GET ON WITH YOUR WINTER SET!

Wireless Magazine

EDITOR: BERNARD E. JONES
TECHNICAL EDITOR: J.H.REYNER, B.Sc.(HONS.) A.M.I.E.E.

VOL.6, NO.32, SEPTEMBER, 1927

1/-

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SHAKESPEARE

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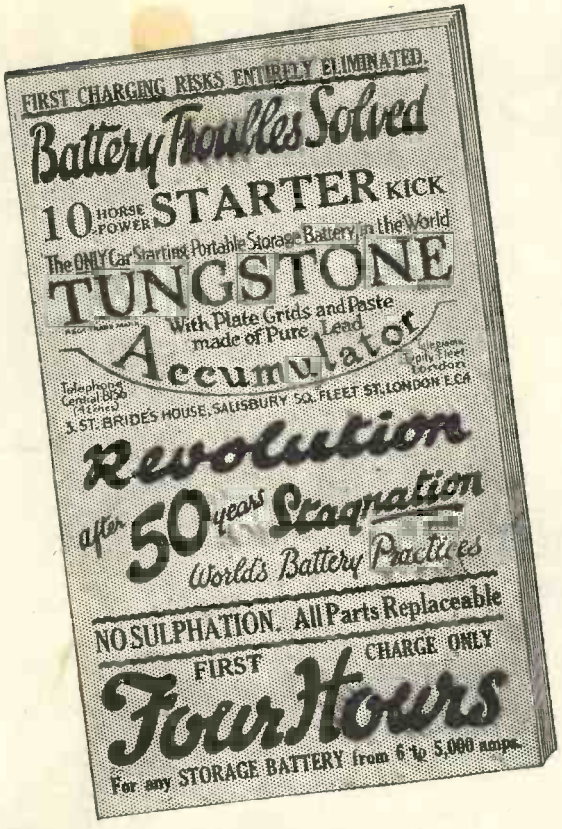

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118 G

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WHEN the chemists of a competing manufacturer under test found that, including their own, all known formulas for the making of high-tension batteries failed to reproduce the results of the LISSEN Secret Process Battery, they took the LISSEN Secret Process Battery to pieces and analysed the contents of the cells.

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There are now tens of thousands of users of the LISSEN Secret Process Battery. They are telling others of the new power smoothness in the loud-speaker, the new freshness of tone, its remarkable clarity, and how they have found that the longest programme does not affect the quality of song, speech, or music when the LISSEN Secret Process Battery is used. That is due to the remarkable oxygen content of the LISSEN Battery, due in turn, of course, to the chemical combination and the process.

And by a price policy pursued by LISSEN, and a new LISSEN policy of direct-to-retail-shop distribution which cuts out big wholesale profits, the price of the LISSEN Secret Process Battery has been made low enough for everybody to possess one.

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357

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Contents of This Issue

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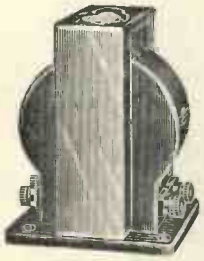

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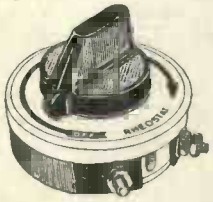
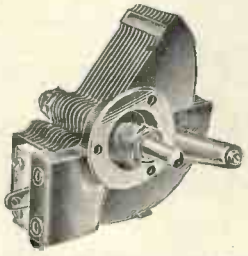


IGRANIC-PACENT PORCELAIN RHEOSTAT

A porcelain base is used on these Igranic-Pacent Rheostats and Potentiometers. Fitted with moulded knob and gold or silver finished dial. Two-unit construction: winding spaced to give maximum cooling effect.



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High-grade Variable Condensers with low-loss characteristics, and negligible minimum capacity. Fixed and moving plates are of brass, riveted together and soldered, ensuring permanent alignment and sound electrical connection.

Success or failure in set construction depends a lot on efficiency of components and accessories; and that is why the experienced radio constructor exercises the utmost care in choosing his components. If you specify IGRANIC components you will get the best results obtainable.

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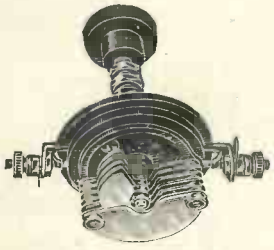

IGRANIC MICRO CONDENSER

The Igranic Micro Condenser is a miniature condenser which proves particularly efficient for neutralising, and is very useful in all cases where small capacity variations are required.

IGRANIC CENTRE TAPPED H.F. TRANSFORMERS

Both windings equal in size with a centre tapping to one which may be used as primary or secondary.

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The Editor Talks About Blueprints

and the "W.M." Winter Programme

At work in the "W.M." Constructional Department—

—building special receivers to be described this autumn.

"GET on with Your Winter Set!" It suggests the top line of my front cover and, by the way, how do you like that cover? Pretty good, eh?

I believe that I can promise you what is certainly the best winter programme ever attempted by this magazine, but while my "talk" this month is closely related to your practical work for the winter, it is not that work itself that I propose to dwell upon. During the past month many discussions have been taking place in the office, and they have centred around our Free Blueprint. I doubt if there is need to emphasise that we have tried to make this blueprint the best thing of its sort issued by any publication; the draughtsmanship is so clear and distinctive, and the paper and print so good, that the reader intent upon building a set finds in the blueprint as a supplement to the constructional article everything that he can possibly require. So far, so good.

But the free blueprint system has one outstanding disadvantage: the set of which we present the free blueprint is not necessarily the one which the reader desires to build, and in every such case the free blueprint is wasted, the reader being put to the expense of a shilling or eightcenpence to get the one he does want. It is, of course, out of the question to give four or five blueprints to cover everybody's requirements, and such a system would be altogether too costly and wasteful.

Yet more and more readers want to build our sets and more and more they insist that to get the best results with the least labour they must have a full-size layout drawing. How, within reasonable limits of cost, are we to satisfy all requirements?

I THINK I have found the way out. It is this: to give every reader the opportunity of obtaining the blueprint of ANY set at quite small cost. So, starting next month, I propose to omit the blueprint, but to insert right at the back of the magazine a coupon entitling you to a blueprint of ANY of the October sets at HALF PRICE ONLY. I propose, if readers like the system, to make it permanent.

You will decide which set you will build, cut out the special coupon and send it to us with stamps or postal order for only HALF THE PRICE OF THE BLUEPRINT, and we will, within 24 hours if at all possible, send you a blueprint post free. Every blueprint under this new scheme will be a real photographic blueprint (made from our draughtsman's original drawing) on ferro-prussiate paper.

How long will the coupon be available? The "Wireless Magazine" is published on or about the 25th of the month. (Our next issue is published on Friday, September 23.) You will have, from that date, a period of at least five weeks in which you can obtain an October blueprint on the special half-price terms, the coupon being current right from the day of publication through the month of which it bears the name. After that the full price will be charged for all back blueprints. In the case of foreign and colonial readers a proper extension of dates will be made.

The ordinary prices of blueprints are 1s. up to three valves, and 1s. 6d. for four valves and over. Thus, by using the coupon, you will effect an immediate saving of from 6d. to 9d.

The system is perfectly clear, is it not? You get ANY current blueprint in exchange for the special coupon and half the price.

[Half-price Blueprint Service NEXT Month]

A FORETASTE OF NEXT MONTH'S GOOD THINGS

Details of a Special Five-valver that is really an Improvement on the Famous 1927 Five.

A Review of the Chief Items of Interest at the National Radio Exhibition at Olympia.

A Four-valver Embodying a New Circuit and a Special Station Selector.

All About the New Screened-grid Four-electrode Valves and How to Use Them.

And Many Other Special Features, including articles by J. H. Reyner, B.Sc., A.M.I.E.E.; Capt. H. J. Round, M.I.R.E.; Major Raymond Philips; Dr. Alfred Gradenwitz; Miss Doris Keane; and Tommy Handley.

DO NOT MISS YOUR COPY—ON SALE SEPTEMBER 23.

Few ceremonies, if any, so impressive as the unveiling of the Menin Gate Memorial have ever been broadcast and the relay that was made from Belgium recently—although somewhat marred by an unfortunate land-line defect—will take its place as one of the outstanding efforts of the British broadcasting authorities. In this article some particulars of the relay are given by an informed contributor

Broadcasting a Great Ceremony

A Special Account of the Menin Gate Broadcast by H. de A. Donisthorpe

This photograph shows the fine Menin Gate Memorial at Ypres immediately before the unveiling

IT was a truly wonderful idea to broadcast that impressive ceremony of the opening of the Menin Gate Memorial. In these matter-of-fact days, after nine years of peace, we are inclined to forget the sacrifices that have been given, and this happy inspiration must have brought home to many ideals which have been overshadowed by difficulties experienced during the tense years following our victory.

Worthy of Best Efforts

The broadcast was made at the instigation of the Imperial War Graves Committee. They suggested the idea last spring to the British Broadcasting Corporation and it was immediately accepted by them as a feature worthy of their best efforts; and it is unfortunate, therefore, that these were spoilt by land-line trouble, which blotted out the King of the Belgians' splendid address.

A few details about the actual Memorial, before dealing with the broadcast, may be of interest.

What It Stands For

The Menin Gate Memorial is situated at the Eastern boundary of Ypres on the Menin Road, and has been erected by the Imperial War Graves Commission to the memory of 56,000 British, Dominion and Colonial troops who gave their lives in the defence of the Salient, and who have no known graves.

The land occupied by the Memorial is the gift of the Belgian people. The new Menin Gate consists of a Hall of Memory covered by a semi-elliptical arch in a single span. At either end is an archway with smaller flat arches on either side of it. Ramparts and loggias, reached by staircases from the sides of the hall, run the whole length of the building.

56,000 Names

The names of 56,000 officers and men are incised in Portland stone panels fixed to the inner walls of the Hall, up the sides of the staircases and inside the loggias. Each of the four straight arches is flanked on either side by an engaged Doric column and surmounted by an entablature. Over the central arches are large panels for the dedicatory inscriptions; and above these panels is a recumbent lion on the east side, and a sar-

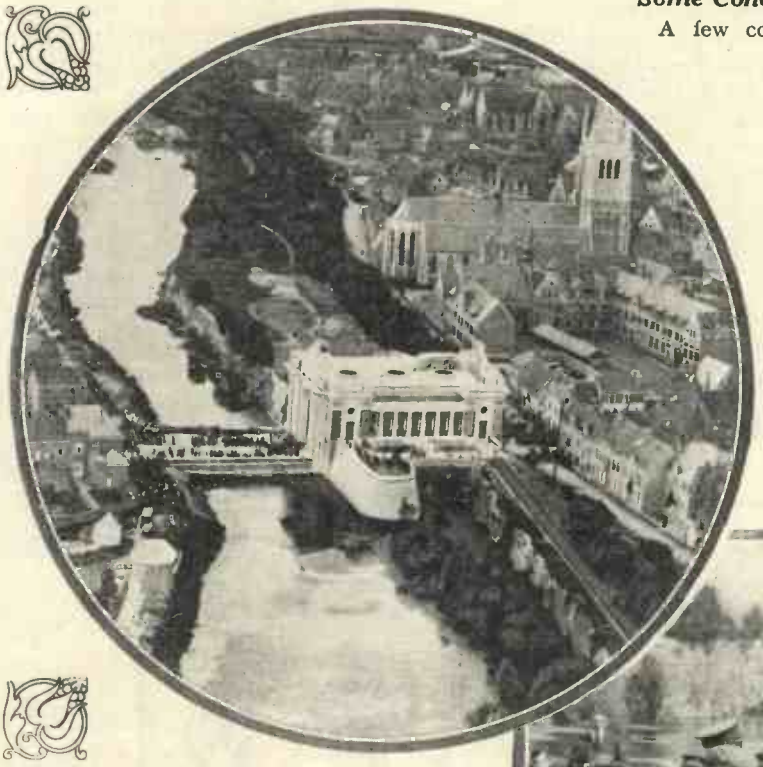
cophagus, with a flag and a wreath, on the side facing the town.

This memorial will hand down to posterity a token of the two nation's co-operation during a period of dire distress. Now as to the actual broadcast.

Apparatus weighing about half a ton was transported from London to the City of Ypres for this broadcast. Three microphones were used for the ceremony, two in parallel to pick up the speech and one for the band music and singing of the congregation. The two were situated on the eastern side of the main arch of the Gateway and were used for King Albert's address, Lord Plumer's address, Sir Laming-Worthington-Evan's speech and the prayers.

How the Relay Was Affected

The relay was affected by means of two pairs of overhead telephone lines from Ypres to Ostend, and thence by submarine cable and underground cable to London.



Above is reproduced an air view of the Menin Gate Memorial, showing the ramparts and the moat. Many, many thousands of listeners heard the relay of the impressive ceremony of the unveiling of this memorial to 56,000 men who gave their lives in the great sacrifice

From the simultaneous board in the control room of the 2LO at Savoy Hill, the transmission was distributed by land-line to all twenty-one stations of the B.B.C.

A second pair of lines also were placed at the disposal of the B.B.C. by the Belgian authorities and were used for "control" purposes, as in the course of a transmission of this type it is necessary for the engineers at the scene of the "pick up" to be in constant communication with their

A Record of An Outstanding Broadcast

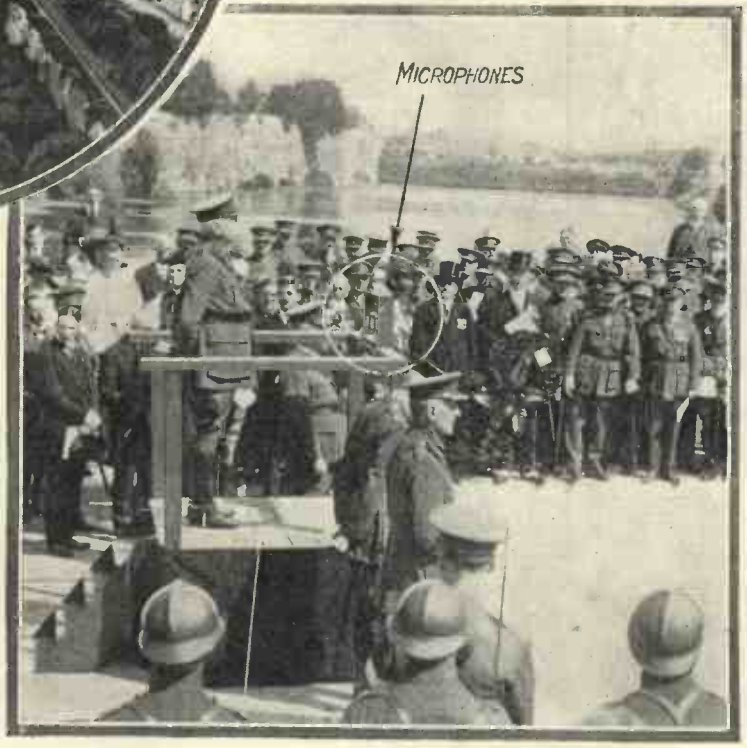
colleagues at headquarters for the purpose of correcting speedily any sudden defect.

It was a pity that the broadcast in this instance had to make use of these auxiliary wires, and they were used to trace the defect which destroyed most of King Albert's noble address. Apparently, the trouble was found to be in the Post Office land-line system in England, and no fault, therefore, can be attributed to the B.B.C. engineer's efforts, which, generally speaking, are all that can be desired.

Some Concluding Remarks on the Broadcast

A few concluding remarks on the actual service broadcast may serve as a record and be of interest. Raised upon a dais, Mr. Stanford Robinson, the well-known conductor of the Wireless Chorus of the B.B.C. wielded his baton for the opening hymn and controlled the singing of "O God our help in Ages past" by the vast multitude present. This was followed by a special prayer spoken by the Rt. Rev. L. H. Gwyane, the Deputy-Chaplain

How the microphones were placed for picking up the speeches at the unveiling of the Menin Gate Memorial is shown by the photograph below. Field-Marshal Lord Plumer is seen speaking. The King of the Belgian's speech was marred by land-line failure.



Broadcasting a Great Ceremony (Continued)

General to the British armies in France and Flanders.

Sir Laming-Worthington-Evans, M.P., then followed with an invitation to Field-Marshal Lord Plumer to unveil the memorial.

After a splendid address by Field-Marshal Lord Plumer, the King of the Belgians spoke on behalf of the Belgian nation, and it was at this junction of the broadcast that the land-line broke down and deprived listeners of most of the King's speech.

Dedication

The Right Rev. L. H. Gwynne then dedicated the memorial, after which the congregation sang the hymn "Now thank we all our God." The Right Rev. W. Keatinge, Roman Catholic Bishop-in-Ordinary for the British Army and R.A.F. then read the Benediction and the service proper concluded with Psalm 129 and prayers.

Most Impressive Part

Perhaps the most impressive part of the whole of the service, and one which was excellent as far as the broadcast was concerned, was the sounding of the Last Post by the buglers of the 2nd Battn. Somerset Light Infantry and the Lament by the Pipers of the 1st Battn. Scots Guards. After one minute's silence, these buglers of the Somerset Light Infantry then sounded the Reveille, and the complete service was brought to an end with the band playing the Belgian National Anthem and "God Save the King."

This broadcast undoubtedly illustrated how useful broadcasting can be for bringing to our homes items of national interest. Probably more wireless sets were in operation during that Sunday morning than have been at one time for some considerable period, as during the summer months the wireless receiver becomes somewhat neglected as a general rule.

Television Possibilities

Looking into the future, broadcasts of this nature no doubt will be accompanied by television transmissions and receptions, and so thousands, perhaps millions, who are unable to attend functions of a national character will then be able to "see" as well as hear them in their homes. What possibilities the future holds!

Our Cartoonist's Impressions of Two Recent Broadcasters

Siegfried Wagner, son of the immortal composer, who recently conducted a special broadcast programme of his father's work.

Tom Kinneburgh, who has been before the "mike" frequently of late and charmed listeners with his fine voice.

HALYARD'S Chat on the Month's Topics — *Sketches by GLOSSOP*

A New Claimant

YOU remember the old story of the Irishman who, when asked to settle the question as to which was the correct pronunciation, *neether* or *nyther*, replied "Noither."

Well! here we are in exactly the same position with regard to one of the most important theoretical considerations in wireless.

Who first suggested the idea of an electrically-conductive layer in the upper atmosphere? The English mathematician, Oliver Heaviside, you reply with emphasis. The American professor, Kennelly, your American cousin replies with equal emphasis.

A new claimant

Now which of you is right? I'll tell you—NOITHER.

A distinguished British scientist, Dr. Charles Cree, asserts that neither Heaviside nor Kennelly first had the idea of a conductive layer in the upper atmosphere, but that the idea of such a layer was first propounded by Dr. Balfour Stewart about the year 1882.

So you see, instead of talking about the Heaviside layer here in England, and the Kennelly layer over there in America, we ought all of us all the time to have been talking of the Stewart layer.

Balfour Stewart, of course, was not dealing with wireless theories when he postulated his conducting layer in the upper atmosphere. He was theorising on the daily changes which take place in the earth's magnetism.

This very distinguished Scottish physicist, for whom the Heaviside-Kennelly layer is now claimed, was born in Edinburgh in 1828, and he died in 1887. It is interesting to note that Balfour Stewart first suggested the connection between sunspots and magnetic disturbances on the earth.

What Watt

It is not often that I can get the better of George, but, last night, by the help of a little advanced wireless information, I pulled one or two rather good ones over him. In fact, I believe at times I had him really foodled.

"George, old man," I said to him rubbing my hands together in pleasant anticipation of what was to come, "I want to discuss a new and very wonderful electronic device with you, but first of all, George, what is a watt?"

"Which what, what or watt?" he asked.

"Don't be silly, George, you know what I mean. Answer my question."

"I'll answer your question if you will answer mine."

"What is your question, George?"

"What not is a what-not?"

"Look here, George, we have no time for foolishness and what-not. I don't believe you know what a watt is?"

"Of course I do. It's the unit of power. For a valve you multiply amps by volts to get watts."

"Good for you, George, and what is the wattage of a valve?"

"Depends on what age the valve is."

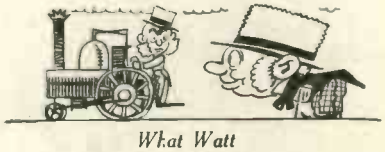
"Assume it to be a new valve, George."

"Oh! well, for a new valve the wattage might be half a watt, a full watt, a double watt or a watt watt, three watts or anything up to five or ten or twenty watts."

"And a valve is an electronic relay, is it not, George?"

"Aye, aye, sir."

"Well! now then, listen. An American research engineer has in-



What Watt

vented a new electronic relay which only requires a billionth of a watt to work it. Imagine that now and compare the wattage with that of one of our valves. A billionth of a watt, George, is the amount of energy expended by a fly walking a distance of one-fortieth of an inch up a wall."

"Why not call it the one-leg energy of a forty-leg fly crawling the whole inch?"

"A horse-power is so many watts. Supposing this new relay comes into use and we measure work in fly-power. What will a fly-power be, George, so many what?"

"Swots. Good-night, old bean."

Four Excellent Sets Described in This Issue—Read About Them!

Under My Aerial (Continued)

Mars

"How would it be, George, if we set about making a giant valve receiver with which we could listen to wireless signals from the planet Mars?" I asked my technical adviser during an astronomical discussion the other evening, after hours, listening hours, of course.

"No, it wouldn't be," replied George.

"Wouldn't be what?"

"What you would it would be."

"Please explain yourself, George. It is much too late for cross-talk puzzles."

"Well! it's like this. No matter how big a set you built, you would never hear a message from Mars."

"Why not, George?"

"Simply because Mars is not inhabited by intelligent beings like ourselves who understan! wireless."

"But I thought it was generally accepted that the markings on Mars were huge canals, and that these canals must have been built by Martian beings of great intelligence."

"That's the old theory, old man. The latest theory is that the markings on the planet Mars are regions of dense vegetation. Whether there is on Mars any other form of life higher

Old age is creeping on

than this vegetation is an open question. I don't think we had better make a ten-valve receiver to listen-in to Mars. A much better proposition would be to make two five-valve sets for the local workhouse in case er——, old age is creeping on, you know."

A Suggestion

Those of you who live in, or know, the northern half of England do not need to be told how wonderful is the singing at the numerous musical festivals held in that part of the country.

I recently attended one of these festivals in a well-known health resort, and I was so charmed with the singing that I came away wondering why it is that these musical festivals, with all the excitement of competitive singing, are not broadcast to us periodically.

In matters musical I am sure my tastes are similar to those of the majority of listeners, and I am certain that all of you would have derived the same amount of enjoyment as I did from the excellent singing at the festival I am referring to.

FAME

O Mike, I'd often heard of you
And hoped that we should meet,
The while your wondrous powers grew,
Who with you could compete?
And when each night you played your part
I dreamed, as maidens do,
That I might help you in your art,
Until my dream came true!
Before you I was down to sing:
When you confronted me
Alas! I could not say a thing,
My voice failed utterly,
But you, you waited there serene,
O Mike, heard nightly, yet unseen!

LESLIE M. OYLER.

There was one branch of the singing which appealed to me more than any other. It was the singing of the male-voice choirs. I listened to the one test piece, A. Dard-Janin's "Peace and War," sung through no less than nine times and I was not in the least wearied by it.

The male-voice choirs I heard were largely drawn from mining districts, and I do suggest that the B.B.C. would give us an unusual treat if they broadcast to us the unaccompanied singing of one of those north-country miners' choirs.

A suggestion

Exhibition Time

Here we are again within sight of exhibition time. If you have any of your holiday still due to you, and you do not know where to spend that remaining portion, you might do worse than decide to go to Berlin to see the big German wireless exhibition which lasts from September 2 to September 11.

Apart from the wireless exhibition at Berlin, Germany seems to me to be a good holiday place for the wireless enthusiast. I should think that the Langenburg broadcasting station would be worth going a long way to see. We hear a good deal of this station one way or another these days and it ought to be as well worth seeing as it is worth hearing.

One of my wireless friends has saved a couple of days of his holiday for the big wireless exhibition at Olympia. He likes to avoid the crush at an exhibition and he intends to have his two days at the exhibition when things are pretty quiet there.

Exhibition time is really not so very far away from us now. Personally, I think that one of the most interesting things about exhibition time is that it is about then that we begin to think seriously of the coming winter and the wireless fashions that will then prevail.

Spend that remaining portion

Wireless at Examinations

A schoolboy friend of mine, who is a great wireless enthusiast, found his knowledge of wireless extremely useful to him in his School Certificate examination a few weeks ago.

He had to take a paper in Physics, and, from what he knew about wireless, he was able to answer no less than three questions he would otherwise have missed.

I was very interested, and I got the boy to show me the paper and point out to me which were the questions in which wireless had helped him.

The first question was one on sound. The length of an organ pipe and the velocity of sound were given.

Halyard's Chat on the Month's Topics

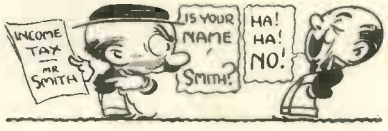
and the boy had to calculate the frequency.

"How did wireless help you in that question?" I asked.

"Well! I just remembered that frequency times wavelength gives you velocity in wireless and it is the same in sound. Most of the fellows got mixed in it pretty badly."

Another question was a real wireless question. The boys were asked to say what was meant by the capacity of a condenser, on what factors the capacity depended, and how these factors affected the capacity. They were also asked how they would make a large-capacity condenser out of some tin-foil and waxed paper.

I can imagine how my schoolboy friend, who has made many a fixed condenser, enjoyed answering that question.



Enjoyed answering that question

Other questions the boy did from his knowledge of wireless were the description of a Leclanché cell and the calculation of a lamp resistance.

I told George about this schoolboy friend of mine and how wireless had helped him to answer some of his Physics questions.

"Splendid," said George, "I know how delighted the boy must have been. You see, my own particular knowledge of wireless enables me to answer many questions with enjoyment."

The Doctor

Amongst the hills of a northern county there is a little town of which I am very fond. In this small town there is a Scotch doctor whom I know full well. Wireless has penetrated into the small town with the result that I have an amusing story to tell you about this Scotch doctor of mine.

It so happened one day that someone was ill in the first of a row of six houses, and that a wireless set in the sixth house was out of action. My Scotch doctor had been sent for to visit the sick person in the first house. His instructions were to go to the end house and, in error, he went to the wrong end house, the sixth house where they were expecting the "wireless doctor."

"It is in the front room," said the

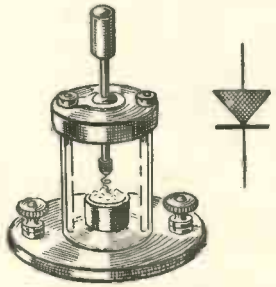
The Doctor

lady of the house to the Scotch doctor as he walked into the kitchen.

"What is?" asked the Scotch doctor.

"The thing in the box," was the reply.

Things to Know About
Crystal Detectors



AS almost everybody must know in the simplest types of wireless receivers rectification is carried out by making a contact, under a slight pressure, between the end of a fine wire and a sensitive spot on the surface of a crystal. The apparatus for making this contact is known as a crystal detector.

In the example of a crystal detector shown in the illustration the crystal and the contact wire are enclosed within a glass tube with the object of excluding dust. One of the two terminals shown is connected to the crystal cup and the other terminal to the contact wire (or catwhisker).

A metal rod, provided with an insulating handle, carries the contact wire at one end, this rod passing through the cover of the tube. The rod works in a ball-joint so that the wire can be placed in contact with any desired spot on the upper surface of the crystal.

Considerably mystified, the doctor went into the front room. The lady followed and pointed to the wireless set.

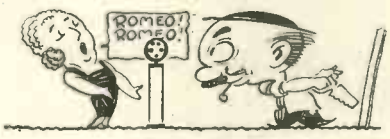
"Great Scott!" said my doctor, "I've been taken for a few funny things in my life, but never before for a wireless operator."

A B.B.C. Theatre

What do you think of the great developments which are expected to take place in connection with wireless drama? According to the latest available reports, the B.B.C. will either rent a real theatre, or build a new theatre specially for the broadcasting of plays.

One interesting suggestion that has been made is that the B.B.C. buildings at Savoy Hill should be scrapped, and a massive new building containing a specially-designed broadcast theatre should be built on the site.

All this is excellent in its way for it is generally recognised that the



A B.B.C. Theatre

wireless play can never be a success so long as it is produced in a studio under present conditions.

You know that our wireless players have hitherto read their parts from the book or from lantern slides. As for dressing for their parts, well! most of the actors have followed the example of Sir Harry Lauder and have carried on in their shirt sleeves.

In the broadcast theatre the play will be acted as on the stage proper, with costumes and scenery and there will be a full audience in the theatre to encourage the players. HALYARD.

Oscillating Neighbours

THE possibility of tracking down unwelcome oscillation by the co-operation of amateurs equipped with direction-finding apparatus was demonstrated recently at an outdoor meeting of the Golders Green and Hendon Radio Society. The occasion was a competition to locate the position of a wireless station in the shortest time, and the results were astonishingly good.

Four of the winners' bearings, taken at a distance of many miles away, were within one hundred yards of the actual transmitter. This comprised a Hartley circuit with two LS5 valves in parallel and the high-tension was obtained from twelve C.A.V. accumulator units.

Some Particulars of An Entirely New Type of Valve

My Favourite "Screened-grid" Valve Circuit

This Month's Causerie Article by Capt. H. J. Round, M.I.R.E., of Special Importance to the Experimenter

SOMETIME in 1912, I was at Glace Bay, the old Canadian Transatlantic Wireless Station, and my job was to improve the reception from Clifden, in Ireland, two thousand miles away. At that time only two types of receiver were in use—one was the old Fleming-valve set and the other was a crystal, usually carborundum.

In the course of many experiments I noted certain results which at first seemed very contradictory, and it was some little time before the meaning of all these results became quite clear.

The general trend of these results pointed out that the audible sound we obtained in the telephones bore no simple relation to the input strength delivered to the crystal system.

Decreased Signals

For instance, if Clifden decreased his aerial current to one half, our signals, that is what we heard in the telephones, decreased a very great deal more than one half, and when Clifden reduced his current again to one quarter the original value, signals vanished altogether.

Then if we reduced, the height of our aerial signals fell off at a very great rate until at about quarter the height they vanished also. We were able to devise an instrument for measuring the real strength of the high-frequency currents in our aerial, and with this we were able to test very exactly what was happening. The result was that we found the relation between the aerial current and the telephone current was what is called a power law.

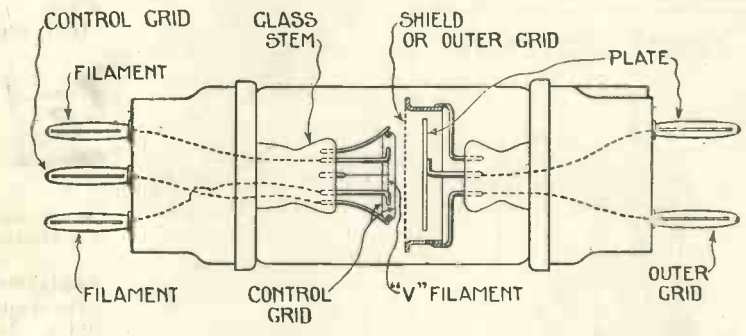


Fig. 1.—Arrangement of Electrodes in the New Screened-grid Tetrode, which is Remarkable for High-frequency Amplification

Reducing Aerial Current

For instance, when the aerial current in the receiving aerial was 10, let us say, the telephone current was 10. If the aerial current was now reduced to 5, then the telephone current was found to be about 2½. If, again, the aerial current was reduced to 2½ the telephone current was found to be about .65, and so on.

Of course, the above figures are not the real ones, but are chosen quite arbitrarily to illustrate my point. The outcome of it was that we finally came to the conclusion that a weak signal is not converted into audible sound so efficiently as a strong one, so that any weakening of the incoming transmission shows up as an exaggerated weakening of the telephone current or audible sound.

The fault lies in the rectifier and is one which is absolutely unavoidable in simple rectifiers—which must always be used in our broadcast reception. One can, of course, suggest amplifying up the telephone current by means of Brown relays or valves—and we used in those days Brown relays to get all we could, but the power of these low-frequency amplifiers to overcome the difficulty is rather limited.

Amplification Required

Let us examine, with the aid of a few figures, what would happen if we amplified up with an L.F. amplifier. First of all the original aerial current of 10 gave a phone current of 10, and by the time the aerial current was reduced to 2.5 we should need an amplification of 16 to bring the signal back to the old value in the telephones.

Reducing the aerial current to .625 or $\frac{1}{16}$th of its original value would necessitate a magnification of 16^2 or 256 to get the signal back to the original value.

Reasoning in the same way, if our signal dropped to $\frac{1}{100}$th of its original value a magnification of 10,000 would be wanted to get it back—an accomplishment which is beyond the limits of all but the most perfect amplifiers.

Another Difficulty

In addition to this difficulty of mere amplification another very serious one comes in for our signal, being a weak one, will nearly always be accompanied by stronger interference, such as atmospherics—and spark stations. These, being stronger, are handled by the crystal more efficiently so that their sound after amplification will be an enormously exaggerated one compared with what

they would have been if the process of rectification had been equally efficient for all strengths of original signals.

Taking it for granted at the moment that this serious fault is unavoidable in a rectifier, how are we going to get over the difficulty?

Importance of H.F. Amplification

Even in those Glace Bay days we saw the answer in high-frequency amplification before the rectifier, and we made various attempts at doing it, but, of course, without the valve we had no real luck.

The point about high-frequency amplification is that it brings the signal to a strength *before* rectification at which the rectifier is efficient, and we only have to devise means of doing it to overcome the chief troubles of long-distance reception.

Our problem is, however, a very difficult one because we have to take care of so many factors. First of all we have to maintain first-class quality in our receivers, then we must be selective, also we like to get all the distant stations, even if they are not worth much from the programme point of view.

One-knob Control

Again, we are insisting that all this should be done with one knob (I wonder if the day will come when the public will demand a receiver which automatically picks out the best programme on its own!), that the instruments shall be fool-proof, portable, require no external batteries and so on—and we can easily see that every little improvement is going to help towards the ideals.

Now this problem of high-frequency amplification has probably been the most difficult one of all to which to get a satisfactory practical solution, and the reason lies in the extraordinary difficulty of preventing the amplified energy in the set getting back to the receiving aerial. High frequency is used in radio because it jumps over distances easily and the property becomes a serious disadvantage on a receiver.

Oscillation

Thus, suppose we have a valve system which amplifies $\frac{1}{100}$ times—if $\frac{1}{100}$th of the amplified signal gets back to the beginning of the receiver by any means it goes through the receiver again, and this process repeating itself produces what is called reaction—and finally oscillation, a condition which is of little use to us for broadcasting reception.

Great precautions are taken in high-frequency amplifiers to stop any back-flow of energy. The tuning coils carry the oscillatory currents, are carefully wound to produce the least magnetic fields (astatic windings), they are enclosed in shielding boxes to still further improve the effect. Metal screens are erected around the condensers and valves. Chokes and condensers are inserted in all the battery leads to prevent energy getting back via these, but after all this is done there is one place where no ordinary process will prevent back-flow of energy.

Grid-plate Capacity

Quite the smallest condenser will transmit frequencies of 1,000 kilocycles (300 metres) in large quantities, and the capacity between the grid and plate of a valve is quite large for these high frequencies.

The neutralising circuits were invented to balance out these valve capacities and have been the main methods used, so far, for obtaining stable high-frequency magnification.

The super-het dodges the difficulty by means of a trick. Capacities which will carry back a lot of energy at 1,000 kilocycles, will only carry back a very small quantity at 100 kilocycles and so by a process known as frequency conversion the wave first received is converted from 1,000 kilocycles to 100 kilocycles, and then amplified easily because the troublesome back-flow of energy does not occur to the same extent in the longer-wave amplifier.

Is the valve capacity necessary? This is a very serious question, and the answer can now be given quite definitely as "No!"

Just as we can shield one coil from another or one condenser from another, we can shield quite effectively one electrode from another in a valve.

New Type of Valve

All we need to do is to invent a shield which while allowing electrons to go through will seriously impede any electrical lines of force. Obviously we must "shoot" the electrons through because if we stop lines of force going through a screen we cannot pull electrons through by means of lines of force. The problem is fairly easy to solve and several valves of this type will shortly be on the market.

For a curious reason not directly connected with the screening action, such valves exhibit at the same time a very large magnification factor which fortunately can be used without any trouble whatever, providing we take the other precautions necessary to stop the back-flow of energy.

I mentioned in a recent review of progress in this magazine the Hull screened valve, and I can now say that during the last two years considerable development of this idea has been going on in England, resulting in the first of a series of new valves which will become extremely popular with all constructors and, what is more, will enable us to make up circuits cheaper,

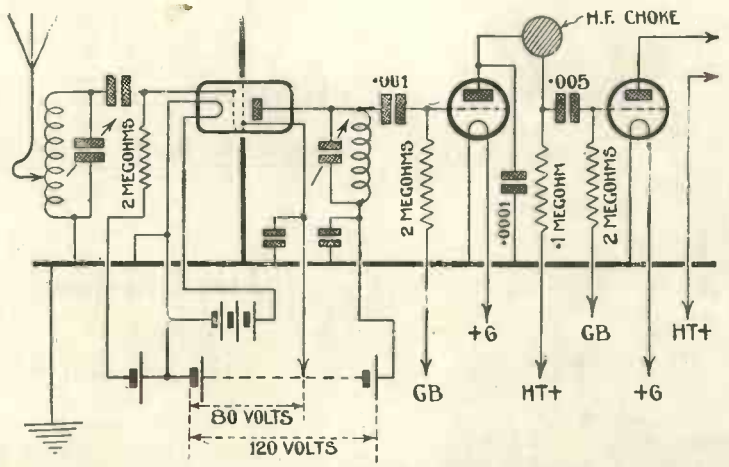


Fig. 2.—Capt. H. J. Round's Favourite Circuit for Using the Screened-grid Four-electrode Valve

My Favourite "Screened-grid" Valve Circuit *(Continued)*

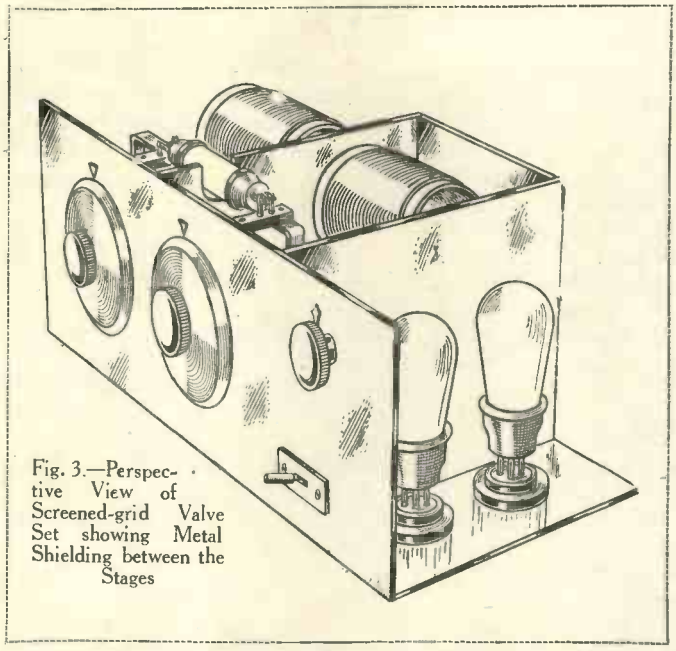


Fig. 3.—Perspective View of Screened-grid Valve Set showing Metal Shielding between the Stages

more reliable and of better reproducing quality.

Think what we have had to do in the past to get a good long-range receiver—reaction, grid-leak rectification, transformer amplification on the L.F. All tend to bad reproduction—and all because we could not amplify easily in the H.F. stages—now all three of the faulty schemes mentioned can be abolished entirely if desired.

The new valve easily amplifies directly from 30 to 40 times, with the simplest possible circuits, and in practical figures this increases the range of a receiver, which at present receives well at 10 miles, to a range of 70 miles.

Our tuning problem now only remains the one big problem to solve—it occurs even with these new valves—the one place where real invention is wanted.

Details of the Valve

I illustrate in Fig. 1 one of these new valves, the S625, which will be on the market in a week or so, and in Fig. 2 I give a favourite circuit of mine for use with this valve—a circuit which, with a good aerial, will do 30 miles on the loud-speaker—without the use of reaction, with irreproachable quality.

First of all let us examine the valve. The ordinary grid surrounds the filament as in a DE5 type valve which in fact they closely resemble in appearance. To enable the special shielding to be easily carried out it was decided to only use the emission from one side of the filament and, as it turned out, this is ample for all practical purposes. Next to this grid is a second grid called the shield grid, of rather fine mesh. And in practice this is maintained at a fixed potential, usually about 80 volts.

The plate, in common with this shield grid, comes out at the other end of the valve from the first grid, and the plate is usually maintained at a potential of 120 volts, but of course, in series with it are placed the tuned coils as shown in Fig. 2.

The first grid can be set with a small grid-bias if required, but this is not absolutely essential and is not shown in the figure. The second grid is sufficiently fine a mesh to effectively cut off the electrical force of the plate from the first grid and thus stop reaction troubles, but the electrons are shot through the second grid without many of them being stopped. Thus most of the current will still be found flowing to the plate although there is a high voltage on the grid.

Further Explanations

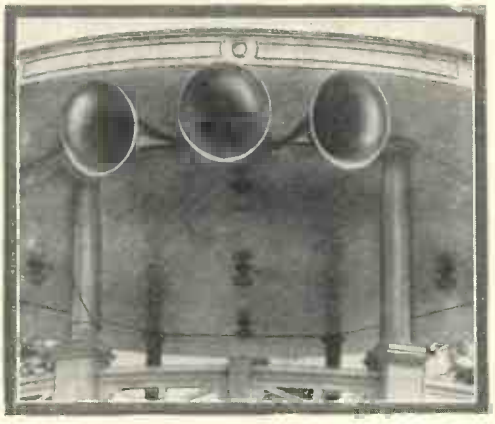
The reason for this valve giving such high magnification I will go into in later articles and I have gone into the subject closely in a book I have recently written on these new valves which will be published by Cassells and Bernard Jones Publications shortly.

Naturally it is necessary to use very good precautions to prevent energy flowing back other than by the valve capacity, otherwise the advantage of these valves would be lost and the diagram attempts to illustrate the shielding, etc., which should be incorporated to obtain this objective. A perspective view of a receiver built on these lines is shown by Fig. 3.

Many other circuits for these valves will be published, but this one is my favourite. Of course if one still cares to embody reaction, etc., the distance-getting properties will be largely increased—but at the expense of quality and simplicity.

Radio Solves an Entertainment Problem in America

The Loud-speaker "Multiplies" the Orchestra!



In this photo the loud-speakers are shown installed on top of the now otherwise disused band-stand.

ONE of the problems of those responsible for the amenities of public life is how to give the people attractive amusements simultaneously in all the places endowed from the civic purse. It is obviously a much too extravagant outlay, for instance, to expect a first-class band to be provided for every one of a city's parks or open spaces. And yet music is an indispensable element if the citizen is to be attracted to a full enjoyment of these civic "health resorts."

An American city has just shown the way to a solution of the problem. One of the city "Fathers" of Jacksonville, in Florida, conceived the idea of giving all the ten parks within its radius an equally fine concert at the same time, so that a resident at one end of the civic boundaries had no necessity to trudge a long way to a park with a concert.

The idea was enthusiastically welcomed. And this is how the corporation proceeded to carry it out. A first-class orchestra was assembled under a highly efficient leader and a really fine programme of selections performed. But instead of being performed in one public park they were given in a hall specially equipped with a public-address system, and the excellent musical entertainment was thereby able to be broadcast. The public-address system was then installed in each of the ten larger parks.

In this particular park the loud-speakers are swung from four separate poles in the centre of the park. The afternoon concerts have become enormously popular with the housewives in the locality, who are thus enabled to enjoy a pleasant recreative hour and respite from domestic cares.

It was quite a simple matter to effect, although established in different ways. For instance, in some of the parks the loud-speaking telephones were placed in a cluster from the bandstand; in others the cluster was hung from a pole some thirty feet from the ground, while in another, four corner poles were used with a horn set on each pole. The amplifying part of the system was, of course, installed in the studio rooms or public hall.

The results of this innovation have been remarkable. Where formerly about 1,000 to 1,500 people used to listen to a concert in a single park, no less than 15,000 to 20,000 people are now attracted to enjoy the programmes from any one of a number of parks. In the residential parts of the city the young housewife takes her children to the nearest park for an afternoon concert, while in the evening those who have been toiling during the day find in the city parks a delightful and cool resort for their recreative hours, made attractive by being able to listen to good music or to the news of the day; the latest sporting results; the political news; recitals and things of that sort, which have now been added to the daily programme.

The enterprise of the Jacksonville fathers has had its reward. It has attracted to the Floridan city, thousands of tourists and visitors who are enthusiastic over the programmes given. The local Chamber of Commerce has been inundated with enquiries from other cities throughout the United States, who are anxious to follow the excellent lead given by Jacksonville.

Because we believe that short-wave work is the thing of the future and that any listener who takes it up will find it full of interest, we are giving free this month a full-size blueprint of a simple two-valve short-wave receiver—the Girdle Two. There is nothing difficult about the construction of this set, which is not at all expensive to build.

The Girdle Two

A Short-wave Set for the Winter

Designed and Built by the "Wireless Magazine" Technical Staff

AS soon as short-wave receivers are mentioned it is natural for the average amateur to ask what use such a set is to him. What will he hear with it and, almost as important, *when* will he hear it?

This is hardly the place (that is, in what is essentially a constructional article) to put forward the reasons why short-wave work should attract the attention of the average listener.

Thing of the Future

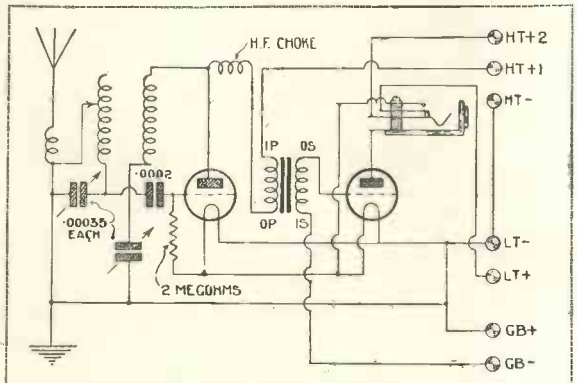
But it is, perhaps, permissible to point out the short waves are the thing of the future, and that short-wave practice will be developed in the best and quickest way by a large number of listeners co-operating in research.

This does not mean that a short-wave receiver is only of value to the man who desires to carry out serious experiment. Already there is a comparatively large amount of broadcasts being carried out on the very short waves, and a short-wave receiver will be found to "tap" a new source of real entertainment.

Ignoring Distance

Another thing about short-wave broadcasts that is worth consideration is the fact that, to all intents and purposes, one's distance for the transmitting station can be ignored. A receiver such as that about to be described will span the Atlantic with ease, and perhaps open up fields yet more remote.

And although we have lost some of our wonder at the way in which wireless waves annihilate distance, there is still a great thrill to be obtained by receiving *good* music from a station many thousands of miles distant.



Circuit of the Girdle Two.

Simplicity is the essence of short-wave receiver design, and this means that even the best receiver can be built at small cost. Indeed, most of the components required for the Girdle Two (the name is, of course, inspired by Shakespeare's "I'll put a girdle round about the earth. . . ." in *A Midsummer Night's Dream*) will already be in the possession of many amateurs. Moreover, alternative components from those used in the original WIRELESS MAGAZINE receiver can easily be worked in if it is not desired to go to the expense of buying special parts until the amateur has convinced himself that short-wave work is really worth while.

Few Components

Perhaps the most striking feature of this receiver, to the observer, is the small number of components used, and the simple way in which they are arranged. No ebonite panel is employed, all the components with the exception of the tuning condenser and terminals being mounted direct on the baseboard. This not only saves expense, but also simplifies construction as no panel drilling is necessary.

In the belief that once they have tried it, many amateurs will find short-wave work an interesting variation of ordinary broadcast reception, we are giving with this issue a *free* full-size blueprint of the Girdle Two Short-wave Receiver.

Valuable Work

Every amateur who builds a short-wave receiver, besides having a new field of reception for himself, will be doing valuable work in helping to standardise short-wave practice, so even if you have not the time just at present to build up this receiver, pass your copy and blueprint to a friend when you have read it—you will be helping radio progress by so doing.

To save expense, the Technical Staff of the WIRELESS MAGAZINE has designed this set so that use can be made either of home-made or manufactured coils. The photographs and blueprint show home-made coils, but by placing three ordinary two-pin sockets in the position occupied by the existing tuner, use can be made of Igranic short-wave plug-in coils.

Low-loss Condensers

Almost any type of low-loss variable condensers can be used—but be sure that they *are* low-loss, or results will be very disappointing. It is desirable that all the components, although small in number, should be of the highest quality.

From the circuit diagram it will be seen that the Girdle Two comprises a detector valve, to which reaction is applied by the well-known Reinartz principle, followed by a single stage of transformer-coupled low-frequency amplification. This combination will be found quite powerful enough to bring in a number of short-wave stations at good headphone strength under reasonably good conditions.

Special Test Report

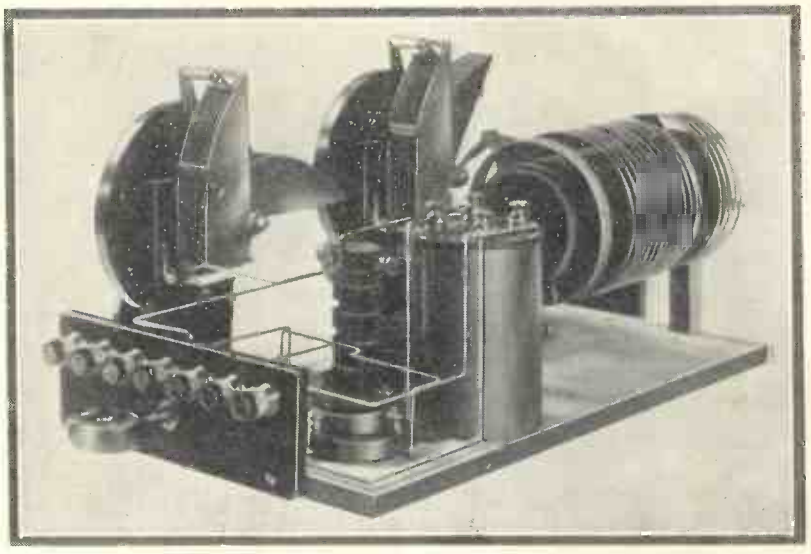
For a better idea of what this set will accomplish in capable hands, the reader is referred to the special test report compiled by 5YM—an authority on amateur short-wave work and contributor of "Below the Broadcasting Belt" every month in the WIRELESS MAGAZINE—which appears on page 176.

Tuning is carried out by means of a .00035-microfarad variable condenser and a tapped grid coil. As arranged in its present form the receiver has a range of approximately 25 to 80 metres. (It may here be emphasised that a long aerial is *not* necessary for short-wave work, one in the neighbourhood of 30 ft. being quite suitable if reasonably free from screening by trees, buildings, etc.)

Reaction Control

Reaction is controlled by another .00035-microfarad condenser. It should be noted that as reaction is applied on the Reinartz principle, there is no need to put a by-pass condenser across the primary winding of the low-frequency transformer.

The high-frequency choke in the plate circuit of the first valve is most important, and should be of low self-capacity.



Everything about the Girdle Two is "low loss."

Switching the set on and off is accomplished by means of a special phone jack. When the phone plug is pushed home, the filament circuit is automatically completed while then the plug is withdrawn the circuit is broken.

Following is a complete list of the components required for constructing the Girdle Two :

Baseboard, 12 in. by 7 in. by ½ in. (Caxton or Hobbies).

Ebonite strips : three, 4 in. by 2 in.; one, 5½ in. by 2 in. (F. A. Hughes).

Coil formers (ribbed, low-loss) : one 3 in. long; one 1¼ in. long; one ¾ in. long (Becol).

2 .00035-microfarad variable condensers (Igranic-Pacent or Ormond, Raymond).

2 vernier dials (Igranic or Ormond, Raymond).

2 antimicrophonic valve holders (Lotus or Precision, W.B.).

High-frequency choke (Raymond or Detex).

Low-frequency transformer (Eureka or B.T.H.).

.0002-microfarad fixed condenser with special insulated grid-leak clip (Dubilier).

2-megohm grid leak (Dubilier).

Phone jack, No. 65 (Igranic).

Phone plug (Igranic).

9 terminals marked : Aerial, Earth, H.T.+1, H.T.+2, H.T.−, L.T.+ L.T.−, G.B.+, and G.B.− (Belling Lee, type M).

Tapping clip (Raymond).

6 yd. No. 16-gauge tinned-copper wire for coils (Lewcos).

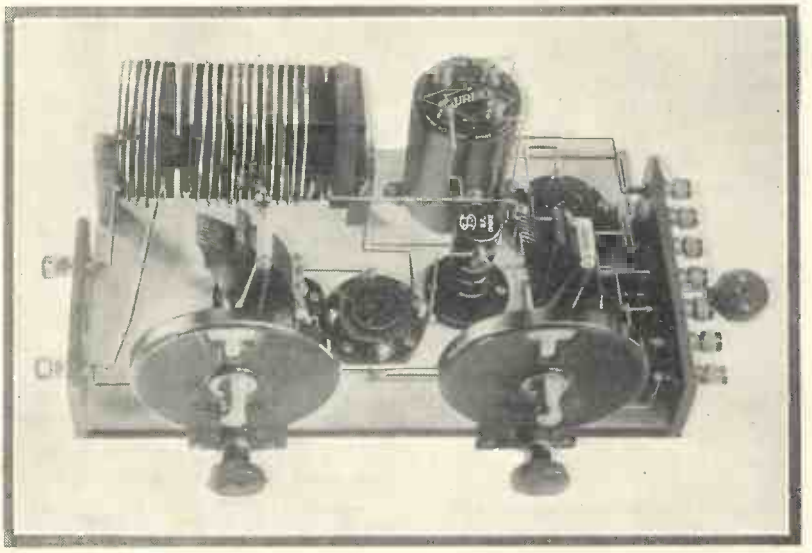
Glazite wire (Lewcos).

5 yd. No. 24-gauge silk-covered wire (Lewcos).

It should be noted that in each case the particular component used in the original set and allowed for in the layout is mentioned first.

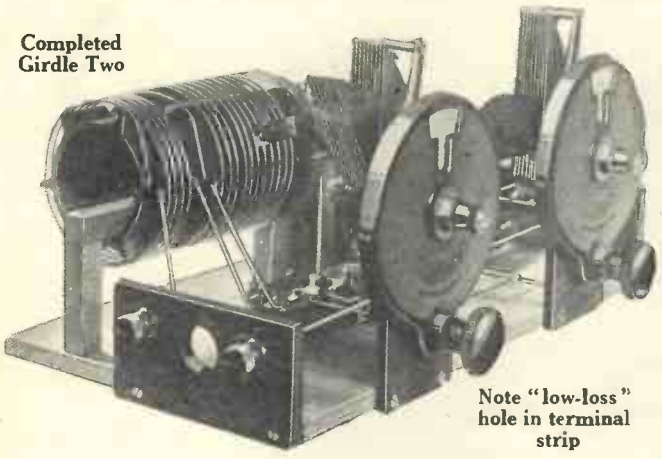
Easy Constructor

Even the most inexperienced constructor will find no difficulty in building this receiver—especially with



Layout of Components of the Girdle Two.

The Girdle Two *(Continued)*



Completed Girdle Two

Note "low-loss" hole in terminal strip

the aid of the full-size blueprint given free with this issue.

First of all it is desirable to mount the two variable condensers on ebonite supports and next the two terminal strips. To keep the dielectric loss through the ebonite between the aerial and earth terminals as low as possible, it is desirable to drill a large hole in the strip as indicated in the photographs.

Phone Jack

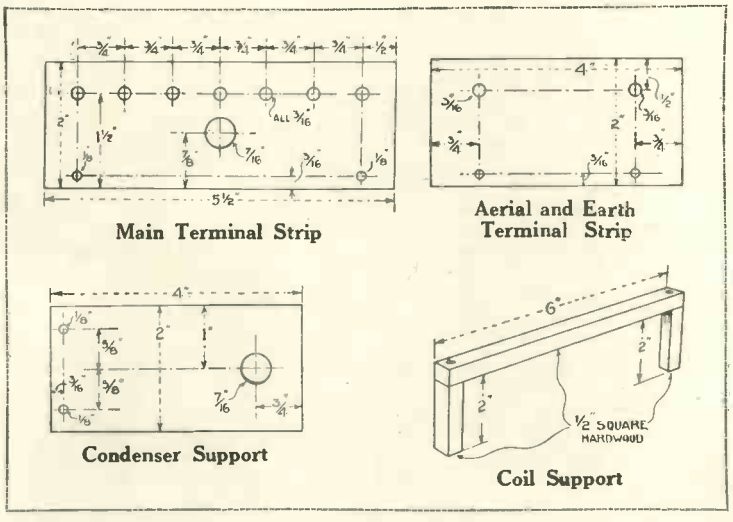
It should be noted that the headphone-jack is mounted beneath the terminals on the main terminal strip. This fact should not be forgotten when the blueprint is being referred to for the wiring.

As soon as the variable condensers and terminal strips have been fixed in position the rest of the components should be laid out on the baseboard as indicated in the blueprint. Any serious departure from the layout shown may seriously affect the results obtained and in all cases constructors are recommended to follow the scheme of the original set as closely as possible.

Arrangement of Coils

Assuming that the condenser side of the receiver is the "front" the tuning coils are arranged in the following order: Ape odic aerial coil on extreme left, tapped grid coil in centre, and reaction coil on the right.

Special ribbed low-loss formers are used for winding these coils and the following method of construction should be used: Obtain a cylinder (cardboard will do) of the same diameter as the main part of the former, that is, *not* including the extra diameter produced by the ribs, and wind on the required number of turns as tightly and closely as possible. Now slip the winding off. It will be found that when the turns are separated the coil will just slip over the ribs of the proper former. The end of the windings can be led through small holes made in the ribs (*see photographs*) and by means of a pair of pliers the wire can be tightened as desired.



For the ape odic aerial coil, four turns of No. 16-gauge bare tinned-copper wire are needed and from the grid coil twelve turns of the same wire. The reaction winding consists of twelve turns of No. 24-gauge d.s.c. wire.

When the coils have been wound and mounted in position the set can be wired up. This operation will be greatly facilitated by reference to the full-size blueprint or the reduced reproduction given in these pages.

Many readers will know that the small letters alongside the terminal points indicate the order in which wiring should be carried out. All the points marked with like letters should be connected together with one wire or as few wires as possible, and this should be done in alphabetical order. First all those points marked *a* should be connected, then all those points marked *b*, and so on through the alphabet.

Choice of Valves

Results obtained will depend to a very great extent upon the choice of the right valves. Almost any high-frequency or detector valve will do for the detector, while the low-frequency amplifier can be of the power or semi-power type (*see table*). In the ordinary way the detector valve will require a voltage of about 60 on the anode, while the second valve will require 90 to 120 volts.

Grid bias must be applied to the last valve as recommended by the manufacturers. With most valves a bias of 6 volts will be ample.

To test the set apply the necessary voltages to the appropriate terminals. Attach the aerial and earth, and push home the phone plug. Now put the main tuning condenser at zero, and the grid-coil tapping clip at the extreme end of the coil. Advance the reaction condenser until a slight rustling or hissing sound is heard that indicates that the set is on the threshold of oscillation. Now tune the main condenser until signals are heard, so adjusting the reaction condenser that the set is nearly on the oscillating point all the time.

Coil Tapping

Should no signals be received take the grid-coil tapping clip back one turn and re-tune again over the whole range of the main condenser. Keep on reducing the grid-coil tapping in this way, *one turn at a time*, until signals are heard. (For approximate adjustments see test report on page 176.)

Special "W.M." Short-wave Receiver

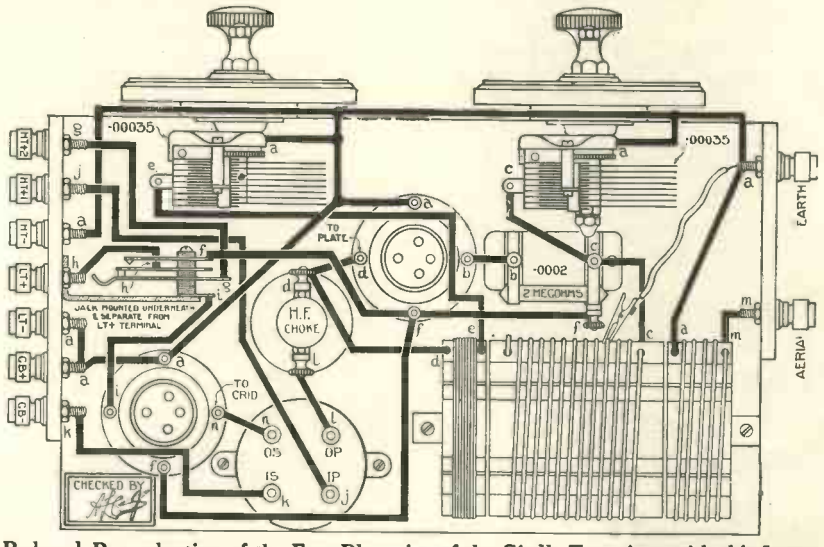
When a station has been picked up readjust the reaction-condenser setting, and the detector-valve plate voltage, until signals are at their best. It is also advisable to experiment until the best grid-coil tapping is found for each particular station (then use as much of the grid coil as possible, with the minimum capacity across it).

Sharp Tuning

Even with a vernier dial tuning on the very short waves is exceedingly sharp, and great care must be taken in adjusting the main tuning condenser that a station is not passed over. In the Girdle Two there is no danger of hand-capacity effects upsetting tuning.

We have no doubt that any amateur making up this receiver who has not had previous experience of short-wave working will find that he has access to a new and intriguing source of entertainment. If, by any chance, he can manage to read morse, his pleasure with the Girdle Two will be more than doubled.

So get down to those short waves now!



Reduced Reproduction of the Free Blueprint of the Girdle Two given with this Issue

VALVES TO USE IN THE GIRDLE TWO

Make	2-volt		4-volt		6-volt	
	Detector	Amplifier	Detector	Amplifier	Detector	Amplifier
B.T.H	B22	B23	——	——	B4H	B4
Cossor	Black Band	Green Band	Red Band	Green Band	Red Band	Green Band
Ediswan	DR2	PV2	GP4	PV4	ES5 H.F.	ES5 L.F.
Marconi	DEL210	DEP215	DEL410	DEP410	DEL610	DE5
Mullard	PM1	PM2	PM3	PM4	PM5	PM6
Osram	DEL210	DEP215	DEL410	DEP410	DEL610	DE5
Shortpath	SP18G	SP18RR	——	——	DE50	SP55RR

Our Wireless Trade Abroad

HAVE you any idea as to the value of Great Britain's export trade in wireless apparatus and valves, and do you know who is our best wireless customer abroad?

Dull Statistics

Like me, I daresay you find trade statistics rather dull, but I am sure you ought to know at least enough about our wireless export trade to answer the two foregoing questions.

According to the latest information, our wireless export trade is now worth well over a hundred thousand pounds per month. And our best wireless customer abroad is Japan.

It is rather striking that Japan should be so good a wireless customer of ours considering the very strong American competition we have to encounter. But Japan seems to like English wireless apparatus. At the present time, the apparatus for three Japanese broadcasting stations is being made in England. One of these stations is to be erected in the capital, Tokio.

Second Best

Our second best wireless customer is Australia. New Zealand is also a good customer. Being so near to the United States, it is hardly to be expected that Canada would buy much British wireless apparatus. There are signs, however, that Canadians ar beginning to like British valves.

European Customers

Of European customers, the Netherlands comes first. British wireless goods are now finding their way into most European countries and indeed, into all the countries of the world. In time, our wireless export trade is likely to be of great value to manufacturers generally.

AERIAL.

In this Article Capt. JACK FROST, M.I.R.E., Discusses

BROADCASTING AND THE GRAMOPHONE

SOME folk might say that I should have made the title of this article "Broadcasting *versus* the Gramophone," and others will be content with it as it stands. But why should broadcasting be in opposition to the gramophone? The two are surely co-partners in the reproduction of music. The more faithfully they both are able to bring about that reproduction, the greater is the benefit to the community as a whole.

Necessities in the Home

In homes where no musical talent is available, these two methods of reproduction become more than mere luxuries—they become necessities. As recently as three years ago, broadcasting was scarcely an infant and to-day it can hardly be styled as anything other than a fledgling. But in those early days of broadcasting the gramophone had already proved of inestimable value to the homes of the world, and had developed considerably in the art of music reproduction. It had the start of broadcasting; that much must be admitted.

Broadcast reception and reproduction has progressed to a high degree of quality of reproduction. When one compares wireless music as ejected in sound waves from the loud-speaker in 1923 to wireless reproduction to-day, the conclusion is very naturally arrived at by which the listener is compelled to admit that enormous improvements have been made. One is compelled, too, to admit that the wireless of the early days can be really compared to the reproduction of the bad gramophone.

Worse?

But what of to-day? Is anyone within their rights in saying that wireless reproduction is worse than a gramophone? I, for one, hardly think so.

It has recently been stated by those who can lay claim to know that hideous sounds are the result of the broadcasting of good music. This may or may not be correct, but I am inclined to the view that anyone who makes such a statement should substantiate it after hearing a well-known firm of wireless manufacturers carrying out a demonstration of wireless reception upon a receiving instrument and loud-speaker of their own manufacture, and as sold to the public.

"But," you may say, "I have heard wireless reproduction which is simply awful." Yes, you may have, and so have I. I have heard bad gramophones, too, but I do not wish

Jack Smith, the famous "whispering baritone."

to judge gramophone music by the worst display, but by the average and the best. It can be definitely said by the gramophone expert that the cause of bad gramophone reproduction is to so-and-so, or to such-and-such a fault. Similarly I can say that faulty wireless reproduction is due to one particular fault, or a combination of a number of faults.

It may be that a fault exists within the ether surrounding the receiving aerial. Possibly, an electric train or tram which passes close by superimposes cracklings upon the music whenever a sparking is made in the electric circuit. A loose connection in the joint between the aerial wire and the lead-in may cause faulty reception, or the touching of badly or uninsulated aerial and lead-in wires against trees or brickwork may be to blame.

Components and Wiring

Within the set, the components or the way in which they are wired together may be found to be the seat of the trouble. The receiving set may be so operated by one person as to produce anything but pleasing results, whilst under the experienced touch of another more experienced operator, the result may be found to be excellent.

The loud-speaker or headphones may be badly adjusted, reaction used carelessly may, too, be the producer of poor reproduction, but given a set well made, an aerial well erected amidst average surroundings, and a loud-speaker of ordinary price and performance, there is no man or woman who in the course of a few minutes' careful and interested attention to the operation of the installation could not so master its so-called "intricacies" to obtain reproduction of sufficient purity and clarity as to satisfy most critics.

No Adverse Effect

Has the amazing growth of radio adversely affected the gramophone industry? No, I think not. In effect I have been told by folk who are connected with the gramophone industry that the result is the reverse. Most households which contain a wireless receiving set also contain a gramophone. When there is nothing being broadcast and where there is no broadcast item which suits the inclinations of the listener, the gramophone comes into its own by reproducing the favourite harmony—some new piece of music, or dance tune, or some well-known but previously unappreciated melody as heard upon the wireless.

Once heard, and then when the strains have died away into silence, the tune cannot be recalled. Here the gramophone comes into its own again. A record holding upon its waxen surface the tune required is

purchased, and is heard just as often as desired. There we have the combination of the two methods of reproduction. The hearing of a melody through the medium of one provides the other with the opportunity for its operation.

The gramophone has the advantage of wireless in that it can be brought into use just whenever it is desired, whereas wireless items can be received only when broadcasting is in progress. That is true, but on the other hand the variety of music and entertainment obtainable by wireless, the news bulletins, time signals, speeches and performances from restaurants and theatres cannot be obtained without a perfect wireless relay.

Library of Records

In fact, the gramophone, to produce certain symphonies, would need a perfect library of records, whilst news, time signals, speeches, theatre items, would be impossible by any means other than wireless. The atmosphere provided by the audience present in the theatre is also provided, and there again the wireless scores over the gramophone.

So you see, there are " fors " upon both sides of the argument. There is surely no need for controversy and for " versus " in my title. The two arts are separate. Each dovetails perfectly into the other wherever and whenever the two meet.

Finer Reproduction

Wireless can be said to have aided the gramophone to finer reproduction by the provision of rarer forms of reproducing devices to replace and assist the horn. The wireless amplifier has aided the gramophone, too, by enabling vibration of a needle upon the waxen surface of a record to reproduce in terms of audible sound that which previously depended upon the vibration of a diaphragm which caused audible sound within the atmosphere.

What more need be said? The gramophone and radio should surely go forward hand in hand along the roadway which leads to perfect reproduction. Much has yet to be achieved. Perfection is not with us yet awhile. Some day it may be. Until that time, away with " versus."

Let my title stand as it is with a big " and " to act as a link between the two—Broadcasting AND the Gramophone.

An electrically driven sausage machine has been known to cause interference in wireless sets on wavelengths which varied according to the number of sausages per metre.

Things Heard

From Norddeich (KAV)

Music from a new orchestra.

Innumerable women talkers who can talk.

A man learning to count. At least, he repeated " One, two, three," up to ten and back again.

A pianist trying to play. At least, he ran the notes up and down again without any method or reason.

A talk on how to listen-in. (It would have been more effective had it been on how to broadcast.)

From a Restaurant

A crockery crash.

Lady's harsh laugh.

A dog bark.

Oscillation.

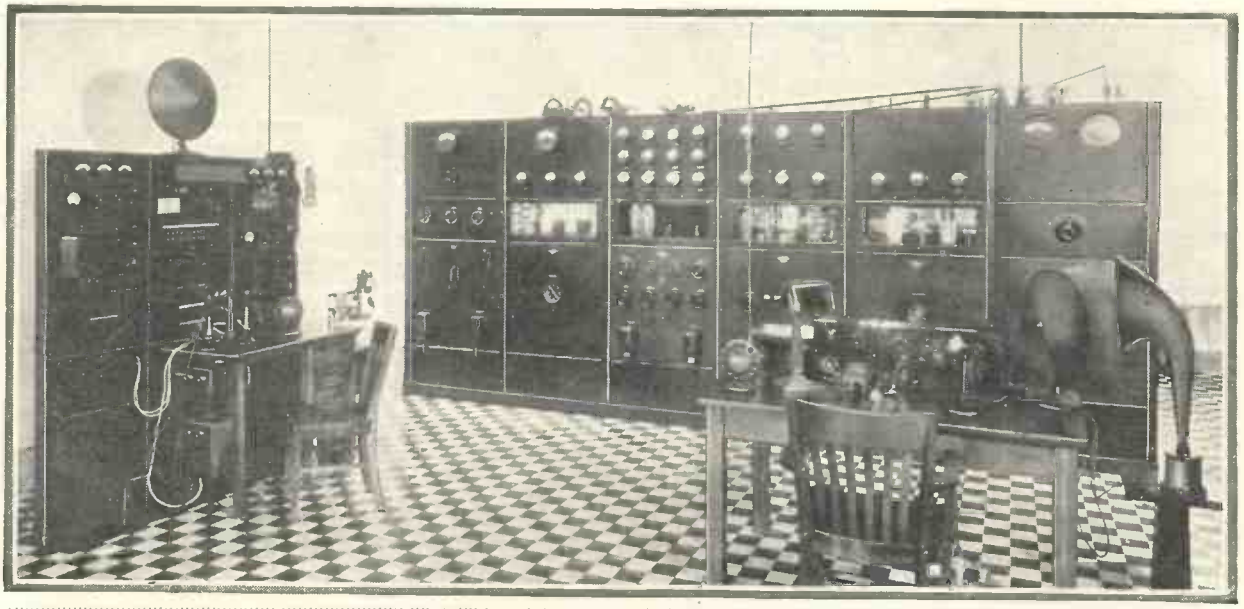
Babel of voices.

A voice, decisively: " All right, but it must not be more than four hundred words." (N.B.—Editors of Fleet Street dailies should not speak so loudly in the presence of a microphone.)

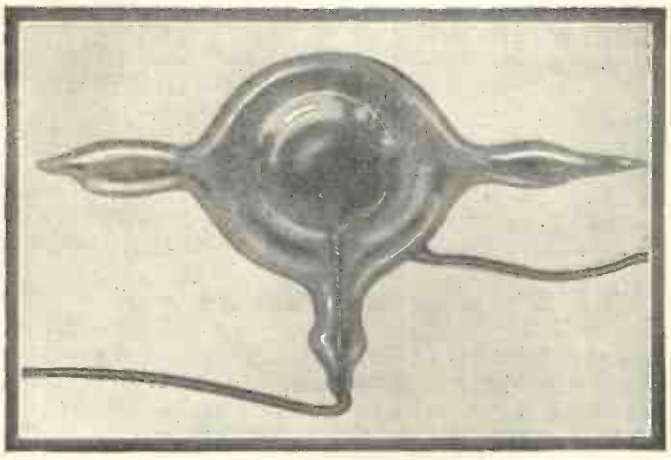
Very loud sneezing.

Uncorking a bottle. No smell came through. E.B.R.

TRANSMITTING ROOM OF WPG—MUNICIPAL STATION OF ATLANTIC CITY



This powerful American station has often been heard on this side of the Atlantic. It is situated on the historical island of Absecon, five miles from the mainland. The absence of skyscrapers, the proximity of the sea and the flat surrounding country all contribute to the excellent reach of the station.



Modern Photo-electric Cell.

WILL SELENIUM SOLVE THE TELEVISION PROBLEM?

An Authoritative Article by
E. E. FOURNIER D'ALBE, D.Sc., F.Inst.P.

IT is now fairly generally agreed among experts that the practical solution of the problem of television is within possibility.

Indeed, the Baird "televisor" is already in operation, and, although the results so far achieved do not come anywhere near the hopes and dreams of expectant radio enthusiasts, it cannot be denied that television is "there" in principle.

Latest Demonstration

Moreover, when on April 7 the American Telegraph and Telephone Co. transmitted a television picture of 2,500 elements from Washington to New York in the presence of some 100 scientific and technical experts and Press representatives, the world was convinced at last that television was a substantial reality.

The method has been worked out by Dr. Herbert E. Ives at the Bell Laboratories, and it implies the successful transmission of 45,000 signals per second.

A photo-electric cell seems to have been used at the transmitting end. In view of the great importance now assumed by all matters affecting television, it is well to examine this matter in some detail.

Transmitting End

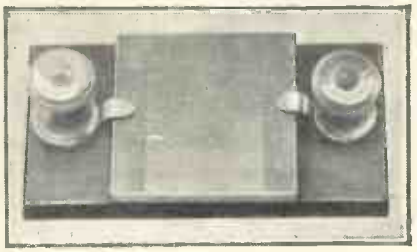
At the transmitting end of a television apparatus there are only two possible elements for translating the picture into electric waves. One of these is the selenium cell, and the other is the photo-electric cell. They are based on two very different principles. Their actions are quite different, and the advantages and drawbacks of each will have to be carefully weighed before a choice is made.

The photo-electric cell is based upon a discovery by Hertz, who observed that a negatively-charged zinc electrode was quickly discharged under the influence of ultra-violet light. This behaviour was found to be due to the expulsion of electrons from the metal into the air around it.

An immense amount of work has been done in the forty years which have elapsed since that momentous discovery, and "photo-electricity" has become a science of great theoretical and practical importance. The quantum on the theoretical side and the valve in the field of practical application are both among the achievements of the new science.

Although television is even now actually possible in practice, it has yet to be developed considerably before taking its place as an everyday phenomenon. In this article a well-known scientist discusses some advantages and disadvantages of selenium and photo-electric cells.

The modern photo-electric cell is a vacuum tube with an inner coating or cathode of one of the metals of the alkaline group—potassium, rubidium, or cæsium. That coating is charged to a negative potential which may amount to several hundred volts. It faces an anode in the form of a ring, which attracts the electrons from the metallic coating without impeding their passage.



Selenium Cell.

Professor Lindemann, of Oxford, has done much to perfect such cells. The performance of a modern photo-electric cell may be gauged from the following table supplied by the makers:—

Volts applied to Cathode.	Current per Metre-candle of Illumination.
40	2.0×10^{-10} ampere
80	3.9×10^{-10} "
120	6.5×10^{-10} "
160	9.9×10^{-10} "
200	14.6×10^{-10} "
240	21.1×10^{-10} "

It will be seen that the current is roughly proportional to the voltage, but the "resistance" diminishes at the higher voltages, just as it does in the case of selenium and many insulators. At any given voltage the current is proportional to the illumination.

Currents Obtained

The cell is provided with an aperture 5 mm. in diameter, and when this aperture is illuminated by a 50-c.p. gas-filled tungsten lamp held at 7 cm. (thus giving an illumination of approximately 10,000 lux), the following currents are obtained:—

Voltage.	Current.
40	18×10^{-8} ampere
80	33×10^{-8} "
120	52×10^{-8} "
160	79×10^{-8} "
200	116×10^{-8} "
240	168×10^{-8} "

Now, it will be seen that with this strong illumination, and the highest voltage applicable without producing a glow discharge, the current is less than 2 microamperes, or the 500th part of a milliampere. But, on the other hand, *this current acquires its*

full value instantaneously, and falls away as soon as the light is withdrawn.

It is this instantaneous response which constitutes the great advantage of the photo-electric cell where quick action is essential (as in television), and seems to place it ahead of selenium and far ahead of instruments depending upon the action of heat, such as the thermopile and the bolometer.

Current Proportional to Light

That the current is proportional to the intensity of the light is another advantage, but this proportionality is not very strict, and in practice it has been found that for quantitative work a secondary standard has to be used, such as a calibrated wedge. In photometry and in the comparison of stellar images the photo-electric cell is used as a null instrument.

Now, any null method requires a sensitive detector for spotting the zero, and for this sort of work the photo-electric cell cannot remotely compare with the selenium cell.

A modern selenium cell, such as that shown in the illustration, has a sensitive surface measuring 1in. by ½in., and a "dark" resistance of 20,000 ohms. With 60 volts it gives a current of 3 milliamperes in the dark. On illumination the current increases in the following manner :—

Illumination in Metre-candles.	Current in Milliamperes.
Dark	3.00
0.0001	3.006
0.01	3.06
1.00	3.65
100.00	5.2
10,000.00	6.3

Useful Comparison

These figures allow us to make a useful comparison between the efficiency of the most modern photo-electric cell and the selenium cell. With 60 volts and 1 lux the photo-electric currents are :—

Photo-electric cell 3×10^{-10} amp.
Selenium cell ... 0.65×10^{-3} ,,

Here the efficiencies are over two million to one in favour of selenium.

With very intense illumination the advantage is not so great. With 10,000 lux we get :—

Photo-electric cell 25×10^{-8} amp.
Selenium cell ... 33×10^{-4} ,,

This, however, still gives a 10,000-fold advantage to selenium.

It is well known that television on the synchronising principle requires extremely rapid signals. As Mr. T. Thorne Baker recently pointed out in *Amateur Wireless* the 100,000 signals per second required as a minimum are perilously near the frequency of the radio transmission itself. The broadcasting frequency is about a million per second, so that each signal would have only about ten vibrations to "modulate." The transmission of television will probably have to be done on shorter waves, which give a higher radio frequency.

If the television signals can be distributed over several different wavelengths or conveyed simultaneously on several different audio frequencies the rapidity can be reduced to 10,000 per second or less. But, whatever happens, it is clear that rapidity of signalling will be of great importance.

Now, the photo-electric cell has a great initial advantage in its instantaneous response. The whole question as to whether selenium or the photo-electric cell is to be preferred for television resolves itself into asking whether the strength of current provided by selenium makes up for the comparative slowness of its reaction.

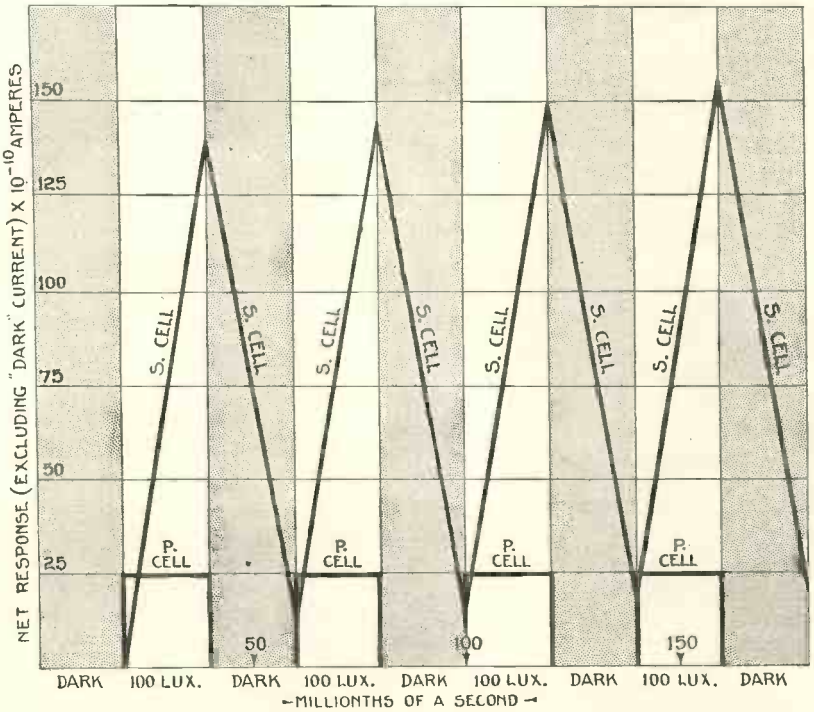
It has often been asserted that there is a "lag" in the response of selenium to light, inasmuch as it takes a measurable time to begin its response. In a recent number of the *Revue d'Optique*, M. André Rio puts this "lag" at "several hundredths of a second." If this were so, it would put selenium altogether out of action for television.

No Lag With Selenium

But it cannot be too often or too strongly stated that *there is no such lag* in selenium, or, at all events, not in a properly prepared selenium cell. That this is so I have proved by a number of absolutely conclusive experiments. In one of these* I exposed selenium to an illumination lasting only one-thousandth of a second as measured by a tuning-fork tracing. The current obtained on a ballastic galvanometer was 20 micro-amperes.

The same fact can be proved even more satisfactorily by exposing selenium to intermittent illumination, as is done in optophone reading. The intermittent light produces a musical note corresponding to the frequency of intermission, and the pitch of the note rises steadily as the frequency increases.

If M. Rio's assertion were true, no note higher than some fifty per second would be heard. Actually,



Comparison of Response of Selenium and Photo-electric Cells to Varying Light Intensities. The zig-zag line represents the response of selenium

* See Proceedings of the Optical Convention, 1926.

Will Selenium Solve the Television Problem?

one hears pitches of at least 5,000 per second in the telephones, and the note is instantly stopped by cutting off the light, as by passing the five fingers of the open hand across the beam. Every finger produces a "click" as it cuts across, however rapidly this is done.

This simple experiment, which has often been demonstrated in public, shows that the sort of lag imputed to selenium by M. Rio and others before him does not exist.

What actually happens is that the response diminishes in amplitude as the frequency increases.

Rapid Response

The response to an illumination of 100 lux is very rapid. It is completed in about half a second, and then amounts to over 2 milliamperes. As we shorten the exposure, we diminish the response. At a hundredth of a second we only get some 50 microamperes, and in a thousandth of a second we only get 5 microamperes. This reduces to half a microampere at a 10,000th of a second. This amount, though still audible in the earphones, is very small. But it is still in advance of the photo-electric cell, and just as rapid.

Shorter Exposures

It is only when we come to much shorter exposures that the photo-electric cell has a distinct advantage over selenium. Thus, with 10,000 lux the photo-electric cell will give a quarter of a microampere in a millionth of a second, whereas selenium, with the same voltage, will only give about a twentieth of a microampere.

The two instruments draw abreast at about a 100,000th of a second, which is just the sort of interval required in television This result is very interesting, inasmuch as it provides us with two entirely different transmitters of nearly equal merit. Any grouping or distribution of the message over several different radio or audio frequencies will, of course, favour selenium unless the number of elements into which the picture or image is divided exceeds 10,000.

The human eye is a magnificent receiver. It has no fewer than 100 million responsive elements. How can we ever hope to satisfy all these as they are satisfied by actual objects?

10,000 Separate Elements

The yellow spot on the retina, which we use exclusively in "looking" as distinct from "seeing," has some 10,000 separate elements, and that is why we must have at least 10,000 distinct signals changed ten or fifteen times per second. But if these signals are "correct"—that is, if each corresponds in degree of brightness to the corresponding point of the original picture or object, the transmission will be practically perfect, though colour effects and binocular vision will still offer tempting problems to inventors in the realm of television.

Defeating Chuffly : : *A Nutshell Novel*

"JAMES, there's a knock at the door."

I rose obediently. I always do when Phyllis tells me to do something.

It was our next-door neighbour, Chuffly, the World's Worst Bore.

"Do you mind, old man," he breathed into my face, "if I listen-in to something on the jolly old wireless? There's a decent item on now. I won't be a second."

It was perfectly true. He wasn't a second. He sat in my armchair and listened to his horrible item. He went on listening for a while and then he began to talk. Heavens, how that man talked! He told us all about Chuffly and the relations of everything to Chuffly. He faded out with the Savoy Orpheans.

That was a month ago.

Chuffly has a catholic taste. He has wanted to listen to all sorts of "decent items" during the last dreadful month. Grand opera, chamber music, variety talks, Albert Hall concerts, and the London Radio Dance Band all came alike to him. He talked as well in one uninterrupted and uninterruptible flow of eloquence. Actually he listened to nothing, and neither did I or Phyllis.

But now I have a sort of feeling that he won't come in again.

The other night he turned up as usual.

"Ah, come in, Chuffly, my lad. I've got a new one-valve circuit I'm trying out. You can experiment with it while I'm doing one or two odd jobs."

Chuffly, I should mention, knows all about wireless. He told us so.

He put the phones on and listened.

"Funny," he said, "there's nothing doing. The valve's alight but I can't hear a sound."

"Perhaps it's not tuned-in," I replied casually, very busy drawing up the fire. "Whiz the condenser round a bit, but mind the reaction."

He did so. There was a beautiful blue flash and Chuffly jumped.

I looked at him sorrowfully and told him all about the many excellences of the deceased valve. It was quite priceless, but seeing it was Chuffly I was willing to take its purchase price—18s. 6d.

Chuffly went to get the money. He is still getting it.

It is comparatively easy to wire a set so that twisting round a knob will short the H.T battery across the filament and blow out a dud foreign valve.

If Chuffly pays one of the hospitals will get 18s. 6d J. A. D

Send in your photographs of the Countryside Four by September 3 !

NEW VALVE MARKINGS

You Can Understand at a Glance

A Special Article of Interest to All Valve Users

By D. SISSON RELPH, of the "W. M." Staff

There is hardly any need to call the attention of valve users to the confusion that at present exists over the various methods of designating their products adopted by various manufacturers. In this article is put forward an original suggestion for sensible markings that could be adopted universally.

ANY amateur who has advanced beyond the stage of merely thinking about building a multi-valve set and who has actually tackled one must be only too well aware of the haphazard way in which valves are at present designated by the various manufacturers. In valve work the choice of the best valves for use in any particular circuit is a matter upon which too much importance cannot be placed and there is a real need at the present time for a system of designation that can be adopted by all manufacturers—not only British, but foreign as well.

Diverse Designations

For some months past the WIRELESS MAGAZINE Technical Staff has, wherever practicable, included a list of suitable valves in its descriptions of receivers. A glance at any one of these will show that valves of the same type made by different manufacturers are indicated by various groups of letters and numerals that bear no relation to each other whatsoever. For instance, in the case of two-volt valves what the Cossor people call a "Red Band" valve, Marconi's and Osram's name DEH210, while B.T.H., Ediswan, Mullard, and Shortpath are B22, DR2, PM1, and SP18G respectively.

Inconvenience

From time to time, suggestions have been made regarding the bringing into use of a series of markings for valves that can be adopted by manufacturers generally. As a result of the present haphazard scheme, which is only logical for valves of a particular make, a considerable amount of inconvenience and loss of time is occasioned both to the amateur and to the trade generally when it is desired to substitute a valve of a particular type for a corresponding valve of a different make.

It requires considerable mental effort even for a man constantly engaged in handling valves of all makes to remember what type of one manufacture is equivalent to a particular type of any other manufacture.

Essential Constants

The essentials of any new system that can be adopted for general use is that it must be simple and sufficiently flexible to cover all types and classes of valves. There seems to be no especial difficulty in arriving at a suitable scheme, for in practice it is only necessary to know three constants in order to place a valve in its appropriate class. These constants are, of course: (1) Filament voltage; (2) Filament current; and, (3) Plate impedance.

There is no difficulty in indicating the filament voltage and consumption quite clearly, and this is already done by a number of manufacturers. Use is made of a three-figure group, the first figure representing the filament voltage and the last two figures the filament current, the arrangement being made in the following way: The current consumption is indicated to the second place of decimals, but when this group is added to the numeral indicating the voltage, the decimal point is omitted. Thus, written out in full, the voltage and current of a particular valve may be 4 and .06. Under the system outlined this is contracted to 406: similarly a valve which takes six volts and .25 ampere is called a 625 valve.

Indicating Impedance

So far so good, but we have yet to indicate the impedance, and here we are faced with a difficulty. If we have the numerals just as they stand we shall have a long and complicated group of figures which may be even more confusing than the present method of employing letters. It has been suggested that combinations of letters should be used to indicate various ranges of impedance. That is all right, but it hardly goes far enough, for in many cases it is desirable to know the actual impedance of the valve without having to look through the manufacturers' lists.

A Solution

A little thought shows a solution of the difficulty and I think that in the scheme I am about to suggest it is possible to designate all ordinary types of valve accurately with the minimum number of numerals, no use at all being made of letters.

If the filament current on the two-figure scheme is placed first and the impedance last the insertion of the filament voltage *in Roman figures* or in **black-face figures** separates the first and last groups without any makeshift and gives an easy means of reference.

Further than this, it is sufficiently accurate for reference purposes to indicate the impedance in units of 1,000. That is to say, if the impedance

New Valve Markings (Continued)

of a valve is 14,000 ohms the group 14 is sufficiently complete for our purpose.

An Original Scheme

Now let me give an example of how I should designate a number of valves under this all-numeral scheme, which, I believe, is quite original. Take a two-volt valve which consumes .1 ampere and has an impedance of 14,000 ohms. This I should designate as a 10 II 14 or 10 2 14 valve. Similarly a six-volt valve taking .25 ampere and having an impedance of 8,000 ohms I should call a 25 VI 8 or 25 6 8 valve.

A further advantage of this scheme is that by indicating the voltage in Roman or **black-face** numerals a two-figure group can be used to indicate the exact filament voltage and not only the value to the nearest volt. That is to say, a valve requiring 3.5 volts on the filament can, under this scheme, be indicated as III V or **35**.

The impedance can also be given to the nearest 500 ohms without difficulty by indicating the 500 as ½ (that is, one half of our assumed 1,000-ohm unit). Thus, if there were a valve taking .1 ampere at 3.5 volts and having an impedance of 9,500 ohms this could quite conveniently be designated as a 10 III V 9½ or 10 **35** 9½ valve.

Criticism

I have discussed this system with a number of radio technicians and so far the only criticism that has been raised is that under this scheme some confusion might arise when the valve is referred to in speech and not in writing. But this surely does not present any great difficulty, for the whole group can quite easily be split up into three parts. Thus a valve indicated in writing as 10 VV 18 or 10 **55** 18 can be split up into the three speech groups "ten," "five five," and "eighteen."

A very slight pause between each group would be sufficient to make the meaning perfectly clear to anybody familiar with the system.

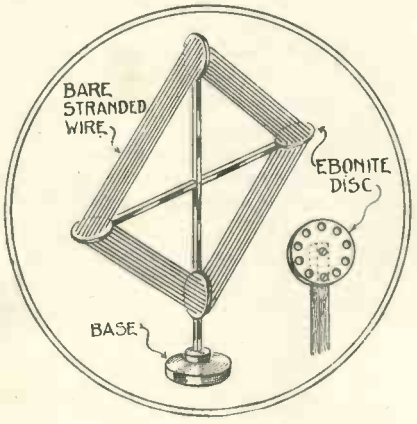
A great advantage that can be claimed for this system over any making use of letters to indicate the best valve for a particular purpose is that the exact impedance is at once known and the only point that arises is that the amateur must learn to recognise a valve's special use from its actual plate-impedance value.

Roughly it may be said that valves intended for high-frequency amplification should have an impedance of 20,000 ohms or more. General-purpose or detector valves may have an impedance between 12,000 and 20,000 ohms, while low-frequency valves, including power valves, should have an impedance below 12,000 ohms. These simple facts will present no difficulty even to the most inexperienced radio enthusiast and once he has learnt to group valves according to their impedance he will find the choice of suitable types for a particular circuit very much easier than when relying upon such designations as "H.F.," "D," or "L.F."

No Serious Drawback?

Perhaps in my enthusiasm I may have overlooked some objection to this scheme, but I hardly think that there is any serious drawback to its general acceptance. However, I shall be perfectly satisfied if anybody can produce a more workable system of designating valves for, to tell the truth, I am rather wearied of the confusion caused by our present medley of "DEH's," "SP's," "PM's," and so on, without end!

Winding a Frame Aerial



EVERY amateur must at some time or other have attempted to construct a frame aerial. In the diagram is shown a simple means of separating the turns; this means that bare copper wire can be used at a proportionate lowering in cost.

At the extremity of each arm is attached a circular ebonite disc, drilled to accommodate the wiring as indicated in the diagram. The distance between the holes can be so gauged that almost any number of turns can be used.

A. P. B.

Your Earthing Switch

IF you suspect your earthing switch of being in the slightest degree inefficient, take my advice, scrap it immediately. You simply cannot afford to take any risks with your earthing switch this time of the year when there are so many thunderstorms about.

Only this morning I examined my own earthing switch and I found it so dirty and corroded with green corrosion that I disconnected it, unscrewed it and took it away to my workshop for a thorough overhaul and clean-up.

Frequent Cleaning

It is really surprising how quickly an earthing switch can get in such bad condition. Four times a year would be by no means too often to clean such a switch.

While my earthing switch is out of action, I am earthing my aerial by connecting the aerial lead-in to the earth lead-in by a length of seven-stranded heavily-insulated cable. I am not sure that I shall not leave this cable so connected when I go away for my holidays. It seems to me as if this cable might be better and safer than an earthing switch. Certainly for a long holiday I would prefer the cable.

AERIAL.

This set is something more than a receiver that will tune to either the local station or Daventry—it will get both simultaneously on two pairs of headphones. It is, in fact, two sets combined in one cabinet, but making use of only one aerial-earth system. Many households have need for a set of this type.

The Two-programme Crystal Set

Something New in Crystal Sets

A Special Set That Will Meet A Great Need Amongst Listeners

Designed, Built and Tested by the "Wireless Magazine" Technical Staff

Receives Two Stations at the Same Time!

NOVELTIES in the design of crystal receivers—apart from the freak productions that are periodically inflicted on us—are few and far between, but in presenting to readers the Two-programme Crystal Set the WIRELESS MAGAZINE Technical Staff believes that it is bringing to their notice something of more than casual interest.

As its name implies, this receiver is capable of receiving two stations working on different wavelengths. "Oh," you will say to yourself, "but a great many 'W.M.' crystal sets are capable of doing that! What is there novel about this one?" And the answer is just one word—*simultaneously*.

Two Sets—One Aerial

Explained more fully the set is really two receivers requiring only one aerial. It has two tuning circuits, two crystal detectors, and two pairs of phones are used, but only one aerial-earth system is required for receiving on widely different wavelengths.

Daventry or "Local"

Thus it is possible (when the receiver is within range, of course) for one member of the family to listen to the local station and another to Daventry without interfering with each other. Or, if they so desire it, both listeners can tune independently to the same transmission.

This very convenient arrangement will, we are sure, be appreciated by a large number of readers who are within crystal range of Daventry and a local station, and it is confidently expected that many of them will build the receiver and put an end, once and for all, to the possibility of wasteful arguments as to which station the evening's amusement shall be taken from.

A glance at the circuit diagram will show that there is nothing at all complicated about the Two-programme Crystal Set. It consists essentially of two straightforward circuits combined with one aerial and earth. Plug-in coils are used so that any desired bands of wavelengths can be covered, both circuits being tuned by .0005-microfarad variable condensers.

Permanent Detectors

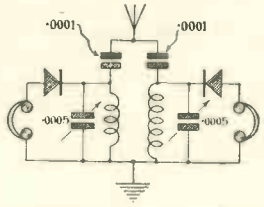
To keep the operation of the receiver as simple as possible, two detectors of the permanent type—which require no adjustment at all—are used, and these are mounted inside.

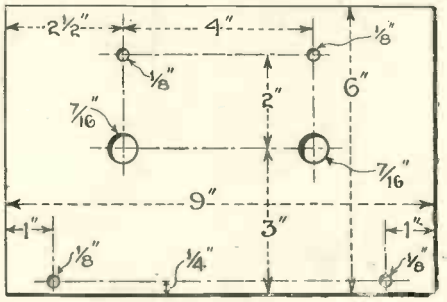
It will be seen from the photograph of the completed receiver that the front panel is particularly imposing in appearance. The other photographs show how simple is the construction.

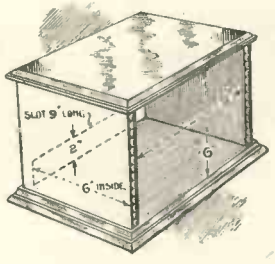
The number of components needed is, of course, double that for the usual type of receiver, but even so the cost

(*Right*) **Layout of Front Panel**

(*Below*) **Circuit of Two-programme Crystal Set**

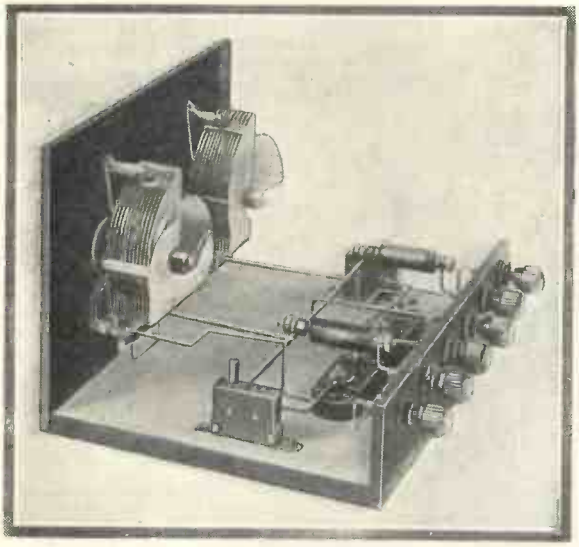






Details of Cabinet

The Two-programme Crystal Set (Continued)



This view shows the simplicity of the Two-programme Crystal Set

is by no means prohibitive. A complete list of the necessary parts follows :

Ebonite panel, 9 in. by 6 in. (Becol).
2 .0005-microfarad variable condensers (Igranic or Cyldon, Dubilier, Peto-Scott).
2 3-in. dials (Trolite or Igranic).
2 single-coil holders (Lotus or Magnum).
2 permanent-type crystal detectors (Griphco).
2 dial indicators (Bulgin).
2 .0001-microfarad fixed condensers (Dubilier or Peto-Scott, Lissen, Igranic).
Terminal strip, 9 in. by 2 in. (Becol).
6 terminals marked : Aerial, Earth, Phones +, Phones −, Phones +, Phones − (Belling-Lee).
Cabinet with 5½-in. baseboard (Artcraft).
6 1-in. brass wood-screws (Economic Electric).
4 ¼-in. brass wood-screws (Economic Electric).
4 ½-in. brass wood-screws (Economic Electric).

It should be noted that the particular components used in the original set and allowed for in the layout are in each case mentioned first.

Full-size Blueprint

Construction of this receiver, although in any case very simple, can be greatly facilitated at the cost of 6d., which is the price of a full-size blueprint layout, drilling guide, and wiring diagram. Ask the Blueprint Dept., Wireless Magazine, 58-61, Fetter Lane, E.C.4, for blueprint No. WM25; it is post free. Although very useful a full-size blueprint is not essential, and complete details (on a reduced scale) are given in these pages.

As only the two variable tuning condensers, which are one-hole fixed, are mounted on the panel there is not a large number of holes to drill—in fact, there are only six in all : two for the condensers spindles, two for dial indicators, and two for screwing the panel to the baseboard.

Terminals

When the condensers have been mounted the terminals should be fixed to the small strip and the latter screwed to the back edge of the baseboard. Next the rest of the components can be laid out and fixed in position.

It is desirable to place two coils in the holders so that these can be placed in such positions that even large coils will not foul the tuning condensers. The crystal detectors are so light that they can easily be held in position by the wiring, as shown in the photographs of the finished receiver.

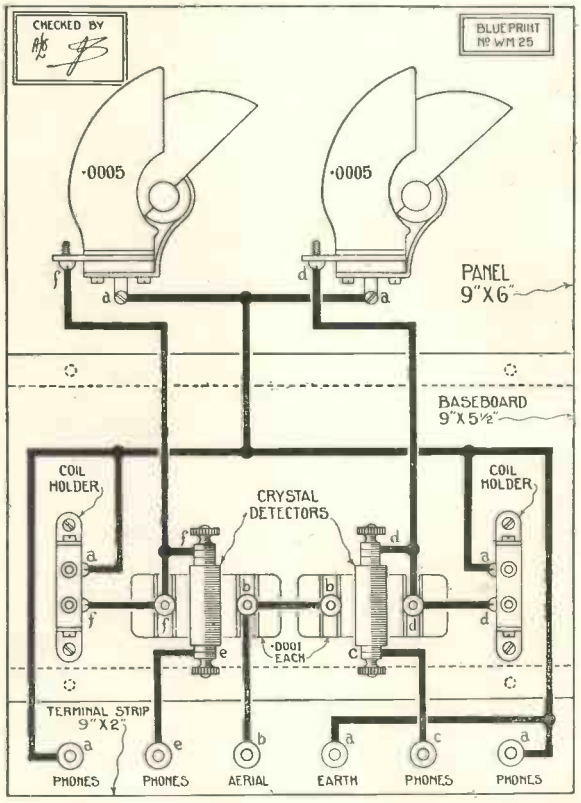
The set is now ready for wiring up. A glance at the wiring diagram, either the blueprint or the smaller one reproduced in these pages, will reveal that each terminal point is marked with a letter of the alphabet—these indicate the order in which wiring should be carried out.

Connecting Points Together

Connect all the points marked with like letters together with one wire or as few wires as possible. Thus first connect together all those points marked *a*; then all those marked *b*; and so on through the alphabet until the wiring is completed.

The operation of the receiver should present no difficulty. Plug into the coil holders a No. 40 (for most stations) and a No. 200 (for Daventry) coil. Attach the aerial, earth and two pairs of phones to the terminals at the back of the set.

If semi-permanent detectors are used pull out the plungers of the detectors gently and allow them to



Layout and Wiring Diagram of Two-programme Crystal Set. This can be obtained as a full-size blueprint for 6d., post free (No. WM25).

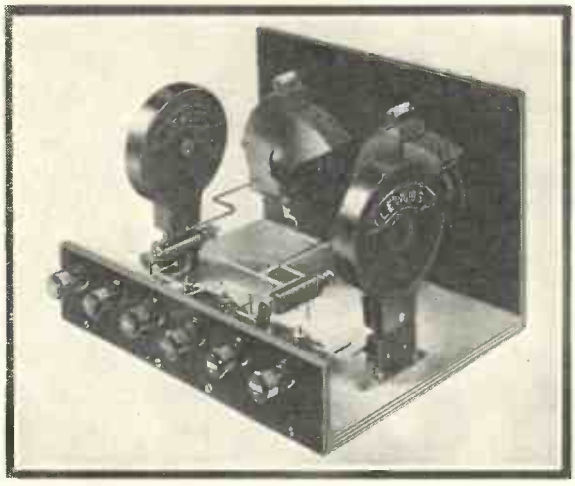
Remember That Full-size Blueprints Are Available of ALL "Wireless Magazine" Valve and Crystal Sets!

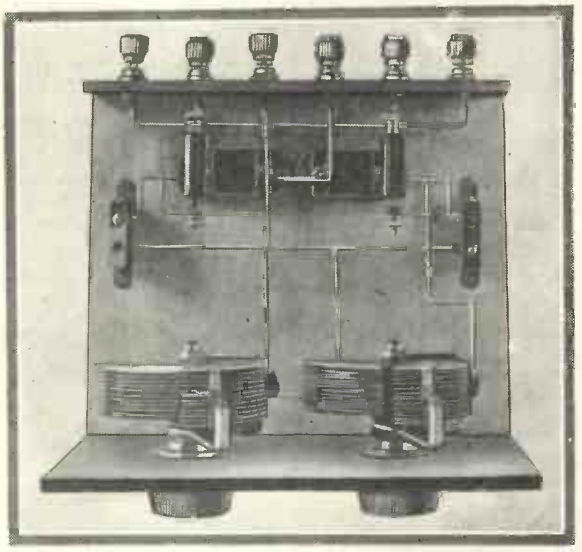
Two Receivers—But Only One Aerial

return into position lightly. This should be enough to set them to a sensitive position, when transmissions from both stations will be received by turning the knobs of the variable tuning condensers.

Reports Welcomed

As always, the Technical Staff of the WIRELESS MAGAZINE will be glad to hear from readers who build up the Two-programme Crystal Set how they like being able to listen simultaneously to transmissions on two different wavelengths, and what results they get generally.





These two photographs of the Two-programme Crystal Set show its simplicity and neat appearance

THE Chicago broadcasting studio, in an attempt to improve broadcast piano music, has installed a piano nine feet long. Of course, in America they have plenty of pianists big enough to play this piano. It is understood, though, that the maker is prepared to fit any of his pianos for export with slider seats.

The Wireless Heroine :: A Record of An :: Actual Conversation !

SCENE.—A suburban wireless shop. An *Elderly Gentleman* is in conversation with a *Bright Lady Assistant*.

◆ ◆ ◆

E.G.: I want a—a (*refers to paper*) —yes, a combined lead-in and lightning-arrester.

B.L.A.: Yes, sir. We can recommend this one. (*Produces one of the spark-gap type.*)

E.G.: Oh, I thought they were more like—well, like this. (*He waves his hands flabbily.*) Anyway, how does it work?

B.L.A.: Well, you see that tiny spark-gap between those points, that leads away—— (*She gives a brilliant description of the gadget.*)

E.G. looks at her with his mouth open; then he says unhappily: "But I don't see it. Why should the lightning go down there instead of along this black rod to the set? I mean, it's not natural."

B.L.A. takes a deep breath and tries again.

E.G.: But it can't be right. It stands to reason, I mean, if the wireless goes one way, the lightning won't go another. Across the air, too! No, my dear, you can't catch me. (*He laughs knowingly.*)

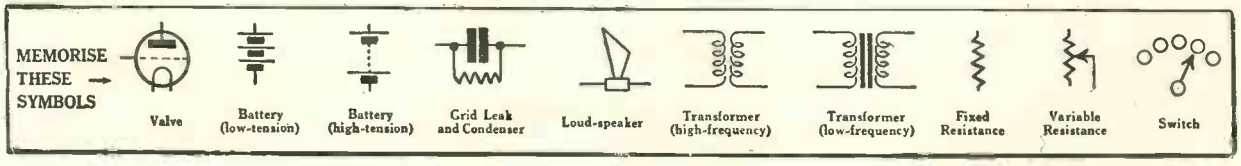
B.L.A. (*with ominous calm*): There's a little leaflet in the box to explain all about it. That might help you, sir. (*She turns to me.*)

Myself: A single coil holder, please.

B.L.A. (*in a weary whisper*): Shall I tell you how it works?

As I closed the door I heard a plaintive voice. "But this leaflet is all wrong. It says just what you say."

I lifted my hat in silent respect and crept away. J. A. D.



Our Programme Ballot!

HAD I guessed beforehand of the discord which would result from the introduction into our peaceful domestic circle of the very latest thing in long-range four-valve sets, I should have remained faithful to a crystal set for the rest of my life.

No Trouble in the Old Days

There was no trouble in the old, halcyon, crystal days. The only station within our range was London. Daventry, even, was beyond our ken, as no one had ever thought of getting a Daventry coil; and so every night we listened in with simple faith and great enjoyment to 2LO.

If we liked the particular talk or piece of music which was being broadcast we listened. If not, we took the headphones off until something more to our taste came on.

But with the loud-speaker came complications. For the first week, of course, we were so anxious to test the paces of our new toy that it would be incorrect to say we listened to any one station at all. Instead, we roamed at large over the British Isles and Europe. Or, rather, Jack did. Jack, you see, is regarded by the family as the wireless expert, and I, his father, am obliged to bow to the communal will and allow him to do all the twiddling of knobs.

As soon as the first excitement had worn off the evil genius of the set began to manifest itself. It started the other Saturday evening.

"Jack, dear," said Doris, my youngest daughter, "*do* let's switch over to Bournemouth to-night. There's just the toppingest dance band at the Winter Garden."

"Have a Heart!"

"Have a heart," broke in Maurice, her brother, who is by way of being a bit of a genius on the piano, "fancy three solid hours of undiluted jazz! Not for this child. How about trying Manchester to-night, Jack? That fellow Moskowiskivitch is giving a Bach recital."

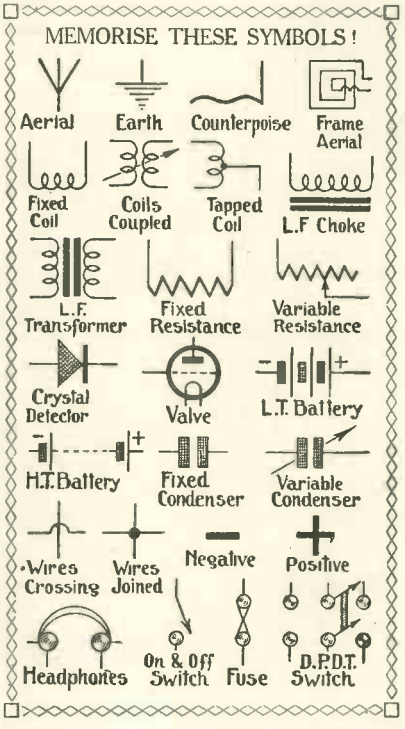
"No fear," replied Jack, 'Bach in large chunks is more than I can stand. What I propose to do is to tune-in to Barcelona at 7.30 p.m. for the weekly Spanish lesson. It will do you all a world of good."

It was high time that I intervened.

"Jack," I said, "you will do nothing of the sort. Please be so good as to get London at once. I am anxious to hear the Presidential Address on 'Bimetalism' at the Meeting of the Institute of Economists."

There was an awed silence for a moment, and then my wife, of whom I expected better things, broke in.

"I don't want to upset your plans, dear," she said softly, "but don't you think that Bimetalism is a little heavy for Saturday evening when all the children are at home? I was about to suggest, before you spoke, that we listened to Birmingham to-



night. There's a very good ballad concert on, and I see from the programme that Mme. Saccharine is giving some of the old-fashioned songs I used to sing years ago."

"Have it your own way," I growled.

And so it would go on, night after night. The only items which satisfied all of us were the news bulletins, though even here the children wanted to switch off while the Stock Exchange prices were coming through. But everything was the subject of a fierce wrangle, with the odds weighted in favour of Jack, who did the tuning-in.

I suggested, as a compromise, that as there were six of us we should each be entitled to choose the programme for one-sixth of the time every evening, but nobody, except myself, seemed prepared to compromise on these lines. We tried each having one evening a week, but that did not work, as the five dissatisfied ones refused to sit in the drawing-room with the loud-speaker and listen to a programme which wasn't their own choice.

Ideal Solution

Things had got to such a pass that I had almost decided to get rid of the set, when I read about the ballot which a London newspaper had just held to decide which were the most popular items in the programmes of the B.B.C. At once it struck me that this was the ideal, or rather the only, solution to the impasse at home, and I lost no time in organising a family ballot.

We decided to classify the items into six groups, and to let everyone cast six votes, to be distributed between the groups according to each person's individual preference. Last night was polling night. The family filled in their papers during dinner, and I was appointed scrutineer.

A Shock

When I opened Jack's paper I had rather a shock. Instead of splitting his votes he had plumped for Spanish talks with his full quota of six. Playing it rather low down, I thought, but as I'd done the same thing myself I couldn't object.

But when I'd worked out the final figures I was filled with a sense of despair. This was how they went:—

Dance Music	6
Ballad Music	6
Speeches	6
Spanish	6
Classical Music	6
Revues	6

I must confess that my faith in ballots is severely shaken. And as I can't see any other way out of the difficulty, I shall be glad if someone who wants a good four-valve set at a knock-out price will apply to me as soon as possible. IRVINE FOSTER.

Half Hours with the Professor

7.—A CHAT ABOUT BATTERIES

"OH, I say, Professor," exclaimed the Amp, "that's no use. Let me have a go!"

The professor looked up gratefully from the box which he was endeavouring to open with little success. Megohm was undoubtedly a wizard in wireless matters, but his magic was not very potent when it came to such things as opening cases.

Superiority

The Amp rapidly had the top off the case and was dipping about inside, rather pleased with himself at being able to show some superiority to the Professor, however slight. He discovered several large box-like looking affairs, which he gave to the Professor. Not knowing quite what they were, he handled them very gingerly, and he was surprised to see the Professor dump them on the table and rip off the paper covering without taking any particular care.

When the covering was finally removed, he was at first a little disappointed to find that they were only batteries—but what batteries! They were huge compared with the batteries that the Amp was used to.

"What on earth are you going to use those batteries for, Professor?" he said.

"High tension, my boy," answered Megohm, as if it were the most normal thing in the world.

Enormous Batteries

"But surely," exclaimed the other, "you don't want such enormous batteries as that, do you, just for the few milliamperes of current that an ordinary receiver would take?"

"Some of the ordinary receivers, as you call them, that we make up to-day, will take as much as a hundred milliamperes of current," came the reply. "That, of course, is exceptional, but I want these batteries for some hard use—they will always have to supply between 20 and 30 milliamperes, and at times will have to supply considerably more for fairly long periods."

"Oh, I see," said the Amp thoughtfully, as he turned this idea over to himself. "Well, won't an ordinary battery give as much current as that?"

"It will, but not for very long, so it is more economical to use a large battery in the first place, which is capable of giving a reasonable current. There is really rather a lot in this question of high-tension batteries, although many people do not realise it."

The Professor was already placing the batteries in a suitable position, and had begun to connect them up to a large experimental set which he had on the bench.

Young Amp watched Megohm in perfect silence and then said:—

"Could you tell me something more about this high-tension battery question, Professor?"

In Scraps

"I will," responded the other, "if you don't mind having it in scraps, because I must get on with this experiment." He looked up with a smile, as the Amp nodded.

"Oh, yes, Professor, please do. I don't want to interrupt you at all if you are busy."

"Very good," resumed Megohm, foraging round for a grid-bias battery, which he finally found tucked away in a corner. "Now this," he remarked as he fitted the battery in place, "is the opposite extreme to the batteries which you have just unpacked. Here the current taken from the battery is nil. The whole object of the battery is to prevent any current from flowing in the grid circuit of the low-frequency valves, so that there can be no current taken from the battery if the receiver is working properly."

"But surely grid-bias batteries give out sometimes, don't they?" interrupted the boy.

"Yes, they do, but it is not because of the current which has been taken from them, but because of a local action which takes place inside the battery. The battery derives its energy from chemicals. Each individual cell consists essentially of a zinc container which acts as one electrode, and a carbon rod which acts as a positive pole, the space in between being filled with a paste of various chemicals, the principal active element in many cases being ammonium choride, or salammoniac, as it is often called."

Chemical Action

"I know," broke in the Amp, "and the chemical action on the zinc provides a current."

"That is true in a sense. Actually there is a potential difference between the carbon and the zinc, and if we connect them to an external circuit then a current will flow, the energy for this current being obtained by the chemical action of the salammoniac on the zinc."

"But does that go on all the time?" queried the boy.

"Not to the same extent," answered Megohm, crossing over to his valve cupboard and taking out some valves. "Due to the presence of impurities in the zinc and the chemicals, there is a danger of what is termed local action, whereby the zinc is attacked by the chemicals even when no current is flowing. Steps are, of course, taken in the manufacturing processes to avoid such local action, but a small amount is always present."

Impurities

"Did you say that it was due to impurities, Professor?" broke in the other.

"Yes, my lad, if the zinc is absolutely pure, the local action is negligible. The zinc is often amalgamated by rubbing it with mercury. The mercury combines or amalgamates, as it is called, with the zinc,

Half Hours with the Professor (Continued)

and this is found to minimise the local action due to the presence of impurities. Nevertheless, there is always a small amount of local action, and if the battery is made up and allowed to stand, it will gradually deteriorate, and in time the zinc will be eaten away without any current having been taken from the battery."

Best Thing to Do

"Then, I suppose," exclaimed young Amp, "the best thing to do is to take a fairly heavy current from the battery before the local action has time to get busy?"

"No," was the reply. "We cannot go to the other extreme in that manner. In the first place, *polarisation* sets in if a very heavy current is taken, this being due, as you probably know, to the presence of hydrogen which forms round the positive carbon rod, and to overcome this, the carbon itself is surrounded with manganese dioxide or some other powerful oxidising agent which is called a depolariser."

"I know," said the Amp, "they put it in little sacks round the carbon rod."

"That is one method," agreed Megohm, with a smile, who had by now finished the external connections and was carefully checking them over in order to ensure that everything was right. "Yes," he muttered to himself, "that is all right. This goes here and that there, and this to that . . ." Here his voice trailed off into a mumble as he satisfied himself that everything was correct.

"Now let me see, where was I?" he remarked looking up once again. "Oh, yes, I remember. Well now, as we take current from the battery, so a definite chemical change takes place in the materials which make up the battery and after a time, when all the material has been used up, the voltage of the battery drops away very rapidly, and it becomes useless."

Voltage Drop

"But," broke in the boy, "I thought the voltage of a dry battery always drops slightly as it was used. Somebody once told me that."

"Yes, you are quite right," replied Megohm, "it does drop gradually from 1.4 or 1.5 volts, when it is new, down to about 1 volt or .9 volt when it has become exhausted. The useful life is practically over when the voltage has dropped to .9, after which the voltage falls very rapidly indeed, and little more can be done with the cells."

"Does the current you take from the battery then have any effect upon the amount of use you can get out of it?"

"Yes, it does, and it is for that reason that there is an economical rate of discharge for any particular size of battery. The greater the current taken from the battery, the less will the life be. If you take a small battery and discharge it at a very heavy rate the life which is then obtained from it will, perhaps, be only one-third of what you would obtain if you used a reasonable discharge such as the battery was designed to supply."

"But at that rate," interrupted the lad, "the less you use the battery, the better."

"Shelf Life"

"No," said Megohm, "I did not say that. There is the question of 'shelf life' to be considered, or in other words, the deterioration of the battery due to local action, which is always going on irrespective of whether any current is taken from the battery or not. Such deterioration takes place while the battery is standing on the shelf in stock, and, therefore, it is often termed as "'shelf life.'"

At this point, the studio was flooded with music as the Professor switched on the set and tuned-in the local station as a preliminary test. Having satisfied himself that everything was in order he switched it off and turned round to the Amp, searching in his pocket for his inevitable pipe.

"Well, that's all right," he remarked in a satisfied tone of voice. "I will carry on with that in a minute or two. To resume our discussion, we have to strike a balance between the 'shelf life' and the rapid deterioration which results from too heavy a load. The balance depends entirely upon the service for which the battery is intended and it is possible to alter the chemical construction of the battery to give different types of service."

"Oh," exclaimed the boy, "that is news to me. I did not know that."

"Oh, yes," responded the other. "A grid-bias battery, as you saw, has to supply no current at all and consequently its life is purely the 'shelf life.' Every effort is made, therefore, in the manufacture to avoid local action as far as possible so that the battery shall give reasonably long service without any current being taken from it at all. With a high-tension battery, on the other hand, we have to allow for a certain amount of current, and there is thus an economical rate at which the most life can be obtained from the battery.

Equal Actions

"This rate is obviously such that the deterioration due to local action, and the deterioration due to the using up of the chemicals, both take the same time. If the local action occurs first, then the battery has become useless before giving the full life which the chemicals could have given, whilst if the discharge rate is too heavy, then the chemicals themselves cannot give such a good life to the battery as they could do if the discharge rate was lower."

"That is very interesting indeed, Professor," exclaimed the boy. "I had no idea that there was quite so much in the design of a comparatively simple looking battery."

"Oh, really it is quite an interesting problem," smiled Megohm, tucking away his pouch in his pocket and proceeding to light his pipe.

"What sort of discharge rates are best, then, with the ordinary types of battery?" asked the Amp.

Economical Rates

"The actual rate cannot be laid down definitely because such a great deal depends upon the amount of use, that is, whether the battery is to be used continuously, or four or five hours a day, or only one or two hours a day. The less the battery is used per day, the greater is the economical discharge, so that the total amount of energy taken out of the battery per day is about the same. That is clear, I take it."

The Amp nodded. "I suppose that is to get the required amount of use out of the battery before local action sets in."

"Quite so," said the Professor.

Some Average Figures

"Well, with reasonable average use we can give some sort of figures for the maximum economical discharge, which at any rate will serve as some sort of guide as to what size of battery should be employed in any particular circumstances. Most battery manufacturers make three sizes of batteries according to the actual dimensions of the cells employed. These are usually called small, large and extra-large, or some such terms. The small-capacity type is really only suitable for one- or two-valve sets, and will handle a current of about 5 or 6 milliamperes satisfactorily. For three-, four- and some five-valve sets, the large-capacity type should be employed, which will give a current of 10 milliamperes without any difficulty.

Large Batteries

"Other five-valve sets, however, take considerably more than this, and for such sets, and for those employing a greater number of valves the extra large capacity type should be utilised, the economical discharge rate for these batteries being 20 milliamperes. This is enough for most practical purposes, and indeed, a set that takes more should be examined rather carefully to ensure that no undue waste of H.T. current is taking place."

"But," broke in the Amp, "what batteries are these that you have here?"

"These are known as the extra-large type," was the reply.

"But I thought you said you were going to take about 50 milliamperes from them."

"That is quite true. I do propose to do so, but not for very long periods, so they will stand up to the job quite satisfactorily. It is the matter I just mentioned—that for short-period work, the discharge rate can be increased considerably."

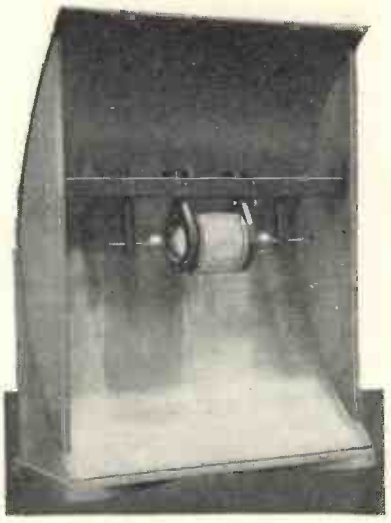
Interesting Points

"I see," said the boy, thoughtfully, "and I must say," he added, "that I have learnt an awful lot to-day. I had no idea that there were so many interesting points about dry-as-dust batteries."

"Good," smiled the Professor. "Well," he went on, "if that is all for the day, I will carry on with this set."

So saying he took a bigger puff at his pipe and switched on the set once again.

Beam Transmission in 1895!



THAT latest development in commercial wireless—beam transmission—is not quite so new as some of us think.

These photographs are reproductions of replicas of a transmitter and receiver with which Senatore Marconi demonstrated the possibilities of beam transmission in Italy as long ago as 1895.

In September, 1896, he confirmed his results officially before representatives of the British Post Office and military authorities on Salisbury Plain.

Neutrodyne Patent

IMPORTANT legal decisions affecting the patent rights of the so-called neutrodyne circuit have recently been issued in the United States. They are the outcome of extensive litigation to determine the respective priority of the Hazletine, Hartley, and Rice patents. The Hazletine inventions relate broadly to methods of stabilising high-frequency valves by feeding back energy from the plate to the grid circuits by means of an inductive coupling in series with a small condenser.

Rice and Hartley Patents

The Rice patent covers much of the same ground, but is of earlier date, whilst the Hartley "oscillator" comprises a circuit arrangement very similar to the others, except that it was originally devised to generate oscillations instead of quelling them. The only difference in practice lies in the size of the feed-back condenser. If the latter is made sufficiently big, the valve oscillates. On the other hand, if it is made small enough to match the inter-electrode capacity of the valve it acts as a neutralising means.

The United States Circuit Court of Appeals has now decided on the one hand, that the Hazletine or Neutrodyne receiver constitutes an infringement of the earlier patents issued to Rice and Hartley. On the other hand, the Federal District Court of New York has granted a decree of infringement in favour of the Hazeltine Corporation against the Grebe Company in respect of the Synchrophase receiver, in which a neutralising coil closely coupled to the plate coil is used to stabilise the high-frequency stages. It rather looks as if still more litigation will be required before the patent situation can be intelligently sized up by the ordinary layman. B.A.R.

Wireless Magazine, September 1927

C. P. Allinson, A.M.I.R.E., Explains the Principles of

Matching Valves for a Super-het

WHILE doing some experimental work on super-het receivers which necessitated the use of three amplifying valves for the intermediate-frequency stages, I found the three in use to be very badly matched, giving rise to various troubles.

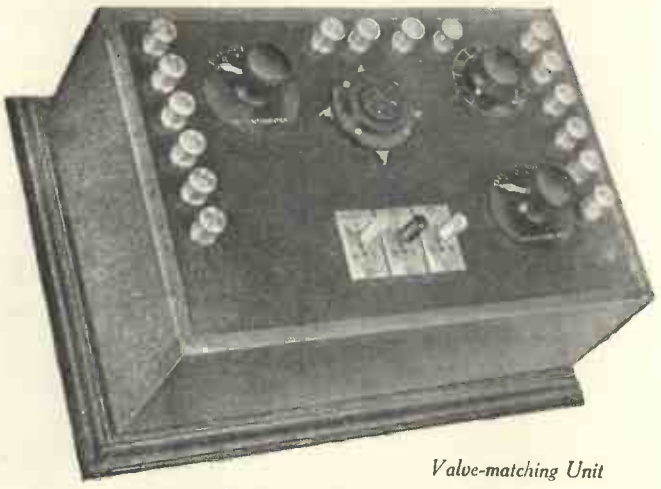
As you know, it is necessary that these valves should not only be matched as regards impedance and amplification factor, but also as regards the value of plate current passed under given conditions of plate voltage and grid bias.

One of the most puzzling faults that can be present in a super-het receiver is when one of the intermediate-frequency stages starts to oscillate by itself at some setting of the potentiometer considerably more positive than that at which the other valves go into oscillation. This gives rise to somewhat peculiar symptoms and utterly spoils the performance of the receiver.

This is one of the reasons why matched valves should be used for the intermediate stages, while it is, of course, important from the point of view of maximum amplification and selectivity that the valves employed should all actually have the values they are supposed to have and which are required in order to get the most satisfactory performance with the particular intermediate-frequency transformers in use.

Exaggerated Need?

I know that many experimenters are of the opinion that the necessity for using matched valves in a super-het receiver, as regards intermediate-frequency amplifiers, is greatly exaggerated, and although this may be true in the case of certain intermediate-frequency transformers, owing to their extremely broad characteristics and heavy damping, it is not the case where highly efficient intermediate transformers, with fairly sharp resonance curves, are being employed.



Valve-matching Unit

Varying Anode Currents

Although it is a fairly simple matter to find valves which are reasonably matched as regards impedance and amplification factor, it was found that the D.C. resistance was greatly different in many cases, so that the anode current given by different values of voltage would vary greatly from valve to valve.

It was also found that with certain makes of valves the required degree of uniformity was not obtainable without carefully testing out the valves which it was desired to use.

It appeared, indeed, that I might have to test quite a considerable quantity of valves before I should obtain three each of the different types with which I was experimenting which would be satisfactory for use.

I therefore determined to make up a small testing unit by means of which the impedance and amplification factor of different valves could be obtained with the minimum of trouble, expense and time. It will be seen from the photograph that the test panel itself is quite a compact instrument and the actual dimensions of the ebonite panel on which the switches and resistance are mounted are only 12 in. by 8 in.

The circuit diagram is shown in Fig. 1, and it should be explained that by the use of two switches, S 1 and S 2, it is possible to vary both anode and grid voltages by a given amount either side of a fixed potential, and this is by far the most satisfactory method to employ where it is desired to test a large number of valves with a reasonable degree of accuracy. The detailed wiring of the switches is shown in Fig. 2, and is the same in both cases.

The only portion of the construction of this unit which took any appreciable time was the wiring up of the Dewar switches. It was necessary to use multi-contact switches of this type, since each switch has not only to reverse the polarity of the bias battery employed, but also to cut it out entirely in the centre position of the switch, and the employment of ordinary double-pole double-throw switches is therefore not suitable for this purpose.

All Voltages Measured

In order that meters could be connected in circuit wherever required, four pairs of terminals were provided so that filament voltage, grid voltage, anode voltage and anode current might be measured.

The actual method employed in obtaining the impedance and amplification factor of a valve was as follows: The valve was inserted into the holder and LT., H.T., grid-bias and anode batteries were connected up. The filament voltage was adjusted to the maker's rating and the anode voltage was adjusted to a suitable value.

This anode voltage could be varied by the anode-bias battery, consisting of 10 volts, which could be connected in circuit either way. Thus, with a fixed anode potential of 100 volts, the operation of the left-hand switch would cause this to become either 110 or 90 volts.

High-frequency Valves

Similarly, a suitable grid voltage was decided upon and this, by means of the right-hand switch, could be varied if desired by any fraction of a volt or any number of volts either

side. In the case of H.F. valves such as were used in my intermediate-frequency amplifier, a fixed grid potential of zero grid volts was employed and this was varied 1 volt either side, or in the cases of valves that ran easily into grid current at a somewhat low positive grid potential, only ½ a volt either side.

The change in anode current per grid volt was obtained, that is, if the grid voltage was varied one volt either side of the fixed potential the change in anode current obtained from the two readings was noted and divided by 2, this giving the change of anode current per change in grid volt. The value of this we may call A.

Calculating Impedance

In a similar manner the change in anode current per plate volt was obtained and this we may call B. Then the impedance of a valve is given by dividing 1,000 by B, while the ratio $\frac{A}{B}$ gives the amplification factor of the valve.

At the same time this unit has many other uses. On one occasion I had a number of valves out of which I wished to select those having an amplification factor above a given value. Now let us imagine that we wish to pick all valves out of a given batch having an amplification factor over 16. It will readily be seen that valves having an amplification factor of this value will give an equal change in plate current when the plate voltage is increased by 16 volts as when the grid voltage is increased by 1 volt.

If, therefore, we arrange for the change in grid voltage to be 1 volt positive and the change in plate voltage to be 16 volts negative the increase in plate current due to the increase in grid voltage will exactly be cancelled out by the reduction in plate current due to the reduction of plate voltage, providing that the valves have an amplification factor of 16 exactly.

In cases where the amplification factor is greater than this value a rise in the plate current will result, but in the case where a valve has an amplification factor lower than the required value a drop will result. All that is necessary, therefore, to make the selection of a valve is to operate the two switches together and all valves which result in a drop in plate current between the two readings being obtained, are rejected.

The unit is, of course, useful also for taking characteristic curves, and once in an emergency it was called upon to act the part of an L.F. amplifier in conjunction with an L.F. transformer.

Next Month's Issue Will Be Full of Good Things—Look Out for A Special New Five-valver!

The New Listener defines an accumulator as a battery, the weight of whose charge depends on the distance from home and the carrying capacity of the carrier.

◆ ◆ ◆

This is one of the many things the Schoolboy Wireless Expert wrote in his summer examination: "In chemistry, Ba is the symbol for the metal Barium. In nature, Ba is the call-sign of the little mutton."

Modernising An Old Set

DURING the last few weeks I have been making use of a three-valve receiver which must be quite four years old. Indeed, some of the component parts of this old and trusty set date back further than four years.

Veteran Set

As I looked at this veteran set the other evening I began to wonder what I should have to do to it to bring it right up to date. In order to fix my ideas, I placed by the side of the old set the modern component parts which would have to replace old component parts in the set to modernise it completely.

By the time I had finished, I had a nice little pile of things on the table by the side of the old set. There were three anti-vibratory valve holders to replace the three old and very crude valve holders in the set. There were two new low-frequency transformers of a type to which I have taken a great fancy.

Condensers and Rheostats

There were also two straight-line-frequency slow-motion variable condensers to replace the old variable condensers with semi-circular vanes. There were three new rheostats . . . . but why go on with it? I think you can see that I might just as well build a new set as try to renovate the old veteran.

By the way, from my list of component parts, can you identify the circuit used in the old set?

AERIAL.

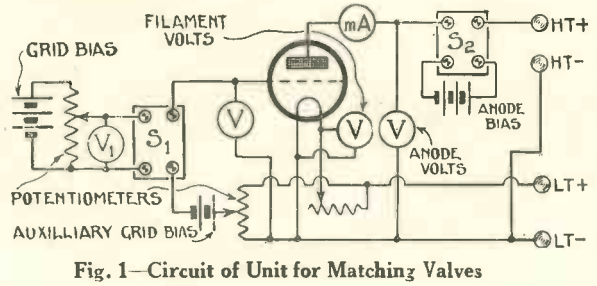


Fig. 1—Circuit of Unit for Matching Valves

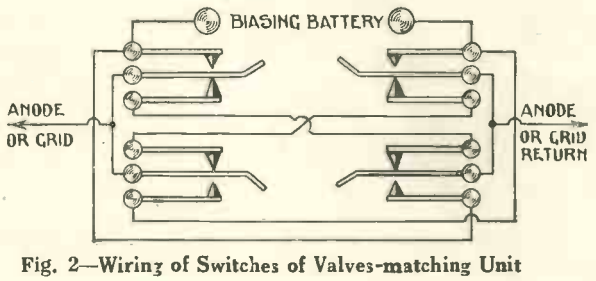


Fig. 2—Wiring of Switches of Valves-matching Unit

Is Wireless Unsociable?

Mlle. Alice Delysia, the famous actress

A Special and Exclusive "Wireless Magazine" Article by that Famous Actress

ALICE DELYSIA

ADMITTEDLY there was a time in the early days of radio, before loud-speakers became as familiar as pianos, when a certain type of radio fiend richly deserved the accusation of unsociability. Every wireless enthusiast—or at least, his wife!—must have met or heard of this strange, unapproachable creature, who was at one time as fruitful a subject for the gibes of the professional humorist and cartoonist as mothers-in-law or penniless suitors.

Cartoonist's Victim

The cartoonist showed him sitting in the most comfortable armchair in the room, earphones apparently glued to his head, and with an expression of ferocity on his face which seemed to dare any other unfortunate member of the family to make the slightest sound or movement likely to disturb the perfect peace and quietness necessary so that he should miss nothing of what he was listening to.

Earphone Fiend

And the comedian told how the earphone fiend would brutally and in an unnecessarily loud voice condemn to immediate silence any friend or relative foolish enough to attempt to get into conversation with him; how his wife and children thereby ran grave risk of becoming deaf mutes through evening after evening of enforced silence; and generally what a danger to the community the earphone fiend seemed likely to become!

He was one of the most unsociable beings on earth, sufficient unto himself, and with a total disregard for the inconvenience he caused to others.

Now although it is true that every dog has his day, it is equally true that his day ends—some time and somehow. The day of the unsociable and self-centred individual described above ended abruptly when loud-speakers were introduced, doubtless by kind-hearted sympathisers with his family, or possibly by some of his victims.

The earphone fiend, although always fairly uncommon, is a legitimate example to be used by those who contend that wireless is unsociable. But he is a dying race, fast being superseded by users of the loud-speaker, and with his disappearance the charge that wireless is unsociable in its effect disappears like mist before the dawn. As a matter of fact, it is not an exaggeration to say that wireless is the most sociable invention of this century.

WHO WAS THAT?

The Editor of the "Wireless Magazine" has made arrangements to assist readers who are in difficulty over the identification of broadcasting stations they receive.

Each query should give as many particulars as possible (such as time, date, wavelength, language, and distinctive call or signal) and should be accompanied by the coupon on p. 175 and a fee of one shilling (postal order or stamps).

Address each query to "Station Identification," "Wireless Magazine," 58-61 Fetter Lane, London, E.C.4.

Look at its effect upon the home!

If there is any place where men and women and children ought naturally to be sociable, and interested in their fellow beings, it is by their own firesides, and wireless is doing more to restore that rather despised institution to the proud position it once held than any other widely held and followed pursuit. There may be fourteen families in a village, but although only one member of each family is really interested in chess or whist or novel reading, it is tolerably certain that every member of every family is to some extent interested in wireless.

Dividing the Family

Dancing, cinema-visiting, increased theatre-going—all are features of recent years, and all tend to separate the members of a household according to their individual tastes and inclinations. Wireless is the one universally enjoyed entertainment which, far from breaking up the home and making the members thereof mutually unsociable, actually draws them together under one roof by the common bond of mutual interest.

The reasons for this are manifold. The various items which nightly issue from the loud-speaker are wonderful incentives to conversation; in fact, the family for whom it cannot provide ready topics for good-humoured discussion must be very hard to please in the matter of things to talk about. After all, the loud-speaker has all the qualifications of the perfect conversationalist. It is entertaining and stimulating, and somehow or other manages at times to interest every possible type of listener.

Prejudice-breaker

Another great point in its favour is that it acts as a kind of breaker-down of prejudices. Before the days of wireless, Mary, an earnest lover of Beethoven, never went out of her way to listen to jazz, and Joan, her sister, who was a jazz enthusiast, could never be persuaded to visit a symphony concert.

Each had her prejudices which wireless has removed, because Mary has discovered that there is, after all, something in jazz, through hearing it whether she liked it or not, and the loud-speaker has revealed to Joan,

pleasantly and easily, that Beethoven has his points as well as Irving Berlin!

And perhaps the most important point in the favour of wireless as a sociability promoter is that it enables people to do one of the things which they most love doing; that is, to enjoy a good thing in the company of others.

Worst Bores

The worst bores on earth are men and women who get so much enjoyment out of a novel that they insist on reading a passage out aloud to anyone who can be prevailed upon to listen to them. Yet the feeling they have is a primary human emotion, the desire to share their enjoyment with others.

You read a particularly good novel, and the first thing you say to your friend is: "Have you read '——'?" He probably replies: "No! But I've just had so-and-so from the library, and it's really marvellous. Have you read it yet?" You would have been happy to discover that he also had enjoyed the book as much as you did, but instead of that, moved by the same emotion, he wants to talk about the latest one he read—the result being a complete deadlock. The only solution would be for you both to read the same novel at the same time, which is difficult to arrange.

Good to Perfect

The one thing necessary to make a nearly perfect entertainment perfect is the knowledge that someone of your acquaintance is enjoying it at the same time as yourself, so that you can exchange impressions afterwards, and while this is a difficult matter with novel-reading and many other forms of entertainment, with wireless it is a simple matter.

This is one of the main reasons why wireless is making the home such a jolly, sociable place. Sociability is not so much a matter of being with a person as of sharing some common interest with that person. Mere nearness to a person does not indicate sociability; it does not mean that you are in tune with that person mentally, as any lover will tell you who has had a difference of opinion with his lass during a ten-mile country tramp!

Because the members of a family live together this does not presume an atmosphere of sociability. This implies common interests—which wireless supplies so admirably.

Then again, sociability is a word which allows of very wide interpretation. There is a wider form of it altogether. Anything which dispels loneliness and a sense of being out of touch with one's fellow human beings is really sociable.

What of the lonely lighthouses, now equipped with wireless so that the inhabitants may feel that they are not completely forgotten by the world? Worse than pain is the feeling of isolation and desertion which illness often gives, and many an invalid nowadays blesses wireless because it enables him to feel that he has not lost touch with the great world. And what of the blind, for whom wireless has meant a greater measure of warm social contact with the world than they have ever known before?

Can there be any doubt in the minds of these people as to the sociability or otherwise of radio?

Alice Delyth

Making a Portable Set Worth While

CHOOSE a number of people at random. Supply them all with sets which as regards design, components, construction and efficiency are identical, and send them away to try out the sets where and how they will. Then get them to report on the results they have obtained.

Dissimilar Reports

If you have expected that all the reports will be similar you will be very much disappointed. Possibly several may have got results which tally fairly well with what might have been expected from a set of the particular type concerned. But you are almost certain to find that at least one or two have obtained results far above the average, while others have found that they could do very little with their sets. If the sets have been portables the results obtained will vary more widely than ever.

This serves to show that the performance of any set, more especially that of a portable set, depends to a great extent upon the conditions under which the set is used and upon the person who operates it. In fact, the personal element plays a far larger part in the success or failure of any given set than most people realise.

Now the additional enjoyment which a portable set can lend to a picnic or ramble has often been emphasised, but no one has yet claimed the trouble of carrying it about to be one of its advantages. This, in fact, must be counted a disadvantage which is to be more than counterbalanced by the pleasure that the set will give when in operation.

Practise Near Home

Therefore, unless it is to be more trouble than it is worth, practise operating your portable set somewhere near home until you are *sure* of being able to get something worth while when you go out into the country. Make a note of the various settings of the controls for the different stations if the set works off a frame aerial. If the set is to be used with an improvised open aerial find the correct coil sizes for aerials of varying length and height, and make sure that you take these coils with you when you go out.

And when you *do* go out on a wireless picnic be sure to give the set every possible chance by being careful to choose a spot favourable for reception. You cannot expect any set to work as well in a thickly-wooded valley as it would on the top of a hill clear of trees.

Improving the Aerial

However, there is no need to go to extreme lengths in this respect, as when conditions are rather adverse this can be counterbalanced to some extent by putting up a really good aerial system. Even should the set have been primarily designed to work from a frame, it is not wise to rely solely on this latter type of aerial. It is quite a simple matter to make provision for either a frame or an open aerial to be used, and a wire slung over the branch of a tree will often prove efficacious when a frame aerial turns out to be inadequate.

Also remember that when an open aerial is used the earth connection is of considerable importance. Quite a good earth can often be formed by throwing a coil of bare copper aerial wire into a handy brook or pond. A useful alternative to this is to lay a length of insulated wire along the ground immediately underneath the aerial.

T. G. M.

Wireless Magazine, September 1927

A Doctor of Science Explains

SIDE-BAND TELEPHONY

How It Saves Power and Prevents Overcrowding of the Ether —and to Some Extent Gives Secrecy

NOW that the Post Office Transatlantic telephony service from the big station at Rugby is in full swing, a little extra interest to the amateur is provided in listening to speech from this station. Some listeners report that speech is excellent, some that it is very gruff or very high-pitched, while others contend that the speech is absolutely and wholly unintelligible. In fact a recent correspondent to the wireless Press has stated that he thinks the Post Office has succeeded in producing an absolutely secret telephony system—so inarticulate are the sounds coming from Rugby.

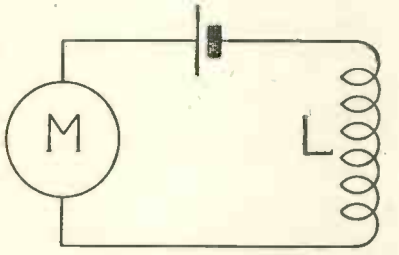


Fig. 1.—Simple Microphone Circuit.

The various results obtained are due to the system used, known as a single-side-band system, and a description of the underlying principles will perhaps help one to understand what is really going on and to appreciate the methods of reception necessary.

Sound Frequencies

It is well understood by most people that when the middle C of a piano is struck there is emitted a sound wave having a frequency of 256 per second. The striking of any other note on the piano will produce a similar wave, but of different frequency. When a word is spoken by the mouth similar sound waves are sent out, but unlike the case of the single piano note, a group of waves of various frequencies and various intensities are set up.

These speech sound waves are very complex and embrace frequencies from about 200 to 5,000 approximately. Intelligible speech can be obtained with a band of frequencies from 200 to 2,500, but for perfect speech an extension of this band as referred to is necessary.

Every time one makes a sound or says a word groups of very complex waves are sent out. If these sound waves are allowed to fall on the diaphragm of a microphone transmitter then the microphone produces varying currents in the coil L, as shown in Fig. 1. The frequency and amplitude of these currents are replicas of the sound waves from the mouth.

Line and Radio Telephony

In the case of line telephony the varying electrical currents thus set up are sent along telephone lines to the receiver, but in the case of wireless telephony, where no such intermediary lines exist, the currents are used to interfere with or modulate a wireless wave that is sent from transmitter to receiver.

In wireless telephonic transmission two things are therefore necessary. First there must be a wireless carrier-wave, and secondly there must be speech currents set up and caused to modulate this. Suppose we impressed on a carrier-wave of 300 metres a note of 1,000 cycles per second. Instead of a carrier-wave remaining constant in amplitude (as it would be before modulation) its amplitude would be increased and decreased 1,000 times per second.

Now it can be shown that this carrier-wave of varying amplitude can be split up into three waves of constant amplitude; this will be better understood by reference to Fig. 2. Fig. 2 A shows the form of the carrier-wave varied or modulated at a thousand times per second. The figures B, C and D show three waves of constant amplitude, but of slightly different wavelength.

Effect of Addition

If these three waves be added together by summing up their amplitudes for each point along the time axis, then the figure like that shown in A would be produced. In other words, it is possible to have three waves of constant amplitude which together are equivalent to the one wave of varying amplitude shown in A.

The frequency of the waves shown in B, C and D are a million, a million plus a thousand, and a million minus a thousand. In Fig. 3 the same idea is expressed in another way. If we have a carrier-wave at A in Fig. 3 modulated by a note of a thousand frequency, then the result is the production of a carrier-wave at A, a wave at B, and a wave at C. The frequencies of the three waves are as shown in Fig. 3 and their amplitudes are constant.

We have already pointed out that spoken words give rise to a complex

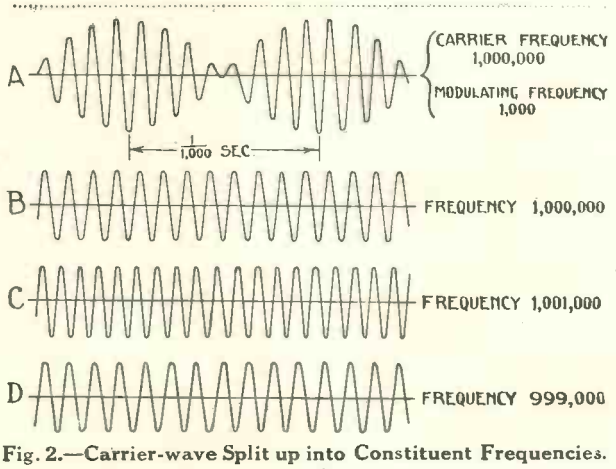


Fig. 2.—Carrier-wave Split up into Constituent Frequencies.

series of frequencies. If such a complex series of frequencies be impressed on a C.W. wave, then instead of producing a central carrier-wave and two side-band waves as shown in Fig. 3, we have produced a carrier-wave and two side bands as shown in Fig. 4.

Impressed Speech Frequencies

Supposing the speech frequencies impressed are of a form shown by A in Fig. 4, then the resultant side bands produced when impressed on a carrier-wave of 25 kilocycles are shown by B and C. It will be seen that the form of C is exactly the same as that of A except that the frequencies embraced by C extend from 25 to 30 kilocycles. In other words, the frequency range of the side band is the same as that of the impressed telephony.

The side band B is the reversed image of A or C. A glance at Fig 4 shows that if telephony be conducted on a wavelength whose frequency is 25 kilocycles, then a frequency-band from 20-30 kilocycles is occupied.

Now since B is the reversed image of C its presence is not necessary for intelligent telephony. Also, the carrier-wave at 25 cycles is pure C.W., and as such is not an "intelligence" carrier, that is, telephony could not be heard by finely tuning to the carrier-wave only. Since the carrier is pure C.W. it is just as easy from the receiving point of view to omit the carrier from the transmitted wave and substitute by a local C.W. at the receiving end tuned to the same wavelength.

Single Side Band

We can thus obtain telephony by sending out one side band only (C in this case) and listening on a receiver provided with a local C.W. signal. The difference between ordinary telephony and single-side-band telephony is therefore simply that the receiver in the latter case must be provided with a local C.W. oscillation which will combine with a single side band and produce intelligent speech.

From the foregoing it will be seen that single-side-band telephony presents advantages over the older and more usual method. Briefly the advantages may be summed up as :— (1) Single-side-band telephony occupies only half the frequency band taken up by ordinary telephony. Stations can therefore be worked with only half the wavelength differences usually necessary between them—thus providing room for more stations in the crowded ether. (2) In ordinary telephony well over half the energy at the transmitting end is used in producing a carrier-wave which does not help in conveying speech, while in single-side-band telephony all the power goes into the wavelengths carrying the speech. This is particularly of importance in the case

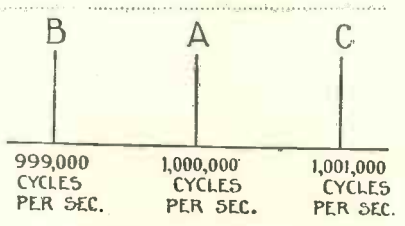


Fig. 3—Modulation of Carrier-wave.

of long-range transmitters where powers of 100 kilowatts and upwards may be used.

At the Receiving End

It is necessary at the receiving end to produce an oscillation which approaches very closely to the frequency of the carrier-wave at the transmitter. If the local oscillation produced approaches too closely to the side-band frequencies then the voice

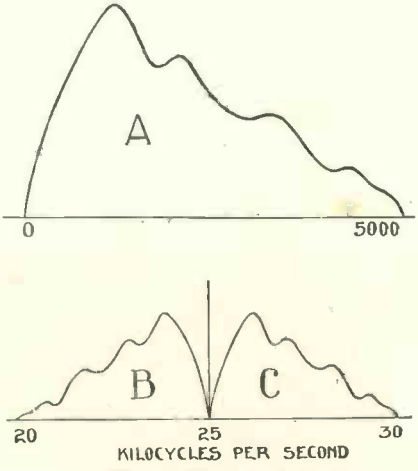


Fig. 4—Wave-forms.

sounds low and guttural. If on the other hand it is too far away from the side-band frequencies the voice becomes high-pitched. In both of these cases articulation is reduced, so that it becomes necessary to adjust the receiver very carefully for good speech quality. It is, of course, also very necessary that the carrier-wave at the transmitter remains very constant, otherwise the good quality of the speech obtained by carefully adjusting the receiver will be lost.

Many people imagined that the side-band system could ensure secret communication between England and America. This, of course, is not so, and anyone can eavesdrop by using a receiver in the oscillatory state. In order to ensure secrecy other methods will be necessary in addition to the use of side bands. NEON.

Praise Indeed!

Comments from America

WE are proud to publish the following comment from the June issue of our well-known American contemporary, *Radio News* :—

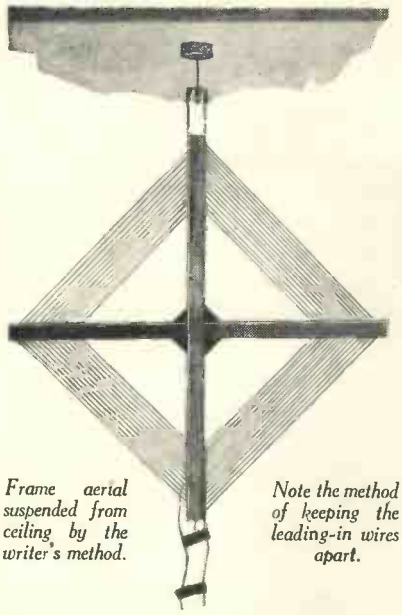
> British broadcasting may be in a terrible mess, but the British radio magazines certainly are not. They are well edited, profusely-illustrated and easily-read publications, containing a wealth of interesting matter. In this number of *Wireless Magazine,* for instance, are articles on a variety of up-to-date radio topics. (A few of the titles follow.)
>
> The magazine also publishes a number of general-comment departments that strongly contradict the erroneous and widely-prevalent impression that the British are humorless, or at least slow to appreciate a joke. Their humor is deliciously subtle, and not at all so extravagant as ours; even the radio magazines show this.

Thank you, American cousins. Now we know for sure there's life in the old lion yet!

Speaking from Denver, U.S.A., a lion-tamer said that although he felt quite bold in a cageful of lions, he was afraid of girls. His wife must have promised to listen-in to him.

It is reported that a well-known wireless transmitter, after eating a portion of "Radio Sponge" cake in a London restaurant, called up the waitress and asked for a little more on the plate.

For certain outside broadcasts, the B.B.C. engineers use, as a wireless link, one of those ultra-short wavelength transmitters which they still keep up their sleeves. A kind of wireless sleeve-link, so to speak.



Frame aerial suspended from ceiling by the writer's method.

Note the method of keeping the leading-in wires apart.

SUSPEND YOUR FRAME AERIAL!

A Simple Method Explained by C. A. OLDROYD

AS our sets become more and more sensitive the frame aerial gains in favour with amateurs. It certainly has some great advantages—it is easily portable, its directional effect reduces interference from unwanted stations to a minimum, and atmospherics as well as "man-made static" are far less pronounced than when a large outdoor aerial is used.

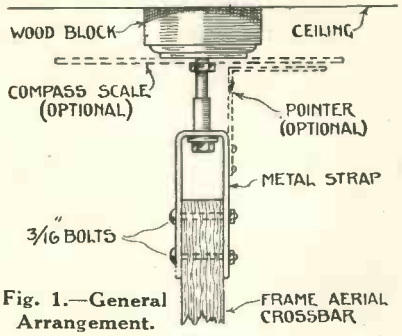


Fig. 1.—General Arrangement.

On the other hand, an efficient frame aerial is bound to be a large affair. Even a frame only 2ft. wide is on the big side for the experimenter's den, and in the average living room it is often difficult to find a convenient corner for the frame, or "loop," as our American brother fans have christened it.

The difficulty of housing a large frame is easily overcome if we suspend the loop. The suspension gear shown in the drawings is arranged in such a fashion that the frame can be inserted in an instant, and removed just as readily when not in use. It swings on its bearing with a touch of the hand, and when once adjusted has no tendency to change its direction. The latter is a point of some importance, for nothing is more annoying than to find that the adjusted loop has shifted from the true direction as soon as the operator gets his hands on the tuning controls of the set.

General Arrangement

Fig. 1 shows the general arrangement of the device. A small circular wooden block as used in electric-light installations is secured to a ceiling beam by two long wood screws. A block of this description can be obtained in every electrical shop for a few pence.

Through a clearance hole in the centre of the wooden block passes a ¼in. steel bolt, about 2½in. long. The shaft of the bolt is plain except for the last ⅜in. which is screwed. Two nuts, one inside the block and one on the outside, fix the bolt securely to the wooden block (Fig. 2).

A fairly thick piece of brass tubing, just wide enough to be a tight fit on the shaft of the bolt, and about ¾in. long, is driven over the bolt right up against the bolt head. If the brass tube should be an easy fit on the bolt it is advisable to fix it in position with a touch of solder at the upper end.

Under the bolt head a cork, rubber or felt washer is glued to prevent idle rotation of the suspended frame. This completes the fixed part of the suspension gear.

Equally Simple

The other section which is attached to the top of the framework is equally simple. It consists of a brass strip about $\frac{1}{16}$in. thick bent to the shape shown in Fig. 1. This strip is attached to the upper end of the wooden cross by two small brass bolts or four short wood screws.

Fig. 3 shows the brass strip developed, as it will appear before bending. It will be seen that it is provided with a central hole large enough to be an easy fit over the brass tube on the fixed part of the suspension gear; from this hole a

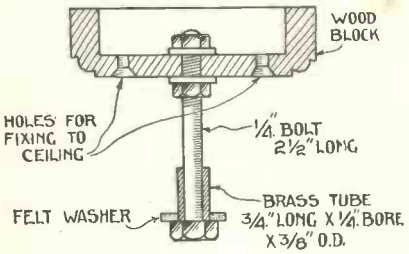


Fig. 2.—Details of Block.

somewhat narrower slot is cut to the edge of the strip. The width of this slot is just great enough to clear the bolt mounted in the centre of the wooden block.

Suspending the Loop

The loop is suspended by sliding the slot in the brass strip over the bolt, holding the frame high enough to clear the brass tube. The loop is then allowed to drop into position, so that the centre of the suspension strip rests on the rubber washer glued to the bolt head.

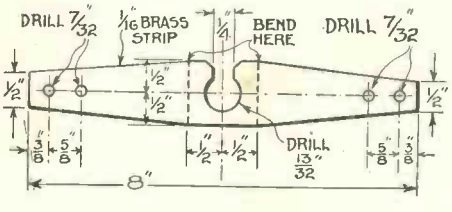


Fig. 3.—Brass Strip.

In this position the loop turns easily on the brass tube as pivot, but the slot proves too narrow to allow the frame to slip off its support.

When taking down the frame, the procedure is reversed; the frame is lifted up an inch or so and then withdrawn sideways. The dimensions given in the drawings are based on a loop framework built up from wood strips 1in. square in section, for a different framework they must be modified to suit. No doubt the experimenter will find some pieces of junk in his scrap box which will come in handy when making the suspension gear.

Although this scheme works very well with a small loop, its advantages over a loop mounted on a foot will be still more appreciated in the case of a large loop, say one of 4ft. side. The space saving effected with a suspended loop will be evident immediately the gear described here is rigged up.

Original Unaltered

This system does in no way interfere with the use of the frame on its original foot as only the upper part of the framework is altered. To show the direction in which the loop points a small compass scale can be fixed to the ceiling block, a pointer is then attached to the metal strip carrying the frame (see dotted lines, Fig. 1). When this is fitted it is not possible to remove the frame aerial from the suspension device.

One point deserves more attention than has been given to it, namely, the manner in which the leads from loop to set are run. A in Fig. 4

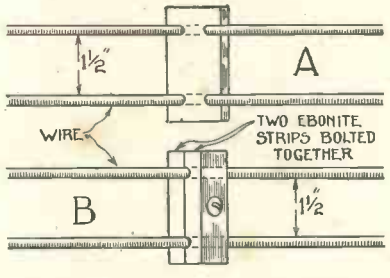


Fig. 5.—Two Methods of Insulating Leads.

shows the *wrong way*; here the leads cross over the set and pass close to the loud-speaker leads, and in this case coupling effects between stages are often produced. They will disappear immediately if the leads are run as indicated in B (Fig. 4), where they are clear of the set.

A frame can only pick up a very small amount of energy on account of its small dimensions as compared with the usual outdoor aerial, and consequently we must do our best to conserve this minute energy until it reaches the set. The leads from loop to set should be separated by a distance of an inch or two; ordinary twisted flex should not be used.

The arrangement shown in Fig. 5 is hard to beat; it can be improvised from scraps of ebonite without much trouble. Here the two leads are held apart by ebonite spacers, the distance between leads is not of great account; 1½in. to 2in. will be ample. The spreaders may be either plain strips of ebonite with two holes at each end (A), or they may be clamps, as at (B).

In the first case the leads are drawn through the holes, the spreaders being about eight to ten inches apart. The second type of spreader is somewhat more difficult to make; each spreader consists of two ebonite strips clamped together by a small central screw. In the inner face of the strips narrow recesses for the leads are filed; the cut need not be deep as it merely serves to locate the lead. The leads are placed in the grooves of the lower piece, the upper part is put in position, the small screw inserted, and a few turns of the nut will clamp the two halves of the spreader together and hold the leads firmly in position.

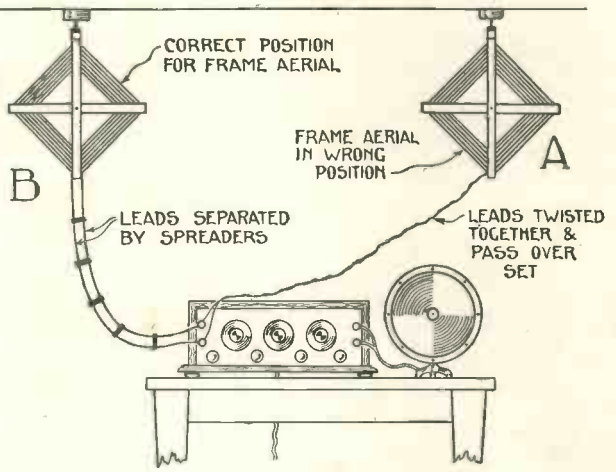


Fig. 4.—Methods of Taking Leads to Set.

Some "speed merchants" may consider these suggestions far too much trouble, but the old hand will agree that for best results we need low-loss not only in the set, but also in every part of the collecting agent, be it outdoor aerial or loop.

Ripples

RECENTLY a woman applied for a summons against some of her neighbours, who were "driving" her mad with wireless waves." The waves must have come from some of the Scottish stations.

THE Committee of the University College of South Wales and Monmouthshire has sent a petition to the B.B.C. asking for a Welsh broadcasting station for Wales. There is a rumour that Bournemouth is to become Dorset and Hull Yorkshire.

AN advertisement in one of the radio magazines describes the boons of a certain three-valve set. It then adds: "Prints and further instructions free," but gives no address. Most of us would object to going to the nearest police station for the free gift.

"MY Pro Gramme" was a printer's error for My Programme. Even then the printer knew that it carried little weight.

AN advertisement in a wireless paper states: "Earth Faults Ended." Has the advertiser an undertaker's business?

AMERICAN stations issue unemployment reports which state where labour is required mostly for the day or week. The result—Mass Move ments.

ACCORDING to the Denver (U.S.A.) broadcasting station, the saxophone is the backbone of the wireless orchestra. Personally, then, as in the case of the breakfast herring, we shall continue to object to too much backbone on the plate.

The Spartans of Sparrowtowne

THAT there would be no "off season" for radio fans this year was a point unanimously agreed upon by our old friends Professor Hiccough and Co. at the twenty-first general meeting of The Society of Radiotricians and Super Inventors at Sparrowtowne, in the quaint little valley of Spouke.

You may remember that the famous S.R.S.I. is no ordinary radio society; each member is a picked super-man—a veritable tiger for brain waves, and should he fail to produce some entirely new radio gadget at least once a month he would be expelled as a malingerer.

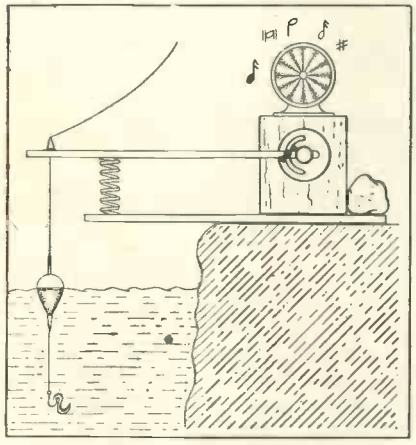


Fig. 1.—The Dingleberry Distortodyne.

The object of this particular meeting was to analyse the why-nots and can-do's of summer-time radio, and the inventions demonstrated by the members had been perpetrated to fit the subject.

Dingleberry's Device

Dingleberry had always been a keen angler as well as a super-radio fan, and at times he had felt himself akin to the fourpenny cork float on his line—a quiet and inoffensive object suspended between two opposing forces—the pull of the unfortunate fish on one side, and the pull of his still more unfortunate self on the other.

Was it true that he was nothing more than a mere float dangling between the strings of two strong passions, radio and angling, being tugged towards one and then towards the other, or tugged at on both sides simultaneously? It was. And so came the great idea: he would roll the two into one and make a job of it.

But not just in the ordinary way; that way was not the Dingleberry way. It must be something which would revolutionise angling as well as wireless-ing. And so it came to pass.

Plank Receiver

You will see the fully developed idea in Figs. 1 and 2, where a special receiver, incorporating capacity reaction, is attached to one end of a plank which extends over the river bank. The large dial fitted to the reaction condenser is provided with a radial slot and a thumbscrew; this forms a locking device for one end of a light wooden lever which is slotted at the outer end to act as a prop, or rest, for the line. A small hardwood stop is placed on the line on the upper side of the slot, this being adjusted as shown, so that the part of the line between the lever and float is fairly taut. A compression spring is placed between the plank and the lever in order to take the weight of the lever, line, float, hook, and worm.

After carefully tuning the set the thumbscrew is tightened, so that when the fish bites as he should do the lever is pulled downwards. This movement revolves the condenser dial sufficiently to detune the set and cause violent oscillations (see Fig. 2),

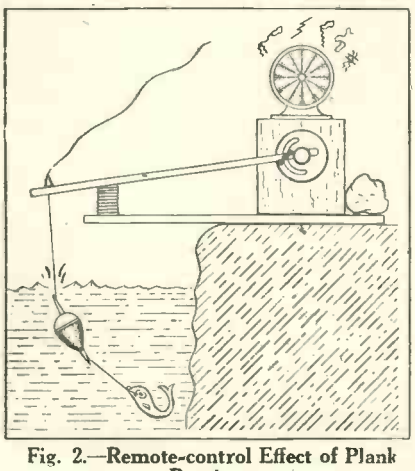


Fig. 2.—Remote-control Effect of Plank Receiver.

and thus every time a fish bites, the loud-speaker emits a warning signal of unbearable shrieks and howls. Dingleberry could sit on the river bank, smoke his pipe, read the paper, listen to a wireless concert, and catch fish all at the same time; he could even doze, or do a little bird's-nesting.

A fish, merely nibbling at the bait, would cause slight intermittent distortion; he would ignore that, and only take action when the fish absolutely *asked* for it, as he is seen doing in Fig. 2. He would then draw in the line, slipping it out of the slot in the lever, and the spring, in returning the lever to its normal position, would set the condenser correctly, and the tuning would be accurate as before. Dingleberry had tested the device under all possible conditions.

Too-sound Sleep

On one occasion he had purposely fallen asleep, but he had slept too soundly, and a neighbour named Hecker-Slea had brought him back to earth by presenting him with a large card which read: "Please unhook it—and HOOK IT."

Curiously enough Clatterton had almost clashed with Dingleberry, for he produced what he called an automatic cut-out alarm for anglers, but where Dingleberry's alarm signal had been an ordinary noise, Clatterton's was an extraordinary dead silence. The device, which consisted of a simple rack and pinion and a small bobbin, was attached to the end of a fairly hefty fishing-rod in the manner shown in Figs. 3 and 4.

The line on the upper part of the float is wound round the bobbin (the latter being integral with the pinion), and the rack is, in effect, the earth spike which makes contact with the water. The earth lead from the set is connected to the top of the rack, so that when the fish begins to throw his weight about, as in Fig. 4, the bobbin is revolved and the rack rises, lifting the earth spike clear of the water, and consequently cutting off the loud-speaker. The professor said he greatly appreciated both efforts, and that the resemblance between the

two ideas merely proved that all great minds think alike.

Boskins then introduced his wireless golf-ball finder (Fig. 5). This, he said, would not only mean the getting of wireless sets out of doors but a drastic change and, incidentally, a great improvement in the design of golf balls. Each ball is fitted with a pair of wings and a small forecastle, the latter accommodating a small but powerful high-note buzzer, which is connected to a small transmitting aerial neatly arranged in one or both wings.

The special long-life battery is housed inside the ball proper, and the circuit is closed by knocking in a pull-push switch which acts as a concussion pin or "war head," for receiving the konk from the player's club. Thus each ball became a miniature broadcasting station the moment it was biffed.

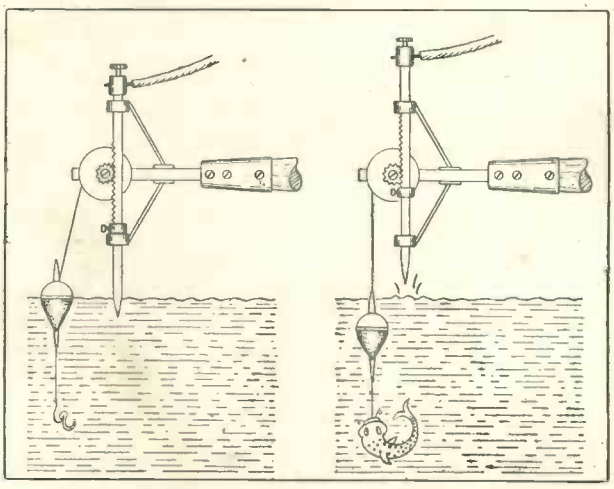


Fig. 3.—Clatterton's Automatic Cut-out Alarm.

Fig. 4.—Showing Fish Unearthing the Receiver.

Caddies were to be equipped with special direction-finding receivers designed for continuous-buzz reception each receiver being mounted on a barrow fitted with a slipper earth contact, as shown in the lower part of Fig. 5. It was then quite a simple matter to keep in touch with any ball during flight, or to track down any ball which, owing to a forced landing, might become stranded in a rabbit hole or under a thicket. The idea was considered a real knock-out.

Formidable Contraption

Then Walloph revealed the formidable contraption shown in Fig. 6, which he called an automatic aerial-earthing switch, the idea being to utilise the forces of an approaching storm in such a way that they (the atmospheric discharges) would automatically operate a special aerial to earth switch.

Electric Charges

It was well known, he said, that when a metal pear-shaped object is charged up electrically, and the point is placed near a metal sphere, a stream of electrons will pass from the point to the sphere. In this case the pear was fed with the oncoming static *via* a large capacity sausage-type aerial, and the accumulation of the charge on the sphere leaked off and actuated the special switch.

Under the sphere is placed an aluminium comb which is loaded with a few hanks of human hair, and one end of the hank is secured to a fine platinum rod. This rod, which is connected to the terminal A1, slides freely in an insulated support, and the upper end is fitted with an insulated cap. Normally, the lower end rests in a small cup of mercury which is connected to the terminal A2.

The aerial lead-in is joined to the terminal A1, and the aerial terminal of the set to the terminal A2. The terminal E is connected to earth; this carries a platinum strip, which is placed immediately above the insulating cap on the rod, and to one end of the comb is fitted another contact strip which is arranged as shown.

Normally, the incoming signals pass to the set *via* terminals A1 A2, but in the case of a hefty discharge of static the accumulations on the charged sphere leak off and charge up the comb. The hair then curls, in semi-permanent wave style, and lifts the rod clear of the mercury cup, thus breaking contact between terminals A1 A2.

At the same time the insulated cap on the rod pushes the strip attached to the terminal E hard against the strip attached to the comb, and thus the whole charge of static is cut off from the set and silently discharged to earth. The hair then uncurls, the rod drops to its normal position, and closes the aerial circuit, and all is ready for the next performance.

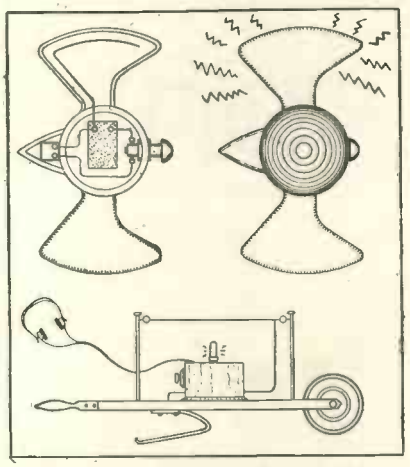


Fig. 5.—Boskins' Wireless Golf-ball Finder.

An actual demonstration, using the laboratory spark coil as an artificial static producer, proved beyond doubt that Walloph had taken the biscuit that evening, and in closing the meeting the professor heartily thanked all members for their efforts, and said he was glad to note that the society was, at last, getting a real move on.

The Big Thing

At the next general meeting he hoped to be able to raise the curtain on The Big Thing—a little contribution of his own which had absorbed twenty-nine years of patient study, whitened his hair, and barred him from joining the Frothblowers. So we may hear more about the S.R.S.I. in the near future.

OSWALD J. RANKIN.

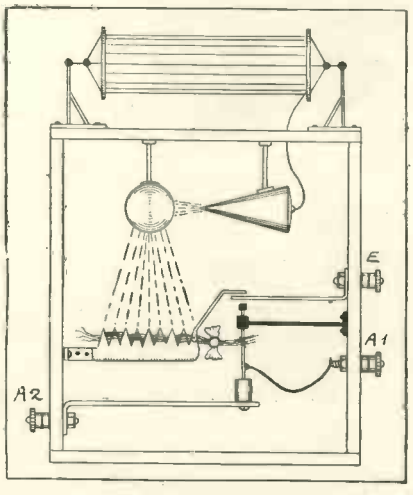


Fig. 6.—Walloph's Automatic Aerial-earthing Switch.

A Special Article by P. K. TURNER, A.M.I.E.E., M.I.R.E.

Don't Let Your Valves Distort!

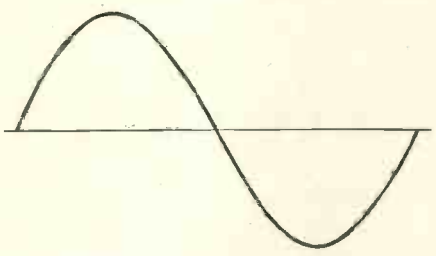


Fig. 1.—One " cycle " of a simple sine-curve.

IN spite of the very large amount of expert attention which has been devoted to this part of the great subject of broadcast reception during the last year or so, the writer believes that there is still a need of rather clearer methods of thinking distortion and dealing with it, and as the point of view now to be developed has been of great assistance to him and many of his friends in getting certainty that the valves themselves are giving pure amplification of the input supplied to them, it has been decided to put it before the public.

Luckily, this can be done in a non-technical manner, which can be understood without difficulty even by those of no scientific training.

What is Distortion?

What is distortion? It consists in the fact that in the case of a distorting amplifier the output current has a wave-shape different from that of the input. If the input is a pure sine-wave, such as would be set up by a perfectly pure musical note—which in turn is an air vibration of *one frequency only with no harmonics*—the output current will contain not only the direct current from the battery and an alternating current of the frequency of the input, but also currents of twice, three times, etc., that frequency, or—another way of expressing the same thing—its shape will not be a pure sine-curve, as in Fig. 1, but some other, such as, for example, Fig. 2, which also contains a third harmonic, that is, current of three times the frequency.

These harmonics are probably the most offensive form of distortion, but are not the only one; another cause is that in some cases currents of various frequencies are not all amplified to the same extent. This especially applies to the low notes, which in many existing sets do not come through at all on the loud-speaker.

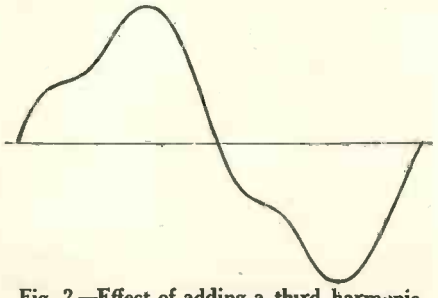


Fig. 2.—Effect of adding a third harmonic to the curve of Fig. 1.

Now, *in the main,* it may be said that the latter form of distortion, which we will call " amplitude distortion," is due to the couplings between the valves, while harmonics are due to the valves themselves. It is with the latter that we will concern ourselves first, for the very important reason that I hope to show that this form of distortion is *totally unnecessary* in ordinary home reception, and can be entirely avoided by choosing the right valves and then giving them a fair chance.

It is only fair to say that the great wireless public of this country has now learned that grid bias is necessary and that the quality of British sets, both commercial and home-built, is probably better than that of most others, but we can do better yet.

When we start in detail to examine how we can avoid distortion due to the valves, we must talk in terms of valve characteristic curves, and I want, if I can, to induce those readers who have hitherto been afraid of these (in the belief that they are part of the high-brow mysteries of science) to get over their fear; after all, a characteristic curve is only a convenient shorthand way of putting down what a valve will do, and it is by far easier than any other form of shorthand I have ever tried!

Valve Curves

Just a word, then, about valve curves. If we light up the filament of a valve in the usual way, and supply grid and anode voltages, but put a voltmeter across the grid circuit and an ammeter in the plate circuit, we find, as all my readers know, that any change in the grid voltage brings about a change in the anode current.

If now we lay out a sheet of paper like Fig. 3, marking values of grid voltage along the bottom edge, and anode current up the middle, we could mark out a series

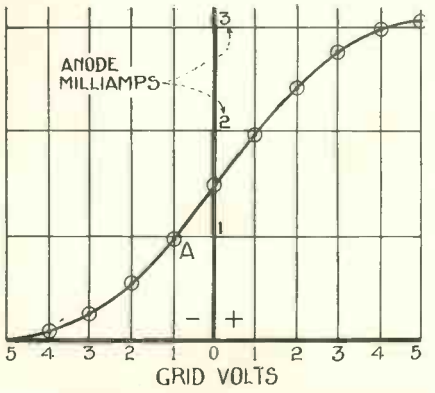


Fig. 3.—Characteristic curve of a valve, showing how, for a constant anode voltage, the anode current increases as the grid gets more positive.

of points, each one expressing the fact that for some particular value of grid voltage we found a definite anode current; for example, point A shows that for −1 grid volt we got a current of 1 milliampere.

Series of Points

Marking a series of such points, all for the same anode voltage (as shown by the small circles), we find that a line can be drawn through them all, which is always of the same general shape; it begins to rise from the bottom in a curve, then runs straight for a bit, then curves over, and finally becomes horizontal or nearly so.

Now if we alter the *anode* voltage we find that the line is almost, if not exactly, of the same shape as before, but is in a different place; if the new anode voltage is higher than the previous one, it will be moved to the left, and *vice versa*. This is shown in Fig. 4, in which the original line of Fig. 3 has been repeated as a dotted line for comparison.

On the other hand, if we alter the filament voltage we find that the curve, though of the same *general* shape, is distinctly altered. If the filament voltage is increased it will be steeper, and at the same time it will rise to a greater height—that is, the maximum anode current is greater. This is shown in the typical example of Fig. 5, where, as in Fig. 4, the original curve is shown dotted for reference.

These lines are the valve-characteristic curves, and it is to be noted that they are still called "curves," even if we only show the straight parts of them.

Current Passing

When, as is always the case with reputable British makers, we can obtain curves of the valves we are using, we are obviously in a position to find out, even without instruments, what current the battery is passing in the plate circuit, provided that the plate and grid batteries are fairly new and giving their rated voltages. But we can do more—we can estimate fairly well what audio-frequency alternating currents are passing, and hence find out whether any distortion we may be getting is due to the valves or not, or, on the other hand, arrange our valve and battery purchases to ensure that the valves *do not* distort.

Suppose that the curve of a valve, with some chosen anode voltage, is as shown in Fig. 6, and suppose that we put a 2-volt battery on the grid, with positive to filament. Then if we draw the vertical AC, and from where it cuts the curve draw the horizontal CB, we find that the steady anode current will be $2\frac{1}{2}$ milliamperes. Now imagine that there is an audio-frequency input to the valve, with an amplitude of 1 volt. Then the net voltage on the grid will vary between −1 and −3, or between D and E. The anode current will vary between 2 and 3 milliamperes; it is as though there were an audio-frequency current of 1 milliampere amplitude as well as the normal direct current from the battery.

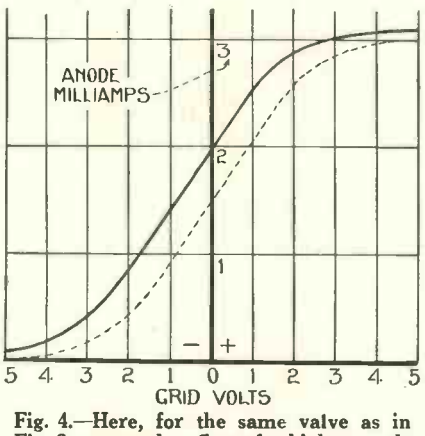


Fig. 4.—Here, for the same valve as in Fig. 3, we see the effect of a higher anode voltage (the curve of Fig. 3 is shown dotted).

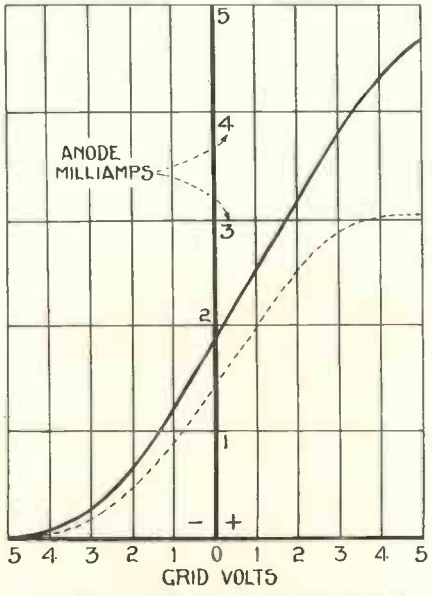


Fig. 5.—Again the same valve as in Fig 3, but now the filament voltage has been increased.

We are now in a position to enunciate the three fundamental points which make for distortionless amplification. We will explain them after we have set them out:—

Long Straight Part

First.—The straight (or approximately straight) part of the curve must be sufficiently long, so that the grid never reaches any part of the characteristic which is distinctly curved. For example, the straight part of Fig. 6 extends from about −4 to +4 volts, and hence no input of more than 8 volts should be applied—we will show later how to estimate the input voltage.

Second.—So much steady grid biassing voltage must be applied that even at its most positive point the grid input voltage is still negative; for example, if the input amplitude is 4 volts, we must have 4 volts of grid bias, so that the net grid voltage varies between −8 volts and 0.

Third.—The characteristic curve must be moved so far to the left (by increasing the anode volts, as already explained) that all the part of the curve between 0 volts and the most negative point—that is, between 0 and −8 in the above example—is straight or nearly so.

But before we can make use of these principles in actual practice we must have one piece of information: we must know what is going to be the amplitude of our input. This obviously depends on the number of valves before the one being considered, and also on the distance from the broadcasting station; and it seems at first sight a most complicated matter to estimate it. For some reason or other it does not seem to have dawned on people that it is quite easy to make an approximate estimate by *working backwards*.

Audio-frequency Voltage

It is a known fact that to operate the usual type of horn loud-speaker of the high-resistance type at comfortable strength in an average room the audio-frequency voltage required in the *anode* circuit of the last valve is in the neighbourhood of 50 volts amplitude. From this we can find, approximately, the amplitude anywhere in the low-frequency side of the set.

All good makers supply information

Don't Let Your Valves Distort! *(Continued)*

as to the magnification of their various types of valve. They usually state that the μ, *or some makers call it the* m, of the valve, is 4, or 10, or 20, or whatever it may be. This means that for every volt of grid input there will be 4, or 10, or 20 volts amplitude in the anode circuit. So if we are using a valve of magnification 5 to operate a loud-speaker, there simply *must* be 10 volts of grid amplitude—otherwise we shall not get enough volume.

Intervalve Transformer

Now suppose that there is a 1-to-3 transformer between the last two valves; this means that the secondary of that transformer is giving 10 volts, so the primary must be working under an input of $\frac{10}{3}$ volts, or say 3 volts, which is therefore the amplitude in the anode circuit of the last-but-one valve.

If this valve has a μ of 10, the amplitude in *its* grid must be $\frac{3}{10}$ volt, and so on. Granted, this method of calculation is an approximate one: different valves—even of the same type by the same maker—have slightly different magnification, we cannot assert that *all* the voltage in the anode circuit gets on to the transformer, and so on: but none the less it forms a sound basis for design.

Now let us try to apply the principles set out above to a practical case. To keep on familiar ground, we will take the favourite type with two L.F. valves, transformer coupled.

From what we have already seen, the last valve will have a grid amplitude of 10 volts if it has a magnification of 5, or 5 volts if its μ is 10. Now if we look at the curves of a few valves, we shall at once find that a "power valve" will be absolutely necessary if we are to keep to our first principle. For, as we have already shown, the straight part of the curve must extend over a range of grid volts equal to *twice* the input amplitude. It will be found that a dull-emitter power valve taking .25 ampere at 5 or 6 volts has a long enough curve—a typical one is shown in Fig. 7.

Now as to the magnification. The valve makers find that as a rule it is easier to get a large proportion of the curve reasonably straight if the valve has a fairly low μ, and for this reason most power valves have a magnification around 5 or 6. "High-μ" valves are to be had, but they are designed for special purposes, and it will be found on examining

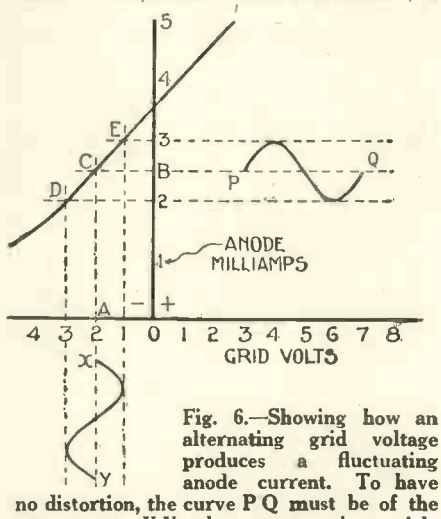


Fig. 6.—Showing how an alternating grid voltage produces a fluctuating anode current. To have no distortion, the curve P Q must be of the same type as X Y: the accompanying article shows how this can be achieved.

their curves that they will not do so well in this case.

The valve of Fig. 7 has a μ of 6.5, and accordingly its grid input amplitude must be $\frac{50}{6.5}$ or say 8 volts. So we need a "straight part" of 16 volts, and we see that this is well within the power of the valve: for example, the curve for 150 volts on the anode is straight enough from −15 to about +6 grid volts.

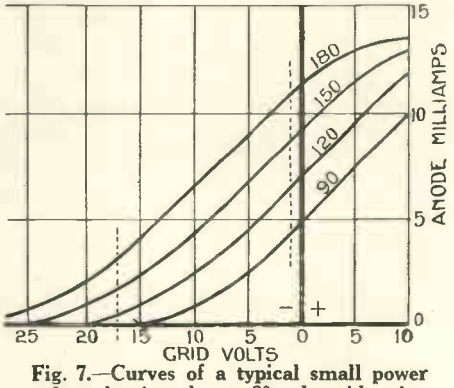


Fig. 7.—Curves of a typical small power valve, showing that a 20-volt grid swing is permissible.

The second principle is quite easy of application: it simply means that in this case we must use not less than 8 volts grid bias. We shall, in practice, use 9 volts, to fit in with the obtainable dry batteries.

The third principle is fulfilled if we make sure that the valve curve is straight from −1 grid volt down to −17, for these are the limits; −9+8 is −1, and −9−8 is −17. Looking at Fig. 7, on which vertical dotted lines have been drawn at −1 and −17 volts, we see that the 180-volt curve is the best, though the 150-volt curve would do.

Now as to the previous valve. Assume that we have a 1-to-4 transformer: then, as the grid amplitude for the power valve is 8 volts, the *anode* amplitude of the previous valve must be two volts. Again looking through makers' valve curves, we find that any ordinary valve will handle this easily, so we can take our choice. Suppose that we pick on one with a μ of 10. Then the grid input amplitude on it will be .2 volt. Thus the bias battery must be not less than .2 volt. Actually, of course, we shall use one cell—say 1.5 volt—and reference to the curves for the valve will probably show that something about 80 to 100 volts on the anode will be sufficient.

The same methods of design can be used throughout, though they need slight modification in the case of resistance-coupled valves.

In Few Words

In a few words, the suggested method of finding the best valves is this: work backwards from the last valve, finding the grid input amplitudes from the known *anode* amplitude in the last valve needed to work a loud-speaker. *First,* choose a valve with a long enough curve. *Second,* use a grid bias at least equal to the grid amplitude. *Third, and not till then,* decide on the anode voltage, which must be enough to give a fairly straight characteristic curve from 0 volt down to *twice* the grid bias.

In this way you will ensure, at any rate, that you are not getting distortion due to the valves, which, in spite of much common talk of to-day, is responsible for probably two-thirds of the unsatisfactory reception that one hears.

Miss Mabel Constanduros, in an Exclusive Interview, Discusses

The Bugginses

ALLOW me, dear Sir or Madam, to introduce you to the Bugginses if you do not already know them. Yet it seems to me you must have met them at some time or other, either at the Zoo, Hampstead Heath or at the seaside on a Bank Holiday.

Poor Poppa!

Surely you will remember Father, tired, hot, his neck constrained in an unfamiliar collar, and tight shoes which do not add to his comfort, walking ahead of his little family, pipe in mouth, and showing by his every movement one desire—that of being home again in the kitchen, in shirt sleeves and slippers; also his wife Emily—a cook-general, I fancy, before she was married—flanked by little "Alfee" in his Sunday best and Emma in a newly starched, but already somewhat crumpled cotton frock, with, when Father cannot be induced to carry it for a spell, the latest addition to the family, "Biby," a child subject to many tribulations, one of which is an unpleasant habit of coming out in spots, without the slightest provocation.

Grandma

To these you must add Grandma, stiff, in a faded black dress, and wearing on the top of her head a small bonnet trimmed with bright flowers. Equally hot and bothered whenever you have met her, she brings up the rear, muttering at odd moments in that pale toneless voice always associated with elderly females suffering from acute deafness.

These are types with which, without doubt, you are familiar, and if you are a listener on many occasions you will have followed their adventures with considerable interest.

Personally, I cannot believe that the Bugginses are not to be found in the local directory, for, mark you, I have assisted at the purchase of Grandma's bonnet; I have followed them in their various outings; I have even accompanied them to the photographers when they wanted a family "group took," and in confidence I may add that I was actually present when the old lady mislaid her guinea set in the scullery sink!

Miss Mabel Constanduros, author of the delightful Bugginses, well-known to many listeners.

The Bugginses! How many times have you seen this name on the B.B.C. programmes? They have become a household word. Who are they? This was the first question I shot at Miss Mabel Constanduros, when I recently met her at Savoy Hill.

How They "Growed"

"The Bugginses? A figment of my imagination. They came from nowhere; they 'growed' like Topsy. From a small beginning they gradually developed; members of the family were added as sketches called for them. Mrs. Buggins was the founder of the family. I regard her as the typical wife and mother of the working classes; over-worked, but indomitably cheerful and kindly. As to Grandma, well, I invented her as the most aggravating character I could conceive. The other members of the household are merely designed as a foil to bring out the characteristics I most admire in Mrs. Buggins."

"And Father?"

"Father is just the husband. There are three children—Emma, Alfred and Baby."

"Is it a fact that you write all your own sketches?" I queried.

Always Scribbling

"Most certainly. Ever since my early school-days I seem to have scribbled at odd times; the theatre appealed to me. I always had an idea I wanted to be on the stage. I can remember an incident which occurred when I was barely seven. My mother found me in an empty pavilion at Southsea, performing to vacant chairs, and I was only recalled to myself by the applause of two men who had stopped to listen. They seemed to be amused by this juvenile play-acting, and one patted me on the head and said that my imitations had greatly impressed him. But I was dragged away by my mother, smacked and put to bed."

A Merry Twinkle

I looked at Miss Constanduros; she is quite a little slip of a thing to-day, and what struck me most was the remarkable way in which her face lit up when she was speaking to me. She has a merry twinkle in her eye and that humorous expression about the mouth which so greatly helps a *raconteur* in putting over a witty joke. Whilst she was telling me the story of the Bugginses, one could see that they were dear to her—that, in fact, she was actually living their respective lives. They may be creations of her own brain, but to her they were in reality creatures of flesh and blood and very human at that. I took out my note-book in a very business-like manner.

"When did you first broadcast?" I asked.

"On Monday, March 2, 1925, if you please, sir," she quickly answered.

The Bugginses (*Continued*)

'Choosing a hat for Grandma' was the subject of the sketch, and I was told I had received more letters of appreciation from listeners than anyone else during that week."

"With the result?"

"That I was immediately engaged for the first Radio Repertory Company, and took part in several one-act plays."

"But how came you to broadcast?"

At Savoy Hill

"I really do not know. I had no idea there was any market for my peculiar talent, but went up to Savoy Hill just because a friend asked me to do so. I was so terrified at my audition that I literally had to go straight home to bed afterwards. I never dreamed that the B.B.C. would want me again. My first broadcast was no less terrifying, and I shall always be grateful to Mr. Hibberd, who was the announcer on that evening, for his kindness to me. Do you know, during my performance before the microphone in that empty room, he greatly encouraged me; I believe that he even smiled once."

"And the Bugginses were well received by the listening public?"

"Yes, they caught on, almost immediately. I have received hundreds of letters, some amusing, some pathetic. On the occasion of Grandma's birthday party, when the old lady mislaid her false teeth, two apparently unwanted sets were sent to me at 2LO. A lady also wrote after one of my broadcast sketches, asking whether she could be baby's godmother, so the latest arrival was named after her. You can hardly realise the extent to which the public will write to artists they have heard over the microphone. Would you believe that I have letters from people with a request for a copy of my original sketches and that most of them do not even include a stamped envelope for a reply?"

By a stroke of luck, my reference to Aberdeen passed unnoticed.

A Charming Note

"Many letters I greatly prize," continued Miss Constanduros. "A man once wrote me a charming note saying that I had helped him to recover from a severe operation; another, from a hospital, very quaintly told me that I had very nearly made him burst his stitches!"

"Love letters?" I queried, looking up from my note-book.

"None to speak of," she replied with a laugh," but a man at Bournemouth once stopped me in the street, and told me he loved me—only my work, of course."

"But where do you get your copy?"

"Everywhere—in the buses, in the trams, in the streets. I take a lot of trouble over my work. I am even contemplating a special trip to France, because I want Grandma to 'set' her foot on foreign soil."

"I can hear her say," I remarked, "that she 'don't 'old with those French people'! I take it that you have had professional training?"

"Yes, I stud ed at the Central School of Speech Training, Albert Hall, and under Miss Kate Rorke."

"Are all your monologues still in manuscript?"

"Not all. Some of them have been published, as well as two one-act plays. In my spare time—of which I now have but little—I still write short stories, poems and songs; I have also taught elocution."

"Do you like broadcasting?" I asked.

"Yes, but it is a great strain. To hold the interest of listeners, I am compelled to write new sketches for each one of my engagements. Is there any other artist who has broadcast so much new and original material? I think not, except perhaps John Henry. Then again, the B.B.C. has grown into such a big organisation. When I first went up to Savoy Hill, the whole concern was so much smaller than it is now. One misses the personal touch which existed in the old days, and newcomers to-day must find in the studio a very depressing atmosphere in which to work."

"For this reason, do you prefer the concert platform?"

Wireless Friends

"I hardly know what to reply to such a question." Miss Constanduros paused for a few moments, then added: "You see, broadcasting has brought me into touch with so big a public that, generally speaking, in a hall I feel now that on every occasion I have wireless friends in front. My most wonderful audience in my early days—my first appearance was at a C.A.A. concert, at which only professionals were present—was Haydon Coffin. He stood right up and clapped me, a great compliment to an amateur. It was while at a concert that Rex Burchell, a regular B.B.C. artist, met me and begged me to make use of my funny talent. He added that I had made *him* laugh, and he had been in the entertainment business for years! He assured me that I was good enough to try my luck professionally; I always consider him my radio godfather."

At that moment we were interrupted; Miss Constanduros was warned that the presence of Mrs. Buggins would be shortly required in studio No. 4.

A New Character

"Do you know 'Ag?" she queried as she rose from her chair.

"No. Any relation to Gog and Magog?" I replied.

"'Ag? She is the daily girl, a plain but affectionate creature, dear to my heart. For some reason the Powers That Be do not seem to take kindly to her though I know she is my best character. Perhaps one day they may relent, and then . . ."

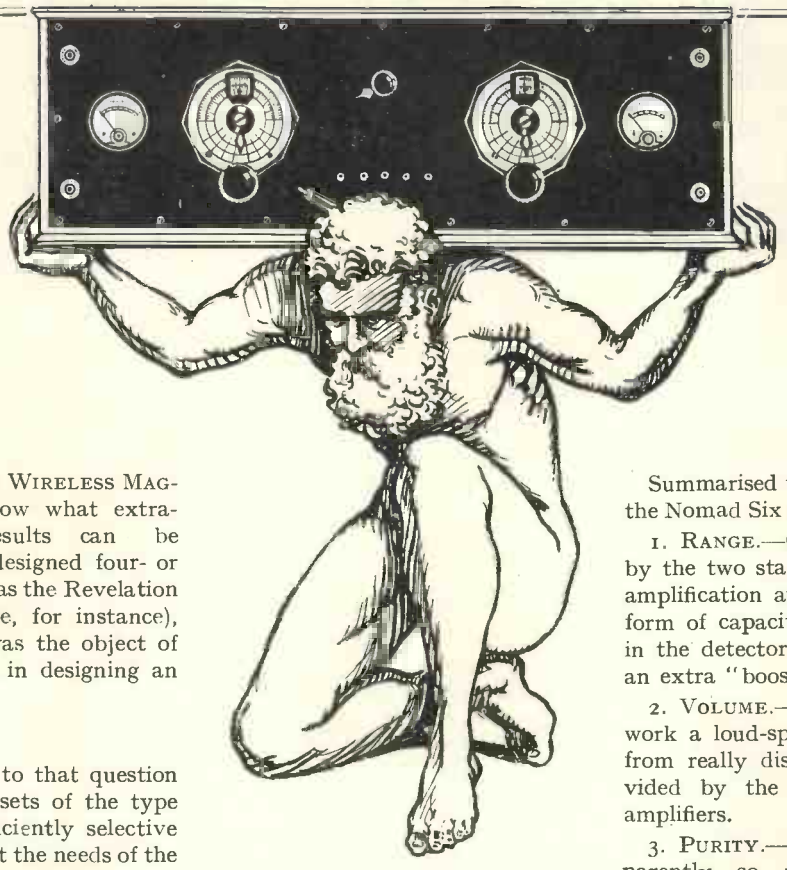
But the broadcast listener may not be kept waiting, and the announcer dragged her away.

Believe me, I knew nothing about 'Ag, and I am watching the programmes.

For Loud-speaker Reception of Really Distant Foreign Stations Build

The Nomad Six

A "De Luxe" Receiver for Range, Volume and Purity



Specially Designed, Built and Tested by the "W.M." Technical Staff

READERS of the WIRELESS MAGAZINE who know what extraordinary good results can be obtained with well-designed four- or five-valve sets (such as the Revelation Four and 1927 Five, for instance), will wonder what was the object of the Technical Staff in designing an elaborate six-valver.

Elaborate Set

Well, the answer to that question is easy. Although sets of the type referred to are sufficiently selective and powerful to meet the needs of the average listener there is a demand also for a most elaborate type of receiver, embodying the best refinements with practically no limit as to cost, and capable of bringing in long-distance transmissions at really good loud-speaker strength and with the greatest purity that can be obtained.

Straight Circuit

In the Nomad Six—the new WIRELESS MAGAZINE six-valver—we believe that we have produced a receiver that for range and volume is almost unbeatable, no matter what number of valves may be used. Following standard WIRELESS MAGAZINE practice the circuit employed is quite straightforward and the "de luxe" qualities of the set are obtained by using the best components available, and arranging them in the most satisfactory way.

Actually the circuit includes two stages of neutralised high-frequency amplification coupled by means of screened split-primary transformers (both stages being tuned simultaneously by means of a gang-control condenser); a detector valve working on the leaky-grid principle; a single stage of resistance-coupled low-frequency amplification; and a final push-pull transformer-coupled stage employing two valves—a powerful combination that ensures extraordinary range, volume and purity of reproduction.

Additional Refinements

Additional refinements are an arrangement for checking the filament voltage of each valve—to ensure that each is working at the best point on its characteristic curve—and a mil iammeter in the final output circuit to produce a ready means of ensuring absolute purity of reproduction without the necessity of relying upon the ear as a guide.

Summarised the chief points about the Nomad Six are :

1. RANGE.—Great range is ensured by the two stages of high-frequency amplification and the inclusion of a form of capacity-controlled reaction in the detector-valve circuit to give an extra "boosting" effect.

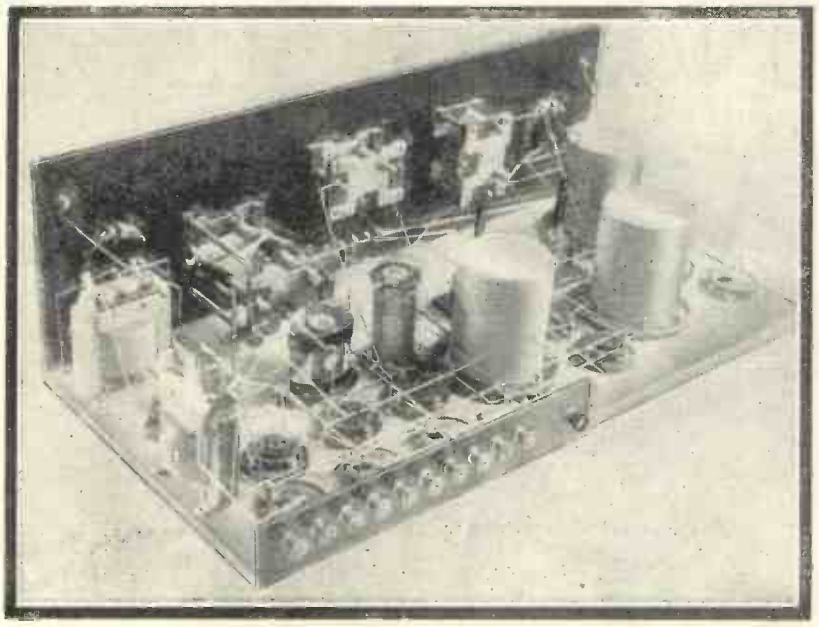
2. VOLUME.—Sufficient strength to work a loud-speaker at full volume from really distant stations is provided by the three low-frequency amplifiers.

3. PURITY.—Although there is apparently so much low-frequency amplification absolute purity of reproduction is obtained by using a stage of resistance-capacity coupling, followed by a stage of push-pull transformer coupling, which gives equal purity to a resistance-coupling, but with greater volume.

4. EASE OF CONTROL.—Only two tuning condensers have to be operated in order to tune this receiver, the reaction condenser being left untouched during tuning once it has been roughly adjusted. Both the main tuning condensers are provided with special vernier dials on which the loggings of stations can be marked in pencil.

5. WAVELENGTH RANGE.—As use is made of manufactured coils, there is no difficulty about obtaining aerial tuners and high-frequency transformers to cover both the lower and upper broadcasting bands of wavelengths.

The Nomad Six (*Continued*)



The Nomad Six has a neat lay-out

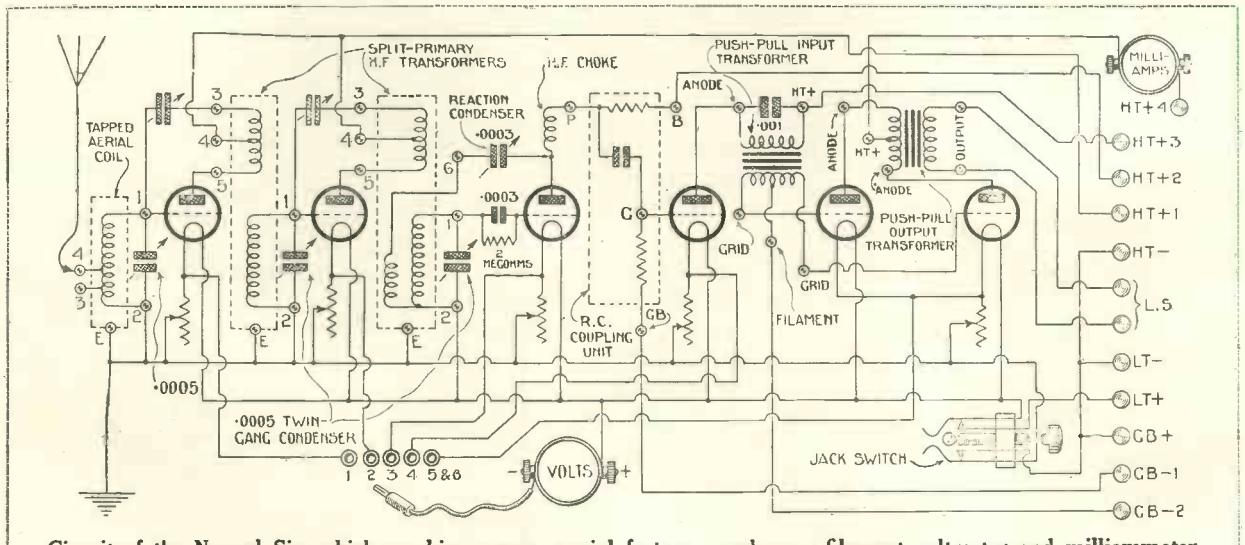
6. EXACT VALVE ADJUSTMENT.—Until batteries get quite old the voltages of the various tappings are more or less accurate within quite narrow limits, and no difficulty presents itself in applying the recommended grid-bias and anode voltages to the valves used. Filament voltage is more difficult to adjust in the ordinary way, but in this receiver individual control is provided for each valve, and the actual voltage applied across each filament can be read quickly on a meter by means of a handy plug-and-socket switching arrangement.

7. DISTORTION MADE VISIBLE.—Although the low-frequency couplings used in this set cannot cause distortion, the valves may do so if they are not working on exactly the right parts of their characteristics. An additional check is provided, therefore, in the form of a milliammeter in the final output circuit. Unless the needle of this instrument gives a fairly steady reading and does not jump about, the receiver is distorting although the amount of distortion may not be bad enough to be perceptible to the ear.

8. ANY VOLTAGE VALVES.—As each valve filament is controlled individually by a separate rheostat, the voltage of those in use is of little account except for the necessity of making a slight re-adjustment of the rheostats when a change-over is made. Therefore, the set is equally adaptable for use with 2-, 4-, or 6-volt valves.

9. SIMPLE AND EFFICIENT LAYOUT.—In spite of the circuit being somewhat elaborate the layout of the actual components is simple enough as can be seen from the photographs. It might be thought that some of the leads in the high-frequency circuits are rather long, but the constructor will notice that they are well separated, and in practice the final layout adopted have been found to give excellent results.

10. FINE APPEARANCE.—The front of the set has an extremely neat and pleasant appearance. In the centre are the reaction condenser knob, and the plug and sockets for measuring the filament voltages. Of the two vernier dials that on the left operates the aerial-tuning condenser, while that on the right is for the two-gang condenser, tuning both the high-frequency amplifying circuits. The meter on the left is the filament voltmeter, and that on the right is the milliammeter. On the extreme left of the panel are the aerial and earth

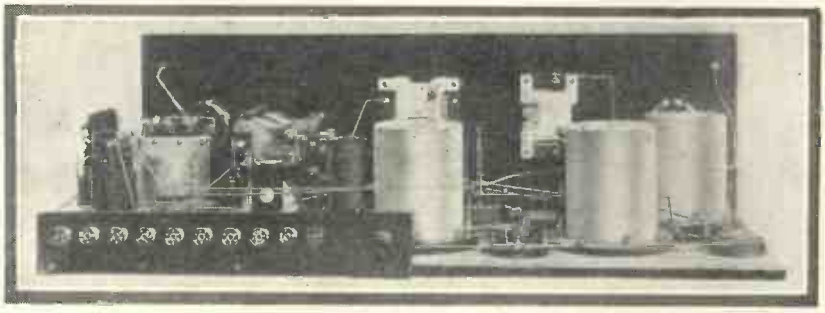


Circuit of the Nomad Six, which combines many special features—such as a filament voltmeter and milliammeter

A "De Luxe" Receiver for Range and Volume

terminals; the two loud-speaker terminals are on the extreme right.

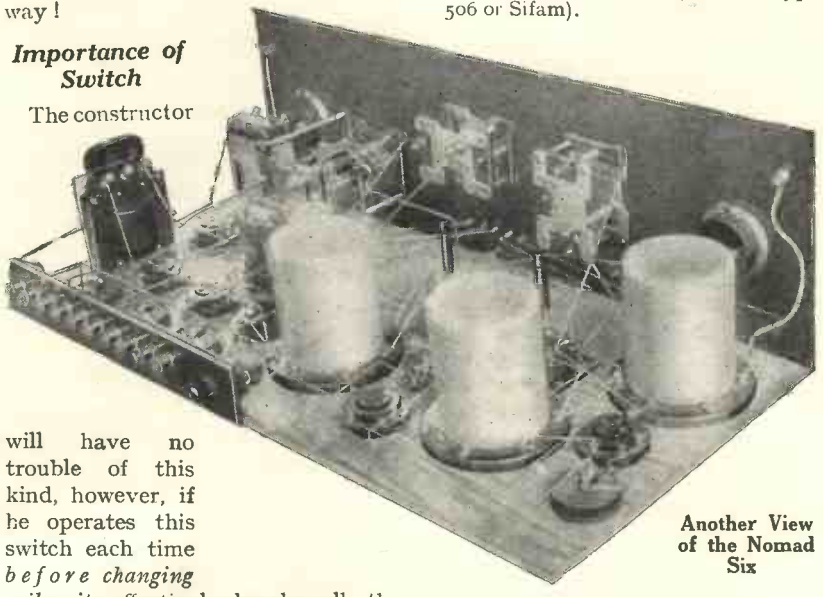
A further device that makes for safety is the push-pull switch mounted at the right-hand end of the terminal strip. Early in the experimental stages it was found that there was a liability to burn-out valves when changing coils because of the metal screens short-circuiting the high-tension supply through the terminals on the coil bases, unless they were very gingerly handled and, as a matter of fact, two complete sets of Cossor valves were ruined in this way!



Back View of the Nomad Six

Importance of Switch

The constructor will have no trouble of this kind, however, if he operates this switch each time *before changing coils*; it effectively breaks all the filament circuits and disconnects all batteries, thus obviating any chance of accidental burn-outs due to coil changing. In spite of burning out twelve of them, by the way, we stuck to Cossors throughout most of our tests and a set of six-volt Cossors was used by Mr. J. Godchaux Abrahams when he compiled the special test report given on page 138.



Another View of the Nomad Six

Components Required

Following is a complete list of the components required for building the Nomad Six. In many cases alternatives can be used without seriously altering the layout of the receiver:

Ebonite panel, 26 in. by 8 in. (Radion).

.0005-microfarad square-law variable condenser (Ormond or Cyldon, Igranic).

.0005-microfarad two-gang square-law variable condenser (Ormond or Cyldon, Igranic).

2 vernier dials (Ormond or Igranic, Formo).

Milliammeter, 0-25 (Weston type 506 or Sifam).

Voltmeter, 0-7 (Weston type 506 or Sifam).

.0003-microfarad variable condenser (Ormond or Cyldon, Igranic).

5 sockets and 1 plug (Eastick or Lissenin).

3 six-pin coil bases with screens (Lewcos or Peto-Scott).

2 six-pin aerial coils, for each wavelength band (Lewcos or Peto-Scott).

4 six-pin split-primary high-frequency transformers, 2 for each wavelength band (Lewcos or Peto-Scott).

2 neutralising condensers (Peto-Scott).

6 anti-microphonic valve holders (Lotus or Precision, W.B.).

5 30-ohm baseboard mounting rheostats (Lissen or Igranic).

.0003-microfarad fixed condenser with grid-leak clips (Dubilier or T.C.C., Mullard).

2-megohm grid leak (Dubilier or Mullard, Lissen.)

High-frequency choke (R.I. and Varley or Cosmos, Wearite).

Resistance-coupling unit (R.I. and Varley or Ediswan, Ormond).

Pair of push-pull low-frequency transformers (R. I. and Varley).

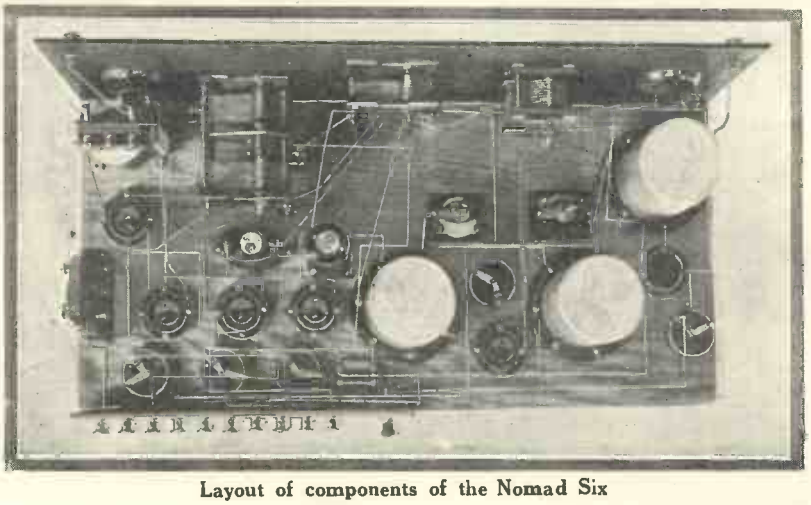
.001-microfarad fixed condenser (Dubilier or T.C.C., Lissen).

4-point jack switch (Lotus).

14 terminals marked: Aerial, Earth, Loud-speaker, Loud-speaker H.T.+1, H.T.+2, H.T.+3, H.T.+4, H.T.−, L.T.+, L.T.−, G.B.+, G.B.−1, and G.B.−2 (Eastick).

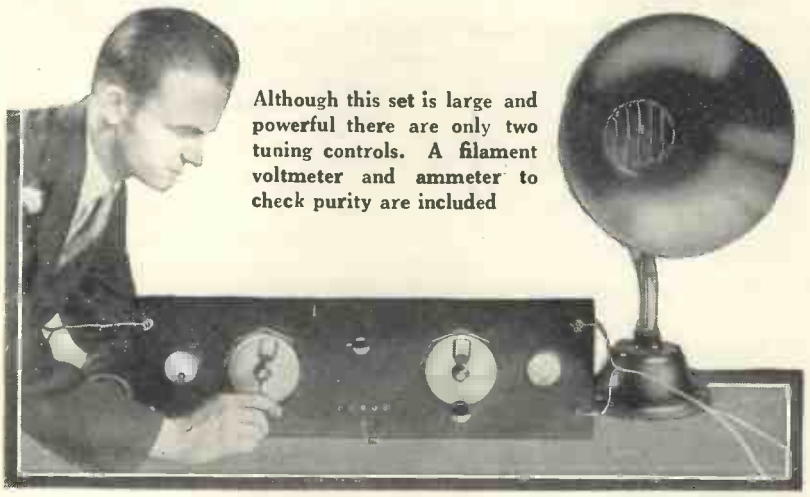
Terminal strip, 14 in. by 2 in. (Radion).

Cabinet and baseboard 13 in. deep (Caxton).



Layout of components of the Nomad Six

The Nomad Six (*continued*)



Although this set is large and powerful there are only two tuning controls. A filament voltmeter and ammeter to check purity are included

Screws for fixing components to baseboard (Economic Electric).
Glazite for wiring (Lewcos).

It should be noted that the particular components used in the original set and allowed for in the layout are in each case mentioned first.

Blueprint Available

Before starting to construct this set the amateur is strongly recommended to invest the small sum of 1s. 6d. in a full-size blueprint layout, drilling guide and wiring diagram of this receiver. Write to Blueprint Dept., WIRELESS MAGAZINE, 58-61, Fetter Lane, E.C.4, and ask for blueprint No. WM31; it will be sent post free for 1s. 6d.

Although the blueprint is very useful in construction it should be understood that it is possible to build the Nomad Six without one; all the essential details are reproduced in these pages.

The preparation of the panel should present no difficulty. All three variable condensers are one-hole fixed, but it is also necessary to drill some extra holes to keep the special vernier dials in position. The holes for the two meters are best tackled with a fret-saw or small key.

As soon as all the necessary holes have been drilled and finished off properly the panel components can be fixed into position, after which the whole panel can be secured to the baseboard.

Next mount the terminals and jack switch on the small ebonite strip, and screw that to the back of the baseboard. At this stage the rest of the components can be laid out on the baseboard as indicated in the layout diagram or blueprint.

Baseboard Components

Looking from the back of the panel it will be seen that the aerial-coil socket is at the extreme right, while the two transformer bases are a little farther to the left and nearer the edge of the baseboard. Both neutralising condensers are placed adjacent to these transformer bases. In front of each valve holder is the appropriate baseboard-mounting rheostat, except in the case of the last two valves which are provided with only one rheostat between them as both must be adjusted to work on exactly the same parts of their characteristic curves.

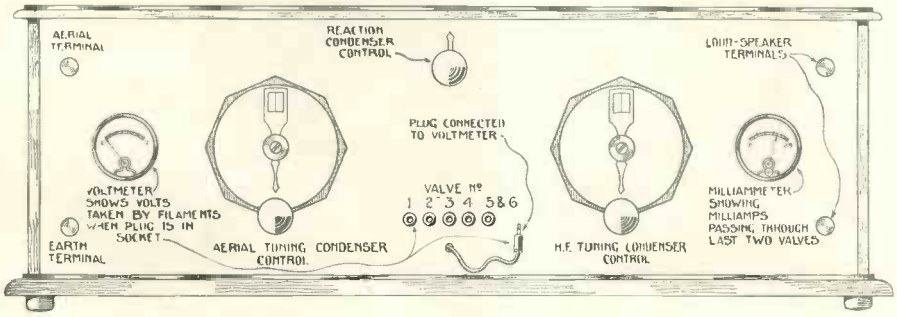
It will be observed that the push-pull low-frequency transformers have their axes at right angles to minimise magnetic inter-action as much as possible, while both are well removed from the screened coils, this again obviating any interference between the fields due to eddy currents in the screens and the low-frequency windings.

Fixed Condenser

In practice it is convenient not to screw the .001 - microfarad fixed condenser placed across the primary of the first push - pull transformer on to the baseboard, but to hold it in position over the transformer by means of the actual wiring.

So long is the two-gang variable condenser for tuning both high-frequency circuits simultaneously that adjustable supports are

ARRANGEMENT OF CONTROLS OF THE NOMAD SIX



For Range, Volume and Purity

provided to keep the extreme end of the condenser raised the right distance from the baseboard so that there is no unnecessary strain on the panel.

As soon as all the components have been satisfactorily grouped and screwed into position, wiring can be started—and this is where the full-size blueprint will be appreciated by large numbers of home constructors who build this set for themselves.

Connecting up

A glance at the reduced reproduction of the blueprint given in these pages will show that each terminal point of a component is marked in a small letter of the alphabet. These letters indicate the order in which wiring should be carried out: all points marked with like letters should be connected together with one wire or as few wires as possible.

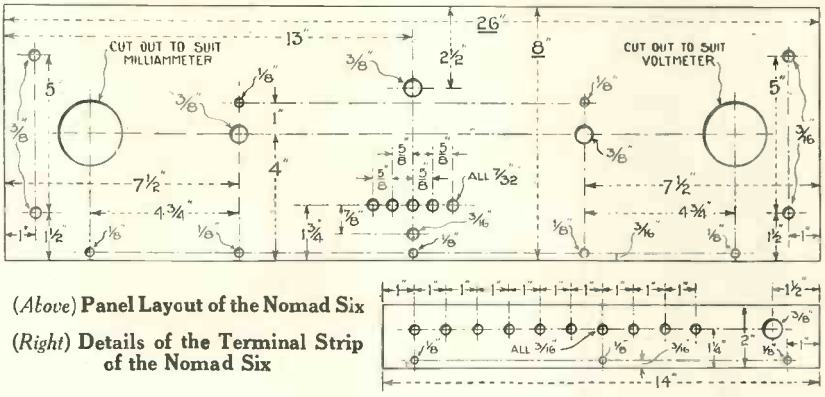
Thus all those points marked *a* are first connected together; then all those points marked *b*; and so on through the alphabet until the wiring is completed.

Six-pin Bases

The only difficulty that is likely to arise is in connection with the six-pin bases, but as the terminals of these are clearly marked by numbers, and as the numbers are given in the wiring diagram no great trouble should be experienced.

Note should be made of the fact that the lead from the aerial terminal is flexible so that the aerial coil can be tapped at either point 3 or 4 (see layout and also circuit diagram). In this way the degree of sensitivity can be controlled to some extent.

It may at this stage be advisable to say something about the most suitable valves for use in the Nomad Six. The fact that 2-, 4-, or 6-volt valves can be used with equal success has been mentioned previously. When there is no difficulty about accumulator charging it is a slight advantage to use the highest-voltage valves possible and, as a matter of fact, during most of our tests we used a set of 6-volt Cossor valves, which were found to "match up" with the components utilised very well indeed.



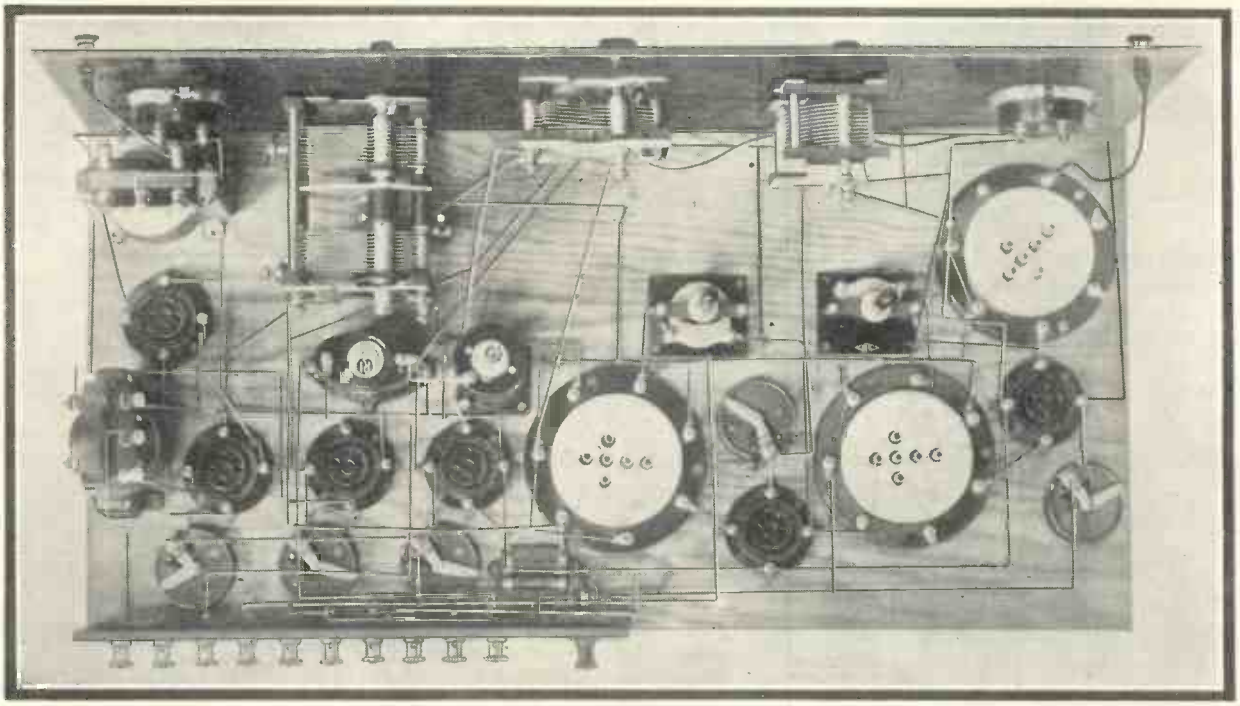
(*Above*) **Panel Layout of the Nomad Six**

(*Right*) **Details of the Terminal Strip of the Nomad Six**

Four Valve Groups

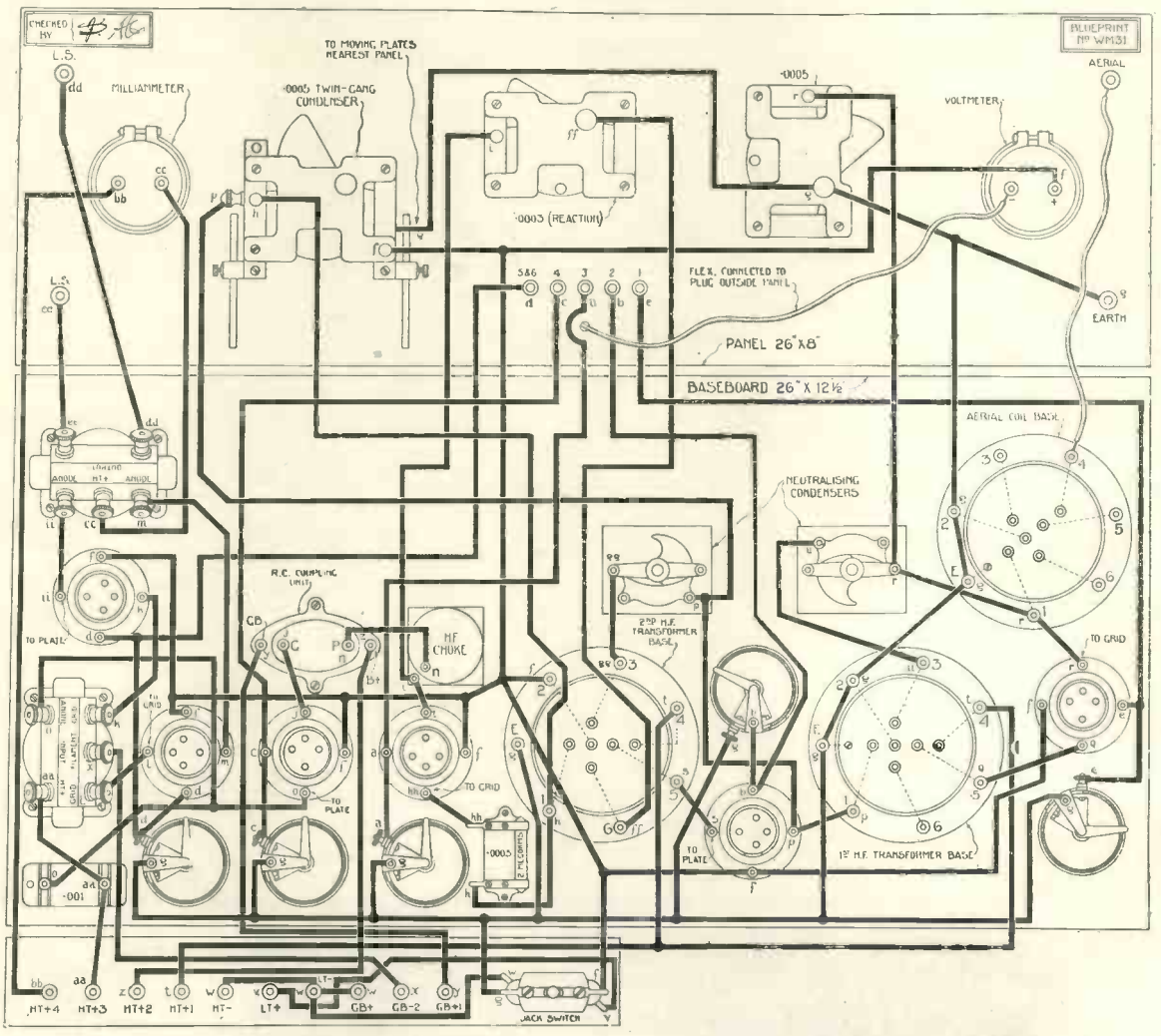
As a matter of convenience, the valves can be considered as four groups, for example, (1) the two high-frequency amplifiers; (2) the detector; (3) the first (resistance-coupled) low-frequency amplifier and (4) the two final "push-pull" valves.

The first group should be valves of a fairly high impedance, say in the neighbourhood of 25,000 to 35,000



Layout of Components of the Nomad Six

The Nomad Six *(Continued)*



This layout and wiring diagram can be obtained as a full-size blueprint (No. WM 31, price 1s. 6d., post free)

ohms; the detector can have a higher impedance value—approximately 70,000 ohms or more; the first low-frequency valve an impedance of 8,000 or 10,000 ohms; and the last two valves should each have an impedance *lower* than 5,000 ohms if really good volume is required. (A table of suitable valves is given on the opposite page.)

Accessories

When the set has been wired up, the valves should be placed in their respective holders—care being taken that the push-pull switch is in the "off" position. Next three coils should be inserted in the six-pin bases—one aerial coil and two split-primary high-frequency transformers are required, and for a rough test it does not much matter whether long- or short-wave coils are used provided it is known that some transmission is taking place on that waveband.

When the coils have been placed in their sockets the screens should be put over them and each rheostat arm put in the "off" position. It is now time to turn for a moment to the front of the panel, the layout of which is clearly indicated by the photograph and drawing on page 134.

It will be observed that in the centre of the panel is a row of five sockets—these put each valve filament in turn in circuit with the filament voltmeter on the left of the panel (the last two valves are controlled by the same rheostat and the fifth socket enables the voltage across both filaments to be read).

Rheostat Adjustments

Before proceeding any further it is advisable to so adjust the rheostats that the voltage across each valve filament is exactly that recommended by the manufacturers. In some cases it may be exactly 4 or 6 volts, but in others it may be 3.8 or 5.5 volts. Therefore, place the tapping plug in socket No. 1, and adjust the rheostat controlling the first valve until exactly the right reading is indicated by the voltmeter. Proceed in the

A Special "Wireless Magazine" Receiver

same way until each valve filament has the proper voltage across it.

Attention may now be turned to the rest of the batteries, and here a word of advice may be given. Do not use small high-tension batteries for the Nomad Six, for although they are cheaper in first cost they will not be nearly so economical in the long run as large-size batteries. In fact, the WIRELESS MAGAZINE Technical Staff recommends that only the largest size (that termed "super-capacity" by most manufacturers) of batteries be used, and then only in cases when a main's high-tension unit or high-tension accumulator is not available.

High-tension Supply

A glance at the circuit or layout diagram will show that four high-tension positive terminals are provided. These supply respectively (1) the high-frequency amplifiers; (2) the detector valve; (3) the first low-frequency valve, and (4) the last two amplifying valves. In most cases it will be desirable to apply the following voltages to these terminals: (1) About 80 volts; (2) 120 volts; (3) 80 or 90 volts; and (4) 120 or 150 volts.

In all cases the manufacturer's recommendations should be closely followed, except in the case of 2-volt power valves in the last stages, which can usually be run quite successfully at voltages above the manufacturer's rating.

Grid Bias

There is still the question of grid bias and this is a point that should receive serious attention. An approximate guide can be obtained from the manufacturer's lists (note the appropriate bias for the high-tension voltage applied, as it varies considerably in some cases), but the final test is the milliammeter reading while signals are coming through. This will be dealt with more fully a little later.

If the aerial, earth, and loud-speaker are now attached to their respective terminals the set is ready for testing out. (Do not forget to connect the flexible lead from the aerial terminal to point No. 3 or 4 on the first six-pin base.)

Turn to Mr. J. Godchaux Abrahams' test report on page 138 and note the reading of the anode (gang-control) condenser for the station it is desired to receive. Place the pointer of the right-hand dial at this point and turn the aerial-tuning condenser (left-hand) dial slowly, at the same time operating the reaction control (centre knob) until the receiver is just on the threshold of oscillation.

As soon as a station is picked up carefully readjust all three condensers until the best results are obtained. In practice it will be found that, once set, the reaction control will not need readjusting except for the reception of really distant stations.

Other Adjustments

Before placing the set in its cabinet there are two other things that should be done, namely the adjusting of the gang-control condenser and the neutralising of the two high-frequency valves. With each gang control condenser is provided a small "tommy" bar with which to get both sets of plates exactly "in step."

The method employed is to get them as nearly equal as can be observed by the eye and then readjust each just a little (without altering the dial setting) until the loudest signals are obtained. With such a

VALVES TO USE IN THE NOMAD SIX

Make	*H.F. Amplifiers*			*Detector*			*1st L.F. Amplifier*			*Push-pull Amplifiers*		
	2-v.	4-v.	6-v.	2-v.	4-v.	6-v.	2-v.	4-v.	6-v.	2-v.	4-v.	6-v.
B.T.H. ...	B21	—	B4H	B8	—	B4H	B22	—	B4	B23	—	B4
Cossor ...	Red Band	Red Band	Red Band	Blue Band	Blue Band	Blue Band	Black Band	Black Band	Black Band	Green Band	Green Band	Green Band
Ediswan ...	ARDE H.F.	GP4	ES5 H.F.	RC2	RC410	RC610	GP2	PV4	ES5 L.F.	PV2	PV4	PV5
Marconi ...	DEH 210	DEH 410	DEH 610	DEH 210	DEH 410	DEH 610	DEL 210	DEL 410	DEL 610	DEP 215	DEP 410	DEP 610
Mullard ...	PM1 H.F.	PM3	PM5X	PM1A	PM3A	PM5B	PM1 L.F.	PM4	PM6	PM2	PM 254	PM 256
Osram ...	DEH 210	DEH 410	DEH 610	DEH 210	DEH 410	DEH 610	DEL 210	DEL 410	DEL 610	DEP 215	DEP 410	DEP 610
Shortpath ...	SP18 G	—	DE50	SP18 B	—	SP50 B	SP18 R	—	SP55 R	SP18 RR	—	SP55 RR

The Nomad Six (*Continued*)

powerful set as the Nomad Six this operation is not particularly easy because of the great volume, and the final adjustment should be made on a comparatively weak signal.

Neutralising

To neutralise the high-frequency valves a loud station should be tuned-in, then switch out each in turn by manipulating the rheostats (on no account remove the valve from its sockets or neutralisation cannot be carried out) and adjust the appropriate neutralising condenser until the signals being received either fade out completely or are only faintly audible. Complete neutralisation has not been achieved unless signals are completely inaudible. Remember that only one valve must be neutralised at a time and as soon as the adjustment has been made the rheostat should be switched on again.

Checking Purity

Next the purity of reproduction should be checked. This is where the milliammeter comes in very useful, for it is a more certain guide to distortion than any human ear and, indeed, will indicate poor quality long before it becomes bad enough to be perceptible to the senses in the ordinary way.

Even when very loud passages are being received the needle should not flicker more than a few milliamperes, say, three or four, in the case of a powerful receiver such as the Nomad Six, either way. During the reception of ordinary passages the reading should remain practically constant. If the needle flickers badly it is likely that insufficient bias is being applied to the grids of the low-frequency valves; this can be remedied by moving the tapping on the grid-bias battery.

Economical Running

The milliammeter also serves to show whether the last two valves are being run as economically as possible, from the high-tension point of view. By increasing the bias the high-tension current consumed can be reduced by an astonishing amount—a point worth watching with a large multi-valve receiver.

Once these preliminary adjustments have been made the set can be placed in the cabinet ready for permanent use. If the loggings of the various stations received are marked on the special vernier dials in pencil there will never be any difficulty about picking up stations at some other time, and the set can be used even by inexperienced members of a family. We have only one warning—*never change coils or move the coil screens without first pushing in the knob of the jack switch.*

Everyone who builds up the Nomad Six will know that they have a powerful set of which they can be justly proud; it will give tremendous range and volume with unexcelled purity—and it was designed by the WIRELESS MAGAZINE Technical Staff. As usual, we shall welcome readers' reports and suggestions regarding this receiver. We are also always prepared for criticism—but is there any to be made?

SPECIAL TEST REPORT OF THE NOMAD SIX

DURING a short test of this receiver on July 29 and 30 I received the following stations at GOOD LOUD-SPEAKER STRENGTH and with particularly pure quality. No headphones were used, all transmissions being tuned-in on the loud-speaker. At 1½ miles from 2LO the London transmission could be CUT RIGHT OUT within four degrees either way on the anode condenser.

WITH SHORT-WAVE COILS
(250-550 METRES)

Wave-length in Metres		*Condenser Settings: Aerial*	*Anode*
326	*Birmingham*	95	109
348	*Prague*	102	116
361	*London*	105	120
379	*Stuttgart*	114	127
428	*Frankfort*	135	143
450	*Rome*	141	150
458	*PTT, Paris*	143	153
468	*Langenberg*	146.5	156.5
478	*PTT, Lyons*	149	159
491	*Bournemouth*	153	164
508	*Brussels*	161	170

WITH LONG-WAVE COILS
(1,000-2,000 METRES)

Wave-length in Metres		*Condenser Settings: Aerial*	*Anode*
1,060	*Hilversum*	76	76
1,111	*Warsaw*	79	79
1,250	*Königswusterhausen*	90	94
1,320	*Motala*	95	98.5
1,603	*Daventry*	116	136
1,750	*Radio-Paris*	132	157

(*Signed*)
J. GODCHAUX ABRAHAMS.

(*A further and more complete test report will be given next month.*)

On Unknown Wavelengths!

WHEN he purchases a wireless receiver, the American farmer purchases the very best receiver on the market. That must be because he gets his "ground" for nothing.

◆ ◆ ◆

A writer complains that the talks from Moscow are unintelligible. *Complains*, mind you.

◆ ◆ ◆

The opening signal of the Geneva station is a long drawn-out whistle. Many of our local radiating stations adopted the same opening signal years ago.

◆ ◆ ◆

A broadcast play which was not a success—— "The Dumb Waiter's Revenge."

A wireless writer has devised a scheme whereby metal paper clips are used to make most of the connections necessary in a wireless set. Cliptomaniacs will doubtless be most interested.

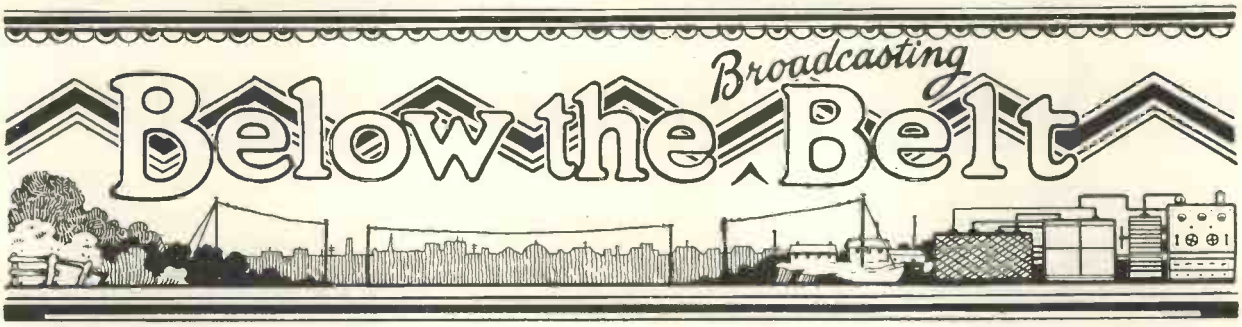
◆ ◆ ◆

An American wireless fan has made a variable condenser out of a couple of thimbles. Results with this condenser, however, have proved to be only sew-sew.

◆ ◆ ◆

Broadcasting stations are springing up like mushrooms all over the civilised world. Listeners are beginning to wish the new stations would spring up more on the lines of domes of silence.

A Special Feature by 5YM—the Well-known Experimenter



BY the time these notes are in print all the amateur transmitters and short-wave enthusiasts who have been giving themselves and their apparatus a rest will be furbishing things up again and getting ready for a really fierce time this winter. Some little time ago, if you remember, I ventured on prophesy. Four out of five of my guesses came true, so I'm going to have another shot at peering into the future. This winter will be noteworthy for the tremendous activity on the 20-metre band ! There you are !

Great Strides

Not much of a prophesy, some of you may say. I admit that there is quite a bit doing on 20 metres—23 metres in this country—but it is nothing to what will be going on when the majority of amateurs really find out how easy it is to whiz signals across six or seven thousand miles with practically no power at all.

Wavelength Extension

I expect that the R.S.G.B. will have to get busy and get a little extension of wavelength band for us. It is obvious that there is not room for many stations on one single wavelength, even allowing for the fact that the most accurate amateur wavemeters are likely to be a sufficient number of cycles apart, to prevent anything but an accidental tuning to 23 metres dead.

I can only hope that no British amateur will be unkind enough to try and start telephony down there. That would mess things up with a vengeance.

◆ ◆ ◆

Another prophesy I would like to make is that we shall not hear quite so much about crystal control as we did last winter. A lot of us have tried it and many of us have come to the conclusion that the idea is all right as regards absolute steadiness; but that a pure d.c. crystal control is not a distance getter save in the most favourable circumstances.

◆ ◆ ◆

Too Sharply Tuned

Many times I have been told that my crystal-controlled C.W. is too sharply tuned to be easy to receive, and I have had difficulty myself in keeping track of crystal-controlled transmissions when they are very faint and there is any movement in the receiving aerial, as there often is on very windy nights, even when every precaution is taken. Personally, I prefer either a single-valve oscillator and a current-fed Hertz aerial, or a master oscillator and a stage of amplification. I have found either preferable to crystal control when real long-distance work is in progress.

◆ ◆ ◆

Recently, I have twice heard a station which is, apparently, stationed in the Dutch East Indies, as its call-sign was given as, I believe, ANJ. Unfortunately, I do not speak or read Dutch and the sound of the letters was difficult to follow, though the speech was clear. The wavelength was about 17 metres and some gramophone records came through excellently.

On a still shorter wavelength, apparently about 14 metres—my wavemeter does not read accurately below 15 metres—I heard a transmission of undoubted American origin, but was not able to get any call-sign. The announcer spoke of the Westinghouse Company; but fading was rather bad and that was all I got. I have been looking out for the station since; but have not heard him.

2XAD and 2XAF

2XAD and 2XAF are still going strong, as most of my readers will be aware. It is some considerable time, though, since I have heard good reception from our old friend KDKA, which used to be the short-wave man's standby.

◆ ◆ ◆

The amount of work on really low wavelengths—5 and 8 metres—is increasing rapidly and shows signs of gathering in a lot of enthusiasts. The building of a receiver for these low waves is not a difficult matter, not nearly so difficult as some folk seem to imagine. Rigidity is essential, so good workmanship must be put into the set.

The chief trouble in working on these very high frequencies is body capacity. Long tuning controls, or remote control, is a necessity and doubtless something might be done in the matter of screening. How careful one has to be is illustrated by a small incident that happened to me recently.

Eight-metre Work!

On the work bench, about six feet away from the receiver, was a tuning coil. Whilst listening to some eight metre signals I pushed my log book a few inches to make room for a writing pad. The log book moved a slide rule which moved a length of glass rod, that completely disconnected tuning inductance. The signals disappeared completely and the set had to be retuned to bring them in again.

VOICES OF THE NIGHT!

Petit Parisien (Paris)

WHEN an enterprising French "daily" decided to operate a broadcasting station on April 13, 1923, it looked around for a suitable

Mr. J. Douglas Pollock, of Petit Parisien

announcer. A wireless-telephony station does not limit its reception to a local audience, and therefore one of the most valuable assets it can possess is a studio official capable of making his announcements understandable by both native and foreign listeners.

Enthusiastic Sub-editor

The *Petit Parisien* was not compelled to make a lengthy search; it found in its foreign news section a young and enthusiastic sub-editor who, opening a door in his office, passed straight out into the broadcasting studio.

Mr. J. Douglas Pollock admirably fulfilled the required qualifications; he had been educated in France and England and was equally at home with both languages. Listen to him; you will find it difficult to detect his true nationality.

Not only does he carry out his duties of announcer, but he also acts as station director, general organiser and personally compiles the programmes. His knowledge of music is extensive—he is a violinist of no mean order—and his many wanderings throughout the United States, the Far East and many European countries have helped him to gauge the tastes of his unseen audience.

Small But Excellent

Although, as broadcasting stations go, the *Petit Parisien* transmitter is but of small power, the excellent concerts it provides four times weekly are appreciated by wireless amateurs in many countries.

With his English announcements, Mr. J. Douglas Pollock has made a strong appeal to British radio fans. Listening to the *Petit Parisien* transmissions is not quite like tuning-in to a foreign station; in your own language you are told what to expect in the programmes, and this greatly adds to the pleasure given by the entertainment.

Prague (Czecho-Slovakia)

M. Frantisek Havel, of Prague

These "five-minute biographies" of foreign announcers, who must be familiar to many thousands of British listeners, are specially compiled for the "Wireless Magazine" by

J. GODCHAUX ABRAHAMS.

This month he gives some information about the announcers at the Petit Parisien, Prague, and Madrid broadcasting stations.

SINCE the first evening on which the new Prague station went on the air, nightly, you must have heard a deep sonorous voice give the call: "Hallo Praha."

Frantisek Havel is the possessor of this voice, and from its tone and deliberate ennunciation you may not be surprised to hear that for twenty-five years he filled important parts in productions given at the National Theatre (Bruenn) and Weinberger Municipal Theatre, the Czecho-Slovakia capital.

In 1913 he abandoned the stage to devote himself entirely to the "screen" and he has been featured in many prominent continental films. But painting also, with him, was more than a mere hobby, and for several years he seriously studied the modern Czech school.

Reticent

He would tell me but little of himself. "On my first appearance before the public, I was fired with the laudable ambition to play in turn all the important characters of our Czech dramatic works. To-day, I say but two words: 'Hallo Praha,' to demonstrate to listeners what I have learnt in twenty-five years."

But Frantisek Havel is a modest man, as apart from the "calls" he contributes to the broadcast pro-

grammes talks on various artistic subjects, and his reminiscences covering a quarter of a century of an actor's life are topics of which the Prague listeners never tire.

Madrid (Spain)

Don Luis Medina, of Madrid

ALTHOUGH I do not doubt that their activities start at an earlier hour, personally, I have only heard the voices of the Madrid announcers when "the iron tongue of midnight hath told twelve." Both Senores Pavón and Medina have been the Union Radio speakers since the official opening of that station on June 17, 1925.

Don Antonio Gomez Pavón is still a young man, but he is the doyen

Don Antonio Gomez Pavón, also of Madrid

of Spanish announcers. He was destined to the Bar, but wireless telephony proved too great a temptation, and on its introduction in Spain he was found in the advance guard of experimenters. Don Pavón was attracted to the microphone as a moth to a candle; he put out the first station call in Spain. Since his initial broadcast, his name has been constantly associated with Madrid (EAJ7), and in the opinion of his listeners he possesses a perfect "microphone" voice, of agreeable timbre to which is added the enviable quality of clear enunciation.

Popular Extemporisations

On the other hand, his colleague, Don Luis Medina, enjoys perhaps even a greater popularity, mostly attained by his extemporisations before the "mike." For several years he studied both Law and Science, he was also a pupil of the Royal Conservatorium of Music and Drama. To broadcast an advertisement in a bald manner would defeat its own ends; Don Medina's versatility has given to the publicity side of the Madrid programmes all the attractions of an extempore entertainment. Many of these "puffs" are in verses of his own composition, and their graceful phrasing and ingenious rhymes, so characteristic of the Spanish race, invariably hold the attention of his listeners.

Holiday Tips

HAVE you had your holidays yet? Good luck to you and good weather wherever you may be going.

Don't forget to leave your wireless equipment in apple-pie order when you set off for the seaside, the lakes or the country. You'll want your wireless to cheer you up when you get back, you know.

The most important thing about leaving your wireless set, of course, is earthing the aerial properly. By far the best plan is to earth the aerial at some point *outside the house*.

Indoor Equipment

With regard to the indoor equipment, it always seems to me best to disconnect batteries, phones or loudspeaker, take out the valves and put everything away. The high-tension battery should be placed in a cool, dark cupboard. Valves should be packed very carefully in their containers and locked up in a drawer. Phones should be wrapped up and put away in similar fashion.

Accumulators are a problem at holiday time. Happy is the wireless enthusiast who has a trustworthy wireless friend who will take care of his accumulators and keep them in good condition by using them occasionally and seeing that they are charged every two or three weeks during his absence. AERIAL.

New Thermal Battery

FREQUENT attempts have been made to solve the battery-charging problem by utilising thermopiles as a substitute for the ordinary type of wet or dry chemical cells. Given a steady source of heat this is converted by the thermo-electric properties of the metals forming the "couples" into an electric current sufficent to energise several valves of the low-consumption type.

Up to 1½ Amperes

A current generator consisting of a number of thermo-electric units has recently been put on the English market under the name Thermattaix, and is claimed to produce from 0.3 to 1.5 amperes at 2, 4, or 6 volts. The battery can be energised by any suitable heater, such as a gas or oil-burner, or by a resistance element connected to alternating- or direct-current mains. B. A. R.

The Largest Valve Yet

THE largest vacuum tube in the world has recently been constructed by the General Electric Co. of America, and has been installed in their broadcasting station WGY at Schenectady. It is over 7 ft. high complete with its water jacket, and weighs 100 lb. The tungsten filament is as thick as the graphite in a lead pencil and is nearly 8 ft. long. In quantity it is equivalent to over seven hundred thousand times the amount required for the filament of a .06 type of receiving valve. The anode is water-cooled, and the rating is 100 kilowatts. A.B.R.

J. H. Reyner, B.Sc., A.M.I.E.E. Writes on

Battery Feedback

IT is a well-known fact that a high-tension battery which contains a certain amount of resistance may give rise to continuous oscillations in circuits deriving their power from this source. This is particularly the case

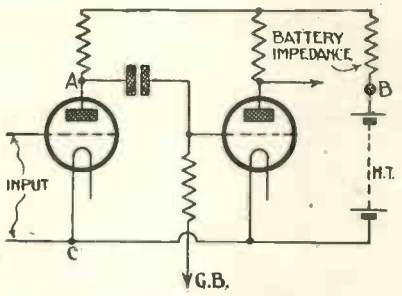


Fig. 1—Simple Two-valve Resistance-coupled Amplifier

with resistance-coupled amplifiers, but it has been found that while some circuits will oscillate with quite a small resistance in the high-tension circuit, others will stand quite a considerable amount of resistance without bursting into oscillation, although distortion may occur.

An interesting analysis of the problem has recently been made by J. E. Anderson (Proceedings of the Institute of Radio Engineers, March, 1927) in which the production of oscillation due to a common impedance in the anode circuits of the various valves is investigated.

Two Classes of Circuit

It is found that there are two classes of circuit, one of which will oscillate with great readiness and the other will not. Referring the matter particularly to the case of a resistance-coupled amplifier and the tendency to oscillate introduced by resistance in the high-tension battery, it is found that with an even number of stages, the effect of the common impedance may introduce distortion but will not cause oscillation, while with an odd number of stages the effect is to cause self-oscillation. Whether this actually sets in or not depends upon the constants of the circuit and the extent of the resistance in the common high-tension battery.

The circuit shown in Fig. 1 illustrates a simple two-valve resistance-coupled amplifier. The anode circuits of these two valves will each be carrying a current which is varying in accordance with the speech or music which is being amplified. Obviously, the current in the second valve will be several times as great as that in the first valve owing to the amplification of the arrangement, and using a high-magnification valve, the ratio of the currents may be 20 or 30, or even more.

It is a well-known fact, however, that the current in a resistance-coupled amplifier such as that shown in the figure changes in phase at each stage. If we cause the grid voltage of the first valve to increase, the anode current will increase also. This will cause a bigger voltage drop on the anode resistance, so that the voltage on the anode itself, which is the difference between the steady H.T. voltage and the voltage drop on the resistance, will decrease.

This anode voltage is transferred through the coupling condenser to the grid of the next valve, so that the grid voltage on the second valve will have decreased. This in turn will

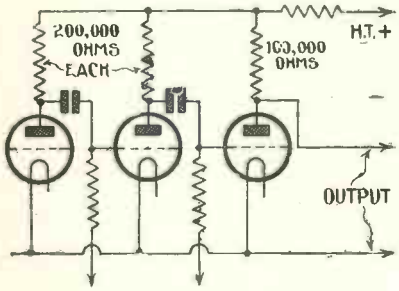


Fig. 2—Three-valve Circuit showing Typical Impedance Values

cause a decrease in the anode current of the second valve, so that a phase reversal has taken place and the two anode currents are in the opposite directions. Both these currents flow through the common battery, which will thus carry the difference between the two, and in the particular case chosen this difference will be the simple numerical difference.

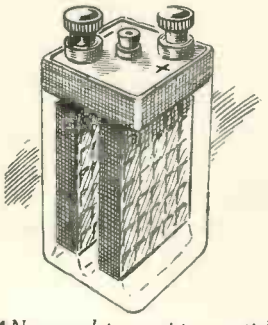
This current flowing through the battery will produce a voltage equal to the product of the current itself and the internal resistance of the battery. The voltage actually produced across the grid and filament of the second valve is that across the points AB, since the point B only differs in potential from the filaments by a fixed amount equal to the voltage of the battery, and this does not enter into the problem.

Varying Reaction Effect

It will thus be seen the voltage developed across the battery resistance is re-introduced into the grid circuit of the second valve, and it will therefore cause a reaction effect which may be positive, in which case it would cause oscillation, or negative, a decrease in signal strength.

It will be clear that if the voltage across this common resistance is to cause an increase in signal strength, it must be in the same direction as

Things to Know About
Accumulators



AN accumulator consists, essentially, of two lead plates (or sets of plates) separated from each other and immersed in a dilute solution of sulphuric acid. If a direct electric current is passed through the cell so formed from one plate to the other the chemical composition of the plates alters and also the specific gravity (or density) of the solution.

If, after a time, the "charging" current is cut off and the accumulator connected up to an external circuit a current, opposite in direction to the current which charged the accumulator, will be forced through the external circuit and the plates of the accumulator and also the solution will gradually return to their normal condition.

the voltage already existing in the second grid circuit. To do this the current through the battery would have to be in the same direction as the anode current of the first valve.

No Oscillation

We have seen, however, that this is not the case in the present circuit, for the battery current is equal to the difference between the two anode currents, and since the second anode current is very much larger than the first, the current through the battery must be in the opposite direction to that in the anode circuit of the first valve, and therefore in the wrong direction to cause oscillation.

Consequently, we should expect the reverse to be the case, and the signal strength to be definitely decreased; and this is what happens in practice. Fortunately, the actual decrease is not very great. With typical values, say, R = 100,000 ohms and the valves in use PM5B's (C = 74,000 and μ = 37), the decrease in amplification with a battery resistance of 1,000 ohms would only be about 10 per cent.

A different condition of affairs is obtained if three stages are employed. Once again we have a phase reversal so that the anode current of the third valve will be in the same direction as that of the first valve. The current through the battery will be equal to the sum of the first and third anode currents minus the second, and this can quite conceivably be in the same direction as the first. In fact, it nearly always is so, so that a reaction effect results, and if the value of the battery impedance is of the right order self-oscillation will ensue.

Impedance Value

The value of impedance necessary to cause oscillation depends on the circuit constants, but a value may be obtained for a typical case, the valves being assumed to be as shown in Fig. 2. For this circuit a resistance of about 350 ohms in the battery circuit will cause self-oscillation.

If the last circuit (or any of the circuits) contain inductance a small percentage of inductance is also necessary in the common impedance.

Practical Values

The question now arises as to the values of battery resistances which are encountered in practice. 350 ohms appears somewhat excessive at first sight, but for a battery which has been in use some time the internal resistance may reach a figure considerably higher than this. It must be remembered that we are dealing not with the simple D.C. resistance but with the effective resistance of the battery to alternating currents, and experiments have shown that the A.C. resistance of a 120-volt battery of standard size is slightly over 1,000 ohms at a frequency of the order of 100 cycles per second.

The D.C. resistance of a battery of 120 volts or thereabouts should be a few ohms only when it is fresh, but as it runs down the resistance will rise very rapidly, and the value of 350 ohms quoted in the last instance is by no means impossible.

Quite apart from the question of reaction, either positive or negative, there is the question of distortion. If the impedance in the anode circuits is pure resistance, then the only effect of the feed-back will be a proportional increase or decrease in the amplification, irrespective of frequency.

A certain reactance is always present, however, due to small inductive or capacitative effects, and when this is the case the feed-back depends upon the frequency. In such a case it is clear that distortion must result, for the reaction effect due to the common impedance of the battery will be different at different frequencies, and amplification will not be uniform.

Battery Resistance

The extent of the battery resistance necessary to cause distortion is much smaller than that required to produce self-oscillation, and this is a very common source of distortion in resistance-coupled amplifiers which is usually completely neglected. Cases have arisen where resistance-coupled amplifiers have given quite disappointing results for no apparent reason, the solution to the problem lying in the feed-back due to the common battery employed.

Safeguards

The only methods of avoiding oscillation or distortion where a common battery is used are, first of all, to adopt circuits which are inherently stable—that is, preferably an even number of stages. Secondly, the common impedance should be reduced as far as possible by using high quality batteries, and connecting very large condensers, also of high quality, across them. A poor by-pass condenser may increase the common impedance instead of reducing it. As a last resort different voltage batteries may be used for different portions of the amplifier.

Two Popular Entertainers

Layton and Johnstone at the piano

A recent Parisian creation for the seaside resorts is a sun-bath costume with wireless set to match. Wireless experts are inclined to look upon the idea as another case of freak reception.

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Station WIBU, Wisconsin, U.S.A., derives its power from a couple of windmills. A suitable motto for this station would be: "It's an ill wind that blows nobody any good broadcast."

A Survey of Recent Developments

Jottings on the Month's Progress

Wireless and the Eclipse

IT will be some time before the thousands of records taken by different observers stationed along the totality track, and also along the shadow path of the Heaviside layer a hundred miles to the south, can be collated and analysed as a whole. From the information at present available, the results appear to agree with what was generally anticipated.

The eclipse caused a rapid cutting-off and restoration of the sun's rays upon the ionised layers of the upper atmosphere. It amounted, in fact, to an abbreviated sunset and sunrise, following each other in rapid succession. There was a corresponding temporary rise and fall of the Heaviside "ceiling" and an intervening period during which the region of low ionisation (which causes most of the absorption losses) largely disappeared.

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Signal Strength

One report reads as follows:

> There were slight atmospherics during the period of test. Otherwise no unusual events were recorded during the period of totality. The rapid darkening of the sun, followed by the rapid growth of light, produced a remarkable increase in signal strength, commencing a minute before totality. This effect reached its zenith when the sun was obscured and diminished as the light reappeared.

Tests made by the Radio Research Board with transmitting stations at Birmingham and Peterborough indicate that absorption by the Heaviside layer fell to one-tenth the normal during totality, the signal strength increasing ten-fold during the same period.

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Directional Effects

Observations made with a direction-finding outfit showed that bearings were subject to the usual "wandering" or night-error effect, caused by the interaction of the magnetic fields of the "earthbound" and "space wave" components of the radiated energy. Directional vagaries grew more striking as the moment of totality approached, and continued to be in evidence until about 7 o'clock, when the normal accuracy was re-established. Similar observation carried out near London on the long-wave signals from the Rugby station showed no appreciable variation.

> The Eclipse : South African Beam : Four-electrode Valves

In the latter case the result is quite consistent with theory, since such waves are propagated along the surface of the earth, and are therefore not affected by variations in the Heaviside layer in the same way as the shorter wavelengths, which travel mainly as "space-waves."

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South African Beam

The new "beam" service to South Africa is now in operation. Outgoing messages are initiated at the G.P.O. and pass along land-lines to the wireless transmitter at Bodmin, in Cornwall. From here the signals are radiated to the distant receiving station at Milnerton, five miles north of Cape Town, and are then relayed to the Central Post Office in Cape Town.

Incoming messages are transmitted from Klipheuvel, 30 miles north-east of Cape Town, and pass through the ether to the receiving aerial at Bridgwater in Somerset, from which they are conveyed by land-line to London. The whole of the intermediate relaying is entirely automatic so that communication, in effect, takes place directly between London and Cape Town.

A wavelength of 34 metres is used by night and 16 metres by day, the shorter wavelength being found to have a greater range during the sunlight hours. The South African beam is the first to employ two different wavelengths, one for the daytime and the other at night.

It is expected that the fourth and last group of the Imperial chain of beam services will be completed between this country and India during the present month.

Renewed Interest in Four-electrode Valves

There is a general revival of interest in the subject of four-electrode valves, partly in connection with the use of the so-called "screened-grid" as a simple means for neutralising or stabilising high-frequency circuits, and partly because they open-up new possibilities in the way of reducing the present working values of high-tension. It may, therefore, be useful to point out some of the different uses to which this type of valve has already been put.

Generally speaking, the object of introducing a second grid is either (*a*) to secure greater sensitivity, or (*b*) to introduce a negative-resistance effect so that the valve will generate oscillations, or (*c*) to reduce the space-charge and so allow of a reduction in the applied plate voltage.

Examples of the "oscillator" type of four-electrode valve are to be seen in the Scott-Taggart "Negatron," and in the American "Pliodynatron." The latter is a development of the original three-electrode dynatron in which secondary emission takes place from the anode owing to the immense velocity imparted to the electron stream.

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The "Bigrille"

The ordinary "bigrille" or two-grid valve has been widely used in France and elsewhere on the Continent for some considerable time. Here the grid acts as an "accelerator" to the electron stream, helping to maintain a large internal current even when there is only a small voltage applied to the plate.

In other words the second grid helps to dissipate the space-charge or crowd of electrons which normally cluster around the filament and impede the passage of the electron stream from filament to plate. From this it follows that the introduction of a second grid serves to reduce the internal impedance of the valve, since it allows the passage of a larger current for the application of a given plate potential.

B. A. R.

Specially Written by the Officials at Savoy Hill

WHAT THE B.B.C. IS DOING

THE B.B.C. has frequently stated that it is anxious to start an Empire broadcasting service as soon as practicable; but a pendant may be added to the note which appeared on the subject under this heading in the July issue. Experiments are being continually carried out to ascertain the best methods of running a service; but there is a good deal of technical development work, particularly in reception, to be done before such a scheme can be operated successfully.

No Ban on Relays

In the meantime, notwithstanding the statements that have been made to the contrary, the Corporation has placed no ban on any proposal connected with the relaying of programmes to the British Empire, although incidentally it feels that simply to send out short waves, without some definite and conscious idea behind the experiments, would lead nowhere and might even, through continued variable results, prejudice the future.

The B.B.C. will not withhold its co-operation in any scheme which is likely to establish technical data of value; but the view is held at Savoy Hill that no useful purpose would be served by giving Dominion listeners a little that is bad rather than nothing at all.

Little Progress in Reception

Four years ago the Americans erected short-wave stations and there has been no noticeable improvement in reception conditions in this country. In other words, we appear to be no nearer a solution of the problems connected with putting short waves into actual service although research and experiment in reception give us reason to hope that we are. There is still, in fact, no reliability in long-distance short-wave broadcasting, using ordinary methods. The difficulty lies chiefly in reception and not in transmission.

Material Available

Apart from technical considerations other difficulties will confront the B.B.C. when plans are sufficiently far advanced for the Corporation to be faced with the necessity of deciding what material may be broadcast from a short-wave station. There is the question of international copyright, now *sub judice*. The B.B.C. pays large sums of money annually for the broadcasting rights of copyright material; but these rights cannot be construed in their present form to include the relaying of programmes in countries outside Great Britain. It would perhaps be near the mark to say that the overseas listener would rather hear the news bulletins than a first-class symphony orchestra, but the consent of Press interests would have to be obtained before news could be included in the broadcast.

At the Proper Time

However, there is little purpose in enumerating the difficulties at this time, when development is taking place along certain definite lines; but it should be clear to most people that the immediate transmission of B.B.C. programmes is not required to make this development more rapid. A real service will be attempted by the B.B.C. at the proper time and in the proper way.

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Encouraged by the public attitude toward the series of national concerts given at the Royal Albert Hall last season—an attitude of interest and appreciation—the B.B.C. has decided to embark upon a more elaborate series of national concerts next month (October). Twenty performances, spread over a period of six months, have been arranged—that is twelve at the Queen's Hall, and eight at the People's Palace, Mile End Road. The Queen's Hall series will begin on October 7, and will continue at the rate of two a month, missing December. Friday is the day of the week that has been chosen in each case for these concerts.

The People's Palace series will take place on intermediate Fridays, at the rate of one a month.

Orchestra Leaders

The orchestra will be led on different occasions by Sir Henry Wood, Sir Edward Elgar, Sir Hamilton Harty, Sir Landon Ronald and Mr. Percy Pitt. An orchestra of 150 performers took part in the national concerts at the Albert Hall; but the accommodation at the Queen's Hall and People's Palace is more restricted, and the orchestra for the new series will be in consequence smaller. At the People's Palace, for instance, it will be almost identical with the usual symphony orchestra of forty players.

The whole of this series of twenty concerts will be broadcast and listeners will, no doubt, further develop the habit begun with the Albert Hall concerts of listening to some of the performances on their receiving sets and attending others in person.

Demand for Good Music

It has been noted that the correspondence received at Savoy Hill shows an increasing demand for good music. The Corporation is doing its best to meet this demand, as is

What the B.B.C. is Doing (*Continued*)

evidenced by the additions recently made to the staff list of musicians. The Music Department is under the direction of Mr. Percy Pitt, who controls all musical activities connected with broadcasting. Sir Henry Wood gives a large share of his time to collaboration, apart from his more active part as conductor.

Lieut. B. Walton O'Donnell, who three months ago became permanently identified with broadcasting as the conductor of the Wireless Military Band, has said that within a short time he hopes to have at Savoy Hill the finest military band in the country. Mr. John Ansell, who has the Wireless Symphony Orchestra under his wing, has made of it a first-class orchestra which, for its size, is an exceptionally efficient combination.

Other Musicians

Mr. Stanford Robinson, chorus master, Mr. Stanton Jefferies, one of the old stagers among broadcasting officials and now responsible for music balance and control, Mr. Millar Craig, formerly Assistant Controller for Scotland, Mr. Edward Clark, who came to headquarters from the Newcastle station at the beginning of the year, Mr. K. A. Wright, who was the first Station Director at Manchester, and Mr. Hely-Hutchinson, the pianist and composer, are all important parts of the structure of musical broadcasts. Others also who have spent their lives in the world of music are now numbered among the useful servants of the public, through their work in the B.B.C. offices.

Encouraging a High Standard

In another respect the demand for music is being catered for in a way that is calculated to achieve the B.B.C.'s aim of giving the listener the best. In order to encourage a high standard of orchestral playing and to meet the demand for their work, the Corporation fixed a scale of payment for the permanent members of its orchestra which exceeds that paid by most other similar interests. Generally, the fees are graded in three classes, that is principals, sub-principals and rank-and-file; but in the case of the B.B.C. all the members of the orchestra fall within two categories, namely, principals and sub-principals. Each member receives respectively £1 10s. and £1 5s. per attendance. A rehearsal and concert therefore represent £3 and £2 10s. paid to each regular member.

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The attention paid by the Imperial Education Conference to the subject of educational broadcasting was a potent of the great interest that will in the future be taken in education by broadcast. The Conference discussed and surveyed the B.B.C.'s activities in this direction since the first experimental broadcast to schools was carried out by the Glasgow station in February, 1924.

The educational facilities offered by broadcasting have largely been limited by compromise with the more popular interests to which broadcasting appeals. Added to this, probably ninety per cent. of listeners have been compelled to be satisfied with the programmes supplied by their local station, due to the lack of alternative programme facilities. The greater part of the educational work of the B.B.C. has therefore been done centrally and transmitted simultaneously from twenty-one stations.

The daily lessons transmitted from London are relayed to Daventry, while the remainder of the stations utilise the wireless link and relay the transmissions received via Daventry. London's school broadcasts thus constitute the main educational programme for the majority of stations, and the local station supplements them in accordance with local needs and facilities.

Imperfect Apparatus

Imperfect apparatus used by many schools has created a prejudice in the minds of various educational authorities, owing to the children having to listen under unsatisfactory conditions. Specifications for three types of receiving sets are now supplied to schools by the B.B.C. engineers, and by this means some assurance is secured of satisfactory reception at varying ranges.

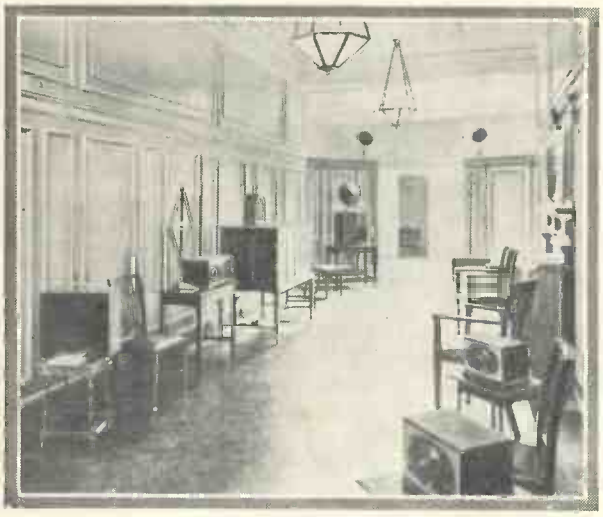
In some of the great towns, for example, Manchester, Liverpool, and Birmingham, little use is as yet made of wireless in schools under the city education authorities. In London the permission granted in the spring by the L.C.C. for the whole of Friday afternoon from 3.0 p.m. to be devoted to wireless lessons led to numerous inquiries from teachers.

Rest of Country

In the rest of the country broadcast lessons enjoy what may be termed a group popularity and the schools in whole areas such as Kent, Bucks, parts of Essex and Oxfordshire, Leicester and Grantham, the Isle of Wight, Stamford, Nottingham, the Pottery District, etc., have adopted the wireless lesson generally.

Under the regional scheme, which is now being considered, it will be possible to provide a programme of general entertainment interest which shall be available for all.

New Radio Showrooms



A corner of the General Radio Company's New Showroom in Regent Street

In playing gramophone records through the medium of a magnetic pick-up, amplifier and loud-speaker, a new and interesting field is opened up for the amateur, who cannot fail to find pleasure in this new branch of radio work. The "Wireless Magazine" Technical Staff here gives full constructional details for building a suitable amplifier, which can also, by the way, be used as an ordinary amplifier if desired.

The Gramophone Amplifier

A Unit of Especial Interest, Designed, Built and Tested by the "W.M." Technical Staff

Trying out records on an Itonia portable gramophone, which, although cheap, is quite satisfactory in use.

SOME of the advantages of playing a gramophone record electrically were outlined by Capt. H. J. Round in his article, "The Electric Gramophone," which appeared on page 53 of the previous issue of the WIRELESS MAGAZINE and those who have not before given any attention to the subject are recommended to refer to it.

Superior Quality

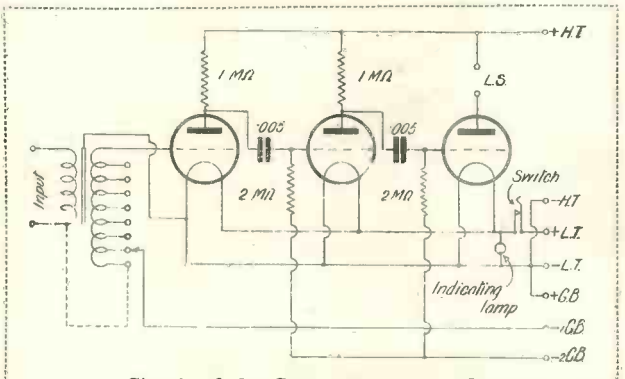
Provided that a well-designed amplifier and a good loud-speaker (one of the cone type is almost essential if really the best results are to be obtained) are used the quality of reproduction is superior to that given by the ordinary gramophone. Two important advantages are, moreover, available—increased volume and the practicability of reproducing the same record simultaneously from two or more loud-speakers in the same building.

These advantages are of especial value in a house where it is possible to hold small dances in, say, one room and the hall. Instead of having one gramophone audible only in one room and almost inaudible in the hall, it is possible, by playing the records through an amplifier, to utilise two loud-speakers placed in advantageous positions.

[We do not propose to stress the argument, propounded by a wit in the WIRELESS MAGAZINE office, that playing a gramophone "by wireless" at last provides the man whose set persistently refuses to work when he has friends to listen with an unfailing means of obtaining good "reception"!]

It is a fact that if a good resistance-coupled amplifier and cone-type loud-speaker are used the quality of reproduction, by virtue of the bass being brought out better than it is by an ordinary gramophone, is better than usual and the result has more richness and "body" about it. In many cases "needle rustle" is also reduced.

The requirements, says Capt. Round, who has done pioneer work in electrical recording and reproduction for some years past, of an electrical equipment that will give better reproduction than mechanical means are a good pick-up device, a first-class amplifier, plenty of volume, and a really fine loud speaker.

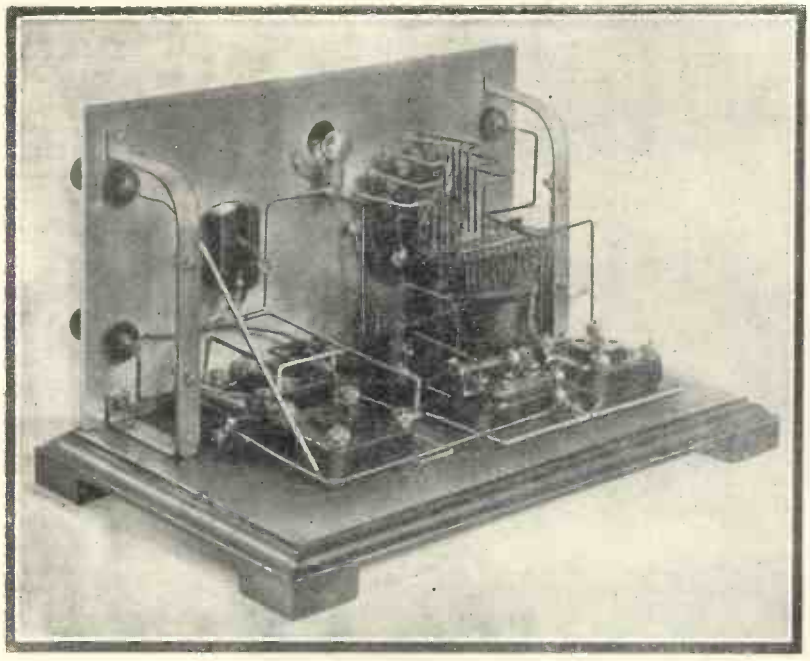


Circuit of the Gramophone Amplifier

Magnetic Pick-ups

Already there are on the market a number of efficient pick-ups and more will make their appearance, the WIRELESS MAGAZINE is able to state, within the next few weeks. The price of a good pick-up is rather high at present, because manufacturers have no idea of what the demand is likely to be, but that is a problem to which only time will give the solution.

The Gramophone Amplifier (*Continued*)



View of the Gramophone Amplifier, showing arrangement of Components

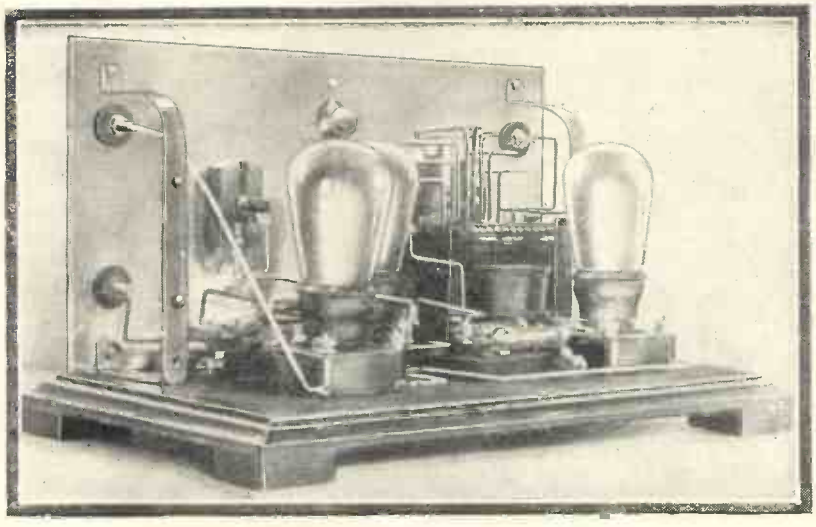
The choice of a "really fine" loud-speaker is not a difficult problem nowadays, and the WIRELESS MAGAZINE Technical Staff is able in this article to give full constructional details of a first-class amplifier.

Bringing out the Bass

To bring the bass out to the fullest extent it is desirable, as has been mentioned already, to use a resistance-coupled amplifier and the WIRELESS MAGAZINE has produced one of this type. So that there shall be plenty of volume, three stages of amplification are used in all.

There is, of course, the problem of taking the input from the pick-up device to the first amplifying valve. It is possible to connect the end of the magnetic winding straight to the grid and filament of the first valve, but in practice it is desirable to use a step-up transformer, and such an instrument is included in the amplifier to be described.

In this case the transformer acts as something more than a mere step-up device for, by virtue of eight tappings on the secondary, it is also an efficient volume control. Adjustment of volume can be made expeditiously by means of a behind-panel stud switch which, by the way, is made as a complete unit and is one-hole fixed. The maximum step-up ratio of the transformer employed is 1 to 4.



Valves in position in the Gramophone Amplifier

R.C. Couplings

A glance at the photographs and layout of the receiver will show that the resistance-capacity couplings are made up of separate resistances and condensers; in this way the appropriate values for any particular valves in use can easily be obtained. The values indicated will be found to give the greatest volume consistent with good quality reproduction with most high-impedance resistance-coupling valves.

With such an amplifier it is not unlikely that the operator might forget to switch off the filaments when no records are being played, and for this reason a small pilot lamp is mounted behind the panel; this is clearly seen in the photographs. A small flashlamp bulb is wired in parallel with the valve filaments (the voltage of the bulb, by the way, must be the same as that of the valves used), and mounted behind a red glass fixed to the panel. When the valves are switched on, the lamp lights and acts as a certain guide that the valves are "running."

Special Panel and Cabinet

Two other points worth attention are the metal panel and a somewhat unusual type of cabinet. The metal panel acts to some extent as a shield from stray magnetic fields, but an ebonite panel can be used if desired (in the latter case no bushing being required). The cabinet is hinged to the baseboard at the back and swings backwards when access is desired to the valves. Connections to the batteries are made with a seven-way battery cord led through a hole in the baseboard.

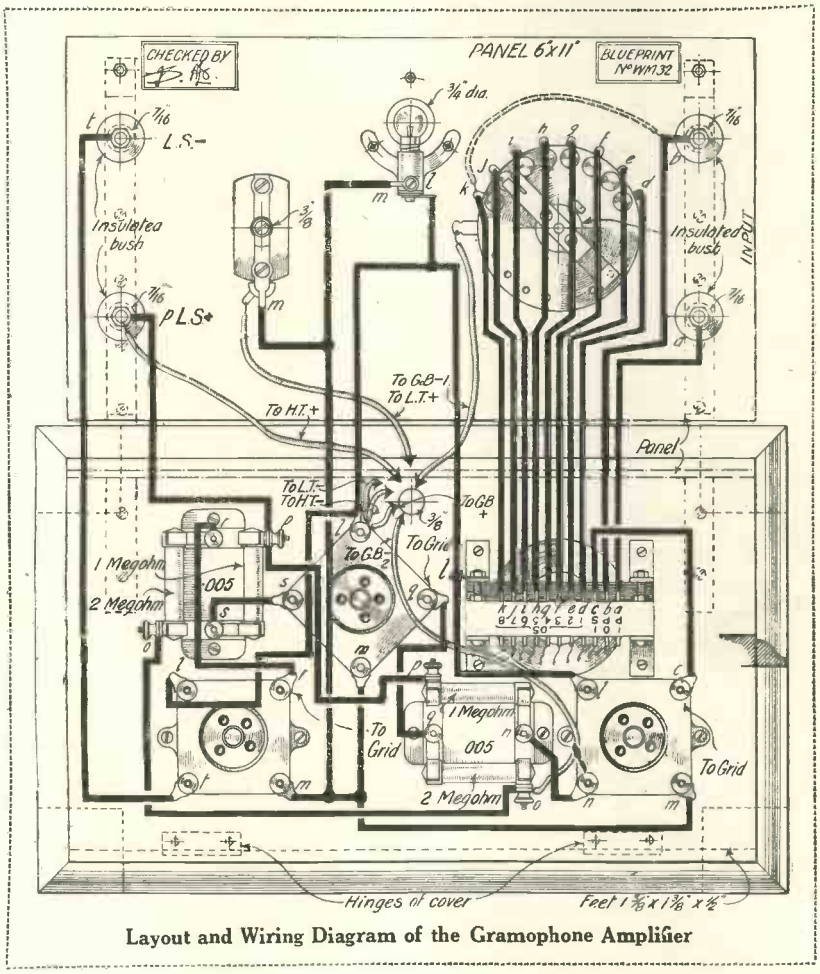
In detail the components required for building the Gramophone Amplifier are as follows :

Aluminium panel, 11 in. by 6 in. by $\frac{1}{8}$ in. (Collinson).

Play your Gramophone Electrically !

3 antimicrophonic valve holders (Benjamin).
Tapped-secondary low-frequency transformer with eight-stud tapping switch (Gecophone).
2 .005-microfarad fixed condensers, with four insulated grid-leak clips (Dubilier).
2 1-megohm grid leaks (Dubilier or Lissen, Cosmos).
2 2-megohm grid leaks (Dubilier or Lissen, Cosmos).
Pilot lamp with bracket and red glass (Bulgin).
2 adjustable panel brackets (Bulgin)
Push-pull filament switch (Lotus or Lissen, Benjamin).
4 terminals marked : Input, Input, loud-speaker +, loud-speaker – (Belling-Lee, insulated).
4 ebonite terminal bushes (Igranic).
Ebonite bush for tapping switch (Economic Electric).
7-way battery cord (Lewcos).
Baseboard and cabinet complete (Artcraft).
10 ½-in. brass wood screws (Economic Electric).
8 ¾-in. brass wood screws (Economic Electric).
4 ½-in. 4BA nickel bolts and nuts (Economic Electric).

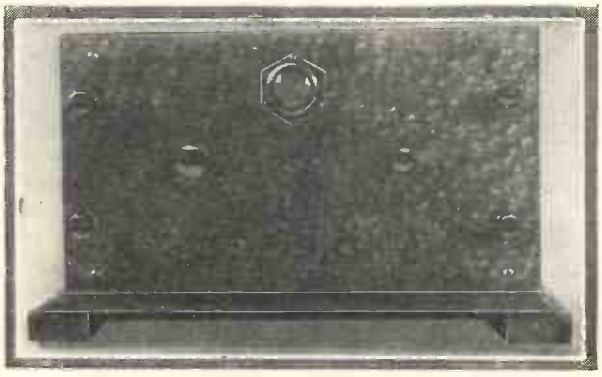
In each case the component used in the original amplifier and allowed for in the layout is mentioned first.



Layout and Wiring Diagram of the Gramophone Amplifier

Full-size Blueprint

Before starting to build this amplifier constructors are recommended to obtain a full-size blueprint layout, drilling guide and wiring diagram from the blueprint Dept., WIRELESS MAGAZINE, 58-61, Fetter Lane, E.C.4.



Front view of the Gramophone Amplifier

The number is WM32 and the price only 1s., post free. Although desirable, a full size blueprint is not of course a necessity, and the complete layout on a reduced scale is given in these pages.

If a metal panel is used the terminals (there are four in all; two input and two output) must be bushed with ebonite. The eight-point tapping switch is also bushed, but the push-pull filament switch is mounted direct on the panel without any bushing.

As soon as the panel has been drilled the four terminals, tapping switch, push-pull switch, red glass, and flashlamp bracket should be fixed in position and the panel itself then screwed to the baseboard by means of the brackets. (It should be noted that the baseboard is actually a part of the cabinet and not a separate piece of wood.)

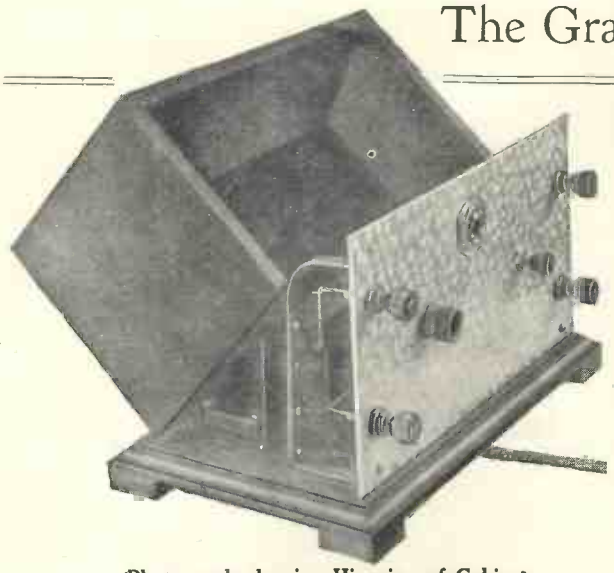
Next, the rest of the components can be mounted in position on the baseboard, the hole for the battery cord first being drilled, however. Wiring can be carried out as soon as all the components are screwed into position.

A glance at the layout diagram will show that each terminal point is marked with a small letter of the alphabet; these letters indicate the order in which wiring should be carried out. All those points marked with like letters should be connected together with one wire or as few wires as possible. Thus, all those points marked *a* are first connected; then all those points marked *b*; and so on until the wiring is completed.

Transformer Connections

Care must be taken in connecting the tappings on the secondary of the transformer to the switch that blobs

The Gramophone Amplifier (*Continued*)



Photograph showing Hingeing of Cabinet

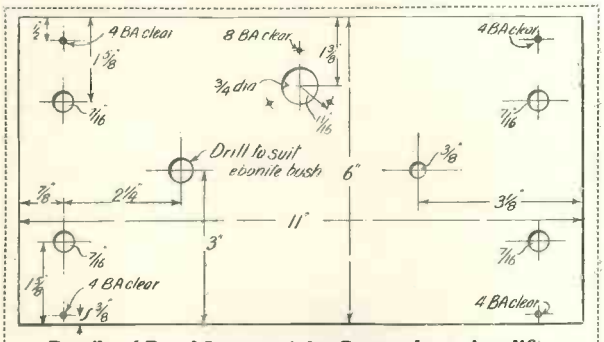
of solder are not dropped across the tapping pins, thus causing a short-circuit. No difficulty should be experienced in connecting up the seven-way battery cord as each wire is coloured distinctively.

The choice of valves for this amplifier is not a difficult problem; the first two must be of the resistance-capacity type and the last a power valve. Either 2-, 4-, or 6-volt valves can be used with equal success, although in most cases the higher-voltage filaments will give slightly better reproduction.

Testing Out

To carry out a test of the amplifier, connect the terminals of a magnetic gramophone pick-up to the input terminals of the left of the panel and a loud-speaker (which must be of the cone type if really good reproduction is desired), to the output terminals on the left. See that the push-pull switch is in the "off" position (that is, the red light is out) and insert valves in the holders. See also that the tapping switch for the low-frequency transformer is turned as far as it will go in an anti-clockwise direction.

Next it is necessary to connect up the batteries. It will be observed that only one high-tension positive lead is provided for all three valves; this is because most resistance-coupling and power valves can be worked at the same high-tension voltage, which should preferably be in the neighbourhood of 120 volts or more.



Details of Panel Layout of the Gramophone Amplifier

Filament voltage presents no difficulty, but unless an external resistance is used valves requiring exactly 2-, 4-, or 6-volts must be employed. Two grid-bias negative leads are provided, one for the first valve, which usually requires a bias of only about 1½ or 3 volts, and another for the last two valves, which may require a bias of 6 or 9 volts.

Adjusting for Purity

Now put a record on the gramophone, start the turntable and place the magnetic pick-up on the record in place of the ordinary sound-box, at the same time pulling out the push-pull switch. Adjust for purity by varying the grid bias applied to valves. The volume can be increased as desired by turning the knob of the transformer tapping switch in a clockwise direction.

Should it happen that, no matter how the grid bias is adjusted, the reproduction is badly distorted or howling occurs a lead should be taken from one end of the transformer secondary to one end of the primary winding. This is shown by a dotted line in the circuit diagram. As a matter of fact, whatever the results are like, it is desirable to see if this connection makes any improvement in reproduction.

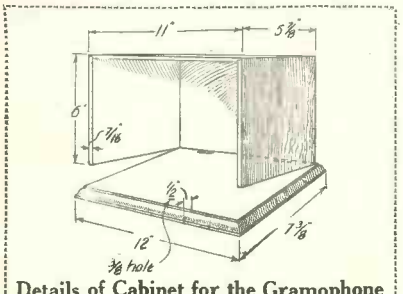
Many Hours Pleasure

There is no doubt that everybody who makes up one of these gramophone amplifiers will obtain many hours pleasure and amusement with it—especially if small dances are organised in the home. The gramophone used can be of the oldest type, without affecting reproduction in any way, as only the moving turntable is needed for "radio" reproduction.

In their experimental work, the WIRELESS MAGAZINE Technical Staff used an Itonia portable gramophone with great success. Such an instrument is quite cheap and will be satisfactory for those who, not already owning gramophones, do not wish to go to the expense of a full-size machine in order to carry out experimental work.

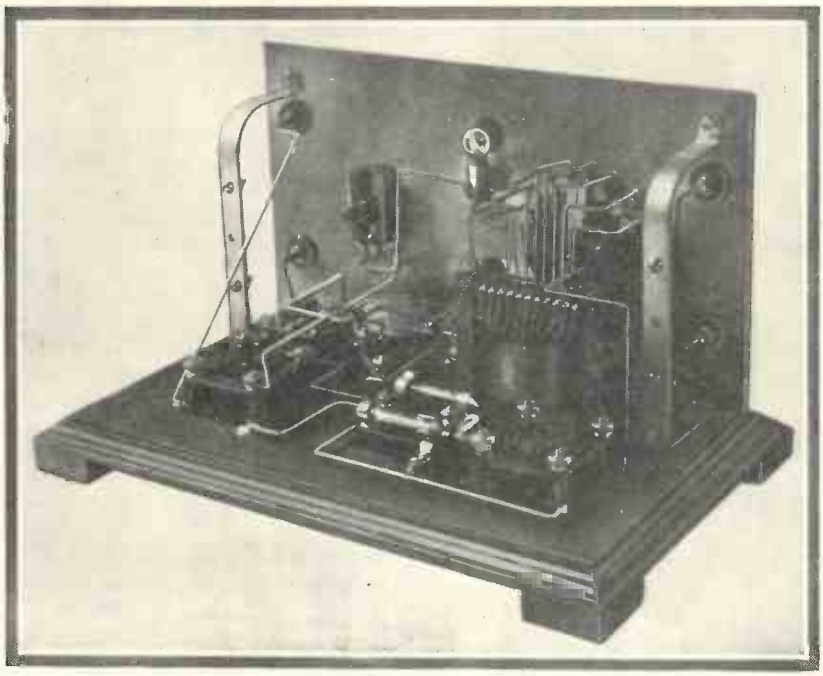
The WIRELESS MAGAZINE Technical Staff will be glad to hear from readers who have suggestions to make regarding this system of "Wireless" reproduction of gramophone records.

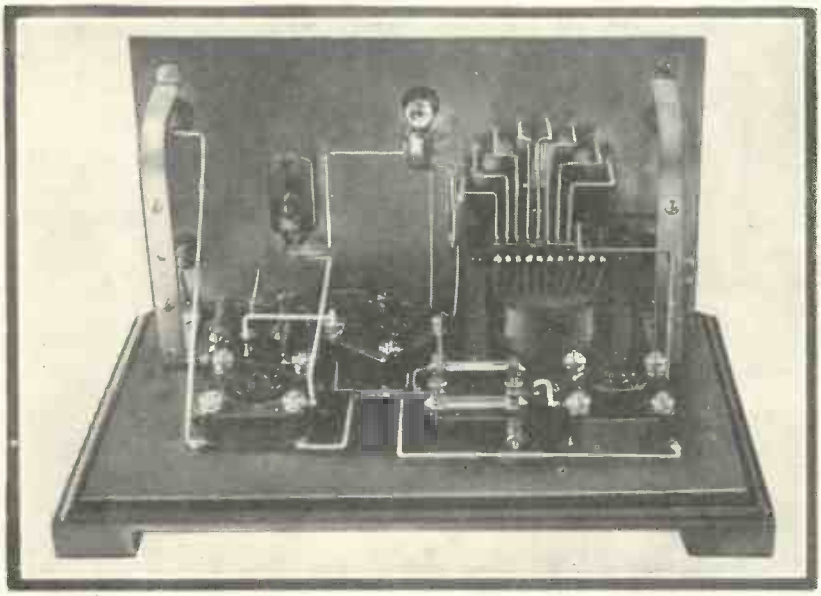
Brown Magnetic pick-up in use on the tone arm of an Itonia Portable Gramophone



Details of Cabinet for the Gramophone Amplifier

MORE PHOTOGRAPHS OF THE GRAMOPHONE AMPLIFIER





These two further photographs show yet further details of the Gramophone Amplifier. The pilot lamp is seen in the centre of the panel, while the special tapped-secondary low-frequency transformer with its switch is on the right. Adjustable brackets are employed to hold the panel in position. It should be noted that the baseboard is actually a part of the complete cabinet and not a separate piece of wood

Aerial-mast Absorption

A curious point which has been raised during the last few months in Europe is one regarding the advantages obtained by the use of wooden aerial masts as against those constructed of steel. In view of the heights to which some of these masts had to be erected, it had been thought that any other material but a metallic one could not be utilised.

Munich Experiments

Certain experiments recently made at Munich in connection with the new transmitter, recently installed in the neighbourhood of that city, demonstrated to the consternation of the engineers that 80 per cent. of the energy, taken to the aerial was absorbed through the steel supports. When these were replaced by wooden towers, proof positive was given that 62 per cent. of the power supplied to the aerial was actually radiated.

I am informed that it is the intention of the German Posts and Telegraphs to replace in the near future all the steel masts used at their broadcasting stations by wooden towers, in every way similar to those recently erected at Munich. A.

More Praise for the 1927 Five

To the Editor, "Wireless Magazine"

SIR,—I feel I should add my quota of thanks to the WIRELESS MAGAZINE for the 1927 Five; I made it up during the past winter evenings and am very satisfied with the results, they being far and away superior to any I've hitherto had with many sets I have made up.

I made a few alterations, which do not seem to have affected results. For example, I substituted zinc for the aluminium shields and, for appearance sake, painted same with aluminium paint.

I made an innovation in the cabinet which, to all appearances, is as specified, but it is detached from its base, so can be lifted right off the set, leaving it all open. This is a great convenience for coil changing or any other adjustments.

In conclusion, I would strongly advise anyone wanting a "super set" to "get on with it."—H. F. YOUNG (Havant).

A Special Article for the Beginner by J. F. JOHNSTON

FIRST STEPS IN AERIAL ERECTION

ONE of the very first things which the amateur learns about wireless is that the results he is able to obtain, whatever the type of set he uses, are very largely dependent upon the efficiency of his aerial system. He may learn this by reading it, he may gather it from the conversation of more experienced friends, or he may find it out by his own experience, but it is never long before he becomes aware of the fact in some way or other.

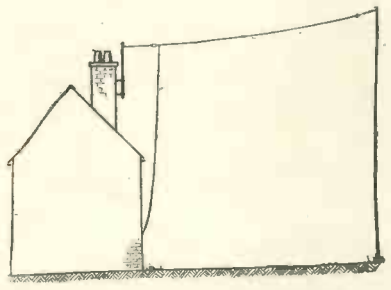


Fig. 1.—Good Type of Aerial : Note wide angle between aerial and downlead

There is one point, however, on which he is generally left with but a vague conception and that is of what, exactly, aerial efficiency consists. So it is often the case that, although he takes particular care in the planning and erection of his aerial and in the making of his earth connection, his aerial system is still far from being efficient, merely from lack of knowledge of a few important points.

Efficient in all Respects

In order that the best possible results may be obtained with any type of set, the aerial system must be efficient in several different respects. First and foremost, of course, the aerial is a collector of energy and should be so erected that the waves from a transmitting station have the maximum possible effect upon it. But it is not sufficient for the aerial to be merely a good collector of energy. It is not in the aerial that the energy is wanted, but between the grid and filament of the first valve of the set (or, of course, across the crystal and phones, as the case may be).

Therefore the aerial should be capable of delivering to the receiver as much as possible of the energy it collects from the ether, and the energy so delivered should be in the form best suited to the requirements of the receiver.

Many aerials which are good collectors of energy are still poor aerials taken all round, simply because a considerable proportion of the energy collected is wasted or allowed to escape before it has a chance of doing any useful work in the receiver proper. Then, again, the actual *amount* of energy (that is, the wattage) applied to the receiver is not of much account in itself.

Whether the set is a simple crystal receiver or a powerful valve set, it is the amplitude of the *voltage* fluctuations which will determine the extent to which the receiver will respond to the incoming signals. We can practically ignore the amount of current supplied to the first valve or to the crystal provided that the voltage changes are comparatively high.

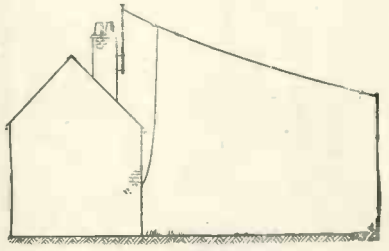


Fig. 2.—A Poor Type of Aerial : Free end too low

When the design and erection of an aerial system is under consideration, all the above points should be given careful attention and if, as will often be the case, an ideal aerial in all respects proves to be impracticable, the relative importance of the various points should be carefully weighed and the aerial so arranged as to provide the best compromise.

An aerial, to be a good collector of energy from the ether, should be of fairly large dimensions. In this respect height is of more importance than length, in fact raising the average height of the aerial is an almost infallible way of increasing the range of any set. From several points of view (especially that of keeping the voltage-current ratio of the energy applied to the receiver high) it is desirable that the capacity of the aerial to earth should be low, and this may be arranged, in the case of a large aerial, by having the greater part of the aerial raised high above the ground.

Inverted-L Best

For the purpose of the average amateur interested in broadcast reception the inverted-L aerial is undoubtedly the best. A good aerial of this type is shown in Fig. 1. Such an aerial is easily erected, especially if only a single wire is employed. No advantage is to be gained from using more than one wire provided that the total length of horizontal portion and downlead can be made to approach 100 feet. If space is so restricted that a much smaller aerial must be used two (or in the case of *very* small aerials, more) wires may be used in parallel in which case the wires should be spaced at least four feet apart.

An important point to remember about the inverted L type of aerial is that the angle between the flat-top portion and the downlead should not be less than a right-angle. In Figs. 2 and 3 are shown two common

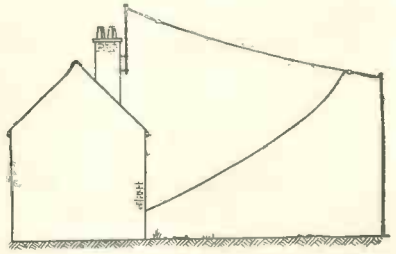


Fig. 3.—Another Poor Type of Aerial

mistakes with regard to the erection of inverted-L aerials.

In Fig. 2 the angle between the top portion and the downlead is sharper than a right-angle, because the free end of the aerial is lower than the downlead end. This should never be allowed to happen. The free end of the aerial should always be at least as high as the downlead end, and if

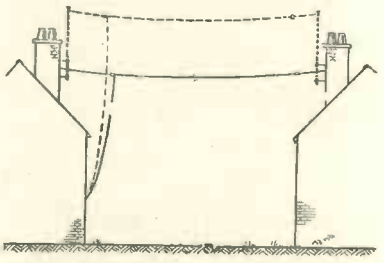


Fig. 4.—Showing how the effect of screening can be overcome by raising the aerial

it can be made higher, so much the better. This latter should, however, be done by raising the free end of the aerial and not by lowering the other end.

In Fig. 3, perhaps in a misguided attempt to increase the total length of wire used in the aerial, the downlead has been taken from the end of the top portion farther from the house. This, also, is a mistake, as it results in the downlead making a sharp angle with the top portion of the aerial, even though the free end of the aerial is higher than the other end.

The reason why the aerials shown in Figs. 2 and 3 are poor is that the energy produced in the top portion and downlead does not, at any given instant, act in the same direction throughout the aerial. In other words, the currents flowing in the two portions of the aerial are, to a certain extent, "out of phase."

Directional Property

A point which is of interest, rather than of any great importance, as far as amateur aerials are concerned, is the directional property of an inverted L aerial. An aerial such as that shown in Fig. 1 will respond most readily to waves reaching it from the direction *opposite* to that in which the free end points. So that, should a free choice of the direction in which the aerial points be possible, it would be as well to point the free end of the top portion *away* from the station it is most desired to receive.

On the other hand it may make it somewhat easier to cut out the local, or any other interfering station, when the free end is pointing directly *towards* that station. This directional property is, however, not very strongly marked in the case of aerials of the usual amateur dimensions.

Now, although such an aerial as is shown in Fig. 1 is naturally a good collector of energy, this advantage will be off-set if the waves from a station it is desired to receive are prevented from reaching it freely. In the very early days of wireless, it used to be taught that houses, trees, and other objects which are opaque to light waves, had no effect whatever on wireless waves, and in no way obstructed their free passage. But for a long time now it has been known that this is far from the truth.

Anything which is a fairly good conductor of high-frequency electric currents is more or less opaque to wireless waves. And such substances as bricks and mortar, and the foliage and trunks of trees, which are very poor conductors of direct-current electricity and of low-frequency elec-

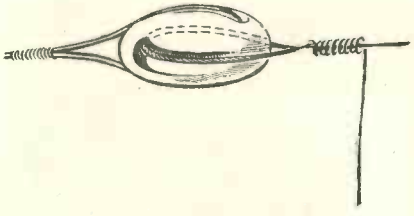


Fig. 5.—Method of attaching Wire to Insulator

tric currents prove to conduct very high-frequency currents with remarkable ease.

So if a building or a large tree, which is higher than the aerial, stands between it and a transmitting station, the waves from that station will, to a certain extent, be prevented from reaching the aerial. In such a case the aerial would be said to be "screened" by the building or tree from that particular station. A badly screened aerial is shown in Fig. 4.

In this case the aerial is supported by two houses, and the whole of the aerial lies below the level of the tops of both houses. Consequently the aerial is screened from two directions. A great improvement could, however, be easily obtained by raising the height of the aerial a few feet, as shown by the dotted lines, so as to raise the flat-top portion of the aerial

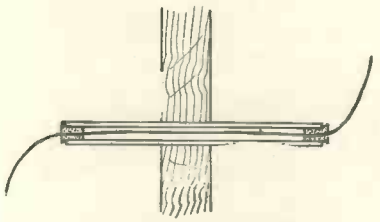


Fig. 6.—Avoid joints at the lead-in insulator

well above the level of the tops of the houses. Such an improvement would, of course, be far greater than would be anticipated were only the increased height of the aerial above the ground taken into consideration.

We can now suppose that we see our way to erecting an aerial which will be naturally a good collector of energy, and one which will not be unduly screened. The next problem is to transfer the energy collected to the receiver with the minimum possible loss. It is at once obvious that the aerial must have a low resistance, or otherwise a good proportion of the energy will be wasted in overcoming the resistance of the aerial.

Stranded Wire

Remembering that high-frequency currents flow only over the surface of conductors, we decide to use stranded copper wire for the aerial in order to provide a large surface-area without using an unduly heavy wire. If this is done the only places where a high resistance can occur are at joints. With care it is possible to make a low-resistance joint in an aerial, but there is seldom any real need to have a joint in the aerial at all, and it is, of course, much better to avoid joints altogether.

Some people make a joint between

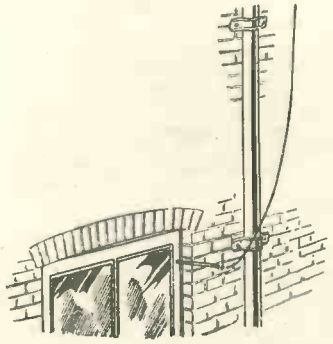


Fig. 7.—Avoid bringing the Downlead near a Drain-pipe

the flat-top portion of the aerial and the down-lead. A joint here can easily be avoided by obtaining, in the first place, sufficient wire in a continuous length to form both the top portion and the down lead. One end of this wire is threaded through the insulator which is to be at the house end of the top portion, and the wire is pulled through the insulator until only sufficient wire for the top portion of the aerial is left between the house-end insulator and the insulator at the free end of the aerial. The wire which is to form the down-lead is then twisted a few times round the portion forming the flat-top as is shown in Fig 5.

Avoiding Joints at Lead-in

Even at the lead-in insulator there is really no need to have a joint, though a joint here is more easily accessible, and therefore more easily examined if suspected, than one between the down-lead and the horizontal portion of the aerial. However, it is a simple matter to leave the down-lead long enough to pass right through the lead-in tube (after the central brass rod has been removed from the latter) and on to the aerial terminal of the set. The ends of the ebonite tube can be plugged with small corks (the wire passing through holes in the corks) in order to prevent rain entering the tube and to hold the wire firmly in position.

Even if very little of the received energy is used up in overcoming the resistance of the aerial, quite a lot may leak away from the aerial before having a chance to assist in operating the receiver.

Absorption Losses

There is, however, another source of leakage, besides that due to poor insulation, which often goes unsuspected. If any part of the aerial wire runs close to, and parallel with, any other conductor currents will be induced in that conductor when the waves from a transmitting station are reaching the aerial. These currents are produced, through induction, by the currents flowing in the aerial and, of course, the energy represented by the induced currents is drawn from the aerial circuit.

Never, therefore, allow the down-lead, or any other portion of the aerial, to hang parallel with a metal drainpipe, as is shown in Fig. 7, or with any other conductor.

Wireless Relieves a Slump in Music

WIRELESS has been a boon as far as music is concerned. This is the considered opinion of no less an authority than Sir Walford Davies. The majority of musicians are in entire agreement with this conclusion. Before the advent of wireless there was a gradual slumping in the musical world.

Music-hall after music-hall was being closed; sales of musical works were on the decrease; the tendency was to get away from music of timeless value to the music of the fleeting type. Musicians and those who sold music came to bad days, when they were not considered of much use to the public at large.

AN IMPRESSION OF EMILIO COLOMBO

Frequently heard with his Orchestra via Hotel Metropole Relays

Then came radio, and what a revolution occurred. The classical stuff that was being forgotten came to the market again; the old masters came into demand; music shops began to sell more and still more; and modern musicians came into their own.

Radio has made us a singing nation once again. We are more musical than we have been at any time during our national history.

Forty-one Hours of Music

In one week no fewer than forty-one hours of music were heard from the London studio only. Another programme contains seven hours of music and musical criticism from 2LO, and seven of the items to be broadcast are new works. In one week no fewer than 750 different musical items—orchestral, instrumental, and vocal—were broadcast from 2LO, and not one of the items was found in the programmes of the previous or following week.

Taking all the B.B.C. stations into reckoning for one week, no fewer than 7,000 musical items were broadcast. This is not thrust on an unwilling listening public; it supplies a demand which was partly created by wireless. There is now not the opposition that there once was to classical music. The nation has been trained to listen to the best that can be broadcast.

Sale of Music

The effect of this increasing demand for music shows its results in the sale of musical works. One music-publishing establishment that was threatened with closure seven years ago is now employing eighty hands, an extra hand having been employed every two months for the last three years.

We are learning music—more music, better music. We are beginning to learn that music is supernational, and are enjoying the music of other nations. And a musical nation will be a happier nation.

The B.B.C. stations have become national music-halls; they will probably increase in their value and service to the nation during the next few years. Wireless has relieved a slump in music!

E. E. R.

Broadcast Music of the Month

REVIEWED BY STUDIUS

Mr. Albert Ketelbey, composer of many popular suites.

Miss May Grant, leader of her own quartette at 5IT.

TO a certain extent wireless music might be well compared to a stream of water, for slowly, but none the less resistlessly, does it flow and overlap till it covers all forms of entertainment. At first, opera gave way beneath the onward march, then the resisting agents—variety, theatrical and concert-hall—capitulated, while last, but not least, has come that most cherished of all musical series, the "Proms."

Vital Factor

These promenade concerts though in all the past years this title has been a misnomer, for the size of the audiences has always prevented any attempt to move, have long been a vital factor of summer music, and many people have been mourning the fact that this year they might be lost to us.

Some Charm Lost ?

But although much of their charm will probably be lost by changes made by the B.B.C., the fact remains that the fine orchestra will be led as usual by Charles Woodhouse (principal violin), Sir Henry Wood will conduct, and some of the familiar artists will be heard.

One is glad to note that the Wagner and classical nights remain unaltered, but why the second half of the programmes should have been interfered with is a question difficult to understand.

Despite the preponderance of talks by unknowns and unwanteds, there has been an attempt to give a little more variety to the programmes, though in such brief snatches as to cause many an evening to be wasted in "switching on and off," instead of one's being able to listen to a steady programme.

Miss Jeanne Paule and Miss Léonie Lascelles, well-known entertainers who specialise in syncopated music and songs.

If the high-brow listener knows that he is going to be given jazz on Monday and Beethoven on Tuesday, he will make his arrangements accordingly, and likewise the lover of syncopation, but if both have got to be "bored stiff" by their respective dislikes or have the greater part of their evening wasted waiting for the unwanted parts of the programme to be finished, there is dissatisfaction all round.

Specified Programmes

Failing the existence of that much-wanted second aerial, a programme of certain classes on specified nights might solve the problem temporarily, especially if the educational element were omitted after 6.30 p.m.

Many known and unknown variety artists have figured in the various station programmes. Familiar names such as those of Helena Millais, John Henry, Fred Duprez, the American entertainer Ronald Gourley and Sidney Nesbitt, vie with comparative newcomers to wireless though widely known to the general public.

Miss Ada Reeve

Amongst these may be mentioned Miss Ada Reeve, the famous dancer and musical-comedy star, one of the original *Three Little Maids* at the Prince of Wales musical comedy success, and Nick Adam, the original Perlmutter in *Potash and Perlmutter* announced for London on August 12.

On the familiar side, also, might be mentioned Miss Mable Constan-

Mr. Gwynne Davies, the Welsh singer.

Miss Sidonie Goossens, harpist of the B.B.C.

Broadcast Music

Mr. Pete Mandell, banjo virtuoso of the Savoy Orchestra.

duros, who took part in a *thé dansant*, amongst other artists being Pete Mandell, the virtuoso banjoist of the Sylvians dance band at the Savoy. Two equally favourite and famous wireless artists are the Misses Jeane Paule and Léonie Lascelles, who have introduced a piano—and themselves—in harmony syncopation and comedy duets all round the wireless circuit.

Other Well-known Names

Many other names are recalled to our memory—Ben Blue and his orchestra fresh from the Alhambra, Ed Smalle, the American "Radio Imp," and Harry Hemsley. The last is one of the finest child impersonators on the stage; indeed, listening to him, one is so painfully reminded of all that we have endured from our neighbours' children, not to mention relatives, that we instinctively look round to see what little Willie is doing "and tell him not to."

Mr. Hemsley is the son of the eminent scenic artist and grand-nephew of the late John Graham Lough, by the way, the great sculptor who bequeathed the Lough Gallery to Newcastle-on-Tyne. Harry Hemsley is himself an artist, and has been a regular contributor to the pictorial press for years. As a mimic, however, he has been in constant demand, and made his first public appearance with the *Follies*.

Mr. Sumner Austin, famous baritone of opera and concert halls.

Famous Pianists

Among the instrumentalists, of course, the pianists are both "fast and furious" in numbers, and amongst the best may be mentioned Lafitte, Edward Isaacs, Yorke Bowen, and the great English lady pianist, Myra Hess, one of the first and the finest exponents of the Tobias Matthay system of pianoforte interpretation. Her recitals at Queen's Hall, and indeed all over the world, have long placed her in the front rank of artists.

Miss Helen Alston, actress and variety star.

It is, however, in violinists that the month's music has been made most prominent. First of all has been heard Emilio Colombo, undoubtedly one of the finest violinists of the day. His interpretation recently in a special programme given by him of the "Polonaise Brilliante" of Wieniawski was a masterpiece of technique which, coupled with sheer beauty of tone, made its performance memorable for most listeners.

A Famous Violinist

Margaret Fairless is another famous violinist, known throughout the kingdom. A pupil of Sevcik in Vienna, she is also gold and silver medallist of the Guildhall School of Music, London, and of the Worshipful Company of Musicians. She made her debut at a Sunday concert at the Royal Albert Hall, under the conductorship of Sir Landon Ronald, and from that time onward quickly established herself in public favour by her masterly performance of the great concertos of Mendelssohn, Beethoven, and Elgar.

Miss Myra Hess, world-famous pianist and one of the first exponents of the Tobias Matthay system.

From the Provinces

From the provinces has been heard, too, Leonard Busfield, a member for two years of the great Hallé Orchestra of Manchester. Amongst his numerous engagements are those with the Margate and Harrogate Municipal Orchestras, and now with the Cardiff broadcasting station. In September, he will lead also the West Wales Three Choirs Festival.

Mr. Harry Hemsley, famous for his child impersonations.

From Blackpool's leading picture-house, at which so many fine instrumentalists are heard, comes the Belgian virtuosi player, Mons. A. Spiero. Since his early appearances at the age of seven, he has played

of the Month *(Continued)*

under all the great continental conductors, including Richard Strauss, Schneevoight, and Gabriel Pierne, while here in London he has also become known for his fine orchestral and solo work. He has met with exceptional success, too, in the provinces, and he has made his orchestra at Blackpool one of the best-known in the country.

At Birmingham a frequent player is Miss May Grant, who has her own quartet there.

For Hull Listeners

Most London listeners have heard Miss Sidonie Goossens, for she was one of the harpists attached to the Queen's Hall Orchestra for the Promenades, and since broadcasting has been attached to the station at 2LO. Hull listeners, however, had the opportunity of hearing her this month in a special recital on August 11. She is a sister of the well-known conductor, Eugene Goossens, and is rightly considered one of the finest harpists in the country.

Mons. A. Spiero, of Spiero's Orchestra, at the Palace, Blackpool.

Naturally one expects the vocalists to be the most numerous, and perhaps the most popular, for the English nation as a whole adores a brass band and a singer more than the individual solo instrumentalist. Certainly this month we have had some of the best.

Opera has been well represented, firstly by the performances of Puccini's opera *La Boheme* with Heddle Nash, Frederic Colliera and Sylvia Nelis in the cast, also *Carmen* with more B.N.O.C. artists, Tudor Davies, Denis Noble, Enid Cruickshank, in the title rôle and Eda Bennie. It is good to know that at least ten operas will be broadcast by the B.N.O.C. during their autumn tours.

Amongst the soloists it would be hard to equal that fine baritone Sumner Austin, whose performance of some of the most difficult song-cycles at the classical concert halls of London and the provinces have long since proved his merits, as well as his operatic rôles in *Magic Flute*, *Carmen*, *Rigoletto*, and many others of the standard operas. His voice is also eminently suited for broadcasting, as every word is distinct, while it is fresh and pure in tone.

Wales has always given us fine singers, as witness Gladys Naish and Gwynne Davies. The latter, heard most recently, has been principal tenor of the Royal Opera House, Covent Garden, Royal Carl Rosa Opera, and has sung at all the great halls and festivals throughout the kingdom. In opera, too, he has played in *Faust*, *Pagliacci*, and most of the principal operas in the repertoire. At Covent Garden, he proved one of the finest "Rudolphs" in *La Boheme* and the contrasting rôle of Pinkerton in *Madame Butterfly*.

Plays and the Stage

Apart from the relays of excerpts from *The Vagabond King* and *Lido Lady*, plays and the stage have been well represented. Miss Constance Collier made a special appearance, also Ben Blue from the Alhambra. Performances have been given of two plays by Lawrence Housman, *A Fool and His Money* and *The House Fairy*. There was also Horace Annersley Vachell's famous play, *Quinney's*, broadcast from Belfast and London. Listeners heard the musical comedy programme including *Bellflowers Blue* and *Miss Hook of Holland*, as well as the equally famous play, *A Butterfly on the Wheel*.

Miss Margaret Fairless, famous violinist and pupil of Sir Landon Ronald at the Guildhall.

A London Artist

Amongst the artists at 2LO has been Miss Helen Alston, an artist of the London Coliseum and variety stage. She writes many of her own songs and has toured all over the world.

Let us hope we shall have still more work from all these artists during the coming months.

Whenever you are in any doubt about a wireless point consult the WIRELESS MAGAZINE. Address your query (written on one side of the paper only) to the Information Bureau, WIRELESS MAGAZINE, 58/61, Fetter Lane, E.C.4, and enclose with it a stamped envelope, a fee of 1s. and the coupon on page 175.

Miss Elsie Payne, "Drewie" at the Glasgow station.

Mr. Leonard Busfield, leader and solo violinist at Cardiff.

Miss Constance Collier, the well-known actress.

Wireless Magazine. September 1927

J. H. Reyner, B.Sc., A.M.I.E.E., writes on—

The Countryside Four in Use

WHEN the Countryside Four was first designed I took it out to the Wye Valley in order to obtain some experience of its use under practical conditions. I have subsequently had an opportunity of taking it rather farther afield when I spent a camping holiday in Scotland. The holiday in question extended for rather more than a fortnight, and throughout the whole of the time I was in touch with broadcasting in one form or another.

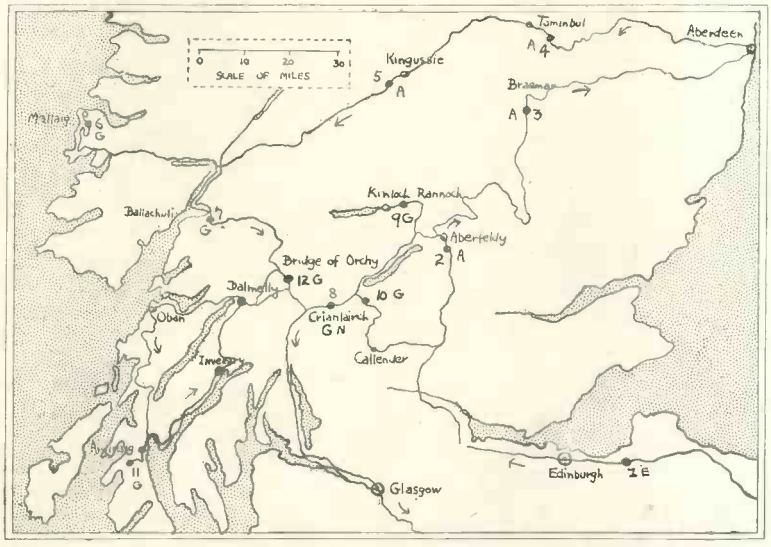
Car Tour

The tour was made in a car, including the journey to and from Scotland, and although quite remote districts were visited, little difficulty was experienced in keeping in touch with one station or another. During the actual journey up most of the time was occupied in travelling, and the wireless set was not brought into commission. The first night it was used was when the objective had practically been reached and a camping site was chosen for the night ten miles east of Edinburgh.

Here the Edinburgh station, although having a power of only 200 watts, could be picked up comfortably on the loud-speaker, using the frame aerial. A temporary aerial was subsequently slung in some trees and, as a result of this extra assistance, excellent signal strength was obtainable during the whole programme, including the weather forecast, which was naturally a matter of some moment on a camping holiday.

Mountain Ranges

The next night was spent two miles south of Aberfeldy. This site is practically midway between Aberdeen and Glasgow, and it was finally decided to use Aberdeen for the transmissions. Here, of course, the distance being over eighty miles across mountains, the reception with the frame alone was not satisfactory, but the erection of a temporary aerial, consisting of about sixty feet of wire, attached to a tree 10 ft. high, gave sufficient extra energy to enable satisfactory reception to be obtained.



Rought sketch map of J. H. Reyner's car tour in Scotland with the Countryside Four. The letters E, A and G indicate the station received best at each stopping place. They are Edinburgh, Aberdeen, and Glasgow respectively.

The change-over to the long waves also enabled Daventry to be received without difficulty, and as Daventry usually relayed the London programme, this provided a very good alternative. Subsequent camping sites were at Braemar, Tomintoul, Kingussie, Mallaig, Ballachulish, Crianlarich, Kinloch Rannoch, Ardrishaig, and Lockerbie.

An Interesting Result

Stops were also made at Tomintoul and Kinloch Rannoch. The former site was devoid of any trees, and in consequence a camera tripod, the actual height of which is only about four feet, was used as a support for the distant end of the aerial, the near end being taken to a suitable point on the car. This gave quite satisfactory results and Aberdeen could be received quite satisfactorily.

On the Kinloch Rannoch site a lone tree was discovered right on top of the moorland, and this was used for slinging the aerial.

It is interesting to note that at the Mallaig site, which was the first spot at which Glasgow was attempted in place of Aberdeen, which had served hitherto, the reception at first appeared unaccountably weak, with a very marked fading. Fortunately, however, reception was achieved successfully for the news, and when the local announcements were given, it transpired that the programme in question was coming from the Newcastle station, over 200 miles away! A fresh search for Glasgow revealed this station at much greater strength, and a satisfactory evening's programme was obtained.

Daylight Reception

It should be remembered that during the period in question sunset in Scotland occurred at from 9 to 9.30 p.m., so that these results were all daylight results, evening conditions setting in from 9.30 onwards. Glasgow in particular was seriously heterodyned by a foreigner, thought to be a German station, which only became troublesome on the later portions of the transmission, that is, when the night-time conditions began to prevail. Fading, of course, is liable to be experienced for a period of one hour or more before sunset actually takes place, and this was noticeable in practice.

On the whole, therefore, the receiver proved to be of considerable utility. It kept us in touch with broadcasting, even in quite remote portions of the countryside, and contributed quite materially to the enjoyment of the holiday. Only local programmes were attempted, although after nightfall some of the stronger foreign transmissions could

be received, but the particular method of reaction control used on the Countryside Four is not such as to permit much really distant work, and the system was devised with a view to simplicity as a first consideration. Consequently, although it appears a little crude at first sight, it produces simple and satisfactory results in practice, which is what is required.

Actual Range

The actual range of the receiver with the frame aerial is naturally limited to 20 or 30 miles from an ordinary main station and 100 or 150 miles from Daventry, but it is a very simple matter to sling a short length of wire to some convenient tree, post, or similar object, and so augment the action of the frame in picking up signals. This aerial is, of course, connected to the grid of the first valve, and it is distinctly worth while fitting a small terminal on the panel, so that the aerial may be added at will without disturbing the set.

Hand-capacity Effects

It was found at first that considerable trouble was experienced owing to hand-capacity effects, particularly if the station to be received was some distance away and, indeed, this was very exasperating, since it necessitated considerable trouble in the tuning.

Fortunately this could very easily be overcome by taking some form of earth connection. In this particular case, the "hand" effect arose from the presence of the car itself, which was a body having a relatively large capacity to earth. To overcome this, a connection was taken externally to the side from the L.S.+ terminal (which is connected to H.T.), to a suitable point on the car.

Actually I unscrewed one of the valve covers and inserted the wire underneath this just as if it were an ordinary terminal. This completely eliminated the defect and at the same time increased the strength to some extent. On another occasion the L.S.+ terminal was connected to some iron fencing close by, and the aerial itself was dispensed with. Signals were picked up quite satisfactorily on the earth lead, and no hand effect was obtained in tuning.

Transit

Perhaps one of the most interesting points has been that of the transport of the receiver. Scottish readers will be aware of the condition of the roads in the more mountainous districts, where anything like a reasonable surface is quite impracticable. The bumping to which any article is subjected to is extraordinarily severe. So much is this the case, that commercial vehicles transporting goods in Scotland are usually equipped with pneumatic tyres, a source of extra expense, which is undertaken as some measure of protection for the goods which have to be transported.

Under such conditions I was a little anxious as to the safe transport of the set. No special precautions were taken. The set was housed in the standard cabinet supplied by the Caxton Wood Turnery Co. Several thicknesses of cotton wool were stuck to the hinged back of the case in such a position that they came up against the valves themselves when the back was shut up. This prevented any large movement of the valves from side to side whereby they might be caused to knock one against the other, as is sometimes found to happen, using the modern vibratory type of valve holder.

Actually no damage of any sort resulted. In one instance the panel carrying the set itself, which was not screwed into the cabinet, but was just pushed into position, jolted free, and I found it in this condition when the set was opened up for use that evening, yet the valves were intact and functioned quite satisfactorily.

Soldered Joints

Such a shaking up as this is also a good test for soldered joints. Many people think that it is a good policy to avoid soldering joints where possible. This particular set, however, contained its full quota of soldered joints. I only found one joint to come adrift during the whole of the trip, which seems to me satisfactory, and indicates that if the soldering is carried out in a satisfactory manner that no trouble can ensue.

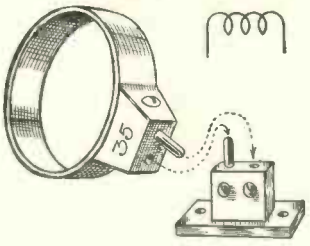
No doubt by now many readers will have built their own Countryside Fours and will have obtained similar results. The addition of the aerial in certain cases and the earthing of the loud-speaker to avoid hand effects are details which will often assist in the obtaining of better results and by the use of precautions, such as have been outlined, some very pleasing results can be obtained.

I must admit that I took the set with a certain amount of hesitation, wondering whether it was not better to forget wireless for a time, but actually I was very pleased that I had done so, for we derived considerable enjoyment from its use.

You still have until September 3 to send in your snapshots of the Countryside Four in use to qualify for one of the £25 worth of cash prizes. The first prize is £15, the second £3, the third £2, and there are five others of £1 each.

Things to Know About

Tuning Coils



THE inductance of coils used for tuning purposes must be of a suitable value for the tuning range desired. If it is required to be able to cover a number of different wavebands some means must be provided of varying the amount of inductance in circuit.

This may be accomplished by using a large coil from which tappings can be taken at different points, but if this is done a good deal of energy will be lost in the unused turns.

It is better to use a number of separate coils having different inductance values, connecting in circuit that coil which is most suitable for the purpose in hand. Hence the popularity of the plug-in coil, an illustration of which is given above.

The coil is provided with a block of insulating material which carries a plug and a socket. One end of the winding is taken to the plug and the other end to the socket. The coil holder has also a plug and a socket to which connection is made from the rest of the circuit.

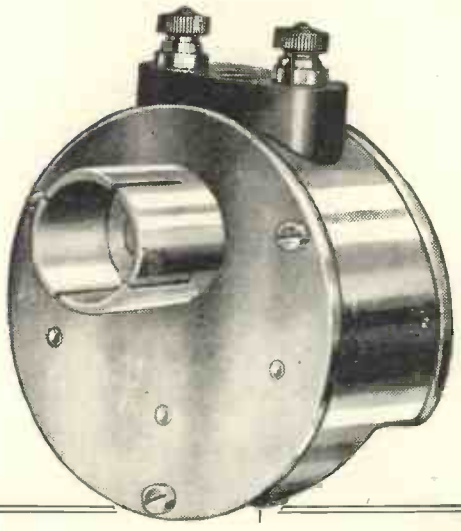
The coil can therefore only be inserted in the holder in one particular way, which is useful when the coil has to be coupled to another coil in one particular sense.

Look Out for Some Extra Special Sets Next Month!

THE WORLD'S BROADCASTING

Wave-length in Metres.	Station.	Call Sign.	Wave-length in Metres.	Station.	Call Sign.	Wave-length in Metres.	Station.	Call Sign.
158	Beziers	—	322	Paris	Radio Vitus	428.6	Frankfort	—
196	Karlscrona	SMSM				434.8	Fredriksstad	—
200	Biarritz	—	322.6	Milan	—	438	Bilbao	EAJ9
201.3	Joenkoeping	SMZD	326	Limoges	—	441.2	Brunn	—
204.1	Gefle	—	326.1	Birmingham	5IT	448	Rjukan	—
217.4	Luxemburg	—	329.7	Königsberg	—	450	Rome	1RO
223.9	Leningrad	—	333.3	Naples	—	454.5	Stockholm	SASA
230	Juan-les-Pins	—		Reykjavik	—	460	Barcelona	EAJ13
238	Bordeaux	—	335	Cartagena	EAJ15		Paris	PTT
241.9	Münster	—	336	Barcelona	EAJ1	461.5	Oslo	—
250	Eskilstuna	—	337	Copenhagen	Radio-raadet	468.8	Langenberg	—
252.1	Bradford	2LS				478	Lyon-la-Dou	—
	Montpellier	—	340.9	Paris	Petit Parisien	483.9	Berlin	—
	Kalmar	SMSN				491.8	Bournemouth	6BM
260	Toulouse	—		Seville	EAJ17	500	Aberdeen	2BD
263.2	Bratislava	—	348.9	Prague	—		Tromso	—
268	Strassburg	8GF	353	Cardiff	5WA	502	Porsgrund	—
270.3	Posen	—	356	Graz	—	508.5	Brussels	—
272.7	Sheffield	6FL	357	Seville	EAJ5	517.2	Vienna	Radio Wien
	Klagenfurt	—	357.1	Falun	—			
	Nottingham	5NG	361.4	London	2LO	526.3	Riga	—
273	Bordeaux	—	365.8	Leipzig	—	535.7	Munich	—
277.8	Leeds	2LS	370	Paris	RadioLL	556	Budapest	—
278	Grenoble	—	370.4	Bergen	—	566	Berlin	—
283	Dortmund	—	375	Helsingfors	—		Augsburg	—
	Cologne	—		Madrid	EAJ7		Hamar	—
287	Lille	—	379.7	Stuttgart	—		Vienna	—
288.5	Edinburgh	2EH	384.6	Manchester	2ZY	588	Zurich	—
291	Radio Lyon	—	391	Madrid	Radio Espana	760	Geneva	HB1
294	Stoke-on-Trent	6ST				850	Lausanne	HB2
	Swansea	5SX	392	Radio Toulouse	—	1,070	Hilversum	HDO
294.1	Dundee	2DE	394.7	Hamburg	—	1,100	Basle	—
	Hull	6KH	400	Cork	6CK		Norddeich	KAV
	Innsbrück	—		Bremen	—	1,111	Warsaw	—
297	Liverpool	6LV		Cadiz	EAJ3	1,180	Constantinople	—
	San Sebastian	EAJ8		Mont de Marsan	—		Boden	SASE
	Marseilles	—		Plymouth	5PY	1,250	Königswuster-hausen	LP
306.1	Belfast	2BE	402	Salamanca	EAJ22	1,320	Motala	—
308	Madrid	EAJ12	405.4	Glasgow	5SC	1,450	Moscow	RDW
310	Agen	—	408	Reval	—	1,600	Daventry	5XX
	Zabreb	—	411	Berne	—	1,760	Paris	CFR
312.5	Newcastle	5NO	416.7	Gothenburg	SASB	1,875	Koscice	—
315.8	Breslau	—	420	Bilbao	EAJ11	1,950	Scheveningen	—
319.1	Dublin	2RN	422	Cracow	—	2,000	Kovno	—
320	Rennes	—	423	Notodden	—	2,650	Paris	FL

Electrify your Gramophone!



and get

Greater tone perfection.
Large increase in volume
Reduced needle scratch.
Controllable volume.
Will fit any model—no alteration necessary.

GRAMOPHONE results never before obtainable are now made possible by the **Brown** Electrical Pick-up. 'Wonderful reproduction' was the description given by the "Wireless Constructor" last month. No need now to buy a new gramophone to appreciate fully the new standard of reproduction set by the electrical record. Just electrify your present gramophone by fitting a **Brown** Electrical Pick-up in place of the sound box and connecting to an amplifier and loud speaker. The result will be an entirely new pitch of tone perfection that will command instant admiration. Reproduction will be infinitely purer; the lower notes with equal fidelity to the high notes.

The **Brown** Electrical Pick-up, with an amplifier and loud speaker, will give you unlimited volume. It is invaluable whenever there is dancing, and an orchestra is not possible or desirable. For the first time, too, volume can be controlled. With this new instrument, gramophone reproduction is infinitely nearer the original. Needle scratch is nearly eliminated. Old gramophones are rejuvenated; old records are re-born.

The Electrical Pick-up, price £4, can rapidly be fitted to any gramophone, and an amplifier connected. No alteration to the gramophone is necessary. Ask your Dealer to demonstrate; or in case of difficulty, write mentioning your nearest Dealer, to ***S. G. Brown, Ltd., Western Av., N. Acton, London, W.3.***

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CA 9427

What Readers Think of Our Sets

Step-by-step Super-het

January, 1926

To the Editor, "Wireless Magazine"

SIR,—Having constructed your famous Step-by-step Super-het some time ago, I am now able to give you some idea of its capabilities.

The set is precisely the same in every detail to that given in your magazine, but I have incorporated a step-down transformer in the output stage in conjunction with a 120-ohm loud-speaker, also the type of potentiometer was altered, but the circuit itself remained as described.

A list of stations will probably be its best recommendation to those who wish to have a set capable of bringing in practically all Britain and the Continent on the loud-speaker, and these I give below :—

D.J.C.'s Step-by-Step Super-het

Aberdeen ... Bournemouth Langenberg ...	Fair loud-speaker strength.
Oslo ... ... Frankfurt ... Gothenberg ...	Good loud-speaker strength.
Glasgow ...	Terrific volume.
Hamburg ... Manchester ...	Very good on loud-speaker.
Stuttgart ...	Fair on loud-speaker.
London ... Birmingham	Good loud-speaker strength.
Dublin ... Newcastle ...	Very good on loud-speaker.
Belfast ... Edinburgh ...	Terrific volume.
Dundee ... San Sebastion	Good loud-speaker strength.
Radio-Paris...	Good loud-speaker strength.
Daventry ...	Very good on loud-speaker.
Söro ...	Fair on loud-speaker.

The reception of these, I think, will suffice to show what the set can do, and to those who wish to tour the stations with ample strength there is no doubt that this will fulfil all their wants. With good luck and an ever-increasing popularity for WIRELESS MAGAZINE.—D.J.C. (Kilmarnock).

Revelation Four

July, 1927

SIR,—I have just constructed from your July issue the Revelation Four. This set I consider to be the best all-round four-valver yet described in any paper. I find the volume, when using 150 volts high tension on the amplifying valves, to be far too great on the Bournemouth and Daventry stations, and it is necessary to reduce it considerably. On foreign stations, however, it is invaluable.

I will not trouble you with a list of stations which I have logged, but suffice it to say that this is the only set with which I have been able to tune them in at really good loud-speaker strength.

I expect you are acquainted with the fact that morse interference is very bad in this district. By using a Lissen No. 60 X coil, this is considerably reduced.

Might I add that several friends of mine have constructed a five-valver described in another paper, and although the volume is greater, the all-round performance is not any better than the set you described with one stage of high-frequency amplification less.

Thanking you for an excellent and useful copy of the WIRELESS MAGAZINE.—FRANK L. HILL (Southsea).

Welcome Three

January, 1927

SIR,—I think it about time I wrote to you, to let you know the results I have obtained with the Welcome Three. I am sure you would like to see this set, made to your drawing in every detail. It is a champion for getting stations under the nose of 2LO and cutting him clean out.

I want no other set, and my friends all fall in love with it for purity and volume. On London and Daventry I can work the set on loud-speaker without aerial and earth.

I give here a list of stations received to date on loud-speaker : Eiffel Tower, Radio-Paris, Radio Toulouse, Radio Lyon, Marseilles, Montpellier, Berlin (long and short waves), Königswusterhausen, Hamburg, Langenberg, Hilversum, Rome, Oslo, Warsaw, Cadiz, San Sebastian, Berne, Birmingham, Cardiff, and Glasgow.

Short-wave stations received on phones and speaker are : 2XO, 2YZ, 5HR, 6AR, 6AI, 2UC, 2KG, 5WL, 6AH, 1KX, 5KH, 2VL, 5UW and on March 17, at 3 a.m., "CKN, Hobart, Australia, Calling XCU London, North." on 22 metres.

I need not say much about getting American stations—they are easy to get most nights of the week.

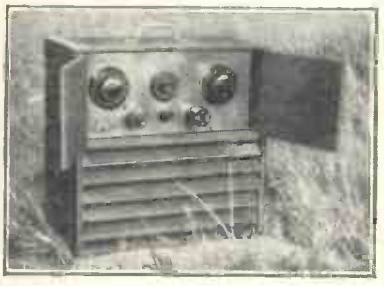
Again thanking you for the results I get from the Welcome Three.—W. G. CORKE (London, W.8.)

Portable Set

June, 1926

SIR,—Having been a reader of the WIRELESS MAGAZINE since February, 1925, which I think was the first issue, and built up many of the receivers described in various issues, including the excellent set, As Good a Set as Money Can Buy, the latter being the first receiver built by me, and done without any other assistance than that given in your magazine, I felt you might be interested in the enclosed photographs of the portable set just completed by me. The cabinet and loud-speaker horn were also made by me, and consist of American white wood.

I have used the four-valve circuit shown on page 501 of the WIRELESS MAGAZINE for June, 1926, made to receive London or Daventry, the latter being at full loud-speaker volume. I have not yet got the necessary coils for London.

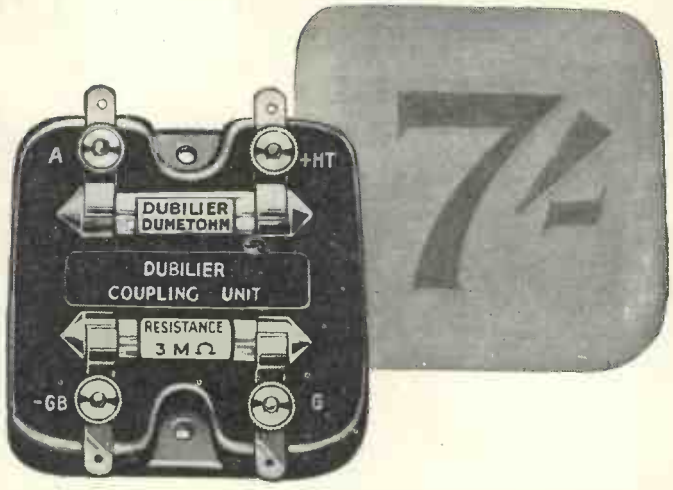


Mr. French's Portable Set

None of the components were purchased especially for portable receivers, and therefore the cost was no greater than an ordinary four-valver. An ordinary aerial and earth may be plugged in if desired.

May I say that I and my family have had many hours of pleasure from receivers described in your magazine. —E. T. FRENCH (Cambridge).

THE DUBILIER R.C. UNIT



COSTS ONLY SEVEN SHILLINGS

For clear, sweet reproduction fit your set with Dubilier Resistance Capacity Units in the Low Frequency Amplification Stages.

Use these Units in conjunction with any of the Valves specially designed by the makers for R.C. Coupling (such as the B.T.-H. Co.'s B8) and obtain perfect distortionless amplification over all frequency ranges from 50 up to 10,000 cycles.

The wonderful properties of the Dumetohm have, as we anticipated, resulted in highly favourable reports on these Units and a veritable flood of orders which we are striving to fill.

This is not surprising when you consider that the Dumetohm is guaranteed by us to be **noiseless in action, constant under variations of temperature and load, to have no self inductance, no self capacity, and to retain these properties indefinitely.**

These qualities make the Dumetohm particularly suitable for R.C. Units, and place the Dubilier Coupler far and away ahead of anything wireless has yet seen.

Order your Dubilier Couplers to-day and enjoy the perfect reception they afford.

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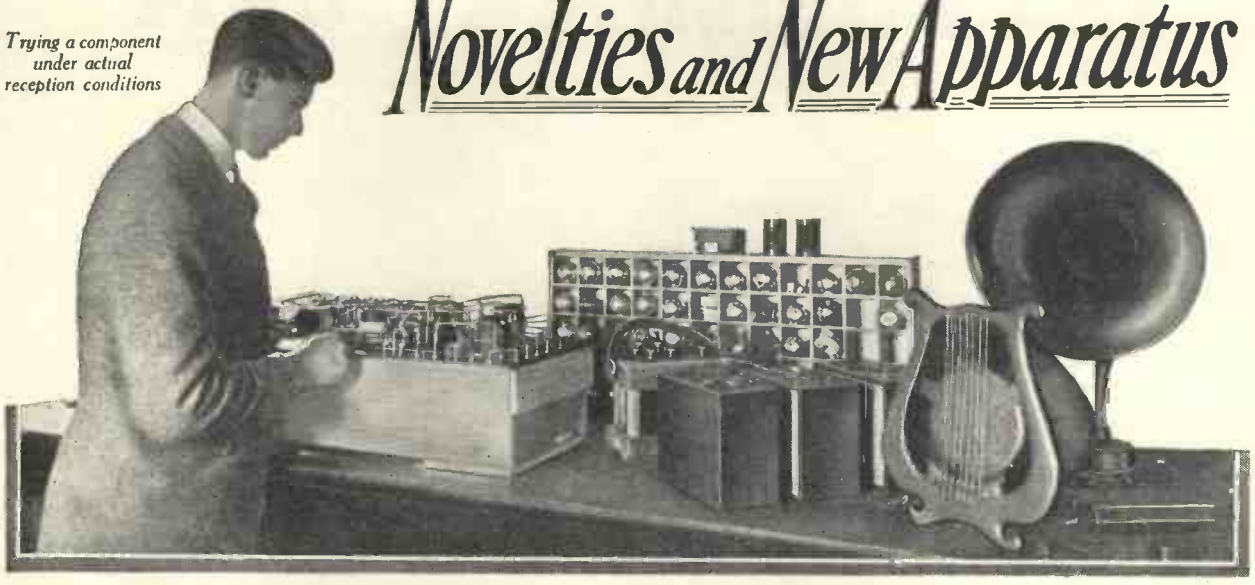
Advt. of the Dubilier Condenser Co. (1925) *Ltd., Ducon Works, Victoria Rd., North Acton, W.3.* TC 22

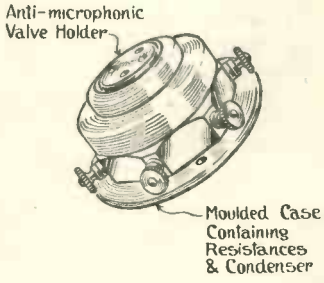
All Tests Are Conducted Under the Personal Supervision of J. H. Reyner, B.Sc. (Hons.), A.M.I.E.E., at His Furzehill Laboratories

Novelties and New Apparatus



Trying a component under actual reception conditions

Magnum R.C.C. Unit



THIS is a particularly neat component which consists of a valve holder together with grid leak, anode resistance and grid condenser: thus the unit provides a complete R.C.C. amplifier.

The antimicrophonic valve holder, which is similar to that normally supplied by the makers, is mounted in the centre of the unit. The resistances and condensers are placed inside and immediately underneath the holder, whilst the input and output terminals are placed round the sides of the component.

On test it was found that the grid condenser had a capacity of .0016 microfarad, the grid leak a resistance of 1 megohm and the anode resistance a value of 200,000 ohms. These figures are satisfactory and bear approximately the correct relation to each other.

When connected in a valve circuit good reproduction was obtained, with a noticeable freedom from distortion.

Burne-Jones & Co. of Borough High Street, S.E.1.

DE610 Valves

THE makers have attempted to give the public valves having a good performance consistent with economy in filament current: from an inspection of the figures obtained by us on test, it is evident that they have been successful in this attempt.

The DEH610 is a high-impedance valve with a high amplification factor, and is therefore especially suitable for use in resistance-capacity amplifiers, although it may be used with advantage in a tuned-anode circuit and as a detector valve followed by resistance-capacity coupling.

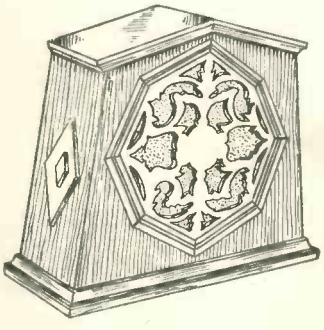
The DEL610 is a general-purpose valve, as its moderate impedance makes it suitable for use in high-frequency circuits; whilst it should prove efficient as a rectifier followed by a transformer- or choke-coupled L.F. amplifier. Finally, it may be used in the first stage of a low-frequency amplifier where an appreciable step-up voltage is desired.

The DEP610 is an efficient power valve capable of amplifying large voltage swings without distortion, whilst the amplification factor is noticeably high for a valve with such a low impedance.

	Impedance	*Amplification Factor*	*Anode Voltage*
DEH610	120,000	36	60
	83,000	33	90
DEL610	18,000	12.3	90
	15,000	10.8	120
DEP610	7,000	7	90
	6,200	6.1	120

These valves are sold under the name Marconi by the Marconiphone Co., Ltd., of 210/212, Tottenham Court Road, W.1, and under the name Osram by the General Electric Co., Ltd., of Magnet House, Kingsway, W.C.

Amplion Cone Loud-Speaker



WHEN a firm of repute, who have manufactured loud-speakers for many years, design a cone loud-speaker, considerable interest is attached to the finished product, which must have been evolved as a result of much experimental work.

The electromagnetic mechanism of this loud-speaker does not follow standard Amplion practice to any noticeable extent. The vibrating armature is held close to the magnet by four supports placed at right angles to each other. This gives a very rigid support, and causes the natural period of the armature to have a high value. In this manner, the inevitable armature and diaphragm resonance is far less detectable.

A 12-in. cone, consisting of stiff gauze,

(*Continued on page* 166)

EXCHANGE DEPT. REOPENED

IF YOU WANT TO BUY NEW PARTS, WE ARE WILLING TO ACCEPT SOME YOU DO NOT REQUIRE IN PART EXCHANGE.

Not more than 4/- in each £ you spend allowed for in old parts. Owing to the thousands of letters received re this department, we are unable to enter into unnecessary correspondence. Please state plainly what you require and what you wish us to take.

Silence polite negative.

ACCUMULATORS.
2-v. 40, 7/11; 2-v. 60, 9/6; 2-v. 80, 12/6; 2-v. 100, 14/6; 4-v. 40, 13/11; 4-v. 60, 17/11; 4-v. 80, 23/6; 6-v. 60, 26/6; 6-v. 80, 35/6. ALSO another good make, 1/6 extra on each of above. Post 1/- each.

BENJAMIN. — Battery Switch, 1/3. Valve Holder, 2/9; with Grid Leak, 5/3. With Condenser and Leak, 7/-. Rheostat, 2/9.

BRETWOOD.—Grid Leak de Luxe, 3/6; with condenser, 4/6. Anode, 3/6.

BURNDEPT ETHOVERNIER DIAL (with Ethelog Station Indicator, 18-), 9/-.

CARBORUNDUM. Detector only (No. 30), 5/-. Stabilising Detector Unit, with No. 30 Detector, 12/6.

CELESTION Loud Speaker —Oak, 110/-; Do. "A2," 130/-; Do. "A3," 150/-. Mahogany same price; walnut extra.

CLIMAX. — Potential Divider, 5/-. Special Choke, 10/6. Shock Absorbers, 3/- pr. Earth Tubes, 5/-. L.L. Insulators 1/- pair.

COLVEERN SCREENED COILS, &c. Former & Base, 5/-. 6-pin Base, 1/6. Former only, 4/-. Screen and Base, 8/6. S.P.H.F.T., 9/6. S.S. do., 9/6. 2 Monodial, 19/-.

DUBILIER. Duwirohm Wire-wound 20,000 to 100,000 ohm resistances, 5/- each; Base, 1/6; 200,000 ohms, 8/-. Vol Control Unit, 1 H.F., 7/6. Duvarileak, 7/6. Dumetohm Holder, 1/-.

DUBILIER MANSBRIDGE. ·1, 2/6; ·2, 2/8; ·25 to ·3, 3/-; ·4, 3/3; ·5, 3/6; 1 mfd., 4/-; 2 mfd., 5/-; 3 mfd., 8/-.

DUNHAM "ALL-WAVE" TUNER will enable you to dispense finally with troublesome Vernier coil-holders and sets of coils. It is adaptable to any set already made, and covers all wavelengths from 150 to 2,000 metres, and is complete with reaction. **"Allwave" Tuner, 9/6.**

EVER-READY H.T. Popular 66-v., 9/6; Do. 108-v., 15/6. Standard 66-v., 12/6; 108-v., 21/-; L.T.3, 7/6 (4½-v.). Flash Lamp, 4·5, 6/- dozen. Grid Bias 9 Tapped 1½-v., 2/-.

USUAL LINES STOCKED.

EXIDE H.T. ACCUMULATORS. 20-v. Unit, 15/-. (Not sent by post).

FORMO Individual-Gang Control Condenser. Twin-Gang, £2 12s. 6d.; Triple-Gang, £3 3s.

GANG Dual ·0005. Ormond, with dial, 32/- Cyldon, no dial, .. 50/-
Triple ·0005. Ormond, with dial, 40/- Cyldon, no dial .. 70/- Igranic, no dial .. 75/- Bowyer-Lowe, no dial. 70/-

GAMBRELL COILS. a/2 4/10, a 4/10, A 5/-, B1 5/3, B 5/6, C 5/9, D 6/3, E1 6/9, E 7/9, F 8/6, G 10/-. Centre-tappcd coils 6d. extra.

GRAHAM FARISH Bakelite Mica Condensers, have S.P.G.L. clip. ·0001 to ·002, 1/-; ·003 to ·006, 1/6; ·007 to ·01, 2/6. Grid Leaks, 1/3; ·0003 and Leak, 2/-.

BROWNIE No. 2. Latest model, 10/6. Complete with pair of high-class 'phones, 4,000 ohms, value 8/11. Aerial wire, lead-in, Daventry Coil, the lot, 18/11.

2-Valve Amplifier.....63/-.

4-way 'Phone Boards, 3/-. Daventry Coil.....2/9.

SPERAVOX LOUD SPEAKER. Speaks for itself. Price, 50/-.

SHAW'S GENUINE HERTZITE. Made from special formula in sealed boxes, with signature. Gold Label, 1/-; White do. 8d.

RADIO MICRO. 2-V. ·2, 5/11. Power, 10/-. 3·5-V. ·06, 5/11. Super Power, 12/-. Post 6d. valve.

SUCCESS. Chokes H.F., 10/6; Super, 18/6; Super Tapped, 22/6: L.F., 10/6.

UTILITY SWITCHES. Anti-cap., 2-w., 3/6; 3-w., 4/6; 4-w., 5/-; 6-w., 6/-; Lever Pattern, 2-w., 4/-; 3-w., 5/-; 4-w., 6/-; 6-w., 8/-. **UTILITY** Variable Condensers stocked.

PANELS. Grade A, cut to size, ½d. sq. inch, 3/16, or ¼d. for ⅛ in. Reduction Large Sizes.

MULLARD VALVES. P.M.1H.F., 2-v., 10/6; P.M.2, 2-v., 12/6; P.M.3, 4-v., 10/6; *P.M.3A (R.C.), 4-v., 10/6; P.M.4, 4-v., 12/6; P.M.5X (G.P.), 6-v., 10/6; *P.N.5B (R.C.), 6-v., 10/6; P.M.6, 6-v., 12/6.

Super Power Valve for last L.F. Stage: P.M.253, 4-v., 20/-; P.M.256, 6-v., 20/-.

WE RECOMMEND THEM

HYDRA MANS BRIDGE Condensers, tested to 600 volts. Eminently suitable for Eliminators. 4 Mfd., 6/-; 2 Mfd., 3/9; 1 Mfd., 2/9. Special price for quantities.

VARLEY. All Chokes and Anodes stocked.

WEARITE, 2-way geared, 5/-. B. of Panel, 7/6. Countryside Four, set of Binocular Coils, 15/-. Rotary o/o Switch, 2/6. M.C.3 Aerial and Transformer Coils, wound on Paxolin formers, ready for use, 3/- pair. Post 6d. M.C.4 Ditto B.B.C., 10/6 set. 5XX, 12/6 set. H.F. Choke, 6/6.

HELLESEN (post free), 66-v., 12/6; 99-v. 21/-. Grid Bias, 9-v., 2/-; 4½-v., tapped 1½-v., 1/2.

BRITISH RADION LATEST VALVES

Type
2-v. 15 H.F. or L.F.
2-v. Power
4-v. 1 H.F. or L.F.
4-v. Power
6-v. Power

5/-

Post 6d. each.

CABINETS, Large stocks of really useful cabinets kept, or made to order. Solid oak. Glass finish. American type, hinged lid, baseboard.

Post 1/6 each extra.

8 x 6 x 7 ins. deep ... 6/11
10 x 8 x 8 ins. deep ... 8/11
12 x 8 x 8 ins. deep ... 10/6
14 x 7 x 9 ins. deep ... 13/6
16 x 8 x 9 ins. deep ...15/11
24 x 7 x 9 ins. deep ... 27/6

Extra quality in Oak or Mahogany, 5/- each extra, worthy of any set.

LOTUS. — V. Holders, 2/3; with Terminals, 2/6. 2-way Coil Stand, 7/-. 8/-. 3-way, 10/6, 12/-.

NEUTRALISING. Peto-Scott, 5/-, 6/3, 7/6. Ormond, 4/-. Bowyer-Lowe, 7/-. Magnum, 5/-. McMichael, 4/9. Reaction (Ormond) ·0001, 4/-. J.B., 3/6.

PEERLESS.—6 or 30 ohm Rheostat, 2/6. Fixed Resistors (State Valves). 1/3.

OUR NOTED 1-VALVE (L.F.) & CRYSTAL SET

In Solid Polished Cabinet.

COMPLETE WITH LION MICRO DETECTOR.

SET only 22/6 Carr. 1/-.

Or complete with valves, phones, H.T. and L.T. Units, Aerial Equipment, Daventry Coil. **45/11**
Extraordinary value. Post 2/-

STOP PRESS!

Mullard, Marconi, Osram, Ediswan, Cossor, B.T.H., Cosmos.

Above valves now reduced.

8/- Bright 4-v. now 5/-
14/- D.E. ..... now 10/6
18/6 ..... now 12/6
22/6 ..... now 20/-

This reduction will enable you to use British valves for all purposes.

JACKS & PLUGS.—Lotus S.C.O., 2/-; S.C.C., 2/3; D.C., 2/6; F.S.D., 2/6; F.S.D., 3/-; Jack Plug, 2/-; P.P.J.S., S.P.D.T., 3/3; D.P.D.T., 4/-.

IGRANIC PACENT 61, 2/-; 62, 2/3; 63, 2/6; 64, 2/6; 65, 2/6; 66, 3/-, etc. Univ. Plug, 1/6.

ASHLEY S.C.O., 1/3; S.C.C., 1/6; D.C., 1/9; F.S.C., 1/9; F.D.C., 2/3. 'Phone Plugs, 1/6.

R.C. UNITS.—Ediswan, 7/-; Dubilier, 7/-; Cosmos, 8/6 with V.H., 10/-); Magnum, 10/-; R.I. Coupler, 20/-; Graham Farish, 3/6.

VALVE HOLDERS. Non-microphonic. — Benjamin, 2/9; Lotus, 2/6, 2/3; W.B., 2/-; Magnum, 2/6; Raymond, 1/9; Harlie, 1/4; Standard, 9d., 1/-.

H.F. CHOKES.—Watmel, 5/-; T.J.S., 4/6; McMichael, 9/-; R.I. Varley, 9/-; Split Coil type, 12/6); Success, 10/6; Cosmos, 6/6; Bowyer-Lowe, 9/-; Lissen, 5/6; Climax, 8/6; Special for Eliminators, 10/6; Wearite, 6/6.

J.B. CONDENSERS, awarded Certificate (1998) of Merit, "Radio News" of America. We sell them.

LEWCOS C.T. Coils, wound Litz wire, 60, 3/6; 200, 5/3. Frame Aerial Wire, 3/6 100 ft. coil; Multiway Battery Leads, 4-way, 5/6, 5-way, 6/6, 6-way, 7/6, 7-way, 8/6 (5 feet in length); Glazite, 10 ft., 1/2 (4 colours); Screens, Bases, H.F. Transformers. Inductance Coils, 25, 35, 50, 3/6 each; 75, 100, 4/- each; 150 and 200, 4/6 each; 250, 5/-. **LISSEN** Valve-Holders, 1/-; Fixed Con., 1/-, 1/6; Leaks, 1/-; Switches, 1/6, 2/6; Latest 2-way Cam Vernier, 4/6; Rheostats, 2/6; B.B., 1/6; Lissenola, 13/6; L.F. Transformers, 8/6; 100-v. H.T., 12/11 60-v. H.T., 7/11; Coils, 60X, 6/4; 350X, 9/9. 'Stats, minor, major, all parts.

BARGAINS

EVERY DAY WE HAVE A QUANTITY OF SHOP-SOILED, NEW AND SECOND-HAND GOODS, WHICH CAN BE PURCHASED CHEAPLY BY CUSTOMERS (ONLY).

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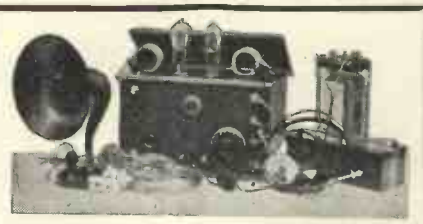
ALL DAY SATURDAY. ALL DAY THURSDAY.
Hours 9.30—8.
SATURDAY 9.30—8.45. SUNDAY 11—1.
TWO SHOPS, ONE ALWAYS OPEN.

IMPORTANT

LEADING DISTRIBUTOR OF LISSEN, G.E.C., BURNDEPT., WEARITE, DUBILIER, EDISON BELL, COSMOS, MULLARD, COSSOR, EDISWAN, B.T.H., MARCONI, STERLING, GAMBRELL, MAGNUM, EVER-READY, RESISTON, T.C.C., IGRANIC, FERRANTI, LEWCOS, "J.B." BENJAMIN, LOTUS, NEWEY, PYE, C.E. PRECISION, EUREKA, UTILITY, FORMO, BOWYER-LOWE, COLVERN, R.I., PEERLESS, POLAR, T.C.C., PETO-SCOTT.



THREE-VALVE LOUD-SPEAKER SET

NOTE THE WONDERFUL VALUE. TRY ONE OF THESE!

(The set shown is two-valve.)

Gets Local Daventry and many Continental stations.

THIS MAGNIFICENT 3-VALVE SET (D. & L.F.), includes Handsome Polished American-Type Cabinet (all parts enclosed), 3 Dull Emitter Valves, Tuning Coils, H.T. & L.T. Batteries, Aerial Equipment, Leads, Loud Speaker or 'Phones. Tax paid.

£ s. d.
5 19 6

JUST THINK of a 3-Valve Set at £5/19/6! It sounds unbelievable, doesn't it? Car. & P'kg. 7/6

WE STOCK ALL LINES IN GENERAL DEMAND. SPECIAL WEST-END AGENT FOR BURNE-JONES (MAGNUM). BEST WAY IS TO MAKE OUT A LIST WITH MAKERS' NAMES AND ASK FOR QUOTATION. IT IS IMPOSSIBLE TO ADVERTISE EVERY COMPONENT NOW ON THE MARKET.

PETO-SCOTT (Keystone, Copex). Neut. B.B., 5/-; P'l, 6/3; B'ing, 7/6; Midget, 4/6. Special 6-pin Base, 2/9. Copex Screens and Base, 9/6. Coils stocked for all sets.

L.F. TRANSFORMERS. Ferranti A.F.5, 25/-; A.F.4, 17/6; Eureka Concert. 25/-; 2nd Stage, 21/-; Baby 1st or 2nd, 15/-; Reflex, 15/-; Formo shrouded, 10/6; Success (Black), 21/-; Royal, 20/-; Ormond, newest model, 15/6; Marconi. "Ideal." all stages, 25/- each; C.A.V., 15/-; Pye, 17/6; Gambrell, 2 stages, 25/6; Ideal Junior, 18/6; R.I., 25/-; Multi-Ratio, 25/-.

ORMOND. Square Law Low-Loss. ·0005, 9/6; ·0003, 8/6; (1/6 each less no vernier); **Friction Geared,** ·0005, 15/-; 0003, 14/6; ·00025, 13/6. **Straight Line Frequency Friction Geared,** ·0005, 20/-; ·00035, 19/6. S.L.F. ·0005, 12/-; ·00035, 11/-. SQ. LAW LOW-LOSS DUAL, ·0005, 16/- each. **Ormond Friction Dial, 10/-. Filament Rheostats, Dual, 2/6; 6 ohms or 30 ohms, 2/-. Potentiometer,** 400 ohms, 2/6. **Standard,** ·0005, 5/-; ·0001, **Reaction,** 4/-; **Air Dielectric,** 2/-; **Neutralising,** 4/-; **Neutrodyne,** 2/-. **Twin Gang,** ·0005, 32/-; **Triple,** 40/-.

MULLARD, COSMOS, MARCONI, B.T.H., EDISWAN, COSSOR VALVES. *The latest always in stock.*

THE NEW No. 3

ORMOND S.L.F. CONDENSER

·00025, 5/6. ·00035, 5/9. ·0005, 6/-. With 4" Dial.

With Friction 55-1 4-in. Dial, 6/- ea. extra.

ORMOND NEW GEARED DIAL 5/-

LOW LOSS SQUARE LAW.

This variable Condenser is simply marvellous value. It cannot be equalled in price or quality

·0003 ·0005 **4/11** each

By Post 5/11.

With VERNIER 1/- extra.

BRITISH HEADPHONES.—BROWN'S FEATHERWEIGHT, 20/-. **BROWN'S "A" TYPE** (Reed), 30/-. **B.T.H.,** 15/-. **STERLING,** 20/-, 22/6.

THE NEW FAMILY FOUR. (P. W. Harris.) I have all parts in stock. Perhaps you would like to use up some of your existing parts. In this case, please say what you actually need, and I will give a fixed inclusive price.

BE SURE IT'S

RAYMOND'S

(SEE NAME) YOU CAN ONLY GET THE RIGHT GOODS AT THE RIGHT PLACE.

FORMO or FINSTON S.L.F. CONDENSERS

With handsome 4" TRIOLITE DIAL AND KNOB. **7/6**

With Geared Dial, 11/6.

BEFORE YOU PURCHASE ELSEWHERE: CALL AND LET ME QUOTE YOU

LISSEN LATEST 2-WAY CAM VERNIER 4/6

HEADPHONES, all 4,000 ohms. N. and K. Standard Patterns 8/11 pr. N. and K. Genuine new lightweight, 11/6, 13/6. Dr. Nesper, 10/6 and 12/11. Telefunken, adjustable genuine (20/- model), 14/11 Brunet, 11/9, 12/11, 14/6, 3 models. Ericsson (Continental) E.V., 7/11 pair.

MAGNUM Neutralising Condenser, 5/-. Single Coil Mount on Base, 1/9. Aperiodic H.F., 10/-. B.B.C. or 5XX H.F. Transformers, 7/- extra.

ALL PARTS STOCKED

LOG-MID-LINE

Try our NEW VARIABLE CONDENSERS, made on the Log-Mid-Line principle. ·0005 or ·0003, with a 4-in. Triolite Dial, the best you can buy for the moderate price of **5/11** each, post free

CALLERS' COLUMN

AERIALS.—100 ft. 7/22 Hard drawn, 1/11. Extra heavy, 2/2. Phosphor 49 strands, 1/-. Electron stocked. Special INDOOR Aerials, phosphor, with ebonite separators and rubber rings (12 ft. x 8 strands), total 100 ft. 4/6. O.V., 2/6. Rubber Lead-in, highest quality, 10 yds. 1/-; 10 yds. 1/3; 10 yds. 1/6. Extra heavy, 2d. and 3d. yd. R. & B. Twin Flex (best), 6 yds. 10d.; 12 yds. 1/6; 36 yds. 4/-. Ins. Hooks, 2 for 1½d. Egg Insulators, 2 for 1½d. Ins. Staples, 4 a 1d. Earth Tubes, Copper, extra value, 2/3. Climax, 5/- (also at 2/6).

EASY FIX AERIALS. with 2 insulators and lead-in, 1/3. **EBONITE GRADE A.** Stock sizes, 6 x 6 and 7 x 5, 1/3; 8 x 6, 1/6; 9 x 6, 1/9; 10 x 8, 2/9; 12 x 6, 2/9; 12 x 8, 3/6; 12 x 9, 4/-; 14 x 7, 4/6. ALSO CUT TO SIZE while you wait at ¼d. per sq. inch 3/16th, and ½d. sq. inch for ⅛ in. Special cheap panels for Crystal Sets.

TERMINALS, Nickel W.O. Pillar, 'Phone, 1/- doz. (3 for 4d. with N. and W.); Brass do., 10d. doz. (1d. each with N. and W.); all high quality. Valve-Pins, with nuts, 2 a 1d. Ormond Screws, 6 or 4 B.A., 6d. dozen with nuts; washers 12 a 1d. Red and Black Spades, screw at side, 3½d. pr. Plug and Socket, Red or Black, 3½d. Wander Plugs, Red or Black, 3½d. pr. (Large, good). 'Phone Connectors, 1d. Flush panel sockets and nuts, 4 for 4d., 10d. dozen. Brass Spade Tags 6 a 1d. Nickel Solder Tags, 4 a 1d. 2 and 4 B.A. Rod, 3d. foot. Nickel Valve Legs and Nuts, 1d.; 8d. dozen. Stop Pins, 2 a 1d. **H.T. BATTERIES.** Highest quality only at lowest prices. Adico (Trade test award best given) 60-v., 6/11; 100-v., 12/11. Theria, 60-v., 5/11; 100-v., 10/11 (with extra Grid Bias). Everready, 66-v., 9/6; 108-v., 15/6. Others from 5/-. 5 L.T. Hellesen's, 2/6; Adico, 1/8; B.T.H., 2/-; Flag, 2/-; British, 1/6.

FLASH LAMP. 4·5 Adico, 4½d., 4/3 doz. British, 6d., 3 for 1/3.

SOLDER, with resin, 2d. foot. 1/16 sq. Bus Bar, 2 ft. 1d. Tinned copper, 16 and 18 gauge, round, 9d. per ½-lb. D.C.C., ½-lb. 20 gauge, 8d.; 22 gauge, 9d.; 24 gauge, 10d.; 26 gauge, 11d.; 28 gauge, 1/-; 30 gauge, 1/2.

MANSBRIDGE CONDENSERS. "Hydra" 1 mfd., 2/9; 2 mfd., 3/9. 0·1, 1/9; ·25 and ·5, 2/3.

SWITCHES on Porcelain, D.P.D.T., 1/3; S.P.D.T., 8½d. and 10½d. Sound quality Panel switches, with Ebonite handle, worth double. S.P.D.T., 1/-; D.P.D.T., 1/6. Insulating Tape, 4½d. Copperfoil, 4d. foot (6 in. wide). Grid Bias Clips, 6d. Panel Brackets, 9½d., 1/- pr. Shorting Plug, 1/-, 1/3. Service Micrometer, with crystal, 2/9, 4/6. **CRYSTALS.** Superzite, 1/6; Shaw's sealed genuine Hertzite, 8d., 1/-; Wyray, 1/6. **HEADPHONE CORDS.** Good, 1/-. 1/3, 1/6. L.S. Cords, 1/6, 1/9. 4-way H.F. and L.T. Leads, 1/9, 2/-. Lewcos Stocked. **COIL PLUGS.** Ebonite on Base, 6½d., 7½d. Lotus, 8d. Burne-Jones, 1/9. Low Loss, 8d. Panel, 6½d. Various stocked. **GEARED COIL STANDS.** 2-way, 2/3, 2/6, 2/11 up. 3-way, grand value, 5/11. Back of panel from 2/11. All ebonite.

K. RAYMOND

27 & 28a, LISLE St., LONDON, W.C.2.

'Phone: Gerrard 4637.

COME TO

LEICESTER SQ. TUBE

(Important)

Ask for *back* of Daly's Theatre

This address is opposite.

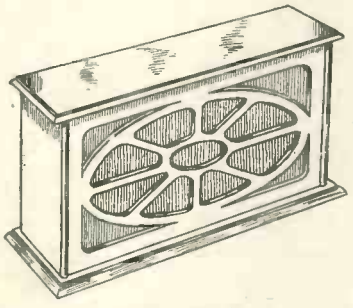
Novelties and New Apparatus (Continued)

painted in gold and edged with cloth material is screwed on to the centre of the armature. The complete mechanism is housed in an oak cabinet.

On test, the tone was distinctly pleasing, there was a marked absence of resonance points, and both speech and music were reproduced with remarkable clarity. The sensitivity of this instrument is slightly less than could be obtained from a horn speaker, but the gain in quality more than compensates for this loss.

The manufacturers are Graham Amplion, Ltd., of 25 Savile Row, W.C.

Oriel Loud-speaker



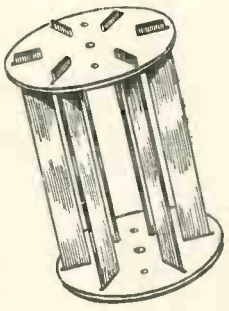
THERE is a distinct vogue for the polished wood cabinet loud-speaker as its appearance conforms to a far greater extent with the furniture in a room: many types of horn loud-speakers are unsightly and do not fit in with the surroundings.

The Oriel loud-speaker consists of an electromagnetic unit to which is attached by a rubber tube a metal horn having a rectangular flare. Thus the speaker can be mounted in a handsome polished wood cabinet which gives a pleasing appearance, and successfully camouflages the horn. The adjusting knob is situated on the bottom of the cabinet so that it is not visible to the eye unless the speaker is lifted up.

On test, the tone from the loud-speaker proved to be pleasing and pure in quality: this is no doubt due to the special shape of horn employed.

It is made by the London Radio Manufacturing Co., Ltd., of Station Road, Merton Abbey, S.W.19.

Peerless Coil Former



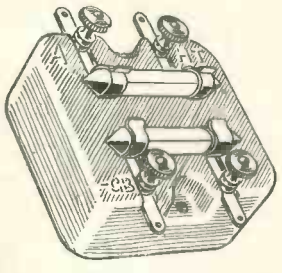
THE efficient low-loss coil of to-day is somewhat different from its predecessors; we now realise the importance of minimising dielectric losses, and this is only made possible by the use of special formers which are apt to be expensive.

A practical and inexpensive former has been evolved by the well-known Peerless people, in which a number of simple parts can be put together to form an efficient air-spaced article.

The outfit is supplied in a small package containing the necessary parts; these can be assembled in less than a minute, as it is only necessary to insert the narrow strips of insulating material in their correct slots cut in the end pieces when a rigid and most efficient article is produced. So robust is this former that there should be little possibility of damaging it even by the most casual treatment, whilst there is no tendency for it to buckle under the strain of winding.

The makers are the Bedford Electrical Co., Ltd., of 22 Campbell Road, Bedford.

Dubilier R.C.C. Unit



IN the quest for quality of reproduction the resistance-capacity-coupled amplifier has few rivals; the popularity of this coupling has been demonstrated by the large number of units which are now on the market.

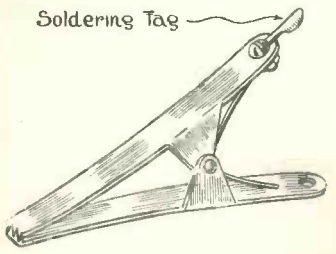
One of the latest additions to this number is the R.C.C. unit designed by the Dubilier Condenser Co., Ltd. This is a neat and efficient unit incorporating components manufactured by the company. The condenser is housed inside a small square moulded base and the necessary resistances with holders are mounted on top of the base; they are thus accessible and allow an easy interchange of different values.

Tested in a low-frequency amplifier, very good results were obtained; the low notes, which are so desirable for pleasing reproduction of speech and telephony, were well in evidence.

The condenser proved to have a capacity of .006 microfarad, whilst the values of anode resistance and grid leak were 1 megohm and 3 megohms respectively.

The address of the makers is Ducon Works, Victoria Road, North Acton, London, W.3.

Quick-grip Terminals



MANY readers must have often felt the need for some quick method of making a connection between terminals, tags, or bare-copper wire. The practice of winding one piece of wire round another when making a connection is apt to lead to bad contacts, whilst making connections in this way is always a tedious process.

Ward & Goldstone, Ltd., of Manchester, realising the need for a quick method of connection, have placed on the market a number of quick-grip connectors in various sizes to suit the different purposes to which they may be put. Essentially they consist of two jaws with teeth cut in them and constrained together by means of a spring. The arrangement is somewhat similar to a normal paper clip, whilst provision is made for soldering or otherwise connecting a lead to the article.

Experimenters and all those who build and test various receivers should find this component of considerable use.

The address of the manufacturers is Pendleton, Manchester.

Aerials

Perikon Detector

Loud-speaker Work

Earth with Indoor Aerial

Shielded Transformers

S.L.F. Condensers

Accumulator Electrolyte

A.T.C. in Series and Parallel

Aerials

Q.—What is the best number of wires to use in an aerial?—D.L.F. (S.W.2).

A.—For ordinary broadcast reception there is nothing to be gained by using more than one wire provided that the total length and height of this can be made to approach 100 ft. If, owing to space restrictions, the dimensions must be much less than this two, or even more, wires may be used in parallel, but should then be separated by at least four feet.—P.C.

Shielded Transformers

Q.—What advantages have the transformers in which the windings are completely enclosed within an iron case over those in which the windings are merely covered with cloth?—K. F. D. (Lyme Regis).

A.—Such transformers are far less likely to pick up interference from A.C. mains, electrical machinery, or similar sources. Also there is less likelihood of interference taking place between two transformers used in the same set. To obtain the fullest advantage from the iron case it is desirable to connect it to earth.—J. K. R.

Perikon Detector

Q.—What type of crystals are used in a "perikon" detector?—E.K. (E.7).

A.—The original perikon detector contained two crystals, of zincite and bornite, in contact with each other. Later, however, the name came to be applied to any crystal detector in which the contact was between two crystals instead of between a crystal and a metal.—P.C.

S.L.F. Condensers

Q.—What is a straight-line-frequency condenser and what is its particular advantage?—G.J. (Berwick).

A.—This is a variable condenser, the plates of which are so shaped that, when the condenser is connected across an inductance coil having a negligible self-capacity, a given amount of movement over any part of the condenser scale will alter the frequency to which the circuit comprising coil and condenser is tuned by the same amount.

The advantage of using a condenser of this type is that, under the Geneva scheme, it has been attempted to separate the *frequencies* on which stations situated close together work by a certain number of kilocycles. Thus when using straight-line-frequency condensers it may be expected that the stations within range will be fairly evenly distributed over the whole of the condenser scale.

This type of condenser receives its name because the "curve" plotted to show the frequency to which a circuit is tuned, in relation to the condenser settings, is a straight line.—G.N.

Long-distance Loud-speaker Work

Q.—What type of four-valve set would you recommend for good loud-speaker reception, mostly from stations over 100 miles away? I am undecided between a set with one H.F. and two L.F. valves and one with two H.F. and one L.F. valves.—T.P.M. (Plymouth).

A.—We certainly think that, for your purpose, you should use two L.F. valves, of which the last should be a power valve. Most likely you will find that a single H.F. valve is quite sufficient for your needs, but if it is not you should use a five-valve set with two H.F. and two L.F. stages.—G.N.

Accumulator Electrolyte

Q.—What is the correct composition of the solution used in lead-plate accumulators and how should it be made?—A. R. G. (Willesden).

A.—Sulphuric acid that is really pure should be added to distilled water until the specific gravity of the solution is 1.22. It is essential that the acid be added to the water a drop or two at a time, as should much acid be added at once, or should the water be added to the acid, the mixture will become very hot.—L. M.

Meaning of "QRT"

Q.—What do the letters "QRT" sent, in morse, by a ship, mean?—D.N. (Devon).

A.—This is one of a number of official abbreviations used by ships and coast stations when in communication with each other. It is a request to the station or stations to which it is addressed to "Stop transmitting."—P.C.

Earth with Indoor Aerial

Q.—Is it necessary to use an earth connection with an indoor aerial as is the case when an outdoor aerial is employed?—F.C.D. (Luton).

A.—No earth connection is required with a frame aerial and this type of aerial may, of course, be used indoors. But by indoor aerial is usually meant an aerial erected on exactly the same lines as one outside, and if, as is probable, it is to this latter type of aerial that you refer, an earth connection is certainly necessary.

Moreover, everything possible should be done to make this earth connection efficient as the aerial itself will be much less efficient than one erected out in the open.—G.N.

A.T.C. in Series and Parallel

Q.—If an aerial-tuning condenser which has previously been used in parallel with the aerial coil is placed in series with the coil, will it be necessary to use a different size of coil in order to tune to a given station and, if so, should a larger or a smaller coil be used?—S.T.C. (Dover).

A.—Changing the A.T.C. connections from parallel to series will have the effect of reducing the maximum and minimum wavelengths to which the set can be tuned with a given coil in the aerial circuit. If you make the alteration you may still find it possible to receive a given station with the present aerial coil by setting the condenser at a larger capacity than at present. If not it will be necessary to make use of a larger aerial coil.—P.C.

H.T. Condensers

Q.—I understand that it is an advantage to connect a large capacity fixed condenser between the H.T. negative and the H.T. positive terminals of a wireless set in order to smooth out any inequalities in the H.T. supply. But how does one proceed when there are several H.T. positive terminals?—G.L. (Blackburn).

A.—When there is more than one H.T. positive terminal in order that different H.T. voltages may be applied to the valves, a large-capacity fixed condenser should be connected between each H.T. positive terminal and the H.T. negative terminal. Therefore, as many H.T. condensers will be required as there are H.T. positive terminals.—P.C.

When You Are In Difficulty—

It does not matter whether your knotty problem is a theoretical or a practical one—in either case the Technical Staff of the "Wireless Magazine" is ever ready to help you out of the difficulty. Just write your query out on one side of a sheet of paper (this small point saves us time and enables us to send an answer quicker) and send it with the coupon on page 175, a stamped addressed envelope and a fee of 1s. (postal order or stamps) to: Information Bureau, "Wireless Magazine," 58-61 Fetter Lane, London, E.C.4.

A Special Feature by Jay Coote

BY the time these notes are in print the German Posts and Telegraphs will almost have completed the constructional programme they set themselves to carry out in 1927, in order to secure for the entire country an efficient broadcasting system. By the end of the year further improvements will have been made by the addition of the Cologne-Raderthal and Aachen (Aix-la-Chapelle) relays, by the official opening of the 40-kilowatt transmitter at Zeesen to replace Königswusterhausen, and by the increase in power of the Berlin Witzleben station.

Eleven Main Stations

The fulfilment of this ambitious programme will give Germany eleven main stations, including two super and one high-power transmitter, and some fifteen relays, which, with the exception of Münster, Hochspeyer and Aachen, individually possess an average energy of some 700 watts. Roughly speaking, the aggregate power of the German broadcasting system will reach 116 kilowatts, with a total of about 1,800,000 licensed listeners.

This is a result of which the broadcasting organisations may well be proud, seeing that three years ago that country's transmitters totalled 17½ kilowatts, serving an audience of but 55,000 pairs of ears.

In order to extend the activities of the microphone and to tap artistic talent from a larger number of districts, although but fifteen relay stations have been installed, over forty studios have been opened to feed these transmitters; in some districts, such as Leipzig, pick-up instruments have been placed in eleven towns within easy reach of that important centre.

By this means, although restricting the number of relay stations to a reasonable minimum, local enterprise has been encouraged, and in each instance the inauguration of a small studio has resulted in a large influx of subscribers to the service of the nearest broadcast transmitter. Notwithstanding the fact that the cost of a licence in Germany is roughly 140 per cent. more than the tax paid on this side for the same benefits, the number of annual subscribers in the Vaterland maintains a steady increase.

* * *

Daily, the field of entertainment and amusement tapped by the microphone is being extended, and as most of the transmissions in the principal European countries are broadcast at reasonably high power, so the lucky possessor of a multi-valve receiver in these Isles finds, in practice, the range of his set considerably increased.

Perhaps the greatest benefits derived by the radio fan to day consist in the fact that as the stations make more use of a wandering microphone, instead of listening to mere studio entertainments, by this means he is taken to districts farther afield for relays of special topical events, or for performances of a peculiarly national character, which, in the ordinary course of events, would be beyond his reach.

Life of the Nations

Whereas in the early days we were given very ordinary vocal and instrumental concerts which differed but little whether they emanated from Berlin, Rome, or Paris, to-day, by means of land-lines, and the use of travelling "mikes" many opportunities are granted to us of studying the life of the various nations and to take part in amusements and other entertainments actually organised for popular consumption, irrespective as to whether they are broadcast or not.

In their search for variety, and for novel attractions, to please a listening audience, which must rapidly become sated with a stereotyped studio performance, the continental stations now take us throughout their respective lands.

(*Continued on page 172*)

NOW READY

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Paper for Diaphragm.
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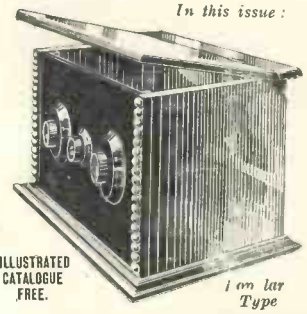

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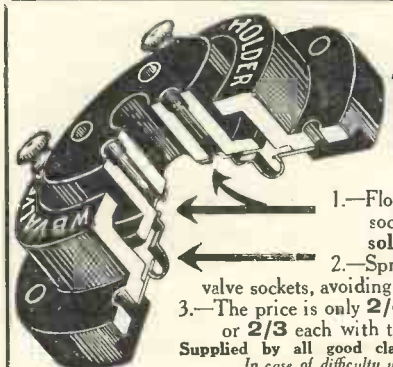

W.B.

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During the last month or so, by means of my super-het, I have listened to a gala operatic performance given in the open air theatre of Zoppot on the Baltic; to relays of musical festivals which have taken place at Salzburg in Austria; I have followed the incidents of exciting motor races on the new Neuburgring Track in the Eiffel Mountains and through Paris have heard the finals of the great Tour de France cycle races.

On one occasion, even, I was taken "by kind permission" of the Breslau station, to the slopes of the Riesengebirge in Silesia, to hear a national dance festival held at Bad Salzbruenn, a fashionable watering-place whose fame dates back to the fourteenth century. Such, therefore, are some of the benefits derived by the listener on these shores, from the rapid development of broadcasting services in other countries. JAY COOTE.

Cheaper Valves for the Listener!

AT last the long-expected drop in valve prices has been put into operation, a fact that will help still further to bring the powerful loud-speaker set within the reach of the normal purse.

The reductions are substantial and will no doubt be appreciated by those who have felt that they ought to have equipped their receivers with the latest types of valves, but who have thought twice about the cost of making this desirable improvement—for there can be no doubt at all that the valve of to-day is a vastly more efficient proposition than the valve of two years ago.

The ordinary range of dull-emitters which were previously priced at 14s. are now reduced to 10s. 6d. All 18s. 6d. valves are reduced to 12s. 6d.; while 22s. 6d. valves, which include most of those of the super-power type, are 20s. Bright emitters are now 5s.

These price reductions apply to all valves made by members of the British Radio Valve Manufacturers' Association and include the following makes: Burndept, Cosmos, Cossor, Ediswan, Marconi, Mullard, Osram, Six Sixty, and Weco.

Magnetic Pick-ups for Wireless Gramophone Reproduction

ONE of the most essential parts of any equipment intended for the reproduction of gramophone records through the medium of a wireless amplifier is a good magnetic pick-up and, as mentioned in the constructional article on page 147 of this issue, there are now on the market several excellent models.

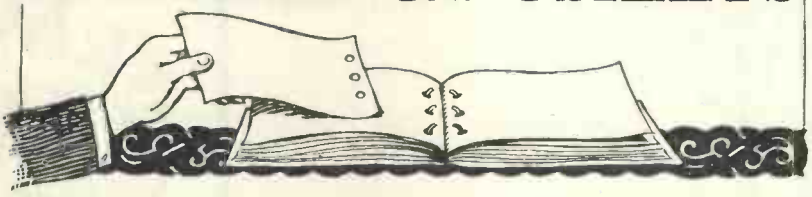
Perhaps the best-known of these is the Brown pick-up, which has so far been used throughout most of the WIRELESS MAGAZINE tests with great success.

Just as we close for press, however, we have received from the Igranic Electric Co., Ltd., a Pacent Phonovox unit which, so far as our preliminary tests show, seems to be a sound proposition. It is used in conjunction with an adaptor for plugging into the detector stage of any receiver combining two or more stages of low-frequency amplification and includes also a distant control of volume.

In our next issue we hope to be able to give photographs and more complete details of both these magnetic pick-ups, as well as of one or two more which we believe will be on the market by that time.

Screened-grid four-electrode valves are going to be "the thing" this autumn. Capt. H. J. Round M.I.R.E., has written a book about them that will be published on September 23 jointly by Cassell & Co., Ltd., and Bernard Jones Publications, Ltd., publishers of the WIRELESS MAGAZINE. The price will be 2s. 6d.

"Wireless Magazine" REFERENCE SHEETS



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

Month by month these sheets can be cut out and filed—either in a loose-leaf folder or on cards—for reference. The sequence of filing is a matter for personal choice. In a short time the amateur will be able to compile for himself a valuable reference book.

WIRELESS MAGAZINE Reference Sheet — *No. 21*

Selectivity

THE selectivity of a receiver is its capability for selecting one particular station and eliminating another station, usually operating on a much greater power, at a frequency quite close to that of the desired station. The design of suitable circuits in a receiver consists of the choice of the constants of the circuit in such a manner that with the required frequency separation the unwanted stations may be eliminated completely in practical reception.

In order to decide what ratio is necessary between the signal strength of the two stations some estimate must first be arrived at as to the relative strengths at resonance. In daylight the strength may be taken as proportional to the power and inversely proportional to the distance for ranges up to 200 or 300 miles. This is not true at night, when the strength on distant stations is greatly augmented by the arrival of other waves reflected from the Heaviside layer. It is not a simple matter to give any practical rule for night-time reception, beyond pointing out that the reception is two or three times as strong as during the daylight hours.

It is, then, necessary to decide what ratio must exist between the wanted station and the unwanted signal (reduced by the tuning). Practical experience shows that if the carrier wave of the wanted station can be made definitely stronger than that of the unwanted station then the former station will take control and reception may be obtained clear of any interference.

In designing the circuit it is advisable to allow a factor of safety as to make the wanted station about three times as strong as the unwanted station. This means that the ratio of the strength obtained at resonance previously determined should be multiplied by three, which gives the necessary ratio between the signal strengths in the particular case required. The circuit must then be designed so that, with the given frequency separation this ratio is obtained.

If f_0 is the frequency of the station required and f_1 is the frequency of the interfering station, then

$$\frac{R}{L} = \frac{4\pi (f_1 \sim f_0)}{\sqrt[n]{S \beta n}}$$

to give a selectivity equal to S. β is f_0/f_1 or $f_1 f_0$ whichever gives a ratio greater than unity and n is the number of tuned circuits employed.

WIRELESS MAGAZINE Reference Sheet — *No. 22*

High-frequency Chokes

A HIGH-FREQUENCY choke coil consists essentially of a relatively high inductance which offers a large impedance to the passage of high-frequency currents, while having little effect upon low-frequency currents or direct current. At any particular frequency a suitably sized single inductance will produce the effect required, but in practice it is desirable to utilise a choke which remains efficient over a comparatively wide band of frequencies, so that it can be used for receivers not intended for one particular limited band of frequencies.

The design of a choke to cover the ordinary broadcast band of frequencies—that is, 500 to 1,500 kilocycles—is fairly straightforward, but the necessity for adequate choking on the longer wavelengths corresponding to frequencies of the order of 150 to 300 kilocycles rather complicates the design. In such circumstances it is found more desirable to wind the choke coil in a series of sections, each one having a medium inductance, while the aggregate of all the sections joined in series presents a very high impedance. This sectional winding also preserves a more or less level choking effect, so that the choke is uniformly effective over the various frequencies which it has to serve.

The insulation of the windings of a choke is also a matter requiring attention. The inductance of the choke must be very high, requiring a very large number of turns, and in such circumstances the self-capacity of the winding becomes appreciable. A value between 5 and 10 micro-microfarads is customary in ordinary commercial chokes. A certain amount of current will flow through this capacity, and if the dielectric is poor considerable loss may be introduced into the circuit. The method of winding and insulation itself, therefore, should be such as to reduce such dielectric loss.

Laboratory tests have indicated that the inductance of a choke coil should be at least 50,000 microhenries if satisfactory action is to be obtained over the wide band of frequencies (150 to 1,500 kilocycles) required in this country, and that a value nearly double this amount is better for satisfactory working. If the inductance is below 50,000 microhenries then the choke will not operate satisfactorily on the longer wavelengths, and will also not be so efficient on the short waves. There are so many circuits which incorporate high-frequency chokes that this is a point requiring considerable attention, and particular care should be taken to choose efficient components.

WIRELESS MAGAZINE Reference Sheet — *No. 23*

Kilocycles

IF a condenser is discharged through an inductance constituting what is known as an oscillatory circuit, the current will discharge through the inductance, which will continue to flow beyond the actual discharge point owing to the presence of the inductance and will charge up the condenser in the opposite direction. This process will then be repeated, the current oscillating backwards and forwards at a certain definite frequency.

Due to the presence of these oscillating currents at a very high frequency, of the order of a million a second, ether vibrations are set up which radiate in all directions, and are known as wireless waves. Each successive oscillation in the transmission circuit produces an individual wave, these waves travelling out one behind the other at a speed of 300,000,000 metres per second. The distance between each successive wave is known as the wavelength of the disturbance, and it became customary in the early days of wireless to refer to the wavelength of the disturbances.

The frequency, however, is the fundamental unit, the wavelength being the derived unit.

The more rapid the oscillation, the less distance can one oscillation travel before the second one is generated, and so the less is the wavelength of the ether vibrations. There is thus a simple proportional relation between frequency and wavelength, expressed as :—

$$\lambda \times f = c,$$

where λ is the wavelength,
f is the frequency,
c is the velocity of the disturbance which in this case is the velocity of light and equals 300,000,000 metres per second.

Every transmission occupies a certain band of frequencies consisting of a carrier and certain side-bands, the extent of which depends upon the nature of the transmission, that is telephony or telegraphy. The harmonious working of any two stations therefore depends on a certain frequency separation between them. This frequency separation is constant, but if converted into terms of wavelengths the difference is no longer constant. It has become necessary to allot frequencies to the various transmitting stations rather than wavelengths in order to facilitate the separation of the various transmissions.

As a matter of fact, recent action both in this country and abroad, indicates that the unit of the future will be the kilocycle per second.

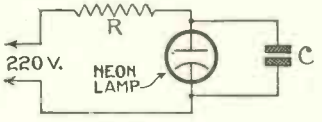
WIRELESS MAGAZINE Reference Sheet — *No. 24*

Neon Lamps

A SIMPLE neon lamp can be made up in the form of a useful testing instrument for measuring very high resistances or large capacities. A neon lamp consists essentially of two electrodes in a glass vessel which is exhausted and filled with neon gas at a low pressure. The space between the electrodes is non-conducting until a voltage of about 160 volts is applied across them, when a pink glow discharge takes place. This discharge continues, once it has been struck, until the voltage falls to some 140 odd volts, when it will cease.

This principle can be made use of in a tester by arranging matters as shown in the diagram. About 200 volts D.C. is applied across a fixed condenser through a high resistance. The neon lamp itself is connected across the condenser. The condenser charges up due to the application of the voltage, the actual time of charging depending upon the relative values of the condenser and the resistance. With a very high resistance the condenser will take a considerable time to charge up, while with a low resistance it will rapidly reach its fully charged condition.

When the voltage on the condenser rises above 160 volts the condenser will discharge through the neon lamp, causing a flash of pink colouration. This will reduce the voltage on the condenser to below 140 volts, when the neon lamp will cease to be conducting and the condenser will again begin to charge. Thus the lamp will continue to flash at more or less regular intervals, and it is possible to compare resistances or capacities by noting the relative times between the flashes obtained.



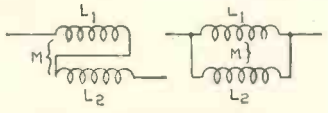
Neon-lamp Circuit

The actual time of flashing is proportional to the product of the resistance and the capacity. The smaller either of these two is made, the more rapid is the flash and conversely. The flash is also dependent on the actual voltage being applied across the whole instrument; the higher the voltage, the more rapid being the flash.

WIRELESS MAGAZINE Reference Sheet — *No. 25*

Inductances in Series and Parallel

IT is often required to know the inductance of two separate coils connected either in series or in parallel. In such cases it is necessary to take into account not only the inductance of the individual coils, but also the mutual inductance or coupling between the coils. This coupling may either be in such a direction as to assist the inductance, in which case it is termed positive mutual inductance, or it may



Series and Parallel Inductances

be in the direction to oppose the additive effect, in which case the combined inductance is less than the simple sum of the two individual coils, and the mutual inductance is said to be negative.

If the two coils are in series, the combined inductance is given by the expression

$$L = L_1 + L_2 \pm 2M,$$

where L_1 and L_2 are the inductances of the individual coils and M is the mutual inductance between them, all the quantities being measured in the same units; that is, all in henries, or in microhenries, etc. The plus or minus sign indicates that the mutual inductance may be either positive or negative. If the mutual inductance is positive, the plus sign is used, while if the coils are in opposition the minus sign is used.

Where the inductances are in parallel, the question is rather more complicated. Here again the mutual inductance exercises an effect, and it is necessary to take account of it in working out the formula for the combined inductance. As before, the inductance may be either positive or negative. If the inductance is positive, and the two coils are very tightly coupled, then the inductance of the two in parallel is the same as each one, while if they are in opposition the inductance of the two coils in parallel is very nearly zero, provided that the coupling is tight.

The actual expression for the combined inductance when the coils are in parallel is

$$\frac{L_1 L_2 - M^2}{L_1 + L_2 \pm 2M}$$

where L_1 and L_2 are the inductances of the individual coils as before and M is the mutual inductance.

Test Report of the Girdle Two

ON test this short-wave receiver is capable of doing all that the average amateur can desire and serves very well indeed on the wave-band extending from 30 to 90 metres. Signals are well up to standard in strength, and tuning is not too critical on telephony. It will be found, however, that caution must be observed in searching for morse signals, as in this case tuning is rather fine.

In practice it is found that earthing the filament by connecting it to the earth end of the tuning coil makes no difference in signal strength or in selectivity.

During a brief test Mr. E. H. Robinson, well known to all experimenters as the operator of station G5YM, has heard all the usual short-wave stations at good strength. These include PCJJ, the Philips experimental short-wave station at Eindhoven, in Holland; 2XAF, the General Electric Co.'s station at Schenectady, U.S.A.; and several amateur stations on telephony. On morse several South American stations have been heard at good strength.

These results show that the receiver is capable of working efficiently over long distances. The usual commercial stations all over the world have, of course, also been heard at normal strength.

Catalogues and Pamphlets

WE have received from Radi-Arc Electrical Co., Ltd., of Bennett Street, Chiswick, two single leaves containing details of their D.C. and A.C. H.T. battery eliminators.

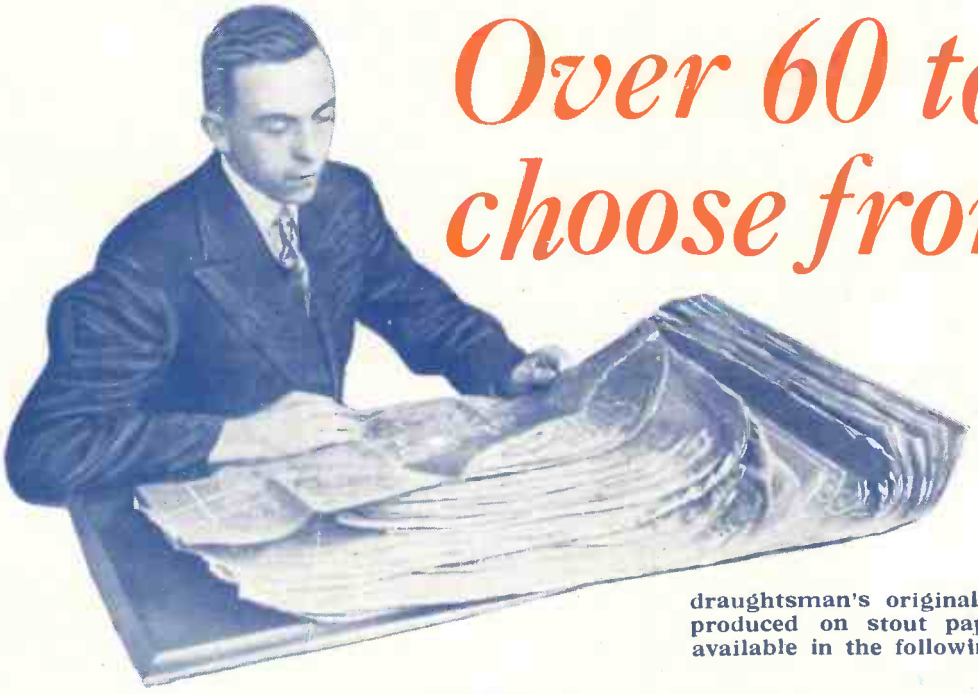
The Athol Engineering Co., of Tiger Works, Seymour Road, Crumpsall, Manchester, have sent in their general price list.

A single leaf from the General Electric Co., Ltd., of Magnet House, Kingsway, W.C.2, gives particulars of their combined H.T. accumulator and charger.

Details of the Trix Portable Four, which is priced at 18 guineas, are given in a folder received from E. J. Lever, of 33 Clerkenwell Green, E.C.1.

Index to Advertisers

Over 60 to choose from!



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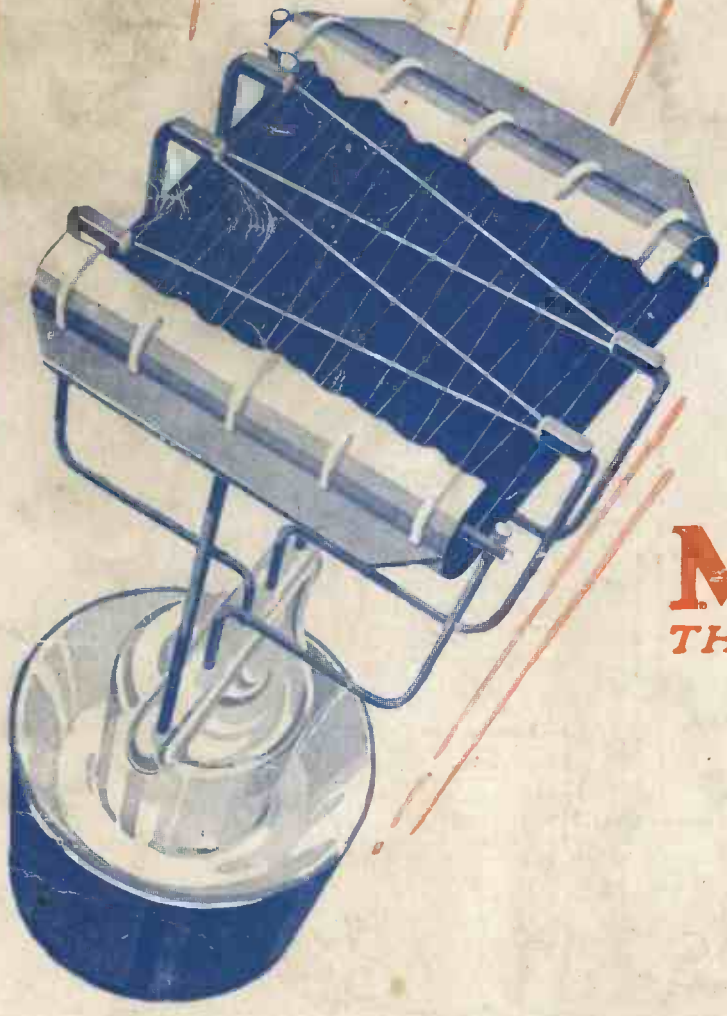

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