FREE INSIDE! DATA SHEET No. 4. "MAINS TRANSFORMERS"

Practical Wireless

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PRAC 7/1/33.
Building The Selectone—A Super Set! See page 766

Practical Wireless

ROUND the WORLD of WIRELESS

British Empire Broadcasting from Daventry

SSW, the short-wave transmitter at

Clarendon, closed down last

December 17th. On December 19th, the British Empire Broadcasting Station at Daventry took over its regular service to the British Dominions and Colonies overseas.

The transmissions are made daily (Sundays included) at the following times: O.S.T.: 22.53 m. (11.760 kc/s), to the Australian Zone; from G.M.T. 9.30 to 11.30 a.m.; GSE, 25.3 m. (11,885 kc/s), to the Indian Zone, from 2.30 to 4.30 p.m.; GSA, 49.6 m. (6,050 kc/s) to the African Zone from 8 to 11 p.m.; to West African Zone, from 8.30 to 10.30 p.m., and to Canada, from 1 to 3 a.m. Simultaneous broadcasts of each transmission are also made through GSC, on 31.3 m. (9,505 kc/s).

Site for the 100 kW. B.B.C. Station

THE new 100 kilowatt, which is to replace the present Daventry National and Midland Regional transmitters, will probably be erected at Wychbold, near Droitwich. The site is about forty miles west of Daventry. It is not expected to bring the station into operation before 1934.

Radio Safeguards for Colliery Workers

EXPERIMENTS with wireless installations are being carried out at several pits in the Yorkshire coalfields, with a view to establishing connection between the workers underground and the engineering staff at the top of the shaft. During the tests made it was found possible to transmit messages to various points of the mine and to broadcast warnings by loudspeakers. Attempts will now be made to establish a two-way communication.

Relays of the Austrian Programmes

THE Vienna broadcasts are relayed by an experimental station operating on 1,250 metres (240 kc/s) every Monday, Wednesday and Friday, from 6 p.m. G.M.T. onwards. On Tuesdays and Thursdays, between 1 and 2 p.m. G.M.T.; these programmes are also broadcast through the short-wave station UOR2, on 49.4 metres (9,070 kc/s).

New Station in Hungary

ONE of the three recently constructed relay stations to take the Budapest programmes is now on the air; it is that of Nyireghaza, which, with a power of 6 kilowatts, broadcasts daily on 267.6 metres (1,120.9 kc/s).

China Calling!

THE Nanking 75 kilowatt transmitter, erected by the Telefunken Company, was formally opened on November 12th. Records of a speech made by the Chinese Ambassador to Germany were made in Berlin and sent to Nanking for re-broadcast at the inaugurating ceremony. The station transmits on 440 metres, and reception of its signals has already been reported by listeners in the British Isles.

Radio Traps for Mosquitoes

THE United States Sanitary Authorities, according to a report, have invented a radio trap for the destruction of malarial mosquitoes. Experiments were carried out by the Engineers of the General Electric Company’s transmitter at Lynn (Mass.). The insects were attracted by a high-pitched buzzer tone produced by an oscillatory circuit, the exact note of a mosquito in flight being produced by careful tuning. When swarms of insects had thus been collected they were destroyed by heat derived from an electric furnace. A description of this peculiar trap was given recently over the National Broadcasting Network.

The advent of wireless broadcasting in that country, of two hundred makers of pianos only ten are in existence to-day. Where six thousand artisans found employment, only three hundred are now in regular work.

In Competition with the British Empire Broadcaster

THE French authorities are studying a proposal to transmit special concerts and news bulletins through the Radio-Colonial short-wave station, between midnight and 3 or 4 a.m. G.M.T. daily, for the benefit of French Canadians resident in the Montreal-Quebec districts.

Special Radio Theatre in Italy

ONE of the principal theatres at Turin has been taken over by the E.I.A.R. (Italian Broadcasting system), to be used as a studio for the broadcast of the majority of entertainments comprised in the Milan, Turin, Trieste, Genoa, and Florence programmes.

France to Build Another High-Power Station

ACCORDING to an official statement, a site has been found at Tramoyes, near Lyons, for the 100 kilowatt transmitter which the French P.T.T. propose to erect in replacement of the present Lyons (Lo Doua) broadcasting station.

Illustrating Bolshevik Industrialism

THE Leningrad and Moscow high-power stations have chosen, as an interval signal, the beat of a heavy hammer on an anvil, to symbolise the feverish activity of the Five Year Plan. The beats are timed to one per second, and at the end of each full minute the letter G (- - -) in Morse is transmitted.
Securing Quality

I AM often asked how improvements can be made to a set which have not reproduced good frequency response. The question is a difficult one because the fault—of one kind more than another—cannot always be traced to the speaker itself, the L.F. couplings, the use of incorrect H.T. and G.B. voltages or even to the tuning circuits. If the speaker is of a fairly old pattern, especially if of the horn type, one can assume fairly safely that it will not do justice to the lower notes. When the speaker is known to be good, one should tackle the inter-valve low-frequency couplings. Where L.F. transformers are employed they should be fairly massive or otherwise they should be connected on the resistance-feed system. In regard to the high-tension voltage, this should be as high as convenient and the grid-bias voltage should carefully be adjusted to suit it. If a sharply-tuned single circuit (as opposed to band pass) tuner is employed a certain amount of high-note loss is inevitable and in that case it is necessary either to change the taps or to apply some form of tone correction in the L.F. stages.

"Boomy" L.S. Reproduction

WHEN reproduction is carried out to an ac-centuation of the bass it is often possible to effect quite a noticeable improvement merely by reducing the capacity of one or more of the coupling condensers used in the L.F. stages. If such locality feed is used for the loud-speaker the usual 2 or 4mfd. output con-denser should be replaced by one of lower capacity, down to .25 mfd. or so.

Better "Attack"

The lower capacity also improves the "attack" in many cases. I might be excused for explaining to non-musical listeners that this latter expression is used to denote the simultaneous reproduction of the same or corresponding note by every instrument in an orchestra. With many sets and speakers, the notes of the higher-pitched instruments, violins for instance, can be heard a fraction of a second before those of instruments of lower pitch such as the double bass. The result is that a certain amount of "blurring" occurs.

Another Cause of Poor Attack

POOR attack can frequently be traced to the use of a moving-coil speaker with an insufficiently powerful receiver. The coil and diaphragm in even the best speakers have a certain amount of inertia, and since they have to move through a speaker have a certain amount of inertia, the coil and diaphragm in even the best with an insufficiently powerful receiver.

The coil and diaphragm in even the best with an insufficiently powerful receiver. This occurs.

Picture of the special transmitting station erected on the roof of the Brighton police headquarters, from whence messages will be sent and picked up by the policemen whilst on their beats. The pocket apparatus is in operation at Brighton, which is the first town in the country to be equipped with the pocket radio.

Ultra S.-W. Television

WE hear that the B.B.C. have already carried out a series of transmission tests from their 7.75 metre station situated on the roof of Broadcasting House. These tests, under the Baird television system, have been well received by the B.B.C. engineers on their experimental receivers at Nightingale Lane, and it is anticipated that a fairly safe Preliminary transmission will soon take place during broadcasting hours.

Russian Stations

HAVE listeners noticed that Radio Stalingrad (Russian) is interfering with Toulouse, whilst Ursaspol, another Russian station, has taken up a position about midway between London Regional and Mijlacker. As a matter of fact, a number of Russian stations appear to be butting in on all parts of the wavelength scale. A newcomer called Tartu has squeezed in between Vienna and Brussels, and Ivanor-Vosnesensk (what's in a name?) has actually taken up a position right on the North Regional's wavelength.

Solve this!

Problem No. 15

Ferguson had built a three-valve set which had worked for some weeks. One day it refused to give any signals, and he accordingly tested the condenser circuits of each valve with a milliammeter. The normal reading was obtained in each valve circuit, but no signals could be tuned in. Grid Bias was normal; the loud-speaker was in order, and on test every con-nection was intact and correctly made. Tuning coils were changed and also tuning condensers, but still no signals could be heard. What was causing the trouble? Three loops will be awarded for the first three correct solutions opened. Mark envelopes Problem No. 15, and send to the Editor, PRACTICAL WIRELESS, 8-11, Southwark Street, London, W.C.3, to arrive not later than January 1933.

SOLUTION TO PROBLEM No. 15

Owing to the low resistance of the speech winding, Jones was virtually short-circuiting his output choke. He should have used a step-down transformer, and joined this to the two anodes through fixed condensers. The following three readers received books in connection with Problem No. 15: F. Bird, Esq., Bury House, Town Green, Wy-mondham, Norfolk; H. Foster, D. Regent Street, Tunbridge, Beds.; J. F. Spore, R. Talisa Terrace, Kitham, S.E.9.
Fitting New Plates in an Accumulator

An Instructive Article on Dismantling and Renewing the Plates of a Low-tension Accumulator, Together with Several Points on Upkeep

By GILBERT E. TWINING

The life of a low-tension accumulator is naturally governed by the manner in which it is treated, taking into consideration, of course, that its capacity was sufficiently large for the output necessary for the set when it was first installed. If a battery is overloaded its life will be considerably shortened and, if the discharge of a battery is too great, the paste will be driven out of the grids of the plates, and it will need to be recharged more frequently. Therefore, it must be emphasized, from the point of view of economy, to choose one of ample capacity whenever purchasing a new low-tension battery.

The writer wishes to point out that the accumulator case is made of celluloid and, in any way cracked or damaged, it will not be worth while fitting it with new plates, for it will not repay the time spent on it. Patching up with odd pieces of celluloid and securing them with celluloid cement seldom makes a satisfactory job. This article deals principally with batteries having transparent glass containers. The obvious advantage of this type is that they do not discolour and it is always possible to see the condition of the plates and to keep the level of the electrolyte up to that marked on the outside of the case.

The plates may be obtained from authorized agents and first-class garages, where they cater for the wireless trade. The name and index or type number of the accumulator should be quoted when ordering replacements. The following is a list of only one of the well-known manufacturer's prices, and these can be taken as representing the average prices in use to-day:

<table>
<thead>
<tr>
<th>Type</th>
<th>Plates</th>
<th>Maximum list price</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>Positive Group</td>
<td>1s. 6d. each</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>1s. 6d.</td>
</tr>
<tr>
<td>0.50</td>
<td>Positive</td>
<td>2s. 6d.</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>2s. 6d.</td>
</tr>
<tr>
<td>0.75</td>
<td>Positive</td>
<td>4s. 6d.</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>4s. 6d.</td>
</tr>
</tbody>
</table>

The prices of the glass jars are as follows, for if an accumulator jar is smashed the plates can quite well be placed in a new container:

<table>
<thead>
<tr>
<th>Type</th>
<th>Container</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25</td>
<td>1s. 2d. each</td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>1s. 9d.</td>
<td></td>
</tr>
<tr>
<td>0.75</td>
<td>2s. 9d.</td>
<td></td>
</tr>
</tbody>
</table>

Removing the Plates

The two terminal knobs and the filler plug should be first removed from the top of the accumulator, and all the electrolyte emptied away. It will be assumed that the accumulator is at least two years old, in which case the top will be filled in with a composition which has first to be removed. Now if the reader has a gas fire handy the accumulator can be placed in front of it on its side upon a block of wood; the wood is for raising it up level with the fire. A tin tray—an old cigarette tin will do—

least two years old, in which case the top will be filled in with a composition which has first to be removed. Now if the reader has a gas fire handy the accumulator can be placed in front of it on its side upon a block of wood; the wood is for raising it up level with the fire. A tin tray—an old cigarette tin will do—

is placed underneath the accumulator so that the heat from the fire will melt the composition and cause it to run into the container below it; any small quantity which is left in the top may be scraped out with a screwdriver whilst still warm. Fig. 1 shows the accumulator on its side before the fire. If no fire is available, however, the composition must be chipped out, or the battery placed in a warm oven, and on removal the pitch dug out and scraped away; shipping takes rather longer than the melting process.

When all the composition is removed from the accumulator the plates can be lifted clear of the glass container, together with the flat piece of composition board which holds the plates in position, and at the same time forms the bottom of the tray into which the composition was originally poured, thus preventing it from running into the interior of the battery. Fig. 2 is a section of the battery, and it clearly shows the board in position. The positive and negative blocks can now be withdrawn from the above-mentioned board, being replaced with the new plates, taking care to put them in the same holes from which the old ones were taken, so that they will correspond—when the battery is reassembled—with the positive and negative markings on the outside of the case. Any sediment at the bottom of the glass container must be washed away and the container rinsed out with clean water.

Inserting the New Plates

The new plates with the board can now be inserted into the case; make sure to push the board right down on to the glass stops on the inside of the container, for this board prevents the plates from any upward movement and so stops rattling. The plug collar, which is threaded on the inside to take the screwed filler cap, is then placed in position over the hole in the board, and the composition heated in a tin over a gas ring. When this is in a molten state, it may be poured into the top of the accumulator.

(Continued on page 758.)
it is not unlikley that even the local station will be interfered with by a powerful foreigner. The methods of increasing selectivity which were popular a year ago, namely, inserting a small condenser in the aerial lead or reducing the length of the aerial, though still useful, are seldom sufficient. Probably the cheapest way to obtain real selectivity with an old set is to change to band-pass tuning. This can be done by buying a new tuner, of course, but a less expensive way is to fit a band-pass adaptor like that described on page 557 of PRACTICAL WIRELESS No. 11. If you plan for a separate unit, and you will if the set is neatly housed in a large cabinet, the adaptor can be built into the set by finding the necessary components at the "aerial" end of the baseboard. In this case, it is essential that the two coils should be screened. If the coils themselves are not fitted with screening cans, a vertical sheet of aluminium should be erected between them, and connected to earth.

Band-pass tuning is open to the objection that it entails the use of two variable condensers. When two similar coils are employed a gang condenser would serve, but that would involve additional expense. If this is your objection, you can get any amount of selectivity by altering your aerial tuner, as shown in Fig. 1. A winding consisting of about twenty-five turns of 24's gauge d.c.c. wire is put on top of the medium-wave coil, and one of fifty turns (equally divided over the slots) on the long-wave coil. Both new windings are connected in series, and the turns must go in the opposite direction to those of the tuner. The aerial is taken from its usual terminal, and connected to the end of the new winding. The other end of the winding is connected to earth. A switch will be required to short-circuit the choke for medium-wave reception, but this can sometimes be combined with the normal wave-change switch by replacing the latter by one of the double-pole-double-throw type, such as the Bulgin type "S.20" or Wearsie type "L.22."

Changing to Variable-Mu

Having settled the selectivity question, we can pass along to the S.G. valve (when used). If the set is so far away from the nearest transmitter that no overloading of the first valve occurs (generally distinguishable from the fact that signals become weaker when the set is tuned exactly to

Fig. 3.—Adding a potentiometer for the employment of a variable-mu valve.

A NUMBER of readers who are in possession of a set made some years ago have written to express their regret at being unable to fit one of the many fine receivers described in PRACTICAL WIRELESS, due to the difficulty in producing the necessary cash. For financial reasons they are obliged to keep the old set, despite its many disadvantages. At the same time they would be quite prepared to spend a few shillings here and there in bringing the old set up to date if they knew just how to tackle the job, and what alterations should be made. The same difficulty must have occurred to hundreds of readers who have not yet written to us, for there is no doubt that times are distinctly hard, and money scarce. It is for the benefit of readers who are in the position of those just referred to that the following suggestions are principally intended, but it is hoped that they might also prove of assistance to others of an experimental turn of mind. None of the alterations I shall suggest will be of such a radical nature that the set will need to be entirely rebuilt, so it must be assumed that it is already in working order, and simply out of date.

Although receiver design has undergone many changes during the past few years (principally due to improvements in broadcasting technique), I do not hesitate to say (principally due to improvements in broad-
THE OLD SET
You How to Bring Your Old Set Up to Date

the station, and louder on each side of the proper tuning position), no alteration need be made, but if overloading does occur, it will be worth while to replace the present valve by one of the variable-mu type. The V.M. valve will also provide an excellent and convenient volume control which can be used on any station.

A number of ways of fitting the necessary potentiometer for a V.M. have been given in previous issues of PRACTICAL WIRELESS so I will mention only one here. This is shown in Fig. 3, from which it will be seen that a small fixed condenser (.0001 mfd. upwards) is inserted in the lead from the grid terminal to the tuning coil and a 3 megohm (approximately) grid leak is connected from the former point to the centre terminal of a 50,000 ohm potentiometer. One of the outside terminals of the potentiometer is connected to G.B. negative by means of a flex and wander plug whilst the other is joined to that terminal of the valve holder which is connected to H.T. and G.B.+ through the switch. By connecting the potentiometer in this way it is automatically disconnected from the G.B. battery when the set is switched off. In cases where the battery is housed inside the set care should be taken that its positive end is connected to the high tension negative terminal and not directly to the filament terminal of a valve holder. The method shown is not quite the best but is most convenient.

The Detector Valve

Now we pass on to the detector valve. No alteration will be required in its grid circuit but several improvements might be possible in the anode circuit. A number of H.F. chokes which were on the market a few years ago had so low an inductance that they were useless on the long waveband. This does not mean that the set would not work on long waves, but that reaction control would be unsteady or insufficient to produce oscillation. If your set suffers in this way, buy a good modern choke; get one of well-known make and pay about three and sixpence, it will be worth it. If reaction control is unsteady on both wavebands, it is unlikely that the H.F. choke is the cause of trouble. Try the effect of a .0002 mfd. or .0003 mfd. fixed condenser joined between the anode terminal of the detector valve-holder and H.T.—. (See Fig. 4.)

Resistance Feed

The L.F. transformer will most likely be connected directly in the anode circuit of the detector valve. Unless it is of a large and fairly expensive type, it will probably cause a loss of low-note amplification so that reproduction will be lacking in bass. This can be overcome by connecting the transformer on the resistance-feed system as shown in Fig. 4. A fixed non-inductive resistance (metallised for instance) is connected in place of the transformer primary terminals and one of the latter is connected to the “anode” end of the resistance through a .1 mfd. condenser. The other primary terminal is joined to earth and the secondary connections remain as before. As the terminals of some of the older transformers are marked differently from those of the present-day ones, both kinds of lettering are given in Fig. 4. The resistance-feed method of connecting the transformer, besides improving bass response, will often cure distortion due to overloading.

Decoupling

The idea of decoupling the anode circuit of the detector valve has been advocated so often in these pages that
I feel I ought not to refer to it again. But it is so important that I cannot restrain myself. Decoupling prevents various kinds of instability besides prolonging the useful life of the H.T. battery, so you really must make provision for it if you have not already done so. The only components required are a fixed resistance of from 20,000 ohms, upwards and a condenser of 1 or 2 mfd., and they are connected between H.T. positive and the L.F. transformer or feed resistance as indicated in Fig. 4.

Preventing Overloading
When two transformer-coupled L.F. stages are employed it often happens that overloading occurs when using modern valves due to the overall amplification being too high. This is especially so when both transformers have ratios greater than about 3:1. The latter difficulty can easily be overcome by connecting the second transformer as shown in Fig. 5. When connected in this way the effective ratio is only 1:1 regardless of the transformer's rated step-up ratio. In any case the transformer should be resistance fed so you can try the connections of Fig. 4 as well as those of Fig. 5, and adopt the one which proves superior. The value of the feed resistance is given as 25,000 ohms, because this is a good average; actually it should be equal to twice the impedance of the preceding (first L.F.) valve.

The Output Stage
We have now arrived at the last valve. When only a single L.F. stage is used this should be a small power valve of the high amplification type such as a Cossor 220 P.A., but if two L.F. stages are employed a "large" valve of lower amplification such as the Cossor 220 P, or even the 230 X.P. will be far more satisfactory. If you have bought a moving-coil loud-speaker, it will be fitted with a suitable transformer and no other output device will be necessary. On the other hand, if you are still using a "cone" speaker it will be much better to employ a choke output filter when a P. or X.P. valve is used in the last stage. For this you will require an L.F. choke and 2 mfd. condenser; they should be connected as shown in Fig. 6.

Use Ample H.T.
Remember that none of the alterations described above can produce the best results unless you give the set plenty of high-tension voltage, certainly not less than 100 volts, and carefully adjust G.B. tappings to their best positions. Besides, if the set is very old, an hour or so will be well spent in testing the components, as explained in the article "Test Your Components Before You Build," published on page 446 of PRACTICAL WIRELESS, No. 9.

Fig. 6—Improving the output arrangements by adding a filter circuit.

SOME method of compensation for the restoration of the higher musical frequencies is becoming increasingly popular in modern receivers. It is a well-known fact that there is a decided tendency for high notes to be lost by reason of sharply-tuned circuits with their consequent side-hand cutting. Moreover, unintentional stray capacities in the circuit have the same effect. In such cases the replacement of a triode output valve by a pentode will often put matters right. There are many little snags, however, which confound the tyro if he is tempted to banish his triode, and he may well be doomed to disappointment unless he be willing to experiment; pentodes are very touchy to slight changes in the output impedance and require careful matching to assure good results.

Tone Compensation in Triode Circuits
Most methods now in vogue necessitate either a special tone-compensation transformer or an extra stage of amplification. This means additional expense. The scheme in use by the writer needs only a suitable L.F. choke. Fig. 1 shows the familiar resistance-capacity-fed transformer. The voltage amplification of the valve depends on the external impedance, which usually is a pure resistance; other things being equal, therefore, the magnification remains sensibly constant over the musical scale. If, however, our external impedance is partially inductive, the impedance will rise with the frequency. Therefore increased amplification will result on the higher frequencies. In order to prevent excessive compensation we retain our usual coupling resistance; the larger this is, or the smaller the choke, the less the degree of compensation.

One must not lose sight of the fact that the choke with its inherent self-capacity will resonate at some definite frequency which should be well removed from the musical scale, and in most cases will be above audibility. Fig. 2 will show this clearly, although it should be borne in mind that the ordinates are purely arbitrary. A bad choke of high self-capacity will cause a very nasty resonance in the audible spectrum, especially if we aim at a high degree of compensation by using a small resistance. In practice, a resistance equal to about half the impedance of the preceding valve will be suitable, in conjunction with a .3H. choke.

Voltage amplification
\[ \frac{I_v}{I_e} = \frac{Z_{ex}}{Z_{val}} \]
where
- \( I_e \) = external impedance
- \( I_v \) = valve impedance
- \( A = \text{amplification factor} \)
- \( R + 2\pi fL \) = resistance in ohms, \( f = \text{frequency} \)
- \( I_v + R + 2\pi fL \) = inductance in henries

The result in each case to be multiplied by the transformer ratio.

Use Ample H.T.
Remember that none of the alterations described above can produce the best results unless you give the set plenty of high-tension voltage, certainly not less than 100 volts, and carefully adjust G.B. tappings to their best positions. Besides, if the set is very old, an hour or so will be well spent in testing the components, as explained in the article "Test Your Components Before You Build," published on page 446 of PRACTICAL WIRELESS, No. 9.
I think the appetite of the reader should by now have been whetted sufficiently to make him desire to know how those one or two quite simple components described in last week's article can be assembled together so as to produce in the television receiver an image which is identical with the scene transmitted from the studio except for the greatly reduced size. Taking the items in turn, we must mount the motor on a bracket, which in turn is held generally on a baseboard having four feet, one at each corner. The height of the centre of the motor spindle from the table on which the apparatus rests will depend on the disc diameter, it being necessary to allow a clearance of, say, 1 in. to permit easy running of the disc.

Now a slot must be cut in the baseboard to allow the disc to revolve, this being shown in the photograph, Fig. 1, which illustrates the assembled apparatus in the case of a Baird disc model machine, the disc projecting below the baseboard a matter of about 4 in. With the disc held to the motor shaft by a screw passing through the boss and gripping the spindle, the neon lamp can now be positioned. To suit the type of television transmission now being sent out by the B.B.C., the disc must rotate in an anti-clockwise direction and when facing the front of the apparatus the single turn spiral of holes is in a clockwise direction. It is essential, therefore, to see that the disc is the right way round on the shaft, otherwise the resultant image seen will be reproduced so that all horizontal movement is reversed. The neon lamp is mounted in its bayonet holder so that it is on the extreme right of the disc immediately behind the spiral of holes.

The centre of the glowing neon plate (assuming one of the flat plate variety is being employed) must be on the same horizontal line as the centre of the motor shaft. The illustration (Fig. 2) gives a fair idea of how the glowing neon lamp plate is scanned, this picture having been taken from the back so that the lamp is not obscured by the disc. Then in front of both our disc and lamp is placed the lens or lenses complete with their own particular type of mount. As a general rule it is wise to have interposed between the disc and the lenses a mask having a shaped area cut out to conform to the shape of the resultant light area revealed by the rotating disc. In this way any section of the light which is not required during the process of image reconstruction will be blacked out.

Fig. 1.—Showing the complete assembly of the various components used in a Baird disc model machine.


Still neglecting for the moment our synchronizing mechanism, as I intend to deal with that fully in next week's article, (the mechanism itself can be seen at the front of the motor in the illustration, Fig. 1), the only additional control we need mention is the variable resistance used for adjusting the speed of the motor. This, by the way, should have no "off" position, otherwise the individual working the apparatus is liable to move the contact arm to this position when the hand is on the control, but the eyes are on the image. The motor speed will at once start to drop and it becomes imperative to begin resolving the picture into an intelligible image all over again. This resistance is seen on the left of Fig. 1.
Points on Maintenance

Never let the electrolyte fall below the top of the plates; keep it up to the level charge and performs an identical function by creating another strip of voltage intensity immediately next to its predecessor.

If this is the way that strip by strip, lying side by side, the complete television image is built up, the various degrees of light and shade intermingling to bring about various ways of building up the invisible image. A reference to the illustration shown as Fig. 3 will no doubt help still more to make it understood. Here a composite image of the head and shoulders of a young woman is built up from tiny elemental areas all correctly positioned one with the other. In actual practice the square pattern shown will of course be modified, as the image is built up from strip formation, but, what is more important, owing to the phenomenon known as visual persistence, or persistence of vision, the eye lag makes the image appear as a whole. A certain amount of flicker will therefore be non-continuous with the twelve and a half pictures per second now used with the transmissions from the B.B.C., something enough to prevent the eye dwelling too intimately on the mechanics of the process.

In this way, therefore, it is possible to show in miniature all the proportions of the light, shade, contour and movement of the artist or subject performing before the photo-electric cells in the television studio, or, in other words, produce "vision at a distance" in the home. Of course, the various changes in this image are transmitted electrically to the receiving end, and this goes on spot by spot from the bottom to the top of the glowing lamp areas.

An Accumulator

With the running in of the charging current, the battery is charging fairly freely with the voltage rising to approximately 2.6 volts. A battery should never be completely discharged or left for any length of time with a low voltage, for then, when recharged, it never reaches its prescribed motion, then the next hole takes over immediately the centre of the scene (see how it is always in step). When this happens, at any one instant, a hole in the disc of the transmitting apparatus will reveal a tiny square area of the neon lamp's glow. If, for example, we imagine the exposed area in the centre of the image, then it must be realised that this hole is the corresponding square area of the transmitting position in the centre of the scene or object at the transmitting end, which is being explored by the moving light spot.

Building Up the Television Image

The intensity of the tiny neon glow area is shown must therefore be in direct proportion to the light reflected and picked up by the photo-electric cells at the transmitting end. This is because of the proportional changes it has passed through from end to end, the "line" in the chain of events being reflected light to photo electric current, amplification, passed to wireless aerial and broadcast, received on the home wireless set, again amplified and finally handed on to the neon lamp to modulate its glow intensity.

In effect, therefore, we are reproducing in terms of light the conditions prevailing at the transmitting end at that one instant, and this goes on spot by spot from the bottom to the top of the glowing lamp areas, recreating a strip of incandescence which shows in miniature all the corresponding position of the light and shade which has been transmitted electrically as a television signal. When a hole has finished its prescribed motion, the other hole takes over and this happens day by day and week by week, there is no difficulty in maintaining the miniature television set, as it is only necessary to keep the level constant by the addition of distilled water.

Fitting New Plates in an Accumulator

(Continued from page 753.)

The composition will probably require to be heated several times, and even then it will be impossible to get an even flow over the surface. If it is possible to obtain a small mouth blow-lamp, and just blow over the surface, it will smooth off the composition and make it settle down to a uniform finish.

The electrolyte may be filled with electrolyte of the correct specific gravity stated by the makers on the outside of the case. The battery is normally called fully charged, but for about one third of its normal period after this first charge, the second charge will then place the accumulator solidly in good condition.

Points on Maintenance

To keep the accumulator up to standard, make sure that the electrolyte is kept up to the correct standard.

Corrosion

When purchasing a new accumulator see that its fitting is made with large non-corrosive and non-interchangeable terminals of the bright red and black top variety. Even if terminals which are said to be non-corrosive with the iron or any other plate may appear bright with a pocket-knife, afterwards wiping over with ammonia, and then using the set is not broken, the bell wire easily, and clean all traces of sulphuric acid away, and scrape the corroded parts free of all traces of acid before using the set is not broken, the bell wire easily, and clean all traces of sulphuric acid away, and scrape the corroded parts free of all traces of acid. The last point has been said concerning cathode ray apparatus, nothing has yet appeared beyond the laboratory stage, while the life of the tube is a very doubtful factor.

The next points that I want to deal with concern synchronism, the operation of the vision apparatus, and one or two peculiar effects which are occasional and which may be due to the description underneath obviously emanates from Germany. Although a lot has been said concerning this ray apparatus, nothing has yet appeared to prevent the eye dwelling too intimately on the mechanics of the process.

Fitting New Plates in an Accumulator

(Continued from page 753.)

The composition will probably require to be heated several times, and even then it will be impossible to get an even flow over the surface. If it is possible to obtain a small mouth blow-lamp, and just blow over the surface, it will smooth off the composition and make it settle down to a uniform finish.
Simple Selectivity Gadget

I have noticed that in order to obtain requisite selectivity a fixed condenser answers perfectly in the aerial circuit, while sometimes it is better in the earth lead, while, when Continentals are extra strong, both are necessary. When both condensers are in circuit the selectivity is excellent. Therefore, I have made a very simple little gadget consisting of two 1000 mfd. fixed condensers, a piece of ebonite, four terminals, two "banana" plugs, and four sockets. These are arranged as shown in the accompanying sketch. Alternatively, the unit may be incorporated in the set with the plugs, and sockets at the back. Thus the "switching in" of the condensers is a simple matter of changing plugs. Another way is to use push-pull switches for "shorting out" the condenser or condensers not required. The "aerial" condenser may be variable.—R. S. Menzies (Scarborough).

A Well-Insulated Lead-in Tube

Experimenters who are not satisfied with the efficiency of the usual ebonite lead-in tube can make a very good one by using two porcelain stand-off insulators, as shown in the illustration. The bolts and nuts are removed from the insulators and after drilling a half-inch hole in the window-frame, one insulator is placed on each side. A piece of threaded 2BA brass rod is run through, and a couple of nuts screwed on each end. It will easily be understood that the insulation of this tube is very high.—V. H. Blair (Edinburgh).

A Station-locating Dial

Here is a simple method for enabling listeners to find stations again (after first identifying and marking them on the chart) in a second, and also giving slower motion. A piece of stiff white paper and strip of thin brass are the only additional parts necessary. Exact measurements are not given as all slow motion dials vary in size.

Adapting a dial for station indicating.

Cut the paper in a semicircle 1 in. or 1½ in. larger than the circumference of the dial, with a piece cut out at the bottom for allowing the paper to slip past lock-nut of the condenser. Slip this behind the dial, making sure that it is perfectly straight. I find the pressure of the dial against the panel quite sufficient to hold it in place. The strip of brass can be quite thin. Cut the strip (½ in. wide) to a point at one end. The length of the strip must be just long enough to solder on present indicator and to bend round over the ebonite of the dial itself. The point should now rest lightly on the paper. In the centre of the brass strip a window is cut so that the degrees on the dial can be correctly registered. As the stations are identified the name of the station can be neatly printed on the paper disc, as depicted in the accompanying sketch.—F. Speik (Peckham).

A Novel Lightning Arrester

When lightning is about, one usually feels a delicate颤 when the spark is protected by some form of lightning arrester.

An efficient arrester can be made as shown in the accompanying sketch. The parts required are a wide-necked bottle, an old sparking plug, and some sealing wax. The neck of the bottle is broken off, the sparking plug inserted in it, and the space filled in with sealing wax. The top of the plug is attached to the aerial, and the bottom to earth.—C. Taylor (Cardiff).

Tone Control

After experimenting with several forms of tone control to be used with a pentode, I find that instead of fixing a resistance-condenser (50,000 ohms var. and 0.1 mfd.) centre across the loud-speaker terminals as recommended, better results are obtained by fixing it across the secondary terminals of the transformer before the pentode. The resulting tone, and the control of tone itself is very much better than the former method and well worth trying, especially to constructors who use moving iron speakers, and where a little more bass is needed than in moving coil types.—Arthur J. Hindes (Great Yarmouth).
A "Safety-first" Gadget

WIRELESS experimenters are fully aware of the nuisance of having to disconnect all leads from the batteries before working on a set and then having to connect up again for testing. This trouble can be eliminated entirely if the gadget herewith described is made use of, as the leads can be connected or disconnected in half-a-second. The requirements are two pieces of ebonite about 3½in. by 2in., and five Clix coil pins and sockets. Put the two pieces of ebonite together in the vice and drill five holes at irregular intervals right through. The drill used should be of a size to suit the coil pins (about 6 B.A. clearance). Fit the pins into position with one nut on each. The holes in the other piece of ebonite are now opened out to suit the sockets (about 2 B.A. clearance) and the latter secured with nuts. It will now be seen that the pins will fit snugly into their sockets. The leads from the H.T. and L.T. batteries are taken to the sockets and well secured. This unit is connected to the wall or bench behind the set, and short pieces of coloured flex are then fastened to the pins, fitted with terminals at the other end for connecting to set. Only one negative lead need be taken to each pin and socket, as the two negatives (H.T. and L.T.) are usually connected in half-a-second. Furthermore, when the set has been switched off there are no complete circuits to produce "shorts." Note that the terminal points of the switch must be joined together with wire for the aerial to have a direct path to earth. The G.B. lead from the grid-bias battery plug is brought out through a small hole drilled in the cabinet and joined on to the same place as the H.T., L.T., and earth. Fit a terminal on each side of the switch, as shown in the sketch, so that connections can be made easily. These terminals, of course, must be wired to the switch.—E. ROBERTS (Croydon).

A safety device for connecting and disconnecting battery leads.

An Easily-made Pole Finder

HERE is a useful and inexpensive pole finder. A short piece of glass tubing about ¾in. in diameter is fitted with a cork (or rubber) stopper at each end through which a short length of copper wire has been forced before fitting in the tube. The tube is half filled with a solution made up of phenolphthalein 10 grains (about a pennyworth), sulphate of soda (Glauber Salts) 1on., and about 2oz. of water. Shake the solution before filling the glass tube as only a small proportion of the phenolphthalein dissolves in the water.

A resistance should be placed in series when used on a source of H.T., but voltages up to six may be applied directly across the pole finder. The negative pole will turn the solution around that particular wire a red colour, which will disappear when the solution is shaken.—J. W. D. (Cork).

A Safely Switch

DOUBLE POLE double-throw switch, fastened to the back of a set, can be made to do some useful switching as shown in the accompanying sketch. One switching either connects the aerial to earth and cuts off the H.T., L.T., and G.B. batteries from the set, or disconnects aerial from earth and switches on the programme. No separate aerial-earth switch is needed, neither is any other switch required for switching the set off. Furthermore, when the set has been switched off there are no complete circuits to produce "shorts." Note that the terminal points of the switch must be joined together with wire for the aerial to have a direct path to earth. The G.B. lead from the grid-bias battery plug is brought out through a small hole drilled in the cabinet and joined on to the same place as the H.T., L.T., and earth. Fit a terminal on each side of the switch, as shown in the sketch, so that connections can be made easily. These terminals, of course, must be wired to the switch.—E. ROBERTS (Croydon).

A double-pole double-throw safety switch.

Pick-up Tone Compensator

WHEN using a standard type pick-up on a home-constructed all-mains set, results are often disappointing, due to a hissing sound on high tones and loud passages, along with accentuated needle scratch. The cause of this would at first appear to be due to overloading of one of the valves, but, on reducing the input by means of the volume control, it will be found that this objectionable sound is still present. The condition is most prevalent in resistance-capacitively coupled amplifiers, and is due to reasons other than over-loading. The trouble is due, satisfactorily overcome by the method illustrated. Connect a condenser of 0.006 mfd. capacity between the grid lead on the volume control and the cathode or negative high tension lead. The required capacity will be best made up of two 0.0005 standard fixed condensers in parallel. This modification will result in reproduction of a rich and mellow quality, without serious loss of volume.—H. B. ROCHESTER (Manchester).

Making a H.F. Choke

A VERY useful H.F. choke for use on the short wavelengths from about 12 to 100 metres may easily be constructed from the ordinates usually found in the possession of an amateur. The former on which the wire is wound is made from a piece of old ebonite, 1in. or 2in. thick. This should first be cut into two pieces 2½in. long by 1in. wide, and the edges over which the wire is wound may with advantage be rounded with a file. Next make a mark on each piece 1½in. from the end, which will give the centre position, and with a hack saw make two cuts from one end to the centre to produce "shorts." Note that the cuts being equal to the thickness of the ebonite. Next remove this centre portion by drilling several small holes; it may then be broken off and filed smooth.

Providing the removing of the centre has been done carefully, the two pieces will now fit firmly together as shown in the sketch. Before fitting together, two holes should be drilled, as shown in Fig. 1, to take terminals. The wire for use on this choke should be of a gauge about 36 or 40; in the writer's case the wire from an old car coil was used. Connect one end of the wire to terminal B and then wind on 175 turns and connect the other end to terminal C. The choke may be mounted by a small brass or aluminium bracket, and fixed as shown in the sketch. Fig. 2 shows the completed choke, which has given splendid results on the wavelengths mentioned.—F. N. P. (Ruislip).

Next week's Data Sheet is entitled "Wire and Wire Gauges."
The Erection of a Mast

To many, this means only the digging of a hole, inserting the mast and ramming the soil home. But, with a little forethought and extra labour at the initial erection, considerable time and labour can be saved when the need for renewals or repairs arises. A rusted pulley, broken aerial wire or dirty insulators all necessitate periodical repainting or re-creosoting.

To remove a mast from its foundation is no easy matter, and to obviate this trouble, the following mode of erection, which embodies the facilities necessary for the lowering of the mast will, no doubt appeal to many readers. Assuming that the mast is from 20ft. to 35ft. in length and of average diameter, purchase from the wood merchant two verticals, insert the top bolt, fit nut, and tighten up until the mast is just sufficiently loose to be rotatable. The mast can now be removed, and the completed bearer should be creosoted or tarred. If desired, the bottom half can be chained for the purpose of preservation.

Fixing the Mast Bearer

The mast until the lapse of a few days, to allow things to settle down to normal. The next stage is the fitting of the pulley, aerial cord. It is often found necessary to fit stays to an existing pole, and if the latter is embedded in the ground, considerable difficulties may be encountered before the operation is ultimately completed. In a case where a continuous halyard is in use, the following method of fixing is worthy of note:

Take the mast end of the stay wire, loop round the base of the mast, twist round to form a slip joint (Fig. 2). Bend a small piece of wire to form a hook, and fasten with string to the mast side of the halyard. Support the wire loop by the hook, and gently pull the halyard upwards at the same time relieving the weight of the wire by an upward pressure of the latter. When the required height is attained, a sudden downward and outward pull on the wire

Stay Wires

If time permits, it is advisable to leave the final fixing of the mast until the lapse of a few days, to allow things to settle down to normal. The next stage is the fitting of the pulley, aerial wire, and necessary stays. When this is done, it is only necessary to raise the mast and fix. This should be done as follows: Place the mast between the verticals, insert the top bolt, fit nut, and tighten up until the mast is just sufficiently loose to be rotatable. The mast can now be raised to the vertical position and the second bolt inserted. Now tighten up both bolts firmly. The completed job will give sufficient satisfaction to recompense the owner for the extra time and labour entailed.

(Continued on page 777.)
TONE CONTROL

An Important and Informative Article on a Subject Which Will Interest All Who Are Interested in Reproduction Problems

By F. W. LANCHESTER, LL.D., F.R.S.

THERE is nothing actually new about tone control, but recently it has come very much to the front. Tone control has been exercised by broadcasting stations for many years, but the tone control which is of interest to the owners of receiving sets means something different; it is the same principle applied to the set itself.

Broader stated, tone control consists in a means of varying, the “centre of gravity,” and distribution of the acoustic spectrum, and it commonly involves the provision of a special circuit whose function is to give more amplification to the bass or treble, as called for. That is one way of expressing it, but it would be more true to say that it is a means of giving less amplification to the treble or bass, as the case may be, because the introduction of a tone control circuit can only act by diminishing the gain or amplification of the upper or lower frequencies. Consequently, tone control cannot be made use of with any success, unless the set or amplifier has a great deal in hand which we can afford to throw away. Ordinarily, to justify the adoption of tone control in a set which gives just sufficient volume without it, it is necessary to supply an additional L.F. stage.

For the Gramophone Amplifier

The subject is best approached by a simple example rather than by generalisation. It is well understood that in the ordinary gramophone record, the bass, say, from about middle C downward (c' = 256 frequency), is not recorded at full amplitude, and the lower the tone the more inadequate the amplitude; the result is that with the ordinary mechanical gramophone the reproduction is always deficient in bass; a characteristic imparting to music what is currently termed “gramophone quality.” This may be regarded as a defect in recording, but it affects all kinds of recording, and it is a necessary defect; the reason being that in making a record the spiral spacing of the needle track cannot be varied to suit changes of pitch in the music; it is necessarily constant and is dependent upon the recording apparatus; it has to be such as will give the required length of run (about four minutes for a 12in. record). Thus, the pitch commonly adopted is approximately 1/100 of an inch; it varies a trifle with different records and different makes of record. If the track “band” (measured radially) on a record is 3/4in., then the record will run for 350 turns, and dividing this by 80 (the speed of the turntable) we find the run to be a little less than 4½ minutes. So we appreciate that the spiral pitch of the track must be strictly limited, and since fully half of this is taken up by the needle point, the maximum amplitude of movement permissible is certainly not more than 3/50 of an inch; Fig. 1 represents enlarged the amplitude for c’ (middle C) and the two octaves c and C below, as it should be for equal energy output, and Fig. 2 the amplitude restricted by considerations of recording; c’ (an octave above middle c) is given in both figures.

Actually, for realism, the energy in the extreme bass should be many times that in the treble; the maximum amplitude of the middle, one octave above and below, the C’ string of a ‘cello 66”, the actual amplitude permissible, that is to say, occupying the whole of the available track width. Now comparing Fig. 2 to Fig. 1, the octave below has an amplitude only half what it should be, and for the C two octaves below (the C string of a ‘cello 66”), the track width is only one-quarter of what it should be. In Fig. 1, the amplitudes shown for the 3 Cs are those of equal energy.

Tone Control for High-Power Amplifier

In an amplifier used to illuminate a lecture given by the author of the present article, in the Town Hall, Birmingham, in January, 1929, gramophone records were used exclusively, there being too much interference from trams, etc., to make use of broadcast; a tone-control circuit was devised, the notation used is that of Helmholtz: c, c’ and c” is middle C.

(Continued on page 764.)
To-day the L.F. Transformer is increasingly looked to for assistance in solving the selectivity problem. A nonlinear and not a straight-line type is needed to compensate for the cutting of sidebands in search of selectivity.

Existing systems of variable tone compensation involve some loss of amplification, which handicaps the simpler and more popular types of receivers deriving selectivity from highly efficient tuning coils and considerable reaction. In these simpler sets, however, the compensation required to restore satisfactory reproduction can be achieved without the complications of variable tone control. An adequate degree of fixed compensation can be obtained with the new Varley Compensating Transformer DP.35, which has a rising treble response carefully based on the amount of compensation required by the average simple selective set. Model DP.35 is completely self-contained. Needs no extra L.F. stage, no variable resistances or potentiometers. Costs less than any other tone-compensating transformer.

In 1933 super selectivity will be more than ever necessary. Start the New Year by constructing the “Selectone,” the last word in selectivity in straight detector L.F. receivers.

The “Selectone” incorporates the Colvern TD Coil, which is completely screened and incorporates tapped aerial coupling and reaction.

Four alternative aerial tappings are arranged as sockets with a wander plug. The first two tappings give aerial couplings similar to those normally employed, but with greatly increased selectivity.

Numbers 4 and 5 give a high degree of selectivity with weak aerial coupling suitable for use in a swamp area. There is no break through on the long waveband from B.B.C. stations.

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**COLVERN LIMITED, MAWNEYS ROAD, ROMFORD**
In considering the function of the circuit in Fig. 6, the current rises in proportion to time; at first, strictly so, and later, at a less and less rate tending to a maximum (which is dependent upon the applied E.M.F. and the resistance in circuit), when the current becomes constant. The resistance in the present case is made up of the pick-up winding, the potentiometer resistance, and the chime resistance of the chime block A. The rise of current with time, and its gradual approach to its maximum value, is shown in Fig. 6, the form of the graph being the well-known logarithmic curve.

The essentials of the circuit are the inductance, L, the current rises in proportion to time; at first, strictly so, and later, at a less and less rate tending to a maximum (which is dependent upon the applied E.M.F. and the resistance in circuit), when the current becomes constant. The resistance in the present case is made up of the pick-up winding, the potentiometer resistance, and the chime resistance of the chime block A. The rise of current with time, and its gradual approach to its maximum value, is shown in Fig. 6, the form of the graph being the well-known logarithmic curve.

The inductance of the circuit, and the potentiometer resistance, and the ohmic resistance of the pick-up winding, the potentiometer, and the rheostat knob is the means of tone control, and acts by varying the extent to which these are used.

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January 7th, 1933

PRACTICAL WIRELESS

Receivers and their Records

We shall be pleased to advise readers regarding purchase of complete sets.

When so many makers are devoting their activities to the production of mains operated receivers it is pleasant to know that there exist some reliable battery sets on the market which, offered at a reasonable figure, fulfil the requirements of the man whose house is not equipped with electric current. The "Aerodyne" Screen Grid "3" is one of the most popular models of the range of receivers made by Hustler Simpson and Webb, at their Walthamstow (London, E.17) works. It is, in effect, a highly sensitive instrument embodying a moving-coil loud-speaker, which, as the manufacturer says, "is the latest development of the type, power grid detector and super-power output valve feeding a permanent magnet moving-coil loud-speaker. (Although the receiver is primarily designed for battery operation, it will function equally well when connected to a 250-volt d.c. or a 250-volt a.c. supply.) The receiver is housed in a cabinet of neat appearance; its design is strictly modern, and the general finish leaves nothing to be desired.

All the necessary controls—four in number—have been symmetrically grouped on the front of the cabinet below the loud-speaker grille. The main tuning knob which works the ganged condensers is also incorporated with a separate trimming device which acts as an auxiliary condenser and is of the utmost importance to fine tuning. By this means it is possible to increase the strength of weak signals in conjunction with the reaction and volume controls. The trimmer or compensator is on a spindle concentric with the main tuning knob. Underneath it will be found the combined "on" and "off" and wave-change lever, and three positive positions, namely, "shortwave" (250-500 m.), to the left, "longwave" (1,000-2,000 m.), to the right, and "off" when the point thus marked is uppermost. On the extreme left is the control which provides a variable volume. This is obtained by means of a 25,000 ohm potentiometer working on the bias to the screened-grid high-frequency valve. Finally, the right-hand knob represents "reaction"; it works smoothly and no difficulty was encountered in obtaining good sensitivity whilst keeping the volume at maximum position. Tuning is a knack in tuning a receiver which the beginner must set himself to acquire at the outset, if satisfactory results are to be obtained. This principle applies to all receivers. A search for a transmission is facilitated if the volume control is first set at its maximum position. Tuning is then carried out by means of the main condenser knob or dial, in conjunction with the reaction control. When signals are heard they should be brought up to the required volume by means of this main control, and a finer reading on the scale secured by the concentric trimmer. Reaction must be kept as low as possible; if the mark is over-stepped the set will burst into oscillation and signals are blurred and distorted. If they are too loud, reaction may be further reduced by the appropriate control knob. When dealing with transmissions on neighbouring wavelengths, which require separation, it is better to reduce volume, to re-tune carefully, in particular with the trimmer or compensator, and to increase reaction within reasonable limits. Controls of all receivers, irrespective of their make and design, should be turned slowly if full advantage is to be taken of the selective properties of a circuit.

On test the "Aerodyne" Screen Grid "3" gave a very good performance and a number of British and foreign broadcasts were clearly heard. On the "long" waves, and positions as Mohacs, Eiffel Tower, Daventry and Hirzen could be tuned in easily, but Königs Wusterhausen was not heard; in the latter case the power portion of the coil there appeared to be a break-through of the London transmission, but this occurred only over a small portion of the scale and did not interfere with the above-mentioned broadcasts.

The dial is very clearly marked in degrees, a feature which makes it easy to adopt, as, against readings in actual wavelengths, unless perfectly calibrated, such markings are liable to puzzle the beginner, because if any discrepancy occurs it makes identification of the transmitter a difficult matter.

The "Aerodyne" Screen Grid "3" may also be used for the electrical reproduction of gramophone records. The pick-up sockets are located at the back of the cabinet and it is only necessary to plug in the pick-up leads to obtain the desired result. To avoid, however, the superimposing of radio on gramophone signals, it is advisable to detune the instrument—namely, to make sure that the dial reading does not tally with the wavelength of the local transmission. If volume of reproduction is too great, an external potentiometer control may be adopted. Generally speaking, the Aerodyne passed its tests very satisfactorily. It has been built with care and forethought and the construction shows a good standard of workmanship. The components have been carefully grouped on the metal chassis, and to ensure efficiency, all wiring is carried out under the base plate. The moving-coil loud-speaker gives an excellent quality of reproduction, with a very even response throughout the scale. Speech was crisp and clear, and tone remained natural so long as volume was not injudiciously forced.

"Aerodyne" Screen Grid "3" (Battery) may be strongly recommended as an all-round efficient receiver which, although listed at the reduced price of £9 9s., is capable of giving the listener the choice of a number of British and foreign programmes. The makers, in order to assist beginners in wireless, have issued clear and concise instructions in the booklet supplied with the set, and to facilitate matters, have labelled every single lead in the cabinet which an unskilled person may be called upon to handle.
Mr. Preston, the designer of this interesting receiver

In the first issue of PRACTICAL WIRELESS the Editor kindly invited me, along with my colleagues, to describe my favourite circuit. Since the time of publication numerous queries have been addressed to me (e/o the Editor) asking for further details and practical data in regard to the construction of a set employing the circuit I described. In each case I have been compelled by reason of our rules to ask those querists to wait for a little while, because (I did not tell them this) I was experimenting on a greatly improved version of my original idea. All readers of PRACTICAL WIRELESS are by now well aware of the fact that we absolutely refuse to supply constructional details of any set which has not been made and subjected to the strictest and most rigorous tests in our own laboratories. In no other way can we give an absolute guarantee of the set's performance.

The Selectone, which I am going to describe, started its life on the test bench several months ago as a practical example of "My Favourite Circuit," but in the ensuing time it has grown to full maturity. It has passed through many experimental stages, and even six weeks ago it was a set of which I was proud. But that was not enough; I was determined that before I would present the design to readers of PRACTICAL WIRELESS the set must not only be good, but it must be as near perfection as possible. I should not have prepared this article now were I not confident that the Selectone is better than any other contemporary receiver in its class, and also that it represents a very definite step forward in design and technique.

Perfect Tone Control.

Before telling you just what the Selectone will do let me give an outline of its special features. In the first place the circuit is on the Stenode principle, which means that tuning is so dead sharp as actually to cut off a portion of the sidebands. For this reason the tuner is purposely designed to weaken the higher musical notes, but by using a variable tone control, which can be operated at will by the listener those notes can be restored to any desired extent. The full significance of this feature must be experienced to be fully appreciated; but it ensures that any desired tone from "shrill" to "boomy" bass can be obtained as desired. More than this, however, it makes possible in mild

LIST OF COMPONENTS

<table>
<thead>
<tr>
<th>Item</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Vibranti plywood panel 14in. by 8in.</td>
<td></td>
</tr>
<tr>
<td>1 Utility type W. 181 micro-dial.</td>
<td></td>
</tr>
<tr>
<td>1 Lissen .0005 mfd. condenser.</td>
<td></td>
</tr>
<tr>
<td>1 Colvern type &quot;T.D.&quot; coil.</td>
<td></td>
</tr>
<tr>
<td>1 Lissen 3-point wavechange switch.</td>
<td></td>
</tr>
<tr>
<td>1 Telsen on-off battery switch.</td>
<td></td>
</tr>
<tr>
<td>1 Wearite type &quot;G.C.O.&quot; radio-gram switch.</td>
<td></td>
</tr>
<tr>
<td>1 Lissen 5,000 ohm. potentiometer.</td>
<td></td>
</tr>
<tr>
<td>3 Eddyson chassis mounting valveholders.</td>
<td></td>
</tr>
<tr>
<td>1 T.C.C. .0002 mfd. fixed condenser.</td>
<td></td>
</tr>
<tr>
<td>1 Dubiller 3 megohm grid leak.</td>
<td></td>
</tr>
<tr>
<td>1 Dubiller grid leak holder.</td>
<td></td>
</tr>
<tr>
<td>1 Telsen Standard H.F. choke.</td>
<td></td>
</tr>
<tr>
<td>1 Benjamin Transfeeds.</td>
<td></td>
</tr>
<tr>
<td>1 T.C.C. 2-mfd. condenser.</td>
<td></td>
</tr>
<tr>
<td>1 Varley Rectatone transformer.</td>
<td></td>
</tr>
<tr>
<td>1 Belling Lee baseboard fuseholder with 60 m.a. fuse.</td>
<td></td>
</tr>
<tr>
<td>10 Belling Lee &quot;Junior&quot; terminals each marked A, E, L.T.+, L.T.-,</td>
<td></td>
</tr>
</tbody>
</table>
SELECTONE

BATTERY SET

in Conception, in Design and in Performance

PRESTON, F.R.A.

cases the complete elimination of heterodyne whistles created by stations working on adjacent wavelengths. This latter is impossible with any ordinary receiver unless fitted with a special whistle filter.

Variable Selectivity

Tuning is perfectly sharp, so that no station (even if it is situated a few miles from your aerial) will occupy more than two or three degrees on the special micrometer tuning dial. The Selectone is not merely highly selective, however, but the degree of selectivity is under full control, and can be altered to suit any and every set of conditions. The extreme selectivity ensures a silent background and real enjoyment of the programme being received. On the long waves, Daventry, Zeessen and Radio Paris can all be received separately, even though the frequency separation of the two former stations is only 4 kilocycles, or insufficient to permit of their separation with a band pass tuner. Such stations as North Regional—Langenberg, Midland Regional—Bucharest and North National—Hilversum on the medium waves can be separated with ease, whilst even Mülhacker and London Regional can be received clear of each other by a slight sacrifice of the higher frequencies.

Sensitivity

Most highly selective receivers, except those using a large number of valves, are not particularly sensitive, but that cannot be said of the set under review. During the first test of the final model (at least four others were made during the experimental period) forty-two stations were well received at good speaker strength when using an outside aerial of 70 ft overall length. Reducing the length to 40 ft. had very little effect, and even when the set was transferred to a poor indoor aerial running round the picture rail of a downstairs room, no fewer than twenty-five stations could be brought in at good programme strength. As the tuner covers a range of from under 200 to just over 500 metres in the medium-wave position, and from about 850 to 2,000 metres on the long waves, practically every worth-while European and American station is covered. It will be of interest to would-be constructors to learn that a few hours after completion the Selectone brought in two American medium-wave stations, KDKA on 306 metres and WGO on 370.5 metres, at fair speaker strength, even though the time (Greenwich) was only 1 a.m. Such popular Continentals as Pécamp, Bucharest, Hilversum, Rome, Mülhacker, Moscow and Radio Paris can always be relied upon to provide really good loud-speaker signals at any time of day or night. As a matter of fact a short test during the afternoon enabled me to obtain good reception of...
a dozen foreigners. I will say no more at this juncture about the actual stations received, but will leave that matter for a later article in which I will give a more complete log and figures in relation to dial readings.

**Loud Speaker Quality**

The quality of reproduction will meet with the approval of the most fastidious of music lovers, whilst the fact that the actual tone can be varied will be keenly appreciated, whether your taste lies in the direction of jazz, chamber music, brass bands, plays or talkies—high-brow or low-brow is equally well catered for.

**Provision for a Pick-up**

Yes, I have made provision for a pick-up, and the quality of gramophone reproduction is just as good as that of radio programmes. The tone control is also operative on gramophone music and, in addition to its normal function, it can be employed as a scratch filter, so making it possible to eliminate needle scratches. The pick-up is brought into circuit by the action of a switch mounted on the front panel, so there is no need to probe about inside the set to effect the change-over.

**Appearance**

Both from inside and out the Selectone looks as good as it is. The clean layout and use of a box-form chassis make the interior "look good," whilst the Cameo cabinet, designed specially for this set, is of particularly handsome and attractive appearance; in fact, I can honestly say that the photographs do not do justice to it.

**Safety**

I must not forget to add that a safety fuse is provided, so that it is impossible to damage either the valves or components by making a wrong connection.

**Not an Expensive Set**

After reading the above introductory remarks you may have drawn the conclusion that the Selectone is going to cost rather a lot to build. I would not go so far as to say it is a "cheap" set, but it is definitely not expensive. Considering that it gives results equal to most super-heterodynes, and better than many of them, its cost is distinctly reasonable. You will see from the list of components that the price of the bare set is approximately £4 10s. Od., in spite of the fact that really high-grade and modern components are specified.

**Low Running Costs**

Reasonable cost is not confined to the building of the set though, because running costs are, in proportion, even lower still. The consumption of high-tension current is no more than 7 milliamps when using a 108-volt H.T. battery, or 10 milliamps with a 120 volts high tension. Filament current consumption is 4 amp., and so the 30 ampere-hour accumulator will give about 75 hours' running per charge. If you have a H.T. eliminator, even of the smallest type, it will be quite suitable for this set, because adequate decoupling is provided, and only a single H.T. positive tapping is required.

**Ample Loud Speaker Output**

When using the valves specified, in conjunction with a 108-volt high-tension battery, the Selectone has a maximum undistorted output of about 110 milliwatts, with a 120-volt battery the output is 140 milliwatts. If desired the undistorted output can be brought up to 170 milliwatts by increasing the H.T. voltage to 150, but this will not be necessary unless the set is to be used in a very large room. For the benefit of those readers to whom the above figures have no significance it should be explained that an output of 100 milliwatts is sufficient to give really good volume in an average sized drawing-room when using a sensitive moving-coil speaker of the type specified.

For "Old Hands"

The Selectone will have a particularly strong appeal to "old hands" who are tired of reading descriptions of so many sets which are obviously mere modifications of those they have been building for years. The new principles, up-to-date constructional methods, de luxe features, really sensible and easily-calibrated tuning dial and businesslike appearance are just a few of the things that will at once be recognized. In addition they will be pleased to have a set with which the number of stations receivable varies in proportion to the skill of the operator. By skilful use of the reaction control the range of reception is truly unlimited.

--- And Beginners

But the beginner will also find the set just to his liking. Its method of construction, combined with the complete wiring charts, sketches and photographs to be given next week, will be found so simple and straightforward that the veriest tyro need not hesitate to build the Selectone with full confidence of success. Although as pointed out in the last paragraph, the results vary in relation to the skill of the operator, I have proved that a person without any experience of receiver operation can bring in a goodly number of stations by the mere process of revolving the tuning knob. As a matter of fact, I recently asked an oldish lady to see what she could do with the Selectone, after I had connected the batteries. The test was made during the evening on an 80-foot aerial situated some twenty miles from the North Region transmitters. She did not attempt to use the reaction control at all, and yet was able to bring in eleven stations on the medium waves and four on the long. The tuning of each of the Northern stations spread over less than four degrees, and neither station could be heard in the slightest degree when the set was switched over to long waves. That, I think, is wonderful proof of the Selectone's capabilities!
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SPECIALY RECOMMENDED BY DIRECT RADIO AS THE IDEAL RECEIVER FOR THE FAMILY MAN. GIVES LIFE-LIKE QUALITY REPRODUCTION WITH THE EPOCH TWENTIETH CENTURY MOVING COIL SPEAKER.

**RECOMMENDED ACCESSORIES**

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Description</th>
<th>Price</th>
<th>S. D.</th>
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<tbody>
<tr>
<td>Bells &amp; B. Battery</td>
<td>120 volts</td>
<td>2 6 9</td>
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<tr>
<td>Standard G.B. Battery</td>
<td>1 0 0</td>
<td></td>
<td></td>
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<tr>
<td>&quot;Cop&quot; Aerial and Lead-in Tube</td>
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<tr>
<td>Selectant Jumbo Antenna</td>
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<tr>
<td>Epoch Twentieth Century Perm. Mirror Station Wiring Coil</td>
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<tr>
<td>Atlas A.C. 324 Eliminator</td>
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<tr>
<td>Atlas A.C. 302 Eliminator with Talk-Charge</td>
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</table>

**Specially Recommended**

Block L.T. Accumulator, 2 volts, 80 amp. hours, 11/6.

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(c) I enclose first deposit of

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**ADDRESS**

PROC. W. 771229

**DISCRIMINATING SET BUILDERS INSIST ON A DIRECT RADIO SPECIFICATION**

**BUILD THE SELECTONE FOR QUALITY REPRODUCTION**

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
<th>Price</th>
<th>S. D.</th>
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<tbody>
<tr>
<td>1</td>
<td>Plywood Panel, 14in. by 10in.</td>
<td>1 0 0</td>
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<td>1</td>
<td>Utility Standard 0005-mfd. condenser, with W/8 Micro-dial</td>
<td>2 6 10</td>
<td></td>
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<tr>
<td>1</td>
<td>Ready Radio 00015-mfd. differential condenser</td>
<td>1 0 0</td>
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<tr>
<td>1</td>
<td>Colvern type &quot;T.D.&quot; Coil</td>
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<tr>
<td>1</td>
<td>Ready Radio 3-pnt. wave change switch</td>
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<tr>
<td>1</td>
<td>Uffol battery switch</td>
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<td>1</td>
<td>Wearite type &quot;G.G.O.&quot; Radiogram switch</td>
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<td>1</td>
<td>Wattad 5,600 ohm Potentiometer</td>
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<td>1</td>
<td>City Chassis Mounting Valve holder</td>
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<td>T.C.C. 0022-mfd. fixed condenser</td>
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<tr>
<td>1</td>
<td>Doblher 1-megohm Grid Leak</td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>Grid Leak Holder</td>
<td>6 0 0</td>
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<tr>
<td>1</td>
<td>Hardy Radio Standard H.F. choke</td>
<td>1 6 10</td>
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</tr>
<tr>
<td>1</td>
<td>Benjamin Transflect</td>
<td>11 6 10</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>T.C.C. 2-mfd. condenser</td>
<td>1 0 0</td>
<td></td>
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<tr>
<td>1</td>
<td>Valve Rottstone transformer D.P.53</td>
<td>15 0 0</td>
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</table>

1 Billing Lee Bassboard 
2 Frameholder, with 10 m.m. fuse 
5 Ohmite strip, 10m by 15m. 
6 Bulgin G.B. Battery clip 
7 Coil Connecting Wire 
8 Length Res, screw, etc. 
9 5-ply baseboard, 10in. by 20in. 2 pieces hard wood, 15in. by 15m. by 15m. 
10 159 Walnut Cabinet 
11 Valves to specification 
12 Calibrator Easy Station Finder (no charge) 

**KIT MODEL No. 1**

<table>
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<tr>
<th>Component</th>
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<th>S. D.</th>
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<tbody>
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<td>(less valves and cabinet)</td>
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<td>2 0 0</td>
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<tr>
<td>or 12 monthly payments</td>
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**KIT MODEL No. 2**

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<td>(valves and cabinet)</td>
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<td>5 4 9</td>
<td></td>
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<tr>
<td>or twelve monthly payments of</td>
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**KIT MODEL No. 3**

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<tr>
<td>(valves and cabinet)</td>
<td></td>
<td>6 4 9</td>
<td></td>
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<tr>
<td>or twelve monthly payments of</td>
<td></td>
<td>11 6 0</td>
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**KIT MODEL No. 4**

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<tbody>
<tr>
<td>(valves and cabinet)</td>
<td></td>
<td>15 6 0</td>
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**RECOMMENDED ACCESSORIES**

- Sommer B.T. Battery 120 volts
- Ollowin R.T. Accumulator
- Thames G.B. Battery
- "Cop" Aerial and Lead-in Tube
- Selectant Jumbo Antenna
- Epoch Twentieth Century Perm. Mirror Station Wiring Coil
- Atlas A.C. 324 Eliminator
- Atlas A.C. 302 Eliminator with Talk-Charge

**SPECIALY RECOMMENDED**

Block L.T. Accumulator, 2 volts, 80 amp. hours, 11/6.

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**DISCRIMINATING SET BUILDERS INSIST ON A DIRECT RADIO SPECIFICATION**
CAN YOU READ A GRAPH?

FRANK PRESTON, F.R.A., here explains in straightforward language the advantages and use of graphs of the types frequently employed for wireless purposes.

As you have observed, graphs are employed very frequently in wireless work and provide a simple means of supplying a large amount of data in what might be called tabloid form. Immediately you open a valve carton you find inside a graph showing the characteristics of the valve; when buying a transformer you are often supplied with a graph which shows its response to various frequencies; every week in PRACTICAL WIRELESS you will find on the page devoted to "Receivers and their Records" a graph showing the character-istics of the valve; when buying a graph for a receiver. You can find the ratio of an output transformer suitable for various combinations of loud-speakers and valves. But I need give no more examples—you know the kind of diagram I refer to. What do all these graphs mean to you; can you understand them and use them to the best advantage? I know perfectly well that many readers fight shy of graphical diagrams because they look uninteresting and perhaps a little "highbrow," if I may use that much overworked word. Believe me, they are neither, if you will spend about half an hour in consider-

Fig. 1.—This graph shows the relationship between voltage drop and current for a 5,000 ohm resistance.

Fig. 2.—A typical tuning curve.

Fig. 3.—A "grid volts—anode current" curve of power valve.

Fig. 4.—Load current for a half-wave rectifier.
vanes with the grid bias voltage. The graph of Fig. 3 is that supplied by the makers in relation to a typical small power valve.) In this case three curves are drawn on the same graph to represent the conditions existing at three different anode voltages. Besides showing how much anode current the valve will consume, the graph can be employed to find the correct grid bias voltage for different anode voltages and also the power handling capacity of the valve. Space does not permit of my entering into the theory of valves here, but it can be explained that to produce distortionless amplification and to prevent overloading, the valve should always be worked on the part of the “curve” just above the lower bend. Thus when 100 volts H.T. is used the correct G.B. voltage is approximately 7.5 and at these voltages the anode current consumption will be about 4 milliamps. In the same way it will be seen that when 150 volts high tension is used, the correct grid bias voltage is about 12 and the anode current rather more than 6 milliamps.

**Rectifier Output**

Another use for a graph is to show the voltage output of a rectifier under varying conditions of current load. Fig. 4 shows the “load curves” for a half-wave rectifying valve when fed from three different transformer voltages. It will be seen that when 200 volts A.C. is applied to the rectifier the output voltage is 290 with a load of 10 milliamps, or 170 volts with a load of 75 milliamps (the maximum for this valve). The graph enables us to see at a glance what the output voltage would be at any particular current load. This information is invaluable when designing an eliminator or mains receiver because it enables us to calculate with certainty the correct values for the various H.T. fed resistances.

**Curve Shape**

Quite apart from obtaining accurate numerical data a good deal of information can often be gained merely by studying the shape of the curve. As an example of this I would ask you to examine the graph of Fig. 5 (A) which shows the response of a tuning circuit to different frequencies. The zero position on the horizontal scale represents the frequency of the carrier wave of a station and the figures on each side refer to the frequency of the side bands or musical notes impressed on the carrier wave. It will be seen that although full response is given to notes of low frequency, the response to high frequencies falls off very rapidly. The curve tells us that the circuit under review tunes very sharply and cuts off, or gives little response to the higher musical frequencies. In consequence, it will provide excellent selectivity, but must be followed by some kind of tone-correction device if good reproduction is required. Now compare the graph of Fig. 5 (A) with that of 5 (B). The latter obviously represents a flatter-tuned circuit which would be unselective but would give practically an even response to all musical notes.

**Voltage Amplification**

Another kind of graph, of which the shape of the curve is most instructive, is that which is used to show the percentage amplification afforded by a low frequency transformer at various musical frequencies. Fig. 6 is a typical example of a percentage amplification-frequency curve and shows us that this transformer represents gives practically uniform amplification to all frequencies from about 150 cycles per second to just over 2,000 cycles. Below 150 cycles the amplification falls off rapidly, whilst the same thing occurs above 2,000 cycles. There is a “peak” at 4,000 cycles, and therefore notes round about this frequency will be emphasised to a certain extent. The curve is fairly representative of an average low-priced L.F. transformer.

It will be noticed that the scale of frequencies is graduated so that the lower frequencies are more “spread out” than the higher ones; this arrangement is generally employed in connection with musical notes since it gives a better representation of performance at the frequencies most commonly employed.

**Pick-Up Response**

And now it will be interesting to compare Fig. 6 with Fig. 7. The latter is the response curve for a good up-to-date gramophone pick-up. The response to frequencies between about 100 and 2,000 cycles is more or less uniform, but the curve “rises” below 100 cycles and falls gradually above 2,000 cycles. A pick-up with characteristics such as these would make it possible to obtain an almost equal (loud-speaker) volume from all sound frequencies because the lower frequencies are of necessity attenuated (reduced in intensity) by the process of recording.

**For the Practical Man**

It would be impossible in a short article such as this to refer to every kind of graph, but it is hoped that sufficient has been said to enable every reader to give a correct interpretation to those that are in common use. Remember that, although graphs are often prepared by the technician and theorist, they are intended for use by the practical man, and it is he who benefits most by them.
THE SIMPLEST WAVEMETER

A Practical Article on the Construction and Use of an Absorption Type WAVEMETER. By K. E. BRIAN JAY

Fig. 1.—A closed circuit as used in the absorption wavemeter.

WAVEMETERS, or frequency meters as we ought to call them in these days, are of two kinds, heterodyne and absorption. The difference between them is this : the heterodyne type puts a signal of known wavelength into the receiver, while the absorption type takes power out of the receiver at a known wavelength. The first kind will obviously be elaborate, since it must contain the means of generating a signal ; older types used a buzzer for this purpose, but were not very accurate; the modern instrument, the true heterodyne type, employs a valve which, acting as an oscillator, generates a signal that sets up a beat note in the receiver. Heterodyne wavemeters can be very accurate, but are unnecessarily complicated and expensive, for such purposes as the ordinary listener requires them.

Absorbing Type WAVEMETER

The absorption type, on the other hand, combines reasonable accuracy with cheapness, and a simplicity that is unusual in radio apparatus. It consists merely of a coil and variable condenser. The size of the coil is not particularly critical : as a guide to making it at home, 25 turns of 20 D.S.C. wire wound on a cardboard tube of 2½ins. diameter were found to tune from 239 metres at 118 degrees to 408 metres at 118 degrees. Corresponding readings of 72 degrees and 170 degrees were obtained with a 0.0003 mfd. condenser, which would therefore require a larger coil to cover fully the medium waveband; probably 70 to 75 turns would suffice for most purposes, any gauge of wire between 24 and 30 being suitable for either coil. A commercial unscreened dual-range coil would do quite well, and cover the long waves in addition. Whichever type of coil is used, however, it will be necessary to put on L2 oneself. On the medium broadcast band about 8 turns wound close to one end of the coil should do, but on the long waveband more may be needed. This is a matter for individual experiment, the aim being to obtain as marked a reduction of signal strength as is possible, compatible with sharp tuning on the meter. To find out whether the coil L2 is of the right size, if it is home-made, tune the receiver to a station as near the bottom of the broadcast band as possible, and adjust the wavemeter to resonance ; the wavemeter dial reading will then be zero, say, 20 to 30 degrees for Fecamp on 223 metres. Do the same for a station, such as the North Regional, near the top of the band ; in this case the meter reading must be around 160 degrees. As long as the whole waveband is within the wavemeter dial all is well. If the shorter wave station is at 217 degrees, however, the coil will be probably too small; if no resonance point at all can be found for it, and the longer wave station is around 100 degrees, the coil is too big.

Calibrating the Instrument

We have now to calibrate our instrument, by no means a difficult operation despite its great importance. All that has to be done is to tune in as many reliable broadcasting stations of known wavelength as possible, and adjust the wavemeter accordingly to resonance with each, and note its dial reading and the wavelength of the station. The

Fig. 2.—Using a small external coil for coupling the meter.

Fig. 3.—The tuning graph for calibration.

Fig. 4.—A practical adaptation of the wavemeter.
B.B.C. stations will give a useful nucleus of points, and there are several high-power foreigners who will be audible on most sets. A graph is then plotted on squared paper as in Fig. 3, wave-meter dial readings being marked along the bottom and wavelengths up the left-hand side.

The wave-meter can then be used to assist in identifying an unknown station. Suppose such a station is heard, the meter is coupled up to the receiver, and the knob turned until the signal strength is suddenly reduced. The condenser setting of the meter is then compared with the graph, and the wavelength read off. From one of the published lists of broadcasting stations the transmission nearest to this wavelength is found, and the station identified quite easily. If it is desired to search for a certain station the meter is set to the appropriate wavelength, and the receiver tuned until there is a sudden falling off in background noise: the meter is then de-tuned.

This type of wave-meter is particularly useful on short waves, but in this case a rather smaller variable condenser is desirable. For example, a .003 mfd. condenser, together with a coil of 3 turns of 22 S.W.G. enamelled wire wound on a 2½ in. former, will tune from 18 metres at 30 degrees to 50 metres at 180 degrees, and this is as wide a range as is comfortable. The same range is covered in less than 90 degrees with the same coil and a .0005 mfd. condenser, resulting in very cramped tuning; hence the smaller condenser is to be preferred. Coupling to the receiver is by a single turn of wire in the aerial lead. The most definite indication of resonance is obtained with the set just oscillating; at the resonant point it will stop oscillating with a click, and the coupling between meter and set should be such that the receiver stops and re-stars oscillating at practically the same point on the meter.

An “All-Wave” Meter

We have seen that a .0005 mfd. condenser, as used for tuning on the broadcast band, is too big for short waves, but in spite of this the wave-meter can be arranged to cover both long and short waves quite easily, by coupling a fixed condenser in series with the variable condenser, and so reducing its capacity to a value suitable for short waves. Fig. 4 shows such an “all-wave” meter. C1 is the .0005 variable, and C2 a .0005 mfd. fixed condenser; the total capacity of the combination is .000025 mfd., which will do for short waves. L1 and L2 are wound on the same former and arranged to plug in; ordinary six-pin formers could be used if they are available. Should it be felt that with .00025 mfd. tuning will still be unduly cramped on short waves, and there is no objection to using two or three coils, the effective capacity of C1 can be reduced still further to about .000017 mfd. by making C2 .0005 mfd. This will make the meter easier to tune, but several coils will be necessary. With the switch S1 closed C2 is shorted out, and the whole .0005 mfd. becomes available for use on the broadcast band. Great care must be taken to keep the wiring of the meter, especially to S1, quite rigid, or the calibration will not hold properly. On either waveband the meter may be left permanently in circuit. Deadspots can be avoided by de-tuning the meter or else cutting it out of circuit by a switch such as S2, arranged as in Fig. 4.

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SHORT-WAVE TUNING
By E. JOHNSON

There is no basic reason why the normal broadcast receiver should not be used for short waves if provision is made for reducing tuning capacity. In passing it need hardly be said that every attention must be paid to wiring and lay-out. Long straggling leads which pass muster on broadcast waves definitely will not do on short waves. Short and direct well-soldered connections are the way to success. Fortunately it is very simple to reduce our tuning capacity. All we need is a .0002 fixed condenser in series with our main tuning condenser. If the latter is the conventional .0005 mfd., our resultant tuning capacity is actually .00014 mfd., a value sufficiently near the one recommended above. Of course, a shorting switch must be fitted to cut out the fixed condenser when normal broadcast wave reception is desired. Fig. 1 will make this quite clear.

Fig. 1.-Method of switching to reduce value of tuning condenser.

The above method is very popular, but in the writer's opinion has rather a serious objection, viz., the switch. The ideal switch should have a negligible resistance in the closed position, a virtue seldom realized in practice. In any case switching in high-frequency circuits (especially ultra-high frequencies), is always a seat of loss. There is yet another drawback. Many short-wave sets are prone to body-capacity effects, i.e., the approach of the hand to the tuning dial entirely upsets tuning. Where the tuning capacity is small, especially at the lower dial readings, body-capacity troubles are usually noticeable because their extraneous capacity is a comparatively large proportion of the whole. A very simple way to overcome this, and one which has much to recommend it in another respect, seems at first sight contradictory to the first part of this article. In short, a .0005 mfd. tuning condenser is used with a .0001 mfd. in parallel. The large condenser is termed a band-setting condenser and is really not used for tuning-in at all. The procedure is as follows: Points are marked on the band-setting condenser corresponding to 20, 30, 40, 50, and 60 metres; the necessary stations must, of course, be tuned in for rough calibration. If we desire to search around 30 metres, therefore, all we have to do is set our band-setting condenser to 30 metres and do the actual searching and tuning on the small condenser which will only have a tuning range of 20-30-40-50-60 metres: thus making the handling of the set every bit as easy as on the broadcast waves. Another great advantage is that our body is known all the time as a very small part of the main circuit capacity, and therefore has extremely little effect on the tuning.

Tuning coils need very little comment. Bare wire is the best, with as little dielectric as is compatible with mechanical strength. Regarding aerial coupling there is little doubt that a neutralizing condenser of low-minimum capacity in the lead to the receiver is the best solution, and simplifies matters by eliminating an extra coupling coil. Many new-comers worry because below 20 metres it is difficult to make the set oscillate without reducing aerial coupling to a low value. Here and now it may be said that there is no need to be upset about this. On 10 metres the writer has known all the necessary aerial coupling to be obtained by merely dangling the aerial near the set. It seems that the lower one goes in wavelength the less necessary an aerial is, and, in fact, it seems quite likely that when these new micro waves are fully explored, aerials may be entirely dispensed with. After all, light is only a form of radio wave of extremely short length, and it would certainly seem ludicrous to find our street lamps complete with aerials to ensure proper illumination. This is certainly a case of reducunt ad absurdum, but it illustrates the point.

MAKING IT OSCILLATE
By B. K. COOPER

OSCILLATION, the bane of the broadcast listener, in the short-wave enthusiast's necessity. Owing to the very small input of energy from the aerial to the grid of a short-wave detector, the valve must always work at maximum sensitivity, on the threshold of oscillation, in fact. Probably the first effect noticed by the new-comer to the short waves on trying out his receiver is that the reaction control is
ineffective at certain settings of the tuning dial. Even with the condenser at maximum, no oscillation can be produced, and the set seems dead, except, perhaps, for faint murmurs from the very high-powered telegraphy stations. These "dead spots" are most likely to be encountered in sets of the simple detector and low-frequency type. Those employing a screen-grid high-frequency stage are usually free from them.

**Aerial Damping**

The dead spots arise from the "damping" effect of the aerial, and this is brought about in two ways. Firstly, there is the damping of a long aerial. This very often manifests itself by the set refusing to oscillate at all on the really short waves, say, from twenty metres downwards. It is often in evidence, too, at the top end of the condenser scale with certain coils, when higher reaction settings would have to be used in any case.

To make an aerial effectively shorter, hence to reduce its damping, it is only necessary to couple it more loosely to the set. Most short-wave receivers include a very small variable condenser for this purpose in series with the aerial. Alternatively, the lead from the aerial terminal to the aerial coil is flexible, and provided with a tapping clip so that it can be connected to any portion of the coil found to give sufficiently loose coupling. Quite often both these schemes are employed, and it may be found that to make the set oscillate right down to fifteen metres or so, it is necessary to tap the aerial on to the coil at a point only half a turn away from the earthed end, and at the same time to reduce the setting of the series condenser slightly from its maximum.

It should be remembered that the more loosely the aerial is coupled to the set, the less volume will be given on all stations. You may find a very loose coupling that lets the set oscillate on every wavelength within its range, but do not leave it at that. Always work with as tight a coupling as you can, and do not grudge the little trouble you may have to take in finding the tightest practicable coupling you can employ on every station. Remember, tightest coupling and greatest volume, provided the set can be made to oscillate, are given with the aerial series condenser "all in," and the tapping clip at that end of the coil which is connected to the grid of the detector.

**Eliminating "Dead Spots"**

Even a short aerial will cause damping effects when its natural wavelength, or a harmonic thereof, coincides with the wavelength to which the set is tuned. "Dead spots" arising from this effect only extend over a few degrees on the dial, and conditions are normal on both sides of them. They can be shifted by making the aerial effectively longer, a proceeding that does not reduce volume. Try connecting a coil of thirty turns or so, wound on a former in series, with the aerial. Even a rather longer wire between the lead-in terminal and the set will sometimes be effective.

Damping may also be caused by long or carelessly-arranged leads in the wiring of the set. Every wire in the detector stage should be as short as possible. The coil holder, valve-holder, and grid-condenser should be spaced so that there is the smallest possible distance between those of their terminals that have to be connected to one another. Keep the leads to the variable condensers short as well, and see that they are well spaced.

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TONE CONTROL
(Continued from page 764)
equal amplitude. And the fact that the recording instrument does actually reduce the amplitude below middle C to a constant, means that the recording instrument does differentiate the "graph" for these low frequencies when engraving graphically. The record must be restored by integration, this means that the graph of Fig. 10 is converted into Fig. 9 by the tone control circuit, and the bass is restored, giving equal energy of.

Since the upper acoustic frequencies—above middle C—are recorded direct, and not differentiated, it would not be satisfactory to integrate everything that comes over; the object of the Resistance R (Figs. 2, 3, and 4) is to by-pass some of the E.M.F. from the pick-up, so that the signal received by the grid of the first valve, through the potentiometer, is in partintégrative and in part direct.

A Question of Harmonies
There are several little points that require explanation. The reason the zig-zag has been chosen for illustration is in order that the original and differentiated graphs should be different in appearance. If a sine curve be differentiated the result is another sine curve, out of phase with the first; the differentiation reduces sine curves of different frequency, but of the same energy value to the same amplitude, as with the zig-zag. This is shown in Fig. 11, but the contrast is not so striking. The zig-zag is justified by the fact that it is the type of trace made in the graph for.

The zig-zag has rounded angles, as shown in Fig. 11. If it were not for this the differentiated curve would be absolutely square at its corners, and the needle could not follow the track.

To appreciate the acoustic theory the differentiated curve of Fig. 10 differ so strikingly from the original zig-zag, Fig. 9, that it is a matter for wonder how the record sounds as true as it does when used with the ordinary gramophone.
Interference from Electrical Apparatus

Mercury at varying low temperatures, and famous scientist—Dewar, I believe—tried it. This was mercury, which, as you may know, becomes solid at low temperatures.

When some machines were cooled far below zero, and among these were cooled far below zero, and among these were cooled far below zero, and among these machines, as to cause them to liquefy. By using these machines, as to cause them to liquefy. By using these experiments, it was reasoned that if an absolute zero could be obtained a metal in this state would possess no resistance at all.努

Conflicting opinions arose and many great minds expressed the opinion that a resistance-less metal even at low temperatures was only a dream about on a par with perpetual motion. I see, however, in the pages of one of our scientific reviews that the subject has been worked upon by a noted British professor, who has been engaged on a series of experiments dealing with the super-conductivity of metals, as it is called.

Metals have been cooled by means of liquid air, hydrogen, and helium, and the scientist has found that at temperatures around absolute zero—273° Cent.—mercury offers no measurable resistance to a current. A ring of metal was made, super-cooled by liquid gas, and a current was started in the ring. It was found that the current would flow indefinitely as long as the supply of liquid gas lasted, and a demonstration of this experiment was made before the Royal Institution during the past summer. This ring was immersed in liquid helium and was carried in an aeroplane several hundred miles. When the current in the ring was measured before the Institution some six hours later it was found that the original current of 200 amperes was still flowing undiminished. For supply engineers and all engaged in the distribution of electrical energy in any form or other have watched the experiments with interest, as it can be imagined the possibility of carrying heavy currents over quite fine wires is attractive, to say the least of it. Further developments may be expected along these lines, as methods of making the system commercially possible are being explored as far as practicable.

Resistance-less Metal

Just as the greater proportion of the power expended in moving any self-propelled vehicle is spent in overcoming wind-resistance, so is the larger part of electrical energy in any circuit used in overcoming resistance. Of course, in our radio sets we deliberately fit certain resistances for purposes peculiar to the circuits, but it is obvious that a resistance in series with any current, is wasteful, and, strangely enough, the less resistance we insert in the flow of current the more will be available to overcome the resistance of the work to be done on the job, whether it be the heating up of a valve filament or in driving an electric motor.

Some years ago—toward the end of the last century—a method was found of cooling certain gases to such extremely low temperatures as to cause them to liquefy. By using these liquefied gases various objects and metals were cooled far below zero, and among these was mercury, which, as you may know, becomes solid at low temperatures. A famous scientist—Bewar, I believe—tried the effect of passing a current through the mercury at varying low temperatures, and found that the lower the temperature the less the resistance of the metal to the current passing. It was thus reasoned that if an absolute zero could be obtained a metal in this state would possess no resistance at all.

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Interference from a Neighbouring Set

LITTLE while ago I came across a genuine case of interference between sets belonging to two neighbours. I had often heard of such instances, but had never come across one myself, with the result that while I appreciated such a position might be possible, I do not think I realized just how serious such interference might be. In this case it certainly was serious, for at times one set seemed to blank out everything for the other next door, and only when both sets were tuned to the local station, or the long-wave Daventry, could reception be said to be worth listening to. Luckily the neighbours were quite good fellows, and were both open to reason, which was just as well, as for either of them anything approaching distance work was impossible when the other set was working. Anyway, we settled the problem by persuading the man with the most powerful set to use an indoor aerial until radial alternations could be effected to both of their outdoor aerials, which, incidentally, ran parallel to each other at about only seven feet apart. If you are troubled in this way it is a good plan to first of all try altering your earthing system. If the other fellow uses a water-pipe earth, try a natural or buried earth, or vice versa. If this does not make sufficient difference, pay attention to your aerial, and try and arrange yours or, preferably, his as well so that they are as far apart as possible, and not running both in the same direction. Again, it is a good plan to try an indoor aerial on your set. Selectivity is sure to improve, and volume does not always fall off to the extent that is often expected, especially as more often than not with a modern set much of the latter can be sacrificed without much loss. An indoor aerial can be placed around the picture-rail, it being assumed, of course, that good insulated wire be used; or you could arrange for one of these to be sold for the purpose across the room from corner to corner. This might be considered unsightly, but during the festive season, at any rate, paper decorations could be hung from it without impairing reception to any great extent; in fact, for party purposes, or for operating short sets in village halls and the like, this is an ideal system. The ideal indoor aerial would be a vertical wire, and while this is not always a mechanical possibility, I have seen aerials taken up to an attic by means of the stair-case well, the wire being neatly attached to the banisters, and once I saw such an aerial pulled up a lift shaft. With the latter, however, the steel framing of the lift and the building shielded to a great extent the incoming signals.

Possibilities of the Quartz Crystal

It is encouraging to remember that constantly a band of scientists are working to improve the lot of the radio amateur. I refer again to the work being done at the National Physical Laboratory in collaboration with the Radio Research Board, which, of late, has been on the lines of research into interference problems. The study of the behaviour of the quartz crystal used in a resonant circuit has been occupying the time of several of these workers, and it is believed that a new principle of "ultra-sharp" reception will be developed with the view of separating near-by transmissions. That there is a need for such a principle is self-evident, as you have only to touch the knobs of any valve receiver to find this out for yourself, and the problem of station interference is the greatest we have yet had to face.
Potato as a detector in your crystal days may now scratch your heads, but please note I am aware that a potato is not a fruit—or is it?

Public Address System

Many of the large stores in London and other cities are now appreciating the possibilities of a public address system, and the Marconiophone Co. are busy fitting up several such department stores with an amplifier installation. S O S calls can be put through, and advice relating to the control of traffic through the stores given out. Samples of soil have been contained in a condenser, and from the measurements of the effective capacity and resistance of the condenser the specific conductivity and dielectric constant of different soils can be determined. It is proposed to measure soils falling into well defined classes from different localities, and the results will be tabulated and placed upon a definite quantitative basis. In this way a standard set of measurements will be available, and each kind of soil will have a certain number of units of efficiency. This is good work, and will enable us to form some idea as to the best locality for transmission and reception. Also the results will enable you to roughly judge the efficiency of the earth in the district where you live, and should, at the same time, indicate the best type of "earth" for your locality.

Faraday's Diary

Volumes I and II of Faraday's Diary have just been made available to the public, and it is doubtful if more absorbing reading can be obtained. The diary was bequeathed to the Royal Institution, and the work of editing and tabulating it has been going on for some time. In a foreword to Volume I, Sir W. H. Bragg refers to the section of Faraday's entries, where he tells of his experiments in which he induced a current in a wire by moving it in the neighbourhood of a magnet. By this Faraday detected the possibilities of electro-magnetic induction, and laid the foundation of all subsequent electrical experiments, experiments which led to the development of practically every kind of electrical apparatus we use to-day, and without which radio communication would be impossible. The whole of the work will be published at intervals, and when complete will consist of seven volumes, the total cost of which will be twelve guineas.

Reise microphones are used, and a special amplifier has been designed by the Marconi-phone Special Products Branch.

Useful Experiments at the N.P.L.

I mentioned, some time ago, the effect of different types of soil formation on the earth's surface has been intensified by the radio frequency of the material of the earth's surface which has been intens ability of ultra-short wavelengths of but a few centimetres, and the subject is being examined by laboratory methods. Samples of soil have been contained in a condenser, and from the measurements of the effective capacity and resistance of the condenser the specific conductivity and dielectric constant of different soils can be determined. It is proposed to measure soils falling into well defined classes from different localities, and the results will be tabulated and placed upon a definite quantitative basis. In this way a standard set of measurements will be available, and each kind of soil will have a certain number of units of efficiency. This is good

PRACTICAL WIRELESS

January 7th, 1933

Electrical Energy in Fruit

An American chemist has found out that fruit possesses a small amount of electrical energy. He found that by inserting the two prongs of a very sensitive milliammeter into an apple that a small current was registered, this result denoting the acidity of the fruit. Different fruits gave different readings, and, as consequence, those of you who experimented with a fruit-or is it a potato?—can be thought of.

ATTENTION can be called to special bargains, and applications too numerous to mention can be thought of. Marconi-electrical readers, and the Marconiphone Co. are busy fitting up several such department stores with an amplifier installation. S O S calls can be put through, and advice relating to the control of traffic through the stores given out. Samples of soil have been contained in a condenser, and from the measurements of the effective capacity and resistance of the condenser the specific conductivity and dielectric constant of different soils can be determined. It is proposed to measure soils falling into well defined classes from different localities, and the results will be tabulated and placed upon a definite quantitative basis. In this way a standard set of measurements will be available, and each kind of soil will have a certain number of units of efficiency. This is good work, and will enable us to form some idea as to the best locality for transmission and reception. Also the results will enable you to roughly judge the efficiency of the earth in the district where you live, and should, at the same time, indicate the best type of "earth" for your locality.

Faraday's Diary

Volumes I and II of Faraday's Diary have just been made available to the public, and it is doubtful if more absorbing reading can be obtained. The diary was bequeathed to the Royal Institution, and the work of editing and tabulating it has been going on for some time. In a foreword to Volume I, Sir W. H. Bragg refers to the section of Faraday's entries, where he tells of his experiments in which he induced a current in a wire by moving it in the neighbourhood of a magnet. By this Faraday detected the possibilities of electro-magnetic induction, and laid the foundation of all subsequent electrical experiments, experiments which led to the development of practically every kind of electrical apparatus we use to-day, and without which radio communication would be impossible. The whole of the work will be published at intervals, and when complete will consist of seven volumes, the total cost of which will be twelve guineas.

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The circuit arrangement of the Bulgin “Transcoupler” and tone control. The central position of the rotor-arm of the resistance is made by its use. On test, these chokes would certainly seem to be substantially normal results such as the people’s requirements. The choke, if it is desired to cut more bass.

The resistance, it, and the value of the choke $L$ governs the extreme positions of the rotor-arm just the of reproduction the reader desires can be obtained. An ordinary three-valve broadcast receiver was employed, and the link was plugged into the valve-holders. With certain combinations of the Pix valves the first results were obtained, with a brilliancy of tone which was quite marked. The Pix valves were subjected to some rough treatment, such as removal of grid bias, severe shocks, etc., and certainly stood up to these tests remarkably well. They would appear to have quite a long life, and in view of the very low price, will be found very useful to the constructor who wishes to make up a cheap receiver employing a number of valves. The normal 2-volt series costs 4d.; the 2-volt power valve costing 6s. 6d. or 8s. 6d., according to class. The 8G. valve is 11s. 6d. For mains use, a range of indirectly-heated valves of indirectly-heated valves of modestly-priced type in order to reduce the overall weight and size. This type of condenser not only has rather large absorption losses and is not advisable where the very best results are required. Messrs. Wilkinson & Wright have, however, developed the condenser shown in the illustration, and this is quite suitable for tuning where really strong signals are obtained and losses do not matter very much. The condenser is very compact, and only the best bakelite is employed in the construction. The overall dimensions are roughly 2 in. square by 1 in. thick for a capacity of 0.005 mfd. The condenser is 6d., is often employed for tuning it for tuning, it may be obtained complete with the slow-motion dial and mounting bracket as shown. This dial is of standard size and pattern, and the integral window enables the dial to be illuminated if so desired. The complete assembly costs 6s. 6d., in either 0.005 or 0.006 mfd.

**Wearite Heterodyne Filter**

It has already been stated in our pages that the trouble of heterodyne wobble, due to two stations working on very nearly the same wavelength, can only be overcome by employing some form of filter to remove frequencies of a high order. This naturally results in a top-note cut off and tends to spoil musical reproduction unless the cut-off frequency is scientifically designed. The Wearite heterodyne filter is a piece of apparatus which may be usefully employed for the purpose in question, and it is made in two types, one cutting off at 2,500 and the other at 5,000 cycles. The cost of these filters is 5s. or 10s., but this will be found a very good investment, and in some localities will be essential if good reception is desired.

**Utility Bakelite Condensers**

For portable or other compact receivers it is often necessary to fit tuning condensers of the solid dielectric type in order to reduce the overall weight and size. This type of condenser not only has rather large absorption losses and is not advisable where the very best results are required. Messrs. Wilkinson & Wright have, however, developed the condenser shown in the illustration, and this is quite suitable for tuning. Where really strong signals are obtained and losses do not matter very much, the condenser is very compact. The overall dimensions are roughly 2 in. square by 1 in. thick for a capacity of 0.005 mfd. The condenser is 6d., is often employed for tuning. It may be obtained complete with the slow-motion dial and mounting bracket as shown. This dial is of standard size and pattern, and the integral window enables the dial to be illuminated if so desired. The complete assembly costs 6s. 6d., in either 0.005 or 0.006 mfd.

**BULGIN “TRANSCOUPLER” AND TONE CONTROL**

The “Transcoupler” gives without the tone control circuit the “D” toe slow-motion condenser, showing the double spindle emuloged for operating the direct and slow-motion drive.

**JACKSON “D” TYPE CONDENSER**

There is a feeling of satisfaction when operating a condenser which rotates with a smooth, voluntary movement. The condenser illustrated below is certainly a luxury instrument from more than a point of view. The finish and workmanship is of a very high order, the framework being highly nickel-plated, and the plates of brass. Connection to the rotor plates is made by a plated brass contact connection which is firmly clamped at each end and provides a perfectly silent connection. Substantial terminals are provided for external connection. The slow-motion drive is effected by an elaborate epicyclic gear which is enclosed in a small box at the base of the spindle. The latter is drilled through and a small spindle runs through this and projects at the upper end. This may be clearly seen in the photograph. The operating knob is divided into two sections, the larger one operating on the spindle proper, and the smaller section sitting on the inner spindle. It is thus simple to obtain a direct or reduced drive by simply operating the appropriate dial. The reduction gear is of the order of 35 to 1, so that tuning of weak stations is rendered very simple, and the condenser is a high-class article which can be thoroughly recommended. The price of the 0.005 capacity condenser is 14s.

**PIX VALVES**

The British Pix Company are marketing a very extensive range of valves which are fitted with a special triple-coated muddy bulbs filament. It is claimed that this gives a much greater brilliance than normal filaments, and that the tone is much improved by its use. On test, these chus has would certainly seem to be substantially normal results such as the people’s requirements. An ordinary three-valve broadcast receiver was employed, and the link was plugged into the valve-holders. With certain combinations of the Pix valves the first results were obtained, with a brilliancy of tone which was quite marked. The Pix valves were subjected to some rough treatment, such as removal of grid bias, severe shocks, etc., and certainly stood up to these tests remarkably well. They would appear to have quite a long life, and in view of the very low price, will be found very useful to the constructor who wishes to make up a cheap receiver employing a number of valves. The normal 2-volt series costs 4d.; the 2-volt power valve costing 6s. 6d. or 8s. 6d., according to class. The 8G. valve is 11s. 6d. For mains use, a range of indirectly-heated valves of indirectly-heated valves of modestly-priced type in order to reduce the overall weight and size. This type of condenser not only has rather large absorption losses and is not advisable where the very best results are required. Messrs. Wilkinson & Wright have, however, developed the condenser shown in the illustration, and this is quite suitable for tuning. Where really strong signals are obtained and losses do not matter very much, the condenser is very compact. The overall dimensions are roughly 2 in. square by 1 in. thick for a capacity of 0.005 mfd. The condenser is 6d., is often employed for tuning. It may be obtained complete with the slow-motion dial and mounting bracket as shown. This dial is of standard size and pattern, and the integral window enables the dial to be illuminated if so desired. The complete assembly costs 6s. 6d., in either 0.005 or 0.006 mfd.

**IMPORTANT NOTE**

Reserve your binding-case early!
Reports Wanted of Reception from Athlone Station

SIR,—I would be very glad to receive reports from any of your readers who may have heard the transmissions from the new Irish Free State High-Power Station at Athlone. The station works on a wavelength of 413 metres and will ultimately use a power of some 50 kilowatts. It would be interesting to hear of the reception experiences of listeners living in various parts of the country. The test transmissions usually take place after the ordinary programme at 10.30 p.m. each night.—JAMES KITCHEN (179, Pearse Street, Dublin).

Don't Use Milk Bottles

SIR,—Upon page 547 of the current issue of your journal, PRACTICAL WIRELESS, I observe that you publish an illustration of an accumulator Topping Apparatus as furnished by one of your readers, which involves the utilization of an ordinary milk bottle. May I be permitted to respectfully point out that it is dangerous and illegal to put any harmful liquid into milk bottles, and that the usage of such bottles for the purpose of topping accumulators is deprecated by the Dairy Trade.--For and on Behalf of Milk Vessels Recovery, Ltd.—J. GILLARD STAPLETON (Secretary).

A "Practical Wireless" Club?

SIR,—As a wireless amateur since broadcasting began, and a radio-service mechanic by profession, I wish to congratulate you on publishing such a fine radio journal as PRACTICAL WIRELESS. Let us have plenty of "How to Make" articles, like some of the excellent articles that have appeared on making dual coils, etc.

I agree with Francis S. Coley, in his letter published from "WILL EVANS" (Paddington), that the highest wavelength used for broadcasting is 1935 metres, used by the Lithuanian station Kaunas.

I vote for a two- or three-valve set with a frame aerial—in other words—an efficient battery Portable for 'phones only. If one must make the choice, do let us have a set which will give the National, all the Regionals and the main foreign stations at good 'phone strength. The frame aerial should be selective and directional and the S.G. H.P. valve could be used on any part of the band. PRACTICAL WIRELESS give us a set so that we may enjoy our programmes in solitary silence. Wishing the paper every success.—THOS. H. WEBSTER (Sydenham).

A Portable for 'Phones Only

SIR,—Every week I read letters published in PRACTICAL WIRELESS asking you for wiring diagrams for building unwanted components and sets at a cheap rate.

Wishing you every success.—ROBERT W. STEWART (West Hartlepool).

Station Chart Wanted

SIR,—In my opinion, what is needed is a chart giving the Continental stations, wavelength and call characteristics. Thus, Mühlacker would be 366.9 m., 60 kW; Call, three notes on tubular bells. These Continental announcers are off their call-signal at such speed and at such long intervals apart, it is very hard to find out what they are, especially the Irish and Norwegian stations.—THOS. H. WEBSTER (Sydenham).

Circuits Wanted for Plug-in Coils

SIR,—I am an enthusiastic constructor, and have purchased your paper since its inception, and have studied all your circuits. These are, however, all based on modern components, coils, etc., and to build these it means the purchase of expensive items. There must be a large number of your readers, like myself, who possess a large junk box of good and serviceable components, and would like to experiment with these instead of leaving them idle. For instance, I have a complete set of plug-in coils of well known make, including short-wave coils; also enough fixed and variable condensers, transformers, etc., to make up several sets. Could you not give us wiring diagrams for building two, three, and four-valve sets using plug-in coils, both for ordinary wavelengths (200-2,000) and for short waves (400-100)? I am confident this would be much appreciated by a large number of your readers.—W. COLLINS (Birmingham).

Entertainment Literature Not Wanted

SIR,—The first part of PRACTICAL WIRELESS that I turn to each week is the portion devoted to readers' letters, and after reading the issue for December 17th, I feel compelled to write in reply to the letter published from "WILL EVANS" (Paddington). This gentleman seems to be under the impression that when one reads PRACTICAL WIRELESS one must of necessity "fiddle with the set," to use his own words. Is this not the very essence of wireless? I read his favourite wireless paper without starting altering the radio set? I consider that the paper should keep to its name, and be practical. No true radio fan wants his practical literature interspersed with notes on gramophone records, broadcast artists, etc. Other papers can be bought that deal particularly with these subjects. Wishing success to the future of PRACTICAL WIRELESS.—J. CUTHLIFE (Huddersfield).

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

Practical Letters from Readers (Continued from page 781)

A Satisfied Scottish Reader

Sin,—I have never before "written to the papers about it," but I feel that I would be lacking in gratitude if I did not add my great appreciation of PRACTICAL WIRELESS to that of your very many highly satisfied readers. After reading the first few numbers, I was highly delighted to realize that, at last, I was able to get a wireless paper that really got down to brass tacks with regard to efficient service, receiver construction, operation and maintenance. However, although I was very well pleased with your without and, indeed, recommended it to my fellow amateurs, I had a feeling that it was incomplete. There were few articles on the design of broadcast receivers nor were there any on television and television receivers. Since then you have started a series of articles on television which will, I hope, continue through to the construction, operation and maintenance of television receivers, and I am hoping that you will soon be able to purchase a copy of a series on the design of receivers. Your gift of data sheets which you recently started are the "very thing." Truly, PRACTICAL WIRELESS in wireless news letters and publications every day in every way it gets better and better. Please do not spoil it by selling it out of order if it could not deliver wireless news relating to broadcast programs, radio stars, studios, etc., as suggested by some of your correspondents. That would, indeed, be a retrograde step. I do not think it is necessary for me to wish you every success because you have already succeeded, in my opinion. I do, however, most heartily tender my best wishes for the good work which you are carrying out so successfully, and I am still dabbling. A complaint on another matter. I joined the Institution of Electrical Engineers in 1892, in which year I dabbled in wireless under Professor Sylvanus Thomson, Engineers in 1892, in which year I dabbled in wireless under Professor Sylvanus Thomp- son, and I am still dabbling. A complaint on another matter. I am, I myself am more than pleased, and cannot be lacking in gratitude if I add my great appreciation of PRACTICAL WIRELESS. I always like value for my money (so they say), and by purchasing your valuable paper I am certainly getting real value for money. There are many ideas on how to run your paper, some are good, others bad, and I would like to suggest that you consider your paper on 100 per cent in keeping with the heading of your paper. I hope you will stick to it. As a Scottish reader I wish to say that if your readers want you will perhaps land with a publication thiefer than the family Bible. I am writing in the hope that you may suggest any further improvement you could make at the price: everything you give is simple arithmetic, I am particularly interested in the articles by Frank Preston, F.R.A., which are highly interesting. He explains everything so clearly that one cannot fail to understand. At the same time I do not belittle other contributors. They are all that can be desired. Carry on with the good work and give us plenty of practical hints of what can be efficiently made at home at a reasonable price. I hope you will stick to it. Good luck for 1933 and onwards.—ALFRED RAMIE (Aberdeen.)

A Bouquet from Aberdeen

Sin,—I have perused reader's opinions from No. 1 onwards, and as an Aberdeen radio enthusiast I always attach value to your paper. I mention to its value, for they are good, others bad, and I would like to suggest that you consider your paper on television sets. I hope you will stick to it. As a Scottish reader I wish to say that if your readers want you will perhaps land with a publication thiefer than the family Bible. I am writing in the hope that you may suggest any further improvement you could make at the price: everything you give is simple arithmetic, I am particularly interested in the articles by Frank Preston, F.R.A., which are highly interesting. He explains everything so clearly that one cannot fail to understand. At the same time I do not belittle other contributors. They are all that can be desired. Carry on with the good work and give us plenty of practical hints of what can be efficiently made at home at a reasonable price. I hope you will stick to it. Good luck for 1933 and onwards.—ALFRED RAMIE (Aberdeen.)

A Canadian Reader's Appreciation

Sin,—Your magazine, up to the present, is much better than I ever thought it could be. Your various articles are very thorough in their explanation, and the editor and contributors deserve to be congratulated on their work. I would very much like to see the "Short Wave Section" expand, and also receive the articles on A.C. short-wave sets operating on 110v. 60 cycle—GEORGE F. COYNE (Toronto, Canada).

A Bouquet from Aberdeen

Sin,—I have perused reader's opinions from No. 1 onwards, and as an Aberdeen radio enthusiast I always attach value to your paper. I mention to its value, for they are good, others bad, and I would like to suggest that you consider your paper on television sets. I hope you will stick to it. As a Scottish reader I wish to say that if your readers want you will perhaps land with a publication thiefer than the family Bible. I am writing in the hope that you may suggest any further improvement you could make at the price: everything you give is simple arithmetic, I am particularly interested in the articles by Frank Preston, F.R.A., which are highly interesting. He explains everything so clearly that one cannot fail to understand. At the same time I do not belittle other contributors. They are all that can be desired. Carry on with the good work and give us plenty of practical hints of what can be efficiently made at home at a reasonable price. I hope you will stick to it. Good luck for 1933 and onwards.—ALFRED RAMIE (Aberdeen.)

A Complaint : and a Practical Hint

Sin,—I have read each number of your excellent paper with much interest, and I think your paper is one of the best in the field. I have perused reader's opinions from No. 1 onwards, and as an Aberdeen radio enthusiast I always attach value to your paper. I mention to its value, for they are good, others bad, and I would like to suggest that you consider your paper on television sets. I hope you will stick to it. As a Scottish reader I wish to say that if your readers want you will perhaps land with a publication thiefer than the family Bible. I am writing in the hope that you may suggest any further improvement you could make at the price: everything you give is simple arithmetic, I am particularly interested in the articles by Frank Preston, F.R.A., which are highly interesting. He explains everything so clearly that one cannot fail to understand. At the same time I do not belittle other contributors. They are all that can be desired. Carry on with the good work and give us plenty of practical hints of what can be efficiently made at home at a reasonable price. I hope you will stick to it. Good luck for 1933 and onwards.—ALFRED RAMIE (Aberdeen.)
January 7th, 1933

PRACTICAL WIRELESS

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

The coupon on this page should be telephoned or posted to every query.

FREE ADVICE BUREAU COUPON

This coupon is available until Jan. 14th, 1933, and must be attached to letters containing queries.

PRACTICAL WIRELESS, 7/13.
PRACTICAL WIRELESS

Broadcast Query Corner.

Under the above title, with the assistance of a recognized authority on wireless broadcasting matters and a regular contributor to wireless publications, we are issuing at home an experimental Identification Service, which should prove of great assistance to our readers. When tuning in well-known stations it happens frequently that listeners pick up wireless transmissions of which they fail to recognize the origin. It is to solve these little problems that the Broadcast Query Service has been organized.

All inquiries should be addressed to The Editor, PRACTICAL WIRELESS, 111, Brompton Road, Strand, London, W.C.2, and the envelope marked "Broadcast Query Corner.

References cannot be sent by post, but will be published in due course, in each issue of PRACTICAL WIRELESS.

Replies to Broadcast Queries


Cossor, A. C., Ltd., 59, Chalcot Road, London, N.W.3.


International Correspondence Schools,

January 7th, 1933

LOUD SPEAKER REPAIRS

Any make. Unit transformers, etc., from 3/- to Blue Spots, 5/-.

Newnes Electric Files, from 5/-.

Repairs guaranteed, post and returned charge prepaid, 10/-.

SERENBAC

RADIO CABINET

Model No. 47.

Radio, £12 10s. 0d. 21st Bk. 1m. 11 m. 21 St. Dq. 95. 211 St.

Radio, £11 10s. 0d. 21st Bk. 1m. 11 m. 21 St. Dq. 95. 211 St.

Bk. 211 St. Dq. 95. 211 St. Dq. 95. 211 St. Dq. 95. 211 St.

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Inside Front Cover

Inside Front Cover

Inside Front Cover

Inside Front Cover

Front Strip

Outside Back Cover

Inside Front Cover

Back Cover

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Wa 313

48 pages

ADVERTISEMENT INDEX

Belling & Lee, Ltd. ..... 773

British Ebonite Co., Ltd. ..... Inside Front Cover

British General Mfg. Co., Ltd. ..... Inside Front Cover

British Pix Co., Ltd. ..... Inside Front Cover

Bulgin, A. F. & Co., Ltd. ..... 763

Cossor, A. C., Ltd. ..... 779

Co-Radio, Ltd. ..... Front Strip

Co- Radio, Ltd. ..... 750

Direct Radio, Ltd. ..... 769

Dubilier Condenser Co., Ltd. ..... 775

Ferranti, Ltd. ..... 779 and 784

Garrard, Ltd. ..... 749

International Correspondence Schools ..... 782

Lissen Ltd. ..... ... 776

London Electric Wire Co. and Smiths, Ltd. ..... Outside Back Cover

Newnes' Practical Electrical Engineer ..... Inside Back Cover

Peto Scott, Ltd. ..... Front Strip

Re-Acto Appliances, Ltd. ..... 777

Slekton Products (Trevor Pepper) ..... 784

Slekton Products, Ltd. ..... 784

Stenibac Ltd. ..... 784

Telegaph Condenser Co., Ltd. ..... Inside Front Cover

Turnage and Partners, Ltd. ..... 784

Valery, Ltd. ..... 763

Watmell Wireless, Ltd. ..... 777

Weedon Power Link Radio Co. ..... 784
Contents of January Issue

Emergency Lighting in Theatres and Cinemas,
by A. T. Dover, M.I.E.E.

Protection of Electrical Plant and Apparatus,
by H. W. Richardson, B.Sc., M.I.E.E.

An All-Electric Printing Works,
by W. T. Kenney, Chief Engineer of Newnes and Pearson Printing Works

A Diesel Electric Shunting Locomotive

Brush Troubles and Cures,
by F. C. Orchard, A.M.I.E.E.

Safety Devices for Small Motors,
by G. W. Stubbings, A.M.I.E.E.

Locating Faults in Power Cables,
by C. Grover, A.M.I.E.E.

Protecting a Building from Lightning

Re-winding a Small Motor

INDISPENSABLE TO PROGRESSIVE MEN IN EVERY BRANCH OF THE ELECTRICAL INDUSTRY
Write for free leaflets, invaluable to constructors, describing these Lewcos Master Components.

The finest in design, manufacture and material.


Every type of component is made by "Lewcos" and stocked by all reputable dealers.

Lewcos

RADIO COMPONENTS

THE LONDON ELECTRIC WIRE COMPANY AND SMITHS, LIMITED, CHURCH ROAD, LEYTON, LONDON, E.10
"PRACTICAL WIRELESS" DATA SHEET No. 4

Mains Transformers

FINDING THE NUMBER OF TURNS.
The formula for ascertaining the number of turns of wire for Mains Transformers is:

\[ V = \frac{A \times B \times n}{T} \]

where \( V \) = Volts per turn in both the Primary and Secondary. 
\( A = \) Cross sectional area of the core in sq. cm. 
\( B = \) Flux in the core in lines per sq. cm. 
\( n = \) Frequency of the supply in cycles per second.

The usual flux density varies between 6,000 and 8,000 lines.

The method of building up the laminations for the core of a mains transformer is as follows:

1. Cut the laminations to the required size.
2. Assemble the laminations in the correct order and stack them together.
3. Screw the stack of laminations tightly together.
4. Wind the transformer with enameled wire.
5. Apply varnish to the transformer.

How to assemble the completed transformer:

- Use a strip of ebonite to carry the various transformers. It is safest to take all the secondary transformer windings to one strip situated on one side of the transformer, and the primary (or mains input) terminals to a strip on the opposite side. This prevents accidentally touching or shorting the mains.
- Before connecting a home-made mains transformer in circuit all windings should be tested for breaks, short-circuits and insulation. A high voltage dry battery may be used, in conjunction with a meter, and there should be no readings between different windings, nor from windings to core.

WIRE FOR TRANSFORMERS.

In the table below the number of turns per sq. in. makes no allowance for the end cheeks of the winding bobbins. This must therefore be taken into consideration. The Safe Current should also be regarded as the absolute maximum value, and if possible the next largest size of wire should be employed, especially for heater windings where large currents are to be handled. When using enameled wire care must be exercised that the covering does not crack during winding. This wire takes up less room but greater care must be taken in the winding.

TESTING.

Before connecting a homemade transformer in circuit all windings should be tested for breaks, short-circuits and insulation. A high voltage dry battery may be used, in conjunction with a meter, and there should be no readings between different windings, nor from windings to core.

Section through core showing the winding area in which all the windings have to be disposed. It is most efficient to arrange the windings on bobbins placed side by side as indicated, with heater windings disposed between the input and H.T. windings. This forms a screen and helps to prevent induced hum. This illustration should be studied in conjunction with the diagram in the upper left-hand corner of this sheet. The actual space available for winding has also to accommodate the formers of the windings, and this should be remembered when measuring the space available.