitting inside any Blue Spot Speaker cabinet.

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The addition of this unit enables any Battery set owner to enjoy Class B output at little expense.

Price without valve. 29/6
Price with Osram B21. 43/6

The chassis can be seen from the revised wiring plan. To simplify the location of the new wires I have divided up the chassis into little squares.

You will see that the two terminals to which the reaction winding was previously joined are now connected to the high-frequency choke. One terminal of the reaction condenser is also connected to that terminal on the H.F. choke which goes to the anode of the detector valve. One end of the reaction winding is joined to a second terminal on the condenser, whilst the third terminal is left free for the connection to a second terminal on the condenser, which is then connected to a second terminal on the condenser, whilst the third terminal is left free for the connection to the second terminal on the condenser.

The two new components we shall require are a push-pull switch and a small angle bracket, but the cost will be one-and-a-half times only. In the meantime I hope you will find plenty of interest in experimenting with the three alternative forms of reaction.

Fig. 7.—The wiring plans above clearly show the new wires which have been added during this week’s experiments.
The consistent specification of Clix components in the Technical Press is eloquent testimony to the improved efficiency obtained by their use.

OVER 30 TO CHOOSE FROM

Clix Products are covered by Pats.—Pro. Pats. and Regd. Designs.

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The most popular and efficient type of fixed resistance for all general purposes. "Better than wire wound." All values, 50 ohms to 5 megohms.

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FLUXITE

IT SIMPLIFIES ALL SOLDERING

All ironmanners sell Fluxite in tins: 4d., 6d., 1s., 6d., and 1s. 8d. Ask to see the FLUXITE POCKET SOLDERING SET—one with full instructions—7s. 6d. Ask also for our leaflet on HARDENING STEEL with Fluxite.

FLUXITE, LTD.

(Dept. W.P.), ROTHERHITHE, S.E.16.

A substantial moving iron unit. Model 66 R.

FLUXITE, LTD.

(Dept. W.P.), ROTHERHITHE, S.E.16.

A substantial moving iron unit. Model 66 R.

BLUE SPOT SPEAKERS

EVERYONE cannot afford a good moving-coil speaker, and there are also many listeners who have receivers which are not really capable of doing justice to a speaker of this type. It might be thought that to these listeners high-class reproduction is barred, but there is no reason at all why it should be.

Amongst the extensive Blue Spot range of speakers is a unit known as the 66R. This costs 27s. 6d., so that some idea of its elaborate make-up may be gauged. It is of the four-pole balanced armature type and is of massive construction. It is wound to a resistance of 1,000 ohms and will handle 50 m/A without distress, whilst delivering an output of 3 watts. The impedance of the windings at 1,000 cycles is 9,000 ohms, and the transformer which is fitted to it enables it to be matched to any type of valve. Whilst it will not reproduce frequencies quite so low as those which may be dealt with by a moving-coil speaker, there are certain features which render this unit very useful to the many listeners who require a high-iron unit. Model 66 R. is a better class, and for those who prefer the moving-coil type of speaker on account of its bass handling capabilities, is the 45 P.M. This is a permanent magnet speaker having the entire magnet system enclosed to prevent the entry of dust, etc., into the gap. This will also handle 50 m/A, but will deliver an output of 4 watts. The speech coil impedance is only 1.9 ohms.

(Continued on page 331)
In This Article the Author Explains the Uses of Various Measuring Instruments, and Gives Examples of Simple Tests

In Part 2, the author explains the uses of various measuring instruments and gives examples of simple tests. He notes that cheaper sort of high reading milliammeters cannot successfully be used as voltmeters, and why some of the cheaper sort of voltmeters are almost valueless for radio work.

Suppose we connect a 3,000 ohm resistance across the terminals of a 6-volt accumulator. Our old friend, Ohm's Law, tells us that the current which will flow through the resistance will be .002 amp. or .005 amp. or 2 milliamperes. If, therefore, we connect a milliammeter reading 0-2 in series with the resistance (Fig. 3) it will give a full scale deflection. We can, therefore, make a new scale for our instrument, reading 0-6 volts, and use the meter for measuring voltages up to 6 volts, provided we keep the 3,000 ohms resistance in series with the instrument for all voltage tests.

Similarly, if we connect a 125,000 ohms resistance in series with the instrument, we could calibrate the instrument to read 0-250 volts, because if 250 volts are applied to a resistance of 125,000 ohms, the current flowing will be just 2 milliamperes. Other ranges can be arranged for in the same way, by employing different values of line resistance, and resistance of the instrument itself, should such be such that, when applied to a source of voltage equal to the maximum voltage to be measured, the current calculated according to Ohm’s Law, will be equal to that required to give a full scale deflection of the instrument.

For example, suppose you require to use a milliammeter scaled 0-5 milliamperes as a voltmeter to read 0-250 volts. From Ohm’s Law, the total resistance required will be 50,000 ohms. If the instrument has a coil resistance of say, 200 ohms, the line resistance should, strictly speaking, be 50,000-200 ohms, or 49,800 ohms. But, bearing in mind the fact that 200 ohms is less than 1 per cent. of 50,000, the error introduced by using a standard 50,000 ohm resistance is negligible.

Note also, in the case of an instrument calibrated in volts, it is important to ascertain what current the instrument requires for a full scale deflection. Many cheap voltmeters take a current as great as 30 milliamperes. It is quite useless to attempt to measure the voltage of, say, a small H.T. battery with such an instrument, as the load of 30 milliamperes imposed by the voltmeter would cause a serious drop in the battery voltage, and result in an erroneous low voltage reading.

Meter Resistance

In this connection it must be remembered that the voltage of a high-tension battery,
A very important type of test Fig. 6.—Make sure in continuity tests that the prods connected in series, and of the limiting resistance and of the instrument) as follows:

\[ \text{Total Resistance} = \text{current in milliammeter} \]

For example, if the meter in the above example reads 2 milliamperes, the total resistance in circuit would be

\[ \frac{4.5 \times 1,000}{2} \]

2,250 ohms.

From this value you must now deduct the resistance of the instrument and of the limiting resistance (in this case 900 ohms), so that the actual resistance of the apparatus under test is 2,250-900=1,350 ohms.

The final type of test which can be applied with even a cheap milliammeter is a test of circuit continuity. Connect a battery, resistance, meter and a pair of testing prods in series, and apply the prods across the points between which continuity is to be tested. A deflection of the pointer will denote that the circuit is intact.

It may easily happen that in testing between two points more than one path is available. Thus, in Fig. 6, continuity would be indicated between the points A and B, even though the transformer secondary had broken down.
The requirements of the present-day listener are first and foremost, selectivity and secondly, quality. The most certain way of obtaining the first mentioned is by means of the superheterodyne circuit, but there are certain drawbacks to this arrangement which are difficult to overcome unless the circuit is thoroughly sound and well designed. The only other way to obtain selectivity is by means of a number of tuned circuits. The band-pass circuit has done much to improve matters, but there is no doubt that two tuned circuits, with two good H.F. stages, followed by a detector feeding a quality output, is only 57s. 6d. by Geo. Neirnes, a 16 Strand, London, W.

A further view of the Igranipak with condenser dust-cover removed.

The difficulty with the band-pass circuit has done much to overcome unless the circuit is thoroughly sound and well designed. The Igranipak with condenser dust-cover removed.

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The price of the Igranipak is only 57s. 6d.

The quality is a good volume, fed into a really capable output transformer. It will be seen from the above remarks, therefore, that a receiver employing two good H.F. stages, followed by a detector feeding a really capable loudspeaker should be a really ideal receiver, and it has been stated in saying that an arrangement would be hard to beat, provided it was soundly designed.

The difficulty with the band-pass circuit has done much to overcome unless the circuit is thoroughly sound and well designed. The Igranipak with condenser dust-cover removed.

The principal requirement for quality is a good volume fed into a really capable output valve. This, of course, would be obtained by a receiver employing two good H.F. stages. It will be seen from the above remarks, therefore, that a receiver employing two good H.F. stages, followed by a detector feeding a really capable loudspeaker should be a really ideal receiver, and it has been stated in saying that an arrangement would be hard to beat, provided it was soundly designed.

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The price of the Igranipak is only 57s. 6d.
UTILITY GANG CONDENSER

One of the most useful gang condensers which we have had the pleasure of inspecting has just been received from Messrs. Williams and Wright. Although this is of the three-gang type, the length is only 2½ in., whilst the width and height are each 2½ in. The comparison with the dial, as may be seen from the photograph, gives some idea of the neatness of this component. The actual structure is very rigid, and the moving plates are joined all along one edge by a solid mass of metal, whilst the usual opening washer is also embedded in solid metal.

The dial of the condenser is of the parallel movement type, the scale being fixed and a pointer moving across it on the top side of the condenser, and these project just over half an inch. An ordinary bakelite base, and it employs a three-hole, and this prevents the wires being bent into contact with any of the metal screws which are fixed in the bottom of the base, and the other end of these is provided with a vertical adjustment to be made in the trimmers. A movement of nearly a quarter of an inch is possible on the condenser, which is ample for all normal purposes. The price of the condenser is 1½s. The dial is of the parallel movement type, the scale being fixed and a pointer moving across it on the same lines as the original Utility Straight Line dial. The movement is rich and smooth, and free from any form of backlash, whilst the scale is marked in wave-lengths (medium at the upper edge and long at the lower edge) with a 0 to 100 scale in the centre. An additional volume control (provided by means of a double-dial-tured disc) is joined to one end of the condenser, and the other end of this is joined all along one edge by a solid mass of metal, whilst the usual opening washer is also embedded in solid metal.

The dial shows wave-lengths (medium at the upper edge and long at the lower edge) with a 0 to 100 scale in the centre. An additional volume control (provided by means of a double-dial-tured disc) is joined to one end of the condenser, and the other end of this is joined all along one edge by a solid mass of metal, whilst the usual opening washer is also embedded in solid metal.

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The new Utility Gang Condenser and Full Vision Tuning Scale are also embodied in solid metal. The spacing is suitably, therefore, to vary under any normal use. A thin dial-coil is provided, and this is of the metal, and clips into position, thus totally enclosing the whole assembly. For comparison purposes lengths of 35-gauge wire are brought out from the fixed sections of the condenser, and then projected out of the coil, as may be seen from the diagram. The price of the condenser is 1½s. The dial is of the parallel movement type, the scale being fixed and a pointer moving across it on the same lines as the original Utility Straight Line dial. The movement is rich and smooth, and free from any form of backlash, whilst the scale is marked in wave-lengths (medium at the upper edge and long at the lower edge) with a 0 to 100 scale in the centre. An additional volume control (provided by means of a double-dial-tured disc) is joined to one end of the condenser, and the other end of this is joined all along one edge by a solid mass of metal, whilst the usual opening washer is also embedded in solid metal.

PRACTICAL WIRELESS

October 28th, 1933

VARLEY 4-VALVE SUPERHET MODEL A.P. 46

IN our last issue October 7th, in which we gave a report on the above receiver, and it was stated in this report that the circuit followed more or less orthodox lines. We now learn from Messrs. Varley that instead of a bond pass input circuit the receiver employs a separate H.F. stage, combined frequency changer and, in L.F. valve. We shall be glad if readers will note this alteration.

GRAHAM FASHAM DRIVER TRANSFORMER

A new transformer for Class B work which is finished in a bond pass circuit, and a label of black bakelite. On the top are the connections in clear glass, and the price is 3s. 4½d. It is very useful indeed, and the wiring of a receiver will be found very easy. It replaces the special form of driver for the triode which has been used in the past, and yet avoids rattle or chatter. The transformer works very well in all the normal types of circuit, and the quality is perfectly satisfactory for all normal requirements.

TESLEN SCREENED SHORT-WAVE CHoke

TESLEN SCREENED SHORT-WAVE CHoke is a very sensitive type of pick-up, delivering a sufficient volume to enable good loud-speakers to be used. The method of armature suspension relieves record wear, and yet avoids rattle or chatter. The transformer works very well in all the normal types of circuit, and the quality is perfectly satisfactory for all normal requirements.

BULGIN POWER RESISTORS

In last week's issue we referred to Bulgin Spirolim resistors on the Facts and Figures page. The ratio is 1:2 to 1, and the D.C. resistance of the primary is, approximately, 500 ohms. The transformer works very well in all the normal types of circuit, and the quality is perfectly satisfactory for all normal requirements.
BEGINNERS’ SUPPLEMENT
(Continued from page 318)

so that they may be operated by one control. This is called a ganged condenser. One such is illustrated in Fig. 7. The coils are all carefully matched, otherwise, if they differ slightly in characteristics, the condensers will each need different settings and it would not be possible to work them from one control.

The object of using several coils and condensers is to cure “flatness” of tuning. With a set in which the tuning is flat you will find that instead of hearing a station at only one particular point on the dial of the tuning condenser, it can be heard for several degrees on either side. Naturally, this makes tuning-in very easy, but it has the drawback that two stations may overlap. For instance, say you have tuned in a station at one point on the tuning dial or scale, and you then turn the knob until you pick up another station. If the setting for the second station is only a few degrees from that of the first one, then you may still be able to hear the first one when the second one is tuned-in. You will be receiving two stations at once!

By using several tuned circuits the tuning is made “sharper,” so that each station can only be picked up at one particular point on the dial. The various circuits act like a succession of filters, letting through only that which is required. There are various ways of connecting the circuits together, but we have not space enough to go into details here. Suffice it to say that sometimes two sets of coils and condensers are connected in front of the first valve, so that the currents flowing in one generate currents in the other (as in a band-pass tuner), and then these are passed on to the valve, or the currents in one circuit may be first amplified by a valve and then passed on to the next circuit, and so on.

BLUE SPOT SPEAKERS
(Continued from page 326)

and a matching transformer is fitted so that any type of output valve may be accurately matched. The cone is of a new moisture-proof material, and the method of mounting the cones ensures that a perfectly moisture-proof material, and the method of mounting the cones ensures that an accurately matched. The cone is of a new material is used. The method of mounting the cones ensures that accurately matched. The cone is of a new material is used.

For the reproduction of gramophone records the Blue Spot pick-up is an attractive model. With a D.C. resistance of 2,000 ohms and an output of 1 volt, this pick-up may be used with a single L.F. stage to deliver a really useful volume for domestic purposes. The method of mounting the armature permits full movement in either direction, and at the same time reduces wear on the recording. For the reproduction of gramophone records the Blue Spot pick-up is an attractive model. With a D.C. resistance of 2,000 ohms and an output of 1 volt, this pick-up may be used with a single L.F. stage to deliver a really useful volume for domestic purposes. The method of mounting the armature permits full movement in either direction, and at the same time reduces wear on the recording.

GET READY NOW FOR F. J. CAMM’S ORBIT—and order next week’s issue with the Free Gift Transfer Wiring Diagram.

ZELOS
TWO-GANGED CONDENSER


THREE-GANGED CONDENSER 19/6
FOUR-GANGED CONDENSER 27/6

Advertisement of Graham Farish, Ltd., Bromley, Kent.

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and the Impregnated Resistor is the cure.

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ENERGY, J. F. CAMM'S ORBIT AND ORDER NEXT WEEK'S ISSUE WITH THE FREE GIFT TRANSFER WIRING DIAGRAM.

October 28th, 1933
PRACTICAL LETTERS FROM READERS

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

The Selecte Three
Sir,—I built one of your sets, the Selecte Three, and had very great satisfaction from it, and I believe it to be one of the best straight three sets ever designed, both for selectivity and volume, but being one of those persons looking for something better, I have tried to convert my set to a screened four, but with very little success. I would like your advice on the matter. Would you please tell me if it is possible to make a satisfactory conversion with this set, and I want to see diagrams carrying much the same components that I could follow when rebuilding as a screened four.

F. J. Sparrow (Perth).

A Somerset Reader's Appreciation
Sir,—I have sent in my application form for one of your tool kits, as advertised in PRACTICAL WIRELESS. I am a keen reader of your valuable book, and have taken it from the start. Wednesdays would seem a complete blank to me if there was no PRACTICAL WIRELESS. One thing that I should like to ask is—when are we going to have some more data sheets? I am looking forward to seeing more in the future, as they are very helpful to me in my work as a radio engineer, and I would not be without them, or the Wireless Construction Encyclopedia. I am convinced that there is no other paper that deals with wireless as your weekly does; it is a great help both to the novice and the expert, and I waste no time in introducing it to many of my friends, most of whom have already placed a standing order. It needs no pushing, and I shall be only too pleased to introduce it to as many as I can, feeling assured that they will be as satisfied as I am. Wishing you every success in the future.—F. C. Palmer (Bradwater).

The "Fury Four" in India
Sir,—I am sure it will be of interest to you to know that I am receiving all the powerful European S.W. stations with the combination of your "S.W. Superhet-Converter" and the "Fury Four." We all find here that Radio-Colonie is about 50 per cent. more powerful than the B.B.C. I am very pleased with both sets, and they have entertained the public very well. I have also built the cabinet from the illustration of the A.C. model. I think that if you gave an article on "How to modernise your A.C. Wireless sets," it would be of great interest to readers who have built them. Even if readers do not actually modernise at the time, a good deal would be learnt by knowing what is necessary.—H. Perkins (Kirkko, India).

[We have in mind such an article, which will be published in the near future.—Ed.]

The "Fury Four" and "The Orbit"
Sir,—I was glad to read last week details of Mr. F. J. Camm’s new set, the Orbit.

I shall certainly make it, for I have a Fury Four at home which has been the admiration of my friends. I bought it some years ago, but it was a complete blank to me if there was no PRACTICAL WIRELESS. I have five friends all interested in radio, and every one of them now takes PRACTICAL WIRELESS. I am always looking for more data sheets and am sending details of the Orbit.—H. G. (Aston).

Index to Vol. 2 Now Ready
Sir,—When will the index to Vol. 2 of PRACTICAL WIRELESS be issued? I am anxious to get a complete index of this vol., which saves me a great deal of time in looking up back articles.—N. F. (Eton College).

[Index and Binding Case is now ready, and an announcement will be made in the next issue.—Ed.]

DO YOU KNOW?

—THAT hum troubles may often be traced to interaction between L.F. transformers and energized loud-speakers.

—THAT acoustic feedback is often responsible for the objectionable "whistling" effect.

—THAT a powerful mains receiver should be mounted on a solid base or shelf to prevent it from being affected by the above troubles.

—THAT a receiver for wavelengths shorter than one inch is not difficult to construct.

—THAT aluminium paint is of no use as a metallizing medium for baseboards, etc.

—THAT a complete "pack" of equipment is obtainable in all components and wiring for receivers in four, M.F., stages.

—THAT a receiver may be constructed with '-'B.C. separation, and perfect quality obtained.

—THAT for the above purpose a special tone-sensitive variable valve circuit is required.

—THAT an ammeter cannot be converted into an accurate reading milliammeter.

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EASY TERMS—PROMPT DELIVERY

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No bracket prices. Bravo Radio Furniture is supplied B.E. a quality and value impossible to better. Send name, P.O. Postage Guaranteed.

PIARKIN (Qld.) QST, Goulburn, N.S.W.

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THE WIRELESS CONSTRUCTOR's ENCYCLOPAEDIA

By F. J. CAMM.

5/-, or 5/4 by post from Geo. Newnes, Ltd., 81-21, Southampton Street, Strand, W.C.2.

This book is up to the rapid progress in the design of wireless apparatus and in every effort to keep our readers in touch with latest developments, we give an warranty that apparatus described in our columns is not the subject of later patents.

PRACTICAL WIRELESS

October 28th, 1933
CATFORD RADIO AND TELEVISION SOCIETY

This Society held its first meeting of the season on Thursday, October 5th, at the newly acquired premises at 257, Bromley Road, S.E.6, for the purpose of reviewing the activities of last season and electing new officers. The Chairman, Mr. H. B. Reyland, first explained the need for a larger reserve to meet the expenses of the new room and the new apparatus which it was hoped to purchase. He therefore proposed that the rate of subscription be increased to 10s. per year, and this was agreed to without dissent.

The election of officers was proceeded with, the result being as follows:

President: Prince de Mahb.
Chairman: Mr. H. B. Reyland.
Treasurer: Dr. Bannounah.
Secretary: Mr. C. B. Dodd.
Publicity Secretary: Mr. W. W. Jones.

The programme for the forthcoming season formed the next item for discussion, and in accordance with general opinion it was decided that a greater part of the Society's time should be devoted to work of a practical nature. All meetings this season are to be held on Wednesdays, and those interested are invited to come along or communicate with the secretary at 38, Como Road, S.E.23, who will be pleased to supply any information that is required.

(FORD AND DISTRICT RADIO SOCIETY

At the twelfth Annual General Meeting recently held, the Hon. Secretary reported that the progress of the Society was still being maintained, and also that the attendance at the forty-four meetings and seven visits had proved to be the best on record for the last twenty years. The financial report was presented in an excellent state by the Hon. Treasurer, and eleven new members were elected during the year.

Mr. E. W. Collinson was unanimously re-elected President, and all the existing officers were re-elected with two exceptions. A successful Junk Sale was held on Thursday last, to open the new session, the largest attendance being seventy.

Seven visits had proved to be the best on record the year. Details of the Society will be forwarded to anyone interested.

KETTERING RADIO AND PHYSICAL SOCIETY

Kettering's "Radiomains" Relay system was the subject of a lecture to the Society on October 5th by Mr. F. E. Collinson, who also gave a full demonstration of the circuit used.

The finances were in excellent shape, and the society was in a position to consider various items of equipment which might be added to its armament.

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

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"Practical Wireless" said—

...Characteristics...were found remarkably consistent...the valves were all very good...they can be highly recommended.

Prices from 4/6 to 12/6
There is a HIVAC compatible for every battery voltages now in general use.

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The wire element high grade iron free resistance wire (1) which is wound on a specially prepared porcelain former (2), the ends of the resistance being spot welded (3) to copper connecting leads (4), and the whole resistance coated in "Vita" enamel (5). This is the most advanced resistance yet put on the market and is already extensively used by leading set makers.

For full details please write to:
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PRACTICAL WIRELESS

October 28th, 1933

CATALOGUES RECEIVED

To save readers trouble, we undertake to send on catalogues, if not already in your possession, in reply to a notified: the names of advertisers are:- W. W. H. Peto, 37, Southampton Row, Strand, London, W.C.2 (Subscribe to "Catalogue"

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In order to meet the requirements of readers who prefer the work from full-size blueprints when building up any of the "Practical Wireless" receivers, we can now supply full-size blueprint Wiring Diagrams of all the "Practical Wireless" receivers for Is. each, post free. When ordering, quote the number. Copies of the paper containing descriptions of each of the particular receivers cost 4d. each. Address orders to: The Publisher, George Newnes, Ltd., 8-11, Strand, London, W.C.2.

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11. Fury Four.
15. Ferretot O.P.-P. Hit-Mag Three.
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23. Double Double Three.
24. Three-State Nicore.
25. The D.C. A.
27. The Anna B. Three.
28. The All-Wave Two.
29. A.C. Three.
30. Premier Super.
31. A.C.-D.C. Two.
32. Luxus A.C. Superhet.

CLUBS AND SOCIETIES

(Continued from previous page)

SMETHWICK WIRELESS SOCIETY

At a recent meeting of the above Society, Mr. Simmonds gave an interesting lecture on "Tuning in Wireless." He showed some of the history of the coil and defined the properties necessary for efficiency. Tuning was demonstrated and the importance of the band-pass filter. Dual harmonics and heterodyne couplings were also explained. The Society has arranged an attractive programme for the winter season. Lectures by various manufacturers are included and one of the more interesting talks is on "Wireless Theory and Practise" for new members is an interesting talk. The committee are invited to the weekly meetings which are held on Friday evenings. Hon. Sec. Mr. F. Fisher, M.A., 15, Fifth Street, Oldbury, Mr. Birmingham.

THE CHESTER-LE-STER AND DISTRICT RADIO SOCIETY

The above Society has just begun its new session and everyone interested is invited to join, the subscribers being 3d. per week. A full programme of novel demonstrations is being arranged, some of the features being "Funicular," "Monopoles," "Types of Transmitters," and "Homo Made Components." For particulars apply to Hon. Sec. Mr. E. Bowes, 60, Ludner Terrace, Chester-le-Street. At the last meeting Mr. E. Bowes demonstrated his all-metal short-wave receiver and a very interesting evening was spent.

Your DISCARDED SET IS WORTH REAL MONEY

LET us take your old Set or Components in PART EXCHANGE for New Season's Radio—NEEDS, KITS, NEW ACCESSORIES, or PART KITS—in fact any RADIO APPARATUS. Best quotations and fullest advance given. Balance Payable by Cash or Post Office Order. We use your enquiry for quotation by return. Call at your convenience or write for FREE NEW KIT SETS. MISCELLANEOUS COMPONENTS REQUIRED. WE GIVE YOU MORE.

PARTEX RADIO, VULCAN HOUSE, Ludgate Hill, London, E.C.4
SPECIAL NOTE

We wish to call the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the use of the transmitters described in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—this is free as a service—provide diagrams of complete multi-valve receivers.

(2) suggest alterations or modifications of receivers described in our containing.

(3) suggest alterations or modifications to superhet receivers.

(4) Answer queries over the telephone.

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

THE LUXUS SUPERHET

I am very interested in the Luxus circuit which you recently published, and I think that it would be a pity to dispose of this information without having at least some experience with it. I have been able to use this receiver for gramoscope wire, and I am now trying to arrange to include it in a grid circuit for certain difficulties which arise.

A. B. (Southport).

To the Editor, PRACTICAL WIRELESS, Geo. Newnes. Ltd., 8-11, Southampton St., Strand, London, W.C. 2, 28th October, 1933.

I am attempting to construct a receiver for the seven-valve circuit described in your recent publication. I am doubtful how to connect up my components, and would be very glad to have a circuit for seven-valve receivers which are sent to us should bear the name of the writer.

Edward R. (Bromsgrove).

If you are unable to associate your component and thus obtain control knobs from 3d. upwards, all having the same style and finish, so that it is simple to replace those which are fitted to a component and thus obtain

DATA SHEET No. 58

Cut this out each week and paste it in your notebook.

TUNED CIRCUIT DATA

In the table given below various short wavelengths are given, together with the inductance and parallel capacity which will tune to them.

<table>
<thead>
<tr>
<th>Wavelength (m)</th>
<th>Frequency (kHz)</th>
<th>Inductance Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>30,000 kHz</td>
<td>5.6 H</td>
</tr>
<tr>
<td>15</td>
<td>22,500 kHz</td>
<td>7.0 H</td>
</tr>
<tr>
<td>20</td>
<td>15,000 kHz</td>
<td>9.5 H</td>
</tr>
<tr>
<td>25</td>
<td>12,000 kHz</td>
<td>12 H</td>
</tr>
<tr>
<td>30</td>
<td>10,000 kHz</td>
<td>15 H</td>
</tr>
<tr>
<td>35</td>
<td>8,750 kHz</td>
<td>18 H</td>
</tr>
<tr>
<td>40</td>
<td>7,500 kHz</td>
<td>22.5 H</td>
</tr>
<tr>
<td>50</td>
<td>6,000 kHz</td>
<td>26 H</td>
</tr>
<tr>
<td>70</td>
<td>4,285 kHz</td>
<td>40 H</td>
</tr>
<tr>
<td>100</td>
<td>3,000 kHz</td>
<td>56 H</td>
</tr>
<tr>
<td>150</td>
<td>2,000 kHz</td>
<td>80 H</td>
</tr>
</tbody>
</table>

From the above table it will be seen that to tune to a wavelength of 100 metres with a 22 microfarad parallel condenser the exact value of 125 microfarads would be required. Any range of wavelengths may thus be chosen from the figures given.

SOLDERING

I have tried to make a set recently, and thought it would be a good idea to solder all the leads. I am only an amateur and found that I had great difficulty in getting the solder to stick when near to a terminal. Does the terminal take away the heat of the iron in getting the solder to stick when near to a terminal. Does the terminal take away the heat of the iron in getting the solder to stick when near to a terminal.

You appreciate, of course, that we choose those which are fitted to a component and thus obtain control knobs from 3d. upwards, all having the same style and finish, so that it is simple to replace those which are fitted to a component and thus obtain

FREE ADVICE BUREAU COUPON

This coupon must be presented in the three last months of 1933, and must be attached to all letters containing queries.

PRACTICAL WIRELESS, 28/10/33.
PRACTICAL WIRELESS
MISCELLANEOUS ADVERTISEMENTS

Advertisements are accepted for these communications.

**PETO-SCOTT** Q.P.P. 4-valve Guardian Kit. EXCELLENT & RELIABLE, mains-operated transformer, 9/3.

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- **ROYAL Radios**, 33, Chancery Lane, London. Offer guarantee for new goods. Resistances I watt watts 100, 200, 300, 1,000, 2,000, 5,000, 10,000, 15,000, 20,000, 25,000, 40,000, 50,000, 75,000, 100,000. Moving Coil Speakers. 
- **Mains TRANSFORMERS**. 250 volt. 60 ma., 4/6, 3/4, 7/8, 1/4 volt. 
- **CONDENSERS**. T.C. 200-300 working voltage, 1/6, 1/4, 1/2, 5/6, 1 volt. 

**PEARL & PEARL**. All the following bargains guaranteed. Guaranteed new, complete with parts. 

- **Pollen**, excellent and reliable, mains-operated transformer, 9/11. 
- **NEW Lissen**. Free constructional chart with each Kit. 
- **NEW Microphone Low-End Magnet MOVING-TOILET SPEAKER**. With input Transformer. Cash or C.O.D. 
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- **AC/P. 41MP, 7/6.** 
- **MSG/LA, AC/P. 1, 41MXP, 8/0.** 
- **MS4, S4VB, DC/HL, R. & A.** 
- **TCC 4x4x1x1x* mf., 4/9.** 

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This offer applies to licences which are actually in force on Saturday, October 28, 1933.

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