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FULL DETAILS—SELF-CONTAINED "CENTURY SUPER"

Amateur Wireless

Every
Thursday 3^d

and
Radiovision

Vol. XIX. No. 473

Saturday, July 4, 1931

THE PORTABLE ::::: :::: "CENTURY SUPER"



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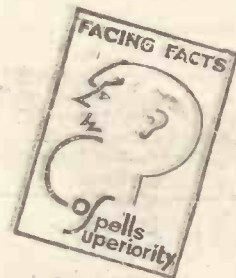


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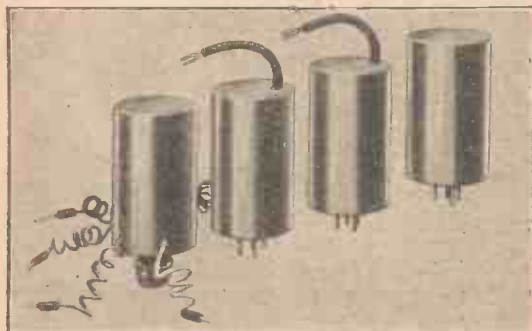
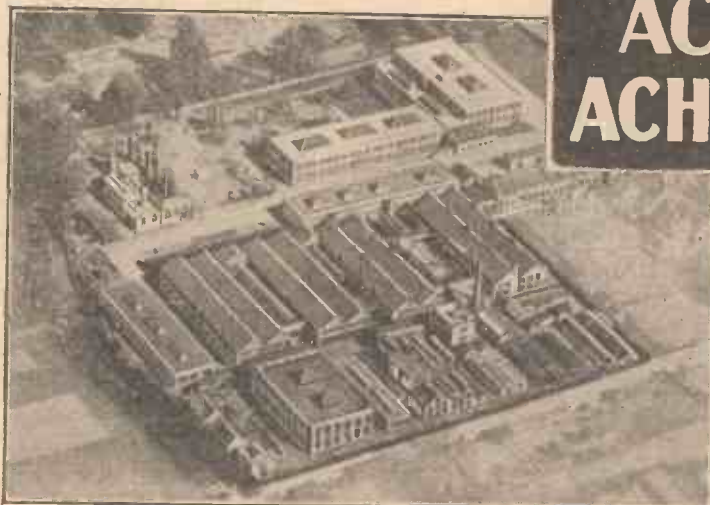
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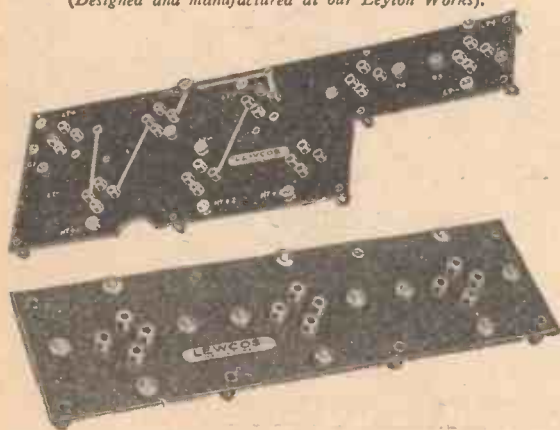
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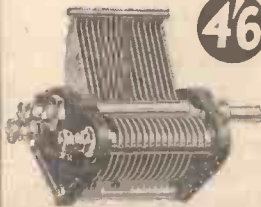
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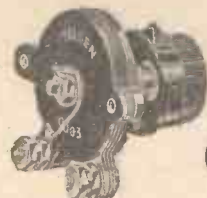
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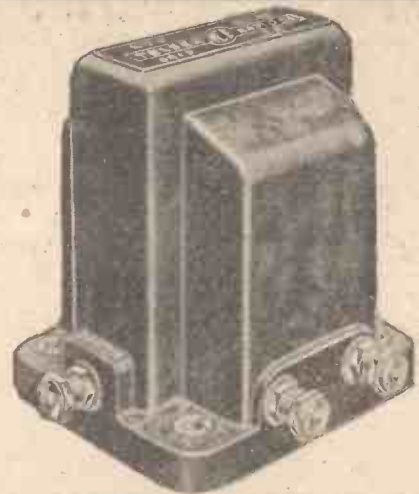
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FOR CONSTRUCTOR, LISTENER & EXPERIMENTER.

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NEWS & GOSSIP OF THE WEEK

A PORTABLE "CENTURY SUPER"
THIS week we present details of our famous super-het. receiver in portable form. The Portable "Century Super" has all the advantages of the original battery model and the added attraction of being readily carried about. As the "Century Super" is a frame aerial set it readily lends itself to portable construction. Tests show that our new set, described on pages 16 and 17, puts up a wonderful show even under adverse conditions. Certainly the

portable of the century—and after dark it will get one hundred stations!

H. G. WELLS ON RUSSIA

H. G. WELLS is to sum up the series on "Russia in the Melting Pot" when he broadcasts a talk on July 13. It will be recalled that Mr. Wells visited Russia in 1920, long before the famous Five Year Plan came into action. A station signalman once completely altered H. G. Wells' outlook on the value of broadcasting. He was waiting on his local station platform for the "up" train when the signalman leaned out to say that he was looking forward to hearing Mr. Wells' talk that evening. He had a portable set ready in the signal box! Mr. Wells altered his script on the way up to the broadcasting studio, because the signalman's remark made him realise that he was about to address the "man in the street," and not a learned society!

MORE SHORT-WAVE RELAYS

AS a result of talks with Sir John Reith during his visit to the Radio Manufacturers' show at Chicago, the Americans hope that within a few months British programmes may be radiated at times that will enable American listeners to hear them from 8 to 11 o'clock Eastern Standard Time.

SIR JOHN RETURNS

HAVING fulfilled his official business in America and shown Lady Reith some of the sights of the land of big business, Sir John Reith has returned to B.B.C. head-

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quarters at Savoy Hill. He delivered an address to an advisory council set up by the Americans to investigate the possibilities of extending education in American broadcasting. Whatever the effect of Sir John's address may be, it is certainly true that American broadcasting organisations are impressed with the B.B.C.'s achievements in broadcasting education.

THE "RADIO PRESIDENT"

WHILE he was in America, Sir John Reith met Mr. Hoover, who has been called the "Radio President" of America, owing to his great interest since the inception of broadcasting. It was President Hoover who warned America against the folly of the wholesale multiplication of broadcasting stations and whose sentiments have been all against the idea of advertisers controlling broadcasting.

A RADIO MEDAL

BEFORE he left America, Sir John Reith was presented with a large medal, inscribed "For Distinguished Contribution to the Radio Art over the Columbia System." We presume the contribution was the relay of B.B.C. programmes through the Columbia system. When Americans give medals they do the thing in style; Sir John's medal is too heavy to be carried about, for it weighs about a quarter of a pound!

NEARLY COMPLETE!



Broadcasting House, Portland Place, London, W., is now almost finished. This photograph was taken from the top of Upper Regent Street

NEXT WEEK: MORE ABOUT THE PORTABLE "CENTURY SUPER"

NEWS · & · GOSSIP · OF THE · WEEK —Continued

PROGRAMME EXCHANGES

PEOPLE are asking whether Sir John Reith fixed up any further programme exchanges between England and America during his recent trip. The truth is that



The organ of the future! The picture shows a new type of instrument recently introduced in the U.S.A. in which electrical methods replace pipes

America has taken many more programmes from us than we have from it. Of course, the five-hour discrepancy in time favours the American relaying because during our main evening programme it is the American's afternoon. During our evening there is nothing worth relaying from America.

NOVELTY BROADCASTS

IT is suggested that in the interchange of programmes between this country and America the novelties of each country and the ceremonies peculiar to each should loom large. For example, America might relay the Ceremony of the Keys from the Tower of London. We might try relaying an American ball game, paying especial attention to the college yells and other incidentals that make an American ball game quite different from an English football match.

COLUMBIA'S VARIED TASTES

WHEN we come to investigate what the American broadcasting companies like best for relaying it is difficult to decide. They certainly seem to get a lot of satisfaction from a wide variety of items in B.B.C. programmes. The Covent Garden and the B.B.C. Symphony Orchestra items have been in great demand. The varied tastes of the Columbia chain are shown by the following recent relays, which were *Rigoletto*, *Our Town*, Chamber Music, and Sir William Beveridge's talk on "Unemployment."

SUCCESS OF COLUMBIA

WITHIN three years the Columbia broadcasting organisation, whose president was interviewed for AMATEUR WIRELESS readers last week, has grown enormously in size and prestige. We are assured that the profit from sponsored programmes during 1930 accruing to the Columbia people was no less than 16,000,000 dollars, or more than £3,000,000.

SCOTLAND BEWARE!

A CERTAIN increase in broadcast licences is anticipated in districts round Glasgow and Belfast. The Post Office detection van will be near at hand for the next month. We do not wish to be uncharitable, but this is the second time the van has visited Glasgow!

CAUSE AND EFFECT

AN amusing tale is told of a B.B.C. staff official's private visit to a certain east-coast resort. His uncle happened to be the local Postmaster and during a municipal concert that took place shortly after the B.B.C. official's arrival, the news of his presence spread round the hall like wildfire. Next morning there was a queue of listeners waiting for licences outside the Post Office! A facetious member of the B.B.C. staff suggests that seaside visits of tired officials even more effective than the P.O. van.

SOPRANOS

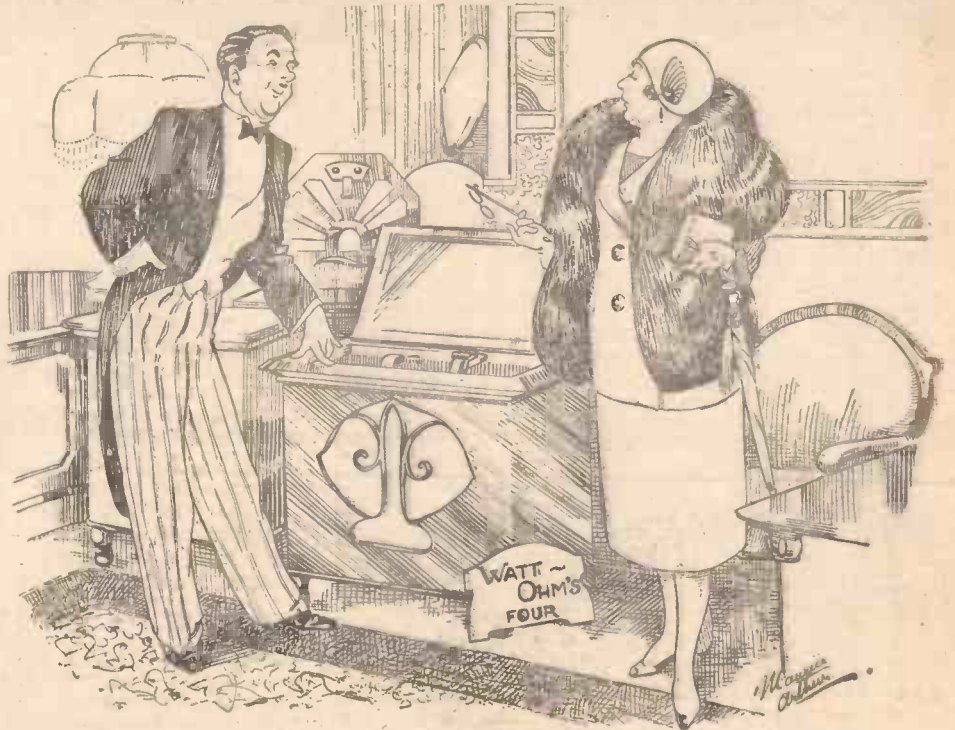
WHY do we have so many? This is really a question for Mr. Sydney Moseley to deal with. But we happened to mention the matter to a B.B.C. official; who said he supposed the reason was that there are more sopranos than contraltos! That sounds rather like the answer a back-chat comedian would give. "Really, it's done for variety and not because we think sopranos make ideal broadcasters," explained the B.B.C. official.

WE WANT AMUSING

SUCH a simple want, isn't it? And because it is simple, we get satisfaction from commercial entertainment people. Because it is not a complex want, involving some deep psychological factor, we do not get it from the B.B.C. We imagine that now America has towed to our educational broadcasting we shall get even less entertainment. While we should never deny the value of broadcasting the speeches of Kings, Princes, Bishops, and Economists, we should like to emphasise the value of entertainment. The B.B.C. is too earnest. Its "mission-in-life" complex ought to be suppressed. Anyway, we feel too hot to argue any more!

NORTH NATIONAL

AT the moment North National is transmitting simultaneously with North Regional. There should not be much trouble in separating the two programmes. Northern listeners have been given more than enough information to enable them to adapt out-of-date sets for modern conditions. The B.B.C. has issued 23,000 copies of its pamphlet on selectivity.



CUSTOMER: "Of course I must have a really high-class set."
SALESMAN: "I assure you, madam, this is such a high-class set that it makes cockney comedians speak with an Oxford accent!"

HINTS & TIPS for PICK-UP USERS



To use a gramophone pick-up seems so simple that its several snags are all the more difficult to surmount when they inevitably crop up. In this article ALAN HUNTER seeks only to explain pick-ups in a simple way—and to point out the best means of enjoying the delights of electrical reproduction.

FIRST of all, what is the matter with ordinary mechanical machines? Why must we, in seeking an approach to perfection, discard this faithful old machine and go in for the infinitely more complicated electrical methods of reproduction? The answer is that, good though acoustic machines can

up construction. Between the four poles of a permanent magnet is pivoted a light armature, over which is wound a coil of fine wire. It will be seen that the armature is mechanically connected to the gramophone needle socket.

As the record turns, its uneven grooves cause the needle to vibrate. In vibrating, the needle moves the armature, which is free to rock on its pivot. This armature movement occurs within the field of the permanent magnet, so the lines of force are varied.

The variations in the field of the permanent magnet induce alternating voltages in the coil surrounding the armature. The net result of the needle vibration, caused by its travel over the record grooves, is to set up an alternating voltage in the pick-up coil. The frequency of these voltages should correspond exactly with the original frequencies recorded.

action, is, like the moving-coil loudspeaker, rather difficult to put into perfect practice! Still, we now have a range of excellent pick-ups, of the balanced-armature and needle-armature types, several responding evenly from 50 to 5,000 cycles. The problem is to make the best of them.

Firstly, it is usually necessary to insert

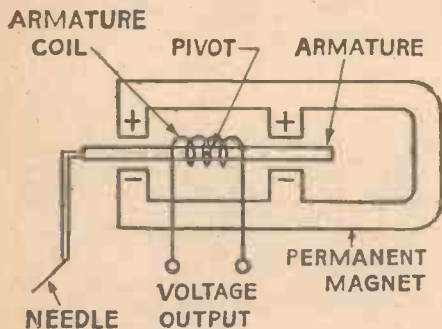


Fig. 1. Diagram showing the working principle of a pick-up

be made, the difficulty of achieving a low-note response is more expensive by acoustic means than by electrical means. This is because nearly everyone who has a good set has a potentially good gramophone amplifier. Another point is that, since the electrical amplification can be readily controlled, so can the volume of sound caused by the reproduction of a gramophone record.

The average factory-built set is provided with gramophone pick-up terminals; and most home-built sets can easily be adapted for gramophone reproduction. For both types of sets the missing link is a gramophone pick-up. What is a pick-up?

The diagram Fig. 1 shows a typical pick-

Choosing a Pick-up

Now we come to the main needs in choosing a pick-up. First and foremost, and most difficult of achievement, is a good frequency response. We want, that is to say, a given velocity of needle vibration to produce an even electrical output, from frequencies of, say, 50 to 5,000 cycles per second.

Unless the pick-up is extremely well-designed we find that certain frequencies are accentuated. That is to say, we get a bigger electrical output at one particular part of the frequency scale than at any other part. To overcome the resonance at one particular frequency the armature movement is often damped down—with a consequent restriction in the movement of the needle, leading to increased record wear.

The aim of most pick-up designers not resorting to damping is to remove the resonant frequency response above the limits of recorded frequencies, that is above 5,000 cycles. This can be done, and is done, in the needle-armature type of pick-up, where the needle is the only moving part, forming a very light armature with a resonant point above the topmost frequency normally recorded.

From what has been said, it will be clear that a gramophone pick-up, although simple in

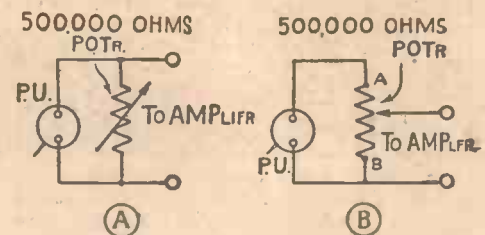


Fig. 2. Two methods of volume control

a volume control between the pick-up and the amplifier. Records vary greatly in depth of recording. Some are much "heavier" than others. The most elementary method of controlling the voltage output from a pick-up is shown at Fig. 2A. This consists of a variable resistance shunted across the pick-up.

The lower the resistance, the greater is the amount of pick-up energy by-passed. Unfortunately, the by-passing of high and low frequencies is not equal, and it is found that when the resistance is appreciably reduced in volume it is also cutting out the top notes.

A much better way of controlling pick-up output is shown by Fig. 2B, where a high-resistance potentiometer is used. With some pick-ups, the winding of the poten-

(Continued at foot of next page)



A typical pick-up and arm

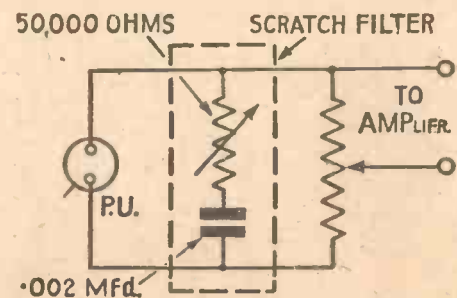


Fig. 3. A simple scratch-filter circuit

QUALITY AND THE SUPER-HET

A FEW years ago to refer to one's super-het, was to raise in the mind of the tyro visions of a most complicated multivalve instrument, of expensive up-keep, but of unlimited capabilities and simultaneously, to arouse in his breast, a feeling of jealousy and envy. It is true that this special circuit with its great selectivity and capacity for making even distant transmissions audible to the ears of its owner fell off badly in the matter of quality of production. It was possible to reach out but the results were not always pleasing. The super-het was a specialised receiver favoured by the few, but in most instances did not satisfy the more serious desires of the household who wished to listen. They were not impressed by distance; distorted music was not enjoyable because it emanated from some far city in Central or Southern Europe.

Until but a few months ago this accusation could be justly levelled against the majority of multivalve receivers of the

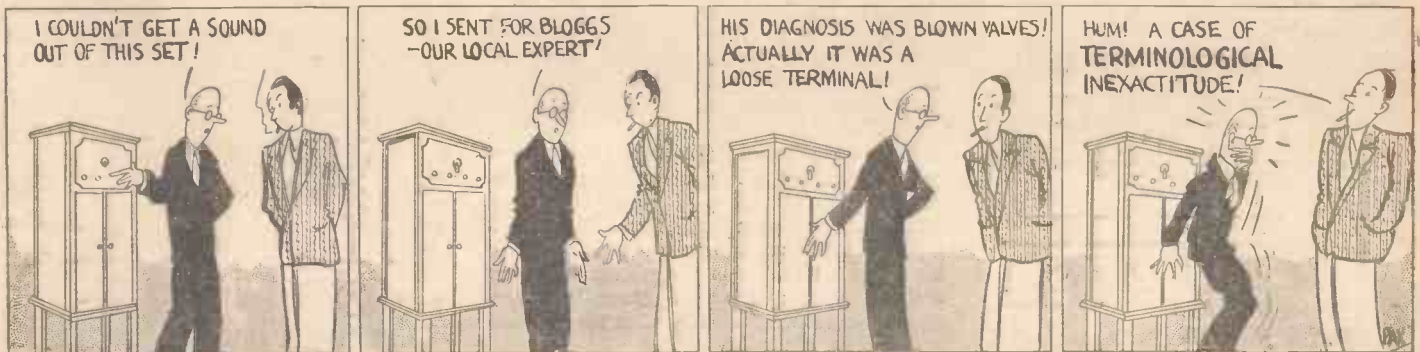
super-heterodyne type; to-day this objection no longer holds good. The up-to-date super-het possesses, in fact, the combined advantages of selectivity, sensitivity, coupled with good quality loud-speaker reproduction. For these reasons everyone in the choice of a wireless set can see their wishes gratified; for individually, in such a receiver they would find the particular points they seek separately in a number of broadcast receiving instruments.

When I tested the "Century Super" some time ago, I stressed the fact that although the latest production of the AMATEUR WIRELESS technical staff enabled me to separate the home broadcasts from other transmissions on neighbouring wavelengths with ease, and gave me every opportunity of listening with pleasure to concerts emanating from the four quarters of Europe, these great assets had not been secured at the expense of quality. Ample proof was given in the working of this receiver that the

components had been carefully chosen and that a circuit had been designed which would answer the requirements of the majority of listeners.

The cost had been carefully studied. The "Century Super" had been brought within the reach of modest incomes; it was easy to handle; its upkeep, even as a battery model, was most reasonable, yet, although built on strictly economical lines, it was thoroughly reliable and efficient. Since its inception, I now see that the "Century Super" has been presented in several forms. You may build it as a cheap but good battery set; you may construct it to take "all the juice from the mains," and if of a more roving disposition, having chosen the portable model, you can remain in touch with your favourite foreign station wherever it may be. So why not plump for the "Century Super" super-het; it seems to me to be and to do just what we want!

J. GODCHAUX ABRAHAMS.



"HINTS AND TIPS FOR PICK-UP USERS"

(Continued from preceding page)

tiometer, which is shunted across the pick-up, must have a high resistance, otherwise top-note shunting will occur.

In the Fig. 2B circuit, the two output connections from the pick-up comprise the slider and one end of the potentiometer—it does not matter which end. Then at the mid-way position of the slider half the total pick-up voltage is handed on to the amplifier; and at a slider position three-quarters towards the B end of the winding, a quarter of the total voltage is obtained. Thus a progressive volume output is achieved without affecting the tone.

Sometimes pick-ups suffer from their own goodness, in that their excellent top-note response causes the high-pitched needle scratch to be excessively amplified. A scratch filter can be used but it must be realised that, in cutting out the scratch, one also cuts out the top notes of the record.

A scratch filter is simply a shunt circuit for frequencies around the scratch frequency. The more we "peak" the scratch filter the less will it absorb other wanted frequencies just below the scratch frequency.

Fig. 3 shows a simple scratch eliminator comprising a variable resistance and a series fixed condenser shunted across the

pick-up. Instead of the resistance one could use a 100 milli-henry low-frequency choke in series with the condenser, whose value should be .01 microfarad.

With a .002-microfarad condenser and a 50,000-ohm variable resistance it should be possible to eliminate scratch from the average pick-up reproduction.

Whenever a gramophone pick-up and arm is fitted, either to a new electric turn-

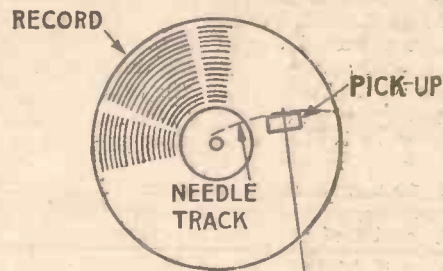


Fig. 4. This diagram shows how correct tracking may be obtained.

table of an existing mechanical machine, the question of correct needle tracking has to be carefully considered, otherwise records will be ruined and reproduction marred by excessive record wear noises.

What is correct needle tracking? That is easy to understand when demonstrated,

but not so easy to explain on paper. Suppose we look at the Fig. 4 diagram. The dotted line shows the track of the needle across the record from the outer to the inner groove. Correct tracking ensures that the needle, which should be at an angle of 50 degrees with respect to the pick-up, dips down straight into the groove and does not drag sideways across the groove.

The most accurate tracking is obtained when the pick-up is so pivoted that a line drawn from pivot to needle is as nearly as possible at right angles to the record radius line drawn through the point of needle contact. In practice, owing to the gradual diminution in the radius of the groove as the needle approaches the centre of the record, this tracking is subject to a small error. But many pick-up makers supply an alignment chart to indicate the best position for pivoting the arm to get good tracking.

In the absence of such a chart, one can readily test the correctness of a proposed pivot point. On a sheet of note-paper punch a hole large enough to enable the paper to be slipped over the spindle of the turntable. Then draw a straight line across the paper, with the spindle centre as starting point.

After slipping this paper over a record the pick-up can be swung across to see whether its face departs radically from the line at any point.



WITH THE O.B. ENGINEERS AT THE CINEMAS

The B.B.C. Outside Broadcasts engineers have tackled many difficult problems in relaying programmes from places outside the studios and here an "Amateur Wireless" Special Commissioner describes the arrangements at a popular "O.B." centre

"WE are now going over to the Commodore Theatre, Hammersmith, for light music by the Commodore Grand Orchestra . . ."

This is a regular Saturday afternoon announcement in the National programmes and these Hammersmith outside broadcasts have become one of the stock features for the programme compilers; and deservedly, too, for Joseph Muscant's orchestra always plays the popular type of music that people want to hear at week-end times.

There is something very satisfactory about these broadcasts on the technical side, too, for there is a noticeable echo in the transmission which adds brilliance to the orchestra and compares favourably with the echo at the now famous Grand Hotel at Eastbourne.

On a recent Saturday I saw how these broadcasts are done at Hammersmith and chatted with one of the "O.B." officials in charge of the apparatus there.

"In the old days before 'talkies' came along," he told me "the orchestra played actually in the theatre and microphones slung up above the orchestra pit picked up the transmission. In various ways these broadcasts were even better than the present ones for there was a fine echo but

not an uncontrollable one in the theatre, itself. With the advent of sound films the programme schedule at the Commodore has been altered, as with all other cinemas, and now the orchestra plays up in the huge café on the first floor and gives a programme specially arranged, of course, for broadcasting, without the necessity for any consideration of cinema requirements.

"When the new arrangements came into being we had to shift the 'mikes' and amplifiers up into the café and make a new balanced test to find the most suitable positions for each instrument in the orchestra.

Choosing the "Mike" Position

"This took a considerable time, I can tell you. Eventually we found that a good centre of measurement was the huge flower basket in the centre of the café and now we put the microphone about 4½ feet in front of this and support it at about head height from the ground. Then we take radial measurements from this very handy flower basket and so get the proper positions for the various members of the orchestra.

"At Savoy Hill, in one of the engineering sanctums, is a big book in which, on squared accurate records of the microphone positions in each outside broadcasts centre, the Commodore included."

I examined the layout of the orchestra and found several surprising things. Practically every week a piano solo or a lengthy piece, combining piano and orchestra is given, and yet the piano is right at the back of the hall and well away from the microphone. Some curious sound reflection effect appears to make this a good position.

The strings (violins) are in front of the microphone on the left, and the wood-winds in front on the right. The 'cellos are behind the strings and the brass in the right-hand corner of the hall, behind the

wood-winds. The string basses are tucked away in an alcove at the extreme right-hand side of the orchestra, for it was found on a balanced test that if these are in the body of the hall there is too much "boom" owing to the fine echo of the café.

In an anti-room near by there are the



This plan gives a good idea of the instrument arrangement at a typical cinema orchestra broadcast—from the Commodore Theatre, Hammersmith

two amplifiers, which link up the microphone with the Post Office line, through to the Savoy Hill control room. At the Commodore these amplifiers (only one of which is normally in use, the other being kept as a reserve) are resistance-coupled jobs, there being three valves in each. The "mike" is transformer-coupled to the first valve, resistance-coupling is used in the transformer itself and there is transformer-coupling to the microphone line.

Every Saturday the Post Office hands over two 'phone lines to the B.B.C. for the Commodore O.B. One line is used for the microphone and the other is used for the telephone by which the engineer at the Commodore speaks to the Control Room official and knows when to switch on his amplifier.

All the time Muscant is conducting, the engineer in the ante-room listens with 'phones in case anything goes wrong with the apparatus. He does no controlling however, for all regulation of volume is done at the Savoy Hill control room where there is a second three-valve amplifier, on the other end of the 'phone line.

On July 8 the organ recital from York will be given by Dr. Henry Ley, who is organist at Eton College. These recitals are giving lovers of classical music examples of the best organ music.



Behind the scenes at an outside broadcast—adjusting one of the dual amplifiers connected to the microphone

RECORDS of the MONTH'S BROADCAST MUSIC

LISTEN TO THE
BEST ITEMS
AGAIN!

The following notes are intended to link up current wireless programmes with the gramophone and assist readers to select permanent records of the most pleasing features. In every case the most suitable presentation of a particular item will be recommended and the name, make and number of the record given

Light Music for the Summer

IT may well be that one changes one's musical fare during the summer. The B.B.C. have served up much that is light and jolly, even to the extent of choosing rather less ponderous works of the masters. For which we give thanks, and recollect many tunes which will most admirably match the season. Thus Nevin's "Narcissus," for instance, may betoken spring, but it might just as easily be "Rose." A most charming, dainty little thing, of which almost everybody can whistle at least six bars. Try H.M.V. B2819 for this piece, or Zonophone 5370. It is no distance to the Boccherini Minuet, a tremendous standby of all orchestras. Columbia DB9092, by the B.B.C. Orchestra itself, is an excellent record. A stimulating composition is Berlioz' Hungarian march from "The Damnation of Faust." Hear H.M.V. D1498, on which it is played by the Berlin Philharmonic Orchestra: there is no better version. And three waltzes in the Viennese tradition are worthy of mention: "Estudiantina," "Skater's Waltz," and "Roses of the South." Polydor 19435, Panachord 125023, and H.M.V. B2599 respectively will adequately render these favourites.

Songs of the Month

Old favourites have been strongly to the fore recently, and many are so good that modern songs seem to mean little to most of us. A melody of haunting character is "By the Waters of Minnetonka," by Lieurance, which has been sung during the past month. It is curious that there are, so far as I can trace, only two versions on records. One is that of Melba (non-electrical) and the other a recent issue of Broadcast. I hoped much from the latter, but, whilst the voice is good, the diction is bad. Perhaps readers who are interested in this song will hear it and judge for themselves.

"Mary of Allendale" is a delightful old song which has a melody of peculiar charm. There is a creditable performance on Winner 4938, which is excellent value.

I do not remember "The Night has a Thousand Eyes" appearing in a wireless programme until early in June. Then the best setting was not chosen. Hear Derek Oldham sing this on H.M.V. B3068: it is a lyric of poetic beauty and an air of appealing melody.

Easthope Martin's songs are still shamefully neglected by the recording companies (reflect that one cannot obtain "The Wayfarer's Night Song," for instance!). For this beautiful song we must wait, but its occasional inclusion in the programmes (as during June) should urge someone to record it. However, one of the best "Songs of the Fair"—"All the Fun of the

Fair"—was given in a midday ballad concert on June 5. This song, which is quite a masterpiece in its accompaniment, is on H.M.V. B2473, the singer being Percy Heming. Buy this record and agitate for more Easthope Martin.

German Folk Songs

A short recital of some of these beautiful old tunes was recently given, and I hastily tried to trace "Ah wie ist möglich dann," but unhappily without success. But an amazing and most satisfactory substitute came my way in a rendering of the tune that everybody knows between its renderings of ordinary and "hot" dance music. It is surprising that "Darling, I'm Longing to Greet You" can, when sung as a quartet on H.M.V. EG2032, make one of the most beautiful vocal performances I have ever heard.

The New Records

The quality of the month's new issues shows a commendable improvement. There are fewer multiplications of ephemeral tunes and more satisfying excursions into the wide fields of popular music which give lasting pleasure. Moreover, new artistes of real merit are making their appearance. Definitely, the latest lists contain records to buy.

Vocal

First comes a record which is always a best seller and of which versions abound, "The Prologue to *Pagliacci*." There has been nothing quite like the performance of Louis v. d. Sande and the Berlin Symphony Orchestra on Sterno 8007. Although sung in German, there is no mistaking the story (for everybody knows it), but the dramatic force of this fine singer and the superb support of the orchestra make a record of great artistic merit. This 12-in. double-sided record would not be dear at three times its price, which is half a crown.

A charming pair of well-known songs by that good contralto, Marguerita Carlton, are on H.M.V. B3699. They are "A Little Silver Ring" and "Sink, Red Sun." A very pleasing record. Foster Richardson's voice suits "Beware of the Maidens," on Zono 5852, to a degree. Columbia have two first-class records in Dennis Noble's "Devout Lover" and "So We'll Go no More A-roving," and a delightful folk-song group by Clive Carey. The numbers are DX248 and DB477. These are wholly delightful and will never tire their audience.

Four good records of the "popular vocal" type can be commended: (1) Piccadilly 747, "Koppa Ka Banna" (Harrington and More); (2) "When You're Married" (Leslie Weston); on Edison Bell Winner 5259; (3) Radio 1481, "I am—She is—We are" (Randolph Sutton);

(4) Radio 1483; "When Gretchen Yodelled" (G. H. Elliott).

For a small outlay these will return their purchasers much good fun.

Orchestral and Band Music

In this class fall a most encouraging number of inexpensive records which will be welcomed by my readers: Imperial are responsible for the "No. 14 Hungarian Rhapsody" (by Gandino and orchestra), a wholesome attempt at an ambitious piece which is quite good—No. 2442. On the same list is the Waldtenfel Barcarolle and Strauss's "Wienes Blut," by George Braun's Salon Orchestra (No. 2441). A really excellent record, this, of which type more would be welcome. On Sterno 678 are the tuneful duo, "Wedding of the Rose" and "Wine, Women, and Song." The Viennese Orchestra playing has the attack of a Guards' band! The Gershom Parkington Quintet play "Ma Curly-headed Babby" and Handel's "Minuet from *Berenice*" on Broadcast Twelve 5233, and "Whisper, and I Shall Hear," with Schubert's "Impromptu in A Flat" on 5234. These radio favourites give of their best on these two records.

H.M.V. 3264-5 are entitled "From Foreign Lands," and on them the Berlin State Opera Orchestra play Italian, German, Spanish, and Hungarian pieces. These are excellent value for money.

Mention must be made of the Scala Trio's performance of Strauss's "Standchen" and Albeniz's "Granada" on Edison Bell Winner 5262. This is a first-class record from every standpoint.

And to wind up this paragraph—a real gem! This is the Overture to "La Gazza Ladra" ("The Thieving Magpie"), by Rossini. The second side of this record (Polydor B21304) is one of the most fascinating compositions one may hear in many months. There is nothing highbrow here; it is just a jolly tripping tune.

Dance Music

The dance records of the month contain a few exceedingly good numbers of waltz, fox-trot, and tango tunes. Amongst the first are Imperial 2441, with Waldtenfel's "Barcarolle," and 2463, "Famous Waltzes of the Past." Both are excellently played and recorded.

Panachord 25016 and 25023, with "Somewhere in Old Wyoming" and "Skater's Waltz" respectively, are fine value in every way.

Amongst the fox-trots "Your Eyes" and "My Song of Love" (Winner 5265) and Brunswick 1103, "We're Friends Again," stand high in a long list.

The best tango is, undoubtedly "Oh! Rosalita." The Imperial version on 2458 is very well done.



The 'Century Super' portable makes use of MULLARD

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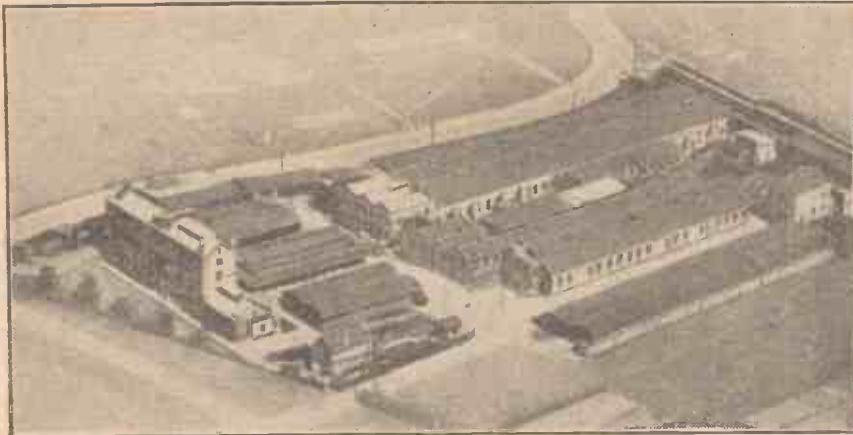
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On Your Wavelength!

THE NEW PENTODE

I HAVE just been trying one of the new pentodes which only takes about 5 milliamperes from the battery. The valve worked so well that I started thinking about it. In order to get the same output with an ordinary power valve it would be necessary to use at least twice the anode current, and probably even more, and the difference in high-tension current consumption is quite large. I know that a pentode costs more than a power valve—in fact, nearly twice as much—but then, surely the economy in H.T. consumption will outweigh this before very long.

If the current from a battery is increased 50 per cent., its life decreases much more rapidly than this. On the face of it we should expect to get 75 per cent. of the life, but actually we shall be lucky if we get 50 per cent. The battery will last just about half as long as it did before. Conversely, if we reduce the current by 25 or 30 per cent., the battery will last twice as long.

AN ECONOMY

USING a pentode, therefore, we can reduce the current consumption of the set from about 15 to 10 and, instead of buying four batteries a year, we buy two. Since the price of a good battery is nearly as much as that of the pentode itself, we really save the cost of the pentode at the end of six months and are "quids in" afterwards.

It seems as if the pentode is going to be the valve of the future. Its price will, undoubtedly, come down, while new samples are continually being introduced. The efficiency of the modern output valve is really appalling, since it only converts about one-eighth of the power taken from the battery into actual audible sound. The pentode is distinctly better, converting approximately one quarter of the energy into actual sound output, even with battery valves, while mains valves are still better. Before long we shall convert 50 per cent. of our energy into sound and this will be a better proposition altogether.

NARROW-BAND BROADCASTING

NOW that it is possible to transmit single side-band telephony on the shorter wavelengths, as was demonstrated in the recent tests between Paris and Madrid, the method may come into practical use for broadcasting. Up to the present it has been chiefly confined to the long-wave transatlantic service between Rugby and the U.S.A. Its chief merit is that it only takes up half the ether space occupied by ordinary transmission, so that the number of existing stations could be doubled without causing any more congestion. That is, of course, if all the present stations were to change over together. I don't expect this to take place for several reasons, but it would be possible to operate certain selected stations on the single side-band system, leaving the other station to

supply crystal sets and the simpler type of valve receivers. At all events it would provide a partial remedy for overcrowding.

AND THE SUPER-HET

TO receive single side-band transmission, it is necessary to have a local oscillator at the receiving end, so as to restore the missing carrier-wave. Now every super-het receiver necessarily includes a local oscillator, so that to receive such programmes it would only be necessary to "tune" the oscillator exactly to the carrier frequency instead of a little above or below it. The super-het is already a warm favourite because of its selective properties, and the fact that it could be used to bring in programmes not available on the ordinary type of receiver would give it a still wider appeal.

THE CRYSTAL USER

NOT that I wish to advocate any change that would be to the disadvantage of the listener who uses an ordinary crystal or straight-circuit valve set. Far from it. But as things are at present, the less selective types of receiver are handicapped in the choice of programme mainly because of the overcrowded state of the ether. By converting some of the existing stations into single side-band transmitters, they would no longer interfere with other stations, and a greater number of programmes could then be brought in on a "straight" circuit without overlapping. From this point of view the innovation might prove to be an advantage all round. In any case, we have to face the fact that the next year or so will see a great many new stations coming on the ether, and unless something is done to make more room for them, we are in for a pretty tough time.

A TOUCH OF FOLLY

I SUPPOSE we all do foolish things at some time or other, and I am no better than the next man in this respect. I am now feeling rather sorry—after the event—since it is going to cost me money. I am in the habit of using a combination meter which measures milliamperes or volts according to the particular terminals you bring into circuit. Perhaps I should say according to the particular terminals you connect the circuit to, because, of course, on the "amp" side the meter resistance is in series with the current to be measured, whilst on the "volts" side the corresponding resistance is in shunt across the main circuit. To cut a long story short, in a moment of aberration, I was stupid enough to try to measure the voltage of a high-tension battery on the "amp" side of the meter. The instrument has gone back to the makers for repair, and I am now waiting for the bill.

SMALLER AND SMALLER

YOU have noticed, I expect, the tendency for complete sets, as well as for individual components, to become smaller

and smaller; and a jolly good tendency it is. In the early days of wireless everything was what we should nowadays regard as huge. You tuned the aerial and the grid of the first valve, for example, by means of a loose-coupler, a neat little contrivance which old hands will remember well. It was, on the average, 18 to 20 in. in length and the grid coil, in and out of which the aerial coil slid, was about 6 in. in diameter and a foot or more in length. The whole thing was usually mounted on a large mahogany stand, and itself took up as much room as a complete modern three-valve set. Variable condensers, then generally of .001-microfarad capacity, employed very wide spacing between their vanes. The aerial tuning condenser (do you remember A.T.C.?) was generally about 8 in. from front to rear and 4 in. in width. Valve holders often "incorporated" a rheostat, and were mounted on small mahogany boxes about 6 in. by 3 in. By far the best low-frequency transformer of those early days was the Sullivan, which weighed two or three pounds, if my memory is not at fault.

THEY SPRAWLED

SETS in those days sprawled quite a bit. My first single-valver of the 1919 vintage occupied the whole of the top of a table measuring about 3 ft. by 2 ft., as well as the shelf beneath. As time went on, we began to make apparatus confine itself to more or less reasonable bounds, but I still have memories of a very popular home-constructor's set whose cabinet measured 42 in. by 12 in. Compare this with the "Century Super," containing the same number of valves. One trouble, of course, was that we had not then discovered the virtues of decoupling, and to avoid what we were pleased to call interaction we had to space our components in the manner of the currants in a refreshment-room bun. Curiously enough, decoupling was not evolved until after screening came in. Coil screening reduced the size of sets to some extent, though they were still pretty hefty. It was not until we discovered the advisability of screening not only coils, but also valves and condensers, and also of combining screening with decoupling, that the really compact set became a practical possibility.

A FURTHER STEP

STILL, sets could not be made very small while components were on the large side. The evolution of the alloy-cored transformer was an enormous step forward. An ordinary soft-iron core of small size becomes saturated when quite a light primary current is flowing. To avoid this the iron core must be made large and heavy. Iron-cored transformers, therefore, for good-quality reproduction had to be cumbersome components, weighing a lot and occupying an unconscionable amount of space. One of the newest nickel-alloy cored transformers is precisely 1¼ in. square. You

On Your Wavelength! (continued)

can obtain a three-gang variable condenser nowadays which takes up no more room than a single variable of a few years ago and, thanks to decoupling-cum-screening, you can place your components pretty well as close together as you can pack them in.

MINIATURE VALVES

CURIOSLY enough, there is only one part of the wireless set which was once smaller than it is now. This is the valve. Some years ago we had in the Weco valve, the tiniest "toob" that has ever been used for wireless. Do you remember it? It was a minute thing whose bulb was about a third of an inch in diameter by 2 in. or so in height. It required, if I remember correctly at this distance of time, a small fraction of an ampere of current at just about 1 volt. If only we had the Weco valve to-day, couldn't we make up some wonderful portables with our other miniature components? Perhaps some enterprising manufacturer will give us a modern version of the Weco valve, no bigger than the original, but of far greater efficiency.

CHANGES COMING?

I HEAR that Sir John Reith has been enormously impressed by American programmes during his visit to the U.S.A. It is rumoured that on his return the programme exchanges between this country and the States will be much less one-sided than they have been in the past and that we shall have just about as much of the best of America as America has of the best of Great Britain. I hope that this is true, for now that the technique of long-distance relaying so closely approaches perfection, there is no reason why programme exchanges should not regularly be made.

I hope that Sir John has also been somewhat impressed by the vastly better service which American broadcasting stations give to their listeners. We have no entertainment until 11 a.m. on weekdays and many of our stations close down for good before 11 p.m. During the early afternoons there is frequently very little to listen to and our Sunday programmes are the laughing stock of the civilised world. Compare these things with the non-stop sixteen to eighteen hours' weekday programmes of American stations which run continuously from 9 a.m. to 12.30 the next morning. America has learnt a vast amount from the B.B.C., and there is just as much for the B.B.C. to learn from America. Let us hope that it *will* learn.

COMPARISONS ARE . . .

WHEN you come to think of it, our broadcasting services are not too good in comparison with those, not only of America, but of European countries. If, for example, you turn to the long waves at times when 5XX is plunged in silence, you will generally find quite a number of Continental stations, such as Oslo, Kalundborg, Motala, Warsaw, the Eiffel Tower, Zeesen, Radio-Paris, and Huizen, merrily at work. On the medium band the Germans are

always busy, and if your set has sufficient high-frequency amplification or conditions are good enough you will find that there are few times during the day or night when you cannot pick up transmissions from many European countries. I do think that we have the right to expect a good deal more than we get, though whether we shall ever get it is another matter. I am sorry to have to say it, but since the B.B.C. became what pretty well amounts to a Government department there is about it an air of that smug "staffiness" which characterises Government departments. You know what I mean, an atmosphere of we-can-do-no-wrong-and-the-rest-of-you-are-just-poor-muts.

GIANT LOUD-SPEAKERS

SOME months ago, in the course of a most interesting day spent down at Hayes, I was introduced to the latest type of Marconiphone high-power loud-speaker. It is to the household instrument very much what a child's pop-gun is to an 18-in. naval gun. For my edification it was made to play a brass band record, and we had to retire to a range of about 300 yards in order to be able to appreciate the music properly. I understood that its extreme range was about four miles, and I can well believe it. These loud-speakers are amongst the most marvellous achievements on the low-frequency side of wireless. They give genuine undistorted reproduction with enormous power and, though the noise is loud, it is most pleasant to listen to in the open air.

DIRECTIONAL EFFECTS

THIS kind of loud-speaker is generally arranged on a mounting exactly like that of a searchlight, so that it can be swivelled in any direction and tilted to any angle. By carefully arranging the speaker,

ON THE AERIAL SIDE

Even if you do not use rigid wire on the square-corner system for the whole of a set's wiring, at least take care to keep the connections on the aerial side



neat and short. Use terminals also for the aerial and earth leads, even if the battery connections are made by means of flexes.

good reproduction is obtainable at all ranges, since the maximum blast passes over the heads of those who are standing close by and reaches those who are far away. These loud-speakers were used at the recent R.A.F. Pageant at Hendon, and those of you who heard them will admit that nothing could have been more natural than the way in which they conveyed running commentaries on the events, announcements, and so on. They are not exactly the kind of things that you can install in a living-room, for each of them weighs about a quarter of a ton.

150 WATTS!

YOU can fill the average room by means of energy of 1 watt or rather less input to the loud-speaker, but these giants require something over 200 watts for the field magnets and will handle an input from receiving sets of 150 watts without overloading. Four of these gigantic things were used at Hendon and the amplifiers feeding them had a total power of 1½ kilowatts, which is just about the same as that used by the original 2LO for broadcasting to the world. The output valves alone each require 24 amperes at 15 volts for their filaments, with a high-tension voltage of 2,000 and G.B. of about 400.

A PROBLEM

AT the present time I am engaged in worrying out a special receiving set for dealing with my local station—or, rather, I should say my twin local station, since what I want is the programme of the two Brookmans Park transmitters. I am trying to design something which at a range of something under fifteen miles will give perfect reproduction. I am told that their outputs are the goods, so to speak, if only one can find a means of dealing with them properly at the receiving end. When, though, you have 70 kilowatts from one and 68 from the other at short range in a locality that is particularly good so far as field strength is concerned, the problem of perfect reception is by no means so simple as it might appear. What I am thinking of doing is to work from a small indoor aerial shunted by a variable resistance to act as a volume control. This will be followed by a screen-grid H.F. valve, a power grid detector, and two L.F.'s. The L.F. stages will, of course, be just about as special as I can make them. Shall I or shall I not succeed in hearing "Raucous Reg" and "Noisy Nat" as they should be heard? At any rate, I shall be doing my best. It is a little funny, isn't it, that high-power broadcasting, which was to make reception easy for everybody, should necessitate the design of such expensive and complicated apparatus for anything like perfection in reproduction?—THERMION.

A delightful domestic comedy—*Drat the Girl*—by Elizabeth Illingworth, is a feature of the Midland Regional programme on July 13. Listeners will hear a typical "scene" between an irate father and his modern daughter.

CURING MAINS HUM

In any mains-driven set there is the possibility that after a while a background of mains hum will become annoying. This can easily be cured, and here is some advice by Kenneth Ullyett.



WHEN a mains-driven set has been working for several months, there are several causes for the gradual increase in the background of hum which is occasionally experienced.

In most cases it is easy to cure this, the various causes for the more noticeable ripple being different from those which cause a loud hum to be heard when an incorrectly adjusted mains set is first worked.

Usually, if a new mains-driven set hums badly when it is first switched on, the smoothing is at fault and the fitting of a new mains choke or, perhaps, the addition of another smoothing condenser to the filter circuit will correct this.

Increase of Hum

What is far more puzzling is the gradual increase in background noise in a set which first operated satisfactorily. Sometimes, too, it is noticed when one first changes over from batteries to mains. In a set which operates quite satisfactorily with battery drive, a hum may be set up which may be found due to the use of too high a grid-leak value. If it is suspected that a high value is accentuating mains hum, then the grid leak should be temporarily short-circuited. If this cuts out the hum, it is possible that a lower value grid leak may eliminate the hum and still give good results.

In some sets where the receiver, speaker, and mains unit are all housed in the same cabinet, an annoying mains ripple is caused by pick-up via the speaker leads. This is more pronounced if it is a moving-coil speaker and is also working from the mains. The smoothing of the eliminator circuit for the speaker field winding itself may be insufficient, but this can always be tested by temporarily working the speaker

away from the set and seeing if the A.C. interference is still heard. It is generally found that if two or three turns come loose in the "pot" winding, or if there is a loose joint in the magnetic circuit of the speaker, then a hum may be set up on some frequencies which may accentuate mains hum, or be mistaken for it. It is a wise thing to keep direct current out of the speaker circuit. With any type of speaker working on a mains set it is advisable to have a choke-output circuit, or preferably a transformer, which latter entirely insulates the speaker windings from the high potential existing in the anode circuit of the last stage.

Checking each Stage

Not only does the D.C. anode current flowing in the speaker windings constitute a danger (in that a shock may be felt if the terminals are touched), but the possibility of hum is increased.

There are so many points in a receiver at which ripple may be introduced that when this trouble is experienced each stage should be checked in turn, starting from the first, for speaker hum pick-up is one of the most likely causes. Take out all the valves excepting the last stage valve and disconnect the primary side of the coupler to this valve so that it is not in connection with the previous stage in the set. One has thus a good opportunity for discovering if it is the coupler or the speaker which is picking up the stray A.C. currents from the mains circuits.

Some designers have suggested that to rid a set of mains hum the grid and anode circuit wiring should be carried out with thin lead-covered cables. It is not easy to get cable so thin as to be easily workable in

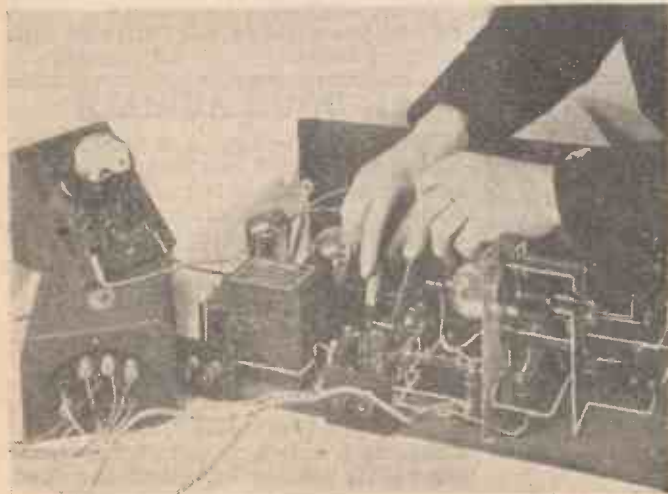
wiring the average set, but there is no reason why the speaker output wires, at least, should not be of lead-covered cable.



"Perhaps the smoothing is at fault. The addition of another condenser to the filter circuit may correct this."

A common trouble is that often what is supposed to be mains hum is actually L.F. oscillation, and this same trouble would be experienced with battery drive if the H.T. voltage were increased. Many set owners are free from trouble of this kind when they are working with only 100 volts from a dry battery, but when the full 150 volts from an eliminator is applied then a ripple is caused.

The cure for this, of course, is the fitting of de-couplers in at least one of the L.F. circuits, and sometimes in the H.F. circuit, particularly if this is a screen-grid valve.



(Left) "Check up the high-tension voltage ... a common trouble is that what is supposed to be mains hum is actually L.F. oscillation." (Right) "If it is suspected that a high value of grid leak is causing mains hum, then the leak should be temporarily short-circuited."



THE HOW AND WHY OF RADIO—XLIII

THE PENTODE POWER VALVE

Written specially for beginners who want simple and practical explanations of the underlying principles of radio

THE name pentode implies five electrodes. In the pentode power valve there is the usual filament, the anode and the control grid. The other two electrodes are extra grids; one is called the high-voltage grid and the other the cathode or filament grid.

So altogether the pentode has three grids. Leaving aside the control grid, what are the functions of the other two? The high-voltage grid is fitted near the control grid and serves a somewhat similar function to the screening grid in a high-frequency screen-grid valve. In other words, the high-voltage grid assists the flow of electrons from filament to anode.

The cathode grid, which is connected inside the valve to the centre of the filament acts as a barrier to electrons tending to be emitted by the anode during its bombardment. If the cathode grid were not fitted, this secondary emission of electrons from the anode would get back to the high-voltage grid.

As the cathode grid is internally connected, there are only five external connections for the pentode, namely two for the filament, one for the normal or control grid, one for the high-voltage grid and one for the anode.

The special construction of the pentode enables a considerable power output to be obtained with only a small voltage input. In other words, the sensitivity ratio of the pentode is very high. In the first pentodes produced in this country, little attempt was made to obtain a large power output. The idea then was to make the most of the pentode construction for low-frequency amplification.

Present-day pentodes give as much power as three-electrode power valves and still have the advantage of requiring only a small grid voltage input.

Unfortunately, the early pentodes gained a bad name over quality of reproduction. The peculiar construction of the pentode makes it tend to accentuate the high notes unless suitable circuit precautions are taken.

The diagram shows the right way to use a pentode valve. Let us examine this circuit in detail. Note that the high-voltage grid is de-coupled. That is to say, between the anode supply voltage and the high-voltage grid is a resistance, a suitable value being about 5,000 ohms as shown. Between the grid end of the resistance and the negative side of the filament is connected a

A choke-capacity filter is very suitable. Instead of connecting the loud-speaker condenser to the anode it is better to take it to a tapping on the low-frequency choke, as in this way bass notes are well reproduced.

We have still to contend with the high-note accentuation of the pentode. So across the low-frequency tapped choke a variable resistance of 25,000 to 30,000 ohms is connected in series with a .01- to .02-microfarad fixed condenser.

A pentode worked with the circuit arrangement shown by the diagram provides excellent quality of reproduction, the pitch of which can be varied by the resistance in series with the fixed condenser across the low-frequency choke.

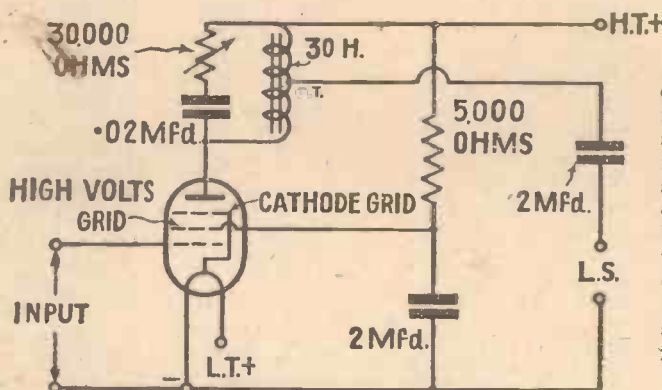
One of the dangers in using a pentode is overloading. The pentode provides its maximum undistorted power output with a much smaller input voltage than is needed to load a normal power valve of approximately the same undistorted watts output rating. Bearing this in mind, beginners using pentodes for the first time should take care to limit the amount of amplification before the output stage.

When the pentode is suitably corrected and not subject to overloading it provides really good quality.

Beginners are apt to think that the pentode valve is exceptionally greedy with anode current. The reverse is true. For a given undistorted power output the pentode is more economical in anode current than the three-electrode power valve.

A simple example will show the truth of this statement. The Marconi PX4 power valve requires 50 milliamperes at 200 volts to give a maximum undistorted output of 1,100 milliwatts. The Marconi PT625 pentode gives 1,500 milliwatts undistorted output for a total anode current of about 33 milliamperes at 250 volts on the anode and 200 volts on the high-voltage grid.

As the new season's pentodes will prove, we lead the world in this particular type of power valve. HOTSPOT.



A typical pentode output circuit

two-microfarad fixed condenser. The resistance and condenser together form a decoupling circuit, preventing low-frequency oscillation. The resistance serves also to cut down the anode supply voltage to a value suitable for the high-voltage grid.

The anode circuit of the pentode valve is very important. As the pentode passes considerable anode current, seldom less than 20 milliamperes, it is advisable to use a loud-speaker filter in order to separate the direct current of the power supply from the winding of the loud-speaker.

NORTHERN WIRELESS RECITALS

WHEN the North National transmitter at Moorside Edge is finally in full service the North Regional transmitter will be free to develop the Regional programme, and one of the interesting features that will then commence will be weekly recitals by the best instrumentalists and vocalists in the North of England. It is expected that these recitals will commence in mid-July and that the first will be given by the well-known Manchester soprano, Isobel Baillie. The recitals will be of thirty minutes duration and will be broadcast every Monday. They will represent the cream of north

country talent and B.B.C. officials in the North are looking to these recitals to demonstrate their contention that there is no scarcity of talent for broadcast programmes in the North of England. Only artistes actually residing in the North Region will be engaged for these recitals.

THE NATIONAL CHORUS

THE 250 amateur choristers who comprise the B.B.C.'s National Chorus are rehearsing again. Apparently there is a dearth of tenors and the cry has gone up for more of them. Some of the National Chorus come quite a long way. One used to come up from Bournemouth and another still comes from Folkestone.

INDOOR AERIALS

ONE of the best types of indoor aerial is the vertical loop variety made by running a wire along one side of the wall up to the picture rail, along the latter, and down again on the opposite side of the wall. A single turn is sufficient for the shorter waves, though for longer waves it is easy to bring two or three turns into circuit by means of a switching arrangement. Such an aerial is open to the objection that it is noticeably directional, though this can be overcome by putting another loop around the adjacent side of the room and arranging a switch so as to bring one or other of the windings into circuit as desired.

A Weekly Programme Criticism—By SYDNEY A. MOSELEY.

Without Fear or Favour



NEW DANCE BANDS?

THEATRES AND PUBLICITY

THAT was a strange incident when Jack Payne in the middle of his programme was heard talking in a rather agitated fashion, and then—silence. When he came on again several minutes later he explained that there was a technical fault, and he apologised for it.

What he didn't explain was, if there had been a breakdown, how was it that the interval clock signal was heard?

The explanation came out later. It seems that one of his bandsmen did not turn up. In the middle of the programme Jack Payne was informed that he had died. This was such a shock that he felt he could not go on playing for a while.

By the by, I wonder how long we are going to have Jack and his band at the microphone?

Marius B. Winter's band and another have been mentioned as possible regular broadcasters. I haven't heard much of the former, but will make it my business to listen to it to see whether the possible appointment will be justified.

The Brahms songs which are being sung in the "Foundations of Music" series are awfully pretty, and I hope you listen to them. The singers were Anne Thursfield and Sumner Austin. I particularly liked the sympathetic and sweet way in which the former sang.

I have more than once expressed my opinion of A. J. Alan, but with an effort to revise it I listened to the incident in "My Adventure in Norfolk," and found that he once more had used the old story of a ghostly visitation. At any rate, in this story he reached a climax, which is more than can be said of many of his other episodes.

I must really strongly protest against this constant favouritism in advertising certain theatres at the expense of others. It is utterly absurd and unfair to advertise Mr. Ronald Frankau (entertainer) as "from the Cambridge Theatre production of *At the Sign of the Seven Dials*."

Underneath this announcement is a portrait of the entertainer and another advertisement of the theatre and the name

of the piece. I say definitely that this is a gross piece of advertising.

I am in two minds about the voice of Marguerite Natalia. She sang "Standchen," and "Freundliche Vision," by Strauss, rather indifferently, but her "Voce di Primavera" was delightful.

I wanted very much to hear Holt Marvell's *Across the Moon*, but was so enamoured with the idea of hearing *Tosca* that I went there instead. I am told, however, that it was quite good and that Hermione Gingold, who usually takes Cockney parts, took the straight part of Dora Lamartine quite well.

As for *Tosca*, this is one of my favourite operas and I enjoyed every note of it. I think it is one of the few operas that tells a story simply and dramatically, while at the same time the music is tuneful and easy to appreciate.

A good deal of fuss was made of the other opera that was relayed, *Fedra*, by Romaina. This was the first time it was put on the stage, and I should say in this case the listener had as much for his money as those

VALUABLE TALKS

A DISTINGUISHED CRITIC

who went to see the opera. The story was utterly absurd, while to watch the gymnastics of that capable singer, Ponselle, was worse still. The music, curiously enough, was as acceptable as a good many other unknown Italian tunes.

I listened with great interest to the talk on India by the Rt. Hon. V. S. Srinvasa Sastri, C.H. Mr. Sastri in the clearest possible fashion gave us a talk pulsating with thrills. These talks on India, like the talks on Russia, are extremely valuable, inasmuch as they enable the serious seeker after truth to appreciate all sides of the question.

As regards Russia, I never believe what the newspapers say about it because it has always been propaganda one way or the other. The idea of the B.B.C. obtaining eminent speakers of all sides gives us an opportunity of appreciating the situation in Russia as it really is.

I enjoyed very thoroughly the singing of Maria Basilides in Schumann's *Frauenliebe und Leben*. This is what I call singing—quiet, resonant, appealing.

The "Escape" series becomes better. Major A. J. Evans told his story in straightforward and arresting style. His deep breathing was a wee bit disconcerting, but one forgave this breathlessness, because some of us listening were equally breathless.

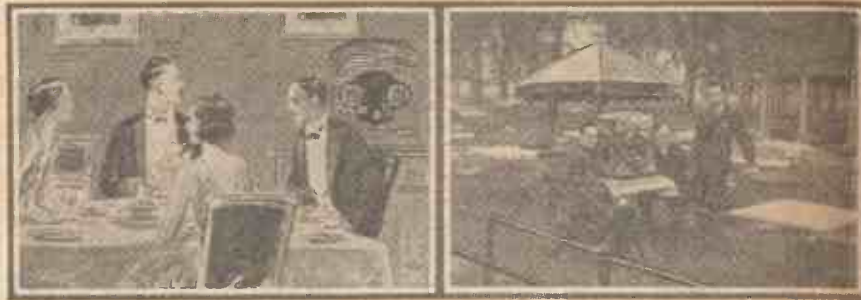
A friend of mine in the House of Commons informed me that the Prime Minister has been criticising the programmes. I therefore invited him to join the Broadcast Critics' Circle, of which your humble servant is president.

I know we are all unconscious plagiarists, but in listening to Stanley Holt's New Orchestra I heard a piece in the suite of "Silhouettes" which, in my view, was definitely reminiscent of Chaminade. I wonder whether this coincidence was noticed by other people.

I felt that Miss Violet Sackville West was becoming rather bored with herself in her last talk on new books. She sounded definitely parsonic. She might follow the example of Mr. Nicholson and have a rest before she becomes too stale.



Versatile Ann Penn



The PORTABLE "CENTURY SUPER"

Designed and Described
By W. JAMES

A view of the Portable "Century Super"

THIS portable receiver has several interesting features.

In the first place, the circuit is that of the "Century Super," but with a different low-frequency coupling arrangement. Nothing is lost by arranging the set in this form, the baseboard and panel being of approximately the same size as that of the "Century Super."

Secondly, the batteries are fitted below the set and the loud-speaker is at the top. This is an unusual arrangement and is surprisingly effective.

The sound comes from the top of the set and is most natural. A further feature is the frame aerial which is wound on the inside of the back. The appearance of the set is striking and as it works very well and has the advantage of being quite self-contained, it is bound strongly to appeal to many listeners.

A strap may be fitted through the side handle pieces of the cabinet and the set carried as an ordinary portable, but it is fairly heavy.

If you look at the circuit diagram you will note the difference between this set and the "Century Super." In the anode circuit of the second detector is a 30,000-ohm resistance. The low-frequency trans-

former is coupled to it through a 1-microfarad condenser.

A transformer, specially made for this resistance-feed method of coupling, is used and from the published curves you will see the excellent amplification characteristics obtained. There will be ample low- and high-note response from this arrangement. At the last valve a .002-microfarad condenser is used in order to avoid high-frequency currents in the loud-speaker wires.

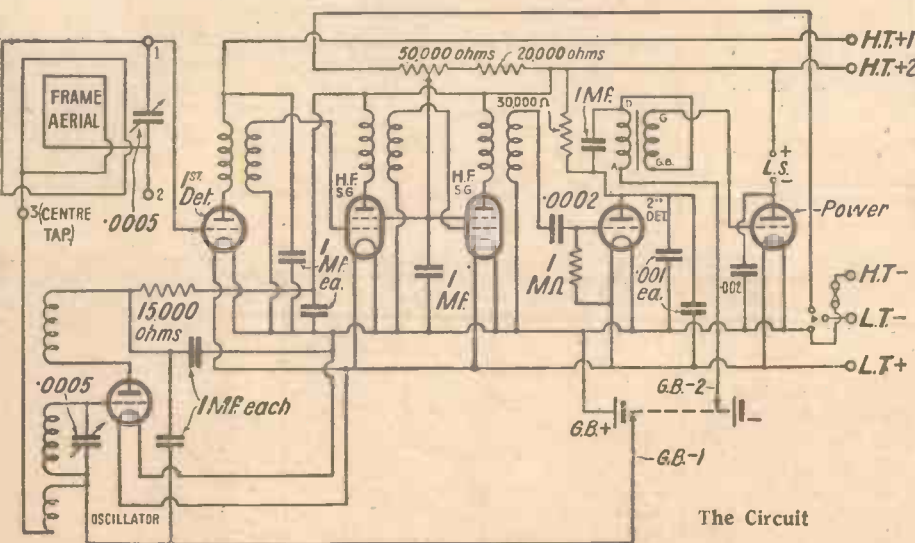
Refinements

In the set itself there are several refinements. A number of 1+1 microfarad condensers are used instead of separate 1-microfarad condensers, resulting in a saving in space.

Then a large ebonite base having valve holders fitted and having strip wiring is used. There are holders for the three super-heterodyne coils and for five valves.

The sixth valve is the oscillator and is mounted separately. A grid-leak holder is fitted to the base and there are various terminals for the filament and other circuits. This unit saves a great deal of trouble. The coils are automatically correctly positioned and so are the valves and there is, of course, the saving in the wiring.

The lay-out resembles that of the "Century Super," with the valve-holder base and the different by-pass condensers. However, the work of assembly and wiring is much reduced. The wiring is shortened and the whole set looks neater. Thus there is nothing much in the construction of the set itself.



The Circuit





E A 100-STATION SELF-CONTAINED RECEIVER CENTURY SUPER™



A rear view: note the unique position of the loud-speaker which faces upwards

There is the panel carrying the oscillator coil and switch, the volume control, and the battery switch, as well as the two tuning coils. These are of the slow-motion type.

Assembling

By the side of the oscillator coil unit is the valve holder for the oscillator valve. The Lewcos coil used has an escutcheon showing the setting of the oscillation coil, and it has wire connections with coloured braid.

It is best to assemble the parts on the front panel first and then to screw it to the baseboard, using counter-sunk screws. Next the large valve-holder base can be placed in position and the fixed condensers.

There is not a lot of room to spare, so you must be sure the parts clear satisfactorily. Screw them down when they are correctly positioned.



Here is the actual receiver portion, remarkable for its simple construction and few components

Be careful of the two condensers fitted at the back of the baseboard. There is a .001-microfarad condenser which is connected between the anode of the detector and the positive side of the filaments, and a .002-microfarad which goes between the anode of the power valve and the negative side of the filament.

On the opposite side of the valve-holder base are two further condensers; one is the grid condenser of .0002 microfarad, and the other is the .001-microfarad joined between the anode of the detector and the negative side of the filament.

All connections on the valve-holder base should be gone over in case one has worked loose.

Then drill holes in the baseboard for the various battery wires. By bringing these out through holes instead of over the back of the baseboard the lengths of the wires are reduced.

There are one or two wires which should be connected to parts on the panel before it is finally fitted to the baseboard. These are the wires connecting the switch and potentiometer. Lengths of wire should, therefore, be connected to these parts and left. Afterwards the free ends of the wires can be taken to the circuit.

Cabinet Arrangements

There are various flexible resistances to be joined in the circuit. A 20,000-ohm resistance goes to the potentiometer. There is a 30,000-ohm resistance in the anode circuit of the detector valve and a 15,000-ohm unit connects with the oscillator. Where an end is left a bolt and nut should be fitted and afterwards be covered with tape to avoid a contact which might damage the parts.

The set is arranged to slide into the cabinet from the back and the back cover must first be removed. The battery leads will then fall in the space below the set and it is arranged that the filament accumulator be put in first and then the grid and high-tension batteries.

These wires ought to be cut to length and have suitably marked connectors fitted to

COMPONENTS FOR THE PORTABLE "CENTURY SUPER"

Special cabinet (Peto-Scott, Read-Rad, Camco).

Ebonite panel, 12 in. by 8 in. (Beacol, Peto-Scott, Wearite, Read-Rad, Goltone).

Baseboard, 12 in. by 9 in. (Clarion, Cameo, Peto-Scott, Read-Rad).

Two .0005 variable condensers (J.B. special 40 to 1, Read-Rad, Telsen, Cyldon, Formo, Peto-Scott, Utility, Ormond, Polar).

Coils (Lewcos or Wearite).

50,000-ohm variable resistance (Watmel, Colvern, Regentstat, Sovereign).

Eight-valve holder base (Wearite or Lewcos).

One valve holder (Telsen, Lissen, Benjamin, Clix, Wearite, Lotus, W.B.).

Two 2-mfd. centre-tapped condensers (Ferranti C2C).

Two 1-mfd. condensers (T.C.C., Lissen, Dubilier, Telsen, Formo).

Five condensers: 1 .0002, 2 .002, 2 .001 (Telsen, T.C.C., Dubilier, Lissen, Formo).

One-meg. grid leak (Lissen, Telsen, Dubilier, Graham-Farish).

Three spaghetti resistances, 15,000, 20,000, 30,000 (Read-Rad, Telsen, Tunewell, Sovereign, Lissen, Graham-Farish, Lewcos).

L.F. transformer (R.I. Parafeed, Telsen,

Lissen, Varley, Lewcos, Ferranti, Burton, Voltron).

Three-point switch (Read-Rad, Goltone, Lissen, Benjamin, Bulgin, Telsen, Junit, W.B., Wearite).

Fuse holder and fuse (Read-Rad, Telsen, Bulgin).

Terminal strip with three terminals (Peto-Scott, Read-Rad, Wearite).

Six wander-plugs, marked: H.T.—, H.T.+1, H.T.+2, H.T.+3, G.B.—, G.B.— (Clix, Belling-Lee, Ealex).

Two spades, marked: L.T.—, L.T.— (Clix, Belling-Lee, Ealex).

Frame-aerial wire (Lewcos, Goltone).

Six yards of flex (Lewcos).

Connecting wire (Lewcos, Goltone).

Sleeving (Lewcos, Wearite, Goltone).

ACCESSORIES

Accumulator (Exide W.P.C3 [free acid]; JWJ7 [jelly acid]; C.A.V., Pertrix).

One grid-bias battery, 9 volts (Pertrix, Ever-Ready, Drydex, Lissen, Fuller).

120-volt H.T. battery (Pertrix, Ever-Ready, Lissen, Drydex, Fuller).

Loud-speaker assembly (Ormond).

'THE PORTABLE "CENTURY SUPER"'

(Continued from preceding page)

avoid confusion. Right above the set is the loud-speaker.

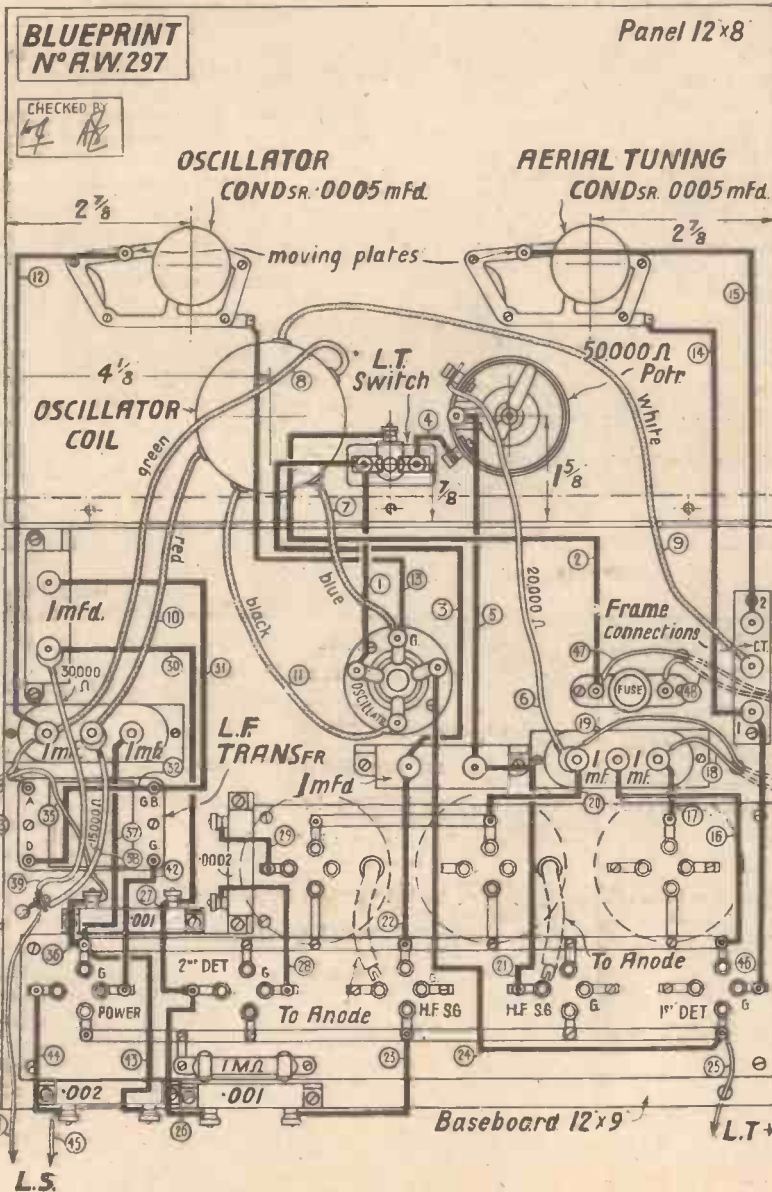
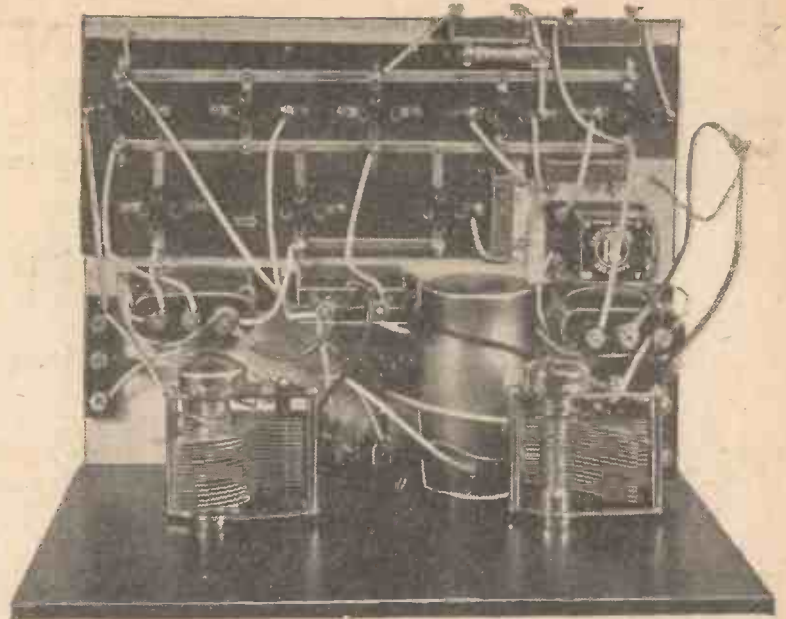
The set had better be removed while this is fitted. With the unit illustrated the pair of connecting wires are passed through a hole in the wooden baffle attached to the unit and brought down to the set fairly well away from the frame aerial.

The Speaker

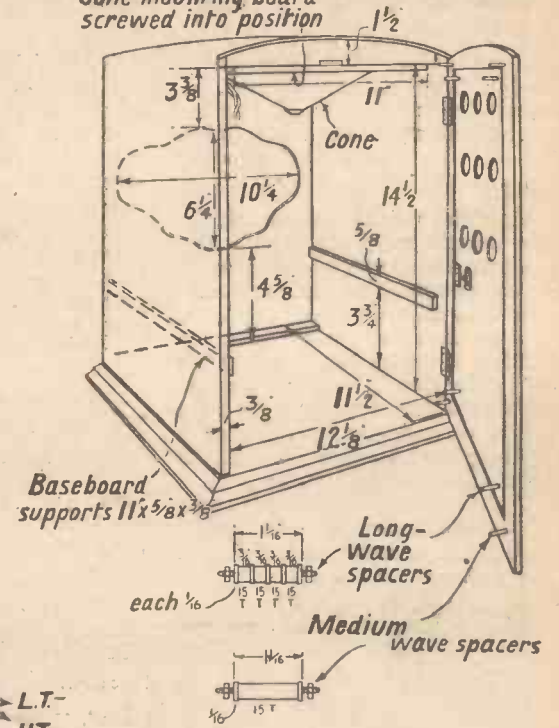
Four fixing screws are used and it is necessary to adjust the unit before finally fixing it. It is better to test the set and unit out of the cabinet and then when the loud-speaker has been adjusted, it can be screwed into the top of the cabinet.

Be careful when putting the set into the cabinet not to foul the loud-speaker with the top of the panel. It will also be necessary to fit a piece of wood to the base in order to prevent the batteries from slipping back against the frame aerial which is wound inside the back of the cabinet.

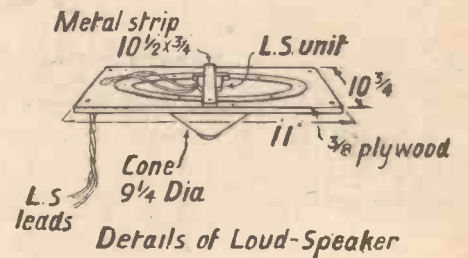
Compare this plan view with the diagram below



Cone mounting board screwed into position



Details of Ebonite Spacers



Details of Loud-Speaker

The layout and wiring diagram of the Portable "Century Super." A full-size blueprint is available, price 1/6

THE LATEST "CENTURY SUPER"— POWERFUL—AND NOW— PORTABLE!

THE "CENTURY SUPER" PORTABLE

	£ s. d
1 Ebonite panel, 12 in. by 8 in. by 3/16 in. drilled to specification	4 0
1 Readi-Rad cabinet in polished walnut to specified design	2 5 0
2 J.B. .0005-mfd. junior log slow-motion condensers, 40-1 ratio	1 1 0
1 Set Leweos super-hot coils	2 10 0
1 Sovereign 50,000-ohm potentiometer	4 6
1 Readi-Rad 8 valve base	7 0
1 Telsen 4-pin valve holder	6
2 Ferranti C2C condensers	9 0
2 T.C.C. 1-mfd. fixed condensers	5 8
5 Telsen fixed condensers; 2, .001; 2, .002; and 1, .0002-mfd.	2 6
1 Readi-Rad 1-megohm grid leak	10
3 Readi-Rad link resistances; 15,000, 20,000 and 30,000 ohms	4 0
1 R.I. Parafeed L.F. transformer	8 6
1 Readi-Rad 3-point switch	1 6
1 Readi-Rad fuse and holder	1 3
1 Readi-Rad 3-point terminal strip	6
6 Belling-Lee wander plugs; 4, H.T., and 2, G.B.	1 0
2 Spade terminals	3
1 100-yds. reel Leweos 9/40 frame wire, L.Z. 2140	4 3
1 50-yds. reel Leweos 27/40 frame wire, L.Z. 2240	5 6
1 Pkt. Readi-Rad "Jifilink" for wiring	2 6
1 Ormond portable loud-speaker unit and chassis	1 5 0
6 Mullard valves as specified: 2, S.G.; 2, H.F.; 1, L.F.; and 1, Power	3 16 0
6 yds. flex, wire, screws, etc.	9

TOTAL (including Cabinet & Valves) £14:1:0

THE "CENTURY SUPER" PORTABLE

Completely assembled, with valves and cabinet, ready for use and aerial tested.

Royalties included, **£17:1:0**

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The Century Super Portable Cabinet with wound frame aerial as included in every Ready Radio Century Super Portable Kit C, can be bought separately. It is constructed of polished walnut, and is built strictly to "Amateur Wireless" specification.

The frame aerial consists of stranded aerial wire, accurately spaced and wound on rigid ebonite spacers.

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RECOMMENDED ACCESSORIES

- 1 Fuller unspillable accumulator, type J.A.P.11. 13s. 6d.
- 1 Fuller 9-volt G.B. battery 1s. 6d.
- 1 Fuller 120-volt H.T. battery 15s. 10d.

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IN MY WIRELESS DEN



WEEKLY TIPS—
CONSTRUCTIONAL AND THEORETICAL

By W. JAMES.

Look Out for Losses

THE chances of unnecessary losses occurring in high-frequency circuits must always be guarded against. If you follow the specification of a set everything should be satisfactory, but it is surprising what seemingly small things will affect the results.

Take the valve holder used with the screen-grid valve, for example. If this is a good average product it will introduce only negligible losses into the circuit. With a poor valve holder, on the other hand, the loss introduced may be serious enough to affect the tuning and the strength.

The contacts of the valve holder are held by an insulating material and if you measured the capacity between, say, the grid contact and a filament contact, you would find it appreciable. If now the condenser is a poor one, having a large loss, the results are bound to be affected as this tuning condenser is across the tuning condenser and the coil. The result is, in effect, equal to that which would be obtained with a poor tuning condenser.

There are other parts that should be watched, such as grid-leak holders and fixed condensers. If, therefore, you obtain poor results from an experimental set you should look into these things and try others of different make.

Use Ample H.T.

Present-day dry batteries are uniformly well made and will give good service when used under the right conditions.

The mistake so often made is of using too small a battery with a set. This is actually much more expensive over a period of time than the use of larger and more suitable batteries.

I know that this has been said so many times, but there are still people who do not believe it. Practical tests show that the use of a battery of the right capacity for the load imposed by a set is cheaper in the long run than when a smaller or larger battery is used.

Faulty "Pots"

Lately I have met with a few faulty potentiometers of the high-resistance type as used in screen-grid circuits for volume controls. If one of these is joined in the screen-grid circuit, no control is obtained or the control is erratic.

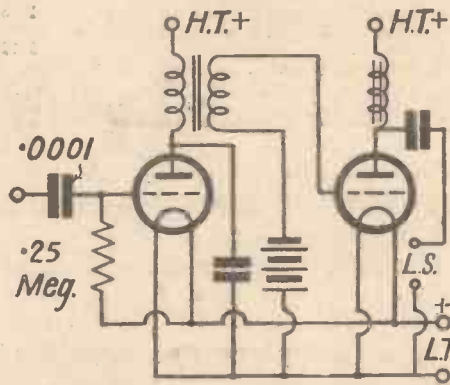
The set may oscillate owing to the voltage of the screen being too high or not amplify very much, according to the setting of the potentiometer and the exact nature of the fault.

Power Detection Points

Power detection is not really obtained unless the input to the detector is several volts, depending upon the valve and its operating voltages.

The mere fact that the grid condenser and leak values are lower than the normal values is not a proof of power detection at all. You can have the detector arranged as in the accompanying diagram, for example, with a grid condenser of .0001 microfarad and a grid leak of .25 megohm, but power detection cannot be obtained because of the high-ratio transformer and the high-magnification factor of the valve coupled with the relatively small output valve.

For ordinary power valves the total low-frequency amplification is usually too great for true power detection.



There are several points to note in connection with power detection, as W. James clearly explains in the accompanying paragraph

The results obtained with these values of grid condenser and leak are better than when the normal values are used, as a rule, because there is less frequency distortion. This is worth having, of course, but the best quality will only be obtained with a suitable input to the detector and a carefully designed low-frequency circuit.

Condensers for Short Waves

Not all makes of tuning condensers are satisfactory in short-wavelength work. Some of those having a fairly long wire or spring contact with the moving plates are not suitable and others with certain forms of slow motion built into the condenser are not to be recommended.

Noises are often produced by such a slow-motion movement and for this reason a knob having a slow-motion mechanism is usually to be preferred. But here again care must

be exercised in the selection of a driving knob that, besides being smooth working mechanically, is without fault electrically.

Some tuning condensers have a pigtail connection with the shaft of the moving vanes and when this is properly secured the results are good in short-wavelength work.

Attention to points such as these will result in better tuning and greater freedom from noise. A fairly large spiral spring connected to the moving vanes is obviously not desirable in short-wavelength work, owing to its inductance. This may not matter at all in the broadcast range, but is likely to be serious in a short-wave set, as the tuning range will be restricted.

"Slow" Mains Valves

The time taken for an indirectly-heated mains valve to reach its normal working temperature from the moment of switching on the current depends chiefly upon the design of the cathode.

There is the heater wire itself, through which the current passes and the insulating material with the electron emitting surface.

In some American so-called quick-heating valves, the insulating material is notched and as the weight of material is less than when the element is not notched, the time taken in heating it to its normal working temperature is reduced.

There seems to be some difficulty in the way of producing quick-heating valves, for everybody agrees that such valves would be preferred by users to the present-day types, which take some time to heat.

Our mains valves are much better nowadays than formerly, being more free from hum and noise, in fact, a set constructed to work entirely from the mains can be made so well that background noises due to the mains is non-existent. Circuit design plays a part in this, of course, but the valves are necessarily a vital factor.

These "Variable Mu" Valves

There are two chief types of the recently introduced American variable-mu valves.

One has a normal anode impedance of 350,000 ohms and a slope of 1 in 1, that is with an anode voltage of 180, a screen voltage of 75 and a bias of 1.5. The slope is only .005 when the bias is negative 40 volts.

The other type may be given a bigger grid bias.

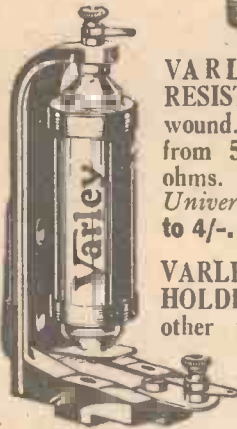
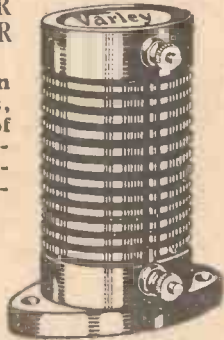
These valves are able to deal with inputs of many volts with but little distortion and no doubt we shall have types produced here in due course. They have great advantages over the usual screen-grid valve.

Varley QUALITY AT POPULAR PRICES

VARLEY JUNIOR MULTI-CELLULAR H.F. CHOKE.

Chokes efficiently on both wave-bands, either in Detector of H.F. stages. Inductance 120,000 microhenries. D.C. Resistance 350 ohms.

List No. B.P.2.
Price 3/6



VARLEY POPULAR RESISTANCE, wire-wound. Made in values from 5,000 to 300,000 ohms. Prices (without Universal Holders) 1/6 to 4/-.

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VARLEY TAG RESISTANCE. Wire-wound. Made in values from 100 to 100,000 ohms. Prices 1/- to 2/-.

VARLEY SPAGHETTI RESISTANCE. Made in values from 100 to 100,000 ohms. Prices 6d. to 1/6.

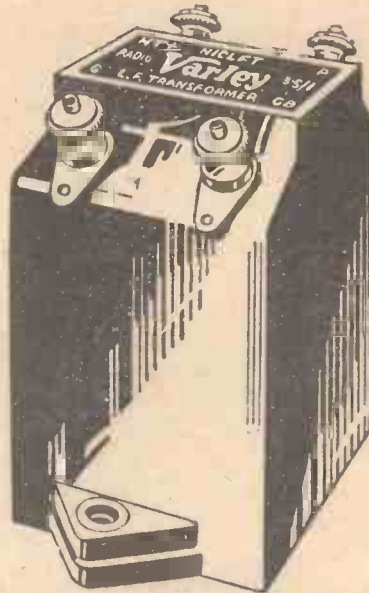
VARLEY THERMAL DELAYSWITCH. Specially designed for use with the Osram G.U.1 Rectifying Valve. Heater circuit 4-volts, and is connected across the G.U.1 filament. List No. EP17. Price 12/6.

THE NEW NICLET

L.F. TRANSFORMER

The core is made from the latest development of nickel-iron alloy. Primary inductance 45 henries with no D.C. Primary resistance 750 ohms. Secondary resistance 4,000 ohms. Can be used as an ordinary 3.5 to 1 transformer with up to 3 m/a D.C. When resistance fed, ratios of 2.5, 3.5, and 4.5 to 1 are obtainable.

List No. DP21. Price, 7/6



VARLEY NICHOKE II.

The latest addition to the range of Varley Chokes. Inductance, no D.C., 20 henries. With 50 m/a D.C. 14 henries. D.C. Resistance 450 ohms.

List No. DP23. Price, 10/6

List No. D.P.21

THINK of it! An L.F. Transformer by Varley for 7/6—by Varley, who, in the early days of broadcasting, supplied the coils for the L.F. Transformers sold by practically every manufacturer of note. A Varley H.F. Choke for 3/6! Varley Wire-wound Resistances from 1/-!

The prices of these new Varley Components are amazingly low. Their quality up to the well-known Varley standard. Build Varley quality into your next Set.

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Advertisement of Oliver Pell Control, Ltd., Kingsway House, 103, Kingsway, London, W.C.2. Telephone: Holborn 5303.

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SETS OF DISTINCTION

AMPLION CABINET PORTABLE

Makers: GRAHAM AMPLION, LTD.

Price 22 guineas.

I BELIEVE the writers of AMATEUR WIRELESS were the first to point out that the portable set attained popularity through its self-contained construction and not because of its use as a purveyor of entertainment at picnics and such-like excursions.

Since it is their self-contained construction that makes portables popular, the suit case is not necessarily the ultimate shape for the container. Indeed, a table cabinet, with suitable side handles for easy transportation, seems to me to be more generally useful.

Two Types

Appreciating the fact that public taste vacillates between the suit case and the cabinet, Graham Amplion Ltd. have produced their two-screened-grid portable in both forms. There is an excellent suitcase container covered in real brown hide; alternatively one can buy the same chassis contained in a handsome table cabinet.

I have just completed tests of the table-cabinet model. All who are confined to battery-operated sets will be interested in this review. At least, I hope they will be, because the Amplion Cabinet Portable is quite an exceptional set, comparing well with the average mains-operated set on the score of quality of reproduction.

This good quality is all the more gratifying because a pentode power valve is used in the output stage. The fact is that when a pentode valve drives a well-matched loud-speaker the quality is as good as—and can be better than—that obtainable from a three-electrode power valve. In this set the Amplion balanced-armature loud-speaker unit must match the pentode with unusual precision. There is no undue accentuation of high notes and the bass has a timbre quite rare outside moving-coil sets.

Excellent Quality

The good quality and the adequate volume of sound produced by the Amplion Cabinet portable is achieved with a standard-capacity high-tension battery. The anode current taken by the set I tested was just over 11 milliamperes. This means that the battery is over-run. Still, you cannot have your cake and eat it!

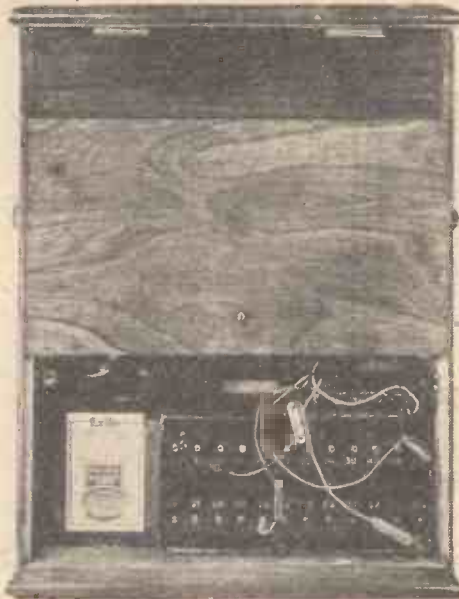
When testing the battery load I was impressed with the accessibility of the battery compartment. Undoubtedly, the

upright type of cabinet lends itself to a neat battery layout.

The controls of the Amplion Cabinet Portable impress me as being very straightforward. And when one actually operates the set, this impression is enhanced.

There are three slow-motion dials arranged in a row, these being, from left to right, reaction, first tuning control and second tuning control. To receive a station it is necessary to adjust both tuning dials. These are marked from 0 to 100 degrees. The "Tune 1" control is quite critical in its setting, but the "Tune 2" control is by no means so.

The only other gadget to be contended with is the three-position switch lever fitted at the extreme left-hand corner. This combines the functions of on-off switch and wave-change switch.



This picture of the back shows the convenient arrangement of the batteries

All the controls are mounted very conveniently at the top of the cabinet and are hidden from view by closing down the lid. To operate the set one would have to be standing, but I suppose very few listeners will mind that. Alternatively, one could place the set on a very low table.

The circuit arrangement is notable for several points of originality. For example, one of the two screen-grid high-frequency valves is untuned. The tuning sequence is, therefore, as follows: Firstly, the frame tuning in the grid circuit of the first high-frequency valve; then the tuning of the

high-frequency coupling between this valve and the second high-frequency amplifier. It is the second high-frequency amplifier that is untuned, being aperiodically coupled to the detector through a choke.

A Sensitive Set

The reaction is unusual. It is obtained between the detector valve and the second high-frequency-amplifying valve by means of a small variable condenser. The method of connecting this condenser is somewhat unconventional but it certainly works well.

The complete circuit comprises two stages of high-frequency amplification, a detector and a transformer-coupled pentode. Even allowing for the fact that a frame aerial is used, one would expect a high degree of sensitivity from such a combination. Nor is one disappointed, for on test the Amplion Cabinet Portable brought in a very creditable number of foreign stations during daylight.

One of the best was Brussels No. 1, logged at full loud-speaker strength at 82 on the "Tune 1" dial and 82 on the "Tune 2" dial. North Regional was even better at 76 and 76. Langenberg was quite good at 75 and 75. Midland Regional excellent at 60 and 62.

I was delighted with the good separation between the two Brookmans Park stations. London Regional, maximum at 50 and 50 had a spread of only 9 degrees on each dial. London National maximum at 19 and 26, had a spread of only 11 degrees on each dial.

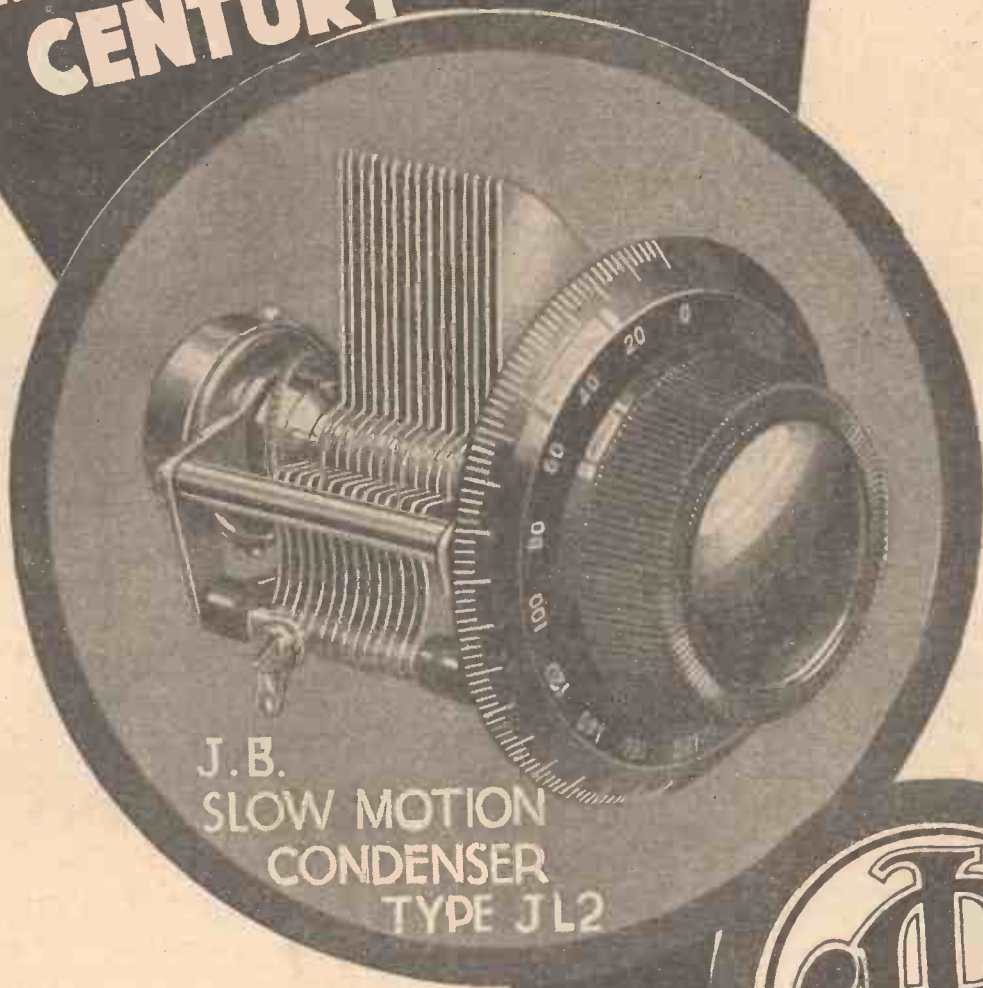
On the long waves this set did quite exceptionally well, bringing in Huiszen, Radio Paris, Eiffel Tower, Motala, Kalundborg, Oslo and Leningrad at good strength.

SET TESTER.

The relays of dance music from Caproni's Palais de Danse, Bangor, which have taken place each summer for the last two years, are a very popular feature with Northern Ireland listeners. During the week beginning July 12, three relays will take place from various outside broadcast points installed for the summer. On July 13, from 4 to 5.15 p.m., dance music will be relayed from Caproni's, Bangor, and later the same evening Sibbald Treacy's Rhythm Kings will broadcast more dance music from the Northern Counties Hotel, Portrush.

Shakespeare nights are a great attraction in Northern Ireland and on July 17 scenes and songs from *As You Like It* will be presented in the studio, with Fred C. Hughes (tenor) as vocalist, to be followed by a Shakespearean Sonnet Recital by Betty Lorimer.

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SLOW MOTION
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Now comes the Portable Century Super—a development of the wonderful Century Super—and of course J.B. is specified and used again.

This time the designers have chosen the J.B. Slow-Motion Condenser type J.L.2, a compact and rigid condenser giving exceptionally fine tuning. It is supplied complete with a 3 inch bakelite dial and gives slow-motion (40/1) or direct drive at will, both with the extreme smoothness that comes from J.B. Precision. Hard brass end-plates and hard aluminium vanes. Pigtail to rotor.

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(Type J.L.2) Capacity .0005. Price 10/6

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A weekly review of
new components

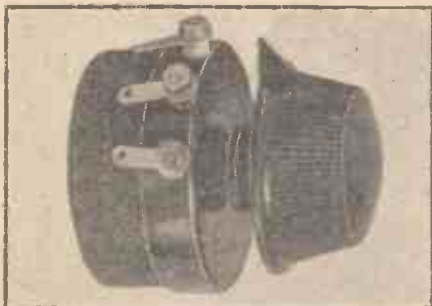


and tests of
apparatus.

Conducted by J. H. REYNER, B.Sc., A.M.I.E.E.

Gambrell Voluvernier

THE new Gambrell Voluvernier which we have tested this week is a neat totally-enclosed volume control similar in appearance to the older models. The rotating element carries a spring loaded graphite plunger moving on a track also coated with graphite. This type of volume control is for use in circuits where no appreciable currents will be passed



The Gambrell Voluvernier

through them, such as a volume control on a gramophone pick-up, or on the grid of a resistance-coupled valve.

On test the resistance was found to be variable from a few hundred ohms up to approximately 500,000 ohms in almost a complete turn of the knob. The action is very smooth, but quite firm. We found the volume control quite satisfactory, giving a very nice control from a mere whisper up to full volume, when used in conjunction with a gramophone pick-up. The Voluvernier, which is arranged for single-hole mounting, full instructions being enclosed, sells at 6s. 9d.

Ebonite Panels

ONE of the disadvantages of ebonite has always been that it changes colour with age particularly if left in bright sunlight. For this reason commercial radio apparatus which has to stand long periods of sunlight is always mounted on some different material such as stabilite.

For ordinary radio purposes, however, ebonite is very convenient. It is easy to work and can be made in a variety of attractive finishes. Readers, therefore, will be interested to hear that the British Hard-rubber Co., Ponders End, Middlesex, have just issued a range of panels in Permcob ebonite, which is similar in all respects to the highest grade ebonite, except that it will not discolour.

We understand that exhaustive tests have been made on this material to prove this point. Naturally, in the relatively brief

time the sample has been in our hands, our tests have been limited.

We have, however, exposed one portion of the panel to bright sunlight for a period of rather more than a week, and have been unable to detect any difference between the exposed and unexposed portions.

The electrical characteristics are up to standard and the material is easy and pleasant to work. It is certainly worth a trial, where there is any likelihood that the panel will be exposed to bright lights or direct sunlight.

Helsby Fixed Condensers

ONE of the most important components in a modern radio instrument is the fixed condenser. On it depends to a large extent stability and good quality, and it is bad policy to buy cheap and badly made condensers.

One of the most important points to keep in mind when buying fixed condensers is the voltage rating. Often we have seen condensers rated to carry 150 volts running continuously on 250 to 300 volts with, unfortunately, very serious results to the insulation resistance.

The Helsby 2-microfarad condenser which we have tested this week is rated to carry 250 volts D.C. continuously, which rating is quite sufficient for all normal uses. On test the condenser was quite satisfactory, having a capacity of 2.1 microfarads, and a substantially infinite insulation resistance both before and after 24 hours run on an A.C. voltage with a peak value of 360 volts.

The condenser is housed in a brown bakelite case of conventional pattern, measuring approximately 3 in. by 1 1/4 in. by 3 in. overall.

Six-Sixty Valve Screen

WITH the advent of the metal coated valve, valve screens will tend to become unnecessary, but for some time to come the

majority of listeners will continue to use the older type of valve. This being so, valve screens will still be in demand for some considerable time, and it is with interest that we review this week a metal screen marketed by Messrs. Six-Sixty Radio Co.

The screen is of spun aluminium and is in the form of cone of small angle, both ends being open. The screen is provided



A useful accessory—the Six-Sixty valve screen

at the small end with a lug, through which one of the filament legs of the valve (preferably the negative) is inserted before the valve is placed into its holder. The valve leg fits the holder quite tightly, thus a good connection is obtained. This feature of the screen is good and it overcomes the difficulty normally experienced of making a good earthing contact on to the screen.

A small brass screw which passes through the screen at the bottom end is provided for the purpose of clamping the valve in position. This screw tends to force the valve towards the opposite side of the screen and thus ensures that the valve makes good contact with the earthing lug.

The screen is a neat piece of work and can be recommended to all who use the non-coated type of valve.

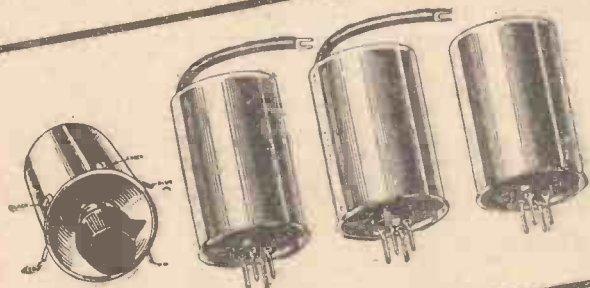
DO YOU KNOW

— that sometimes an annoying ringing sound can be cured by moving the speaker away from the set and not standing it on the set's cabinet? This ringing is caused by loud sounds from the speaker setting the valves in vibration.

— that a high-pitched whistle is sometimes set up if the leads of a speaker (not connected through an output filter) pass too close to the battery or aerial wires? A neater arrangement of the wires at the back of the set will cure this but the need for an output filter is indicated.

Blue Spot Speakers Abroad.—There are Blue Spot agents in many countries, and overseas readers should make a note of the addresses of the leading agents. (Australia) H. Hecht & Co., 450 Collins Street, Melbourne, C.I. (New Zealand) Rodger Importing Co., Ltd., 159 Manchester Street, Christchurch. (India) Bombay Radio Co., Wireless House, Queen's Road, Bombay 2; Colombo Stores Ltd., Ceylon. (Burma) Rowe & Co., P.O. Box 77, Rangoon. (Malta) Mamo Bros., Ltd., 262 Strada Reale Valetta. (South Africa) Garden & Co., 41 Bury Street, Capetown.

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Don't Forget to Say That You Saw it in "A.W."

HOW TO TUNE IN SHORT-WAVE STATIONS

By J. H. REYNER, B.Sc., A.M.I.E.E.

EXPERIMENTING on the short waves is great fun, and it is a hobby in which one can indulge even in the summer time. At the end of these long evenings it is really quite pleasant to sit down and endeavour to obtain one or two American stations just to cheer one up before going to bed.

I have explained before in these columns how easy this feat is. The principal difficulty which the newcomer experiences is that of finding where he is. Anyone with a reasonable experience of wireless has some idea where to look for stations on the broadcast band. There are usually some strong stations which one can recognise and which give one a clue to the position on the dial at which other stations may be expected.

Really, the same state of affairs applies on short waves, but owing to the much finer tuning, the circuit may possibly appear lifeless at first and an inexperienced operator may have trouble in picking up stations when he first tries his hand at short-wave reception. The best plan in such a case is to make up one of the short-wave sets described in AMATEUR WIRELESS, because usually some indication is given in the article as to where the stations may be found. In experimenting, however, one often hooks up a circuit with plug-in coils and a few pieces of wire, and has to find out for one's self what the tuning range of the circuit is.

The Useful Wavemeter

I have the same difficulty myself when I first set a circuit up, and I invariably make use of a short-wave wavemeter in order to establish my landmarks. It occurred to me the other day when I was using one of these instruments that some information on the point would probably be interesting to those readers who are similarly placed. A wavemeter of this kind is very easy to make up, the difficulty being in calibrating it, but this problem is easily overcome if one does not require a very accurate calibration, as will be explained shortly.

The arrangement consists simply of a coil and condenser. A standard short-wave plug-in coil may be used, tuned with a .0005-microfarad condenser, and this is all the construction necessary. The condenser should be rigidly mounted and provided with a slow-motion dial, while the coil must be so placed that the leads between it and condenser are short and relatively close together.

The wavemeter is used as an absorption circuit in the following manner. Suppose we have a short-wave hook-up or set actually working. We tune in to some signal and bring the wavemeter fairly close, i.e., within three or four inches of the tuning circuit. We rotate the wavemeter dial slowly, and at one particular point the signals will be found to be reduced in strength. Sometimes they are even blotted

out completely. This effect will persist over perhaps two or three degrees, after which the signals will return to normal.

Over this region, of course, the wavemeter is absorbing energy from the tuned circuit, and thus reducing the voltage applied to the grid of the valve. If the wavemeter is very close, this absorption will be so large as to blot the signal out completely, while the spread on the wavemeter dial will be several degrees. This is hardly accurate enough for us to say what the proper wavelength is, so we move the wavemeter a little farther away. We go over the same region again, and we now find that the dial spread is much less; we continue in this manner moving the instrument away until the absorption is only noticeable over about one degree of the dial. We can then take the reading and by reference to the calibration of the wavemeter obtain the actual wavelength of the circuit at that setting. This, of course, corresponds to the tune of the circuit we are trying to measure, since the wavemeter only absorbs when it is tuned to the same wavelength as the circuit under test.

Using a Wavemeter

Often we have no signal to tune in. Perhaps the hook-up is just finished and we do not yet know where we are. Fortunately an actual signal is not necessary. Adjust the short-wave set until the circuit is just oscillating. Now bring the wavemeter near to the circuit again and go through exactly the same operations as before. When the wavemeter comes into tune with the oscillating circuit, extra damping will be introduced due to the fact that the wavemeter absorbs some of the energy. The reaction, therefore, will not be sufficient to maintain the circuit in a state of oscillation, and it will stop oscillating. This will be accompanied by a click in the headphones or loud-speaker, or by a flicker in the reading of the milliammeter in the H.T. supply circuit if such a meter is provided. (In passing, the use of a milliammeter in the anode circuit of the detector valve provides a very sharp method of detecting the wavelength by an absorption method of this kind.)

Thus, by bringing the wavemeter close to the tuned circuit either adjusted to receive a signal or permitted to oscillate gently, we are able by absorption to find what the wavelength is. The only difficulty we are left with is that of determining the calibration of the wavemeter.

As a first approximation, the tuning characteristics of the coil itself may be taken. An Igranic four-turn coil, for example, will tune with a .0005 condenser from 20 to 70 metres. If we are using a square-law or even a log-law condenser we may assume for a first approximation that

the wavelength is proportional to the dial reading, and this will give us a rough idea of where our circuit is tuning.

The next step is to locate and identify certain well-known stations. The three American stations, 8XK, W2XAD, and W2XAF, make three landmarks which are easily tuned in. Pick these up on the receiver and tune the wavemeter to them in the manner already described. Note the setting on the wavemeter. This corresponds exactly to the wavelength and you have, therefore, three calibration points for the meter.

It is possible to put a smooth curve through these three points and assume that the calibration is then correct over the rest of the range. The accuracy resulting from such a method depends upon how skilfully one is able to draw a curve through the three points; it will be sufficient for many purposes. However, as more experience is gained other stations will be identified, and they may be tuned in on the wavemeter at the position noted. Thus, more and more points will be obtained.

Harmonics

Harmonics of one's own local station will often be found on the short wavelengths. These harmonics are exact multiples of the fundamental frequency, and their wavelength therefore, can be obtained by dividing the fundamental wavelength by some fairly large whole number. For example, the London Regional programme operating on a wavelength of 356 metres, has 10th, 11th, and 12th harmonics on wavelengths of 35.6, 32.3, and 29.6 metres.

These are only a few selected for purposes of illustration.

Such harmonic transmissions from the local station can usually be tuned in quite easily, and if one already has some idea as to the approximate wavelength it is easy to discriminate between one harmonic and the next. For example, suppose we find a transmission operating on about 30 metres which we identify as a harmonic of London Regional. In this region we have the 11th harmonic on 32.3 metres and the 12th on 29.6 metres. The latter is obviously the correct one and we can mark the point on our wavemeter calibration as 29.6 metres accordingly.

Hence, a little time will enable the wavemeter to be calibrated quite accurately for practical purposes, and it is then useful in any further hook-ups. Its function is not so much the identification of stations in the first place, although this afterwards becomes a valuable asset, provided the calibration is sufficiently accurate. It is rather that the use of a wavemeter overcomes that slight feeling of being lost which one is apt to experience when exploring short-wave channels on a new hook-up. I hope to give practical details regarding the construction of a simple meter in an early issue.

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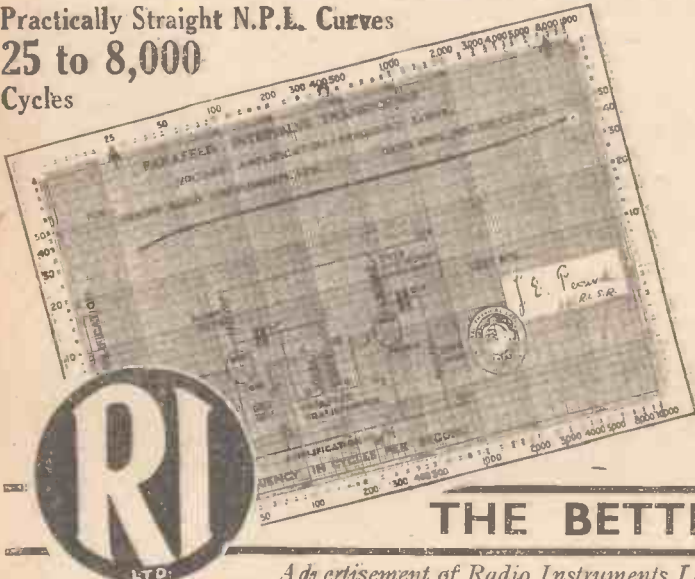
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As specified for the original Century Super-het. Three-way lead and six spacers. Each strand of wire is enamelled and covered overall, which ensures maximum results. Correct centre tap. The only Frame Aerial complete with wave-change switch and base.
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Mention of "Amateur Wireless" to Advertisers will Ensure Prompt Attention.



An Amazing Set

SIR,—The "Century Super" is an "amazing set," and one feels proud to be able to follow Mr. James in getting better radio reception. Many thanks to the designer. The coils (Lewcos), frame (Lewcos), transformers (AF5 and OPM1, Ferranti), all go towards making up a really fine set. I have in the past used the "Best By Ballot 3" and "Binowave 4," all topping sets, yet they are very inferior to this latest product of your wireless wizard, Mr. James. To cut out the local station, Cardiff, and receive stations at full loud-speaker strength by themselves is now child's play.
H. I. (Cardiff).

Storms and Wireless Reception

SIR,—Here is a strange happening which occurred during the thunderstorm and tornado which visited this district on a recent Sunday.

I had my set going and, as you can guess, atmospheric were pretty bad, and the following is how they affected me.

Midland Regional.—Very good reception.

Daventry National.—Nearly blotted out.

London Regional.—Quite blotted out.

North Regional.—Nearly as good as Midland.

The point that seems queer to me is that

the best results came from stations that were in the direct path of the storm, other stations which escaped the storm being bad.
J. B. (Birmingham).

Short-wave Reception

SIR,—Re letter from T.H. (Twickenham) as to short-wave reception on "Century Super," I have found that reception is possible in all the following conditions: (1) Merely clipping a short aerial on to one of outer terminals of "Ready Radio" frame, switch at either medium or long; (2) Disconnecting the three-way connecting wire of aerial from frame, and either (a) short-circuiting the three loose ends of terminals, or (b) leaving them free, with or without short aerial; (3) Using a special Wearite coil wired on to the aerial terminals of receiver; in this case I leave the three-way connecting cord *in situ* and it seems to work best if it is plugged in to the long-wave switch of frame!

Taking off the three-way cord from set terminals and using Wearite coil only with no wires, causes violent oscillation when frame condenser is at about 15 degrees on dial.

Reception is strongest of all when S.W. coil is used and three-way flex is connected to L.W. windings on frame, in which conditions Moscow, 50 metres, is received nearly

as loud as the local station. It would seem that when the oscillator coil is switched to "ultra-short," almost any arrangement (or none at all!) suffices to pick up stations and the readings of right-hand dial do not greatly vary. Pittsburg (25.25) comes often quite loud on L.S. with oscillator dial at about 18½.
G. M.

"Century Super" and Selectivity

SIR,—I have constructed the "Century Super" receiver and whilst reception of stations is good, I find that tuning of the frame aerial condenser is very flat and that tuning with the other condenser provides quite a number of alternative settings around the dial for one station. I realise that in some way I have not got the receiver working properly and would welcome any advice you can offer.
J. B. (Charlton).

If your frame aerial tuning condenser gives flat tuning, it proves that your frame aerial circuit possesses resistance which damps your tuning. If the frame aerial you are using is wound with ordinary single-strand wire or even ordinary multi-stranded copper wire, you will not get the selectivity which is claimed for the receiver. Only a frame aerial wound with Litz wire can be expected to give the utmost selectivity and your close proximity to the London stations warrants your using a Litz-wound frame. The other trouble you experience is due to your oscillator valve generating oscillations of too powerful a nature. This is due to the particular characteristic of the oscillator valve you are using, coupled with the amount of anode voltage being applied to it. Reducing the anode voltage will effect a cure and this is accomplished by increasing the value of the anode-feed resistance from 15,000 ohms to 20,000 or even 30,000 ohms.—Ed.

**HERE IS THE
RADIO GRAMOPHONE CABINET
YOU ARE LOOKING FOR**

INSTALL A
"LANGMORE"

and have your Gramophone, Wireless Set, Loud-speaker and Batteries all in one cabinet.

These cabinets are very strongly constructed of selected Oak and Plywood. Size overall, 3 ft. 2 in. high by 21 in. wide by 15 in. deep.

THE TOP SECTION. Size, 4½ in. high by 18 in. wide by 14 in. deep, gives ample accommodation for gramophone and pick-up

THE CENTRE SECTION. Size, 10 in. high by 18 in. wide by 14 in. deep, is for the Wireless Set, to take a panel either 18 in. by 7 in. or 18 in. by 8 in.

THE BOTTOM SECTION. Size, 14 in. high by 18 in. wide by 13¾ in. deep, gives accommodation for Loud-speaker and Batteries.

The whole of the back is enclosed by double doors, so that all parts are easily accessible. ALL are fitted with hinged top, heavy platform to take a 12-in. turntable for the Gramophone, and a substantial baseboard for the Wireless Set.

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Rigid construction throughout.
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CHASSIS** 12/6

which brings out the Best in every Unit.



Hearing is believing. Obtainable from all Dealers.
M. LICHTENBERG, 4 Gt. Queen St., London, W.C.2.

RADIOGRAMS

There is no "mystery" attached to the gramophone transmissions sometimes heard on the Scheveningen-Haven (Holland) wavelength; they are merely the usual speech and music tests made by the engineers of that Dutch commercial transmitter.

"Arms and the People" is the title of a national demonstration to be held at the Albert Hall on July 11, in connection with the coming World Disarmament Conference, under the chairmanship of Field Marshal Sir William Robertson.

One of several Germans who have written to the B.B.C. *apropos* the series of "Escape" broadcasts, says: "Even in captivity, I found the English decent and very good, as things went better with me in prison camp than they do to-day. If you are desirous of knowing all I have to say accurately, I am ready to do so, provided you pay for the postal charges. Three cheers for your good King."

It is stated in German wireless circles that the Kroll Opera House at Berlin has been taken over by the broadcast authorities for the special purpose of relaying performances to all German transmitters.

A programme by some of the South Wales winners of the Urdd Eisteddfod, held at Swansea in May, will be given on July 17. The Urdd Gobaith Cymru is a League of Young Wales of which the active membership is nearly 30,000 drawn from 500 sections.

A Hawaiian orchestra is to take part in the vaudeville programme on the Regional wavelength on July 9 and the National wavelength on July 10. Jack and Claude Hulbert are in the same "bill"; Arthur Young and Doris Hare also. "Uncle Sam and John Bull" will round off the programme with another of their efforts to bridge the Atlantic in a cynical friendliness towards each other's characteristics.

On July 22 a Serenade, performed by the B.B.C. Chamber Orchestra, conducted by Adrian Boult, will be relayed from the Cloisters, Canterbury Cathedral, in the National programme. The Serenade is part of the Canterbury Festival of Music and Drama which will be held during the week.

Founded on Sapper's short story, *Raymond Blair—Drunkard*, a new play for broadcasting is to be heard by Regional listeners on July 18. It is entitled *Jim Mailland—Knight Errant*, and is by Peter Creswell and M. H. Allen. The action opens in one of the South Sea Islands.

A commentary on the Tewkesbury Pageant which takes place in a meadow beside the Abbey of Tewkesbury; will be relayed to Midland listeners on July 15. The scenes include famous historical incidents, many of which occurred originally on the actual spot. The old Abbey, with its wonderful Norman tower, provides a natural background for the Pageant, which is being produced by Gwen Lally. Mr. Percy Edgar, the Midland Regional Director, will be the commentator.

Ensure the best results with the PORTABLE CENTURY SUPER

The designers of this fine set recommend these Exide and Drydex batteries for low and high tension and grid bias. By keeping strictly to their recommendation you will make certain of fine reception.



EXIDE "GEL-CEL" L.T. BATTERY. Unspillable jelly-acid battery. Type JWJ7, 20 ampere hour. Price 16/6



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Exide Service Stations give service on every make of battery

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THE LATEST WATMEL PRODUCT

Specified by "Amateur Wireless" for the "CENTURY" PORTABLE

Our latest product—the Watmel 50,000 ohms wire wound potentiometer, has been specified by "Amateur Wireless" for use in their "Century" Portable

- 1—Contact finger. Phosphor-Bronze.
- 2—Large contact plate.
- 3—Wire Wound Former.
- N.B.—The resistance is Wire, not compound with wire contacts.
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- 5—Polished pointer-knob.
- 6—Stops at end of wiring.
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GET THESE CATALOGUES FREE.

Here "Observer" reviews the latest booklets and folders issued by well-known manufacturers. If you want copies of any or all of them FREE OF CHARGE, just send a postcard giving the index numbers of the catalogues required (shown at the end of each paragraph) to "Postcard Radiō Literature," "AMATEUR WIRELESS," 58-61, Fetter Lane, E.C.4. "Observer" will see that you get all the literature you desire.

A New Gramophone Motor

I like the new Wate's gramophone motor which works from A.C. mains and, operating on the induction principle, is absolutely silent in working. Two models are available, one being a standard job for ordinary radio-grams, and the other a rather bigger outfit for heavy work. Through my free catalogue service you can get literature describing these. **291**

A Good Catalogue

I have just received part two of Catalogue F distributed by Claude Lyons, Ltd. This is bound to appeal to the technical man for it gives very full details of a wealth of experimental gear which is handy in connection with set testing and in the wireless "den." Special condensers, resistances, quartz oscillators, wavemeters, and testing meters of all kinds are included. I strongly advise any amateur who is really interested to write for a free copy of this most interesting book. **292**

Building Your Own Cabinet

Have you ever contemplated building your own cabinet? It is easy to do if you buy a set of parts ready to assemble. Messrs. Charles A. Osborn will send you a catalogue which gives details of many types of cabinet suitable for housing ordinary sets and gramo-radio outfits. These can be obtained either in parts ready to assemble or complete. **293**

Ferranti Mains Sets

A number of fine mains-driven sets are now made by Ferranti Ltd., and I have just been looking through an illustrated folder giving full details of the models 21 and 22 two-valvers. Model 21 is a set of the normal type, while model 22 is a "preset" set which is supplied permanently tuned to tune separate wavelengths. This is certainly a novelty and I advise you to get the literature describing it. **294**

Choosing New H.T.

Should you be on the look out for a new high-tension battery then get a copy of a folder which describes the whole range of Grosvenor batteries, popular, standard, and super-capacity. Three types of grid-bias battery are also available and are described in the same folder. **OBSERVER. 295**

Vestinghouse Metal Rectifiers are reduced in price. . . .

From July 1st, prices of constructors' Metal Rectifiers are as follows:

	Old Price	New Price
H.T.5 ..	15/-	12/6
H.T.6 ..	17/6	15/-
H.T.7 ..	21/-	17/6

. . . . and a new unit is added the H.T.8

with a D.C. output of 250 volts, 60 milliamps, meeting the requirements of the majority of three- and four-valve receivers.

The H.T.8 is priced 21/-

This will be available shortly.

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BROADCAST TELEPHONY

Broadcasting Stations classified by country and in order of wavelengths. For the purpose of better comparison, the power indicated is *aerial energy*.

Kilo- Metres cycles	Station and Call Sign	Power (Kw.)	Kilo- Metres cycles	Station and Call Sign	Power (Kw.)	Kilo- Metres cycles	Station and Call Sign	Power (Kw.)
GREAT BRITAIN								
25.53	11,752 Chelmsford		316	950 Marseilles (PTT)	1.5	410	721 Radio Maroc	
242	1,278 Belfast	1.2	328.2	914 Grenoble (PTT)	3.0		(Rabat): 10.0	
267.9	1,148 London-Nat.	68.0	329.3	911 Poste Parisien	1.2	1,250	240 Tunis Kasbah	0.8
288.5	1,040 Newcastle	1.2	345.2	860 Strasbourg (PTT)	15.0	NORWAY		
288.5	1,040 Swansea	0.16	385	779 Radio Toulouse	8.0	235.5	2,274 Kristiansand	0.625
288.5	1,040 Plymouth	0.16	427.1	621 Paris (PTT)	2.0	240.6	1,247 Stavanger	0.625
288.5	1,040 Edinburgh	0.4	466	644 Lyons (PTT)	2.3	364	824 Trondelag	1.35
288.5	1,040 Dundee	0.16	1,445.7	267.3 Eiffel Tower	15.0	368.1	815 Frederikstad	0.7
288.5	1,040 Bournemouth	1.2	1,725	724 Radio Paris	17.0	453.2	662 Porsgrund	0.8
288.5	1,040 Aberdeen	1.2	1,725	724	85.0	493.4	608 Bergen	1.35
301.5	995 North National	70.0	(testing shortly)			587.1	571 Hamar	0.8
309.0	968 Cardiff	1.2	GERMANY			1,071	280 Oslo	75.0
356.3	842 London Reg.	70.0	31.38	9,560 Zeesen	15.0	POLAND		
376.4	797 Glasgow	1.2	217	3,382 Königsberg	1.7	214.2	1,400 Warsaw (2)	1.0
398.9	752 Midland Reg.	38.0	213	1,373 Flensburg	6.0	234	1,283 Lodz	2.2
470.2	626 North Regional	70.0	227	1,319 Cologne	1.7	244	1,229 Wilno (tests)	22.0
1,553.4	193 Davenport (Nat.)	35.0	227	1,379 Aachen	0.6	314.2	954.3 Poznan	1.5
*testing on 470.2 m. (826k.)			227	1,379 Aachen	0.3	355	896 Lvov	1.9
AUSTRIA			232.2	1,292 Kiel	0.31	381	783 Katowice	21.0
218	1,373 Salzburg	0.6	239	1,256 Nürnberg	2.3	408	234 Warsaw	10.0
240	1,220 Linz	0.6	240.4	1,277.3 Cassel	0.3	1,411.8	273.5 Warsaw	158.0
283	1,058 Innsbruck	0.6	253.8	1,282 Gleiwitz	5.6	PORTUGAL		
352	851 Graz	9.5	259.3	1,257 Leipzig	2.3	290.5	2,033 Lisbon (ETIA)	2.0
453.2	666 Klagenfurt	0.6	269.8	1,113 Bremen	9.3	also on 42.9 m.		
517.3	581 Vienna	20.0	276.5	1,085 Heilsberg	75.0	ROMANIA		
also testing on 1,240 m. from 8 p.m. (Mon. Wed. Sat.)			283.6	1,058 Magdeburg	0.6	394	761 Bucharest	16.0
BELGIUM			283.6	1,058 Berlin (E)	0.6	RUSSIA		
206	1,456 Antwerp	0.4	283.6	1,058 Stettin	0.6	427	702.5 Khar'kov	25.0
215.6	1,391 Radio Conférence		313.8	941 Dresden	0.3	720	416.6 Moscow (PTT)	20.0
Brussels 0.25			325	923 Breslau	1.7	800	375 Kiev	20.0
246	1,020 Schaerbeek	0.5	300	833 Mühlacker	75.0	937.5	320 Khar'kov (RV20)	25.0
388.2	887 Brussels (No. 2)	20.0	372	806 Hamburg	1.7	1,000	300 Leningrad	100.0
508.5	590 Brussels (No. 1)	20.0	418	770 Frankfurt	1.7	1,000	283 Tiflis	10.0
BULGARIA (Rodno Radio) 1.0			452.1	663 Berlin	1.7	1,073	276.6 Rostov Don	4.0
318.8	941 Sofia		473	635 Danzig	0.2	1,103	272 Moscow Popoff	40.0
CZECHO-SLOVAKIA			533	635 Langenberg	17.0	1,304	230 Moscow (Trades Unions)	165.0
263	1,179 Moravska-Ostrava	11.0	533	563 Munich	1.7	1,431	202.5 Moscow (Kom)	40.0
279.5	1,073 Bratislava	14.0	533.7	536 Kaiserslautern	2.0	SPAIN		
293	1,023 Kosice	2.5	559.7	536 Augsburg	2.0	266.5	1,125.4 Valencia (EAJ13)	8.0
341.7	878 Brunn (Brno)	34.0	560.7	536 Hanover	0.3	277.7	1,080 Barcelona (EAJ15)	1.5
487	617 Prague (Praha)	5.5	560	530 Hannover	0.3	349	860 Barcelona (EAJ1)	8.0
487	617 Cesky Brod	75.0	570	527 Heilberg	0.35	368.1	815 Seville (EAJ5)	1.5
(testing shortly)			1,635	23.5 Zeesen	75.0	424	707 Madrid (EAJ7)	2.0
DENMARK			1,635	23.5 Norddeich	10.0	453	662.2 San Sebastian (EAJ8)	0.0
281	1,067 Copenhagen	1.0	HOLLAND			SWEDEN		
1,153	260 Kalundborg	10.0	34.28	9,599 Eindhoven (PCJ)	30.0	230.3	1,304 Malmö	0.75
ESTONIA			298.8	1,004 Hilversum	8.5	257	1,266 Hörby	15.0
206.1	1,023 Tallinn	0.7	298.8	1,004 Radio Idzerda (The Hague)	3.0	306.9	977.2 Fafun	0.05
465.8	644 Tartu	0.5	1,875	260 Scheveningen-Haven	10.0	322	932 Göteborg	15.0
FINLAND			1,875	260 Huizen	8.5	436	689 Stockholm	75.0
220.8	1,358.3 Helsinki	15.0	HUNGARY			512	554 Suedsvall	15.0
291	1,031 Tampere	1.0	550	545 Budapest	23.0	770	389 Ostersond	0.75
291	1,031 Viipuri	15.0	ICELAND			1,229.5	244 Boden	0.75
1,700	167 Lahti	54.0	1,200	250 Reykjavik	21.0	1,352	221.9 Motala	40.0
FRANCE			IRISH FREE STATE			SWITZERLAND		
219.7	1,365.6 Béziers	0.6	22.4	1,337 Cork (6CK)	1.5	244.7	1,226 Basle	0.65
237.2	1,265 Nîmes	1.0	413	725 Dublin (2RN)	1.5	246.7	1,215.2 Berne	0.5
238.5	1,258 Bordeaux		25.4	25.4 Rome (3RO)	0.0	403.5	743 Sttens	32.0
Sud-Ouest 2.0			247.7	1,213 Trieste	15.0	456.6	657 Beromünster	75.0
250.2	1,199.3 Juan-les-Pins	0.5	206.1	1,023 Turin (Torino)	8.5	760	393 Geneva	1.5
252.3	1,189 Feamp.	5.0	312.8	959 Genoa (Genova)	1.5	TURKEY		
255	1,175 Toulouse (PTT)	1.0	332	905 Naples (Napoli)	1.7	1,216.2	246.6 Istanbul	5.0
264.5	1,134 Lille (PTT)	15.0	441	680 Rome (Roma)	25.0	1,538	295 Ankara	2.0
372	1,103 Rennes	1.2	456.6	657 Bolzano (IBZ)	0.2	YUGOSLAVIA		
284.6	1,054 Montpellier	2.0	501	599 Milan (Milano)	8.5	307	977 Zagreb (Agram)	0.7
287.4	1,044 Radio Lyons	0.5	541.5	554 Palermo	3.7	430.4	697 Belgrade	3.0
294.7	1,017.8 Lamooges (PTT)	0.5	LATVIA			574.7	523 Ljubljana	2.8
304	936 Bordeaux (PTT)	20.0	525	521 Riga	13.0	NETHERLANDS		
344.3	954.5 Natan-Vitus (Paris)	0.5	LITHUANIA			PORTUGAL		
			1,935	155 Kaunas	2.0	290.5 2,033 Lisbon (ETIA) 2.0		
			NORTH AFRICA			also on 42.9 m.		
			303.4	825.3 Algiers (PTT)	13.0			

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Toggle "On-Off" Switch. Fully Insulated, Snap Action, N.P. Finish, Engraved Plate. List No. S80 1/9

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JACOBEOAK CABINET
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WIRELESS OR RADIO - GRAM
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Sovereign Components are specified again and again in "A.W." Circuits. Fit them wherever you can.

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