This month we present the most comprehensive survey of loudspeakers that has ever been attempted. It will prove of interest and value to every listener desirous of acquiring the latest and most authoritative information regarding the selection and use of radio loudspeakers.
YOU may think us guilty of exaggeration in saying that BLUE SPOT 100U is the equal of the most expensive Moving-Coil Speakers. Yet, far from being an exaggeration, this is actually an under-statement. Ask your dealer to let you hear this wonderful inductor type speaker and compare it with Moving-Coil Speakers. You will find that it is every bit as sensitive, that it reproduces bass notes to perfection and yet gives full value to the remainder of the musical scale.

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CONSISTENCY—
LONG LIFE
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A copy of the 72-page Cossor Wireless Book will be sent you free on application to A. C. Cossor Ltd., Melody Dept., Highbury Grove, London, N.5.
Loudspeakers of To-day : An Important and Comprehensive Review—Two Special Sets—Accurate Time from a Mains-Driven Clock—The B.B.C.'s Experiment in Economics—Marconi's Researches.

We publish a special feature in this May issue of *Modern Wireless* entitled “Loudspeakers of To-day.” Readers will observe that this is not merely a catalogue or a series of generalisations on loudspeakers, but that it comprises an attempt thoroughly to analyse and classify the dozen or different types and makes of speakers which are offered to the public to-day.

We have made every endeavour to bring this section quite up to date, and we feel confident that our readers will find all there is to be known about commercial loudspeakers in this special supplement.

Two Special Sets

There are two special sets in this issue which we would like to bring to the attention of our readers. The “Timepiece Three” is an all-mains receiver incorporating a built-in electric clock. The latter is driven and kept in accurate time by the mains, so that it never needs any attention. The radio side of this receiver consists of an S.G., det., pentode circuit, and provision is made, of course, for gramophone pick-up working. The set contains a built-in loudspeaker, so that the outfit is of a complete and attractive type.

But we would like to point out also that this is not a set specially designed for millionaires! Actually it costs barely as much as a simple commercial set of ordinary design.

We also publish a full description of a simple unit with which any mains set can be immediately converted for short-wave reception. Alternatively, the unit can be used as a single-valve short-wave receiver for headphone reception.

We are continually receiving letters asking us to enlarge our “World’s Programmes” section. There is no doubt that readers find it packed with useful information, and in this issue we have retained the recent space-expansion of this special feature. Readers will see that it does not contain old data, but new and vital facts of considerable interest to those who concentrate on listening to foreign stations.

The B.B.C.'s Experiment

In a recent issue of *Modern Wireless* we waxed rather sarcastic concerning the B.B.C.'s collaboration with the London School of Economics in organising a family census. Well, as we forecast, the scheme has by no means set the Thames on fire. In fact out of the millions of listeners in this country, 48,340 requested the B.B.C. to send forms. We now understand that only approximately 5,000 listeners completed the forms and sent them in to the B.B.C.

It will be remembered that this Questionnaire was prepared in collaboration with Sir William Beveridge, the Director of the London School of Economics. Listeners were asked innumerable questions relating to the most intimate details of their family life, such as “Where did you first meet your wife? ” “Has your grandfather got grey eyes,” etc., etc.

It would certainly seem that this scheme has not justified the considerable expense to which the B.B.C. has been put in printing and sending out the forms, together with stamped, addressed envelopes. In fact, it is a clear case where listeners' money has been wasted, for there can be no doubt that 5,000 replies are not sufficient to make the experiment worth while to the London School of Economics.

We should also like very much to see some of these 5,000 completed forms. No doubt many people sent for them out of sheer curiosity, but, if we know anything of the British character, a good many of them were sent back to the B.B.C. with the questions very waggishly answered. In fact, we should very much like to know how many of those 5,000 replies received at Savoy Hill are really worth the paper they are written on.

Anyway, perhaps this will be a lesson to the B.B.C. in future not to indulge in experiments of this nature at the expense of the listening public.

Marconi's Researches

The Marchese Marconi's latest ultra-short-wave experiments in Italy indicate that he is now able to communicate over a distance of 10 miles, and as the Marchese is using waves that were previously considered to be limited to a distance of 10 miles (for practical purposes), whatever the initial power used, his success will certainly have important influence on present theories about short-wave radio transmission. It has even been suggested that Marconi has made a discovery that might mean an alteration to the wireless valve as we know it to-day, but until the Marchese sees fit to disclose technical details concerning his latest success with ultra-short-waves, it would be best to refrain from imaginative flights of fancy.
A BRILLIANT MUSICIAN
who, although a comparatively young man, is already remarkably successful.

I was a musical ignoramus when I first met Stravinsky in Paris about twelve years ago.

It was at an orchestral concert of modern music, which I had been pressed to attend although loathing all such noises at the time! After some trivial overture the hall was all agog with excitement because the great "Stravinsky" was himself, coming to conduct one of his own works.

Stravinsky. I expected a typical Russian of the Moussorgsky variety, with fiery antics and a flowing beard, military and madly musical. Stravinsky appeared. I thought he was the man to turn over the music!

A frail figure walked on to the platform. A lithe man with thin, straight, fair hair, wearing tiny spectacles and appearing to be enormously self-conscious and a trifle short-sighted. Picture what a disappointment for a poor listener who vaguely appreciated Russian music and who hoped to find the composers as bizarre and impressive as the crashing chords of their music.

When the orchestra played my disappointment was dispelled. Perhaps you have seen him at the Queen's Hall when he broadcast in the B.B.C. Symphony Concerts.

A Talk with the Great Man

Last season, when my musical education had widened to the extent of appreciating modern Russian music in general, and Stravinsky's in particular (bear with me if Stravinsky bores you stiff), I met him in the old Number Ten "wharf" studio. A B.B.C. friend and I talked to him after his broadcast. For the first time I realised how unlike the average composer Stravinsky really is. He is a broadcasting enthusiast.

Stravinsky speaks French, volubly and with gesticulations, but it is not my English-French. He knows a little English, but not the words I wanted to use!

Ansermet, with his charming pronunciation of English, came to our assistance. During the evening there had been a short out-of-tune passage in the wind section of the orchestra, and I ventured to ask Stravinsky's opinion of our B.B.C. Orchestra.

Stravinsky gesticulated. Ansermet translated. "Yes," he said. "That was a little out of tune. But Strrrrravinsky 'e like eet! Eet give zo colour to ze music!"

But I don't really think that's typical of Stravinsky, or fair to him!

Writing Special Music for Radio

Perhaps it's because he's a young man, and not full of conservative ideas, that he is keen on broadcasting and wants to write special music for radio performance. He is what I suppose the average non-musical person would call a "crank," and yet he himself is very much a man of the world.

He did not intend to be a musician. He is just forty; surprisingly young for a man who is known internationally.

Of course, he came of a musical family. His father was an opera singer in Leningrad (then St. Petersburg), and little Igor was born in a suburb of the great city.

That was before the Revolution. Opera singers made money in Russia in those days. The family had enough money to send Igor to the St. Petersburg University.

They wanted him to be a lawyer, and although he could play the piano very well he was quite content. He passed legal exams. at St. Petersburg with flying colours, and went to Heidelberg to "finish off"—a fortunate accident for modern music!

His First Important Work

One of his fellow-students was the musician Rimsky-Korsakov, who wrote Le Coq d'Or, and the time which the two used to spend together composing and studying music completely prevented Stravinsky from taking what we should call the "Bar Final."

Korsakov begged him to turn to music instead, and with
Our Special Correspondent gives here an intimate character sketch of this famous Russian composer—one of the romantic futurist musicians who are destined to play a big part in the development of music for broadcasting.

the same mental ease with which Stravinsky turns now to the production of music for broadcasting he turned then from legal studies to writing a symphony.

His first big work, this symphony, was finished in 1907. Unlike most musicians, Stravinsky had a stroke of luck in his early days. He wrote two orchestral pieces called *Fireworks* and *Scherzo Fantastique*. I suppose nowadays we shouldn't regard these as ultra-modern music.

**Music for a Russian Ballet**

But just before the war they created a sensation. Serge Diaghilev, of the famous Diaghilev Russian Ballet, heard the Scherzo, and, realizing that Stravinsky was a budding genius, asked him to write some music for the ballet. That is how *The Fire Bird* came to be written. Probably you have heard it broadcast from Number Ten Studio.

His studio experience goes back a long way. One of

(Continued on page 480.)

**AT THE QUEEN'S HALL**

(Above) Dr. Adrian Boult, who is Musical Director of the B.B.C.

(Left) The B.B.C. Orchestra performing at the Queen's Hall. Stravinsky has conducted this orchestra on several occasions, and is himself a very enthusiastic broadcaster. (Right) Mr. Jack Hylton is well known to listeners as leader of the famous dance band.
A silent-running gramophone motor is essential for successful pick-up operation, whether it be of the clockwork or electric variety. Below is a description of two of the latest electric types.

I have just received for trial a couple of the latest Garrard electric gramophone motors. This firm is too well known in the clockwork motor line to need any introduction, but possibly not so many readers are familiar with their electric motors.

The models that have been sent to me are the new 202a induction type, and the universal motor. The 202a is an A.C.-only motor, which has been brought on the market as a follow up of the successful senior motor, the 201.

Perfectly Silent
It runs on the induction principle, and is perfectly silent in operation, a feature that will immediately place it among the very finest, in spite of the fact that the price is only 58s. 6d., with automatic stopping and starting switch.

I have had the motor running continuously for many hours, and cannot find the slightest trace of heating, while the power is quite sufficient for the playing of records having the heaviest of recording passages.

The cost of running, too, is extremely small, being a matter of only one unit for 75 hours or so, while the motor is self-starting, and the whole instrument is mounted on one chassis integral with the plate under the turntable.

For D.C. or A.C. Mains
In my opinion, the other motor, the universal model, is an even finer piece of engineering than the one we have just been considering. It is suitable for either D.C. or A.C. mains, and is as smooth running as the induction type.

No Vibration
This is largely due to the fact that the motor is a very slow-running one, and therefore there is no vibration due to speed, while the floating spring tension under which the motor drive is kept ensures a smooth transfer of energy from the motor to the turntable.

It is as easily fitted as the other motor, and is supplied with one of two forms of mains resistances that makes it perfectly easy to install. The price is higher than in the case of the A.C. motor, but there is, of course, more work in the instrument, and £5 £5s. complete with resistance is not too much to pay for a high-class job such as this is.

The insulation resistance is carefully tested to a voltage of 1,000 volts, while the power of the motor is really surprising—it takes quite a lot of stopping with the hand.

The cost of running is negligible, for about 300 12-in. record sides can be played for one unit of power. Here, again, on very long running I could trace no sign of heating, while placing the ear close to the turntable detected no suspicion of vibration noise.

Non-Interfering
The great test of an electric motor is not the mechanical vibration, though this is important, but the degree of electrical interference that is set up in the gramophone amplifier while the motor is in use. Most motors that I have tested have been guilty of either one or other of two faults, sometimes both.

These are vibration transferred mechanically to the pick-up armature through the turntable, and electrical interference due to sparking at the commutator of the D.C. type, or the A.C. field in the case of the A.C. variety of motor.

In the case of the Garrard motors I could trace no sign of either interference. The turntable ran perfectly smoothly in each instance, and the eye could not detect any sway or indication of the spindle being slack or out of truth. Truly a very fine piece of work.

TWO OUTSTANDING ELECTRIC MOTORS

In the above illustration are shown the Garrard A.C. induction motor type 202a (left), and the universal type that is suitable for either A.C. or D.C. mains operation.
SHORT WAVES
FOR MAINS SETS

The user of an all-mains set generally finds that, no matter how interested he is in short waves, he cannot listen to them without building another complete receiver. But if there is provision on your set for a pick-up, then the practical details in this article will enable you to use it for listening to the short waves.

By A. S. CLARK.

It is generally appreciated that there are difficulties connected with mains short-wave working that are not encountered on ordinary broadcast wave-lengths, whether it be just a matter of using an H.T. mains unit, or whether all-mains work is attempted. But the reason for this is not at all obvious.

Undoubtedly there are several factors concerning mains interference in relation to wave-length which are in the nature of mysteries; but the reason why the use of A.C. for heating the detector valve is not always successful is clear enough; it is simply a matter of the "noise"/signal strength ratio.

A.C. Hum

Slight mains irregularities do not worry us when working on broadcast waves and fairly strong stations. But with short waves the set generally has to be "pushed" a little more, and signals are generally much weaker; the result being that a given amount of ripple is made louder by greater amplification and at the same time is more noticeable because the stations are not so strong.

All of which is liable to make the possessor of a mains receiver, whether home-built or commercial, arrive at the conclusion that he must give short waves a miss, unless he is prepared to build another complete receiver, which is both a bother and an expense.

Separate Supply Advisable

Obviously the use of an adaptor is impractical, because, as already explained, in nearly all cases A.C. for heating the detector militates against success. (An adaptor obtains its current from the set to which it is attached.) With D.C. the trouble is more or less similar, as there is naturally a large fluctuation in the heating current, since it is unusual to arrange any smoothing for the L.T. But there is a simple and inexpensive way out.

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A Way Out

Indeed, it so happens that this difficulty is met with in many of the commercial battery sets on the market. And in many cases where it is possible to get at the detector valve socket to insert the necessary plug for an adaptor, the changing over to short waves becomes "too much of a good thing."

A UNIT WITH WORLD-WIDE RANGE

It won't take long to assemble, but it will give added pleasure in the use of your mains receiver, whether A.C. or D.C.; and it will also work with any ordinary battery receiver that is capable of playing gramophone records.
ong as the set has provision for the use of a pick-up—and few mains sets have not nowadays—the unit is suitable, whether the receiver is run from A.C. mains, D.C. mains or batteries.

VARIABLE AERIAL COUPLING IS PROVIDED

The three plug-in coil holders for the short-wave inductances can be seen to the left of this “aerial” view of the receiver. The one on the outside is held by only one screw so that it can be swivelled away from the next one, thus providing a simple and convenient method of altering the aerial coupling to the grid coil.

It is, of course, intended for loud-speaker reception of short-wave broadcasting stations, but if ‘phone reception is desired for very weak stations this may be carried out. True, ‘phone reception would be on one valve, but has not W. L. S. often explained that one valve is often all that is wanted where ‘phones are concerned?

Easily Adapted

Anyway, you can search around on the ‘phones until a good station is found, and then, in a moment, bring the receiver and speaker into service. This is another way in which the unit can sometimes be preferable to an adaptor.

I expect that by this time, having read as far as this and had a look at the photographs and diagrams, you have got a pretty good idea of exactly what the unit is. It is a complete one-valve short-wave set with batteries incorporated, which can be plugged on to the pick-up input of the receiver. Thus the gramo. amplifier is used as an amplifier of the rectified low-frequency currents from the short-wave station being received. The amplifier part works from the mains in the usual way, while the separate batteries supply the detector valve with humless H.T. and L.T., and since they have to give only a small amount of current they last a very considerable time.

Concerning the Circuit

But first of all let me indicate one or two items of interest in the circuit. It is arranged along accepted lines, but the use of a separate coil for the aerial circuit is of interest.

It is found that this greatly helps to keep down the background-noise level, a fact worth bearing in mind, as in many cases a good bit of amplification will be in use. The holder for this coil is arranged to swivel so that the coupling can be adjusted and reaction dead-spots overcome.

The use of a potentiometer for the grid-leak return is also bound up with the reaction. It enables a smooth control to be obtained, a vital necessity for long-distance short-wave reception.

What is termed "throttle control" of reaction is used, and the anode feeds into the primary of an L.F. transformer via the short-wave H.F. choke. The secondary of this transformer is connected to the amplifier via the pick-up terminals, thus taking the place of the pick-up winding.

Constructional Hints

Some form of volume control is needed, but as this will quite often be incorporated in the receiver itself, there is not one in the unit. However, farther on you will find details for connecting up one in case your set is not provided with such a component.

And so to the construction. With the aid of the list of components you will see that there is a wide choice of makes. While you may choose any of the makes, you must keep to the values, although a hundred ohms or so more for the potentiometer would not matter. Be sure that you get variable condensers with slow-motion dials.

The circuit, seen here, is arranged on well-tried lines, and the method of aerial coupling keeps background noises down to a minimum, thus providing the clearest possible reception.
of the holes in the panel are marked, and from them you must mark up the points to be drilled on your panel. Incidentally, the panel can be of wood instead of ebonite, or, again, it can be of metal, in which case the copper foil can be omitted. This foil is secured at the top of the panel by two small nuts and bolts.

At the bottom it is held by being pressed against the baseboard. This is particularly simple and consists of putting in a few wood screws.

Spacing Out the Parts
Arrange the parts in a similar manner to the wiring diagram, although slight deviations due to different parts may have to be made.

Hand-capacity will not trouble you

What you must remember is to allow plenty of room for the batteries, and it is as well to stand these in place to ensure that they will be O.K.

See that the coils will be well clear of the valve and tuning condenser when they are inserted in their holders. To ensure this, put them and the valve in their holders when arranging the components.

Having done this you are ready for the final job in the construction, that of wiring. This should be carried out with some form of insulated wire. It is not essential that you should make a neat-looking job of it and keep all the wires dead straight, but if you can do so much the better. What you must avoid is bunching several of the wires together.

Very little wiring
Follow the wiring diagram carefully. The majority of the connections are permanently anchored wires, but there are six flex connections. Two for L.T., two for H.T., and two for the aerial coil holder, which has to be fixed in place with one screw only, so that it can be swivelled.
It is not necessary to solder the connections, but be sure to tighten all the terminal screws and nuts with pliers to ensure that they are really tight. You will see that there are two soldered connections between wires, but these leads can be taken to terminals on the components instead.

For instance, the wire from the filament of the valve to the lead joining the two moving vanes terminals of the variables can go instead direct to the moving vanes of the tuning condenser. In the case of the other junction the wires can all be taken to the terminal on the grid-coil holder.

**Adding a Volume Control**

Before going on to the operating details there is the volume control, if you want to connect one up. It should have a value of about 100,000 ohms, and be of the three-terminal or potentiometer type.

One end terminal of its resistance should be connected to one output terminal marked P.U. and the other end terminal to the other P.U. terminal. The two wires for connecting up to the pick-up terminals or plug of the set will then come, one from the slider of the volume control and the other from one of the two P.U. terminals; it does not matter which.

If your set has a plug for joining up the pick-up you will need to get another one like it for the unit. Then you simply plug in either the pick-up plug or unit plug, according to which you desire to use.

So far as accessories are concerned there is little to say. Almost any valve of the detector, H.L. or H.F. types will be suitable for the unit.

**Special Coils**

The accumulator seen in the photograph on the last page of the article is of the portable "jelly" type, but there is no reason why a small ordinary one should not be used, as there is ample room for it.

In the set of coils you will find four with turn numbers something like this—2, 4, 6 and 8. You will be able at some time or other to hear stations with any one of the three larger ones in the grid socket.

Use a size smaller in the aerial socket, except in the case of the 8-turn one, when the 4 may be used for the aerial position, the 6 going in the reaction holder. Otherwise, a size larger can be used for reaction.

The 4-turn and the 6-turn coils will be the most useful, and, to give you an idea of the wave-lengths, the 4-turn will go up to somewhere around 45 metres at the top of the tuning dial. This, of course, is a very rough estimate.

**Ready for Test**

You will find that quite a low H.T. voltage is best for smooth reaction control. Before connecting the unit up to your receiver, give it a try out on a pair of telephones, connecting these across the P.U. terminals. You may lose a little in the transformer, but results will still be quite good.

When you have got the hang of the tuning you can connect the unit up to
May, 1932

MODERN WIRELESS

Connected Up In Half a Minute

TWO DIALS THAT CAN COVER MILES

These two dials on the panel are the only ones that have to be manipulated for searching over the short waves. All the tuning controls on the main receiver are temporarily out-of-action and standing-by.

the receiver. There is just one point here that must be mentioned. It concerns the earth connection.

It is desirable to have an earth connection to both the unit and the set, and the same earth will answer quite well. In the case of a D.C. set that has a fixed condenser connected in the earth lead for safety purposes, the earth for the unit should be taken from the earth side of this condenser, and not straight from the earth terminal of the mains set.

Separate Earth Advisable

If this is not done you will be almost certain to experience an increase in hum when the unit is used instead of the pick-up. If the hum is worse with the unit than with the pick-up, it would be worth while trying a completely separate earth connection for the unit.

Also, in case it is due to the inductance or resistance of the transformer secondary being very much more than that of the pick-up, you could experiment with a resistance across the secondary of the transformer. Its value would depend on circumstances and might vary from 250,000 ohms to as low as 25,000 ohms. But it is highly improbable that such schemes will prove necessary.

Adjust the slider of the potentiometer so that it is as near the positive end as possible consistent with smooth reaction. In the wiring diagram the positive end is that nearer to the end of the baseboard on which the batteries are accommodated.

Should you find one or more spots on the tuning dial where the set goes out of oscillation for a degree or so (what is termed a dead spot), try reducing the coupling of the aerial coil to the grid coil by swivelling the aerial coil more towards a position at right angles to the grid coil. This should overcome the trouble, but if it does not, increase the H.T. a little, making the potentiometer a little more negative to maintain smooth reaction control if necessary.

A Fascinating Wave-Band

Finally, read all you can about short-wave reception and stations, particularly under “On the Short Waves” each month in MODERN WIRELESS. You will then get a good idea of what times to listen, and on what wave-lengths to expect stations to come through. Do not be disappointed if you choose the wrong time and wave-length at your first shot; and turn the dials very slowly, investigating every sign of a station.

You’ll soon get into it!

IT IS COMPLETELY SELF-CONTAINED

The small batteries which supply the short-wave detector valve are kept inside the cabinet, on the baseboard. The only external connections are to aerial, earth, and pick-up input of main receiver.
The Aerial Lead-In

L.C. (Berkhamsted).—"I have often heard that it is undesirable to run the lead-in from the aerial close to a wall for any distance. My lead-in is an insulated wire which I have secured to the house with small staples to hold it in position. Would this account for the poor results I am getting on my two-valve set? I also find that the selectivity is bad."

In considering the effect of an aerial it must be remembered that the energy picked up is minute, particularly when the station is a distant one. It is therefore essential that no loss of this precious energy should take place on the way to the set.

In the ordinary course of events direct leakage to earth is prevented by the aerial insulators and the lead-in tube. But there is another source of leakage. The lead-in wire forms one plate of a condenser, and the neighbouring brickwork, pipes, etc., the other plate. The capacity of this condenser is increased by decreasing the space between the wire and the earth bodies (i.e. the wall, drain-pipes and guttering). Energy may leak away through this condenser, particularly if the lead-in is secured to the wall at intervals. The use of insulated wire does not prevent this, and it is therefore advisable to keep the leading-in wire well clear of the walls of the house.

Increases Capacity

We often hear of cases where readers have taken a lead-in wire from a back-room window, round the wainscoting of a room, and then through a dividing wall to a set in a front room. This, of course, is a fertile source of inefficiency and should be avoided. Moreover, since this procedure increases the total capacity of the aerial system it also makes the question of obtaining good selectivity more difficult.

A Loud Whistle

M. K. C. (Barnhurst).—"My set is a detector and two transformer-coupled low-frequency stages. The receiver worked perfectly until I made up a D.C. mains unit, since when I have been troubled with a high-pitched whistle and a hum which I cannot eliminate. In addition my reception is now distorted, and although I have tried alterations in the

TECHNICAL QUERIES DEPARTMENT

Are You In Trouble With Your Set?

The MODERN WIRELESS Technical Queries Department is in a position to give an unrivalled service. The aim of the department is to furnish really helpful advice in connection with any radio problem, theoretical or practical. Full details, including the revised scale of charges, can be obtained direct from the Technical Queries Department, MODERN WIRELESS, Fleetway House, Farrandon Street, London, E.C.1.

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Every reader, please note: Inquiries should not be made in person at Fleetway House or Tallis House.

increases the capacity of the aerial system it also makes the question of obtaining good selectivity more difficult.

A Loud Whistle

M. K. C. (Barnhurst).—"My set is a detector and two transformer-coupled low-frequency stages. The receiver worked perfectly until I made up a D.C. mains unit, since when I have been troubled with a high-pitched whistle and a hum which I cannot eliminate. In addition my reception is now distorted, and although I have tried alterations in the

grid bias, the whistle, hum and distortion still persist. Is there anything I can do to remedy this?"

Unfortunately you do not give any particulars of your mains unit. Since it is home-made there is the possibility that the current output is not sufficient for your valves. The use of the incorrect types of smoothing chokes would account for this, and inadequate smoothing would also produce a background "hum."

The first procedure is to decouple the detector stage, and this is carried out as follows: Insert a 15,000-ohm spaghetti resistance between H.T.+ (the detector tapping) and the terminal marked H.T. on the first L.F. transformer. This entails the removal of the H.T.+ lead which is at present joined to H.T. on the transformer. One end of the spaghetti is then connected to this H.T.+ wire and the other end of the spaghetti is joined to the H.T. terminal of the transformer. Then you will also need a 2-mfd. fixed condenser. Connect one terminal of the condenser to H.T. on the transformer, and join the other condenser terminal to L.T. negative.

It is always worth while to try the effect of reversing the connections to the secondary terminals of one of the transformers. But you must make quite sure that your H.T. mains unit is up to standard.

Coupling Condensers

A. C. (Liverpool).—"I have heard that one of the essential features of an R.C. coupling condenser is high insulation. Surely this also applies to all other condensers in the set. Why should the point be stressed so much in the case of the coupling condenser used in a resistance-capacity-coupled L.F. stage?"

You are perfectly correct in your statement, A. C. All the condensers in a set should possess high insulation, especially those connected to high-tension positive.

The R.C. coupling condenser is usually singled out because if there is a very small leak through the dielectric material between the plates serious distortion may occur. The reason is this. The coupling condenser is joined between the anode of one valve and the grid of the next. Since the anode of the valve is at high-tension potential, a leakage through the dielectric material of the condenser will cause a positive potential to be applied to the grid of the following valve.
LOUDSPEAKERS OF TODAY
A Comprehensive Survey

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TECHNICAL CONSIDERATIONS

By G. V. DOWDING, Associate I.E.E.

One of the best articles our Technical Editor has ever written
— no more than which need be said!

Four years ago the loud speaker was regarded as the black sheep in the radio family; one spoke of it apologetically, even despairingly. It was known that a moderately high loudspeaker efficiency could be achieved, but only by elaborate instruments of expensive construction.

In the Early Days

Those were the days when the possessor of a "moving coil" had the undisputed right to air a superiority complex. Lesser men were happy with mere intelligibility; he had bass!

And it did seem that in this department of the radio art we had reached something approaching finality. Only the most daring prophet had the temerity to suggest the possibility of anything much more than the slightest of slight progress.

Meanwhile, owners of 1922 horn-type speakers cynically smiled at their friends' excursions into "cones," and if they deigned to listen to these novelties, they merely shrugged their shoulders, said something about "squeakiness" or "harshness," and settled down again to their throaty little tin trumpets.

Spurred into Activity

Then, all of a sudden, the industry woke up... "Better and cheaper loud speakers," became a war cry instead of a pious hope. All over the world frenzied technicians, spurred into activity by harsh-voiced managing directors, focussed their microscopes and slide-rules on the "black sheep," and realised that it was black mainly because it had not been subjected to the cleansing rays of intensive research.

You see, "loud talking" had been taken for granted by the radio expert. Telephone receivers were there when broadcasting began. You merely had to stick a horn or a large diaphragm on one telephone earpiece so as to amplify the sound and, hey presto, the loud speaker was a fait accompli! Now, they said triumphantly, let us tackle this valve business; what about high-frequency amplification, neutralisation—and so on?

It is true that in a restricted way there was development, but the fruits of this limited research could obviously be enjoyed by the comparatively few.

A PATENT ARMATURE

The new Motor type S.40 unit, which has a patent compensating armature, is presented in the hope that we can convince radio enthusiasts that inexpensive modern loudspeakers are as good as their three- and four-year-old predecessors were bad.

Well, the credit must be given to the public, for the public is the master of big business, for that exists for no other reason but to give the public what it wants.

The Demand for Quality

Broadcasting had lost its novelty appeal, and instead of marvelling at the miracle that sounds could be transmitted through the ether, listeners grew more critical of the actual results. They began to ask themselves whether the thin pipings of their 1924-5-6-7 loudspeakers really were quite as pleasing as they had once thought them. Letters appeared in the Daily Press on the subject of "those horrible wireless loudspeakers"; eminent musicians refused to do their stuff before the microphone.

But the industry, having solved the problem of mass-production of pretty good sets, was able to turn a fair proportion of its energies into the direction of "better and cheaper loudspeakers"—with surprising results.

And that brings me to the reason-to-be (raison d'etre—if you prefer French) of this special "M.W." section.

It is presented in the hope that we can convince radio enthusiasts that inexpensive modern loudspeakers are as good as their three- and four-year-old predecessors were bad.

Give Them a Chance

In addition we shall have plenty to say to those of you who have 1932 instruments, for we shall show how these should be used in order that they can have a fair chance to "speak for themselves."

I think 1931 will always be remembered as the "loudspeaker" year.
Are You "Drugged" by Distortion?

because it was during that twelve months that the moving-coil principle became available to the masses. And coincident with falling prices for "M.C.'s," the balanced-armature rose in quality (but not in cost), and the inductor appeared on the scene as a popular commodity.

For make no mistake about it, the moving coil has not killed these other types; rather has it set a standard which these other types have risen towards.

But, of course, it is not every 1932 loudspeaker which can give a performance equal to that indicated by one of these really good response curves which you see as representing what is possible with a modern speaker.

Those "Museum Pieces"!

On the other hand, it is quite safe to say that a loudspeaker which could not eject a curve better than almost any 1922 instrument would be thrown into a 1932 dustbin! But between the two extremes lies a whole museum of distortion, and the pity of it is so many people harbour museum pieces without realising it. Their ears have become adapted to distortion and their aural nerves are blunted against "peaks" and tolerant of frequency deficiencies.

I know the riposte to this is: "So long as they are satisfied—what you don't know about you can't miss."

But this is most negative argument, as is proved by the intense new enjoyment the man who changes from a "puddy" speaker to an even-response modern type gets—once he has got used to the change-over.

Making a Change

For you have got to get used to such a drastic change. Realism in loud-speaker reproduction can actually be heard as fearful distortion if one's ears have had a long training in accommodating themselves to distortion!

I have had personal evidence of the truth of this, and I expect there are also many "M.W." readers who could quote striking instances. However, just as one's ears can adapt themselves to distortion, so also can they "unadapt" themselves. During the Great War I spent many hundreds of hours with my ears within a few feet of roaring aeroplane engines, not to mention screaming flying-wires and tearing artificial gales caused by the passage of big "birds" through the air. I got "used" to it. Then, after the war, I got "unused" to it again, and found such noises as intolerable as when I first had to hear them!

Higher Efficiency

But it sometimes happens that a further factor impeding a quick appreciation of the potentialities of a new loudspeaker creeps in. And this is incidental to the greater efficiency of the instrument.

In brief, a new loudspeaker may show up faults in the output of a radio set which were smothered by the original loudspeaker. Supposing there had been valve overloading. Now this generally evinces itself in the higher register, and is heard as a harsh cracking and grating. A speaker which is "mellow" (which means it can't handle "top")
may need a lot of this overloading distortion before it reveals its presence. But on the efficient 1932 speaker it is plainly heard, and the listener says: "Why, that loud speaker is worse than my old one."

Of course, he is visiting the sins of his set on the new loud speaker!

Not All Perfect

Nevertheless, I must hasten to add that every 1932 loudspeaker will not be so perfect that the speaker can now be dismissed from our minds as a source of distortion. But if mechanical and other troubles can develop, or even if serious inherent faults still exist in some products of 1932 factories, the plain fact remains that, providing you choose your make with discrimination, modern loudspeakers are very well worth while buying as replacements for two or more-year-old models.

Indeed, no better investment can be made than one such as this. And now let us examine in detail some of the changes in technique which have been made to bring about such a revolution.

Diaphragm Design

I think one of the most striking is to be seen in the diaphragm. At one time it seemed to be almost universally believed that a large diaphragm was essential for the proper treatment of bass frequencies.

This idea was probably due to the fact that more energy is needed for the development of bass than for the higher notes at proportional loudness. (A large diaphragm displaces more air than a smaller one; ergo, a big diaphragm is needed for the bass!)

Now it is commonly known, especially with the moving-coil principle, that the smaller you make the diaphragm the more uniform is the distribution of the sound waves in space at all frequencies, although with a decrease in diaphragm size there may be a loss in low-note power owing to an increasing disparity in the relative size of the coil.

Which all goes to show that there is a "best size," and that that size isn't the huge one that designers at one time appeared to think it should be.

Construction of Cones

Then there is the question of cone angle—for nearly all modern diaphragms are cone-shaped in order to achieve both stiffness and lightness. The more acute the angle, the more directionally are the high notes radiated, and the nearer to flatness it is the thicker a given material has to be to achieve the required stiffness. Special constructions and special materials are used in modern diaphragms in order to affect the best possible compromise.

Then there has been great concentration of what is known as "paper break-up." This is the tendency of a diaphragm to vibrate sectionally instead of moving backwards and forwards as a whole in the air. It occurs at the higher frequencies and, obviously, to a greater extent with larger diaphragms.

The upshot of all this is that a modest-sized diaphragm and a baffle board, or a scientifically designed cabinet, are nowadays in the make-up of most speakers.

Avoiding Box Resonance

And no longer is a speaker unit encased in a box of haphazard design. More scientific thought is given to the cabinet of a speaker than was directed at the very unit itself five years ago.

And as for the unit, well, here progress has been phenomenal. All three types—balanced armature, inductor and moving coil—have advanced. In the last the use of special cobalt-steel permanent magnets and skilful engineering have given us inexpensive instruments of high quality and great sensitivity.

If the ordinary listener desired great volume, the choice between the three types would be much easier, but modest volume eliminates most of the bass anyway—you cannot have bass without loudness. The moving coil scores in the bass because of the greater motional freedom of its driving element—the moving coil itself. But it also tends to score in that its impedance remains moderately constant at all frequencies and does not rise steeply at the higher frequencies and thus give these poorer treatment.

An Equal Response

Also, it does not deal with strong inputs more favourably than with the weaker ones. But at the "quieter" levels such amplitude distortion does not show itself markedly in a balanced-armature type, and is absent in the inductor.

So you see, that from the average radio enthusiast's point of view there are no sharp divisions to be drawn. It is a foolish vanity to make a fetish of a principle—it's the results which matter.

Fortunately, the price scale is fairly well representative of the relative qualities of the various types and makes.

You will see exactly what I mean if you carefully note the products of a...
—and Begin to Enjoy the Real Thing

firm which specialises in loudspeakers and which has a wide range of models on offer. Of course, this constitutes only a rough guide as to the individual merits of speakers of different makes.

The prices and qualities of all the models of all the manufacturers do not run parallel. Nevertheless, there is something of a standardisation among the leading concerns. This is not arrived at by mutual

The Loewe type E.B.85 four-pole cone loud speaker (upper picture) has an attractive front panel of genuine Caucasian walnut.

The sturdily-built chassis of the Goodman “Dreadnought” permanent-magnet moving-coil model (below) is surmounted with a multi-ratio output transformer.

A balanced-armature unit is employed in the Goodman walnut “Mitre” cone speaker seen in the lower illustration.

arrangement, but by a mutual and general endeavour to give the best value for money.

Economics are a strongly deciding factor in speaker design, and it is not practical to give, for instance, volume for “parlour listening,” as technicians say, will be losing much if by force of financial circumstances he cannot purchase one of the more expensive models.

But enough of generalities; it is high time I handed my pen over to Mr. Kelsey so that he can particularise to good purpose on the subject of speaker selection.

I have endeavoured to show you that the time has come when you can buy loudspeakers fearlessly, knowing that hard-and-fast standards of performance have been aimed at and achieved, and that there is not so far to go on the road to perfection that your 1932 loudspeaker can be “dated” before the year is out.

Mr. Kelsey will marshal all the important models in review for you, and Mr. Rogers will conclude by telling you exactly how to use them to the best effect.
LOUDSPEAKERS

The fine array of cabinet speakers in this picture are (left to right) the H.M.V. S.7, the B.T.-H. Minor R.K. (top row), the Marconiphone Model 131, the W.B. P.M.3, the Graham Farish "Snap" speaker, the Rotor Midget Dynamic, the Celestion J.12, and the Ormond R.130.

If only we were conscious of sound through the medium of our eyes, what a glorious hundred of obsolete loud-speakers there would be! Would they all the old tin horns in one concerted rush be dumped on the nearest rubbish heap, yes, and not a few of the old ones would quickly be committed to the flames, too!

But perhaps you do not see the connection. Well, let us consider the matter from another point of view. Suppose you went to the cinema and you saw a full-size picture projected on to a screen only one-twelfth of its actual width. It would, in fact, be exactly as if you were sitting in the stalls, looking at a scene on the stage. It must not be an extreme case—in many cases it would be.

The main thing to remember is that you must interest yourself particularly in those types which are most suitable for your set, and your final choice will be governed very largely by the type of output circuit you are using. But here again I must not digress, for the question of output arrangements is fully covered by Mr. Rogers in a later article.

Starting With Cones

B.T.-H.—The B.T.-H. people strike rather an original note in the design of their cone loudspeaker. A distinctive circular moulding having an ornamental grille and backed by gold gauze takes the place of the more conventional cabinet, and at the reasonable price of £2 10s. Od. it represents an attractive proposition. This particular model is especially suitable for pentode output.

Some more modern loudspeakers. The cabinet model on the left is the Marconiphone Model 131 permanent-magnet moving-coil speaker, while on the right (above) is shown the Type 91 permanent-magnet moving-coil chassis produced by this company.

In this connection, perhaps the best scheme will be to start with the smallest cones and to work up to the super moving coils, dealing with the various makes in alphabetical order. Be here does!
Cabinet cone loudspeakers—energised and permanent-magnet moving-coil types—units—chassis equipment, etc.—all are dealt with in this informative review of loudspeakers of to-day. This is the most comprehensive guide to that all-important, but often-neglected accessory—the loudspeaker—that has ever been produced, and it shows in rather a striking way the tremendous advances that have been made during the last year or so in the technique of reproduction.

OF MODERN "MOVING COILS"

Have you heard these? The chassis on the left is the Magnavox D.C. 144—an energised model for D.C. mains—while immediately above it is the Ampion permanent-magnet chassis and transformer. The right-hand picture is of the Ampion Two-Guinea.

FALK, STADELMANN. There are plenty of types of moving coils at hand, but the "super cone" range of cabinet cones, because Messrs. Falk, Stadelmann, are the only manufacturers of loudspeaker units to introduce into the field of cone loudspeakers. The Ampion Two-Guinea model is built around type 66R loudspeaker unit, retailing at £3 15s. 0d., and it is clearly classified among the best of the super cone speakers.

Next, the biggest advance in price comes the W.91551 and W.91552—both handsome cabinet models at £1 10s. 0d. and, finally, the W.91765 and the W.91630, both at £2 15s. Od. The open cone model at £1 17s. 6d.—the W.91500—is the cheapest of the lot, and next to this in price comes the W.91550, a neat, polished oak cabinet model selling at £1 17s. 6d. Then, in order of cost, comes the W.91511 and W.91512—both handsome cabinets selling at £1 10s. 0d. and, finally, the W.91765 and the W.91630, both at £2 15s. Od.

Original in Design

The "Puravox" W.91765 sets an entirely new standard of cabinet loudspeakers, and altogether there are five models in this range, varying in price from £1 18s. 6d. to £3 7s. 6d. The J.14, which is the cheapest one, is built into a plywood polished and artistic oak cabinet, and it has the appearance of being extraordinarily good value for money.

The J.14 and the M.12 (the latter retails at £3 12s. 6d.) incorporate the Celestion super " N " movement and the reinforced diaphragm principle of construction, which is an exclusive feature of all Celestion cone models. At the top end of the price scale in this particular range is the model D.10. It is obtainable in an oak or mahogany cabinet at £5 and £5 7s. 6d., respectively, and it can rightly be classified among the best of the super cone speakers.

A Well-known Firm

CELESTION. The name of Celestion requires no introduction into the field of cone loudspeaker manufacturers, and altogether there are five models in this range, varying in price from £1 18s. 6d. to £3 7s. 6d.

The J.14, which is the cheapest one, is built into a fully polished and artistic oak cabinet, and it has the appearance of being extraordinarily good value for money. Next in price comes the D.10 at £3 12s., and the M.12 at £3 12s. 6d. The J.14 and the M.14 (the latter retails at £2 10s. 0d.) incorporate the Celestion super " N " movement and the reinforced diaphragm principle of construction, which is an exclusive feature of all Celestion cone models. At the top end of the price scale in this particular range is the model D.10. It is obtainable in an oak or mahogany cabinet at £5 and £5 7s. 6d., respectively, and it can rightly be classified among the best of the super cone speakers.

The next step higher in this particular range is the model 295 at £1 5s. Od. It is extremely modest in price in view of the fact that it is built into an oak cabinet (model 500) or a walnut cabinet (model 550), is priced at £2 10s. 0d. for either model, and, finally, the W.91765 and the W.91630, both at £2 15s. Od.

OF MODERN "MOVING COILS"

Have you heard these? The chassis on the left is the Magnavox D.C. 144—an energised model for D.C. mains—while immediately above it is the Ampion permanent-magnet chassis and transformer. The right-hand picture is of the Ampion Two-Guinea.
ANOTHER FINE SELECTION
OF UP-TO-DATE SPEAKERS

(Below) The Ormond R/432 cabinet cone and the Ultra "Imp" chassis.

(Left) The Blue Spot model 44R, and (right) the new and ingenious Donotone speaker.

The solidly-built chassis on the left is the new Igranic permanent-magnet moving-coil model. Below is seen the chassis and cone assembly of the Undy 5-pole dynamic speaker.
Say Good-Bye to Half-Truths!

and all that need be said about it is that it is quite up to the high standard that one associates with H.M.V.

LESSEN—There are two cabinet loudspeakers in the Lesseen range which fall into the cone class. The first is the type L.5,958 at £3 2s. 6d.—a very good proposition indeed for the money—and the other is the type L.5,959, which retails at £2 15s. 0d. The higher-priced model incorporates a four-pole balanced-structure unit of special design, and the oak cabinet is in keeping with the high standard of construction.

An Inexpensive Instrument

LOEWE.—The Loewe type E.B.85, which is the only cabinet cone loudspeaker produced by this company, has established its reputation not only on the grounds of low price for high performance, but also on account of its particularly attractive appearance. The cabinet has a slotted front of genuine Casseboom walnut, and the actual cone opening is covered with pleated silk. The cone is actuated by a four-pole power unit, and the complete speaker sells for the extremely moderate price of £2 2s. 0d.

MARCONPHONE.— Mention of the name of Marconiphone immediately conjures up visions of something good in the realm of cone loudspeaker manufacture. The vision in this case is something more than a mere possibility—it is a very definite reality, and the Marconiphone model G4 at £2 10s. 0d. leaves nothing to be desired. It employs a special balanced-armature movement, and the speaker is housed in a polished oak cabinet of truly artistic appearance.

GRUND.—Originality of design is the keynote of most of the cabinet cone models produced by Messrs. Ormond. They are the manufacturers of sound, and it is the only cabinet pedal model designed to fit into a corner, and a very fine-looking job it is too. The actual speaker part of it is built up on the famous Ormond four-pole adjustable unit, and at the price of £3 19s. 6d. it is a model that will appeal to many.

In addition to this model, the Ormond people contribute three good table models, the R.470 is a pedestal cabinet and employing the No. 3 unit at £3 2s. 6d. (£3 5s. 0d. in mahogany), the R.626 incorporating the No. 4 unit and with the choice of an oak or mahogany cabinet at £3 9s. 6d., and a super model designated the R.456 at £3 19s. 6d., again with the choice of an oak or mahogany exterior.

Special Floating Armature

RETOUR ELECTRIQUE.—The three cabinet cone speakers marketed by Retro Electric, Ltd., are known as the Super-Dynamic, the Junior-Dynamic, and the Midget-Dynamic. The two former units are £1 17s. 6d., £3 3s. 0d., and £2 12s. 6d. respectively, and the particular feature of each of these speakers is that the finish is of a very high class.

The Midget-Dynamic unit is employed in the Midget and the Junior, but in the case of the Super model the unit is of special design. By the means of a special mechanism in the Super model a double movement is provided, which largely enhances the performance, and it is capable of very fine results indeed.

STANDARD BATTERY COMPANY.—The famous Wates loudspeakers, of which there are two that fall into the cone class, are built up on a very ingenious principle. Instead of having just one cone, each of the Wates models is provided with two cones, one specially designed for the lower frequencies, and the other to bring out the high notes. As a result of this combination scheme the Wates models give a very pleasing performance.

The "Star" 14" model, which is spalled in an oak cabinet complete for £5, can be had in a mahogany cabinet for an extra 5s. The larger model, w'ich is known as the "Star" 20" model, sells for £6 in an oak cabinet, but as in the case of the "Star" 14" it can be had in mahogany for an extra charge of 5s.

Who could want anything more artistic than this? It is the new H.M.V. model S.7, and the cabinet is of solid walnut.

TEBADE (Motor).—In the case of both of the cabinet cone speakers produced by the British Radio & Electric, Ltd., the cone is driven by the new "Motor" balanced-armature loudspeaker unit designated at the type S.60. This is one of the most recent units to make its appearance on the market, and it is claimed to have an extremely good frequency response. Certainly the results given from it are very realistic.

This new unit is featured in the Motor model S.7, and is a very fine-looking job altogether, and it is very reasonable at the price of £3 15s. 0d.

Famous for their "Moving Coils"

H. Rees, The Whistley Electrical Radio Co., Ltd., have built up their reputation as a loudspeaker manufacturing concern on the merits of their famous moving-coil models, and perhaps not all are familiar with the fact that they also make two cabinet cone models.

As a matter of fact, they are very nice-looking jobs, and at the price of £1 2s. 6d. and £1 19s. 6d. they would be difficult to better in their respective classes. The cheaper model, known as the "Popular," is housed in a polished oak cabinet; while in the case of the senior model, the cabinet is an actual polished oak, but the unit is a specially sensitive four-pole balanced-structure movement capable of handling large volume.

That brings us to the end of the cabinet cone models, but before passing on to inductors and moving-coil units I want to bring this section to a close with a brief review of the best loudspeaker units and loudspeaker units. Again it will be best to deal with them in alphabetical order.

BLUE SPOT.—The chassis equipment produced by the Blue Spot Co., Ltd., is very solidly constructed, and is available in two different types. The Master Chassis costs £10, and the special Chassis retails at £7 6s. 0d. These prices do not include cabinets, but the complete units are obtained separately and fitted. The Blue Spot range of units is a very famous trio, and includes the original but improved 60K at £1 5s. 0d., the 60F at £1 7s. 6d., and the 60H at £1 15s. 6d. The last-named unit, fitted to a well-designed cone, is capable of handling very large volume without the slightest distress.

Cone Chassis and Units

BRITISH RADIOPHONIE, LTD.—British Radiophonic, Ltd., specialists in the production of loudspeaker units, and although they produce several of the cones which are of particular interest to those who construct their own home equipment, the No. 198 at 7s. 6d. and the No. 295 at 10s. 6d. are their well-made units of the adjustable type, and in the case of the 295 a choice of three different impedances is possible.

GRANT.—It is only comparatively recently that the Crezelle people have produced a loudspeaker chassis, but the type M.12, as it is called, at £1.15s. 0d., is quite up to the high standard of their older-established productions. It incorporates a very small loudspeaker and a four-pole balanced-armature movement, and is remarkably good.

GRAHAM FARRIS.—The one-gainer A.C.4 chassis and unit manufactured by Messrs. Graham Farris is similar to the chassis assembly employed in their "Amazing A.C.4 loud speaker. In other words, it is very good. This company also produce two efficient units—the "Snap" at 9s. 6d. and the "Airflote" at 12s 6d.
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<td>Minor R.K.</td>
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<td>Minor R.K.</td>
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<tr>
<td>Minor R.K.</td>
<td>£10 10 (all in wood)</td>
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<td>Minor R.K.</td>
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<td>Minor R.K.</td>
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<tr>
<td><strong>BRITISH ROL.</strong></td>
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<tr>
<td>Model P.M.</td>
<td>(available with single, push-pull, or pentode transformers)</td>
<td>£2 0 0 (without transformers)</td>
<td></td>
<td></td>
<td>Model F.</td>
<td>(available in various ranges for D.C.)</td>
<td>£15 0 (without transformers)</td>
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<tr>
<td><strong>CELESTION</strong></td>
<td>P.P.M.</td>
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<td></td>
<td>Model S.P.M.</td>
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<tr>
<td><strong>COSSOR</strong></td>
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<td></td>
<td>Model S.P.M.</td>
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<tr>
<td><strong>EDISON BELL</strong></td>
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<td></td>
<td>Model S.P.M.</td>
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<tr>
<td><strong>EPHICH</strong></td>
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<td></td>
<td>Model S.P.M.</td>
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<tr>
<td>New Model</td>
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<td></td>
<td>Model S.P.M.</td>
<td>£2 15 0 (with transformers)</td>
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<td>Model S.P.M.</td>
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<tr>
<td><strong>FERRANTI</strong></td>
<td>Type M.1</td>
<td></td>
<td></td>
<td></td>
<td>Type M.2</td>
<td>(D.C. model)</td>
<td>£2 5 0</td>
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<tr>
<td><strong>GOODMAN'S</strong></td>
<td>&quot;Dreadnought&quot;</td>
<td></td>
<td></td>
<td></td>
<td>&quot;Dreadnought&quot;</td>
<td>(with multi-range output transformer)</td>
<td>£2 19 0</td>
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<tr>
<td><strong>H.M.V.</strong></td>
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<tr>
<td><strong>IGRACIE</strong></td>
<td>Ironic P.M.</td>
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<tr>
<td><strong>LANCISHER</strong></td>
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<tr>
<td><strong>LISSEN</strong></td>
<td>Model L.N.965</td>
<td></td>
<td></td>
<td></td>
<td>Model L.N.965</td>
<td></td>
<td></td>
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<td>Model L.N.965</td>
</tr>
<tr>
<td><strong>MAGNAVOX</strong></td>
<td>Model C.120</td>
<td></td>
<td></td>
<td></td>
<td>Model C.120</td>
<td>(Output transformers are included in the prices of all the models listed by this company.)</td>
<td>£3 0 0</td>
<td></td>
<td>Model C.120</td>
</tr>
<tr>
<td><strong>MARCONI</strong></td>
<td>Model 81</td>
<td></td>
<td></td>
<td></td>
<td>Model 121</td>
<td>(with transformers)</td>
<td>£4 19 6 (inc. transformers)</td>
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<tr>
<td><strong>MOTOR ELECTRIC</strong></td>
<td>Model R.164</td>
<td></td>
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<td></td>
<td>Model R.466</td>
<td></td>
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<td></td>
<td>Model R.466</td>
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<tr>
<td><strong>ORMOND</strong></td>
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<tr>
<td><strong>R.F.</strong></td>
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<tr>
<td><strong>NEWELL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Model D.110</td>
<td>(and D.C.220)</td>
<td>£2 15 0 (with rectifiers)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TORRÉ</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Model G.1</td>
<td></td>
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<td>Model G.1</td>
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<tr>
<td><strong>WALTERS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Model D.5</td>
<td></td>
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<td></td>
<td>Model D.5</td>
</tr>
</tbody>
</table>

* Indicates that the company's models are divided up into the appropriate sections.
### ALL RANGES AND PRICES OF "MOVING COILS" (Continued)

<table>
<thead>
<tr>
<th>Make</th>
<th>Permanent Magnet M.C. Chassis</th>
<th>Permanent Magnet M.C. C.</th>
<th>Moving-Coil Chassis</th>
<th>Main Type</th>
<th>Chassis</th>
<th>Moving Coils</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. &amp; A.</td>
<td>R &amp; A. &quot; 100 &quot; £2 5 0 (Challenger inc'd's trans.)</td>
<td>£1 15 0</td>
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<tr>
<td>STANDARD BATTERY COMPANY</td>
<td>Water Permanent Magnet (with mullti-ratio output trans.) £2 4 0</td>
<td></td>
<td>Waters Mains Energized (with multi-ratio output trans.) £1 17 0</td>
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<tr>
<td>TEKADE (Motor)</td>
<td>Motor £3 10 0 (including trans.)</td>
<td></td>
<td>&quot; Chester &quot; £1 19 0</td>
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<tr>
<td>ULTRA</td>
<td>Model 95 £4 15 0 (including trans.)</td>
<td></td>
<td>D.C. Type £2 19 0 (inc.walnut cabinet)</td>
<td>£4 17 0</td>
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<tr>
<td>WHITELEY ELECTRICAL RADIOLAND CO. (W.B.)</td>
<td>P.M.1 £5 0 0 (including trans.)</td>
<td></td>
<td>D.C. Type £4 17 0 (inc'd's trans.)</td>
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<tr>
<td>CELESTION</td>
<td>Type M.13 £1 19 0</td>
<td></td>
<td>Type £3 5 0 (inc'd's trans.)</td>
<td>£3 0 0</td>
<td>£6 0 0</td>
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<tr>
<td>COSROSS</td>
<td>Model 293 £2 10 0</td>
<td></td>
<td>Model 600 &amp; 550 £2 10 0</td>
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</tr>
<tr>
<td>FALKY STADENMANN</td>
<td>&quot;Paravox&quot; Model O.322 £1 17 0</td>
<td></td>
<td>Model £1 17 0</td>
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<td></td>
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<tr>
<td>GENERAL ELECTRIC COMPANY</td>
<td>Stack Phage Model £2 17 0</td>
<td></td>
<td>Stack Cabinet £2 10 0</td>
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<tr>
<td>GOODMANS</td>
<td>Cabinet Cone £1 19 0</td>
<td></td>
<td>&quot; Mike &quot; £1 9 0</td>
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### LOUDSPEAKER UNITS

<table>
<thead>
<tr>
<th>Make</th>
<th>Type 68R. £1 10 0</th>
<th>Type 50K. £1 5 0</th>
<th>Type 66F. £1 7 0</th>
<th>ORMOND Model B/463 No. 3 unit £60</th>
<th>Model B/460 No. 1 unit £126</th>
</tr>
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<tbody>
<tr>
<td>BRITISH RADIOPHONE</td>
<td>No. 190 7/3</td>
<td>No. 275a 10/6</td>
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<tr>
<td>GRAHAM FARISH</td>
<td>&quot;Snap&quot; unit 5/6</td>
<td>&quot;Aurion&quot; unit 12/6</td>
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<tr>
<td>LISHED</td>
<td>&quot;Super&quot; 15/6</td>
<td>&quot;Cones&quot; 15/6</td>
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<tr>
<td>LOEWE</td>
<td>Type L.S. £1 14 0</td>
<td>Adjustable unit</td>
<td></td>
<td></td>
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<tr>
<td>TEKADE (Motor)</td>
<td>Type S.10</td>
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<tr>
<td>TELSEN</td>
<td>No. W.54 Unit 5/6</td>
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### INDUCTOR DYNAMIC TYPES

<table>
<thead>
<tr>
<th>Make</th>
<th>Inductor Chassis</th>
<th>Cabinet Inductors</th>
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<tbody>
<tr>
<td>BLUE SPOT</td>
<td>Type 100D. £1 19 0</td>
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</tr>
<tr>
<td>FERRANTI</td>
<td>Ferradi Chassis Inductor £5 10 0</td>
<td></td>
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<tr>
<td>GENERAL ELECTRIC COMPANY</td>
<td>Inductor Dynamic £10 0</td>
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<tr>
<td>LAMPLUGH</td>
<td>Model £1 10 0</td>
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### ALL RANGES AND PRICES OF CONES AND CONE CHASSIS

<table>
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<th>Make</th>
<th>Cone Chassis</th>
<th>Cabinet Cones</th>
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<tbody>
<tr>
<td>BLUED SPOT</td>
<td>Chassis only, Mahogany Special - 7/6</td>
<td>Model 30R. £3 13 0</td>
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<tr>
<td>KOSTER</td>
<td>Bakedite Model £2 10 0</td>
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</tr>
<tr>
<td>CELESTION</td>
<td>Type M.13 £1 19 0</td>
<td></td>
</tr>
<tr>
<td>COSROSS</td>
<td>Model 293 £2 10 0</td>
<td></td>
</tr>
<tr>
<td>FALKY STADENMANN</td>
<td>&quot;Paravox&quot; Model O.322 £1 17 0</td>
<td></td>
</tr>
<tr>
<td>GENERAL ELECTRIC COMPANY</td>
<td>Stack Phage Model £2 17 0</td>
<td></td>
</tr>
<tr>
<td>GOODMANS</td>
<td>Cabinet Cone £1 19 0</td>
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### BLUE SPOT

<table>
<thead>
<tr>
<th>Make</th>
<th>Cone Chassis</th>
<th>Cabinet Cones</th>
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<tbody>
<tr>
<td>GRAHAM FARISH</td>
<td>A.C. £1 10 0</td>
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<tr>
<td>KOSTER</td>
<td>Bakedite £1 17 0</td>
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<tr>
<td>LISHED</td>
<td>Type £4 12 0</td>
<td></td>
</tr>
<tr>
<td>LOEWE</td>
<td>Type £2 15 0</td>
<td></td>
</tr>
<tr>
<td>MARCONI PHONE</td>
<td>Model £4 17 0</td>
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<tr>
<td>ORMOND</td>
<td>Model £2 13 0</td>
<td></td>
</tr>
<tr>
<td>TEKADE (Motor)</td>
<td>Model £2 15 0</td>
<td></td>
</tr>
<tr>
<td>TELSEN</td>
<td>Major Chassis (excluding unit) £3 0 0</td>
<td></td>
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</tbody>
</table>
Modern and Realistic Reproducers

The Rotor dynamic series sell at £1 6s. 6d. for the "Midget," £1 15s. Od. for the "Junior," and £2 19s. 6d. for the "Super," which prices, of course, include the unit.

Two balanced-armature units are also manufactured by Messrs. Rotor Electric. One is an adjustable cone type at £1 1s. 6d., and a non-adjustable model at 19s. 6d.

SIX-SIXTY. — It is hardly correct to refer to the Six-Sixty equipment as a chassis, because, in point of fact, it is not! But the one-box-frame scheme employed in the Six-Sixty cone speaker assembly renders a chassis unnecessary, so that at the price of 19s., which includes a quite a good unit, it represents an excellent proposition.

In view of the fact that the Six-Sixty people manufacture two really excellent units — the "Standard" at 19s., and the "Junior" at 6s. 9d. — manufacture a loudspeaker unit which at 6s. 6d., the price at which it sells, is excellent value for money.

In moving from the cone section to the review of moving-coil models, there is another class of speaker — the inductor dynamite—which can instantly be classified as between the two. As a matter of fact, although there are only a few models available, the modern inductor dynamic speakers are of such a high standard that in operation it is not at all an easy matter to distinguish them from moving coil types.

Four well-known firms have tackled the production of inductor dynamic models, and, alphabetically, they are as follows:

BLUE SPOT. — Although it is only comparatively recently that the Blue Spot people have entered the inductor dynamic market, with the reputation that they have established in other branches of speaker production, it is only to be expected that their latest model is something really good.

As a matter of fact, their 100P, as the chassis is designated, is good — very good — and it ranks among the best of the inductor dynamic types at present available. The price of the chassis assembly at £1 15s. 6d., but it can also be obtained mounted in a special oak cabinet for £3 3s. 6d.

LISSEN.--An interesting feature of the Lis sen loudspeaker units is that each one is made in two different types, one for ordinary power valve output, and the other for use with panels. The Lis sen "Standard" unit at 6s. 6d. is, without a doubt, an excellent value-for-money proposition; and even in the case of the four-pole balanced-armature models, the prices strike one as being extremely reasonable for what they are.

The Lis sen chassis equipment, which includes a cast aluminium frame and a specially treated fabric cone, can be obtained for £1 2s. 6d., including their special four-pole balanced-armature unit. Without the unit the chassis and cone retail at 10s.

TWO HANDY PLAQUE MODELS

Although far from being a chassis assembly — at least, to the extent that an appearance is concerned — there are two speakers in the Lis sen range to which I want to refer under this heading, and they are their well-known plaque models. The Lis sen — Plaque models are, of course, complete loudspeakers, and they are provided with a stand so that they can be placed on a flat surface or even mounted on a wall.

There are two models, the L.N.5077, which has a metal frame and costs 10s. 3d., and the L.N.5078, which is surrounded with a black and silver bakelite frame, and retails at 15s. They are both good speakers at the price, and they are very pleasing in appearance.

LOEWY. — The Loewy loudspeaker chassis type L.0H85 is especially suitable for use in portable models. The basic framework is of wood, and it is therefore light in weight. The price of 19s. includes the two speakers.

In addition to this special chassis, Messrs. The Loewy Radio Company also produce a solidly-built portable model, the so-called "Standard," in which a metal frame and costs 19s. 6d., and the L.N.5078, which is surrounded with a black and silver bakelite frame, and retails at 15s. They are both good speakers at the price, and they are very pleasing in appearance.

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STANDARD BATTERY COMPANY. — For those who are interested in the home construction of loudspeakers, the Waters double-cone scheme, to which reference was made in the review of their standard cone speakers, is also available in chassis form.

The Waters special double-cone chassis is available in three different sizes, catering for a twelve-inch cone £1 13s. 6d., for a fourteen-inch cone £1 16s. 9d., and for a twenty-inch cone £1 19s. 6d.

Especially suitable for this double-cone equipment, although, of course, adaptable to any other chassis, is the Waters "Star" speaker unit, at £1 19s. 6d., and for another-cone £1 16s. 9d.

Radio at Popular Prices

TELSEN.—The Telsen chassis, known as the "Major" and the "Popular," are available at prices which are very reasonable. They are both very well made jobs, and the retail prices are 10s. 6d. for the "Major" and 5s. 6d. for the "Popular."

To go with either of these models — or, of course, for use in conjunction with other standard chassis — Messrs. The Telsen Co. also offer a wide range of accessories and cabinets.
May, 1932  "Loudspeakers of To-day"  MODERN WIRELESS

LAMPLUGH.—The Lamplugh model C10 inductor chassis has recently been improved both in regard to sensitivity and frequency response, and it now represents an excellent example of the almost perfect reproduction that can be obtained from this type of speaker. So far it is available only in chassis form, but for what it gives in the way of reproduction it is very reasonable in price at £3 10s. Od. By the way, before we leave the question of inductor dynamic speakers, it is rather important to mention that this type of reproducer requires some sort of baffle board or baffle cabinet in order to obtain the best results that it is capable of giving.

Now, concerning moving-coil speakers, when I break into this section with the news that there are well over a hundred different types to be reviewed it will be obvious that there will only be room for just a brief reference for each particular model. So without any further preliminaries, here are the moving-coil loudspeakers of to-day.

BAKERS.—Almost every conceivable type is included in the Baker's range of M.C. speakers. They specialise in nothing but moving-coil reproducers, and they are responsible for over a dozen different models. Illustrated with the chassis models first, there is the S.P.P.M., a super-power permanent magnet speaker at £5 6s., Od.; the S.P.M., another permanent-magnet model, at £4 10s. Od.; the P.F.M., also a permanent magnet, at £3 15s. Od.; (a transformer is included in the price of each of these); the S.P.6 (6-volt battery) and the S.P.D. (D.C. mains), both at £5; the R.P.A.C., a model for 200/250 A.C., at £1 15s. Od.; the R.P.D., another model for 300/330 A.C., at £7 15s. Od., including rectifier and smoothing equipment; and, finally, the F.D. for D.C. mains of all voltages from 50 to 250, at £3 15s. Od. All these models can be obtained suitable for plate or power output.

The Baker's cabinet models include an excellent permanent-magnet model called the "Permag," at £2 7s. Od., including transformer; the "Biomax," assembly for D.C. mains at £3 7s. Od., the British Blue Spot Company have made two worthy contributions to the modern quest for perfect reproduction. They also do a really beautiful cabinet-permanent-magnet model. The cabinet of the "Bolitho" type of speaker requires some sort of baffle board or baffle cabinet in order to obtain the best results that it is capable of giving.

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For D.C. mains, at £1 14s. Od. (which price also includes transformer), and finally, something really outstanding in the design of modern speakers—the combination of a battery-driven clock and a remarkably good P.M. speaker in one really handsome-looking cabinet. I consider the Baker's "Klock" speaker, as it is called, to be cheap at the price of £11 !

Moving-Coil Types

BLUE SPOT.—The Blue Spot reputation for high-quality cone speakers and units has been fully maintained in their more recently produced moving-coil types. In producing the Blue Spot P.M. (a permanent-magnet chassis at £3 15s. Od., including transformer), and the model 72 (a chassis of which are particularly sensitive and can therefore be used in conjunction with quite small sets—and three senior models. The Blue Spot Company have made two worthy contributions to the modern quest for perfect reproduction. They also do a really beautiful cabinet-permanent-magnet model. The cabinet of the "Bolitho" type of speaker requires some sort of baffle board or baffle cabinet in order to obtain the best results that it is capable of giving.

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MODERN WIRELESS

"Loudspeakers of To-day"

May, 1932

The Right Route to Radio Realism

varieties. The model F, for instance, which is an excellent mains-powered chassis at £1 15s. Od., is available in four different voltage ranges, and in each separate range there is a model for power, pentode or push-pull output. The average power required to operate the field in this D.C. chassis is from 5 to 9 watts.

The Rola permanent-magnet chassis, as in the case of the D.C. version, can be obtained for power, pentode or push-pull output, and at the price of £2 15s. Od. (£2 10s. Od. without transformer) it has the appearance of being a very well-finished instrument.

CELESTION.—Several of the leading firms have recently endeavoured to produce high-class moving-coil instruments at prices within the reach of all, and the Celestion R.P.M.12, permanent-magnet chassis at £6, is available in four different voltage ranges, and in each separate range there is a model for power or pentode output, for £2 10s. Od., the Edison Bell people also offer a "super-permanent-magnet" model at £3 7s. Od. As in the case of the "De Luxe" chassis, the price of the "Premier," as it is called, includes a transformer which can be supplied for power or pentode output.

For those who are interested in "drawing-room" models, the Edison Bell "De Luxe" speaker is available in a solidly constructed and well-finished oak cabinet for an extra cost of £3 5s. Od.

EPOCHE.—In reviewing the Epoch range of moving-coil speakers one is tempted to think that the earliest course would be to tell you of the types which Messrs. Epoch do not make! That would mean that I could pass straight on to the next review, for I do not believe that there is a simple set

How is this for originality? This artistic fire-screen baffle idea is due to the G.E.C., and it can be had in conjunction with either of their energised moving-coil speakers.
Another fine array of 1932 instruments. From left to right they are the cabinet and chassis models of the Lanchester "Senior" permanent-magnet speaker, and two famous chassis models in the W.B. range—the P.M.3 and the P.M.1 permanent-magnet "moving-coils."  

**FERRANTI.**—In the Ferranti descriptive matter concerning their moving-coil loudspeakers there is a very apt remark to the effect that a receiver can be only as good as its speaker. I would go a stage farther than that, and add that if the reproducer is a Ferranti it will not be the speaker that is at fault if you get anything but the very best stage farther than that, and add that it is a very apt remark to the effect that a receiver chassis on the market, and the whole of the main equipment is totally enclosed. Some Really Inexpensive Models  

**GOODMAN.**—Messrs. Goodman are responsible for one of the cheapest permanent-magnet moving-coil speakers on the market, and credit must be given to them for the production of what is unquestionably a good instrument at the low price of £1 16s. 6d. The price of the "Dreadnought," as it is called, includes a multi-ratio output transformer, and it is also available in cabinet form for an extra charge of £1.  

**M.V.**—It is obvious that the Gramophone Company had their high reputation in mind when they set about the design of their moving-coil loudspeakers, for I do not think it would be possible to better them at any price. Both from the point of view of appearance and reproduction, the two models produced by M.V. are among the finest loudspeakers of the day. The model S.7, at £5 5s. 6d., is housed in a beautifully-grained walnut cabinet, and it has a remarkably even frequency response over a very wide range. A transformer is included by which the speaker can be adjusted for use with any type of output circuit.  

**High-Class Workmanship**  

The other model, the S.5, is rather more expensive, costing £10 10s. Od. for the complete instrument. But when you have seen the delightful cabinet in which it is housed, and have heard the astonishingly good reproduction that it gives, it is quite easy to appreciate that even at this price it is far from being expensive. As in the case of the first-mentioned instrument, the S.5 is provided with a universal transformer that enables it to be used satisfactorily in connection with pentode, power, or push-pull output.  

**Remarkable Degree of Perfection**  

**LISSEN.**—The degree of perfection to which modern moving-coil speakers have advanced is exemplified in the range that Messrs. Lisson are producing. There are two electro-magnetic types, and one permanent-magnet model, and in each case the reproduction is of a standard which would not have been thought possible a matter of eighteen months or two years ago. The D.C. model (for 200-250 mains) and the permanent-magnet type are available in chassis form at prices of £5 5s. Od. and £7 10s. Od. respectively. These two models are also available in cabinet form, the price being £1 16s. 6d. more in each case. The A.C. model (for 200-250 mains) is not available in chassis form, but it is sold in an attractive-looking cabinet for £10 10s. Od. It is a very fine speaker, as are the other two models in the Lisson range.  

Here we have, reading from left to right, the Epoch A.2—a permanent-magnet moving-coil model for normal domestic use; the Epoch D.25—a super-power P.M. speaker; the Baker's "Permag" M.C. type; and something really novel—the Baker's "Klock" speaker.
MODERN WIRELESS

"Loudspeakers of To-day" May, 1932

"An Inefficient Speaker Can Make a Good Set Bad!"

MAGNAVOX.—The Magnavox people certainly ought to know all that there is to be known about manufacturers, for they have produced a model over twenty years ago! And it is obvious from the description of their present-day products that the twenty years' experience has been put to good use.

The new model 132 at £4 10s. Od. is housed in an elegant dark oak cabinet, 24" high, with a walnut finish. The reproduction it gives is truthful, and it is an example of the kind of iridescent finish which is so much in favour at present. The speaker—represents the last word in up-to-date loudspeaker design.

For these who are interested in chassis assemblies, the Magnavox model 90 is available. This model is of 6 s., 6d.—which is a permanent-magnet speaker—it is all that we have been able to learn from the point of view of reproduction.

OSBORN.—Messrs. Osborn, H. & A. as manufacturers of high-class permanent-magnet reproducing models, have improved and up-to-date cabinet form for £3 15s. Od. The Osborn cabinet kits are extremely reasonable in price. The cabinet versions work out at £2 2s. Od. for the paper cabinet, or £7 10s. Od. for the mahogany veneered cabinet. There are, however, no less than three cabinets, of which the Osborn cabinet is the cheapest one of the "Electrophone" in oak, £2 19s. 6d.; the "Cameo" in mahogany or walnut at £4 4s. 0d. and £4 6s. 0d.; the "Regent" (another handsome cabinet) in mahogany at £7 10s. Od.; and, finally, the "Navire" pedestal cabinet at £11 0s. Od., for mahogany veneered cabinet, or £7 10s. Od. for the cabinet in walnut.

All these cabinets are of a very high quality, and special attention has been paid in the design to the avoidance of box-resonance effects.

PENDANT.—Most of the cabinets manufactured by Messrs. W. T. Lock are slightly bulkier in appearance, but without exception they are particularly artistic, and the finish is of a high standard.

The cheapest one is the "Electrophone" in walnut, £2 19s. 6d.; the "Cameo" in mahogany or walnut at £4 4s. 0d. and £4 6s. 0d.; the "Regent" cabinet at £7 10s. Od.; and, finally, the "Navire" pedestal cabinet at £11 0s. Od., for mahogany veneered cabinet, or £7 10s. Od. for the cabinet in walnut.

Here are two of the fine speakers in the Ferranti range. The model on the left is the super-permanent-magnet-moving-coil chassis, the M.1, while the right is the artistic walnut cabinet in which is housed the type D.2. All of the Ferranti chassis models can be obtained in this cabinet.

We have not yet had an opportunity of testing it out, but it certainly has every appearance of being well made. The price of the chassis is £2 6s. 0d., including transformer, and it can also be obtained in cabinet form for £3 15s. Od. The Motor Senior chassis is £3 10s. Od.

Specialists in Speakers

ULTRA.—Messrs. Ultra is another one of the firms who have successfully carried a reputation with one-type loud speakers, and the same high standard is fully maintained in their more recent moving-coil types. They are responsible for two permanent-magnet models, the model 95 at £4 15s. Od. (£6 6s. Od. in walnut cabinet), and the famous Ultra "Empire" £37 15s. Od. £4 2s. Od. (£4 in walnut cabinet), and three electro-magnetic versions. The standard D.C. type for accommodation of mains costs £2 15s. Od., or the chassis, with which is included the transformer, or £2 15s. Od. complete in a walnut cabinet.

There is also, a rather a dearer D.C. chassis known as the "Ultra Minor," and it represents an improvement on the standard D.C. model at £10 0s. Od. £12 10s. Od. (£10 0s. Od. in walnut cabinet). The cabinet version of the "Minor" retains at £14 10s. Od.

The Ultra A.C. speaker equipment consists of a well-built chassis with output transformer for £4 10s. Od., and a cabinet version of the same speaker for £6 6s. Od.

W.R.—Messrs. The Whitley Electrical Radio Co. have concentrated their activities on the production of permanent-magnet moving-coil chassis, and it is a result the famous "quartette" of W.R. chassis models has reached its culmination. There is the "P.F.M.1" at £8, the "P.F.D.1" at £4 6s. Od., the "P.F.M.2" at £6 10s. Od., and the "P.F.4."—the most recently introduced one—at £3 10s. Od. In each case an output transformer is included. The cabinet versions work at £5 10s. Od., £6 10s. Od., £4 2s. Od., and £3 10s. Od. respectively, and they are equally well worth investigating, as excellent speakers which they contain.

That brings us to the end of the moving-coil speaker review, in fact, to the end of the complete survey, but a comprehensive feature supplement such as this can hardly be considered absolutely complete without just a reference to cabinets.

For so many of all those readers who are interested in the home-construction side of this question, I propose to bring this article to a conclusion with a short review of loudspeaker cabinets.

Loudspeaker Cabinets

SACMO.—There are, altogether, six high-quality cabinets in the chassis range, forming in price from £12 0s. Od. for an attractive-looking oak model at £12 0s. Od. to £7 10s. Od. for the pedestal cabinet. The Cabo win includes the "Triumph," which is the cheapest one; the "Trustone" at £11 0s. Od.; the "Balloon" at £11 10s. Od.; and the "Regent" at £12 0s. Od.

In two different sizes and in walnut, oak, or mahogany, according to taste, from £9 10s. Od. to £11 0s. Od. is the "Colonial" (another handsome cabinet) in walnut £9 10s. Od.; and, finally, the "Navire" cabinet costs £11 10s. Od., for mahogany veneered cabinet, or £7 10s. Od. for the cabinet in walnut.

All these cabinets are completely finished, and so need no further attention; but a comprehensive feature supplement such as this cannot possibly be considered absolutely complete without just a reference to cabinets.

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For so many of all those readers who are interested in the home-construction side of this question, I propose to bring this article to a conclusion with a short review of loudspeaker cabinets.
In the foregoing pages the various types of loudspeakers have been discussed, but it is of no avail to be the owner of even the "most perfect" of speakers unless it is used properly. This section, therefore, is included with the express purpose of assisting all set users to obtain the very best from their loudspeakers.

This is impossible unless the output circuit of each receiver is properly designed; a simple procedure, as is shown in the following article.

By K. D. ROGERS.

**THE LINK BETWEEN PROVIDING POWER AND PURITY**

In the foregoing pages the various types of loudspeakers have been discussed, but it is of no avail to be the owner of even the "most perfect" of speakers unless it is used properly. This section, therefore, is included with the express purpose of assisting all set users to obtain the very best from their loudspeakers.

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By K. D. ROGERS.

**THE OUTPUT STAGE**

There are pitfalls for the unwary in every stage of a set's design, but although most constructors seem to get away with it pretty well in the H.F., detector, and the first L.F. stages, when it comes to the output they fail lamentably.

Not that there are not plenty of good excuses, for this particular section of the set is one of the trickiest, and at the same time the one with the most external limitations.

Let me explain. We can get along all right in the design and operation of the S.C., detector, and voltage amplification L.F. stages, valves for these are pretty much of a muchness as regards their requirements, but when it comes to the conversion of the voltage step-up into power so that the loudspeaker may be successfully operated, it's another matter.

**POWER OPERATED**

For the loudspeaker is a power-operated device, and seldom is there much more undistorted power available than is required. Without casting any reflections on any loudspeaker manufacturer, we can honestly say that it is a most difficult job to design a good loudspeaker that will make full use of more than a small portion of the power supplied to it by the last valve.

Taking into consideration the fact that with the ordinary triode valve something like 1/2 to 1/4th of the energy supplied to it from the H.T. batteries or mains unit is converted into undistorted "electrical sound" for the use of the loudspeaker, we see how very necessary it is that we make the utmost of the potential sound energy at our disposal in the last stage. Let us be sure that the link between is a true and efficient one (within the limits that are set us).

**A FINE CHASSIS**

The Edison Bell "Premier" permanent magnet moving-coil chassis is a very well-finished instrument.

We have not taken into consideration the fact that of the tiny proportion of energy that does get transformed into sound by the speaker only a very minute part acts upon any particular individual ear; this loss is one common to all diffusion systems, whether of sound or of radio, and so we mention it in passing so that our readers may get a little of the correct perspective of the position.

Now let us get down to practicalities as they affect the average set designer and constructor. To do this we must realise the limitations placed upon us by the need for quite considerable energy supply by the power valve.

**ANODE WATTAGE**

This very necessary part of the outfit can be classified in many ways, but the most useful is that of output power, either D.C. or A.C. The former gives the anode wattage consumption of the valve from the power supply, and the latter the amount of that power that is turned into useful account.

Power valves can be divided into six groups, as they are grouped by the B.V.M.A. specifications. These are: (1) valves with a power dissipation of 1.2 watts (anode volts 150, anode current 8 m.a.) or less; (2) those that take the same voltage, but up to 16 m.a. in current (24 watts); (3) valves of 6-watt rating (200 volts and 30 m.a., or 250 volts 24 m.a.); (4) 10-watt valves (200 volts and 30 m.a., or 250 volts 24 m.a.); (5) 15-watters; and (6) above 15 watts.

**SOME INSTANCES**


Here at once we see that the undistorted output will be limited as follows, assuming that in practice about 1/4th of the D.C. dissipation is usually obtained, with a maximum...
that never exceeds \( \frac{1}{8} \)th. For safety we will take it that \( \frac{1}{8} \)th is the more likely figure, and then we see that, on the average, class (1) gives only 12 watts, i.e. 150 milliwatts; (2) 300 milliwatts; (3) 750 milliwatts; (4) 1,250 milliwatts; (5) 1,875 milliwatts; and (6) 1,875 milliwatts or more.

These figures are on the conservative side, but in the design of radio receivers it is advisable to keep well within the maximum limits. The undistorted output powers and the other details we shall refer to later are given in the valve tables published in last month's "M.W."

Economy Considerations

Now, for very best reproduction on a moderately sensitive loudspeaker we really need more than 150 milliwatts output, though if we are to run the set off dry H.T. supply we are economically limited to output valves of classes (1) or (2). Batteries to run class (3) can be obtained, but here we are running into rather high upkeep costs.

For moving-coil speakers 300 milliwatts is about the minimum that is likely to be any use at all, so that those who cannot use valves of the 24-watt dissipation type will do well to keep to armature-driven speakers. If an attempt is made to make the valve do more than it should in the way of A.C. output, the result is only a sort of "rattle" in the speaker due to the harmonics introduced by the overloading of the valve.

Safety Factor

We have said that you need at least 300 milliwatts for anything like satisfactory operation of a moving-coil speaker, but this does not mean that 300 or more milliwatts are too much for the moving-iron type. It should be remembered that the greater the maximum wattage of the valve used in the output circuit of a set the greater the possible volume, and the greater the factor of safety from overloading.

Thus if we consider classes 3 and 5, we see that 5 gives more than twice the output of 3; but we may never want to use that output as a mean or average level. To do that we should need a larger valve still, but we may occasionally get somewhere near it on a peak passage of music, and the factor of safety lets us run up, say, from a mean of round about 600 or 700 to a peak of well over 1,000 milliwatts.

As a matter of fact, it has been stated that though the average sound level of a broadcast programme received on a moderately-sized set may be quite small, yet the loud passages may represent a surprising number of times the energy of the mean. So a good factor of safety is well worth having, is it not?

So much for a generalisation of the power valve, and its possibilities. We have shown that the larger the valve (within sensible limits) the better, not necessarily because you often need its full power, but because you need a full factor of safety.

The use of a set with a 150-milliwatt valve cannot have any factor of safety on local reception, and the 300-milliwatt man is hard put to it to keep his set from overloading before he has "got enough" from it.

Other Troubles

But true overloading is not the only trouble that beets the set owner. Just as serious is the fact that not infrequently the output valve does not get a chance of delivering the full

Two elegant-looking cabinet models in the Blue Spot range; (above) the 70R and (below) the type 45R

The cabinet of the B.T.-H. permanent-magnet Minor R.K reproducer (right) has an ornamental fountain grille with an old gold corded background of original design. The chassis model of this particular speaker is seen immediately below it. The impressive-looking chassis in the lower picture is one of the magnificent B.T.-H. Senior R.K reproducers.
May, 1932

“Loudspeakers of To-day”

MODERN WIRELESS

Match Your Output Circuits for Best Results

Power of which it is capable because it is (1) not matched to the loudspeaker; (2) starved of H.T., and (3) incorrectly biased.

Taking 2 and 3 first, we find they are naturally interlinked, and if stereo owners will only remember (especially those who use no filter output circuit) that the voltage that reaches the anode of the last valve may be

Valves of the category of this Mazda D.C./Pent. give an undistorted output approaching 2.5 watts. This represents volume much in excess of what is normally required for domestic purpose.

Very much less than that applied, over-biasing of the valve and starving of H.T. would be far less frequent. The average moving-iron loudspeaker has a D.C. resistance of 2,000 ohms or so. Now place that in series with a valve that should have 150 volts on its anode, and, properly biased, should take 15 milliamps. To get that 150 on the plate you should be applying about 180 volts.

Voltage Drop

Obviously you are starving the valve and over-biasing it at the same time. That voltage drop in the external anode circuit occurs whatever output system you employ, but it is less serious if choke-filter or transformer output is used, for the well-made choke, or transformer primary will have a D.C. resistance of a mere few hundred ohms.

The most important factor in the power output and quality of the reproduction is the so-called “matching” of the valve to the loudspeaker.

It is essential that the right relationship of valve A.C. resistance to speaker impedance (at average musical frequencies) be obtained, otherwise the full output of the valve will not be obtained without distortion.

There are several ways of feeding the output from the power valve into the loudspeaker. One is to have the loudspeaker direct in the anode circuit of the valve, another is to use an ordinary filter output scheme with a low-frequency choke (either tapped or untapped), a third is the use of a transformer link between valve and speaker, and a fourth is a development of No. 3, the use of a push-pull output. Let us deal with them in order.

The Filter Output

The first method necessitates the use of a high-resistance loudspeaker and simultaneously includes the great disadvantage of causing a serious drop in the anode voltage of the valve, as we have seen. Where long speaker leads are used, or a mains unit is employed, it is not a good scheme, as the loudspeaker leads carry the anode voltage and current, and so risk of shock and leakage is run.

The choke filter is better, but as in the case above the impedance of the speaker has a D.C. resistance of 2,000 ohms. Thus the choke filter is better, but not nearly as good as the transformer connection.

Two of the good modern battery pentodes which have adequate outputs for reasonably sensitive moving-coil speakers. On the left is a Marconi, while the valve on the right is from the Osram range.

The tapped, choke allows a ratio of coupling between valve and speaker impedance to be obtained, and

Approaches the advantages of the transformer output.

This third method (transformer) enables exact “matching” to be obtained, while the fourth method (push-pull) has the same advantages, and allows more power to be provided for the speaker with less anode voltage than would be required when only one valve (instead of two in push-pull) was used.

Now let us consider the practical details. Briefly, the rule for the obtaining of maximum undistorted power out of the valve is that the anode circuit impedance shall be twice that of the rated A.C. resistance of the valve.

Empirical Value

Naturally, as the valve impedance is to all intents and purposes unaffected by frequency, and as the anode circuit impedance varies with frequency, this value must be taken at some empirical figure. That usually chosen is 300 or 1,000 cycles.

Obviously, above that figure the impedance will increase, and below we shall have a decrease. But with a well-designed circuit these variations will not be serious in their effect on the reproduction. It is essential, of course, that a good choke, or output transformer, be employed, and that no chance of core saturation shall be possible.

Now, taking it as granted (it can easily be proved) that an impedance ratio between anode circuit (not necessarily speaker) and valve of roughly 2:1 is required, let us re-examine the positions of the various forms of coupling.

Two to One

Where the direct method is used obviously the impedance of the speaker must be twice that of the valve, as the speaker is the only impedance in the external anode circuit. This means that with a power valve of class No. 1, which has an average impedance of 4,000 ohms, the speaker impedance must be around 8,000 ohms. (Last month’s valve lists will show the optimum loads for the various power and super-power valves.)

Again, if the valve is a 2,000-ohm,
How to Get the Greatest Possible Power

the speaker impedance of 8,000 will be too high, and you will require a speaker having an impedance of about 4,000 ohms. Ackward, is it not? For it means you are tied hand and foot to the use of a certain valve with a certain speaker.

The choke output filter has the advantage of isolating the speaker from the direct anode current, but as the speaker and choke are in parallel across the valve the same "matching" trouble exists.

**Choke Design**

The choke should have as high an impedance as is practicable with reasonably low D.C. resistance, and then the speaker and valve are balanced as before.

The tapped choke gives some latitude in that definite ratios can be obtained, but the transformer (either fed via a choke output, or direct in the anode circuit of the valve) is the most satisfactory way of matching the two impedances.

It allows two things to be arranged with complete independence of each other. The valve anode circuit impedance can be chosen, and at the same time this same impedance (which will be the optimum load for the valve you are using) can be suited to any particular loudspeaker by means of the ratio between the primary and secondary windings of the transformer.

**"Moving-Coils"**

Thus if you have, as is the case when dealing with low-resistance moving-coil speakers, a valve with an impedance of 800 ohms (P.X.4) and a speaker with a coil impedance of 16 ohms, you can "match" the valve and the speaker via the transformer ratio.

Thus you require a primary impedance of 1,600 ohms and a secondary that will transfer the maximum energy to the speaker—i.e. of the same impedance, 16 ohms.

Here, perhaps, it is necessary to explain that although with a valve, as in the case of any other "generator" of energy, the maximum power developed is when the external impedance equals the internal impedance, this is not the maximum undistorted output, which is obtained when the impedances bear a ratio of approximately 2:1.

**Equal Impedances**

In the case of the transformer, however, the same phenomenon does not exist, and so we have the secondary winding of the same impedance as the speaker winding we are feeding.

Now, then, how shall we go about matching our valve and speaker? Practically, the best thing is to get the makers of the speaker to supply the requisite transformer for that particular valve. They may do it by means of a tapped secondary or primary, or in one unalterable instrument. But they will work out the requirements something like this:

If $N$ is the ratio required, the formula is:

$$ N^2 = \frac{\text{twice impedance of valve}}{\text{Impedance of speaker}} = \frac{1,600}{16} = 100. \text{ Therefore the ratio is } \sqrt{100} = 10/1. $$

This is quite simple, is it not? And it allows practically perfect "matching" or balancing of the speaker and valve impedances.

Transformer coupling between the valve and the loudspeaker is the most straightforward method of coupling, and it can be employed whether or not the use of a filter output circuit is contemplated. We say this because many set designs are published with a filter output, and if it is desired to use a transformer this can be done without disconnecting the output choke scheme, the primary of the transformer being connected to the loudspeaker terminals as if it were a high-resistance loudspeaker.

**For Pentode Valves**

The tapped choke is different unless the taps are ignored and the output is taken right across the choke. This choke is usually only used when it is intended that a pentode valve is to be employed, when the loudspeaker impedance is likely to be less than that of the valve, and a step-down ratio between the two is required.

The output choke system is excellent for purposes where speaker and valves are likely to be pretty near each other as regards matching, as in the case of the small power valve and many of the ordinary loudspeakers; but when it comes to the larger valves, with their lower A.C. resistances, the need for more careful matching becomes very apparent.

In connection with this it should be mentioned that the ordinary reed-driven loudspeaker varies a great deal in impedance, according to the make, and a study of the details given in the preceding sections of this
supplement will show how very difficult it is to be at all dogmatic about the values of the components that are likely to be needed in the average output circuit.

**Treatment of Pentodes**

We have said nothing about pentode valves because they are subject to just the same treatment as the ordinary power types, except they need very careful matching.

We have not yet touched upon the push-pull type of output circuit, so we will pass on to that interesting device.

The whole idea of push-pull, as you probably remember, is to allow the owner of a set that cannot be provided with much anode voltage to get extra punch (punch that can otherwise be obtained only by using more voltage) by using two output valves of low voltage instead of one.

There are two limiting factors to the amount of power that an output valve will provide, assuming that the input to it is not limited; one on the amount of H.T. voltage (assuming that the H.T. current is not also limited), and the other is the grid swing of the valve.

**Limiting Factors**

They are mixed up with each other, for if the valve is starved of H.T. the grid swing will be limited, and if the valve has only a small grid swing it is probably due to the fact that it is a small valve, one that does not need and will not take much H.T.

You will be able to see from the foregoing classification of the power valves that if you want a big output power you must use a valve that will supply that power, and that valve will need a lot of H.T.

Thus if you have a limited voltage, such as in the case with a 200-volt D.C. set, you can use, say, two 8-10-watt dissipation valves in push-pull and get an undistorted output of about 2 watts, a state of affairs that would otherwise necessitate the use of a larger valve, which would demand well over 200 volts H.T.

In the smaller classes it is sometimes advantageous to use two 2 4-watt valves on a large-capacity H.T. battery of 150 volts, or a D.C. mains unit giving that voltage, rather than to increase the voltage to 200 or 250 volts and employ the 6-watt type. The two push-pull 2 4-watters would not give quite the output that you would get from the 6-watter, but they would go a long way towards it.

**Separate Grid Bias Advisable**

In using push-pull it is advantageous to use an input transformer to the push-pull stage with a double secondary so that separate grid bias for the two valves can be applied. This obviates the necessity of exact matching of the valves, a most important consideration if the valves have to be worked off the same bias point.

**Impedances in Series**

As regards the output side of the push-pull arrangement, the matching with the speaker is done in the same way as with the single valve, except that it has to be remembered that the valve impedances are in series, and so the impedance figure is twice that of one of the valves. Otherwise the matching process is exactly the same, it being borne in mind that the output system is usually of the transformer variety. Choke output, the choke having a centre tap as well as other taps for matching, can be used, but, as a rule, the transformer method gives the more satisfactory results.

In push-pull it is often said that the valves can be biased down to their anode-bend points, so that the anode current is saved, and the rectified part of the output is automatically cancelled out in the output transformer. In theory this is all very well, but very exact matching of valves and the exact transformer impedances are required, so that in practice it is usually somewhat disappointing.

It is better to bias the valves as if they were being used in the ordinary way, though this does not constitute any special economy in anode current.

Parallel output valves in the average set are not worth while, as owing to the anode voltage drop in the output circuit, due to the greater anode current when two valves are used instead of one, nothing like the power output that one might expect is actually obtained.

**High-Note Loss**

There is one snag in push-pull that we ought to mention for the sake of the quality man. It is that this system of amplification does a great deal to check the generation of harmonics by the output valve; and though this is a laudable object in itself, it often results in a slight loss of high notes that would otherwise be present due to slight harmonic generation.

Thus in a set that is particularly selective, and consequently cutting off some of the side-hands from the received transmission, the use of push-pull may give the reproduction a somewhat dead quality; and in such a case it is useful to have some sort of high-note lift in the previous stages of the I.F. amplifier.

**Not Always a Disadvantage**

A good hand-pass set, on the other hand, can often be improved by the slight loss of some of the highest notes, that are usually accompanied by heterodynes.

We have said that the reduction of harmonics by the use of push-pull is sometimes a disadvantage, but we should not like it to be thought that
**"A Good Speaker Cannot Make a Bad Set Good"**

This is a real fault in the system. It is, in fact, the opposite, provided that the previous part of the set is properly treating the high notes.

**Gives it Extra "Life"**

Harmonics are not in themselves desirable except in such cases where high-note reduction has already occurred, when slight harmonic distortion, though technically wrong, gives some welcome "life" to the reproduction. The pentode valve is prone to produce harmonics, and this is the cause of its shrill reproduction in cases where it is not properly used, and its welcome brightness in cases where a little harmonic distortion is the lesser of two evils.

But whatever type of output circuit you favour, please bear in mind the vital necessity of properly "matching" your output valve to the loudspeaker. This matching business is not just the cry of some technical faddists, it is a most important part of the design of a radio receiver or electric gramophone. And it can easily be carried out satisfactorily if set owners will only take the trouble to get in touch with either the manufacturers of their loudspeakers, or with the makers of the valves they want to use in the output stage.

**Match up the Output**

The best way to go to work is to decide which valve will best suit your requirements as to its power output and its anode power consumption, and then get into touch with the speaker people, telling them the speaker you want and the valve you will use with it, and asking for the correct transformer to link the two together. That link between is most important. See that yours is a strong, well-designed one, and you will benefit by it in increased power and better quality more than you can possibly imagine.

In conclusion, perhaps it will not be out of place to discuss briefly another point that concerns the output valve, though somewhat indirectly. This is the provision of anode power from mains units, or in all-electric receivers.

**Mains Unit Problems**

The mains H.T. supply is ideal from the point of view of economy and power, but it is also the forerunner of certain troubles that do not beset the battery user, troubles that are often the result of careless design, or employment of the power unit.

For instance, to attempt to use a mains unit that will not comfortably supply the anode current required will usually result in hum and possibly motor-boating. Hum is also caused by insufficient smoothing in the unit, and, in an all-electric receiver, by unsuitable return between the heaters of the valves (or the filament if a directly-heated output valve is used) and the L.T. winding of the mains transformer.

This is a most important point to watch in the design of a mains set, and readers will notice that in the three-valve all-A.C. set described in this month's "M.W." special precautions regarding the "earth" return have been taken.

Many constructors consider that the fact that the L.T. winding of the transformer has a centre-tap on it is sufficient to guarantee proper balance between the two ends. But such a tap is no criterion of an electrical centre, and as often as not it is far from being that desirable fact.

Consequently we in our set designs usually neglect the centre-tap of the L.T. winding and place a potentiometer across the L.T. circuit, taking the grid returns and cathodes of the valves to the centre of the potentiometer. This is adjustable by means of a slider and so by trial and error the exact electrical centre of the transformer can be found.

This may seem to be a lot about little, but if you want to get rid of the last trace of A.C. hum you will usually find that the use of a potentiometer of some sort (and it should have a low resistance) will be necessary.

In mains sets, too, it is of advantage to decouple the automatic grid-bias resistances, otherwise a certain loss of bass-note amplification will be likely to result.

**A Price Alteration**

Since the preceding pages of this special supplement went to press we have been advised of a slight alteration in the prices of MoToR loudspeakers and units. The MoToR "Chester," which is the cabinet version of their Minor moving-coil loudspeaker, is now £3 10s., and the chassis alone, with output transformer, is £2 5s. The new MoToR type S.40 cone speaker unit is 2s. less than the price given in our table, i.e. it is £1 12s. 6d., and not £1 14s. 6d. as stated.

We also learn that Messrs. Tekade Radio & Electric, Ltd., are now producing a cone chassis assembly designated as the MoToR C.400, which is £2 5s. complete with the now S.40 unit, or 12s. 6d. without the unit.
Midday Transmissions

I find that the B.B.C. still does not attach to midday transmissions the importance they deserve. These concerts have an enormous public. It was, of course, an excellent plan to regularise the arrangements so that there would be uniform and general timing.

But it is a mistake to put on organ recitals at midday. These are much too lugubrious. Concerts of light music should be the invariable rule. And what about Sunday? Is there ever anything to be done about lunch-time entertainment on the Sabbath?

P.M.G. and Television

Col. L'Estrange Malone, M.P., arranged the other day for the Postmaster-General, Sir Kingsley Wood, to go and have a look at Baird Television in the Long Acre studios. They were accompanied by Mr. Noel Ashbridge, Chief Engineer of the B.B.C. I hear the P.M.G. was interested, but unimpressed.

"Rungs of the Ladder"

The forthcoming "Rungs of the Ladder" series of talks promises to be specially interesting. The idea is to induce representative successful men to come to the microphone and "enthuse" others to go and do likewise.

Some of the speakers will talk about themselves; others will talk about others. Lord Beaverbrook is one of those who will talk about themselves; likewise Mr. J. H. Thomas and Lord Ashfield. I hear Mr. Gordon Selfridge declined in the face of great pressure.

Programme Recording

The recording of British programmes for use abroad is likely to become an important business before long. The B.B.C. has interested itself in a scheme for merging the various companies involved into a sort of concessionnaire combine.

As it gets more generally recognised that reception of the new Empire station will be variable, listeners in the Dominions and Colonies will be increasingly glad to hear an admixture of recorded British programmes on their own stations.

Regional Directors

The status of Regional Directors of the B.B.C. is again under review. True, not for the first time; the subject coming up whenever there is a move at headquarters for greater centralisation, which happens about twice a year.

But this time the Regional Directors themselves are taking the initiative in establishing their status. Their idea is that as they are responsible not to branch heads at Savoy Hill, but to the Director-General, they should be put on the Control Board, thereby exercising more influence on policy.

THE RETURN OF WILL ROGERS

Will Rogers, the great American humorist, and his wife, being interviewed for the talkies on their return to the States, after an extended tour of Europe.
Latest News Items for the Listener

At the same time as this move, Mr. Siepmann and Mr. Roger Eckersley, the programme and talks chiefs for London, have put their heads together to bring about a much more stringent measure of centralisation. So this time the issue is well joined, and will be fought to a finish. I am not a prophet, but I am inclined to back the "Regionals."

Those Wireless Exchanges

The number of subscribers to wireless exchanges is increasing steadily all over the country, and this is well on the way to becoming a big industry. The B.B.C. and the Post Office do not agree about wireless exchanges, the former wishing to control them much more extensively than the latter will accept.

There is a good deal of bother over the Sunday programmes. The exchanges naturally want authority to take Continental programmes when the B.B.C. is closed down, notably at lunch-time on Sunday. And the Post Office agrees.

This, however, does not please the B.B.C., which nevertheless has acquiesced as long as foreign advertising is eliminated from the transmissions. And there is another complication.

Threatening the Trade?

The Radio Manufacturers' Association look with some concern at the growth of wireless exchanges, which threaten to cut into the wireless trade. Indeed, the feeling in the trade is so strong that in one North Country town a local trader is said to have purposely interfered with the reception on the exchange receiver to such effect that the exchange had to ask the B.B.C. to let them have a land-line link with a control room.

Wave-length Changes

The next change in wave-length will probably be at Newcastle. The suggestion is that Newcastle take on the 200-metre spare wave. This allotment, of course, confers the advantage that Newcastle could resume the origination of programmes, which it has not been able to do since being put on 288-5 metres—the National common wave.

On the other hand, there is the disadvantage that listeners would have to make adjustments to their receivers, most of which at present would hardly go down as low as 200 metres. Yet, if the B.B.C. would give a guarantee that the new arrangement would be permanent, it probably would be welcomed by local opinion.

The evolution of the Regional Scheme makes certain periodical re-shuffles inevitable, but listeners are none the less impatient of changes which make a difference to receiving sets. Once Newcastle is straightened out, something is to be done about Aberdeen, but I don't know what.

The Ultra-Short Waves

If only the ultra-short waves would come along serviceably, the B.B.C. would surmount most of its troubles readily enough. A number of local stations would be set up, probably at Inverness, Wrexham, and Sheffield and Londonderry. But this appears to be some years distant.

The Governors Quiet

The B.B.C. Board of Governors seem to have settled down. I hear much less criticism of them by the staff than was the case a year or even six months ago. Then there was irritation at their alleged interference with programme arrangements.

Now, however, this feeling has definitely subsided. Sir John Reith, of course, is on excellent terms with his Board, which appears to be giving him as free a hand as he had in the days of the Company, when the wireless manufacturers were responsible for broadcasting in Britain.

Holt Marvel at Hollywood

Holt Marvel, the brilliant dramatic producer, known otherwise as Eric Maschwitz, the editor of "The Radio Times," is taking his holidays this year in a visit to Hollywood, where he is exploring film possibilities. I would not be surprised at all to see him kidnapped by American interests, which would be a signal loss to the B.B.C.
The importance of a good earth is sometimes overlooked, but many cases of instability, both H.F. and L.F., are due to a poor earth.

A really stable circuit ought not to be seriously affected by the efficiency of the earthing system. That is to say, the removal of the earth lead from the set should not cause the H.F. or L.F. stages to go into oscillation.

A Dry-Weather Tip

There are, however, designs which emit startling howls and moans immediately something goes wrong with the earth. Some sets with two transformer-coupled L.F. stages are particularly sensitive to variations in this portion of the circuit, and rely upon a good earth to hold them down.

With the approach of summer and the possibility of dry weather those who use buried earth plates or earthing tubes should keep a close watch on the soil surrounding the plate or tube.

In order to ensure good electrical contact the soil should be damp, and the best way of achieving this is to soak the ground in the vicinity of the earth connection with plentiful supplies of water at regular intervals.

When the Foreigners Fall Off

Apart from the question of stability which, of course, does not apply to every set, it is surprising how the efficiency of the earth affects sensitivity.

I frequently get letters from puzzled readers who tell me that for some mysterious reason the “reaching out” properties of their sets seem to have been reduced by umpteen per cent.

There are many factors which can account for this, such as run-down H.T. batteries, valves which have partly lost their emission, dirty or defective contacts in the wiring, or a faulty component.

But I find that these points all come under suspicion directly the symptoms of vanishing power are noticed, whereas the earth system is rarely suspected.

It is well worth while to have a look at this first of all. Water-pipe earths can give just as much trouble as the buried variety.

Connection to the water pipe is usually made via a copper or brass clip, and unless the connection is very carefully carried out at the beginning there is a tendency for the surface of the lead pipe to oxidise. This coating of oxide has a comparatively high resistance, but can easily be removed with a piece of fine glasspaper or emery cloth.

In the absence of these the surface can be scraped with a knife.

While dealing with the subject of earths I feel that I ought to point out that aerial joints also require attention once or twice a year.

I receive a certain amount of correspondence relating to interference by tramways. Sets situated close by an overhead trolley system suffer from crackling noises produced by sparking between the trolley wheel and overhead conductor wire.

Tramway Interference

There is practically nothing one can do to the receiver itself to remedy the trouble. By cutting down the aerial length and improving the selectivity of the set some measure of relief may be obtained. A re-arrangement of the position of the aerial may help, but this is not always a practical proposition.

Removing the earth lead, providing the receiver remains stable, may also assist matters, but generally speaking the remedy lies at the source or the interference.
One of the most interesting and at the same time valuable consequences of the development of A.C. electricity supply in this country, especially where the grid system is employed, is the fact that all-electric synchronous clocks can be used in every home that has such a mains supply.

The benefits are obvious, for with the electricity main time controlled there is no possibility of the clocks going more than a few seconds out at any time, while the exact checking at the station corrects the mains frequency that the plus and minus errors cancel out in a very short period.

Correct Time Always

Therefore, those who are lucky enough to be on time-controlled electricity mains can be assured, at a mere nominal cost, of the correct time all the year round. For the synchronous clock is very inexpensive to buy, and it takes a mere 1 or 2 watts, or even less, from the power supply.

Another advantage accruing from A.C. mains is the fact that it is particularly easy to run all-electric radio receivers from them. That is a fact that is already well known, and we mention it here not because of its particular value in itself, but because we are going to suggest the use of an all-electric receiver and that of an electric synchronous clock combined in the one instrument.

Table Model

Why not, indeed, combine the clock with the radio receiver, and have an instrument that is at once right up to date, and of practical use the whole day long? The clock does not interfere in any way with the operation of the set, and the latter in no way affects the timepiece. The clock goes merrily on, providing the correct time, regardless of whether the set is in operation or not.

DESIGNED and DESCRIBED

By K. D. ROGERS

There should be no more complaints about not knowing the exact time, at least not from those readers who build this novel receiver. It is a highly efficient three-valver, working completely from the A.C. mains, and having an electric clock let in the front of the cabinet.

There is ample room inside for a large moving-coil loudspeaker, and it is a set that is very easy to build.

The combination of the two is quite an easy matter, as you will see when you have read this article. It is quite simple to construct an average 3-valver and include in the design both speaker and clock so that the table type of cabinet shall house the whole lot.

Easy Operation

That is what we have done in the set to be described, and illustrated in the photographs. It is an easy set to build, and has absolutely nothing tricky in the construction, though as the set is fairly compact care has to be taken that no mistakes in layout or wiring are made.

The theoretical circuit shows at a glance that there is nothing out of the ordinary about the circuit, and indeed, we claim no more than ordinary 3-valve results with it. It is powerful and moderately selective, while its ease of operation makes it ideally suited for home use.

One stage of screened-grid H.F. amplification is employed, followed by a detector and pentode. External power supply is arranged for, the power unit fitting inside the cabinet, so that the whole thing is self-contained.
Two of the lately introduced Lissen screened coils are employed as aerial and tuned-anode tuning, the desired degree of selectivity being obtained by means of that simple but effective device the series aerial condenser.

As the set is fairly powerful, a pre-detector volume control is included, and also an L.F. volume control that can be used either in conjunction with the H.F. control or only when the set is used with a gramophone pick-up. This latter is provided for by the jack situated under the Extenser control.

No Wave-Change Switches

No wave-change switching has to be carried out when you want to go from long to medium, or vice versa, the whole of the wave-band control being done by the Extenser, which is of the dual-gang type.

The most important part of the set is naturally the H.F. end, and so in considering the construction of the receiver we will deal with that part first.

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**An Electric Clock and Moving-Coil Speaker are Incorporated in the Design**

As an A.C. S.G. valve is employed, it is essential that the screening be of the best possible, consistent with reasonable ease of construction of the set. We have, therefore, kept the screening down as far as possible, but a certain amount has to be done to make the set properly stable.

**The Screening**

In the first place, the ganged Extenser is not of the enclosed type, so that a certain amount of screening has to be done here. This consists of cutting a metal screen so that, besides allowing the S.G. valve to protrude through in the usual manner, it is also carried on to fit in line with the front screen of the back section of the Extenser.

**Baseboard Covering**

A thin strip (about 1 in. wide) is continued along above this screen belonging to the Extenser, and allows the new screen to be bolted to the Extenser screen at each end. This makes the job perfectly rigid, and also provides excellent screening. A further screen along the L.F. side of the back portion of the Extenser, as shown in the photographs, completes the screening with the exception of the copper foil that is used to cover the whole of the baseboard.

And having mentioned the screens, we can go ahead with the actual construction and assembly of the set. Having covered the baseboard with foil, the next thing to do is to drill the panel to the dimensions given in the

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**Some Points of Interest in This Novel All-Mains Set**

(1) The two screws at which the arrows are pointing secure the main screen to the smaller piece of metal that is part and parcel of the dual Extenser; (2) indicates the small trimming condenser which is connected across the aerial section of the ganged Extenser; (3) when screwing this bracket to the baseboard, care should be taken that the metal foil does not touch the bracket, because it is at high potential; (4) this is the control rod of the volume control and is also at high potential, it is therefore necessary to make sure that the hole in the main screen is sufficiently large for ample clearance.
Diagram. Then mount the panel components and temporarily fix the panel to the baseboard.

This will show how the land lies as regards the mounting of the baseboard components, which must be done with the panel in position, though it will be an advantage to remove it when the wiring is commenced.

**THERE IS ONLY ONE TUNING KNOB**

Although there are several controls on panel, one only is used for tuning purposes. This is the octagonal knob in the centre, and just below there is a socket for plugging in a pick-up.

The pre-detector volume control will have to be mounted on a metal bracket, control from the panel being arranged by an extension rod about 8 in. long, and fitted with a short collar. And here, as with the mounting of the small 30-ohm potentiometer known as a humdinger, a special precaution must be taken. This consists in so arranging things that the mounting bracket supporting the H.F. volume control and the humdinger do not come into contact with the metal foil covering the baseboard.

**Alternative Methods**

This is essential, because the spiral of the volume control is not insulated from the slider, while the metal ends of the humdinger would be shorted if they came into contact with the foil. There are two ways of carrying out this insulation. One is to cut away the foil round the components in question, and the other is to mount them on blocks of wood, taking care that they do not come into contact with the screws used to fix the blocks on the foil.

The other components are mounted in the usual way, though it is advisable to fix the Extenser in place permanently until the pick-up jack has been mounted and wired up. So after mounting the various components on the baseboard the panel components before you finally fix them on the baseboard and connect them up.

This does not mean that such parts as the Extenser and the L.F. transformer need testing if they are new, but it is really advisable to check up the health of the fixed condensers, the valve holders, and H.F. and L.F. chokes before going right ahead with the receiver.

Most of the present-day parts can be relied upon to be pretty sound, but we have come across such things as faulty valve holders, chokes that will not pass even D.C., let alone any choking, and leaky fixed condensers, quite recently, so that the day of one-hundred-per-cent perfection has not yet arrived.

**A Reason for Everything**

It is easy, however, to check up the few parts in the set, and then, with the sure knowledge that the condensers will not leak, and that the valve holders will make good contact with the valves, and the chokes will really be likely to choke, one can go full-steam ahead and get on with the building of the set.

In the wiring diagram you will probably notice that some of the leads in the two tuning circuits are apparently unnecessary; they could have been replaced by short connections to the earthed metal covering on the baseboard.

This use of wire connections where apparently the foil could have been employed is done deliberately, however, for it is not a healthy practice to return the tuning coils to the earthed sides of the Extenser.

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**A COMPLETE LIST OF THE PARTS REQUIRED**

**PANEL**

- 16 in. x 8 in. (Perkul, Bocle, Ready Radio, Polco-South, Wescot).
- **CABINET**
  - Merco " Gothic " No. 1000, with baseboard 18 in. x 10 in.
- **EXTENDER**
  - Double-gang disc-drive (Klydon, Wave master).
- **SWITCH**
  - On-off rotary snap (Claude Lyons, Ready Radio).
- **VARIABLE CONDENSER**
  - 00005-mfd. solid-dielectric (Telson, Ready Radio, Polar).
- **RESISTANCES**
  - 1 5-mfd. volume-control potentiometer (Igranic, Ready Radio, Sovereign, Colvern, Wearett, Glazite, Lacolinc, Magnum).
  - 1 50,000-ohm potentiometer (Igranic, etc.).
  - 1 5-meg. grid leak, with holder if required (Graham Farish Ohmite, Telson, Ready Radio, Igranic, Sovereign, Watnall, Ferranti, Lissen).
  - 1 40,000-ohm Spaghettil (Telson, Graham Farish, Bulkin, Tunewell, Ready Radio, Varley, Igranic, Colvern, Sovereign, Watnall, Ferranti, Lissen).
- **COMPRESSION CONDENSERS**
  - 1 0-mfd. (Dubilier type 9200, etc.).
  - 1 2-mfd. (Dubilier type 9200, etc.).
  - 1 2-mfd. (Dubilier type 9200, etc.).
- **SWITCHES**
  - 1 "Shunt-feed" 5-pin socket (Colvern, Varley, Telson, Ready Radio, Colvern, Sovereign, Colvern, T.C.C., etc.).
- **CHOKES AND COILS**
- **VALVE HOLDERS**
  - 1 Terminal strip, 18 in. x 2 in. (Wearite). 1 Ferranti electric clock chassis. 1 Screen, 5 in. x 11 in.
- **L.F. TRANSFORMER**
  - 1 5-mfd. transformer of medium ratio (H. L., "Parsford," Igranic "Privo").
- **NISCELLANEOUS**
  - 1 Short copper foil, 18 in. x 10 in. 1 Ferranti electric clock chassis. 1 Screen 5 in. x 11 in.
  - 1 Screen, 5 in. x 4 in. 1 Screen, 5 in. x 4 in. 1 Screen, 6 in. x 4 in. 1 Screen, 6 in. x 4 in. 1 Screen, 6 in. x 4 in.
  - 1 Brassed and 8-in. rod for 50,000 volume control, also panel bush and collars for same (Wescott).
  - 1 Terminal strip, 18 in. x 2 in. 9 Indicating terminals (Bulkin, Igranic, Belling Lee, White, etc.).
  - 1 Radio-preamplifier jack and plug (Igranic type F.662).
  - 18 in. Twin metallised wire (Lowcon).

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**May, 1932**
The Tuned Circuits are Accurately Ganged

by way of the foil, for that is likely to set up instability, due to the fact that the foil is common to both of the tuned circuits.

It must also be remembered that the moving vanes of the Extenser and the framework of it are common, and are therefore at earth potential. With the tiny screws on the cans screwed down, these cans are also electrically connected to the moving vanes, and so only one contact on each section of the Extenser is required, and there is no need to insulate the Extenser from the foil.

In replacing the lids of the canned coils after wiring has been carried out, care should be taken that the edges of the lids do not cut into the wire as it comes out through the slots provided in the lids. It is regretfully easy to cut into the wires in this manner, and a fault developed in this way very often takes a lot of finding, and it is not unlikely that it might prove detrimental to the life of the mains unit.

The Clock Wiring

At this point perhaps we should say a little about the arrangements made for the inclusion of the electric clock and the wiring controlling it. Obviously, the control switch on the panel of the set must not switch off the clock every time the set is "closed down."

So that switch is completely independent of the action of the clock, and controls merely the input to the set via the mains unit. What happens is this. The mains unit, which is a separate part of the outfit, is supplied by the makers with a plug and flex for plugging into the electric-light socket. This plug is still used for operating the set, but one of the leads is broken and the switch on the panel of the set is inserted in series with it. It obviously does not matter in the slightest which of the two leads is broken.

Independent Switching

So far we have arranged for the set to be switched on or off without the need to touch either the plug in the electric-light socket or the switch controlling that socket. The clock must, however, be so wired that although the whole outfit could be switched off by removing the plug from the socket, the clock must not be affected by the control switch on the panel.

This is easily arranged by tapping the clock connections on to those from the plug to the set. So one side of the clock is connected to one of the flex leads, say the one that goes to the panel switch, but on the side of the switch that goes to the plug. The other connection of the clock is connected into the lead from the plug that is unbroken and goes to the mains unit direct.

Moving-Coil Speaker

These connections are easily made by just baring the flex and twisting round and soldering to the bare portion the ends of the flex from the clock. The joins afterwards must be carefully covered with insulating tape.

The loudspeaker we have chosen for use with the set is the Ultra moving-coil, but obviously any other make of suitable size, and of the permanent-magnet type, can be employed if it is desired to change.

Mains-Unie Rating

The mains unit must be capable of supplying 3 amps. at 4 volts for the heaters of the valves, and an anode current of 30 to 40 milliamps. at a voltage of not less than 200. We have shown in one photograph the Haybird M.W.1 unit, which will give over 50 m.a. and up to 5 amps. for L.T.

As the load on the unit will not be approaching its maximum, the voltage will rise above 200, and so we must apply an additional load across the maximum H.T. and H.T. negative terminals. This can conveniently take the form of a resistance of about 7,000 ohms, which will load

SHOWING THE COILS WITH "CANS" REMOVED

This photograph was taken from the aerial end of the receiver. The two coils can be seen in the foreground with their "cans" removed. That nearer the panel is the intermediate coil, while the other is the aerial tuning inductance.
This photograph, with the back of the cabinet removed, shows very clearly the disposition of the various items. At the bottom is the set itself; above is the loudspeaker, with the mains unit to its right, and immediately above the speaker can be seen the case of the electric clock.
It Employs an S.G.-Det.-and-Pentode Combination

the unit sufficiently to keep the voltage down to a safe limit. This resistance must be capable of carrying 30 milliamps., such as the Colvern Colverstat.

There is no need to place any extra load on the L.T. side of the unit, but you will probably think that to use so ambitious a unit is unnecessary.

Actually this is far from the case, because this particular unit is designed so that H.T.-is not permanently connected to the L.T. winding of the transformer, as it should not be for this receiver.

As a matter of fact, ordinary units that just provide the necessary output will not be found to be appreciably cheaper, while there is an added advantage in purchasing the M.W.1 in that one becomes the possessor of a thoroughly reliable unit that has an output capable of supplying practically any type of set that one may construct in the future.

For Future Use

Nothing is more annoying than to find, after buying a unit for a particular set, that on the construction of a larger receiver the unit has to be scrapped and a complete new outfit obtained.

Remember that if you use a metalised S.G. valve the bulb must not come into contact with the screen through which it passes, or the grid-bias resistance will be short-circuited.

A Highly Efficient Three-Valve Circuit Arrangement

The circuit which is shown in its theoretical form above, aims at getting the maximum possible out of three valves. The first valve is one of the screened-grid type, and works as a high-frequency amplifier. Then follows the detector, and, finally, the output valve, which in this case is a pentode. The set is designed for operation from A.C. mains, the power being supplied by a separate unit.

Actually this is far from the case, because this particular unit is so designed that H.T. is not permanently connected to the L.T. winding of the transformer, as it should not be for this receiver.

As a matter of fact, ordinary units that just provide the necessary output will not be found to be appreciably cheaper, while there is an added advantage in purchasing the M.W.1 in that one becomes the possessor of a thoroughly reliable unit that has an output capable of supplying practically any type of set that one may construct in the future.

So when cutting the hole in the screen bear this point in mind.

G.B. Resistances

We have purposely left out the bias resistance values of the three valves, because they will depend upon the particular types of valves employed. The value can be obtained either from the makers of the valves, or by the simple formula, \( R = \frac{E}{C} \), where \( R \) is the required value, \( E \) is the voltage of bias required, and \( C \) is the anode current of the valve.

In our list of accessories the correct bias figures for the various valves mentioned for the three positions are given, so that those who use these types of valves need not work out the values in the manner described above.

With the valves in position, connect up the mains unit with the variable tapping to H.T.+1. In the M.W.1 Hayberd unit there are two other fixed taps besides the maximum, but these are neglected, and H.T.+2 is taken to the full voltage of the unit.

The H.F. volume control will allow easy voltage variation of the screen voltage of the S.G. valve, and the voltage on the detector is not at all critical.

Trimming Tuning

After switching on, tune in a low-wave station (preferably not the local) and trim the two sections of the Extenser by means of the trimmers that have been mounted as shown in the diagram on the fixed vane terminals of the two sections. These are
adjusted to maximum results, and then the set is tuned (still on the medium wave band) to a station near the top of the scale. Probably it will be necessary to re-trim here, but this cannot be done with the trimmers, and must be carried out by very carefully adjusting the setting of the two sections of the Extenser.

This sounds a terrible thing to do, but the setting will only have to be altered a minute amount, probably an almost unnoticeable fraction of the rotation, for the coils are sent out by the makers ready matched, and we have only the stray capacity and inductance of the circuits to account for.

**Coupling Adjustments**

This adjustment is done by slacking off the screws in the universal coupling between the two sections of the Extenser and slightly rotating one of the sections (preferably the rear one) while the set is in operation and tuned to a distant transmission.

The tuning is not so sharp that this task is critical, and you need have no fear that the series aerial condenser will upset things, for it has yet to be set. This, in fact, is the next task, and the series condenser should be adjusted to provide the requisite degree of selectivity, and its setting will depend upon the local conditions under which the set is to be used.

Once set the condenser will not...
There is Provision for a Pick-Up in This Set

have to be altered, and we can finally adjust both the trimmers.

The ganging should now hold reasonably well for both medium and long wave-bands, and the set will be found to be a very easy one to handle, with selectivity quite adequate for all general purposes, and a high degree of sensitivity. It is intended as a household set rather than as an ether scourer, and so the design is such that maximum ease of operation has been given primary consideration.

As a Radio-Gram

The pick-up is added if required by means of a plug inserted in the jack below the Extenser on the panel, and this simple operation at once converts the receiver into a radio-gramophone.

One word about the loudspeaker. A moving-coil type of speaker is employed, and the mains unit and the speaker all pack into the top part of the cabinet. To avoid boxiness it is advisable to keep the back of the cabinet out, or else to cut a large piece of it away and fill in with gauze to leave the back fairly open.

And now to start the clock, which is fitted just as a tight fit at the top of the speaker fret. This is “on” all the time the set is plugged into the electric light mains (provided the transformer from the lighting supply is omitted). And it operates independently of the receiver.

Starting the Clock

The hands are set by means of the other spindle in the same way as with an ordinary clock, and thereafter the correct time will be available as long as the mains supply is switched on. Operating the set has absolutely no effect on the clock and the latter has no effect on the receiver.

One word more about the set. In order that the correct electrical centre of the L.T. supply may be found it is necessary that the mains unit be such that the filament winding of the transformer is not centre-tapped, or if it is that tap be free and not connected to the H.T. negative of the unit. In the “M.W.1” this tap is brought out to a separate terminal, marked E, and in this set that terminal is not used.

Instead, to find the electrical centre finally housed in the cabinet. If you should desire to try a unit that has no such free transformer centre, the humdinger should be omitted.

In conclusion, we would like to say a few words about the use of the set where it is intended to be employed on the electric power circuit instead of the lighting supply.

Normally the lighting supply has in its circuit fuses of 5-amp. current-carrying capacity, but the power or heating supply has anything from 5 to 15-amp. fuses. Such fuses are not sufficiently delicate to safeguard the clock mechanism, and so where the set is to be used on the power or heat mains different fuses should be employed.

Plugs with Fuses

This is not as difficult as it sounds, for to use the receiver on such a supply it is obviously necessary only to change the adaptor provided with the mains unit for a two-pin power plug. This at once carries out the required alteration of the unit connection and the safeguarding of the clock. It is not yet certain whether the Ferranti plug will be available in a size to fit 10-15 amp. power sockets;

RECOMMENDED ACCESSORIES

Loudspeaker.—Marconi phone, Blue Spot, Coliseum, H.M.V., R.T.H., Epooh, Graham Farish, W.B., K & A., Unity, Cossor.

VALVES AND BIAS RESISTANCES

The following are the required bias resistances for use with a suitable selection of valves:

S.G.: Mazda A.C./R.G., 1,000 ohms; Marconi and Osram M.S.4B, 750 ohms; Mullard 5.A.V. B. 200 ohms; S.S. 4 Y.S.G.A.C., 200 ohms; Cossor 41M.S.G./L.A., 250 ohms; Eta D.W. 1,000 ohms; Tungsram A.B.4010, 750 ohms; Triotron 124A.C., 750 ohms.

Det.: Mazda A.C./H.L., 600 ohms; Marconi and Osram M.H.4, 750 ohms; Mullard 325V., 1,000 ohms; S.S. G.P.A.C., 1,000 ohms; Cossor 41M.H., 1,000 ohms; Eta D.W.4025, 1,000 ohms; Tungsram A.B.4100, 1,000 ohms.

Pen.: Mazda A.C./Pen, 250 ohms; Marconi and Osram M.P.T.A, 350 ohms; Mullard Pen.4V., 250 ohms; S.S. 4 Pen.A.C., 300 ohms; Cossor M.P./Pen., 400 ohms.

Mains Unit.—See text (Heavyberg M.W.1).

THE PENTODE OUTPUT STAGE

Here you see the L.F. end of the set, with the parallel-fed transformer, last valve holder and pentode output choke all clearly illustrated. The choke, by the way, has several tappings so that the loudspeaker can be properly matched up to the pentode. The standard plug is for the 5-amp. size, which has smaller pins and closer spacing, but if not it is a simple matter to use a power-plug adaptor, which can be obtained from any electrician for a few shillings.
There has always been a certain amount of difficulty about producing a set that is really efficient both on the broadcast wavelengths and on the ultra-short waves.

Simplicity Essential

By the words "really efficient" I include the desirable factor of simple operation, for the most effective of sets is not very useful if only an expert can handle it!

The whole trouble has, of course, arisen from the fact that the whole business of tuning nowadays is a compromise. An ideal set would be tuned with a condenser of about \(0.0015\) capacity on the long waves, \(0.0005\) or perhaps \(0.00075\) on the broadcast (medium) band, and \(0.001\), or something even smaller, on the short waves.

This would give reasonably equal spacing between stations on all waves.

TUNING TWO TURNS

On short waves the variable condenser is across only part of the coil, so that its effect is similar to a smaller one across the whole coil.

The most optimistic of us will not admit that it is a nice thing to make our short-wave tuning exactly ten times as difficult as our broadcast-wave tuning, and this has brought us up against a choice between another compromise and a complete breaking-away.

Obviously, we don't want to reduce our \(0.0005\) to something smaller unless we are going to use our set for short waves only. If we decide on the latter solution we can, of course, come down to \(0.001\), and our difficulties are almost over. But anything smaller than \(0.0005\) is very undesirable if we intend to use the set for broadcast as well.

Various schemes have been proposed from time to time for "ironing out the tuning-range," as the Americans call it. One of the best-known is the use of a small fixed condenser in series with the variable, provision being made to short out the fixed condenser when the set is used for the broadcast waves.

Automatic Change-Over

The only disadvantage to this, in the way in which it was then arranged, was the necessity for "crocodile clips," and the provision for tappings on the coils.

The method by which I am now arranging this does away with switching, and brings the set down to the very simplest form. The condenser automatically goes across the whole coil when the broadcast-band coils are inserted, and the principal of tuning only a small portion of the coil by means of the conventional \(0.0005\) capacity. Similar tuning ranges are, of course, given by \(0.0001\) across the whole coil and \(0.0005\) across one-fifth of the coil.

Using Two Condensers

Another arrangement, preferable to the above, is to arrange two variable condensers in parallel. One is the usual \(0.0005\) and the other almost as small as you like to make it. Then, for short waves, one sets the \(0.0005\) to zero and tunes on the other.

For broadcast the small condenser serves as a useful vernier control. The chief disadvantage is, of course, the unnecessary expense of installing two separate tuning condensers in the one set, together with the fact that valuable space is also taken up.

The third scheme, of which my own is a modification, was used in one of my sets as far back as 1927, and used...
HE DOESN'T LOOK AT THEM! Paul Whiteman, the “King of Jazz,” conducting an audition in an American broadcasting studio. He is blindfolded so that the beauty of some of the candidates cannot prejudice him!

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BROADCASTING A VOLCANO!

Some striking photographs of an amazing "O.B." conducted by American radio engineers on the island of Hawaii.

The picture below shows one of the broadcasting engineers engaged in the tricky task of lowering the microphone over the rumbling and boiling pit of lava, so that listeners should hear the big noise.

Above is a close-up of the microphone with the commentator describing the scene to listeners.

The spectacular photograph below shows the lake of boiling lava on the summit of the volcano, as seen from the air.
When you tune in some far-off foreign station do you wonder about the background? When your set takes you over the sea like Barcelona do you ever get a geographical kick out of your journeying?

It is surprising how much more interesting the stations sound if you imagine the country in which you are listening. And as all the Continent is your doorstep, so to speak, you can visit any part of it in which you are especially interested, jumping the boundaries and ignoring the traditional barriers, paying your calls just when and where you will to the countries of Europe.

As an example, let us suppose you are interested in harbours and coastal routes, and would like to visit some of the seaboard stations of Europe. Let us try a trip over the Bristol Channel, then on to the Coast of France, across to the Mediterranean, over to the Adriatic, and finally home by the North Sea.

One Starting Point

Such a circuit will lead you across England, to Ireland, across France, Spain, and Italy, through the Balkans to Turkey, and right across Central Europe to Northern Germany, where we return home via Scandinavia. And a convenient starting point is Cardiff, the great port of Wales.

Cardiff looks, dates from Roman days, and not where their early fortress stood there is now a great city of over 300,000 inhabitants, with some 200 acres of docks and many magnificent buildings and streets. Just how the Romans found Cardiff we do not know, but listeners will agree that it is not a very easy place to find on a wireless set, unless one happens to live in the West of England.

The reason for this is, of course, that the power is low, being only 1 kw. Cardiff's nearest powerful neighbors are the North Regional and Bordeaux-Lafayette, which are just over 300 miles and about three or four degrees lower on the dial than the Welsh station, which has a wavelength of 309.9 metres. The most powerful station just above it, and one which is well received in this country, is Genoa, on 312.8 metres. This wavelength is immediately above Cardiff's, and as there is a Swedish and a Yugoslavian station on the next wavelength below Cardiff the disentangling of the Cardiff programme from these others is quite a feat for most listeners.

That is one thing that makes these radio tours so interesting—you often find difficulty with the stations near at hand and get the distant ones quite easily!

If your set is sensitive enough to give you Cardiff from the crowd all around him you will then be able to pass on to Cork, which is the next step. Cork uses a wavelength of 226.4 metres, and comes right at the bottom of the list; in fact, some sets will not tune as low as this, in which case the owner will have to do what the Atlantic liners have to do in bad weather—give the Irish port a miss!

ONE OF THE NEW ITALIANS


Italy is reorganising her broadcasting service, and our tour this month includes the very latest station, Bari, on the Adriatic. This photograph shows the station at Trieste, also on the Adriatic, and in the heading is a typical scene taken on the shores of this famous sea.

But call at Cork if you can; the lady announcer has a charming lilac lisp of her own, and appears to be losing the extraordinary language equations which led her to announce in incomprehensibilities instead of in English.

Cork, by the way, is a city of some 75,000 souls (mostly cherries), with a dream of a harbour. Both Crosshaven and Mallow has to cope with it, at odd times, and it gives dreams of the strenuous days of old when there always plenty of trouble without the trouble of looking for it!

Now just a twist of the dials to a couple of degrees or so below Cardiff and we find Bordeaux, the great French port of the Bay of Biscay. The wavelength is 334 metres, and the station is on a more or less continuously from just before noon till 9 p.m. or after.

The full name of the station is Bordeaux-Lafayette, and it is announced frequently and clearly. Announcements of its Paris relays also be heard frequently.

A Picturesque Port

With a population of well over a quarter of a million, Bordeaux is the fourth port of France. When the German invasion threatened Paris in 1914 it was to Bordeaux that the French Government migrated—they had had to do exactly the same in the war of 1870!

In the centre of the wine trade, Bordeaux is a picturesque port with a homely air, due to its situation sixty miles up the River Garonne. In the 14th, 15th, and 16 centuries it belonged to England.

All but the largest ships can lie at the magnificent modern docks of this great Atlantic port, and on of its main squares are two tall towers that serve as light-houses. Bordeaux is nothing if not picturesque!

The next step of our radio journey is the short one across the Pyrenees to Barcelona. The wavelength is 340 metres, so listeners do well to wait until the neighbour- ing Regional has closed down, as the dial reading will be only one degree or so lower.

The second largest city and the chief port of Spain, Barcelona has
May, 1932

"The World's Programmes"

MODERN WIRELESS

Cities That Were Old Before Britain Was Known!

A population of about 622,000. In its sheltered and picturesque situation on the Adriatic coast, it enjoys a fine climate and the reputation of being the pleasantest city of Spain. It is a port of call for about forty important shipping lines, and its average annual commerce is valued at some £150,000,000. There are large manufactories of silk, cotton and wool, and many other important industries.

Like the surrounding city, the Barcelonca radio station is not isolated; and, in fact, it is generally on the air by about 8 a.m., continuing at intervals till about midnight. Lectures in English are regularly read on Tuesdays at 7.30 p.m.

Another Port

We must push on to another attractive Mediterranean port in our next move by tuning to 453.2 metres for Palermo. This is the old Italian station that works on a wave-length between Budapest and Brussels. No. 1. (Incidentally, its proper wave-length is 346 metres, but it has—-at the time of writing—changed to 525.6 instead.)

The town is gloriously situated on the Bay of Palermo, backed by mountains, surrounded by its sheltered and picturesque situation on the Mediterranean, it enjoys a population of about 460,000.

As Palermo, that was seized by the Romans an an indolent ; the city which the Turks themselves.

Of its inhabitants, it is a port of call for about forty

It is a city of considerable size with a population of about 110,000. It was an important place in Greek and Roman times, when it was known as Barium.

Really Distant

The Normans those inveterate explorers of other people's property, entered Bari in 1071, and it was a very important town upon a wave-length of 453.2 metres. As Palermo, with a mere three kilometres, has been getting over quite well, Bari should be a comparatively big noise. Remember that for programmes it will be linked with Rome and Naples, and thus "Radio-Roma-Napoli," the frequently heard announcement from these stations, will be heard as "Radio-Roma—Napoli-Bari" instead.

Although Bari is not a name familiar to English ears, the town is a graceful and often beautiful city. Its wave-length is certainly over a million, and its name is now used, appropriately perhaps, as a prison.

And, probabiy on account of the fact that it has a floe of life behind those clustering

For most people the easiest way of searching for Istanbul is to remember that it is about 1 degree higher than Kulundborg's wave-length. And that it can be identified by its bi-lingual announcements—Turkish and French—and by a quick-ringing Gong, shifting 77 times to the minute.

The announcer calls "Ici Radio-Stamboul!" and as the local time is two hours ahead of Greenwich the station closes down rather early. It is, however, not at all strong, because the distance from London is well over 1,500 miles, and the power is of the order of a mere 6 kw.

Thus only a powerful set is likely to pick up Istanbul, although the writer remembers getting it strongly on one occasion with a battery-run 8.9, Det. and L.P. in daylight. This was certainly something of a find!

Delightful Situation

The city itself is situated in a truly delightful position on the famous Golden Horn, one of the most natural harbours in the world, leading from the Bosporus and Sea of Marmora. With easy access to the Black Sea and to the Sea of Marmora, and with the city itself, or by its long-wave relay, Kulumbourg. Copenhagen itself, or by its long-wave relay, Kulumbourg, works on 251 metres, and it is thus only three stations above Heilsherg below the London National, and below the British relays, Heilsherg itself is a small and unimportant place, but Konigsberg, its broadcast station, "father," is the capital of Russia, and it has a population of nearly a quarter of a nation.

It is a town of great historical interest, and as recently as the Great War it was in turmoil, for the Russians almost reached it in 1914. But the great philosopher, and was buried here in 1534.

From East Prussia we can return home via Breslavia—either by Copenhagen itself, or by its long-wave relay, Kulumbourg. Copenhagen works on 251 metres, and it is thus only three stations above Kulumbourg on the tuning dial, the intervening stations being Festalaya, and Radio-Liege, a small Belgian station.

Popular Station

On nearly all sets Kulumbourg the distant relays of Kulumbourg, will be easier, this station being well known and situated a few degrees above the Oslo wave-lengths. Kulumbourg is a small station, and is probably an island station common to both the Danish stations.

When Kulumbourg gets its programme, it will certainly be a highly popular station, and it will be particularly well received in this country, probably one of the best-known stations, as no one can doubt its fine and well-beaten path.

A Good Relay

Some sets will be able to tune in one of the Swedish stations, such as Malmo, or Karlskrona, which are on the Baltic, while others will more easily pick up Konigsberg, the German Baltic station on 217 metres. But the news is that most receivers will be able to do this with the high-powered relay of Konigsberg, named Heilsherg, on 251 metres.

This is one of Europe's best-known stations, located a little above the London National, and below the British relays, Heilsherg itself is a small and unimportant place, but Konigsberg, its broadcasting centre, is the capital of East Prussia, with a population of nearly a quarter of a nation.

It is a town of great historical interest, and as recently as the Great War it was in turmoil, for the Russians almost reached it in 1914. But the great philosopher, and was buried here in 1534.

What is the best way to visit the Baltic shores by radio?

It is thus particularly appropriate to set one's last port of call in a visit to some of Europe's seacoast stations—a visit that has shown what an amazing diversity of life lies behind those distant programmes.

One of the Broadcasting Stations on the Baltic

This picture shows the broadcasting aerial of the Free Town of Danzig, which acts as a relay of the Konigsberg programmes, mentioned above. Danzig works on rather low power on a wave-length of 453.2 metres.

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HOW IT WILL LOOK
The picture above is a plaster model of the architect's conception of the completed Radio City as it will appear when the £50,000,000 contracts are completed. Some idea of the towering and impressive height of the skyscrapers can be obtained by noting the "tall" church spire, which will be left in position on the left-hand corner of the site.

EXCAVATION EXTRAORDINARY!
Above and to the right are more views of the great excavations now in full swing for the foundations of the world's largest amusement centre. Located between Fifth and Sixth Avenues, and Forty-eight and Fifty-first Streets, the group of buildings will include three giant skyscrapers, and embody several theatres, as well as the broadcasting headquarters. They will take three years to complete—even at New York speed.

BELOW THE STREET LEVEL
As one of the skyscrapers is going to rise to 68 storeys the foundations have got to go down to solid rock! Above are seen some of the steam shovels and cranes, working many feet below the street level.

MORE VIEWS OF THE FIRST RADIO CITY
The great home of New York's Radio and Television interests
During the past few weeks reception on the long waves has been of the all-quiet-and-humdrum variety, and if there has been nothing very pleasing to brag about there has certainly been nothing very displeasing to grumble at. Apart from a few bursts of atmospherics, especially noticeable during the stormy period following Easter, the long-wave band is standing up to the encroach of spring very well.

In connection with the Soviet radio plan, mention has already been made in these columns of the new Russian broadcasting stations, and for the listener on long waves there has been evidence of increasing activities here. Both the Moscow Trades Union and the Leningrad transmissions have been unusually powerful or unusually lucky—the effect being far better reception in England than was to be expected from past performances of these stations.

Several New Russians

In addition, a number of new heterodynes and strange carrier-waves suggest that the Soviet radio campaign is going forward in good style.

Right at the top of the waveband, near Huizen, a total stranger has been butting in, which is presumably one of the new Russians. And in addition to the actual broadcasting stations I understand a number of telegraphics are in contemplation, so there should be plenty of links with Russia very soon.

DESIGNED FOR D.X.

This rather unusual picture shows two of the special type masts used at Nauen, Germany, to support the aerials for work with America.

LONG-WAVE LISTENING
Some practical details of recent reception from stations working on wave-lengths above 1,000 metres.

for those who wish to hear their programmes in Morse.

The reports received from different parts of the country indicate that Radio-Paris is now putting out a very satisfactory transmission, and has settled down with the new transmitter to give consistent service. It is probable that more listeners tune to 1,725 metres than to any other foreign wave.

Variable Reception

The Scandinavian stations have been interesting, and have introduced an air of unexpectedness into the search on long waves. On some nights Motala would come over like the local, while a couple of nights later hardly a trace of it could be heard. Oslo, too, has been switch-backing in strength, with surprisingly rapid ups and downs.

One curious feature which has been commented upon is that if you tune to, say, Motala, and find he is coming over well, it is most improbable that he will let you down in listening to him for an hour or so. And yet on the next night it may be almost impossible to get good reception.

It is expected that before the improvements are effected to our own Daventry long-waver, the Danes will have increased the power of Kalundborg. When this happens there should be a great increase of interest in this station, which already is greatly favoured on account of its lively and good musical programmes.

A Disappointing Station

Of the other long-wavers, Warsaw maintains its remarkably good degree of strength and quality, coming next to Eiffel Tower as an excellent alternative. The most disappointing station has been Konigsruherusbanden, which now seems completely overshadowed by Daventry, and far, far more difficult to get than the equivalent-power Germans on the medium wave-lengths.
Countries to Listen For

POLAND

Some details of the great country that lies on the east side of Germany, and of the excellent broadcasting network it has installed.

The great country of Poland, over 420,000 sq. miles in extent, is a republic that was created by the Peace Conference at the close of the Great War. It has a population of about 30 millions.

Poland is almost entirely an inland state, though a short strip of it extends northwards to terminate on the coast of the Baltic Sea—the famous "Danzig Corridor." To the west of it lies Germany, and to the east, East Prussia, which is thus cut off from the rest of Germany by the Corridor.

Nearby Countries

On the north, Poland is bordered by Lithuania (as well as by East Prussia), to the east by the Baltic republics, while to the south are Ruthenia, and Czecho-Slovakia, with Germany in the south-west and west. Prior to 1914, Poland had been partitioned among some of these powerful neighbours, but it did exist as a separate country; but it had a long and glorious history as a separate entity before that took place.

The Polish language is of Slavonic origin, and although it is difficult to paper, having full of s, z, r, s, and similar difficulties, it is really a distinctly pleasing language, one may judge by listening to the Polish stations.

A Romantic City

The chief town and present capital is Warsaw. It lies in the heart of the country that has always been Poland, from the 11th to the 19th centuries the capital was Cracow, in Little Poland.

The language, literature and music of Poland has survived conquest and partition, and to-day the Polish stations are linked together more closely than ever before by radio for Poland has a first-class broadcasting system.

The Voice from Poland

You can hear this charming young lady on 1,411 metres, where she announces the Warsaw programmes with great clearness, introducing her station to listeners as "Varshova."

At home she is Mrs. Janina Sztompka-Grabowska.

British Built

The Warsaw transmitter which was built at the Marconi works at Chelmsford, England, not only supplied programmes in the second week of January, 1931, and in the short time which has elapsed since then it has become one of the most familiar and well-liked stations in Europe.

Its power five times as great as Dynamo 5 X X, was at that time in excess of any other broadcast station in the world. The fort that Warsaw No. 1 gives is the most powerful from the whole of Poland—which, with its great forest areas, is not a particularly easy country for broadcasting—and will indicate the high efficiency of Poland's central broadcasting station.

On a sensitive set this station is powerful enough to come over quite well in daylight, and a good receiver will hear it just before 11 a.m. which, incidentally, is midday in Warsaw. Since Home Hour is at this hour on an aerodrome which is unknown to him, or if (as happens frequently in a heavy fog) it be a forced landing on an open field, there are obvious and ugly possibilities in such a tremendous landing speed.

Broadcast Warnings

The radio services from meteorological stations and from airports have greatly mitigated the fog danger by warning the pilot of fog banks, thus enabling him to avoid them in many cases, either by circumventing them or by rising above them. But this service does not enable the aviator to dispel the dangers of fog when he is actually in the midst of it.

The present invention attempts to eliminate the dangers by means of an ultra-short-wave apparatus. Preliminary tests have proved successful, and the Lofotians is only waiting for the final report of the German experimental station for aviation before adapting the system to its planes on the various air routes.

"Polskie Radio"

When you hear a man's voice from Warsaw you can be fairly sure you are listening to Mr. Tadensz Bohemski.
STATION ALTERATIONS

Items of interest about the world's broadcasting stations, the increases in power, and particulars of new services, and so forth, chronicled for the benefit of long-distance listeners.

LEIPZIG. The new high-power station is scheduled to be on the air for first tests by next June.

LILLE (France) is to follow the example of Poste Par- sien, and install a high- power transmitter.

MADRID. The great Conference on Radio is to be held from September to December, 1932.

VIENNA. The proposed increase of power to 100 kw. will not raise Vienna to the same status as Prague and Warsaw, which each employ 120 kw.

RABAT. The Moroccan station recently increased its power from 2.5 to 6 kw.

POSTE PARISIEN recently enlarged its announcing staff by engaging M. Laporte, who was one of "Radiola's" original announcers.

RADIO VATICAN. The opening call of this station is "Laudatur Jesu Christus."

TOULOUSE has engaged several professors for a new series of language talks, including English.

AMSTERDAM is holding an International "Bound and

THE JUNE "M.W."

Don't forget to order your next month's "M.W." It will be on sale June 1st, and will contain another "World's Programmes" supplement specially compiled for the long-distance listener.

MILAN'S new station will be of the same rating as the B.B.C. Regions—50 kw.

MOSCOW can often be heard outside the service range of tomorrow—1,715 metres.

BAKU. A new Soviet station has been opened at Baku, on 1,715 metres.

LISBON. Portugal is contemplating a Government-owned broadcasting station to work with a power of about 30 kw.

PIETRA'S exhibition from May 6th to May 16th, representative of radio and allied interests.

ABERDEEN. There is no intention of withdrawing this transmitter when Falkirk's two services are in operation, as the area it serves is outside the service range of the latter.

FALKIRK. Tests from the new Regional on 376.4 metres will probably be radiated about the time these words appear in print.

CSEPEL. The powerful new Hungarian station is now due on the air (on 211 metres), and should shortly be using its full power.

THE SCOTTISH NATIONAL, which will be "faded-in" for service when the new Scottish Regional has properly settled down, will at first use a wave-length of 2,983 metres.

PLYMOUTH. Like Bourne- mouth, this station relies on the wireless link from Daven- try S X X for all its "morn- ing" transmissions, i.e. those up to 2.30 p.m.

RADIO NATIONS. The new League of Nations equipment at Prangling includes two powerful short-wave transmitters—one French and one British, the latter having a power of 20 kw.

LJUBLJANA. Listeners in South America have recently been amazed to tune in this famous Yugo-Slavisa on 574.7 metres.

REYKJAVIK. Iceland's long- wave has been getting over better of late. Its time is one hour behind Greenwich.
Surely there are few broadcasting stations situated so picturesquely as Salzburg, part of which is shown in the foreground of the picture above. Another view of the station is given below, and to the right is a close-up of one of the transmitting panels.
BUSINESS in Vienna prevented me from seeing the broadcasting station there. But, from a radio point of view, the visit was not entirely unfruitful. I managed to get a promise from a "Radio Wien" official that when in Salzburg I should be allowed over the transmitter.

"That's a relay station?" I inquired.

"Yes," said the Vienna man, "the Salzburg station is connected by telephone cable with the studio here. When you get to Salzburg you will be able to see what our relay arrangements are."

After a week's delay I did manage to get to Salzburg, and lost no time in getting over to the west side to see the station.

Relays Vienna

Salzburg is only one of the five stations which take the Vienna programme, and to me, as a British listener, it is hard to see why, considering the fact that Vienna's power at the moment is 20 kilowatts, so many relay stations should be needed to put out the same programme. The other relays are at Graz, Linz, Innsbruck, and Klagenfurt.

There was difficulty in getting a wave-length for Salzburg when it opened on December 21st, over two years ago. The Vienna man had told me that.

The relay works on 218 metres, and it is a common wave-length with Flensburg, Graz, of course, has a wave-length of its own, 352 metres, and adheres to it remarkably well. The average error over a month's working is only 0.3 kilocycle.

Dodging Interference

Salzburg's error is much greater than this, and the reason is that the engineers have had difficulty in getting a free transmission space in the ether.

In the previous month, for instance, Salzburg remained dead on its wave-length for seven days, but afterwards had to shift up and down, always keeping slightly above the common wave-length of 218 metres in order to be free of interference.

The station is in most picturesque surroundings, being under the shadow of one of the many old towers which are a feature of Mozart's birthplace. It is a little one-storey affair of reinforced concrete and is even smaller than the B.B.C. Tatsfield listening station.

Almost Amateurish

Inside most of the space is taken up by the transmitter panels, which look for all the world like those of an American amateur's transmitting station. The apparatus is on rather more ambitious lines than is owned by the average British amateur transmitter, but as the output power is only just over half a kilowatt it does not make a very big show.

The panels are enclosed in a metal framework with safety locks at the back so that as the gates are opened the power is switched off. All the power comes from the local supply lines, and is rectified by a separate bank of valves.

For a small relay station the gear is unusually compact. Each panel carries five separate racks, the valves being at the top and the coupling and smoothing condensers below.

The master oscillator drive is enclosed in a separate metal box at the extreme left-hand side of one of the panels, so that there is no chance of any feedback from one of the earlier valves.

Crystal Control

The wave-length is kept constant by a quartz crystal, and this, too, is enclosed in the metal box. I was shown the crystal stage, and the engineer made a great point of the fact that one of the reasons why Salzburg always keeps on its wave-length is that the crystal and valve of the master control are connected through a special trap circuit to the first valve of the actual transmitter.

The idea of this is, that if the frequency of the last valve of the transmitter changes at all—if the aerial sways, or if there is any variation...
Salzburg's Wave-length is Controlled by a Crystal

in the power lines—it cannot react back on to the drive valve.

All the valves are lit from the A.C. supply and special precautions are taken to prevent the H.T. supply of the first valve after the crystal varying.

There is one complete panel devoted to the modulating gear, and this is coupled up at an early stage in the transmitter—almost immediately after the crystal drive. The other valves in the transmitter are ordinary high-frequency amplifiers.

Air-Cooled Valves

Not one of them is water-cooled, for the power is too low. The coils are about 6 in. in diameter, and are wound on light ebonite supports with little tapings, so that it is a matter of only about five minutes to choose new tapings, put in a new crystal, retune the drive, and alter Salzburg's wave-length.

There is, of course, a long land-line back to the Vienna studios. There is no studio at Salzburg. Ordinary telephone lines are used, and I saw the filter circuit at the Salzburg end, which is used to make up for a loss of bass over the long lines.

A permanent-magnet speaker is connected to the first stage of the amplifier which deals with the studio programme on the incoming line, and on the automatic telephone the station operator has a private line through to the studio so that he can give the signals on the indicator board.

I saw the station started up for a late afternoon programme. It had been in use all day, and the Vienna programme on that particular day had started at 8.20 in the morning.

An Easy Starter!

It took only three minutes to get the whole station going; a big difference from the B.B.C. Regional station, where they have to get in readiness about half an hour before the programme begins!

Badly Screened

Salzburg was chosen as the site for the station because of the huge population in and around the city. My private opinion is that it is not giving the relay a chance, because of the trees and big buildings in the neighbourhood. The aerial is quite a short one, and there is a vertical lead-in from the flat roof of the station building.

Mental comparison with the Newcastle relay station, which I saw a year ago, is in favour of the B.B.C. gear, at least as far as constancy of wave-length goes. Crystal control is all very well in a big commercial station, but an ordinary master oscillator—as the B.B.C. uses for its relays—is more reliable and automatic for relays. At least, that is how it strikes me.

Patent Difficulties

I asked if they had tried tuning-fork drive, but there appear to be patent difficulties. The man at Salzburg had never been to England, but he had heard all about our fork-controlled relays, and from the Brussels wave-length he knew of, and marvelled at, their rigid adherence to our National common wave-length, 2885 metres.

The reason why Graz, Linz and the rest don't share common wave-lengths is that they are too close. There would—at least, so they think—be "fringe" wave-length changes which would cause sideband distortion.

If they could devise some scheme whereby a common wave could be used, other stations would benefit considerably. Our own relays have the advantage that their tuning-fork synchronising gear enables them to "keep station" with far greater accuracy than with any crystal-controlled arrangement.
PROBABLY 50 per cent of the readers who glance at this article know quite well that signals from untold distances may be received on the short waves with the help of quite a simple receiver, but are just content to accept it as some queer sort of magic and leave it at that. Certainly there is no reason why one should bother one's head about the technologies, any more than one needs know all about radio to be able to enjoy a symphony concert or a vaudeville programme. But it is always interesting to know, for these waves (below, say, 100 metres) behave in quite a different manner from the longer broadcast waves. The chief difference is that when they leave the transmitting aerial a great proportion of them are sent off upwards into the ether at an angle varying between 15 and 60 degrees to the horizontal. The main part of the transmitted power spreads out in the same manner as a beam, it spreads still farther, with the result that it does not arrive back on the earth's surface at one isolated spot, but over a fairly wide region.

As the "refracted" portion emerges in the form of a broad beam, it spreads further, with the result that it does not arrive back on the earth's surface at one isolated spot, but over a fairly wide region. Thus the plan where the direct ray fades out -- owing to the absorption mentioned -- and the place where the reflected beam arrives back, there is a "dead" region in which that particular transmitter cannot be heard at all.

To complicate matters still further, the Heaviside layer is constantly changing. Its height varies with the time of day and the angle at which the rays in the particular part that is treating our signal. It also varies with the condition of the sun -- sunspots cause a marked variation in short-wave reception conditions; and it probably changes constantly with the movement of the earth round its orbit.

Thus the distant spot at which our given signal produces the greatest effect may be shifting about from day to day, accounting for the "skip" over a greater distance, 60-metre transmissions are heard quite well at 500 miles, 40-metre at 900 miles, 20-metre at 2,000 miles, but 10-metre ones do not "come down" again at all. The best-known of all the Empire stations is the Olympic (G L S Q), the Homeric (G D L), and the Heunebeck (G M J). They work on 34-95 metres, 53-9 metres, and 59-0 metres, respectively, and all have desirable effects upon short-wave signals.

One factor that has not yet been mentioned is the wave-length used. Waves of different lengths behave in quite a different manner, as we come to different parts of the world. How far these waves go, as determined by the wave-length used. Further, by the wave-length used.

The Seven-Metre Band

Reflected Back to Earth

As the "refracted" portion emerges in the form of a broad beam, it spreads still farther, with the result that it does not arrive back on the earth's surface at one isolated spot, but over a fairly wide region. The chief difference is that when they leave the transmitting aerial a great proportion of them are sent off upwards into the ether at an angle varying between 15 and 60 degrees to the horizontal. The main part of the transmitted power spreads out in the same manner as a beam, it spreads still farther, with the result that it does not arrive back on the earth's surface at one isolated spot, but over a fairly wide region.

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WORKING ON THE MEDIUM WAVE-LENGTHS

Some topical notes on reception conditions and on the outstanding stations between 250 and 550 metres.

Higher Power and Daylight Results—Rome’s Decline—Fall-off of some of the Favourites—The new Poste-Parisien, etc.

In spite of what the calendar says about the progress of 1932, good long-distance results on the medium waves are still easily obtained.

Good Results in Daylight
With a sensitive set there is still no need at all to wait for dark, and a careful combing of the dials will soon provide an alternative or alternatives, probably from as far afield as Toulouse, Heilsberg, Trieste or one of the other Italians. And it seems quite on the cards that such daylight reception of medium waves will be possible to some extent right through the summer.

There is no doubt that the general increase in power of the European broadcasting stations is going to be a great blessing in the summer, whatever it may have been in the winter. On the dark nights, when even low-powered stations come over well, there may have been a certain amount of resentment at the punch behind Prague or some such powerful South-East Europe transmitter. But in the brighter weather, when there is a constant muttering of atmospherics and only comparatively weak reception, a few extra kilowatts at the transmitter make all the difference to the foreign listener.

On the other side of the picture we have to record several stations who have distinctly fallen from grace, so far as British reception is concerned. One very noticeable example is Rome (441 metres), and, to a lesser degree, Toulouse (385 metres) comes in the same category.

Beromunster, on 459 metres, is another foreigner which does not seem to be putting over anything like the programme strength that obtained several months ago. And several other stations might be mentioned, notably Sottens (403 metres), which has definitely deteriorated according to reports over large areas.

But the decline and fall of Rome, and of these other favourites, tends to emphasise the very high level attained and maintained by the majority of the popular foreign programme-providers.

A rather curious point raised by one reader is whether the stations tend to fall off singly or in groups? He has noticed that Rome and Beromunster, for instance, on wavelengths not far apart, fell off at about the same time and failed to supply their usual standard of reliability. While a few weeks before his chart showed that higher up on the tuning dial, round Budapest and Vienna, similar groups of stations with wavelengths close together began to get weak simultaneously.

Over another period, Berlin Witzleben (419.5 metres), and Katowice, Poland (408 metres), showed a noticeable decline within a few days of each other; and although in the case of Rome and Beromunster there is a rather wide wavelength separation, it does certainly seem as though not only single stations, but certain sections “on the dial,” do seem to get weaker at certain times together.

More Power from Post-Parisien
The Post-Parisien station on 328.2 metres is putting up a great show during the test of its new transmitter.

Incidentally, this station is still listed officially as using 1,2 kw. at the time of writing, but judging by the thump with which it arrives, a great deal of power in excess of this is employed for the tests.

Reports in France indicate that the final power of Post-Parisien will be 60 kw., at the Copenhagen rating, which is the same as Stuttgart, Muhlacker, and Heilsberg, Germany, and is in excess of our own Regional stations, which use only 50 kw.

Incidentally, Rome is a 50-kw. station, Langenberg and Beromunster rejoice in 60 kw., while Prague is in a class right by itself with exactly double this amount. The British Regional stations by the way, use 50 kw.
STATION INFORMATION

Items of broadcasting news of interest, from here, there and everywhere.

FECAMP. The popular Radio Normandie station has recently been using a television transmitter.

W 2 X A B. This famous American station broadcast a television portrait of the Lindbergh baby continuously for four hours and at 15-minute intervals during the main evening programme in the early efforts to trace the kidnappers.

CZECHOSLOVAKIA. Preparations are being made for the provision of a Czechoslovak national short-wave station.

KALUNDORG. When the new transmitter comes into operation the old station will be used as a standby for Copenhagen.

ACHEN. The German station which recently closed down, was the German name for what we call Aix-la-Chapelle.

COLOGNE and MUNSTER relay stations were closed on March 21st, in conformity with the German regional scheme.

COBLENCHE. It is possible that one of the recently closed German relays will be re-erected in Coblenze, owing to the rather poor results obtained there from Langenberg.

W B Z. This famous station at Springfield, Mass., which was lately well received in this country on medium waves, is employing a new transmitter and 100 per cent modulation.

TASHKENT is the name of the new Russian station that was causing interference with Kalundborg.

YOUR OVERSEAS FRIEND—

Why not send him "Modern Wireless" every month, to keep him in constant touch with all the latest radio news and developments?

Post his name and address with qs. to the Subscription Dept., Amalgamated Press, Ltd., Fleetway House, Farrington Street, E.C.4, and "M.W." will be sent every month for a year.

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VOLGA BOATMEN are receiving wireless navigation reports from a new station at Nijnj Novgorod. Wave-length, 4,725 metres.

DROITWICH. At the time of writing, tests for a site for the new Daventry station are still proceeding in the Droitwich area.

"5 X X." The B.B.C. has stated officially that the power of the new "3 X X" will be about four times that of the present outfit, and approximately 100 kw. will be delivered to the aerial.

MIDLAND REGIONAL. The improvements to 6 G B will bring this station up to the status of the other new Regionals—about 50 kw. to the aerial and a peak modulation of 80 per cent.

LEEDS. The new buried cable (for even frequency response between 50 and 6,500 cycles per second) is now in service to Edinburgh, via Newcastle.

ST. PIERRE and MIQUELON. A broadcasting station is to be installed for the islands of St. Pierre and Miquelon, near Newfoundland, to relay the programmes from Port-aux, the French colonial station.

WESTERGLEN. The Scottish Regional station at Westerglen, near Falkirk, is due for its official public tests about the time that these words appear in print.

THE SCOTTISH REGIONAL. The 376.4-metre wave length is allotted to the Scottish Regional, and 288.5 metres to the Scottish National. The latter will be introduced in August or September, if the present arrangements materialise.
WHEN I HAD COMPLETED THE RECEIVER
my work that think unusual enough to relate.

I was listening to music

transmission which appeared to be working on the exact frequency of the American broadcaster. It did not take me many

minutes to determine the exact frequency of the

station audible, and strength was

constant that it was a

American station.

As one may imagine, these broad-

casts to convince me that a few

stations offer prizes to those re-

ports of American stations broadcasting D.X. concerts to me as an interesting new and,

probable, to readers.

D.X. Concerts

These concerts are named "D.X.

concerts," owing to the fact that these are broadcast, with a view of ascertaining how far the station

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probable, to readers.
This article is the commencement of a new stage in this extremely fascinating series. In it our contributor discusses ammeters and milliammeters, and gives some very useful N-diagrams for finding shunt values.

Up till now we have been concerned with the "dry bones" of the subject of radio—the essential preliminaries which every wireless amateur must get acquainted with if he is to understand the "hows" and "whys" of his science. Such matters as the impedance of series and parallel circuits—however dry and uninteresting they may be in themselves—are seen to become of vital interest and importance when one thinks of the wide part they play in modern radio practice.

**Varying Impedance**

For instance, the well-known principle of varying impedance with frequency is universally employed on the H.F. side of receivers, where it appears under the guise of the "tuning system," be it straight, coupled, or even band-pass. On the L.F. side the identical principle is finding no less important applications in the various methods of "tone-control" which are now being developed with such striking success to correct tonal distortion.

It is of the greatest importance that the maximum value of current indicated on the scale should never be exceeded, or damage is likely to result.

To use an ammeter, i.e. to measure the amperes passing in any circuit, the instrument should be placed in series with the circuit. Thus if current is supplied to a resistance from a battery as shown in Fig. 1 (a), the ammeter would be connected as shown in Fig. 1 (b), since it is thus in series with the medium conveying the current.

"It's Not Done"

To connect it directly across the battery would be to court disaster, and a burnt-out ammeter. It is important to remember this, especially as, if the voltage of the battery is desired, the normal procedure is to place a voltmeter across its terminals. Many a beginner has thought it strange that, although he can measure the voltage of an accumulator by applying a voltmeter to it directly, yet to measure its current-producing powers by the similar application of an ammeter is one of the things which, electrically speaking, is simply not done!

**More Economical**

In this case, however, it is more economical to consider why it should be so rather than make the test. The reason is to be sought in our old friend, Ohm's law. An ammeter, being intended for insertion in a circuit in which current is already passing, is constructed to offer as little resistance as possible to the current which passes through it.
It is, as we say, of "low resistance." Hence, if such a low resistance element is placed directly between the terminals of an accumulator, the resulting current will be very large indeed, and will certainly burn out the coils of the instrument.

**Different Ranges**

Ammeters are made in various ranges. The largest used in ordinary wireless work will measure filament current up to five amperes, while others suitable for filament current work may have maximum readings of 1 amp. or 0.5 amp.

The very much smaller currents used in anode circuits are measured by means of a similar instrument called the milliammeter, whose scale is graduated in milliamperes, the milliampere being the one-thousandth part of an ampere.

**HOW SHUNTS WORK**

Here you see how the greater part of a large current (I) is deflected through a shunt, leaving only a small current (i) to pass through the ammeter.

A milliammeter reading up to 10 or 20 milliamperes is a very useful part of the radio experimenter's outfit. Many valves pass an anode current well within this margin, and the skilful use of such an instrument is wellnigh essential if any serious attempt is to be made to eliminate distortion or cure other ills to which the modern receiver is liable.

We have already seen that it is desirable that the resistance of an ammeter should be small, in order that its inclusion in a circuit may not appreciably affect the current flowing. A milliammeter suitable for use in the anode circuit of a receiving valve may have a resistance of anything up to a hundred ohms without causing the readings to depart substantially from the true current measures.

**A Useful "Dodge"**

The reason is, of course, that ordinarily the resistance in the anode circuit—including that of the valve itself—is of the order of many thousands of ohms, so that the addition of the odd hundred ohms due to the meter resistance makes very little difference to the current flowing.

Although we may not use an ammeter directly to measure currents greater than the maximum value indicated on the scale, we may, nevertheless, use the instrument indirectly to measure such large currents by employing a very useful "dodge."

**Making Multipliers for Milliammeters**

What we do is to connect a shunting resistance of small value across the terminals of the meter; if the value of this shunt is sufficiently small as compared with the meter resistance, most of the current will pass through the shunt, leaving only a small part to pass through the greater resistance of the meter, which is thus actuated in perfect safety.

Of course, the current shown by the meter is not the total current passing in the line circuit, but this total current is always proportional to the meter reading, and can easily be found from it. The principle is illustrated in Fig. 2, which shows how a comparatively large current, I, flowing along a conductor may be apportioned between meter and shunt so that only a small part of it, i, passes through the instrument, the remainder being deflected through the shunt.

The precise distribution of the current as between meter and shunt...
All Those Complicated Calculations are Quite Unnecessary

Ammeter by some nice, round number such as 5, 10, 20, 50, etc., but in order to do so we must know the precise value of the shunting resistance that will work the trick.

When we know the resistance of our meter—and if it is unmarked the makers should be able to help you—the necessary shunt values to obtain any desired multiplier may be readily ascertained from the two N-diagrams which are published this month. (See Figs. 3 and 4.)

Reading Off the Value
It is evident that the scale values of the instrument must all be multiplied by 20 when the shunt is connected up; 20 is therefore the “multiplier” corresponding to the required shunt, and this figure is sought on the diagonal scale.

FOR LOW-RESISTANCE METERS

Here is another N-diagram which is very similar to the one shown on a previous page, but intended for meters having a lower internal resistance.

A Suitable Shunt
An example of their use will make the matter quite plain. Let us suppose that a milliammeter whose full-scale reading is 2 milliamps, and whose internal resistance is 57 ohms,

is intended to work in conjunction with a shunt to measure currents up to a maximum of 40 milliamps. What value should the shunt have?

40 milliamps is intended to work in conjunction with a shunt to measure currents up to a maximum of 40 milliamps. What value should the shunt have?

THE PRINCIPLES OF TELEVISION
A new book on this vitally interesting subject.

However the progress of television proper may be regarded, there is no doubt about the progress of the literature of the subject. It grows and it improves.


It is certainly a book of outstanding interest to the serious student of television, as the author sets out to expound the principles of the subject, rather than to describe individual efforts in what is admittedly a vast field.

Essentially Practical
Yet Mr. Dinsdale’s treatment of the matter is essentially practical, and he is an adept at pointing out the vital and interesting points. His chapter on Elementary Considerations, for instance, leaves the reader with the feeling that the subject is going to be dealt with thoroughly, and the following chapters justify this confidence.

The illustrations are noteworthy, there being many excellent photographs of apparatus and of those responsible for the various systems; in addition there are the copious explanatory sketches and diagrams, which are unusually well adapted to illustrate the text.

Worthy of Study
In summing up, the author is quite frank about the deadlock which television seems to have reached, and yet he holds out a hope that some development of the cathode ray, or some entirely new system, may accomplish the desired end. Certainly this book shows the subject to be one full of interest, and worthy of study by the amateur as well as by the professional engineer.

P. R. B.
MODERN WIRELESS
May, 1932

A DE-LUXE RADIO-GRAMOPHONE

Some interesting details concerning the H.M.V. "Super-heterogram"
Model 531.

The appearance of the receiver leaves nothing to be desired.

HIS MASTER'S VOICE have done a great many noteworthy things in the way of set designs in the last two or three years, but we can confidently say that all pale in significance against the 531, the super-het radio-gramophone introduced in their 1931-1932 range.

Not that the other receivers are unworthy of the highest praise, but the nine-valve super, with its single-knob control, is a technical achievement of which any firm might be proud. And the Gramophone Company rightly regard it as their ace set.

One Tuning Control

In designing this model the H.M.V. engineers have aimed at a de-luxo proposition from every point of view.

They have reduced the tuning controls to one, and produced a super-heterodyne which will operate satisfactorily on both long and short waves. Between 80 and 90 stations can be received regularly at any time on this instrument with really satisfactory quality, power and tone, using the mains or a few inches of wire as an indoor aerial. There is no need for an elaborate outside antenna.

Although the output is over 4 watts, the quality and range of reproduction is extremely fine.

The dial settings for the stations, once noted, are permanent, the illuminated scale reading directly in wavelengths. An extremely useful feature in the form of a "local-distance switch" is provided, the normal high-frequency amplification of the instrument being so terrific that any attempt to receive a powerful transmitter within 100 or so miles would swamp the low-frequency and detector stages. This switch makes it possible to reduce the high-frequency amplification for the reception of comparatively nearby stations.

Quality Compensations

Whenever the tuning of any control is likely to affect the quality, the control has been arranged in such a way that it will automatically compensate for any loss of quality.

The "local-distance switch," for instance, while introducing desensitising loads into the high-frequency stages, automatically compensates the quality of reproduction so that it is exactly the same as that received on an insensitive high-quality receiver.

The same automatic compensation occurs when tuning from long to medium waves, so that the wooliness characteristic of so many receivers on the long-wave band has been eliminated.

The cabinet is of a form which has received general approval, and, while being larger than the popular "His Master's Voice" Model 521, it is not by any means unwieldy or unsuitable for the average small home. At the same time it loses no dignity by the fact that it is not a large piece of furniture.

Ten Band-Pass Circuits

The single tuning knob, which operates on a horizontal illuminated scale countersunk at an angle in the motor-board, and extremely convenient to read, has been arranged to handle ten tuning circuits, either directly or indirectly, according to the circuit in question.

In spite of the fact that there are nine valves employed, and ten tuning circuits utilising band-pass tuning, the operation of the tuning scale is as simple as on the smallest two-valve instrument.

The cost of running the instrument is negligible in comparison with its performance—about 100 watts with gramophone in operation.

The instrument is available for alternating current on any voltage between 100 and 260, and any frequency between 50 and 100 cycles, and at the price of 70 guineas its popularity and success is assured.

A REAL TIME- AND TROUBLE-SAVER!

Automatic record changing is incorporated, making the outfit the very last word in luxury listening.

(Continued on page 492.)
Plenty of Plugs

An extremely wide variety of terminals, battery plugs and sockets is covered by the latest Eelex leaflet, recently sent to us for perusal. Everything you are likely to desire in the way of "binding posts" and plugs of all descriptions are included among a galaxy of minor parts, such as switches, link connectors, and so on. The number of different switches is amazing, for we are introduced through the leaflet to practically every conceivable type of small power switch. Black tumblers abound among key switches and snap types of all descriptions, while in every instance the price is right.

But "small stuff" is not the only reason for the production of this interesting catalogue. Besides the terminals, switches and plugs, there are frame aerials, cabinets made on the well-known "Byldurone" method, and short-wave adaptors, and oscillator wave-meters. It is worth while getting a copy of this leaflet, which the makers will be pleased to supply to anybody who will write for it to Messrs. J. J. Eastick & Sons, Eelex House, 118, Bunhill Row, London, E.C.1.

A Watmel "Pot."

We have received details of the latest Watmel potentiometer, which has been designed for the requirements of those wanting a potentiometer of 50,000 ohms and upwards. It is of the wire-contact-element type, and is of special self-cleaning design. Retailed at 4s. 6d., it should have a ready sale.

Comprehensive Cossor Collection

So well known have A. C. Cossor been for the manufacture of radio valves that few people probably are completely aware that those magic little "bottles" by no means complete the activities of the firm. The Cossor kit sets are also well known, but there are still some surprising things that emanate from the factory at Highbury or from their associated factories.

One of these is the Cossor pick-up and tone-arm, which sells for the moderate figure of 30s., while another is the 8s. 6d. volume control that is designed for use with the pick-up or elsewhere in an I.F. amplifier.

Another, as you will have seen from the special loudspeaker supplement, is the "Utah" series of loudspeakers. These are of the moving-coil type, and can be obtained in several models. Then there are I.F. transformers, H.T. batteries, and accumulators for supplying low tension; truly a remarkable set of adjuncts for a firm that is mainly interested in the production of valves.

A Polar Reduction

In this issue you will find a description of a special short-wave adaptor that is designed for use with mains sets. It employs one of the popular Polar type C condensers, the double-spaced vane short-wave variable that till recently cost 10s. 6d. In order to meet the requirements of our readers who are interested in short-wave

Behind the Scenes at Ealing

H.R.H. The Prince of Wales, who always has the welfare of British trade at heart, inspecting the talkie studios belonging to Associated Radio Pictures at Ealing Green. Note the transportable type of control-board for the electrical apparatus.
British Radio Firms Still Forging Ahead

reception and want a really good condenser, Messrs. Wingrove & Rogers have reduced this price specially to assist those who intend making this adaptor. It is a wise move, and one that should have a considerable effect on the sales.

Changing Colour
I understand that for reasons of production the Ferranti A.F.10 transformer, recently introduced on the market, is to have a case of a different colour. At present it is brilliant vermilion, but I understand that there is a little difficulty in producing a case of this colour to the high standard of purity demanded by this critical firm, and so it is on the cards that the case will in the near future be considerably changed, though not in shape or dimensions.

More Price Reductions
We are rapidly reaching rock bottom in the prices of radio goods of all sorts, and the latest drop that has been recorded is in the series of dry batteries manufactured by Messrs. Ediswan. I understand that the battery is being introduced with a voltage of 9 to sell at 1s. It will be known as the “Minor,” being somewhat smaller in capacity than the standard 9-volt battery.

Down Below 100 Metres
An interesting folder has been prepared by Messrs. Burne-Jones & Co., Ltd., dealing with their latest design of short-wave adaptor, Model T. The adaptor is a rather curious-looking instrument, and is designed to operate on any kind of set, whether mains or battery energised. It is fully dealt with in the folder, and the latter is made doubly attractive by the very comprehensive list of short-wave stations given on the fourth page.

Forging Ahead
The Essex air seems to be agreeing with Messrs. E. K. Cole, for they are still rapidly extending their works. The latest activity is connected with the installation of some new and up-to-date moulding plant. Hundreds of new hands are being employed to work the three 1,000-ton

SPEEDING UP PRODUCTION AT HAYES

A new simplified method of constructing the H.M.V. automatic record-changing mechanism has recently been introduced at one of the factories at Hayes. The chassis are mounted in jigs which can be tilted at any angle to facilitate adjustments, while overhead conveyers do a great deal to speed up production.

standard 60-volt battery is now down to 6s. 9d.—a shilling reduction; while the 99-volt unit has come down from 13s. to 11s.

These reductions are continued in the super class and in the series of grid-bias batteries. A new grid-bias hydraulic presses, which are said to be the largest moulding presses in the country.

Some idea of the enormous size of these may be obtained from the knowledge that they are 100 tons in weight, and that a factory 180 ft. long and 63 ft. wide with a height of 50 ft, is required to house them.

Princess Elizabeth's H.M.V. Gramophone
One of the interesting features of Princess Elizabeth's miniature house, which was recently shown at the Ideal Home Exhibition, is a portable H.M.V. gramophone finished in royal blue and presented to the Princess by The Gramophone Company, Limited.

Accompanying the instrument is an album of H.M.V. records made by the little Princess's royal relatives. She will no doubt be interested to compare the human voices with the records of her father, H.R.H. the Duke of York; her grandparents, Their Majesties the King and Queen; and her uncle, H.R.H. the Prince of Wales.

A set of the records of Elgar's Nursery Suite, dedicated to the Princess, and recorded by "His Master's Voice" in the presence of T.R.H. the Duke and Duchess of York, will also entertain her in her little cottage.

The portable gramophone was made by Welsh workmen at The Gramophone Company's factories at Hayes.

Miniature Mullard Museum
Mullards are always well to the fore where there is any sign of a radio exhibition, and their latest activity in this respect was at the recent radio show at Bobbies, of Folkestone. An exhibit arranged by the famous valve firm depicted the history of radio valves, and included some two dozen specimens covering the period 1914 to 1932.

Another section of the display comprised examples of Mullard A.C. mains valves, and a case containing valves in various stages of manufacture.
I am frequently asked by short-wave listeners, as well as would-be short-wave listeners, what the differences are that one has to consider when designing receivers for short-wave work and "ordinary" work.

This is a question that would take anyone a lot of time and space to answer fully; it certainly could not be done in two pages of "M.W." But there are one or two important points that beginners frequently forget, and I may as well deal with them here and now, since they are of importance to practically everyone with an interest in the short waves.

Covering the Bands

We need not go into the first very deeply. It is just the old, old question of "frequency-spread," and can be summed up quite shortly. Of course, you realise that we have, on a short-wave receiver, to do one of two things: either we have to cover a ridiculously large band of frequencies in one sweep of the tuning condenser, or we have to do an infernal amount of coil-changing. The former method involves difficult tuning, and the latter is just a nuisance.

Accordingly we arrive at a compromise between the two. We use a tuning condenser of about 0.0001, and we use three sets of coils to cover the band between 18 and 8.5 metres. This makes tuning about five times as critical as it is on the broadcast waves, which means that it is not too bad if we use a good slow-motion dial.

Special Coils

Another way of getting round the difficulty is to decide on the "bands" over which we want to listen, and to design coils that will enable us to cover those bands with small tuning condensers. Those of us who are interested in amateur work will elect to listen in the neighbourhood of 20, 40 and 80 metres, while those who want broadcast will listen in the regions of 19, 25, 32, 49 and perhaps 80 metres.

It is impossible to give any "rules" for this game. It is up to you to decide on how many wavelengths you want to cover, and to plot a graph showing your skill in tuning against your hatred of coil-changing!

Background Noises

So much for that. The second basic difference that one meets when changing over from broadcast receiver design to short-wave design is rather more important. It is the whole question of "mush."

Unfortunately for us all, it is far more difficult to obtain a really silent background with a short-wave set than with any other. Some of the "mush" comes from outside, but not all of it. Furthermore, even the "outside" component of it can be dealt with to a certain extent.

Put in plain language the situation is this—that the multi-valver is often at a definite disadvantage, and that the small set scores every time. Particularly is this the case when listening to weak amateur signals, which are, after all, the greatest test of the efficiency of one's gear.

We need so very small an aerial to give us the necessary "pick-up" on short waves that everything in the set can do its share. Without a semblance of an "intentional" aerial we can receive distant stations on the inductances only; very often we hear people boasting about their feats in this direction. It is, however, much better to use a decent aerial and to cut down the amplification in the set itself.

The Important Detector

This seems an opportune moment to preach my old sermon once more: Look to your detector to do the real work. Don't cover up the shortcomings of an inefficient detector by

WEE—THE VERY SMALLEST STATION IN THE WORLD!

Here it is, complete with diminutive waiting room, miniature transmitting gear, and tiny studio. Beside it is the ingenious builder, John Boyle, of Philadelphia, who showed parties over it during a Boston Radio Show. When he applied for a call-sign for it the authorities entered into the joke and, learning that it was only 55 in. wide and 8 ft. high, they allotted to it the appropriate letters WEE!
W.L.S. Says You Should Look to Your Detector

Piling on L.F. amplification until you can’t keep the ‘phones on your head. If you do you will probably have one of those terrible sets that gives an output with 60 per cent of mush and 40 per cent of signals. It is a real education to listen on your detector alone, and to see just what it brings in. You will find that when it is working well you will hear the outside “mush”—just a faint hiss—quite clearly, and that any signals that are stronger than this mush are likewise audible.

“signal-mush ratio” slightly worse, but one note-mag. doesn’t do much harm in that way. Put on some more, though, and unless you are going to be content with strong broadcast signals I am afraid you will find that the single-valve man will beat you every time.

Valve Noise

The snag that is responsible for all this is “inside mush.” I have not yet met a valve that operates without a very faint “hiss.” It may be very faint, but it is there, and when further amplification follows it becomes a serious matter.

One set that a friend demonstrated to me was so sensitive—and so noisy!—that I swear I could hear the electrons leaving the filaments!

So here, definitely, we have to split up into two parties. Those who want real good programme-value from the short-wave broadcast stations take the super-sets; those who derive their thrill from logging unbelievably faint signals from, say, Fiji Islands, take the more humble affairs, and generally get away with it.

I could demonstrate to any of my readers a simple experiment which would probably make them think very hard. I could give them the headphones on my own single-valver and tell them to tune-in the weakest amateur Morse signal they could find. I would then switch in two note-mags.—quite good note-mags, too—and I wager they would not be able to read that signal any longer. Not if it were really weak in the first place.

This seems all wrong, but it isn’t really. The reason is simply that the battery of note-mags has increased the signal by about 1,500 per cent and the mush by about 2,000 per cent, with the result that the signal has just about disappeared beneath the noise-level.

For Loud Stations

On strong signals, of course, this doesn’t matter. If they are already signals in the category of W 3 X L—about five times as loud as the mush to start with—they will sound all the more impressive when the “heavy stuff” is switched in, and the increase in the proportion of mush will probably pass unnoticed.

It is a queer anomaly that one has to use a small set for weak signals and a big one for strong signals, but any experienced short-wave amateur will tell you that it is perfectly true.

Now for some hints about keeping this “mush” down to a reasonable level. First, use inductive aerial coupling rather than capacitative. Signals may be a little weaker, but the loss will be worth it. Next, if you want some amplification, use screened-grid H.F. rather than too much L.F.

If you are in a “noisy” location—troubled by car ignition, trolley-buses, vacuum-cleaners, or anything of that sort—use a fairly small indoor aerial and, if possible, dispense with an earth connection.

“Man-Made Static”

If you have an enormous amount of this kind of “man-made static” in your neighbourhood, build the receiver in a metal box and thus ensure that most of your signals are picked up on the aerial, and not by all the bits and pieces in the set.

Regarding “inside-mush,” make sure that your grid-leak is not “hissy”; some of them are, unfortunately.

RADIO REPORTERS OF THE U.S.A.

The two gentlemen in the baggy nether garments are conducting a running commentary, and you will note that a portable transmitter of the knapsack type is being used, with single-loop, short-wave aerial. Note also the pole for taking the weight of the receiving gear.

This being the case, I simply cannot see how that state of affairs can be improved in any way! Surely, if the signals are weaker than the “mush”—when, of course, the latter really is genuine outside interference—we shouldn’t be able to make much out of them with the best “super-set” in the world!

With One “Note” Mag.

So, when you have reached that point, if you want louder signals, add one “note” mag. and review the situation again. I am afraid you will always find that you have made the
BEHIND THE SCENES OF BROADCASTING

An account of some interesting events, both humorous and dramatic, which have occurred in British Broadcasting Studios.

He smiled cheerily and walked over towards the door, and whispered something to a man who had been leaning against the wall interestedly watching the proceedings.

Then the door was shut, and the red light above it flickered into evidence. Suddenly I felt panic-stricken. This was no joke; that wretched station director had called my bluff and thrown me on to the ether! Millions, perhaps, of people were going to hear every word, every articulated sound. If I coughed or rustled my papers, I would "deafen thousands of listeners."

My tongue seemed to grow in size and become awkwardly uncontrollable. I licked my dry lips and smiled feebly at the flinchingly cool and collected B.B.C. man, and anxiously watched his arm for the signal, vaguely wondering why we were waiting for such an interminable space of time. I didn't realise until afterwards that he was, on his part, studying the clock! Whether or not a time signal preceded that news bulletin I do not know to this day.

Frozen with Fright!

All I can remember of the next few minutes is that I moved my lips, and a thin, shaky voice appeared to hang round my teeth. I didn't seem able to get it "away," and I couldn't develop any resonance! (It must have been a horribly-damped studio!) In my attempt to make my voice sound like a voice, and not the reedy chirruping of an asthmatic old lady, I suppose I dropped it about an octave in tone, for the station director waved his hand upwards frantically.

I thought at first he meant I should lift my head higher, but as I did that I nearly choked with the constriction on my Adam's apple, caused by my efforts to develop bass!

However, I am thankful to say I managed to overcome my "mike fright," and half-way through the bulletin I became almost light-hearted, and found myself putting more feeling into the news than has ever been shown by a single stunt. For one thing, it wouldn't be allowed! You see, I experienced a complete reaction, and from sheer fright swung right over to a super-hyper-over-confidence! I gracefully plucked my handkerchief out with a free hand and, with a grin at the B.B.C. man, snapped my streaming brow. I dramatised the remaining news atrociously. I was coy, oleary and affectingy resonant in turn, with different items of news.

The Finishing Touch

At the end I said gaily:

"Well, that is the end of the news. A rather interesting bulletin, wasn't it? Please stand by for a moment: your station director will now take charge of the microphone and make some further announcements regarding the radio fare he has to offer you."

I think I might have amplified these somewhat fatuous and most irregular remarks had not the worthy "S.D." borne down on me with a terrible frown and, politely but firmly, indicated that I should vacate my position. Brimming over with triumph at my "broadcasting debut," I waited until he had polished off the session. The red light went out, thus indicating that the microphone was out of circuit.

"And that is that," he observed, with what sounded like a sigh of relief. "O.K. ? " I queried.

"Not bad for a first show, but you shouldn't have been so frightfully conversational about it. Still, it was my responsibility."

He changed the subject with significant quickness, and nothing more was said. And now for the sequel. Just before I left I had a few words with

(Continued on page 490.)
For the Short Waves

Of the many short-wave adaptors which have come our way we do not remember any one which appealed to us as strongly as the one due to Messrs. Hustler, Simpson and Webb, and known as the "Aerodyne."

It bears the stamp throughout of careful and knowledgeable design. For example, there is slow-motion reaction, a feature which is fast becoming to be regarded as indispensable for "hot" short-wave apparatus.

THE "AERODYNE" ADAPTOR

Two coil units are provided, and they cover 15-50 and 50-100 metres. The price of this efficient adaptor complete and ready for use is £5.

But such a control is of little real value if it is not in itself efficient, as in the "Aerodyne," where both the tuning and reaction slow-motions are a delight to handle.

The "Aerodyne" is not sold as a kit, but markets complete in a handsome cabinet and all ready for use. It can be employed with practically any set, and it takes only a matter of moments to bring it into commission.

We have carefully tested the instrument in conjunction with two or three sets of widely different characters, and in all cases excellent results were obtainable.

We recommend all listeners who are attracted by the idea of being able to venture on to the fascinating short-wave bands at little additional cost, and without the need for great operating skill, to obtain full details of the "Aerodyne."

New Watmel Potentiometer

The latest pattern Watmel potentiometer has been designed for values of 50,000 ohms upwards. It is of the wire-contact type. But that is to say, there is a composition element, although the moving contact does not scrape round this, but along an intervening and protective wire track.

This method of construction appears to us to be an excellent compromise—when carried out efficiently as in the case of this Watmel component, in which we find a special system of clamping the contact strip and the actual resistance element.

The retail price is £4.6d. The movement is smooth, and on test we found the technical characteristics of this Watmel potentiometer to be perfectly satisfactory.

Ohmites

One of the ostensibly simplest of all radio components is the fixed resistance. We can well imagine that many constructors think of these as merely pieces of material of graded lengths and thicknesses.

A WIRE TRACK

The moving contact of the new Watmel potentiometer runs round a wire track which is rigidly clamped to the resistance element.

And so they are if taken at their face value, but preceding the production of any satisfactory fixed resistance inevitably lies a wealth of research and experiment. This even applies to the wire-wound types, but there is vastly greater difficulty in producing the less expensive and more compact "composition" type.

There are two main requirements which have to be satisfied, and these are stability of resistance and current-carrying capacity; the one being, of
Test Bench

This month we deal with the H.S.W. "Acodyne," Graham Farish "Ohmites," and components due to Ferranti, Lissen, Watmel, and Lotus.

course, largely dependent on the other. And even to-day there are all too few completely reliable fixed resistances available—probably the most frequent cause of set noises and breakdown are fixed resistances of an unsatisfactory kind.

The Graham Farish "Ohmite" is not, in our opinion, in this category, selling at around about six shillings have very low reliability factors—the majority of those little Continentals give a distinctly poor showing in this respect.

But we need not look in vain to Hollinwood for reliability, as Ferranti's have a very high reputation for this.

After all, the noticeable audible difference between the performance of two different transformers may be slight, even though their "curves" are widely divergent—when the receiver concerned uses an average loud speaker and average component parts.

Judged purely as an inexpensive transformer, the Ferranti A.F.10 gives good results, and we feel sure Ferranti's will not regret their decision to bring their brand of radio goods within the reach of tens of thousands more radio enthusiasts.

The Lissen Shielded Coil

It is an interesting commentary on the article on "Power Curves for Coils," which appeared in "M.W." recently, that Messrs. Lissen publish dynamic resistance curves in connection with their new shielded dual-range coil.

But they are one among a most select company, and it should be noted that their literature was published before our article appeared in print.

It goes without saying that the curves are good—in fact, they constitute something of a challenge to coil makers who do not venture into the open with their publicity matter!

However, Lissen maintain their reputation for good stuff at low prices, for the price of the new shielded coil is only 6s. 6d., complete with shielding. In construction it is compact and well finished, and in operation it reaches a high standard of performance.

It can be used for simple single-tuning circuit sets, or it can be employed in ganged formations.

Three Lotus Components

The new Lotus dual-wave aerial coil is available either unscreened at 5s. 6d. or with a "can" at 7s. 6d., and is a component which will

(Continued on page 489.)
The Drama of Dead Man's Rock

Owing to an unusually virulent outbreak of "spring cleaning" in this house, I find myself relegated to a spare bedroom-cum-lumber-room. Those graceful ladies who, when the sickness of spring cleaning is not upon them, pay so much attention to the dressing of their hair and to the things called hats which they ram on it—these charmers now charge about the premises wearing dusters on their heads.

The Annual Junk-Hunt

"What a collection! Enough to give a chance visitor the wobbling willies!"

In their hands are mops and feather-brooms, and on their lips are strange words of power. I suppose it's all right.

Like a Dad H.T.

Meanwhile, however, here I am, all amongst the old trunks and lino, without any inspiration whatever. My mind is as blank as Mordred's shield. Not a bee in the bonnet, not one single bat per belfry!

What a collection of junk! Enough to give a chance visitor the wobbling willies! Two Gladstone bags, period 1897! Half a bicycle and a baby's "go-cart."

A large kite, four rolls of pre-war lino, the gas-fittings we brought with us ten years ago, and a mounted dog's head which we found here when we moved in: a polo stick, a doll's cradle made from an orange crate, a couple of iron fenders, two cornice-poles, and the ruins of some "Venetian" blinds; a large framed photograph of an unknown house, almost faded out; a frame-aerial used by me in 1919—and never since; sundry trunks and hat boxes—and my dear old solar topee!

By gum! How the sight of that topee brings back the old days, when I used to chuck some collars and things into a suitcase, take my stick in my hand and set out for the wilds just as though I were stepping round the corner to buy an ounce of tobacco.

A Thriller This Time

Two or three years later I would breeze back again, hurl the suitcase into a corner, bung the stick into the same old hall-stand—and there I was, at home. ("And is old Higgins still the verger at St. Mark's?" etc., etc.)

Well, well, you'll be wanting a radio yarn from old Jones, I suppose, so I had better tell you that one about "Dead Man's Rock."

It's a thriller, and it actually happened to me, though I had almost forgotten it till that old sun-helmet of mine brought it back as fresh as paint.

In August, 1916, a fellow called Buck and I were sent by a certain branch of H.M.'s Forces on a confidential mission to a certain small island belonging to a certain Latin country.

We took with us, besides the impedimenta of a camp, certain very special radio apparatus with which we were to make certain measurements and signals.

The Secret Code Book

In addition we took—or rather, I took, being the senior man—a certain secret code book. Thus up to the moment when we landed on the mole at a certain sub-tropical port, every-...
May, 1932

SPECIFIED FOR
THE MAINS SET
SHORT-WAVE UNIT

IN FOUR SIZES
15-100 Metres
Size 2 ..... 2/6
4 ..... 2/7
6 ..... 2/8
9 ..... 2/9
Set of 4 10/-

"ATLAS" Short-Wave Coils are recognised as the standard of short-wave coil efficiency, and all the leading receiver designers invariably specify them in their component lists. They consist of turns of the correct gauge of bare wire, rigidly supported by accurate ebonite spacers. Porcelain anti-capacity plugs are fitted, with plated inserts, sideplates and screws. If your dealer cannot supply, write direct to the manufacturers.

By carrying off the Olympia Ballots in both 1930 and 1931, "ATLAS" Mains Units are proved unapproachable in design, performance and value. There are models for every set, D.C. Models from 39/6, A.C. from 52/6, and a wonderful special Model, A.C.244/ST, at 59/6, for the “S.T.300.” Write for free booklet, “Power from the Mains.”

Westinghouse Rectifiers Guaranteed 12 Months.

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DUBLIER IS THE NAME OF THE CONDENSER YOU CAN TRUST

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MODERN WIRELESS
community, about the ownership of “Dead Man’s Rock,” whereon, we had decided, our camp should be pitched; but when they learned that we proposed to pay rental—and no question asked—nine families were very certain that the rock belonged to their nine paternal grandisires.

**Backing the Winner!**

These islanders were uncertain who would win the war, and so they were very, very neutral, with that passionate sort of neutrality which is exhibited by the jackal when the tiger is fighting the buffalo. But they were certain that might is right and that money is money. I feel sorry for the Jews; their “genius for finance” is quite overshadowed by that of the French—and of these islanders.

By the third day after our arrival we had secured our stores and were ready to move to camp. Then my malaria paid its annual visit to my circulatory system, and I was shuddering and shivering in the good old way. But duty is duty, and there was no alternative but for me to order Buck to go on with the mules, set up the tents and apparatus, and get a move on with the job, which was scheduled down to Split—minutes.

**Bound with Brown Paper**

I gave him the code book, carefully bound with brown paper, and warned him not to go lending it to girl friends, and so on. Then I collapsed on to a bench in what might be called the inn’s saloon bar, and slept like the dead, having taken a huge dose of rum.

They let me alone, though I heard afterwards that I was inspected during the day by several policemen, a photographer, two priests, all the kids and most of the girls of the village. Old Mother Poierat, the publady, grew very sympathetic about nine of the evening, and threw a mouldy goatskin over me; this partially awoke me, and I lay in a kind of heavy doze, the rumble of the guests’ voices sounding like the sea far off.

It must have been about a quarter to midnight when bits of conversation began to get through to my mind. The place was full of men, gambling and drinking as usual.

Presently I heard a deep voice say: “Pooh! I’d cut his throat for two ha’pennies.” I do not know why I jumped to the conclusion that this cheery butcher was alluding to my throat, but that is what I did, and with a big effort I sat up in order to have my say about the throat business. The lever had left me, but I was as tipsy as a Highland tinker. Everyone

**A DAMSEL IN DISTRESS**

I’m American,” she said, “and I’ve been putting over a bit of painting.”

The throat-cutting person took the greasy coppers on the card tables! The throat, but that is what I did, and the cheery butcher was alluding to my throat business.

**THE MISSING CODE**

Quick! Mister! Ze gal. She are esp.”

They were uncertain about my sanity, but most emphatically undesirous of trying the matter out. A second-rate pack of yellow, jumping monkeys, without the nerve to grab the greasy copiers on the card tables! The throat-cutting person took the first and longest jump—and I heard later that he had been talking about the Mayor, not me.

This little interlude, plus another drink and a dip in the tub, sobered me sufficiently. I laughed for about five minutes, and then staggered off to Dead Man’s Rock, about 800 feet above sea level, where I arrived at two o’clock in the morning and found the camp looking snug and trim.

Buck was smoking his pipe and doing odds and ends to the apparatus.

“What’s this Stink?”

“Good lad,” I said. “Gimme a bottle of soda-water and a gnaw of ham. I’ve defeated the whole militia and taken no prisoners.”

“Glad you’ve come,” be answered. “I’m ready for a snooze. How do you feel? Hadn’t you better get some sleep?”

“Sleep? I slept for twelve hours and feel like a giant.” Then I told him of the throat affair and the retreat of the ten thousand. “By the way,” I added (sniff sniff), “what’s this stink of scented soap on something? Have you pinched the bit from the inn, you Scotsman?”

He edged up to me, and jerking his thumb at the other tent, hissed: “We’ve a visitor, a lady.”

“You know perfectly well, Buck, that you can’t do the garden party racket here—on this job. I don’t care who she is, or where you picked her up. She’s got to buzz off.”

“But, Jonesy—she’s straight stuff, and in a frightful state. Came tottering up here last evening, tongue hanging out, but over one eye, panting fit to bust. Said the Mayor of this one-eyed hole was chasing her. You know what these dagoes are, Jonesy, over a real white girl. Take a dekko yourself!”

Far from Distressed

I did take a look. Moreover, I took that look through a slit in the tent, and there was my lady, looking far from distressed, powdering her nose, and chewing gum. Somehow, though, she seemed to be an innocent little baggage.

“I’m ready for a snooze. How do you feel? Hadn’t you better get some sleep?”

“Glad you’ve come,” be answered. “I’m ready for a snooze. How do you feel? Hadn’t you better get some sleep?”

“Sleep? I slept for twelve hours and feel like a giant.” Then I told him of the throat affair and the retreat of the ten thousand. “By the way,” I added (sniff sniff), “what’s this stink of scented soap on something? Have you pinched the bit from the inn, you Scotsman?”

He edged up to me, and jerking his thumb at the other tent, hissed: “We’ve a visitor, a lady.”

“You know perfectly well, Buck, that you can’t do the garden party racket here—on this job. I don’t care who she is, or where you picked her up. She’s got to buzz off.”

“But, Jonesy—she’s straight stuff, and in a frightful state. Came tottering up here last evening, tongue hanging out, but over one eye, panting fit to bust. Said the Mayor of this one-eyed hole was chasing her. You know what these dagoes are, Jonesy, over a real white girl. Take a dekko yourself!”

“Quick! Mister! Ze gal. She are esp.”

They were uncertain about my sanity, but most emphatically undesirous of trying the matter out. A second-rate pack of yellow, jumping monkeys, without the nerve to grab the greasy copiers on the card tables! The throat-cutting person took the first and longest jump—and I heard later that he had been talking about the Mayor, not me.

“Glad you’ve come,” be answered. “I’m ready for a snooze. How do you feel? Hadn’t you better get some sleep?”

“Sleep? I slept for twelve hours and feel like a giant.” Then I told him of the throat affair and the retreat of the ten thousand. “By the way,” I added (sniff sniff), “what’s this stink of scented soap on something? Have you pinched the bit from the inn, you Scotsman?”

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(Continued on page 492).
HOW TO CURE "BREAK-THROUGH"

**Some practical pointers on a troublesome form of interference.**

By D. GLOVER.

"Break-through" is probably the most commonly met fault of all in the earlier types of sets. It is, of course, the breaking through on to the medium-wave tuning adjustments of one or even two powerful medium-wave local stations.

And, in order to deal with it, you must first discover the reason why it occurs. But this is no mystery in the majority of cases. The primary circuit of the tuner is generally the culprit.

**Tuned to the Local**

Either the separate coil winding, or a part of the main winding lying between a tap and earth, have a "natural" wave-length near enough of that of the powerful medium-wave local for this to be able to jam through the moderately-tight coupling with the secondary or grid winding.

And this effect can be duplicated in an H.F. transformer, so that "break-through" is possible in a two-tuned-circuit H.F. set, although it is not so frequently met with in such as it is in the simpler Det.-L.F. types.

But let us analyse an example. Take a dual-range tuner of the simple variety in which there are three windings in addition to the reaction. The one comprises fifteen or so turns, and operates as the medium-wave aerial winding. This is coupled to a medium-wave grid or secondary winding.

**Why It Occurs**

By means of a switch the grid-winding is loaded for long waves by the bringing in of the third winding in series with it, while the long-wave coupling is reinforced by the aerial winding being joined to a tap on this new long-wave section.

This tap may be twenty or thirty turns from the bottom of the coil. Now it is obvious that the aerial circuit includes about forty-five turns in all, and though an excellent long-wave coupling may be afforded, that forty-five turns is going to bring the tuning of the aerial sufficiently close to the wave-length of the powerful medium-wave local to enable this to "break through." You see, an aerial circuit never is selective!

The cure is to push this natural wave-length well away from the region of the medium waves. One "M.W." method which has attained considerable popularity, and which is known as the "Contradyne," is to arrange the circuit so that the long-wave switching introduces a small coil of about sixty turns into the aerial circuit, and so send up its inductance.

Another and not so well-known scheme is to join a 0.0005-mfd. compression condenser across the primary with that of the potential "breaker-through."

A definite tuning for the "break-through" is often to be noticed when one of these selectivity condensers is in use, for at one particular setting the "break-through" is at a maximum.

**Always Move Up**

But never endeavour to tune down in an attempt to get away from "break-through." Always aim at pushing the wave-length of the long-wave primary circuit in an upward direction. Incidentally, this will also improve your long-wave volume.

But it should be mentioned that, in successfully dealing with "break-through," you may lower the long-wave selectivity, and you can deal with that only by reducing the degree of coupling between primary and secondary circuits.

This can be done by lowering the long-wave tap. It must not be forgotten that our old friend the wave-trap is able to deal with "break-through" quite successfully so long as there is a tendency for only one station to cause the interference.

Where two regional stations are offenders, then there is no real alternative to the "tuning away scheme."
MODERN WIRELESS

This month we are arranging our record review a little differently, so that it is easier to pick out the type of disc required from the necessarily large and mixed collection at one’s disposal. Records will therefore be listed in the order of the recording rather than the titles displayed, so that a dancer will suffer to select one from another.

BROADCAST RECORDS

Everyone’s Favourites From Grand Opera, (3172.) The London Opera Grand Opera Company, this lively “Super-Twelve” includes half a dozen more of the most popular selections from well-known operas. It constitutes what are known as Parts 9 and 4 of the series but it is, of course, complete in itself, and well worth hearing.

Toot and The Rosary, (3189.) Bonnie Johnson, with Minnie Hall, orchestra and chorus, has chosen for this disc a rather hackneyed, first-named piece is excellently rendered. She has chosen the melody, and the tuneful, if rather monotonous refrain is excellently suited to the item.

One Little Quarrel and I’ve Got “It,” (3181.) Billy Carylles impersonation of Billy May. This fine, record made in the style of this favourite ditty, is rather “hot” and the feeling, if rather hackneyed, first-named piece is excellently rendered. He has chosen the melody, and the tuneful, if rather monotonous refrain is excellently suited to the item.

Stein’s Tango Orchestra Tipica, the former tame and rather weak number get monotonous; the latter is a better ditty with a more interesting refrain.

Johnson’s voice is admirably suited to the item. The tempo is fast but the refrain is not one of those sickly drawls, but it is clearly cut and sympathetic, and does a great deal to make the disc a success.

Another excellent rendering of “Trees” is given on (3167) by Turner Layton, of the indefatigable Layton and Johnstone duo, who are considered on the other side to provide To Be Worth of You.

A brief selection from some of the records released during the month.

They have been chosen because of their special value to the pick-up user.

Haydn and His Orchestra, are excellent numbers. One of them is “The Old Man’s Song,” which cannot be said to have heard via the ether played by that much-touted Blue Blower.

The Zonophone list always contains an unusual selection of records, and this month is certainly no exception, for it is always a matter for congratulation, but it does at any rate create interest.

The London Orchestra, playing medleys of “The Cat and the Fiddle,” and played by Gracie Fields, “Gracie Howard. A couple of light items that are always a matter for congratulation, but cannot be said to have heard via the ether played by that much-touted Blue Blower.

The London Orchestra plays “The Old Man’s Song,” which cannot be said to have heard via the ether played by that much-touted Blue Blower.

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COLUMBIA

Among the large selection sent to us this month by Columbia and others we have chosen the following varied programme:

Petite Suite de Concert (C2372 and C2373.) London Symphony Orchestra, Samuel Coleridge-Taylor is mainly famous for two of the many works that he composed “Humahwa” and the “Souvenir de Colombie” which is recorded in the records numbered above. Probably the Souvenir de Colombie is even better known than the Chinese Air, and is very well known to the handling of the oriental melody. It is one of the most beautiful melos that has ever been written.

This recording of the work by the London Symphony Orchestra does it full justice, for the Zonophone is usually played by small gentle orchestra, with which it is extremely popular, it is very refreshing to hear a full-bodied orchestra dealing with the four tuneful airs.

It is on B6150, and is the best way to explain what a blue blower is.

Layton has a fine voice, which we like better in the second disc, but it is clear-cut and sympathetic, and does a great deal to make the disc a success.

So says an eminent authority on modern dance music, the B.B.C. band, though they are of quite a different nature.

ZONOPHONE

The Zonophone list always contains an unusual selection of records, and this month is certainly no exception, for it is always a matter for congratulation, but it does at any rate create interest.

As the makers themselves say, we do not usually make a record and the one on the other side of the disc has had very good reviews. As a matter of fact, unless one has read the book, or has the trend of the story, reading the record is probable to be heard by the ear, but not by the eye.

The London Orchestra, playing medleys of “The Cat and the Fiddle,” and played by Gracie Fields, “Gracie Howard. A couple of light items that are always a matter for congratulation, but cannot be said to have heard via the ether played by that much-touted Blue Blower.

As we makers ourselves we are very much aware of the importance of that matter, and we would put them in a serious position: the novelty by that instrument is really worth white.

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COLUMBIA

May, 1932

The Lorn Chord and Good-bye, (DB1025) Benjamin Gigi. This is a record with the approval of a very large section of the gramophone public. The reason for this is that the tenor tenor has made in English. You should hear it.

Gracie Fields Western Spur is given to a remarkable twelve-inch disc that contains a wide selection of the hits of our most popular comedians. Her voice is particularly charming, and fine singing and delightful looking have endowed her to everyone, and on this disc she is seen evide of a number of her greatest successes.

In the dance section there is a particularly interesting records this month. Of these probably the more unusual is the “hot” rhythm section of modern dance music. It is on B6150, and is called One Blues, being played by the Savoy Hotel Blue-Blowers.

As Gracie Fields had said to one of the dance band and “consists of having a rhythm transcription of the original melody. Original version of some one’s was obtained by the use of jazz, classes, kazoo, etc., but to-day the voice is modulated merely by a drier effect to explain what a blue blower is.

It is a pleasant record to explain what a blue blower is.

This is a record that is always a matter for congratulation, but it does at any rate create interest.
By the time these words appear in print the great trek from Savoy Hill to Broadcasting House may be completed. And this article is in the nature of a personal tribute to the interesting times I have spent at Savoy Hill. I trust "M.W." readers will enjoy my brief "look back" at the one-time headquarters of British Broadcasting. There were no less than ten studios at Savoy Hill.

The First "Double-Decker"

Manchester has a double-decker—the first studio with a gallery to be built by the B.B.C. It holds a hundred people and, when first constructed in 1929, it was the largest in Europe. There is also a smaller studio for soloists, and a third very small studio furnished only with a chair and reading desk. This is for the talks, of course.

But Savoy Hill was more elaborate. Studio Number Three was formerly Number One; it was in the old "No. 2, Savoy Hill" building, and was the first ever opened by the B.B.C., but having been redecorated all the old heavy drapings were scrapped. The later Number One was also in the old building.

Studio Number Two was down in the basement and was used for radio plays; next to it was the "effects" studio. Rooms Four and Eight were used for variety, the children's hour, and so forth. Number Eight was immediately above Number Four, and you passed the doors as you went up in the lift at the main Savoy Hill entrance.

Used by Jack Payne

The double-decker, Number Seven, was always used by Jack Payne; this had no balcony, however, as has Number One at Manchester.

Our B.B.C. Special Correspondent describes microphone mannerisms of Vernon Bartlett, Dean Inge, A. J. Alan, Philip Ridgeway and many other firm favourites.

The gramophone records were broadcast from Number Six—the "weather oak" studio—and this was also often used by Sir Walford Davies. Number Five was the talks studio, which has been used by the Prince of Wales and from which the news was read every day. Number Nine, the last actually at Savoy Hill, was the Chinese studio in the basement, and Number Ten was the converted wharf on the south side of the Thames. There is our total of thirteen studios, and when you think of the thousands of artistes who passed through them for broadcasts and auditions it is not surprising that there were sometimes humorous and interesting happenings. Most artistes have peculiarities, especially if they are regular broadcasters and are allowed to exhibit their particular fads. Vernon Bartlett, for instance, likes to speak from Talks Studio, and prefers not to have any audience—even the announcer. The Hon. Harold Nicolson has the same ideas about broadcasting.

An Ideal Broadcaster

A little while ago, John Barbirolli, the famous conductor, was appearing a great deal; he is an ideal broadcasting musician, for he never gets flustered. He always seems to be in evening dress, and in jolly good taste, too, which is more than can be said of many musicians!

TWO REAL FAVOURITES

It is not difficult to guess which is which out of Clapham and Dwyer, the two patter comedians whose turns are seemingly completely spontaneous.
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M.W. MAY, 1932
Some Broadcasters Like an Audience—Others Don’t!

Dean Inge is a broadcaster who is utterly regardless of the “mike.” Until recently there was the famous notice “If you sneeze you will deafen millions” at the side of one of the microphones, but the Dean disregards it and puts the engineers to confusion!

When he wants to cough, he coughs, and the microphone catches the full blast of the noise. He cannot be persuaded to be careful in turning over the pages of his manuscript when reading—always a difficult job—and that is the explanation of the cracking noises you may often hear!

Mysterious as His Yarns!

A. J. Alan is a mystery, even at Savoy Hill itself. When he is due to broadcast he is taken by the announcer to a vacant studio—no one knows which studio it will be. “Ladies and gentlemen—A. J. Alan,” says the announcer, and then a mystery “thriller” yarn is spun.

Some say that A. J. Alan is a doctor, others that he is a high official in the Civil Service, and others that he is a member of the B.B.C. staff itself. Only the announcer on duty at the time knows.

Clapham and Dwyer like an audience in the studio; theirs is the kind of humour that goes down better with a laugh at the back of it. Studio audiences, by the way, are not always chosen from the artistes’ friends, and, contrary to the critics, the laughter is genuine and spontaneous!

HE KNOWS THE WORLD

Mr. Vernon Bartlett, whose talks on “The Way of the World” are probably the most popular of the talks series.

By the lucky chance I was once able to see the “behind-the-scenes” of a radio play. Studios Two, Four, Six, Seven, “Effects” and “Echo” were used, the artistes being in Two and Four, the orchestra in Seven, and the gramophone records in Six.

In the artistes’ studio an electric bulb was hanging down near the microphone—I believe the B.B.C. name for this is a “flash”—and when this bulb flickered (each was switched on from the control room) the actors had to start. Each piece of acting seemed disjointed and nonsensical at times, and the orchestra appeared to play a few bars now and then when the light flashed: but, of course, the producer at the D.C.P. (dramatic control panel) was linking each part up into the complete play.

Good Entertainment

On another occasion I saw a part of Tyrone Guthrie’s The Flowers Are Not For You To Pick being broadcast, and although this is a very serious play so far as listeners are concerned, it was almost laughable to watch, in the studio, the disjointed pieces of acting, and some radio-play artistes do not care how they appear before the “mike”!

The Ridgeway broadcasts were usually given in Studio Four or Eight, and there is no greater fun to watch. Hermoine Gingold, Irene Vere, Hugh Dempster and all the others—not forgetting Ridgeway himself, who is “Mr. Hambottom”—are always as amusing to watch as they are to hear.

Yes, there are some very jolly evenings in the studio.

FULL-DRESS FOR RIDGEWAY PARADES

Here we see a rehearsal for one of those popular shows directed by Mr. Philip Ridgeway, who believes in dressing the part in order to get the right atmosphere.

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MANCHESTER.
THERE are many people who, when choosing a radio-gramophone, are influenced by the exterior appearance of the instrument to such an extent that they will not have an instrument that does not harmonise or match their furniture to the utmost degree.

Manufacturers of present-day mass-produced radio-grams cannot make up their instruments in a wide variety of woods to suit everybody, at a moderate price, and this fact opens up very interesting work for the constructive amateur.

There are many pieces of old furniture whose very solidity and cumber-someness lend themselves to the inclusion of radio-gramophone apparatus; sideboards, dinner wagons, writing desks and bookcases to mention a few.

As the writer has had some experience with this kind of work, a few practical suggestions may be of value if only to readers who themselves have ideas in the same direction. On the following page is a photo of one of Mr. Lewis's conversions which illustrates the complete practicability of his admirable suggestions.

**Points to Remember**

Now when one is gazing thoughtfully at an odd-shaped piece of furniture, wondering how on earth a multi-valve receiver and electric gramophone motor, turntable and pick-up, not to mention the loudspeaker, are to be crammed into it, there are two or three things that we are apt to forget. Chiefly they are:

1. That the modern valve will operate just as well whether it is working in a vertical or horizontal position.
2. That the H.F. and detector stages may be yards away from the L.F. stages. The latter can be made up in one unit with a rectifying valve and mains transformer, the whole being technically termed a power pack.
3. That with the aid of flexible shielded wire, pick-up leads, loudspeaker leads, H.T. and L.T. wiring, etc., may be bunched if necessary.

With these in mind we will run over the conversion of one of the most difficult pieces of furniture, a sideboard, into a radio-gram. There will probably be two cupboards with doors and two drawers over the cupboards, and we wish to preserve the outward appearance of the sideboard so that no one would guess that it was also a radio-gram.

We will assume that we have decided upon a four-valve all-mains circuit, with moving-coil speaker and an electric gramophone motor. The receiving circuit will comprise, say, screened-grid, detector and two L.F. stages, using M.S.4, M.H.L.4, M.H.4, P.X.A class of valves. This will, of course, give good power, but we are not concerned with the circuit of any particular kind, but with the disposal of the components.

**A Good Drawer-Full**

Now the H.F. and detector stages, with their coils, long-wave-medium-wave switch, radio-gram switch and tuning condensers (the mica-dielectric type are very compact and nowadays quite reliable if of good make), may be accommodated in one of the drawers. A panel of ebonite, half the area of the interior of the drawer, may be supported on fillets sunk sufficiently to give clearance for the control knobs when the drawer is shut. To the back of the drawer the valve holders may be placed, either horizontally or vertically, according to the depth.

Next, the power pack can be made
The P.P.M. Speaker incorporates an impregnated diaphragm, and a patented twin suspension permitting large cone movements without undue distress. The new patented cobalt steel magnet produces a very high flux density. Housed in a strong metal chassis. Dual impedance output transformer included. (Pentode supplied only if specified.)

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Specified for "Short-Wave Mains Unit" described in this issue by A.S. Clark.

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The following indicating discs are available—either black lettering on white, or white lettering on black.

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If you have any difficulty in obtaining Wearite components, send to us direct—giving name of your usual dealer. We will post your requirements by return C.O.D.
Placing the Power Pack in Position

up and bolted down at the bottom of one of the cupboards, preferably the one you decide to have the speaker in. This will leave the other cupboard free for record storage.

H.T. and L.T. Leads

The power pack will consist of the two L.F. stages and the rectifying components. From this leads will convey H.T. and L.T. to the H.F. stages, the latter having their own voltage-dropping and biasing resistances incorporated, so that the H.T. leads are taken from the smoothed output of the rectifying unit and the twisted L.T. leads from the 4-volt winding of the mains transformer.

This may be objected to, a good plan is to take the door off its hinges and fix it with four pegs or plugs that engage firmly with four holes or sockets in the baffle board. The door can then be pulled out and stood behind the radio-gram when the latter is playing.

The gramophone motor and pick-up can be accommodated in the remaining drawer, if one of the latest induction disc type of motor is used. They are a little deeper than the ordinary turntable.

If you have to use a D.C. motor or spring-drive type, it could be mounted on a shelf in the empty cupboard with a pilot lamp to switch on when changing records, placing the motor amplifier or power pack, the speaker being connected, of course, to the output of the power pack. These wires should be shielded flex.

The mains wiring would consist of a twin flex to the mains transformers and a twin flex to the motor. These flexes to be joined in parallel through a tumbler switch and fuses to a two-pin plug or bayonet socket.

A Motor Control

A separate small switch should be fitted beside the motor turntable to control the motor without disturbing the amplifiers. A potentiometer volume control can also be mounted on the motor board if desired, and wired across the pick-up leads.

The loudspeaker is the next thing to be tackled. The position is, of course, undisputed. It will occupy a central location in the front of one of the cupboards. It is not wise to try to cut a circle through a couple of inches of solid oak door, besides which it is our intention to hide the true nature of the one-time sideboard.

The speaker may be fixed to a stout baffle board screwed just behind the door with a fret grill covering the cone aperture. The baffle should be stained to match the exterior wood.

The door must now be wide open when reproduction is required, and, as far forward as possible. This is done in some American instruments.

Finally, the wiring-up should present no difficulties.

Pick-Up Output

The output from the pick-up is taken to one side of the radio-gram switch. The leads should be in shielded flex and the shielding earthed. Also earth the motor casing and pick-up arm. These leads can all be joined and a single wire connected to the earth terminal at the back of the instrument.

If the end of your aerial is stayed near a chimney, or in any position where it is particularly liable to pick up soot or smoke, remember that its insulators will frequently require cleaning.

The output from the switch is taken to the input terminals of the L.F.
There are many practical details of component values contained in this informative article on an interesting subject.

The most notable features of a screened-grid-detector circuit is the large amplification and exceptionally good quality which are easily obtainable. A typical circuit is reproduced in Fig. 1. Having experienced consistently excellent reception of the two London stations with such a scheme, the project of extending the range of the receiver, by the addition of a high-efficiency H.F. stage, became increasingly attractive.

It was anticipated that with proper design it would be possible to secure a large overall amplification adequate for long-distance reception, with an output of better quality than that usually passed to the loudspeaker by the average three-valve H.F.-detector-L.F. receiver.

In this type of receiver, range and volume often depend very considerably upon the "boost" of reaction, and the skill with which this control is manipulated. When reaction is employed to increase the overall amplification of a receiver, the consequent sharpening of tuning may take much of the brilliance and some of the clarity from reproduction.

Many Experiments

Recently I have had the opportunity of laying out and testing an experimental circuit, and the performance expected of the trial receiver was more than realised. High spots of general interest, such as adequate selectivity, large output and excellent quality, were at length developed in the final receiver to a very satisfying degree. In consequence, I am sum-

maring here the developments leading to the final design, with some notes on results and operation.

I should mention, in passing, that, as far as I can recall, only one receiver with a S.G. detector was to be seen at the 1931 Show, but this year quite a number of new designs made use of this method of detection in some form or other.

Adding an H.F. Stage

The first circuit drawn up for practical test is that shown in Fig. 2. This has quite a simple S.G. H.F. stage preceding the detector, with our old friend the tuned-grid circuit as the H.F. interstage coupling.

The H.F. valve is well decoupled and screened from the detector stage by a metal sheet. Separate tuning condensers were used merely to save time in assembly and initial operation, with 60-turn tapped solenoid coils, unscreened, in both grid circuits.

A preliminary test confirmed the expected large overall amplification. For example, the two London transmissions produced such enormous volume that the output valve was well-nigh paralysed! This, needless to say, without reaction, and a signal input from an indoor aerial.

The degree of selectivity, although rather better than usual for this class of receiver, was yet inadequate for really satisfactory long-range reception. The high magnification increases local station swamping, and selectivity consequently suffers. The selectivity of the S.G. stage, with single tuned input and output circuits, is notoriously poor, and without some form of input station selector it is almost impossible to confine powerful local transmissions to a narrow tuning band.

Curing Instability

Some H.F. instability was also observed on the lower wave-lengths, resulting in oscillation unless screen volts were reduced considerably below the optimum value. This was later traced to H.F. leakage into the output stage. Apparently the S.G. detector functions rather well as an H.F. amplifier in addition.

Unless proper precautions are taken, therefore, the audio-frequency input to the power stage will carry a relatively larger H.F. component than that met with in the normal transformer-coupled detector. The cure for this will be discussed later.

By J. ENGLISH.
In planning the next experimental receiver attention was first devoted to improving the overall selectivity. For this the now increasingly popular band-pass input tuner was selected as being most effective; the actual tuner used was a Varley Square Peak unit with the companion H.F. inter-valve screened coil for the tuned-grid circuit. These two units proved to be both convenient and efficient.

The full theoretical circuit is given in Fig. 3. A ganged condenser was, of course, more or less essential for the band-pass coils, but the other was separately tuned for convenience of layout.

**Simple Screening**

No attempt was made to elaborate the inter-valve screening, just a metal sheet between the input tuning circuit and the H.F. valve, shown in dotted lines in Fig. 3, with a very short grid lead to the latter valve. If a "canned" S.G. valve were used here, it is probable that this metal screen would not be required, especially as the inter-valve coil is also "canned."

The H.F. instability of the original layout, to which I have already referred, was effectively nailed down in this receiver by inserting a stopping resistance in the grid lead of the output valve, with an H.F. filter in its anode circuit. This arrangement is much to be preferred to the more usual detector H.F. specified for a transformer-coupled detector.

Here the presence of any appreciable capacity, shunting the detector output, such as a by-pass condenser would provide, would largely impair the high-note response which is such a good feature of this S.G. detector. The filter scheme of Fig. 3, however, should result, theoretically, in the minimum loss, and in practice the reduction of the upper audio-frequencies is imperceptible. The properties of the band-pass tuner itself tend to counteract any such distortion of the frequency balance by passing to the H.F. valve a wave form with a full complement of the upper modulation frequencies.

**Splendid Performance**

The performance of the re-designed experimental receiver was now definitely better, both as regards selectivity and stability. The problem of adequate selectivity had virtually been solved by adopting band-pass input tuning, both on the medium- and long-wave bands.

Once again the very small input damping of the S.G. detector was prominent. With the normal grid detector the tuning of the inter-valve H.F. circuit is relatively flat, but here more accurate tuning was found to be necessary for maximum response.

If anything, an even greater overall magnification was obtained with this receiver, a number of Continental stations were easily received after dark at the large volume associated with the "locals" on circuit of Fig. 1. In one or two cases some volume control was necessary. Quality of reproduction was exceptionally good, speech crisp and remarkably clear, with a full frequency balance on musical items. Where no heterodyne note intruded, and unfortunately it often does when receiving foreigners under present ether conditions, stations were brought in against a quiet background.

**Plenty of "Mag."**

As the overall magnification of this receiver going all-out is far too great for local station reception, it is necessary to incorporate a severe form of volume control. An obvious method would be to cut out the first valve, switching the H.F. input straight through to the detector. This could be done, but the necessary switching is complicated, and leads to instability unless carefully arranged. It is simpler to reduce...
Making the Most of Modern "S.G.'s"

The amplification of the H.F. stage, which can be done in several ways in addition to the potentiometer control of screen volts.

The easiest method is to connect a small semi-variable condenser in the aerial lead, adjust this to give sufficient volume for local transmissions, with a switch to short-circuit it for distance reception. This is the simplest form of "local-distance" switch. It is certainly quite satisfactory in operation, provided the dual condenser tuning the band-pass coils is accurately ganged.

**The Volume Control**

Another easy scheme of volume control, which incidentally must come before the detector, is to arrange a fixed resistance of 50,000 ohms to be switched across grid and filament terminals of the inter valve coil for "local" reception. This does not impair selectivity, which is well cared for by the B.P. input tuning, while theoretically it should improve quality.

Although it is quite a practical plan to use a three-gang condenser for the tuning circuits, thus giving onedial control, I have a preference for a separate condenser tuning the inter valve H.F. circuit, with the trimmer wired across one section of the B.P. unit, mounted on the panel. This enables you to get the last ounce out of the receiver on weak transmissions.

Just a touch on the trimmer very often makes all the difference in volume. Even if fully-ganged tuning condensers are used, the panel-mounted trimmer is an idea well worth adopting in any receiver.

**Inter-Stage Screening**

As regards layout, some screening is necessary between H.F. and detector stages. Usually a metal sheet is sufficient, unless coils and tuning condensers are all "canned," in which case no extra screening is necessary.

I also found it of advantage to use a metallised S.G. for the detector stage, as this further stabilises the H.F. stage and reduces the internal capacity of the detector itself. You can easily "metallise" an ordinary S.G. by wrapping it in the foil removed from a packet of tobacco! The foil is secured by a few turns of bare wire, the free end of this being taken to the negative filament pin.

The layout of the components forming the coupling between detector and output valves should be such that stray capacity and leakage paths are not excessive. A sound scheme is to use the new type fixed resistors with a length of wire at each end; no holders are then required, and a particularly compact assembly can be adopted.

In all the experimental tests described above a mains unit of generous output was used to supply H.T. current for all three valves. No trouble was experienced, at any time, from mains hum or other troubles often concurrent with mains operation.

**Constructional Details**

Place a sheet of the cone paper on a flat surface—I use a piece of plate glass—and after gumming the turned-up serrations, place the cone on the flat sheet of paper and, gently pressing the apex, let the cone take up its natural seating. Then press down the flange. This does not impair selectivity, which is well cared for by the B.P. input tuning, while theoretically it should improve quality.

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**CONCERNING CONES**

An interesting letter from an enthusiastic home-constructor.

To The Editor.

Sir,—The article in a recent number on cone construction is very interesting to me as it confirms almost in detail a method which I have already tried out with excellent results, though employing a slightly different suspension.

For the benefit of those who perhaps have not had much experience in production of cones of truly symmetrical shape, may I suggest two variations from the methods you suggest.

First as regards attachment of the half ring. Instead of serrating the ring, cut the cone material one quarter of an inch larger than your specification, and serrate the edge back to the measurement you prescribe. Fold up (outwards) the serrations.

The latest in American radio receiver stunts. It can be set in advance to pick out any 15-minute programme from any of six stations. When the time arrives it automatically switches on and delivers the "goods."

To The Editor.

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For the benefit of those who perhaps have not had much experience

**ANY STATION—ANY ITEM—ANY TIME!**
The Scottish Regional

The B.B.C.'s new Scottish transmitter, which is being erected near Falkirk, has already reached an advanced stage of construction. The engineers' tests from the Regional have already started, but the National will not be introduced until August or September.

Something Revolutionary?

The B.B.C. is taking great pains to keep the secrets of the new transmitter closely guarded. Day and night watchmen are on duty at the site in quite surprising numbers, and they have instructions to exclude everyone from the station grounds until the station comes into operation.

The New Danish Transmitter

We learn that the Danish Government recently placed a large and important order in this country for wireless gear for a new broadcasting station at Kalundborg. When this station is finished it will take its place among the ranks of the important high-power broadcasting stations of Europe.

The carrier power will be 60 kilowatts, increased by modulation to 100 kilowatts. We congratulate the Standard Telephones and Cables, Ltd., on securing this important contract. It is quite likely the station will be on the air early next year on a wave-length of 1,100 metres.

Our Empire Broadcaster

Small wooden masts, from 60 to 80 ft. high, will be used for the aerial circuit of the Empire wireless station at Daventry. In all there will be seventeen aerials. Eleven of them will be of the reflector type and focused for transmitting beam-like waves in specific directions. Six different wave-lengths will eventually be used: 14, 17, 20, 25.6, 32 and 48 metres.

A B.B.C. official stated recently that there was every likelihood of the station being completed before the end of the year, and that in all probability it would be possible to use it for broadcasting Christmas greetings to the Empire.

The Radio Exhibition

The Radio Exhibition this year will be at Olympia as usual, but it will open a month earlier than last year, viz., on August 19th. Furthermore, the Grand Hall of Olympia will be used for the Exhibition for the first time. The idea of having the show earlier is that the trade will have a better opportunity of getting ready for the autumn season, and also that provincial listeners on holiday in London will have a better chance of seeing the Exhibition.

Naturally, Modern Wireless, with its contemporaries, "Popular Wireless" and "The Wireless Constructor," will occupy a very conspicuous stand (Continued on page 487.)
at the Exhibition, and I understand that many surprises are in store for our friends who pay us a visit there.

Reciprocal Programmes

It will be interesting to see whether the reciprocal broadcasts between the B.B.C. and the Columbia broadcasting stations of America prove popular. By the time this issue is on sale, listeners on both sides of the Atlantic should have had an opportunity of judging.

Newcastle's New Wave-length

As we go to press we understand that 5 N 0, Newcastle, is to have a new wave-length between 200 and 220 metres. At the time of writing no definite decision has been made, but there is no doubt that some alteration in the wave-length for Newcastle is necessary, for the new Scottish National transmitter will eventually operate on 288.5 metres — the common wave-length at present used by Newcastle.

Probably the change will not take place in 5 N 0's wave-length until August or September, but it is just as well that listeners in that district should be fully informed in plenty of time beforehand.

Good Progress

Judging by the statistics recently published, the wireless trade advanced by 50 per cent during 1931, the sales figure of £20,000,000 for 1930 giving way to one of £29,750,000 last year. The Post Office state that 900,000 new licences were issued during 1931, and there must be at least one and a quarter million wireless sets in use in Great Britain to-day — and that is not taking into account pirate sets, if any. (We say "if any" because, to use a colloquialism, the G.P.O.'s vans have certainly "put the wind up" the pirate fraternity, and we should think that by now their ranks have been thinned very considerably.)

(Continued on page 488.)
RADIO NOTES AND NEWS OF THE MONTH
—continued from page 487

"It Is a Lie!"

A suggestion was made in the House of Commons recently that the Government's £17,500 a year Opera subsidy was being used not only for the presentation of new operas, but to pay off losses incurred by the syndicate before the subsidy was granted. Lady Snowden, who is a Governor of the B.B.C. and a Director of the Covent Garden Opera Syndicate, stated emphatically to a newspaper man in respect of this suggestion: "It is a lie!"

More Advertising!

Sponsored programmes from the Continent are becoming more frequent, and in a few weeks' time, when the Luxemburg station is completed, listeners in this country will have another example of the sort of fare sent out by a sponsored station.

The new Luxemburg transmitter has been testing lately on a small scale, but when the station is really ready to take its place in the ether it will use a power of 200 kilowatts—more than six times that of the present Daventry long-wave transmitter, and twice that of the proposed National transmitter to be erected on a site near Droitwich.

Seven-Metre Tests

At the time this issue is on sale the B.B.C.'s new 7-metre transmitter should be delivered at Broadcasting House. No transmissions may be expected, however, for about a month, and tests—when they begin—will be definitely of the experimental nature.

The B.B.C. admits that 7-metre transmission will be a distinct novelty in this country, but it attaches great importance to the possible technical results obtainable, and, should the experiment prove successful, it is quite likely that within a year or two we may have quite a number of 7-metre transmitters dotted about the country.

Of course, the object is to provide miniature relay stations, each one serving a restricted area, and using a wave-length of 7 metres, so as to avoid interfering with the other baby transmitters.

Fig. 1 shows you a straight detector circuit arranged in this way. The five numbered points represent five of the sockets of a six-pin coil-base. You will note that the 0005 condenser is tuning two turns of an eight-turn coil, and that the aerial is tapped, through the usual small series condenser, down on to the bottom end of the coil.

Simplifies Tuning

In Fig. 2 you see the broadcast coil in action. The whole coil is now tuned, and the aerial is tapped, still through its condenser, on to the top of the coil.

Probably your only comment will be: "How very obvious!" It certainly is! So much so that I have frequently kicked myself for not having thought of it before; particularly as the first set in which I have incorporated the scheme is by far the best "all-wave" set I have ever used myself.

On short waves it is really easy to handle. The band covered is not more than about 4,000 kc. wide until one gets right down to the bottom of the spectrum, and in those regions there are not many stations to bother about. But with almost any good slow-motion drive I guarantee that the rawest novice could tune in Nairobi or Sydney after five minutes' practice.

There is another distinct advantage that this arrangement can claim over those relying on complicated switching—that of short wiring. I have chosen the pins on the coil-base in such a way that they give a nice layout; you will not find parts of the tuned circuits straying all round the set.

Full Details Later

Later I hope to publish full details of the first set incorporating this system, together with dimensions for the full range of home-made coils. The latter will probably be obtainable from certain component manufacturers, and I believe there are still plenty of folk who enjoy the task of coil-winding! For their benefit the particulars will be given.

In the meantime, please don't write and point out to me that I have always expressed the opinion that a separate set is desirable for short waves. Even the male sex is allowed to change its mind sometimes.
commend itself to the constructor on account of its compactness and reasonably high efficiency.

It has been designed for universal application, although there is to be a special H.F. type for use in centretap tuned-anode circuits.

A New Output Choke

Equally attractive in its way is the new Lotus output choke, having an inductance of 20 henries, and designed for sets in which the anode current of the output valve does not exceed 12 milliamperes. The price is 5s. 6d., but despite its small size this choke has a D.C. resistance of only about 700 ohms, which is by no means high for this class of article.

And within the limitations of its specification it functions very well indeed, and should prove a good seller among the owners of the smaller types of sets.

In a quite different category is the new Lotus ganged condenser which incorporates a really splendid slow-motion drive. It is a thoroughbred Lotus product in every way, and is one of the best pieces of condenser engineering we have come across.

It is built on robust lines in order to ensure a permanence of matching between the units, each of which is completely screened from the other. There are easily accessible and easy-to-adjust trimmers.

Easy to Fit

A great feature from the constructor's point of view is that the component is particularly simple to mount. There is an illuminating light and a handsome escutcheon. In operation this Lotus gang is delightful to handle, and the readings are quickly and accurately obtainable. It is available in two-, three-, and four-gang models, with either disc or drum drive.

NEXT MONTH

Look out for a special article by "M.W.'s" popular contributor, W.L.S., in which he will describe his new ALL-WAVE RECEIVER

The June "M.W." will be
ON SALE JUNE 1st.
1/- ORDER NOW.
MEET STRAVINSKY . . . !

—continued from page 401

The best selling of modern-music records is his Capriccio for Piano and Orchestra. That was the piece in which he recently played at the Queen's Hall when Ansermet conducted.

Stravinsky went with a Russian producer to a gramophone studio in Paris, and the producer rehearsed the Walthar Straram Orchestra of Paris in this exceedingly difficult concerto, while Stravinsky looked on and executed staccato comments.

S invert the Record !

On the final day, when the recording was ready to take place, Stravinsky turned up in a sporting outfit, woollen pull-over and flannel " slacks," and played the loud piano passages in the manner of a boxer! But the engineers were expecting it, and careful handling of the volume control prevented the cutting needle jumping right off the wax! As a matter of fact, it is a very good record.

He is not always able to have his own way, though. Just before the Queen's Hall was taken over by the B.B.C., Stravinsky came over to England to conduct the first performance in this country of his Les Noces. It was not broadcast. The B.B.C. was not asked to do so.

Even if there had been an invitation, the engineers would probably have turned it down! Les Noces is scored for four solo singers, four pianos, a xylophone and a battery of percussions!

It was not broadcast, but a concert-hall audience heard it. So many rude things were said by anti-modernists that Mr. H. G. Wells wrote to "The Times" asking that there should be a fair hearing for what he thought was a work of genius!

Listeners Like Him

Yet, strangely enough, he doesn't seem to infuriate listeners in the way he upsets concert-goers. He has broadcast, eight times, and yet even the most musically uneducated listener doesn't class his music as " foul, " as he may do of other modernists.

Although he knew that the Capriccio for Piano and Orchestra would be recorded in Paris, and he probably guessed that the B.B.C. would ask him to do it over here, it is a most unsuitable piece for the microphone. There are huge climaxes of sound suddenly ending in a sustained note on the piano, while the orchestra ceases entirely.

When at the Queen's Hall last year he spent the best part of a day discussing with Jack Hylton how a dance orchestra could orchestrate some of his (Stravinsky's) pieces for broadcasting and gramophone recording.

Deserves a Hearing

He was quite prepared to change the scores of some of his less important pieces if a better microphone effect could be obtained.

After all, if a modern musician can try to rope in his genius to accommodate the deficiencies of the " mike, " then we ought to give him a hearing.

To me the Queen's Hall doesn't seem the right place for Stravinsky. John Ireland, one of our own British modern musicians, spent long hours with Jack Payne in arranging broadcast material, and he worked up in the studio.

That is in the Stravinsky style. Stravinsky is more at home in a gramophone or broadcasting studio, in sports outfit, than in the dress-shirt atmosphere of a concert hall.

BEHIND THE SCENES OF BROADCASTING

—continued from page 467

one of the control-room engineers. As a by-the-way, I asked:

"Did you broadcast?" he returned with a grin.

And that is where the story ends. To this very moment I cannot say for certain whether or not I really did broadcast. You see, it was a highly irregular proceeding if I did, and the engineer might have been giving me a broad hint that officially I had not broadcast. On the other hand, the whole thing may have been a leg-pull, for our broadcasters, or many of them, are sufficiently human to enjoy little jokes of that character! I had neither the opportunity nor the inclination to probe the matter deeply, and so it remains one of the minor mysteries of my life.

But I should make it clear that the above incident happened about five years ago, and even if the officials concerned are still with the B.B.C., they need have no fear that I shall reveal their names, and this also applies to the following.

(Continued on page 491.)
Behind the Scenes of Broadcasting

Continued from page 400

At around about the same period, but at another British broadcasting centre, a jovial radio "uncle" was conducting a children's hour. It was a cheery little performance, and no doubt tens of thousands of kiddies thoroughly appreciated it.

Poor Listeners!

There was appropriate music and much lively patter by the various "aunts" and "uncles." At length the conclusion arrived and our particular "uncle," thinking the microphone had been switched off, emitted a loud "Phew!" and added: "Thank heavens we've got that so-and-so slosh off our necks!"

But he didn't say so-and-so, and the microphone hadn't been switched off!

Which reminds me of a very similar radio faux pas.

At yet another station the announcer was reading something for the benefit of listeners. For the space of about twenty minutes he had been exercising his epiglottis with all the grace and skill at his command. He had nearly reached the end of his session when the door of the studio was abruptly opened and an engineer came in, said, loudly:

"We've broken down."

A Little Forcible!

The announcer threw aside his book:

"Oh, well," he said, resignedly, "let me know when we're O.K. again. How long have we been down?"

"About a quarter of an hour, I think."

"And you mean to say you've let me blurt away here!?!?!?!?!?!?!"

His language was forcible, if not exactly B.B.C.-ish!

And the tragedy was that two seconds before the engineer had burst in, the transmitter had been got working, and the whole of the above dialogue broadcast through the startled ether!

Although, as I have already indicated, the people concerned in the foregoing incidents must remain anonymous, there is no reason why I should not tell you that the Cardiff station was the locale and Mr. Settle my informant of my next batch of radio reminiscences.

Cardiff's first broadcasting studio was situated on the premises of the Castle Street Cinema, and it was a rather cramped, tiny studio. There were four microphones, and one of these had been fixed only a few inches from the floor level in order to cope with certain "effects" necessitating a particularly low "mike" position.

The Resourceful Director

The station director of the time (he has since resigned) was broadcasting something one evening when his "mike" suddenly went out of action. Quickly, but without panic, he sprinted across to another, but that also was "dud."

With growing anxiety he tore across to the third, but, as luck would have it, that too was right out of commission. Not to be daunted, he threw himself down on to the floor and continued his broadcast through the fourth and floor-level mike!

And yet, so I was informed, this resourceful broadcaster's speech went out perfectly and nothing of the behind-scenes contretemps was evident in his voice except a slight pause!

On another occasion this same man was taking part in a radio play. There was a scene when, in naval fashion, he was supposed to drink a toast and then throw the glass over his shoulder into the fireplace.

Being a great stickler for realism, he had provided himself with a full glass of water. But presumably the liquor did not prove sufficiently inviting to ensure him polishing it off. In actual fact he only sipped at it, and then cast the glass behind him.

The fluid swished over his head, swamped down his neck and cata- racted down his shirt-front. And yet such was his and the other actors' self-control that not an exclamation or a giggle was allowed to escape into the ever-alert mike, and the play proceeded uninterruptedly!

Another Cardiff Story

Although it may not sound true, but it is a fact that during a serious play of a military character one of the actors had to utter the melodramatic words:

"Ah! I hear soft strains of mysterious music."

This was the cue for the band which was in attendance to play very softly, "St. George For England."

But the cue badly miscarried, and instead they blared in loudly with "It's a Long Way to Tipperary!"

Very funny—but the station director didn't think so!
"Waal, I'm American, and I've been putting over a bit of painting in Minalj, yonder. Guess I sorter strolled too far last night, and got kind lost. Then I hit that burg where the Mayor fell for me."

"Minalj."

"Er-yes! That is, how did you know?"

"I got papers about 'er."

"But Alonzo didn't. Some-"
B.I. ENAMEL COVERED WIRES

B.I. Enamelled wires are unequalled for the field windings of small motors, measuring instruments, radio transformers, and other pieces of electrical apparatus where space is all-important. They are produced throughout in our own works, from the raw material to the finished wire, and every phase of manufacture is under the strictest control as regards quality of material and accuracy of gauge. B.I. Enamelled Wire is unexcelled for its high insulation, dielectric strength, flexibility of enamel, and general dependability. We regularly manufacture Enamelled wire as fine as '002' dia.

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The R & A 'Challenger,' notwithstanding its phenomenally low price, will, given an undistorted input, reproduce speech and music with absolute fidelity. Its sensitivity is such that it gives satisfactory results when used with the average power valve, and it will accept 3 watts undistorted A.C. without distress, thus providing a volume of reproduction more than sufficient for normal requirements.

CHASSIS.
8/" diameter, pressed steel, stove enamelled black, fitted with felt facing sectors.

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6/" diameter, moulded in one piece with surround.

COIL.
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Forged 15%, cobalt steel, cadmium plated. Flux density 6,800 lines per square centimetre.

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Bolted to chassis. Ratios 19, 33 and 44 to 1, large core, sectional primary winding. Made by Ferranti, Ltd., to R & A specification.

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The R & A 'Challenger' PERMANENT MAGNET MOVING COIL REPRODUCER

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(TO R & A SPECIFICATION)
Never, in the history of 2-volt valves, has there been such an amazing range as this—so much evidence of brilliant engineering—so many valves with outstanding characteristics. Instance the Pen.220; a pentode valve which at once presents the solution to the output stage problem in portable sets, giving an extraordinary large output for a combined screen and anode current of under 5mA. It is a valve for which dry battery users have long waited.

Being typical of all Mazda valves, it is outstanding in its efficiency. Mazda 2-volt valves, both metallised and clear bulb types, are sold by all good radio dealers.