WIRELESS

2D

THE ONE—WORD WEEKLY

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THE WEEK'S NEWS AND NOTES

LICENCE DODGERS.

THE Post Offices, I am told, have been kept very busy issuing wireless licences to those who have hitherto dodged the payment of the nominal sum we contribute to the Government for the excellent programmes we receive. There is no further excuse for not paying up, as the Post Office position is now quite legal. Personally, I have not a ha'p'orth of sympathy for the licence dodgers.

A MILLION AND A HALF.

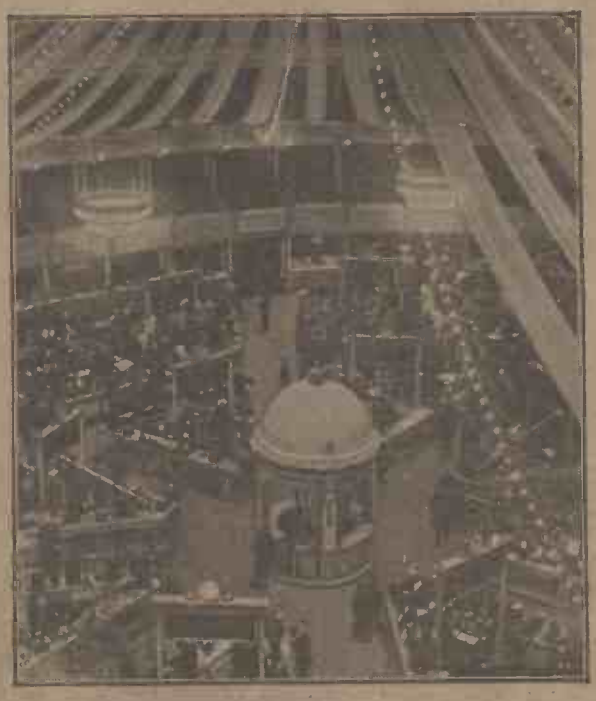
Speaking of money, do you know that the British Public is now spending about ten million pounds a year on wireless? No less than 35,000 people are engaged in the British industry, while the number of licences issued is now a million and a half. Up to August 31 it was 1,423,000.

A GOOD IDEA.

The Barcelona Station, I see, has taken a poll to ascertain the listeners' favourite operatic composer. Verdi headed the list, Wagner came next, closely followed by Donizetti. Rossini and Puccini each gained half of the votes cast for Verdi, while the rest of the operatic composers were a long way behind.

GERMAN THOROUGHNESS.

The Germans are keeping up their reputation for thoroughness. At the German Wireless Exhibition, recently opened, extraordinarily careful attention was paid to the convenience of English trade buyers, who were personally conducted to the various stands by English-speaking officials. The Berlin Radio Hall has been specially constructed of wood and concrete with no steel work.



Some Interesting Novelties which may be seen at the Wireless Exhibition are described on page 64.

FROM SENATORE MARCONI.

"Congratulations on the first number of your new journal, 'Wireless.'"

Guglielmo Marconi

WIRELESS AND THE POLICE.

Scotland Yard have always been interested in wireless, and have made a careful study in the last year of how radio can be turned to good purpose in tracking criminals. It is, of course, no secret that they have a number of vans fitted with wireless apparatus for both transmission and reception. Of course, a secret code is used when communication is carried out to prevent leakage of information. Now, I understand, the Dudley Police Force have followed the example of Scotland Yard.

SELLING TO AMERICA?

American visitors to the Wireless Exhibition have been much impressed by the high finish and quality of the British apparatus. "Make your apparatus more selective, and we will buy your sets by the hundred," said one prominent man.

DAINTREE OR DAVENTRY?

I had a chat at the Wireless Exhibition with Mr. Litt, the engineer in charge of the Daventry High Power Station. Mr. Litt told me of many interesting experiences while the tests for the new station were being carried out. On the day following some tests in which he had

THE CENTODYNE.

By PERCY W. HARRIS, M.I.R.E. (Editor).

SEE PAGE 78.

STEREOSCOPIC BROADCASTING.

By CAPTAIN H. J. ROUND (Chief of the Marconi Research Dept.).

SEE PAGE 55.

frequently announced the station as Daintree, letters of protest arrived from Northampton, asking why he did not pronounce the name of the station properly, as no one would know where it was. He therefore announced the following evening as Daventry, only to be worried next day with a deputation from the local residents, who were highly indignant that their town name should be mispronounced. Mr. Litt thereupon hit on the brilliant expedient of announcing on the following evening Daventry-Daintree. After which he received no further protests.

Some of the apparatus belonging to Mr. W. R. Whitmore (inset) who has succeeded in hearing with leadless telephones 30 yards from an ordinary valve set. A system by which this may be done was fully described in "The Wireless Constructor" for April, 1925.

GOOD THINGS IN STORE.

The Elstree Laboratories of Radio Press, Ltd., are a hive of industry these days. Dr. Robinson is here, there, and everywhere, and when he is not at Elstree you will find him investigating all those wonderful scientific instruments which Great Britain produces so well, in the endeavour to find the best and most precise apparatus with which to equip the laboratory. I wish I could tell you about one wonderful piece of apparatus which is now being prepared, but at present the pledge of secrecy is on this, as on many other matters.

CALL-SIGN.

OUR NEXT ISSUE.

SPECIAL FEATURES.

LICENCE PROFITEERING BY THE POST OFFICE,

By Lt.-Commander Kenworthy, R.N., M.P.

HOW TO GET THE MOST FROM REACTION,

By Major James Robinson, D.Sc., Ph.D., F. Inst. P.

HOW AMERICA PAYS FOR BROADCASTING,

By Percy W. Harris, M.I.R.E.

Preserving 'Phone Leads

Telephone leads, especially those made of the rather flimsy and not too well protected tinsel that is often used, are very apt to become kinked in use. Kinks, I believe, are responsible for more breakages than any other cause. The experimenter who is frequently connecting and disconnecting his telephones, and who, when they are out of use, bundles up the leads and leaves them lying on his bench, not infrequently finds that a casualty has occurred.

Here is a simple way of preventing kinking, and therefore breakages, which I have found very useful.

How to Start.

Obtain a piece of rubber tubing, with an internal diameter of about 3/16 in., as long as the twisted portion of the leads. Attach a small weight—a bodkin answers very well—to the end of a piece of thin but strong string. Hold the tubing so that it is vertical and drop the weight through it. Attach the other end of the string to the phone cords and pull them through the tubing. Lastly, bind the tubing tightly so that it grips the cords firmly at both ends. It will now be found that the leads are amply protected, for the springiness of the tubing prevents the formation of kinks. The tubing need not be of thick, heavy rubber, and its presence will not be found to cause any inconvenience worth talking about to the user of the telephones.

R. W. H.

A SAFETY DEVICE

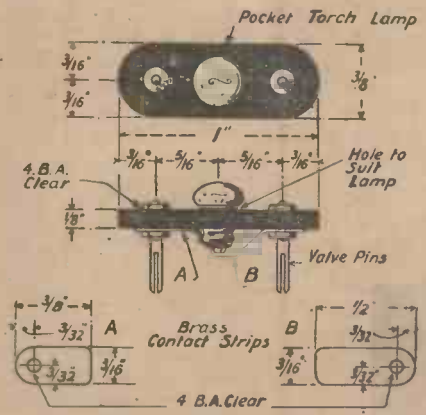
WHEN making up new panels, it is as well to ascertain that no short circuits have been made in the wiring which might cause the burning out of valves. A simple device for carrying out the test is shown in the diagram. As the construction is on a small scale it is as well to drill the ebonite before cutting to shape, to prevent splitting. First draw a centre line upon which the drillings are made. The centre hole is drilled to suit a pocket torch lamp. Drill the other two holes to clear the screwed portion of the valve pins, for which a 4 B.A. clearing drill should be used. Next cut out the ebonite piece to the given dimensions. Two contact strips are made from thin springy brass, as shown (A and B).

Construction.

In assembling the bulb is forced into the centre hole, and the strip A is slightly bent over to make contact with the side of the lamp and secured by means of the valve pin. Contact strip B is bent as shown to make contact with the pip on the underside of the lamp, and is secured by means of the other valve pin. If the centres of the drillings have been accurately worked out, the unit will fit the filament sockets of a valve holder.

Testing.

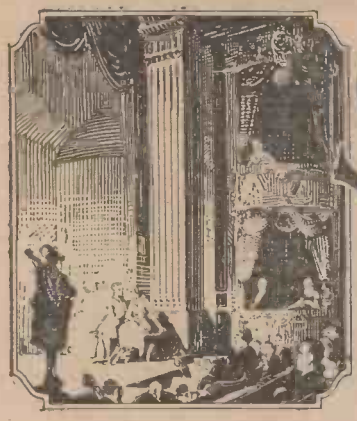
To carry out a test, insert the tester across the filament sockets of the



The safety device is easily made from the details given.

holder on the panel under test. Place a pocket battery across the low-tension negative and positive terminals on the panel. If the lamp lights up, all is well as regards the filament circuit. Remember during the test to place the filament resistance in the "on" position. Next place the battery across the high-tension negative and positive terminals. In this case, the lamp should not light up; if it does, the high tension is wrongly connected somewhere. This little device may possibly save the price of a valve in reward for a few pence and the little trouble expended in its construction.

R. A. M.



Stereoscopic Broadcasting

By Captain H. J. Round.

M.C., M.I.E.E.,

Chief of the Research Department of Marconi's.

A GOOD many years ago a demonstration was given of what might be called stereoscopic transmission of sound. I believe the first demonstration was given at one of the Paris Expositions.

The idea was revived in the early days of broadcasting in England, and some notes on the possibilities of it were published by Capt. Lewis of the B.B.C.

Experiments at the Opera House.

During the winter before last the writer was able to do some preliminary experiments with modern microphones at the Opera House, and a little later the experiments were continued in the laboratory to determine if the results produced would be worth while actually broadcasting.

Two loud-speakers are used at the receiving end.

I propose here to put on record the results of these tests and to describe how reception can be carried out on this system, so that if in the near future Captain Eckersley finds it convenient to do some transmission experimenters will be ready to receive.

Direction of Sound.

Our ears, due to the fact that they are spaced about 6 in. apart and also due to the fact that the head acts as a sound shield partially protecting the left ear from sounds on our right and the right ear from sounds on our left, are able to indicate to us the direction of sounds. It is usually considered that low notes have their direction indicated by the phase difference of the sounds arriving at the two ears, and that high notes have their direction indicated by mere strength difference.

Personal Experiments.

Some experiments of mine in which the low notes of an orchestra were reproduced by one loud-speaker and the high notes reproduced by another loud-speaker indicate strongly that we get our chief sense of direction from the low notes, as the apparent direction of the orchestra from the two loud-speakers is always from the loud-speaker giving the low notes. However, the exact line one should draw as to what is a high note and what is a low one is hard to make out.

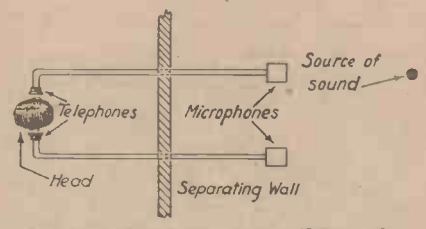


Fig. 1.—This system allows the listener to construct a mental sound picture.

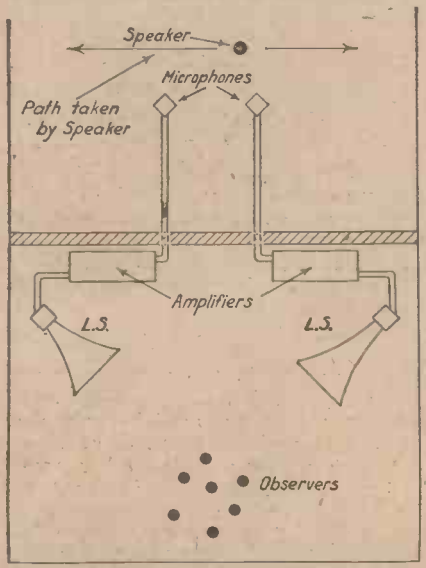


Fig. 2.—Arrangement of microphones and loud-speakers to give a stereoscopic effect.

The Brain and Sound Pictures.

The brain seems to be able to use the phase difference received by the two ears and not only determine the direction of a sound, but build up from a complicated mass of sounds produced over an area a solid sound picture.

An Experiment.

If we take two microphones and place them side by side and connect each microphone to a single head receiver and then listen *via* this double system to a sound produced in the neighbourhood of the microphones, by means of the two head receivers, one placed on each ear, we shall get to some extent the same effect as if we were listening directly.

The experiment should naturally take place in two rooms so that the observer will not receive the direct sound. If a man speaks at the source of sound and then moves about from side to side in front of the two microphones, the relative phases of the sound to the two microphones will vary, and from this the observer will be able to estimate the motions of the speaker. Also, if in the room a number of sounds are produced in different places the observer will mentally construct a sound picture exactly as he would if his head was in the position of the two microphones (Fig. 1).

Two microphones are employed at the broadcasting station.

A First Attempt.

The first time I tried this experiment was at the Opera House. The B.B.C. had placed side by side near the footlights a Western Electric Carbon microphone and a Marconi magnetophone, each with its attendant amplifier.

One of these microphones was in use for broadcasting and the other was a stand-by. We tapped on to the two amplifiers, each with a separate headphone, and because the tone of one was lower than the other we equalized the tones approximately with a series condenser in one telephone lead. On listening in, the effect was very realistic.

STEREOSCOPIC BROADCASTING—continued.

A Peculiar Effect.

The performers could be followed about mentally on the stage as they sang and acted, but the most extraordinary thing was that the orchestra seemed to be behind me.

This "behindness" I at once put down to the fact that the microphones were on the footlights and the orchestra was behind them.

At the time I noticed nothing peculiar about the performers.

None of the sounds one heard could be imagined as coming out of the 'phones until one or other 'phone was removed, when the result became by contrast very flat.

Laboratory Tests.

Soon after this—and shortage of amplifiers delayed the experiment—a systematic series of tests were carried out in the laboratory, and then it was again noticed, and this time much more definitely, that all sounds seemed to be reproduced behind one, although one or two people seemed to get the impression that they were above them.

Observations.

If the speaker walks from side to side of his room in front of his two microphones, when he is, say, to the extreme left, the listener hears his voice and his footsteps more or less in a line with his two ears.

As the steps near the position facing the microphone the listener hears them coming nearer, but they pass behind him. By no trick could we get them to pass in front.

If the speaker walks behind the microphones the effect is exactly the same.

Reversal of the connections to one of the microphones or telephones merely shifts the speaker from right to left.

One of my friends listening-in had the impression of the man walking through him, and still another that the speaker was walking overhead, but the majority had the back impression.

A Suggested Explanation.

The explanation of this curious effect is probably that if phase is the only criterion of direction there are two positions at the back and the front which give this same phase difference, and in actual listening we use some other effect to determine which of these directions is right. Certainly our sight to a great extent, and after that head movements and perhaps, to some extent, the high notes in sounds, and the fact that owing to the shaping of our ears intelligibility is better from the front than from the back. None of these criteria can be applied in listening *via* microphones, and perhaps the brain, getting no results from these sources, writes down the sound as from the back.

I had some idea that voices did not give the effect so much as other sounds, and certainly in the first opera house experiment we did not notice the voices were behind, but all the time the orchestra was definitely there.

Muffling.

Muffling the transmission of the voice with condensers seemed to throw the voice more behind, but unfortunately it did not occur to me at the time to cut off the low tones.

Aside from this very annoying effect, the spacing of the microphones and the effect of shields between them to simulate the effect of the head were tried. A best effect could be obtained, but it was not very marked, and we came to the conclusion that simply putting the two microphones about 1 ft. apart, the active side of each one turned slightly outwards at about 45 deg., gave the best general effect.

A close-up of the Marconi - Sykes microphone, which is largely used by the B.B.C. and with the development of which Capt. Round is closely associated.

Results with Loud-Speakers.

These results were obtained with headphones, and an attempt was next made to produce the results with two loud-speakers.

These two loud-speakers were placed as shown in Fig. 2, one on either side of the room, each one connected up as shown.

If one stood in the position shown the effect produced was very real. And in rather an artificial way the sound was made in front of one.

A man walking in the other room backwards and forwards in front of the microphones walked apparently backwards and forwards in the receiving room in an astonishingly natural way. Different sounds produced simultaneously at different places in front of the microphones came out approximately similarly placed in the receiving room, and one could differentiate then better than with one loud-speaker alone.

A Difficulty.

But there was a serious difficulty now introduced. Any movement of the observer at once altered the relative phases of the sounds, resulting in an apparent shift of the transmitted noise; and different observers in the room were getting different apparent effects at the same moment, particularly those too near one loud-speaker, who got no stereoscopic effect at all.

Perhaps in a big hall with the audience well in the centre and loud-speakers far to the sides, this effect would not matter, but in a small room it would cramp the listener's style to some extent.

The sound in this case is forced to the front in a purely artificial way, and, needless to say, the effect of the speaker walking behind the microphones is reproduced still in front of one.

Broadcasting.

There are no serious difficulties in the way of giving out some of our broadcasting in this stereoscopic way. But it is doubtful whether, owing to the lack of back and front effect, many people will care to listen to it for long.

Two transmitters and two receivers are necessary, separated all along the lines. That means two wavelengths fairly well separated, with consequent liability to fade at any big distance in a different way.

But people listening in at short distance should get reliable effects.

Studio Conditions.

The two microphones side by side in the studio must be connected to two control amplifiers, which latter must be linked together so that if for any reason the control operator requires to weaken the output to the two transmitters this is done simultaneously.

No other troubles are likely to occur, and we have here in England an ideal arrangement for giving the "stereoscopic" effect from 2LO and Daventry, which frequently send out the same programme, and each with very carefully checked quality.

A Chance for the Crystal User.

All those in easy range of both stations may even with crystal receivers be able to get the solid effect and listen to the various performers in a way one degree more natural than our present way.

The simple way to go about preparing for the double reception is to erect two receivers on separate aerials, and connect one to one side of your headphone, the other to the other side.

To get the "right" and "left" right, the announcer in London will have to say what position he is in with regard to his microphones, and then you will, if necessary, reverse the leads on one pair of 'phones to get the same effect.

SECRETS OF AMERICAN SELECTIVITY

By PERCY W. HARRIS, M.I.R.E. *Editor*

LAST week I told readers of WIRELESS about many of the remarkable characteristics of modern American radio receivers. This week I want to go into some detail regarding that great feature of such receivers—selectivity. On the audio frequency side British sets are unequalled by any others in the world, while Americans have no special feature in their detector circuits, which distinguishes them from British. In valves we are considerably better off than our American friends, for not only have we a wider variety to choose from, but the standard of quality and uniformity is higher here. The secret of selectivity in American radio receivers lies in the design of their high-frequency amplifying stages and their exceedingly careful disposition of the wiring.

Direct Pick-up.

I have often heard experimenters boasting of the wonderful sensitivity of their sets. As a mark of the sensitivity it is often stated that the receiver will give loud-speaker results from the nearest station even though it be ten or fifteen miles away, without any aerial or earth connection! It is true that the fact that a receiver will act in this way is a proof of its sensitivity, but—and this is a very big "but"—it is also a proof of non-selectivity! You will see why when you consider a moment. Think this over carefully. If your circuit is sufficiently sensitive to pick up signals for ten or fifteen miles without any aerial or earth connection, it *must be picking up those signals on the wiring of the set.* A properly designed receiver should be exceedingly sensitive when either aerial or earth or both are connected to it, but should give *nothing whatever* when these wires are disconnected. If the wiring of your set will pick up signals from, say, London when you are tuned to, say, Manchester or Bournemouth, you cannot expect to get rid of London when you want to.

Directional Effects.

To avoid pick-up on wiring, the leads must be very short and spaced very carefully. The ordinary connecting wires, however, are not generally the leading source of trouble in pick-up. The radio frequency transformer and the aerial tuning coil, particularly this latter, are the chief sources of pick-up. Recently, in preparing my notes for this article, I performed the interesting experiment of using a very sensitive receiver without aerial or earth, in such a way that it would give loud-speaker results from London. The pick-up took place almost entirely on the aerial tuning coil, and I proved this by slowly rotating the receiver.

An Experiment.

When the line connecting my house with the London station came through the axis of the coil (that is to say, when the coil was at right-angles with this line) no signals were heard, but when the line was at right-angles to the axis of the coil (the coil not being in line with the station) full loud-speaker volume was obtained.

The Grebe binocular coils.

All kinds of different schemes are used in American receivers to avoid pick-up, in some cases the coils being shielded by a metallic screen. In others, special double coils are used with a closing field, so that the pick-up of one coil is neutralised by the pick-up on the other. Such a special double coil is shown in the illustration in this article, and is the chief means by which the receiver illustrated in my last article is practically free from pick-up on the windings.

A Special Arrangement.

Another leading reason why higher selectivity is obtained in American wireless sets of modern design is that loose-coupling is used between the aerial and the grid circuit of the first valve, between the plate and grid circuit of the first and second valves, and between the plate and grid circuits of the second and third valves. Loose-coupling has two main advantages: (1) It adds greatly to the selectivity, and (2) it minimises the tendency to feed-back energy from the grid circuit to the plate circuit, thus introducing unwanted reaction. In one receiver (the Zenith) the coupling is loosened to such a degree that there is not sufficient feed-back to set up self-oscillation in the receiver, and as the value of the minimum coupling to get rid of this feed-back varies with different values of tuning condensers, a special arrangement is incorporated on the end of the condenser shaft, so that as the condenser value is varied, so the coupling is varied to correspond.

Low-loss H.F. Transformers.

Finally, I would mention the fact that the secondary circuits of the high-frequency transformers are of the low-loss variety, and are considerably more efficient than most of the high-frequency transformers produced in this country. The nearest approach to a low-loss transformer produced in this country is probably that sold by Messrs. Lissen, Ltd., and originally designed for a set described by Mr. R. Tingey, M.I.R.E., of the Radio Press staff, in *Wireless Weekly*. In many receivers the feedback effect is neutralised by a special arrangement. Americans have abandoned potentiometer control, for it introduces damping, which considerably decreases selectivity.

SPECIAL NOTICE

In next week's issue of "Wireless" will appear a powerful article by

LT.-COMNDR. KENWORTHY, R.N., M.P.:

"Licence Profiteering by the Post Office."

"COMING SOON"!

Some of the Stars in Next Week's Programmes.

VARIETY will be the keynote of next week's programmes, and a judicious mixture of light and classical music will feature strongly. Commencing on Sunday with an afternoon Wagner concert, conducted by Mr. Percy Pitt, the programme includes the Prelude and Closing Scene from "Parsifal," with Mr. Walter Hyde as soloist.

A Wagnerian Singer.

Mr. Hyde has been a familiar figure in London's musical schemes from his first appearance in "My Lady Molly" at the old Terry's Theatre twenty years ago to his latest *rôles* with the British National Opera Company. He has filled nearly every Wagnerian part with Hans Richter and Sir Thomas Beecham at Covent Garden and the Theatre Royal, Budapest, while he was the first Englishman to play "Pinkerton" in "Madame Butterfly." Few people remember Mme. Liza Lehmann save for "In a Persian Garden," but one of her best works was a romantic opera, "The Vicar of Wakefield," produced in 1907, and with Mr. Walter Hyde as Squire Thornhill. His broadcasting successes are now legion.

Miss May Blyth as Siebel in "Faust."

The Celeste Octet plays on Sunday evening, with Mr. J. H. Squire himself directing. A new-comer to broadcast work will be found in Miss Katherine Bacon, who hails from America, although English born. She is a highly-esteemed pianist on both sides of the water. Miss Gwladys Naish will be the soloist. Known to us as "The Welsh Nightingale," as a coloratura singer she is unequalled.

British Music.

During the last few years a little group of English song writers have come to the front, and since the era of wireless their names are household words to the general masses of the public. Wilfred Sanderson, Alfred Ketelbey, Roger Quilter, and East-Hope Martin are all names that figure largely in the popular programmes, and Monday night's scheme, in which the last-named's new song cycle, "The Way of Ships," will be probably enjoyed by most of us. This should prove as popular as "Come to the Fair," which will also be performed. The soloists are Miss Kate Winter and Mr. Herbert Heyner, while Miss Anne Godfrey will play some of the composer's violin solos to his own accompaniment at the piano.

Pavlova at Covent Garden.

Although to hear a dance without seeing the dancer is losing nearly all the charm, yet many listeners, unable to be actually at Covent Garden, will welcome the third season of the great Russian dancer Pavlova, at Covent Garden on Wednesday, when some of her "divertissements" will be relayed. Probably Mme. Pavlova will give her most popular item, "Le Cygne," from Saint-Saëns' "Carnival des Animaux."

Mr. Walter Hyde.

Opera will be represented later by the third act of "Rigoletto," from the Theatre Royal, Glasgow, where it is being performed by the B.N.O.C.

A Plebiscite Programme.

It is always interesting to find out just what the public really wants, and our contemporary *Tit-Bits'* ballot held recently has obviously achieved its object. On Tuesday next will be held a concert, in which appear the ten most popular artists as decided by the public itself. These are Miss Carmen Hill, one of the earliest of the famous ballad singers to broadcast; John Coates, the English Shakespearean singer; Robert Radford, of the B. N. O. C. The instrumentalists are Miss Daisy Kennedy, the Australian violinist, one of the earliest of famous artists to recognise the value of wireless; Mr. Maurice Cole (pianist), another early broadcaster; De Groot, of Piccadilly Hotel fame, who will play with his coadjutors, Samehtini ('cello) and Gibilaro (piano); while the brand of humour preferred is from "John Henry" and "The Roosters" military concert party. As a finish comes the 2LO Military Band, and thus realising what the public wants, it should be up to the B.B.C. in future to see that the majority gets what it wants.

Miss Daisy Kennedy.

John Henry.

Military Music.

Someone once said that England's national instrument was the German brass band at the street corner. Certainly a brass or a military band appeals to a very large section of the public, so that the programme of Friday, October 2, should prove more than ordinarily interesting. Under the title "Regimental Reminiscences," a series of interesting episodes from the histories of the English territorial regiments, most of which are commemorated to this day, will be presented under the direction of Mr. R. E. Jeffrey. The musical illustrations will be supplied by the Band of H.M. Royal Air Force, under the direction of Flight-Lieut. Amers. They will also give subsequent band items, including some Old English Dances by the late Mr. Cecil Sharpe. Mr. Charles Penrose, who has been fulfilling many variety engagements, returns on this night also to give us an attack of his "Laughteritis."

Miss Gwladys Naish: "The Welsh Nightingale."

Humour for Next Week.

Humour will be well represented next week, for on Saturday, October 3, Ronald Gourley, the blind pianist, will open the evening's programme. Mr. Gourley's ability to make a classical symphony out of such ingredients as "It Ain't Gonna Rain No Mo'," Rachmaninoff's "Prelude," "The Lass with the Delicate Air," and "All Alone," have become by now phenomenal, and, added to his gifts as a siffleur, his name is always a welcome one. Later will follow the second and third acts of "La Boheme" (Puccini), from the Theatre Royal, Glasgow, by the British National Opera Co. For this the principals are Browning Mummery and May Blyth. Both are famous opera singers, and Miss Blyth was heard again to capital advantage last week as Siebel in "Faust." This is a favourite part of hers.

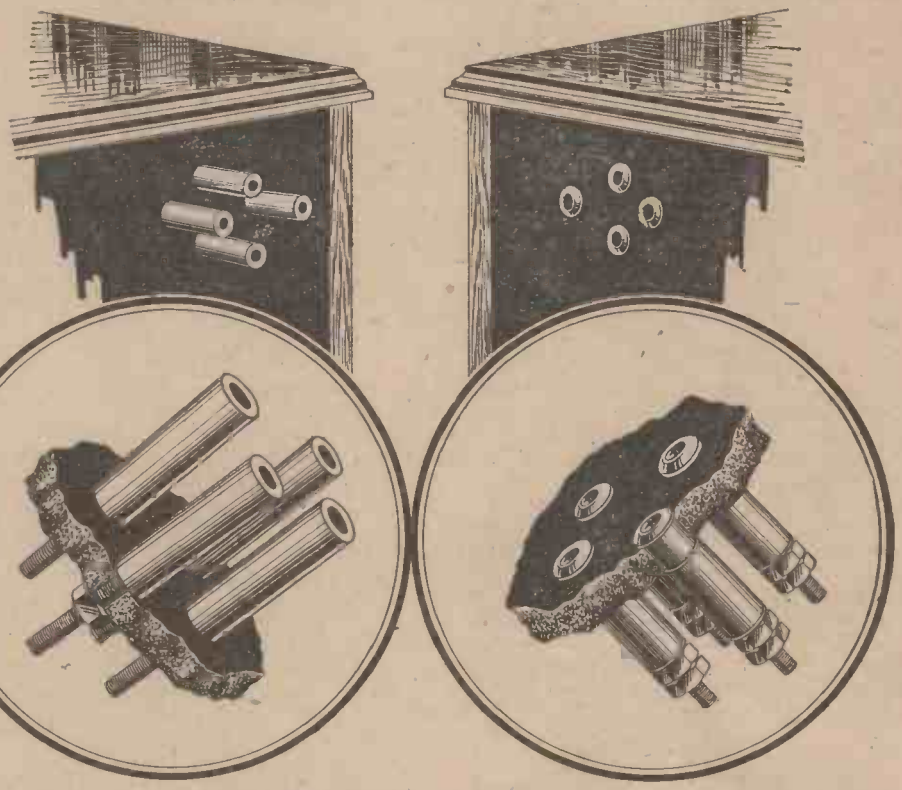
PUT YOUR VALVES ON VELVET

Prof. A. M. Low on "THE POSSIBILITY OF TELEVISION."

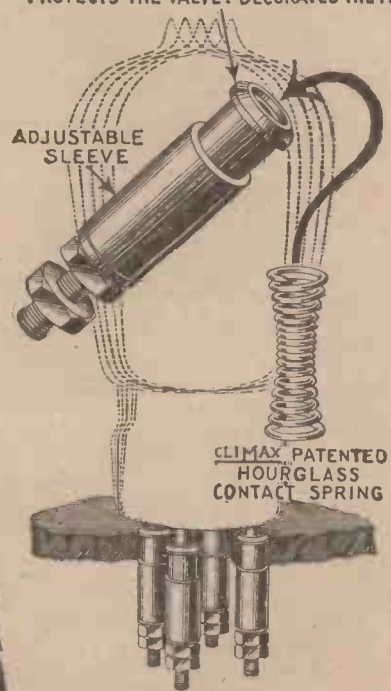
W. B. Medlam, B.Sc., A.M.I.E.E. on "Building a Superheterodyne."

Articles on "Building a Wireless Set," "Upkeep of a Crystal Set," "Those Microphonic Noises," "Dodging the Aerial," and many others

Full details of all the new CLIMAX RADIO COMPONENTS & SETS.



INSULATED HEAD FITS FLUSH ON PANEL PROTECTS THE VALVE: DECORATES THE PANEL



Use the Climax way of protecting the valve and getting rid of those annoying microphonic noises. Your reception will be immeasurably improved by using **Climax Anti-microphonic Valve Sockets.**

The **Climax Anti-Microphonic Valve Socket** is designed to eliminate mechanical shocks from the Valve while avoiding the introduction of additional electrical capacity between the valve stems.

The barrel of the socket is provided with a circular rim which enables the socket to be mounted flush on the panel, the upper surface of this rim being insulated to prevent accidental burning out of the valve.

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Price: One Set of four **Climax Anti-microphonic Valve Sockets** fitted with patent hour-glass contact springs complete with nuts and washers (hour-glass spring patent applied for) .. .. .. 2/- per box.

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CLIMAX RADIO

Animals as Broadcast Artistes

by Capt.n A.G.D. West, M.A., B.Sc.

Chief of the Research Department of the British Broadcasting Co.

ANIMALS have often appeared in the rôle of broadcast artistes, but it is seldom that they have done so with a knowledge that they were giving something in the nature of a performance.

Two of the earliest animals to be broadcast were quite unconscious that their actions would have such a wide effect. One of these was a dog in the street outside Savoy Hill, the announcer having left the doors of the studio open one hot night when a specially sensitive microphone was being tried while he read the news bulletin, so that the dog's bark interfered considerably with his even reading.

A Queer Artiste.

The other case was that of a curious buzzing that developed in the transmissions from the Aberdeen studio at about the time when this station opened. The interference was eventually found to be due to a fly which was settling on the diaphragm of the microphone, no doubt attracted by the heat developed by the microphone (which in this particular type is considerable), and further pleased as a true Aberdonian at the opportunity of having free and sole use of the microphone as a warm home without having to pay for its lodging.

Miss B. Harrison, the famous 'cellist, charming the nightingale in her Surrey garden.

Since then many animals have made their microphone début, and have produced varied sounds characteristic of their species.

The great difficulty is, of course, to make animals perform at any given time and according to programme.

Choosing the Animals.

With domestic animals and wild animals in captivity at the Zoo it is not so difficult, as recourse can be had to a primitive instinct, such as hunger, or to habits peculiar to any particular species. When broadcasting the Zoo was first suggested, Uncle Leslie, of 2LO (Mr. L. G. Mainland) made a comprehensive tour of the Zoo in consultation with the officials and keepers, and found out which animals were most reliable in making noises to order. And from these were chosen those that appeared to be the star performers. The sea lions, the hyena, the walrus, and the baboons responded well at feeding time, especially if the food was shown to them for a few moments before it was given to them. The elephants trumpeted and performed to the order of their native keeper; the parrots became alarmed when a strange bird was introduced among them; and a certain little monkey, well known to visitors, made the most terrifying yells when his playmate was taken away from him for a few moments.

A Few Difficulties.

In this way the most difficult part of ensuring a good programme was overcome. But the case of providing sounds from wild animals and birds in the open country is quite different. A close study of the habits of the animal must be made. There are so many factors adding additional difficulties that it is impossible to make a definite promise beforehand of a successful transmission. The case of the nightingale forms a good illustration. A year ago the song of this bird was successfully transmitted on two occasions without any difficulty, and exactly when promised. Only one microphone was used, and the bird in question—the best of several in the district—sang every night with amazing regularity, without changing its position or time of performance. The reason was undoubtedly that the weather was perfect; it was warm and still, and the season was normally advanced. This year we had, as before,

The native keeper, at 2LO inducing the elephants to perform.

the benefit of Miss Harrison's assistance, and of the experience of the wise men of the local countryside, who know all that there is to be known about birds and their habits. We had much improved apparatus, several microphones placed beforehand in readiness exactly where we knew the birds were singing, and plenty of assistance to change these positions should the birds change their minds and sing elsewhere. But for some reason or other we were unable to make a complete success of it.

More Difficulties.

On only one night, out of four attempts made, were we able to transmit really good bird music. The birds seemed to change their position every night, and sang at all sorts of times; sometimes they sang all day and not at night; another time they would not start until 2 a.m. The season was certainly abnormally late, the evenings were cold, with strong winds; nightingales will never sing, so they say, on nights like this. Or did they, by natural intuition, suspect that something was happening? The following incident is rather curious, but it may be just an example of that universal law of nature, "the general cussedness of things." We had found

ANIMALS AS BROADCAST ARTISTES—continued.

in the middle of the woods one bird that was a wonderful singer when it started, and the night before the last attempt it gave a wonderful concert. We could not transmit it then because it was an early night for broadcasting, and all stations had already closed down.

A Wily Bird.

It was a long way away, but the next day we quietly ran a very long cable (about half a mile), and, without making any more noise than on the previous night when listening to it, installed a sensitive microphone all ready for the evening. But that evening the bird never sang a note (nor did any other bird), so that at midnight we sorrowfully went to bring in the microphone from the woods; and then immediately after we had disconnected it the bird started; it sounded to us exactly like a song of derision.

A Typical Case.

This is typical of many of the difficulties and disappointments of such attempts. The nightingale is not a contract artiste (many forget this), so we must consider ourselves lucky if we are ever able to produce a really good transmission to order. The difficulties are in many respects very similar to those in the attempts at relaying American programmes—we don't know in advance how strong atmospherics will be, and we are just about as capable, with our present state of knowledge, of foretelling conditions for Transatlantic relaying as of promising a good nightingale concert.

The Wireless "Pram."

The Zoo broadcast utilised for the first time a semi-portable wireless relay set. The method of using a short wavelength transmitter for sending concerts to 2LO for re-transmission had been made use of many times before, but this was the first time that a transmitter of this nature had been made movable.

It is essential to have for all broadcast purposes apparatus that will give the highest quality possible, and this naturally complicates things.

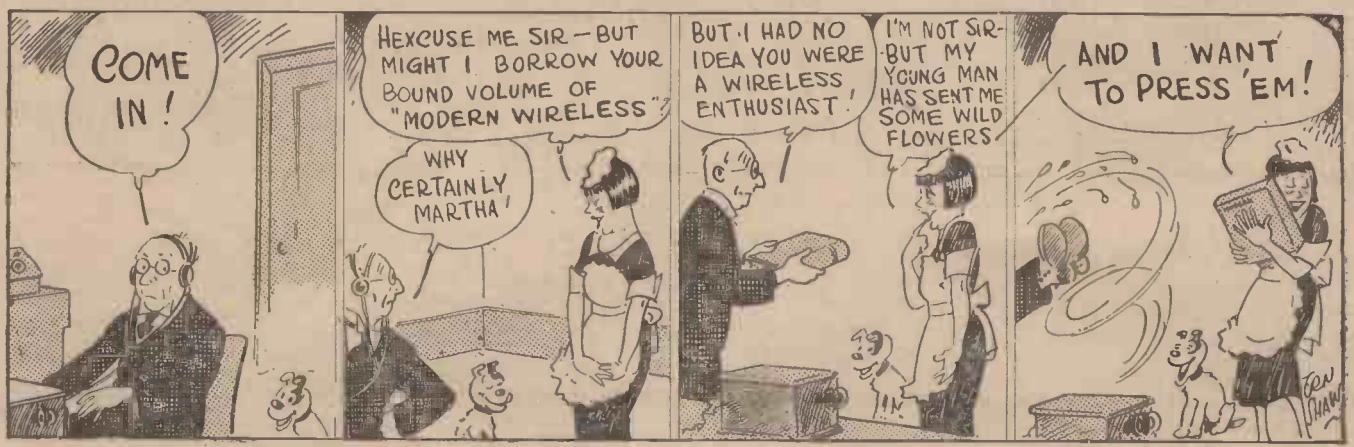
One cannot yet make up in a suit case a small transmitter suitable for this purpose, and giving a satisfactory range of about a mile, using, say, a fishing rod for an aerial. But perhaps next year, or the year after, we shall use something of this nature in pursuit of the nightingale, and thus be able to follow it without having the necessity of laying lengthy cables and carrying about heavy batteries. The essential point, however, is that the quality of microphones and amplifiers and transmission must be every bit as good when picking up animal noises and songs of birds, whether domestic or in captivity or wild (especially the latter, as it is difficult to get close up) as in studio transmission. That this standard has given effective results is evident by some of the stories, perfectly true, that have come to hand after these transmissions. Although the native keeper of the Zoo elephants, when he spoke to them from 2LO, through loud-speakers in the grounds of the Zoo, was unable to make them obey his commands, probably because the voice represented only a part of his authority over them, his presence being missing, there have been cases when animals have responded to loud-speakers reproducing broadcast animal sounds.

A dog obviously interested in his brother's broadcast efforts.

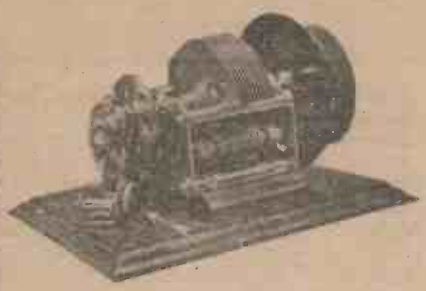
The portable wireless transmitter in use at the Zoo.

Some Future Possibilities.

On one occasion in the Children's Hour Uncle Jeff brought his dog and asked children to listen with their dogs. The result was the "great howl," when the dog in the studio commenced a howl that made dogs in hundreds of suburban homes have a sudden desire to bring forth music (of its kind) and howl in unison. And, similarly, when the nightingale was broadcast it was perfectly true that in three different localities listeners placed their loud-speakers in their gardens and immediately local nightingales responded. This result suggests a wonderful experiment, namely, a wonderful duet between two birds a hundred miles apart, each nightingale hearing and answering the other.



Novelties at the Wireless Exhibition



A large model of the new G.E.C. variable condenser compared with the actual component.

Some Brief Notes upon the Exhibition at the Albert Hall.

Senator Marconi holding the receiver used in the first trans-Atlantic wireless communications which is on show at the Exhibition.

THE wireless enthusiast will find much to interest him at the Albert Hall Exhibition this year. The man who wants to buy a ready-made set will find almost every conceivable variety, from prices suitable for the humblest purse to those capable of gratifying the most extravagant wishes of the rich. Super-heterodyne receivers are prominently shown by several well-known makers, and one or two neutrodyne sets, following very much on the lines of American receivers. In accessories there has been much progress, and we notice particularly the step forward that has been made in developing robust high-tension accumulators to take the place of the dry cells for high tension supply in multi-valve sets. Several firms are now marketing good wavemeters.

Two Giant Valves.

Much interest is aroused by the two giant valves, illustrated on this page. One is exhibited by Messrs. A. C. Cossor, and the other by the Mullard Radio Valve Company. Many visitors imagine that these represent actual valves for practical work, but actually they are merely enlarged models. A very ingenious arrangement is adopted in the first of these. A Neon tube is arranged in the shape of the filament so as to give a pink glow very closely resembling the appearance of the actual dull burning filament itself. The Mullard valve model shows the internal construction of their new P.M.4, a dull filament power amplifier taking only a tenth of an ampère at 3.5 to 4 volts. Other valves of interest are those of the Marconi Company and the General Electric Co. Marconi valves and Osram valves are now being marketed separately, and no longer as "Marconi-Osram" valves.

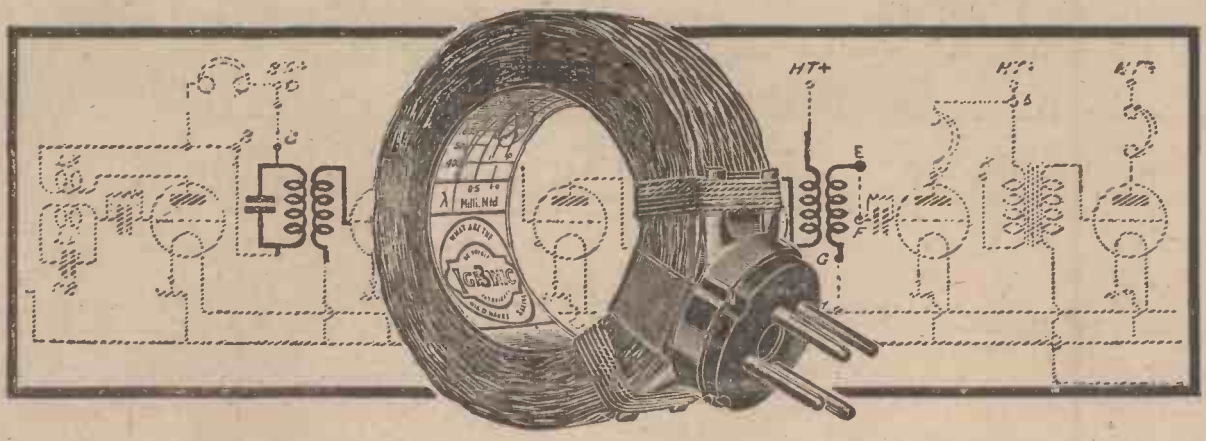
A Handsome Bowyer-Lowe Cabinet Superheterodyne Receiver.

A large model Cossor valve which has a specially shaped Neon tube as a filament. The lady is holding a piece of crystal.

Artistic Cabinet Receivers.

On every side one notices the growth of the artistic in design. Whereas a year or two ago most wireless sets looked very much like scientific instruments, without any attempt to make them pleasing, at present practically every maker markets a set made up in a form which would not disgrace the most elegantly furnished living room. Some, indeed, are masterpieces of the cabinet maker's craft. Loud-speakers, too, are gradually departing from the conventional horn type, and several are made up in most pleasing designs, resembling in appearance lamp stands, cabinets, pedestals, and other objects. A word of praise must be given to some of the exhibits on the smaller stands, especially those catering for the home constructor. Quite a number of most ingenious components are now available, adding not only to the efficiency of sets, but to the general pleasing appearance which every home constructor aims to obtain.

This model shows the internal construction of the new Mullard P.M. 4 power valve. Note the real valve at the top.



The high-frequency coupling that ensures the least of losses

The chief aim in coupling high-frequency valves is to secure a maximum transference of anode potential fluctuations to the grid of the succeeding valve with a minimum of distortion. This is attained to a remarkable degree with Igranic High-Frequency Transformers, as the honeycomb form of winding ensures a highly inductive coupling and self-capacity in the coils is reduced to a minimum. These qualities are absolutely essential for efficient reception, especially on very short wavelengths, when the frequencies involved are exceptionally high.

At these frequencies losses, due to the presence of undesirable capacities, are very heavy, and unless these capacities are cut down to a minimum the quality and volume of reception is bound to suffer.

The transformers should be tuned by means of a .0005 mfds. variable condenser across the secondary windings and give the wavelength ranges stated below, although a .001 mfds. condenser may be employed with No. 4 transformer, adding considerably to the range given, without any appreciable decline of efficiency.

A four-pin plug is fitted for mounting purposes for use with any standard type of valve holder. These plugs are secured to the transformers in such a manner as to give an angular setting of the coils when the valve holders are mounted with their grid and anode sockets in a vertical line, thus reducing any possible mutual coupling between two or more transformers to a minimum.

Two of these transformers may be tuned by means of a double variable condenser of conventional pattern.

No.	Wavelengths obtainable when secondary is shunted by the capacity indicated.			Price.
	0 mfds.	·00025 mfds.	·0005 mfds.	
1	238	442	538	8/-
2	530	846	1110	9/6
3	1050	1625	2090	11/-
4	1860	2500	3200	12/6

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Circuits You Will Use This Winter

No. 2.

By JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.

LAST week I gave a number of circuits which will undoubtedly become popular during the coming winter. Obviously it is not possible in a single article to give all the information regarding future popular circuits.

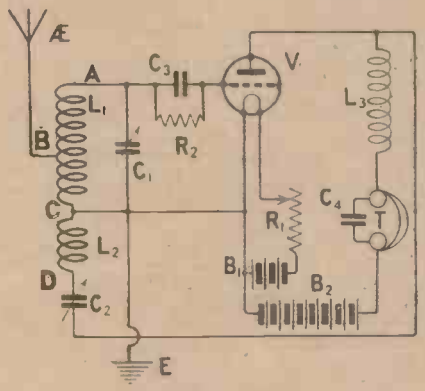


Fig. 1.—A form of the Reinartz circuit.

In the present issue I am giving three more. The first is illustrated in Fig. 1, and is a form of Reinartz circuit, in which capacity reaction is employed. The coil L1 may be all in one and wound on a low-loss former, such as is provided by the Collinson Precision Screw Co. Tappings are taken at the points B and C. The number of turns between A and C is such that with the condenser C1, which may have a capacity of .0003 μF, the wavelength range desired is to be covered. If a longer wavelength range is desired, C1 may have a capacity of .0005 μF. Turns between B and C are variable, while the portion between C and D is approximately equal to L1. The condenser C2 regulates the amount of reaction fed into the circuit while L3 is a choke coil consisting of a No. 200 plug-in coil.

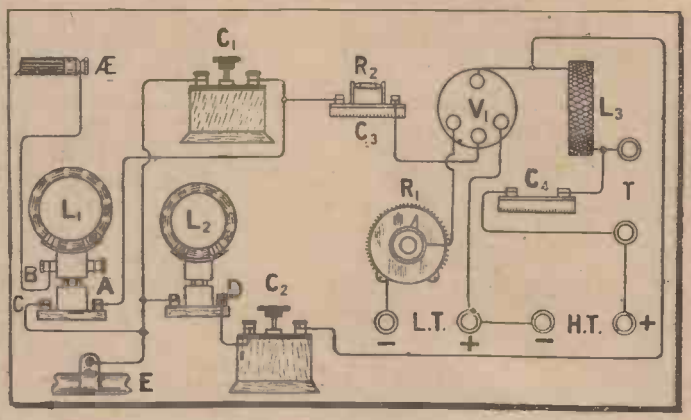


Fig. 1a.—The circuit of Fig. 1 in pictorial form using plug-in coils.

The second circuit is one which I described in the March issue of *The Wireless Constructor*, and which is probably new to a large number of readers. This is a form of reflex circuit, but of a very different kind from the normal type. It really consists of an ordinary crystal set followed by a low-frequency amplifying valve, in which the low-frequency amplifier is also used to introduce reaction into the aerial circuit. Condenser C3 has a capacity of .0002 μF, whilst C1 may have the usual capacity of .0005 μF.

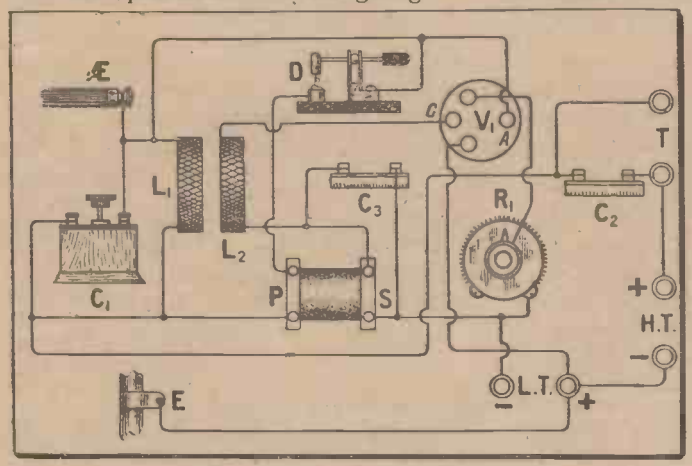


Fig. 2.—An unusual form of reflex circuit.

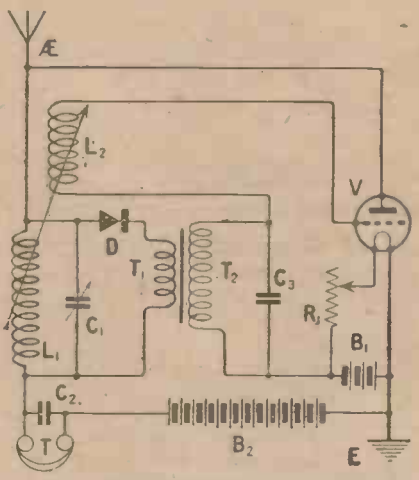


Fig. 2a.—The theoretical arrangement of Fig. 2.

Fig. 3 is a single-valve reflex circuit similar to the first half of the new ST100 receiver. In other words, it is a single-valve ST100 of the new type.

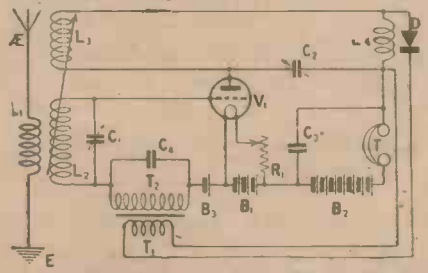


Fig. 3.—A single-valve reflex circuit which resembles the new ST100.

These circuits will all be incorporated in sets which will be described in WIRELESS later.

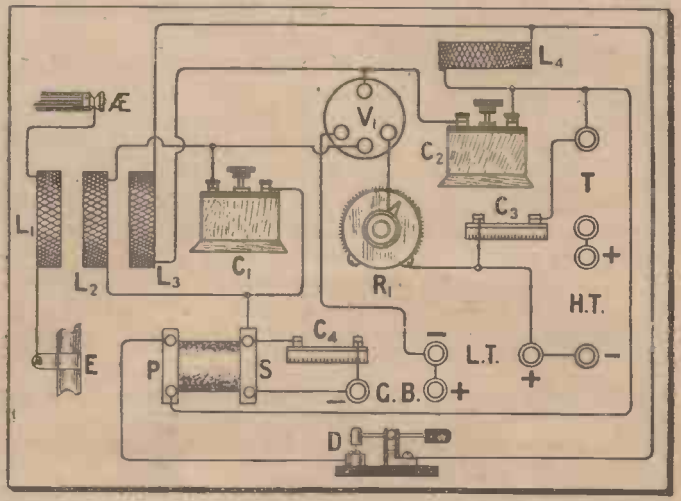
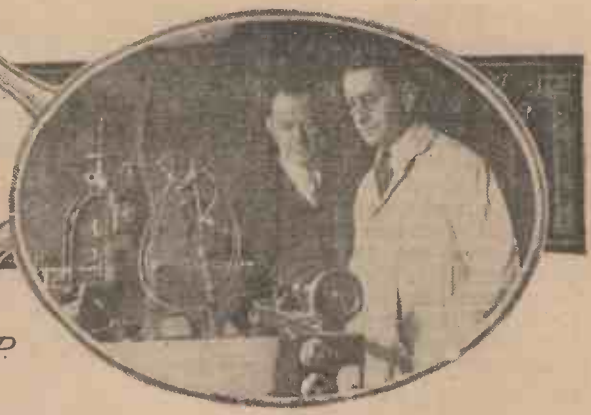


Fig. 3a.—The conventional plug-in coils may be used if desired.

THE INNER HISTORY OF THE GRINDELL-MATTHEWS DEATH RAY



By Major James Robinson, D.Sc., Ph.D., F.Inst.P.

Dr. Robinson, before becoming Director of Research of our Laboratories was in touch with this subject as Wireless Head of the R.A.F.

IN the recent Death Ray of Mr. Grindell-Matthews, one of the tests was to stop a motor-cycle engine, and the engine was certainly stopped instantly. It was, however, also under the control of the inventor. The method employed was not disclosed, and the Government scientific experts were not concerned with the method at first, until they were convinced that any engine could be stopped. The same severe but common-sense test was proposed by them as in the case of Signor Ulivi: that Mr. Grindell-Matthews should have control only of his Death Ray, whilst our scientific experts would provide the engine. An offer was made to Mr. Grindell-Matthews of £1,000 if he performed this experiment satisfactorily without involving on his part any explanation of how it was done. This must be considered by everyone as an exceptionally fair test, but the offer was not accepted. Any Death Ray properties claimed might also have been put to a very severe test, for one of our scientific experts offered himself as a test for the death-dealing properties of the ray. Again the offer was declined.

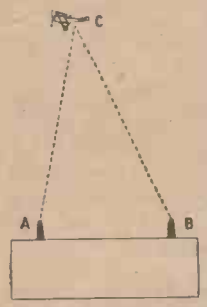


Fig. 1.—In this scheme the points A and B "sent" negative electricity, the circuit being completed across the sparking plugs of the aeroplane!

Another Demonstration.

Another demonstration actually given by Mr. Grindell-Matthews was to light an Osglim lamp across a room, but as this does not differ much from the very first demonstration of electro-magnetic waves or wireless waves by Hertz we need not pay much attention to it. Hertz actually obtained a spark in a small spark gap formed by an almost closed hoop of wire.

The actual experiments performed by Mr. Grindell-Matthews, those of stopping an engine and of lighting a lamp, were actually repeated by one of the Government scientific experts at a reception a few days afterwards. Any conjuror can perform these experiments.

A Fatuous Scheme.

Another instance of the attempt to stop aeroplane engines was very interesting as showing the thoroughness and patience of our Government scientists. The suggestion in this case was that it was possible with a particular box with two sharp points A and B outside (Fig 1) to send negative electricity from both points. The electric circuit was to be completed across the sparking plugs of the aeroplane, and we were to have the circuit thus complete. What was to happen then was never explained. As the inventor was a foreigner who could not speak English, certain tests were carried out for him in case his explanations were mere bluff to conceal his discovery, if any. It actually did appear that his supposed invention did consist of these impossible ideas, and he was soon disposed of.

The lamp lit by the Death Ray.

Other Devices.

Other means for bringing down attacking aircraft have also been called Death Rays, though the description in these cases is somewhat far-fetched. One suggestion was to send vortex rings through the air to the aeroplane, and so cause such a disturbed condition of the air near the aeroplane that it would be impossible for the pilot to control it. Another idea is to explode shells of poison gas near the aircraft to poison the pilot. Such suggestions come more nearly into the realm of ordinary fighting weapons, and it would be easy to find defensive measures against them.

Photographic Rays.

In the year 1916 a claim was made by a sergeant in the R.A.M.C. by the name of Shearer that he could take photographs of internal organs of the human body by a process which is different from that of X-rays. He extended this claim, and one day produced a photograph of a Zeppelin which had attacked Amiens on the preceding night, this photograph, he stated, having been taken at a dis-

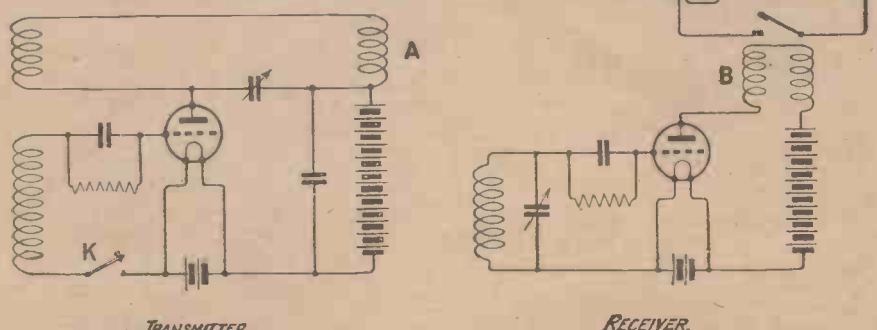


Fig. 2.—A reader trying this arrangement will have wireless control over the Osglim lamp E, given by the key K. B is an electro-magnet.

The Inner History of the Grindell-Matthews' Death Ray—*contd.*

tance of ten miles without the Zeppelin being visible. As a matter of actual fact, a Zeppelin attack had taken place at Amiens on this night. He further claimed that his ray could kill animals at a certain distance. These claims were too important to be ignored, and Col. Blandy, now Head of the Signal Branch of the Air Ministry and Member of Imperial Communications Committee, was given the task of investigating these claims and, if necessary, developing them to a successful issue.

Investigation.

Sergt. Shearer was then promoted to Captain and given a free hand to develop his apparatus. Col. Blandy decided to ignore the Death Ray claims and concentrate on the photographs at a distance. A considerable number of photographs of battleships, aircraft, etc., were obtained, but on one occasion a photograph was obtained of a German submarine attacking a British steamer by night. This was supposed to have happened on the preceding night. Col. Blandy investigated this matter and found first of all that the steamer was using navigation lights, a very suspicious circumstance. Secondly, the photograph showed a perfectly smooth sea, whereas the sea had been exceptionally stormy. This condemned the whole thing as a fraud, and Capt. Shearer was arrested. His papers were searched. and the original photograph of a submarine attacking a steamer was discovered as an advertisement in the *Strand Magazine*. He was sentenced to some months' penal servitude.

An Ingenious Theory.

An ingenious form of death ray has been suggested from time to time, which is to use a searchlight beam and direct it on to the object to be influenced. The idea was that light is known to be capable of producing ionisation, and thus it should be possible to have the whole path of the beam ionised, and thus conductive. Having such a conductive path, it is only necessary to have a difference of potential at two points in the beam to produce a current along it. For instance, if the beam is directed on an aeroplane, and if we have a grid in the beam near the searchlight, and raise the potential of this

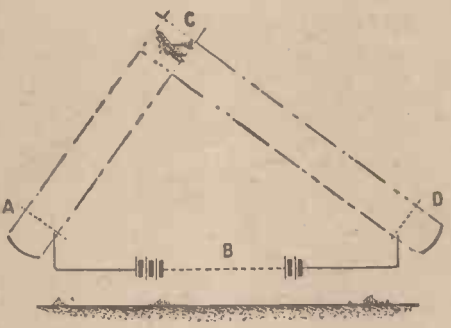


Fig. 4.—Two beams complete this novel Death Ray Circuit.

to thousands of volts, a current would pass along the beam to the aeroplane, provided this is at a widely different electric potential. Then it is presumed some damage would be done.

It may be somewhat difficult to appreciate how current can pass from one point on the earth to an aeroplane some thousands of feet high without some return path. Some inventors of this form of ray have actually suggested a second beam which will cut through the first beam, and to consider the circuit to be completed by the high-tension battery B and the searchlight beams A C and C D, using wires to connect the two grids in the two searchlight beams (Fig 4).

This idea again is purely imaginative, for the amount of ionisation produced by the light is not large, and any possible current will be so minute as to defy measurement, quite apart from being capable of doing any damage.

An Effective Death Ray.

Apart from the realms of imagination, there are already many ghastly weapons of war, and one of them fits our conception of a Death Ray almost entirely in that it can be aimed, and deals out death quickly, but it is not intangible. The machine-gun is a very good form of Death Ray!

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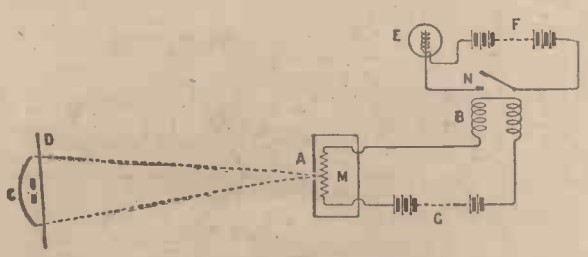

Fig. 3.—The heat-rays from C affect the wire M, which in turn controls E. B is an electro-magnet.

How to Imitate Mr. Grindell-Matthews' Experiments.

Our object is to have some form of instrument which can send out certain forms of radiation which will start or stop a motor-cycle engine, or light an Osglim lamp at a distance. We shall restrict ourselves to a small scale, say a distance of 20 or 30 ft. There must be no direct form of connection between the transmitter and the receiver, such as wires. Both, however, are under our control, so we can install any convenient apparatus we require on the receiver. Any radiation that we use should, of course, not be visible. There are three obvious forms of radiation which can be employed:—(*a*) Wireless of any wavelength; (*b*) Ultra-violet radiations; (*c*) Infra-red rays.

(*a*) With wireless the problem is quite simple. The transmitter can be of any simple form. As the distance is small, a loop antenna A can be used (Fig. 2). Similarly, a simple form of tuned receiver can be used, again using a loop antenna. In the anode circuit of the receiver there is a simple relay B which controls a switch in the circuit E F. This circuit contains the lamp E and a battery F, and if the voltage of the battery is sufficient, the switch B controls the lighting of the lamp E. Thus the lamp can be lighted or put out by operating the key K in the transmitter.

(*b*) Ultra-violet and infra-red radiations are present with nearly every form of light known. The spectrum, as is well known, embraces all colours from red to violet. Infra-red and ultra-violet are beyond the two extremes. Infra-red rays are often called heat radiations, because they are the most active heat-giving part of the radiations. Ultra-violet rays are often called actinic rays because they are most active photographically.

Screens exist which will cut out the visible light and let through either the ultra-violet or the infra-red. A thin sheet of ebonite cuts out ordinary light but lets through a considerable amount of infra-red. In Fig. 3 a searchlight C is shown with a screen D of ebonite, to let through only the infra red.

Detecting Heat Rays.

(*c*) It is possible to focus heat radiations in a manner similar to the focussing of ordinary light. The receiver can be a dark box A with a hole in it to let through the radiations. A simple method of detecting the heat rays is to allow the heat to be absorbed by a wire M, whose resistance is thereby changed. The absorption of heat can be increased by blackening the surface of the wire. The wire M is in circuit with a battery G and a relay B, which can be set conveniently to close a switch N at a definite current. This switch is made to open or close an electric circuit containing the Osglim lamp E and a battery F. Thus the lamp E is under the control of the transmitter. Other forms of detection can be used, such as the selenium cell or photo-electric cell.

In place of the Osglim lamp E and the battery F, a motor-cycle engine can be controlled by merely having the circuit E F as the magneto circuit, and the switch N makes or breaks this circuit.

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At Last—Radio Music for those who need it most

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With an outside aerial you can hear all the B.B.C. Stations on the headphones with the Polar-Twin—and most Continental and some American ones, under favourable conditions. Two or more main Stations can generally be received on the Loud Speaker.

Complete Set, ready to connect to aerial ... **£13 : 10**

Accessories include: 2 Mullard D.06 Valves, 2 H.T. Batteries and Plugs, 3 Polar D.E. Cells, 1 Short-wave Aerial-Reaction Coil Unit, 1 Daventry Aerial-Reaction Coil Unit, 1 Amplion Junior Loud Speaker and the necessary connecting wires.

The sign that means service.

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Set, without Accessories, but including short-wave Aerial-Reaction Coil Unit, Royalty paid .. .. **£6 : 15 : 0**

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THE NEW ST 100 RECEIVER

By John Scott-Taggart, M.C., F.Inst.P., A.M.I.E.E.

IN last week's issue general constructional details of the set were given, but in case any home constructor still feels uncertain about some of the points, the following further details will help him:—

The use of Glazite wiring will prevent the short circuiting of various wires, but, in any case, these should be kept spaced from one another to avoid injurious interaction effects.

Flexible Leads.

It will be noticed that a number of leads come to the Watmel fixed condenser; these leads are sufficiently stiff to hold the condenser in place above the casing of the C.A.V. transformer. Another point that should be noticed is that the flexible leads from the moving socket of the coil holder are taken to two terminals on a small ebonite strip. Under these terminals are connected the two wires which go to the fixed coil holder at the back of the instrument and to the valve socket respectively. The ebonite strip is secured to the baseboard by a screw passing through a small block. The use of these terminals enables the leads to the coil holder to be conveniently reversed.

The Sockets and Valve holders.

It will be observed that the Benjamin valve sockets are provided with both terminals and soldering lugs. In the instrument illustrated connections have been taken to the soldering lugs, but, for those who prefer it, the leads could equally well be taken to the screw terminals, provided these are screwed down tightly after the bare wire has been placed underneath.

The strip which carries the sockets along the back of the instrument is secured to the baseboard in rather an unusual manner. At each end of the strip a hole is drilled edgewise—that is to say, so as to enter the strip from the bottom when the terminal strip is placed in position. Into the holes from the underside of the panel are passed wood-screws of the size known as No. 4, ¾ in. long. The sharp edges of the wood screws cut into the sides of the holes and make a firm grip. In this way the difficulty of tapping the holes is obviated.

Fixing one of the wires in position.

The more advanced constructor will be interested in the circuit diagram illustrated in Fig 1. Several important differences from the original S T 100 receiver will be noticed. All are distinct improvements.

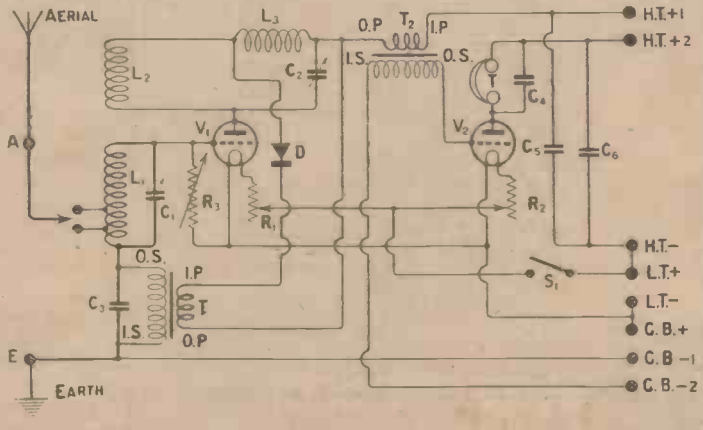

Fig. 1.—The theoretical circuit of the new ST 100 receiver.

Coils.

The size of Lissen X coil to use in the aerial circuit is a No. 50, No. 60 or No. 75. For wavelengths below 300 metres I advise a No. 50, while a No. 60 will cover the ordinary B.B.C. stations. On test this X coil gave a wavelength variation of from 260 metres to over 500 metres.

The reaction coil was a No. 25 Lissen, and the third coil was a No. 50 of the same make.

Valves.

As regards the types of valves to use, I propose to get the Elstree Laboratories to give a report on the functioning of the apparatus under different grid-bias voltages and anode voltages with different types of valves.

The set works perfectly well with general-purpose valves, but I am most emphatically in favour of using a power valve in the second stage. Purer reproduction is obtained, and also louder signals. An Ediswan A.R. valve in the first stage and a B4 valve in the second stage give excellent results. Instead of the B4, the D.E.5, of course, will work equally well, while the B6 valve (3 volts, .12 ampere) or the B7 type of valve (6 volts, .06 ampere) are equally good.

A power valve in the first valve holder tends to make the first valve oscillate more readily. If a dull emitter valve is required for the first valve, a B5 or D.E.3 valve working off a 4-volt accumulator (fully charged) will be quite satisfactory, the second valve being then a B6 or equivalent type made by other manufacturers and working at 3 volts. If dull emitter valves are used, the Polar rheostat bobbins, of course, should be of the dull emitter type, whereas with bright emitters the ordinary bright emitter rheostat is eminently satisfactory.

As regards the reaction coil, do not attempt to move the coil itself, as with the particular two-coil holder all the control must be carried out by the front knob.

The anode voltage to use is normally 100 volts, although at times the second

The New ST100 Receiver—*continued.*

valve may be given 120 volts and the first valve 60. If two B5 valves are used in the set, or two D.E.3's, a voltage of about 70 may be placed on both anodes.

It is impossible to give broad instructions which will apply to all valves, but it is our intention to give in further issues of *Wireless* necessary details to cover different combinations of valves.

A grid-bias battery is absolutely essential, and should be tapped up to 9 volts. Usually about 4½ volts on each grid will be satisfactory, but this again depends on the type of valve used.

Further Details next week.

FREAK AERIALS

By A. V. D. HORT, B.A.

FROM time to time letters appear in the papers from people who have either casually or of set purpose "discovered" new forms of aerials. They have taken a lead from the aerial terminal of their wireless set and connected it to some handy metal object, such, for instance, as an iron bedstead, the firegrate, or the framework of a piano. Quite good results may be obtained with such "aerials," especially, of course, if the receiver is situated quite close to a broadcasting station.

At first sight it may appear to be somewhat puzzling that such domestic objects as fenders or curtain rods should assist in the reception of signals. But, in fact, any metal object is a potential "aerial," in the sense that it can be used, if it is satisfactorily situated, as a means of picking up the desired signals. It is well known that electric bell or lighting wires are often quite suitable for use as aerials, but an aerial need not necessarily be in the form of a wire.

Rod Aerials.

Miniature transmitting and receiving sets, such as are often used for laboratory demonstrations, are sometimes equipped with aerials, or rather antennæ, in the form of short rods with metal discs at their outer ends, the whole device being shaped like a racquet. The use of bedsteads or fenders for reception purposes is thus seen to be only a variation of the type of antennæ employed in this method of transmission and reception.

Now in the vicinity of a broadcasting station these unusual aerials may well seem all that is required for enjoying the programmes. But they cannot be expected to be highly efficient, for the reason that the insulation from earth of such objects as have been mentioned is at best of doubtful quality. This may lead to a considerable falling off in signal strength in damp weather.

Those who live in flats or in houses where outside space is limited to the area of the roof often find it simplest to put some form of aerial indoors. If wires are undesirable, and a more compact type of aerial is wanted, assuming, of course, that a frame is insufficient, quite good results may often be obtained with a large metal plate. This should be preferably of copper or zinc, and may be suspended horizontally or vertically in any convenient position. Great care should be taken to see that it is well insulated and that it is clear of walls or ceilings. A good earth connection should also be provided for the receiver.

A spring mattress may be used as an aerial when the local broadcasting station is within a few miles.

Another novel aerial is a fire guard.

If it is at all possible, however, an aerial of the more conventional type is greatly to be preferred, and is practically essential if the reception of distant stations is desired without employing a number of valves. A properly insulated wire out of doors, or failing that, slung indoors well away from walls and ceilings, can be more confidently relied upon to give satisfactory and consistent reception.

DUST

It is curious to notice what large numbers of wireless enthusiasts fail to realise the evil effects of allowing dust to accumulate on their apparatus. Ebonite seems to have a curious fondness for collecting dust, and if a set is left uncovered for some hours it will generally be found that there is a thin layer upon the panels. The dust deposit in the average room consists of minute particles of wool and other fabrics, of grit, and of little pieces of ash and soot. If it could be kept perfectly dry, dust might not seriously affect the insulation, though some of its components have conducting properties. Unfortunately dust is distinctly hygroscopic and absorbs some of the moisture which must be present in every room owing to the respiration of those who use it. Once it has become damp, dust forms a conductor quite good enough to impair seriously the working of a sensitive set. Further than this, the surface of ebonite is always slightly porous, and dust, if allowed to accumulate, forms a film, often quite hard to remove, which leaves deposits in the pores and greatly reduces the insulating properties of panels.

A Simple Experiment

Try this simple experiment to convince yourself that such a film is formed. Leave a piece of ebonite in a position where it can remain undisturbed for a week or so. At the end of that time rub it over lightly with a duster to remove the obvious layer of dust. If you compare it after this process with another piece of the same make which has been kept free from dust you will find that there is a distinct difference between the two in colour. Now take the piece that has been exposed and rub it as hard as you can with a white cloth. The cloth will be soiled at once, and the portions of the ebonite that have been rubbed hard will show up quite distinctly. You will have to put some real elbow grease into the work to make the ebonite quite clean.

Prevention is admittedly better than cure. We cannot entirely prevent dust from being deposited upon our panels, but we can see that they are protected from the worst of it.

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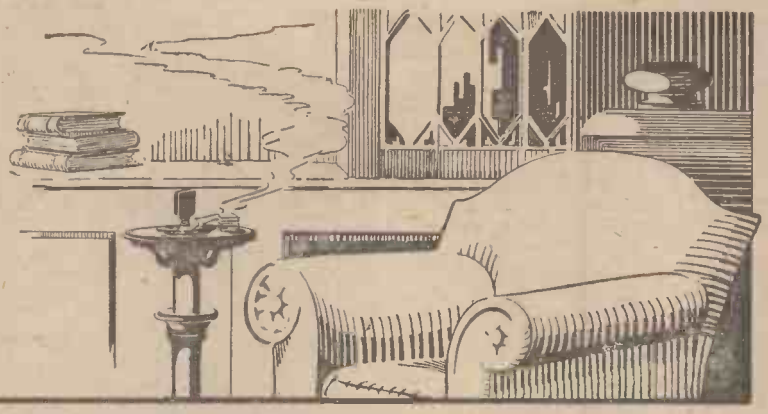
From my Armchair

BY EARL RUSSELL.



COMMENCING WITH THIS ISSUE, EARL RUSSELL WILL GIVE A WEEKLY CAUSERIE UPON VARIOUS SUBJECTS.

IN almost every wireless paper one may see at frequent intervals instructions that aerials should not be shielded, that earth leads should not be long, and various other precautions recommended. Far be it from me to suggest that the advice given by the great, wise, and eminent is not perfectly sound, but it is wonderful what results can be obtained with bad aerials.

A Personal Experience.

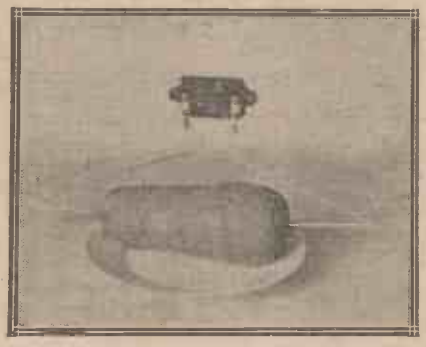
I have an aerial which consists of a single strand of old telephone wire, supported on ordinary telephone insulators only ten feet above the ground, screened along its whole length by trees. To make it worse (though not intentionally) it had been led into a first-floor room, where several yards of mixed earth and aerial insulated wire were coiled upon the floor, then down to a ground-floor room. From here the earth went up to the room above, coiled on the floor, went round the house, and was connected to a lightning conductor. It will be seen that this aerial had almost every fault an aerial could have, and yet a quite ordinary three-valve set received stations fifty miles away perfectly.

Reception Without Earth.

As this particular set seemed so accommodating I ill-treated it in other ways, finally ending by giving it an aerial of 15 ft. of insulated wire flung upon the floor, and no earth at all. Bournemouth, fifty miles away, was received quite clearly at about R.4 or R.5. On another three-valve set I received 5XX on 100 ft. of insulated wire flung upon the lawn without any earth at about R.8. Readers must not suppose from these experiments that the aerial does not matter, but the fact is that a good set will receive on a bad aerial, and a good aerial will give wonderful results on a bad set. Perfection is only attained by a combination of the two.

Precaution Worth While.

As illustrating the value of conventional advice I will give an experiment in the other direction. I was using about 40 ft. of insulated wire on a three-valve set which in the first instance I had led round the walls of a room, along the walls of a hall, and draped over a clock, finishing on a sofa. I received ordinary broadcasting stations at about R.5. I took the same wire and tied its end up to the staircase, so that the greater part of it swung freely in air 6 ft. or more from the walls and 2 to 3 ft. from the ceiling. A definite improvement was at once manifest, the reception rising to R.6, at least.



A carrot used as a grid-leak makes a strange looking component!

Vegetable Grid-leaks.

If one once begins fussing about them grid-leaks may easily prove a curse. Even some of the best makes are by no means always at their rated value, and as for the variable ones, well, there may be a really reliable one, but I have not met it. The other attitude to grid-leaks is that of a writer about a year ago, who used carrots and other products of the vegetable garden with satisfactory results. Certainly a slice of a nice hard mangel-wurzel would be at least as reliable as some grid-leaks I have known. Of course, in most straight sets the value of the grid-leak seems fairly immaterial, but this is far from being the case with special circuits.

USING FINE DRILLS

I suppose that there are more casualties amongst fine drills than amongst any other tools in the wireless constructor's workshop. When I speak of fine drills I mean those of $\frac{1}{8}$ in. or less in the inch fraction sizes, or from the thirties upwards in Morse sizes. They are so thin that a slight pressure seems to be enough to bend them, and once they bend a breakage is pretty sure to follow within a very short time.

These little drills cut away such a small amount of ebonite that the slightest pressure will drive them through. With a $\frac{3}{8}$-in. drill a certain amount of force has to be used, but with little drills one should always bear in mind the old saying, "It's gently as does it."

When a common hand drill is used, there is a tendency as the crank is turned for the tool to wobble a little. When this happens, the drill bends in the hole and usually snaps off like the proverbial carrot. When using fine drills in the hand drill, more than usual care is required to ensure that one is going straight. The pressure exerted should be of the lightest, for the weight of the drill itself is almost sufficient to take the drill through. Personally I do not think that very fine drills can be used satisfactorily, even for drilling such soft stuff as ebonite, unless a guide block is used in conjunction with the hand drill. This consists simply of a piece of hard wood $\frac{3}{4}$ in. or so in thickness, which is slipped on to the drill before its point is placed in the punch mark. In the wood a hole is made about two sizes larger than the drill in use. So long as you are holding the drill straight, the block will not turn, but directly you begin to wobble or to go crooked it will do so at once. Use a guide block, hold straight, turn slowly, and do not press. These are the four important points to remember when doing fine work with the hand drill. Attention to them will mean neat work and economy in drills.

R. W. H.

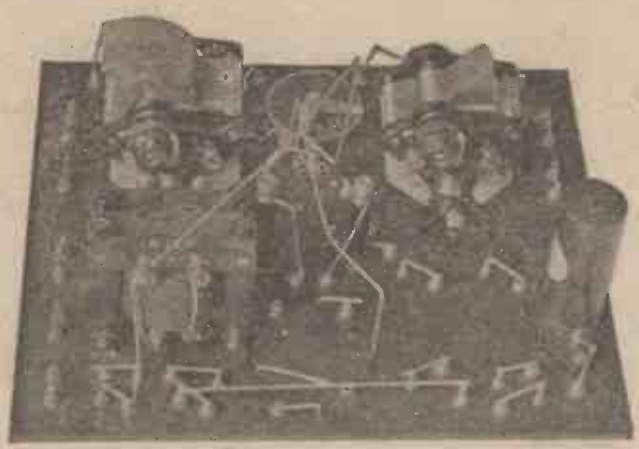
THE CEN

By PERCY W. HARR

This instrument has been especially d single-valve circuits by the simple inte which may be tried will be given each w

HAVE you ever thought what it would be like to have a hundred different valve and crystal receivers ready at hand? Have you ever suddenly wanted to try a new single valve circuit and grudged the time taken to make it up? Have you ever wanted a single-valve instrument with plenty of variety in it? If you have, then the Centodyne will appeal to you.

The Centodyne takes its name from the fact that it is an instrument permitting the use of a hundred different circuits, if not more. Its appearance, as you will notice from the photographs, is quite handsome, the constructional work is simple, and the flexibility is really astounding. In a few moments you can fix up with it a simple crystal receiver, a loose-coupled crystal receiver, a direct-coupled single-valve set, an inductively coupled single-valve set, a single-valve set with split secondary, with or without reaction, a single-valve note magnifier, a crystal detector with valve magnifier, a high-frequency amplifier with crystal detector, a Reinartz circuit, a Flewelling circuit, a De Forest Ultraudion circuit, a single-valve reflex receiver, a resistance coupled high-frequency amplifier, a resistance coupled low-frequency amplifier—in short, almost any variety of crystal or single-valve receiver. The idea of such an instrument is not new, but I *do* think that it has never before been made up in such a convenient form or with such a variety of possibilities.



The connections are all short and easily made.

Constructional Work.

Here are the components required. In accordance with Radio Press practice, I have named the actual makes used, but for these you can substitute any of the well-known high-grade components without loss of efficiency.

One panel of guaranteed ebonite, 12 in. × 10 in. × ¼ in. (Peto Scott Pilot).

One suitable cabinet ("Camco").

Eleven terminals.

Thirty-eight Clix sockets for panel mounting (without bushes).

Clix plugs. (The actual number of these you will require will vary according to the circuit. I would suggest you buy two dozen. You can always get more when you need them.)

Two two-coil holders (Burne-Jones "Magnum").

One anti-phonic valve holder (Burndept Wireless, Ltd.).

One dual filament resistance (L. McMichael Ltd.)

The receiver presents the ance as that of one desig

One high-frequency choke (Lissen, Ltd.).

One good quality L.F. transformer (Radio Instruments, Ltd.). That shown in the photograph is an old pattern which has served me faithfully for two or three years. The firm now makes an improved pattern which should suit even better.

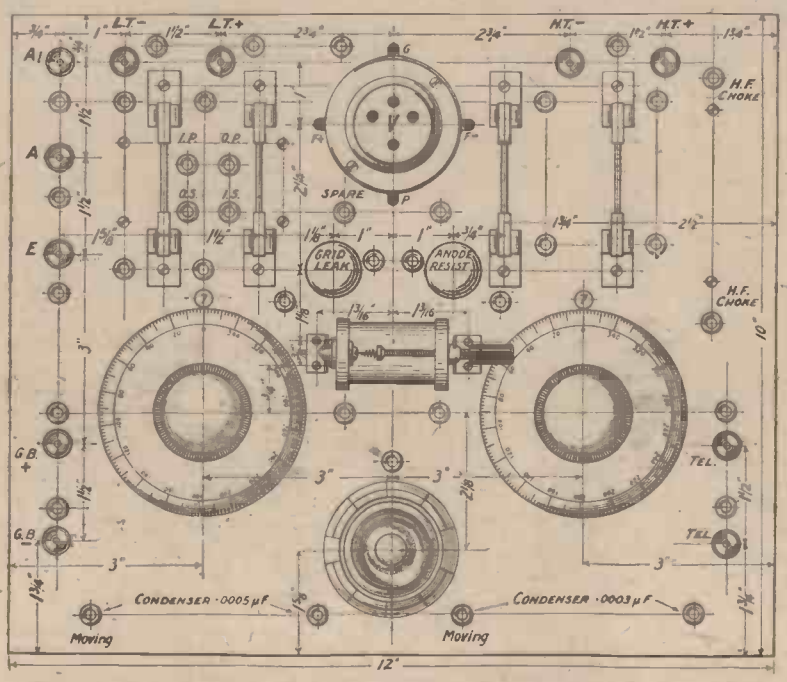
Five fixed condensers with clips (L. McMichael, Ltd.). The value of these condensers will vary with the circuit, but to start with I would suggest you obtain the following: One .0003 μF, two of .001 μF, one .004 μF, and .008 μF.

One variable grid leak (Bretwood).

One variable anode resistance (Bretwood).

Two variable condensers, square-law pattern, one .0005 μF and one .0003 μF (Collinson's Precision Screw Co., Ltd.). This particular pattern has a geared control, which is convenient but not essential. Any good make of variable condenser will do here.

One crystal detector (Burndept Wireless, Ltd.). You can, if you like, substitute for this one of the many



All the necessary dimensions for drilling and placing the components are given in this drawing. Blueprint No. W. 2002a price 1/6, post free.

TODYNE

IS, M.I.R.E., Editor.

esigned in order to lay out innumerable connection of a few sockets. Circuits eek, together with a key to the wiring.

"permanent" detectors now sold, but the true experimenter will probably prefer the catwhisker type of detector, as with this he can try various crystals and select the best positions on each.

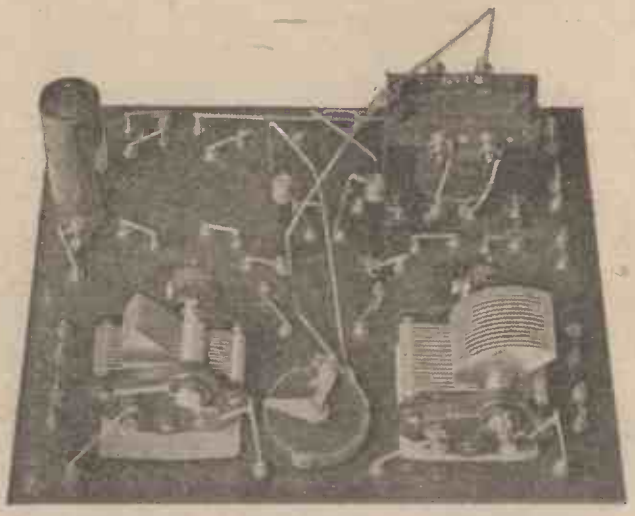
Radio Press panel transfers.

The disposition of the parts is clearly indicated in the drawings, but I would suggest that you do not drill the holes for the Clix sockets until you have mounted the other components, as the positions of these will vary slightly with the different makes used.

No difficulty will be found in making up the set, as all the parts are mounted on one panel. The wiring is an extremely simple matter, and in most cases consists merely in joining up a Clix socket to the nearest terminal. A few longer wires, however, are required, as, to save trouble in wiring up various circuits, arrangements have been made to keep the filament resistance permanently to the negative leg of the valve.

same handsome appearned for a single circuit.

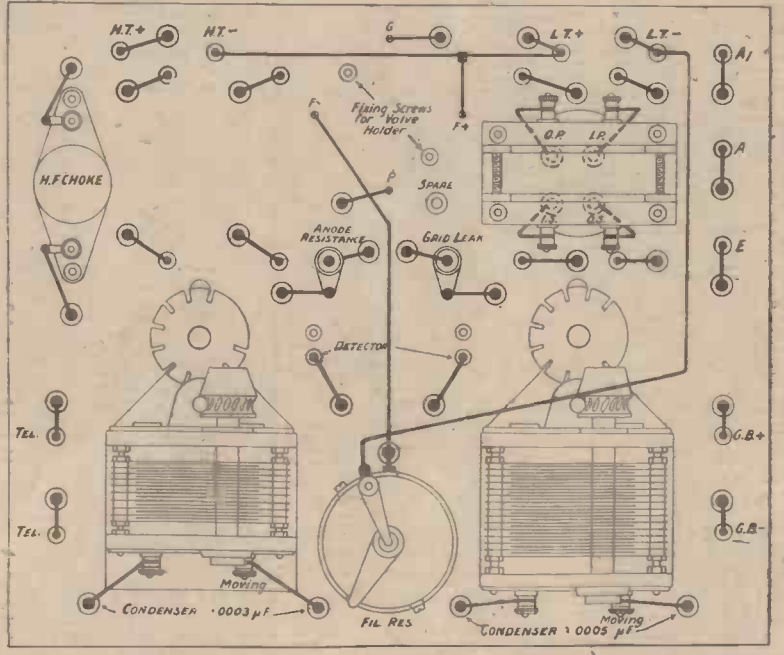
Notice particularly that the four sockets for the IP, OP, IS, and OS respectively of the transformer are placed together. In other cases the various sockets are placed as close as possible to the actual component to which they are connected. In this way a large amount of labelling or marking is avoided. It is, however, advisable to label with the Radio Press panel transfers the L.T. positive and negative, the H.T. positive and negative, the grid bias positive and negative, and the telephone terminals, as well as aerial and earth. Notice that on the aerial and earth side an extra terminal and socket have been incorporated, and there is also a spare socket near the valve holder. It is as well to place these two where shown, as they may be needed for a special circuit later. I would also suggest marking the fixed and the moving plates of the two variable condensers for future reference. Notice particularly that any changes of fixed condenser values can be done without removing the panel from the box—in fact, it is proposed that the panel should be screwed down permanently after the wiring is finished.



Every component has its own particular connecting points.

Next week I shall show you how to wire up a number of circuits in this receiver, but meanwhile, when you have finished wiring up, you would perhaps like to try a simple crystal set. This is made up as follows: Take a pair of flexible leads from the fixed socket of the two coil-holder mounted on the left of the instrument and attach plugs to them. Plug these to two of the sockets on the left (second and third from top), and from the same sockets take a couple of leads to the left-hand variable condenser, making sure that the moving plates are connected to the earth side. Now from the aerial socket (or the fixed plates of the variable condenser) take a Clix lead to one side of the crystal detector, another from the other side of the crystal detector to one of the 'phone terminals, and from the other 'phone terminal a lead to the moving plates of the condenser, or to the earth terminal (it does not matter which). Plug a No. 25, 35, or 50 coil, according to your aerial, into the fixed coil socket, connect the telephones, and listen. You will find this arrangement makes an excellent crystal receiver.

(Next Week: Further Constructional Details and Crystal and Valve Circuit for the Centodyne)



The wiring may be easily followed. The connections shown here will be recognised in the photographs. Blueprint No. W. 2002b price 1/6, post free.

A Low-Loss Set for Daventry

By A. S. CLARK.

Although this crystal receiver is specially designed for 5XX, the short-waves may still be received at good strength.

THERE are many crystal receivers designed with low-loss coils to give the best results from the short wave local station. But in the majority of these sets a plug-in loading coil is the only method of receiving the high power station, whereas for best results from this station the receiver should be specially designed. The set to be described is intended for those within crystal range of Daventry, and employs a coil similar to that described by Mr. Cowper in

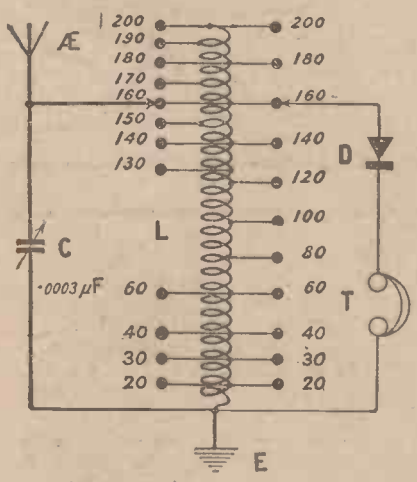


Fig. 1.—The circuit employed showing the tapping points.

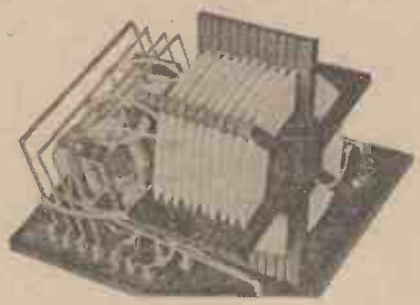
Modern Wireless for September, in his article on "Receiving Daventry."

The Circuit.

The circuit is shown in Fig. 1, and it will be seen that a variable crystal tap is provided, and that direct coupling is employed, tappings being provided for rough tuning, and a .0003 μF condenser for fine tuning. By means of the lower tappings 20, 30, 40, 60, it is possible to tune in one of the short wave B.B.C. stations if it is within range.

Components Required.

The components required are given in the following list, the names of the makers of the particular components used in the original receiver being given in brackets. It is not necessary to adhere to these makes, as other parts of equal quality will be quite suitable.



The coil is wound in ten sections.

Ebonite panel, 6 in. × 8 in. × ¼ in. (Peter Curtis, Ltd.).

.0003 μF variable low-loss condenser (Jackson Bros.).

Catwhisker type enclosed crystal detector (Radiax, Ltd.).

Twenty-three plug sockets and two plugs for same (Radiax, Ltd.).

Two large terminals (Burne-Jones & Co., Ltd.).

Four telephone terminals.

Coil-former (Burne-Jones & Co., Ltd.).

1-lb. gauge 22 D.C.C. wire.

Decko dial indicator (A. F. Bulgin & Co.).

Suitable cabinet 6 in. deep (Camco).

Packet Radio Press panel transfers.

Quantity square wire, flex, screws.

Winding the Coil.

The first part of the constructional work is to wind the coil. Although not quite a pound of wire is required, it is best to make sure of having enough, and the wire will always be useful. It

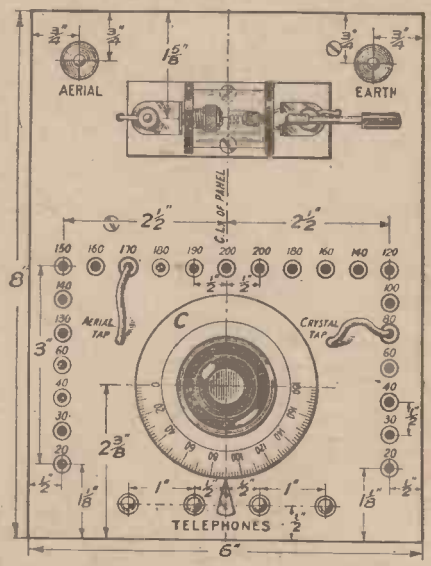
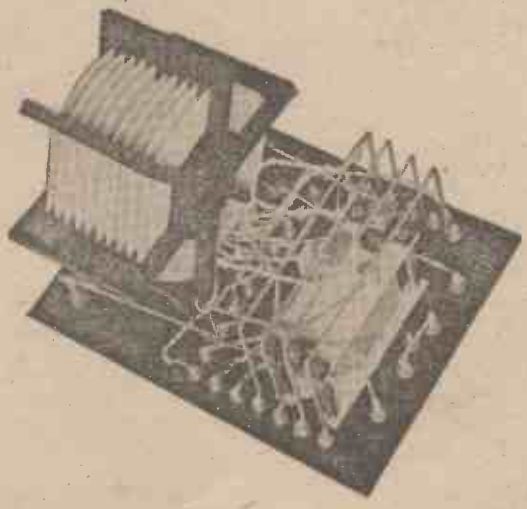


Fig. 2.—This drilling diagram shows the spacing of the various parts.



The wiring needs a little patience, but is not difficult.

will be seen on referring to the circuit diagram that the coil has to be tapped at 15 points, and the number of turns at which these tappings are made is indicated. The coil former has three cross pieces, thus making the coil hexagonal, and there are ten slots for the wire, spaced ¼ in. apart. Twenty turns of 22 gauge d.c.c. wire have to be wound in each slot. The constructional work involved in making the former is rather difficult, and the constructor is advised to buy it ready-made.

Tappings.

The method employed to make the tappings is to double the wire back on itself for about 6 in., and then to cut it at the centre of this loop and twist

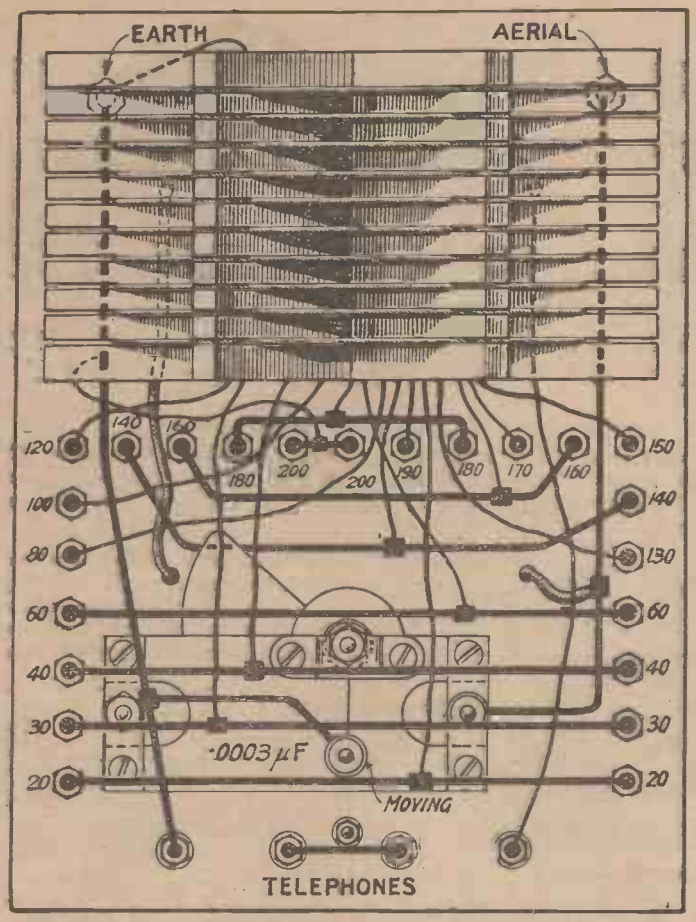


Fig. 3.—When wiring the set take care to connect the right tappings to the correct sockets.

the two ends together. Wind the wire in the same direction all the time, and keep all the tappings in one section of the coil. Sufficient wire must be left at the beginning and end of the coil for connecting purposes. Wind the first slot full, make the first tapping and then pass on to the next and wind on ten turns, and again make a tapping. Do this, making the tappings at the correct points, until the coil is completed, when attention can be turned to drilling the panel.

Drilling the Panel.

This will not be difficult, and the necessary holes, with their dimensions as to spacing, are given in Fig. 2. These should be followed exactly, and the panel marked out on the back with a sharp-pointed tool. All points where there are to be holes should be centre punched before drilling.

The next step is to affix the necessary transfers as shown on the drilling diagram, when the components may be mounted.

Put on the small parts first, leaving the coil till last. This is fixed by means of two small brass brackets bolted on to cross pieces. The tappings should be arranged underneath the coil.

Wiring-up.

The wiring is carried out in accordance with the diagram of Fig. 3, the coil tappings being soldered as follows:—First cut the tapping to the required length, untwist for about ½ in. and remove the insulation, then twist together again, and solder to the bare part. Before the coil is attached to the panel it is important that the tappings are marked in some way. This is best done by writing the turn numbers on small pieces of paper and twisting the wires round them. The numbers against the plug sockets indicate turns, and in some cases the tapping has to be connected to two sockets.

Working the Set.

Having wired the set, place the aerial and earth on their terminals, and one or two pairs of telephones on the telephone terminals. If only one pair is used, it will be necessary to short the two terminals not in use. Either the two right or the two left may be used.

The plug to the left of the panel controls the number of turns in the aerial circuit, and that to the right the crystal tapping. The left-hand plug should be placed in the socket which gives the smallest condenser reading when the station is in tune. This applies whether the station is the long wave one or a short wave. If it is the latter, the plug will have to go in one of the first four tappings. The position of the right-hand plug is controlled entirely by signal strength, and is placed in the socket which gives best results.

Test Report.

The set was tested in S.W. London at a spot which is not very favourable for reception from 5XX. The aerial was rather short, but signals from this station were at comfortable telephone strength, and louder than those from a crystal set employing a plug-in loading coil. The best results were obtained with the aerial tapping at 200 and with the crystal tapping at 100.

2LO was also tuned in and the strength was quite up to the average for crystal sets designed chiefly for the shorter wave stations.

Correspondence

Congratulations.

SIR,—Congratulations on your new paper, very bright, interesting and full of "pithy bits." I am pleased to see you haven't side-tracked the despised crystal user.

Best wishes for your success and long life to the new O.W.W.—Yours faithfully,

ALFRED SQUIRES.

Bishopsgate, E.C.2.

The General Purpose Three.

SIR,—I think it may interest you to know the results I have obtained from my "General Purpose" three-valve receiver, described by Mr. Johnson-Randall in *Modern Wireless*, April, 1925. I am able to receive all B.B.C. stations except Edinburgh and Plymouth at good 'phone strength, and several of the nearer ones on the loud-speaker, Birmingham, 35 miles, being too loud for comfort. This set seems to have an appetite for Continental stations, some of my best being Petit Parisian, Radio-Toulouse, Hamburg, Frankfurt, Rome and one Dutch on about 360 metres.

Some evenings Toulouse comes in at quite good loud-speaker strength. One evening recently I heard an American station, WGY, at about 12.35 a.m., but atmospherics were so bad that at times nothing was distinguishable. Considering that I have been at wireless for just under a year, and that I am only just 16, I do not think the results at all bad. If you can make any use of this letter I shall be very pleased indeed. Meanwhile I remain a faithful reader of your excellent papers.—Yours truly,

S. E. KENWORTHY.

Priors Lee, Salop.

Are Coupled Circuits Worth While?

By J. H. REYNER, B.Sc. (Hons.), A.C.G.I., D.I.C.

ONE of the most troublesome problems with a crystal set, particularly in a locality close to a shipping centre, is the difficulty of avoiding interference from ships' stations using spark transmitters. This is the most serious type of interference which the average broadcaster has to put up with, and it is by no means an unimportant problem.

Now the average crystal set is provided with only one defence against interfering stations—that is to say, it has only one tuned circuit. Even so, it would be possible to construct a circuit capable of giving reasonably good selectivity were it not for two inherent disadvantages. The first of these is the aerial circuit itself, and however low-loss a coil we may construct for the tuning of the circuit, there remains a considerable resistance in the aerial circuit itself which is usually many times as big as the resistance of the coil.

Effect of Crystal on Selectivity.

Secondly, there is the damping of the circuit which is introduced by the crystal itself. Theoretically, a detecting device should have so high a resistance that it causes no appreciable effect on the tuned circuit across which it is connected. An ordinary crystal does not fulfil this condition, and has a comparatively low resistance of the order of a few hundred

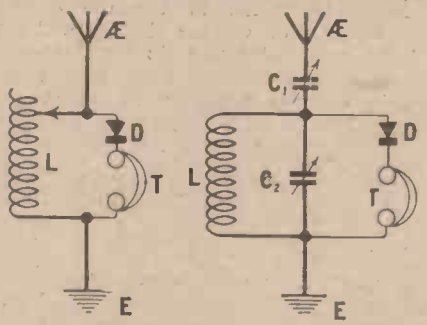


Fig. 1.—Two simple direct-coupled crystal circuits, the one on the left is tuned with a slider, and that on the right by means of a condenser either in series or parallel with L.

thousand ohms only. Consequently the introduction of the crystal across the circuit causes the tuning to be flatter than it would otherwise be.

This question is one which has been dealt with in other articles, and is outside the scope of the present discussion. We will confine ourselves to the consideration of the first source of flat tuning—the aerial circuit.

Use of Two-tuned Circuits.

The tuning can be considerably improved if a second tuned circuit is introduced. We can design a really low-loss secondary circuit, and couple this to the aerial circuit with a loose-coupling. If both these circuits are tuned, the selectivity is very much increased, because the secondary circuit, not having the aerial damping associated with it, is able to be tuned very much more sharply. Such a circuit is shown in Fig. 2. in which both the aerial and secondary circuit are tuned

Untuned Aerial Circuit.

It is quite possible to use an aerial circuit which is not tuned, and it is surprising what efficient results can be obtained from a simple aperiodic aerial coil coupled to the secondary, which is then the only tuned circuit employed. It may even be found satisfactory to couple the aerial directly to the secondary circuit by taking a tapping a few turns from the end of the coil, instead of using a separate aerial coil. This circuit still remains a species of coupled circuit and retains the sharp tuning properties. A circuit of this sort is indicated in Fig. 3.

Does Signal Strength Suffer?

A very vital point to be considered is the signal strength obtained by these arrangements. It might be thought that the signal strength with a coupled circuit would be very considerably less than that with the simple type of circuit. This, however, is not the case, for it is found that the signal strength obtained with a coupled arrangement is very nearly as good as that with a simple circuit. This is because the increased efficiency of the coupled circuit arrangement not only gives greater selectivity, but enables the circuit to respond to the wireless waves much more efficiently, and consequently what signal strength is lost

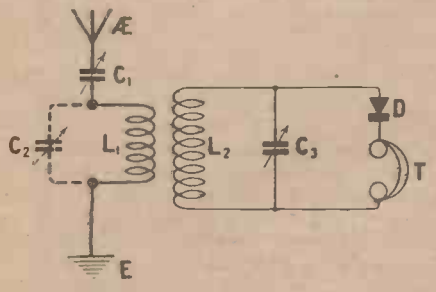


Fig. 2.—A typical loose-coupled crystal receiver.

in the coupling is made up for by the increased efficiency.

A crystal set of the type described has actually been tried by the writer at Whitley Bay, only about a mile from the Cullercoats transmitting station, and no ill-effects were experienced in the reception of Newcastle, ten miles away.

In any case where interference is experienced, therefore, a coupled circuit is worth while, and will be found to reduce, and possibly eliminate completely, the jamming in question.

The Crystal Store Box

THOSE interested in the use of crystals of various kinds will find it a useful idea to make for themselves a small store box, which can be kept in a handy place for immediate use. One made on the following lines will answer the purpose most admirably. Make a small shallow box from any kind of wood, say 4 in. by 3 in. by ½ in. deep, inside dimensions. Divide the box into twelve equal divisions with thin wood or cardboard. Each division will be 1 in. square. In the top six divisions should be placed the crystals and in the lower six different kinds of contacts or catwhiskers. Each division should be labelled according to its contents.

To complete the box, a glass lid should be provided, which may be made to drop on, slide in a groove, or be hinged by means of a surrounding wooden frame. H. B.

Hints to Crystal Users

WHEN choosing crystals and detectors there are a few features which should be observed. A "micro-

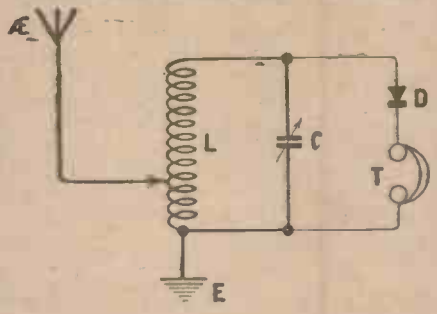


Fig. 3.—Another loose-coupled arrangement, known as auto-coupling.

adjusted" catwhisker is often preferable to the ordinary ball and socket, as a much finer degree of pressure may be brought to bear upon the crystal. A locking device is a very desirable feature, as it enables contact at a sensitive spot to be maintained for a considerable period. The question of choosing suitable crystals is also important. There are innumerable "ites" on the market, all of which are much the same in the results they give. Lastly, a cheap detector is a false economy. B. R. A.

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"UTILITY" WIRELESS PRODUCTS

The "UTILITY" Automatic Crystal Detector

No. W.152.

As used in the new ST100 Receiver, described in this issue, is entirely automatic, and by turning the Knob, the Cat's Whisker is withdrawn from the Crystal surface, a new point is found on the Crystal, and the whisker pressure adjusted to a nicety—three operations in one. Tediousness usually experienced with the ordinary type is entirely eliminated, and the Detector is fool proof, shock proof and dust proof. It is made in two patterns. W.151 for mounting beneath the panel, and W.152 for mounting on the panel surface. The prices are as follows:—

No. W.151 - - **7/6** each.
No. W.152 - - 8/- each.

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The truth about the Mansbridge Condenser

In view of certain misconceptions, it is well that the public should know the facts about the Mansbridge Condenser—its origin and development.

THE Mansbridge Condenser was invented in 1905. Up to this time all condensers were made by assembling alternate sheets of either mica or paper with tinfoil. This process was carried out by hand and was, therefore, relatively slow and expensive. The Mansbridge patent effected several improvements.

Firstly, it enabled the condenser unit to be assembled at a rapid rate because the dielectrics and conductors are fed in continuous strips. Secondly, by reason of the very thin layer of metal which is used in the foiled paper forming the electrode (or conductor), the condenser is not easily short-circuited. This feature forms its well-known self-sealing property.

Undoubtedly the Mansbridge Condenser was a wonderful advance—and even to-day is unexcelled where a compact condenser of large capacity is required.

As a pioneer condenser-making firm, it was only natural that these improvements should attract the attention of the Telegraph Condenser Co. Ltd., and negotiations were early concluded between this Company and the inventor for manufacturing condensers under his patents. Since then T.C.C. Mansbridge Condensers have been supplied in large quantities to the British and Colonial Post Offices, while during the War the T.C.C. supplied the Army with the majority of Condensers for field telegraphs and many other purposes. In fact, there is hardly a corner of the globe into which these familiar little green condensers have not found their way.

The Mansbridge Patent lapsed in 1919 and, provided that it possesses the requisite scientific resources, the right kind of machinery and a capable staff, any firm can now make Mansbridge Condensers.

But—and special emphasis is necessary here—experience plays a very big part in condenser making. The T.C.C. reputation has been built up over a period of 20 years. Obviously, the mere possession of a plant will no more ensure accurate Mansbridge Condensers than the purchase of a kit of tools will make a man a skilled mechanic. The manufacture of Mansbridge Condensers presents its own difficulties—just as any other product. These difficulties must be faced and overcome. For many years T.C.C. experts have been co operating in making in the T.C.C. Mansbridge a Condenser which, in all the world, is unequalled for accuracy, dependability and constancy. When you choose a T.C.C. in its familiar green metal case in any value from .004 mfds. to 2 mfds., you obtain a *genuine and fully guaranteed Mansbridge Condenser.*

¶ *Millions of these T.C.C. Mansbridge Condensers have been made.*

T.C.C.
Genuine
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Condensers

Backed by 20 years' Condenser Knowledge

Telegraph Condenser Co. Ltd.
West Park Works. Kew. S.W.

Gilbert Ad. 3601

How Crystals are Ruined

By JOHN W. BARBER.

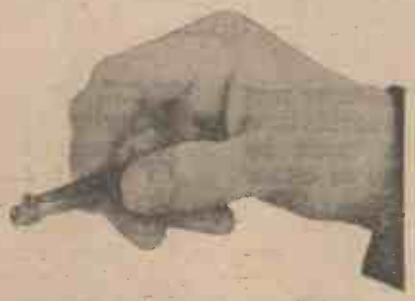
"I CAN'T get such good signals now as I used to," said a friend to me one day, when we were discussing crystal sets; "the strength seems to have fallen off, and it is as much as I can do to hear the announcer's voice at all."

Ruining a Crystal.

I suggested that possibly the crystal was an old one, and that if it were turned over in its cup and a fresh surface exposed, results might possibly improve. "Oh, I have tried that," he said, "but no improvement resulted. Incidentally, what an awful job it is to melt that stuff in the crystal cup." This struck me as an extraordinary statement to make, as, of course, Woods' metal, which one should always use to secure the crystal in its cup, is an alloy which melts at quite a low temperature, it being possible to melt it over the flame of a match. Upon investigating my friend's case I found that he was using ordinary solder in his crystal cup, and this lead to an explanation. A crystal is of delicate construction, which may easily be ruined by heat, and, of course, considerable heat is necessary to melt solder, as everyone who takes up wireless will find out when using a soldering-iron!

Here is one point, then: *don't* use anything but Woods' metal to secure your crystals with. If the stuff you purchase doesn't melt very easily indeed, you may be sure it is not the correct substance. I have almost had my crystals floating about in their cups during some very hot days in midsummer!

Crystals will be ruined very quickly indeed if they are handled in the fingers. No matter how "clean" your



Crystals should never be handled except by means of tweezers.

hands may be (even if you have only just washed them), there will *always* be a thin film of natural grease upon your fingers, which will be transferred to the crystal upon the latter being brought into contact with your fingers, thus utterly spoiling all the nice little sensitive spots that we spend so much time searching for with our cat-whiskers.

How to Take Care.

Crystals should always be held with a pair of tweezers, as shown in the accompanying photographs, and placed in position in the crystal cup, which should have been previously heated to melt the Woods' metal. The crystal is gently pressed into place with the tweezers and held there until the metal solidifies, thus securely fixing the crystal in position. Another great enemy of crystals is dust, and it will be found that a crystal exposed to the air will lose its sensitivity in a remarkably short time, while if it were enclosed in a glass tube, it would remain serviceable for a much longer period. In the old days we used to put vaseline over our crystals, which were set deep in the cups, in order to exclude air and dust, but with the modern glass-enclosed detectors the need for this is done away with. Take care of your crystals and you will get better results!

Tuning a New Set

By A. JOHNSON-RANDALL

MANY of you have, I expect, just become the proud owners of a wireless set. Let me give you a few hints on tuning. The essential details are very similar for all receivers.

The Procedure.

Perhaps you own a crystal set. I will assume that you have connected the aerial, earth, and telephone leads to their respective terminals. Now look at the receiver, and you will find that, in addition to the detector, some means is provided whereby the circuit may be tuned to the same frequency as that of the station you wish to receive. Adjust the detector by placing the catwhisker lightly against the crystal, and bring your circuit into tune. You will, perhaps, have a simple inductance coil, either plug-in or fixed with a variable condenser joined in parallel; or, on the other hand, you may have a tapped coil with a condenser in parallel. The procedure is the same in both cases. Rotate the condenser dial slowly until signals are heard, and when you have found the position in which the volume *decreases*, if the dial is turned to the right or left, try adjusting the detector once again until no further increase in volume can be obtained. Try varying any tappings. When a variometer is employed, the procedure is similar, the dial of the variometer taking the place of that of the variable condenser.

Valve Sets.

Tuning a valve set is just as simple really, for if you have been wise you will not have chosen a complicated design to commence with. Having turned on the valve filaments and plunged in the H.T. + plug at, say, 60 volts, follow the method which I have just explained, rotating the variable condenser dial until signals are heard.

The reaction coupling should be varied with extreme care.

Control of Reaction.

You will, no doubt, have a movable coil (called the reaction coil), which can be brought nearer to a fixed coil. Move this coil slowly towards the fixed one, and note whether signals increase. If they do not, reverse the two flexible leads and try again. Each time you move the reaction coil, retune by rotating the condenser a little. Never work with the reaction coil too close to the fixed coil, or signals will be distorted, and you may spoil your neighbour's enjoyment by oscillating. If you are using plug-in coils, a No. 35 or 50 is usually correct for the broadcast band with a No. 150 for 5XX. The size of the reaction coil depends to a certain extent upon the aerial and earth system, and a little experiment is well worth while. A No. 50 may be found adequate for the ordinary broadcast wavelengths, and a No. 100 for 5XX. Remember, a little practice and it becomes very simple.

The 'phone leads should not be allowed to twist.

Look After Your Telephones

By PHILIP H. WOOD, B.Sc. (Hons.)

An article of interest to every wireless man.

FEW parts of wireless receiving apparatus get less attention than the telephones, and yet the latter form one of the essential links in the radio reception chain. However sensitive and efficient the receiver, it will fail to do itself justice if the telephones are being improperly used or have developed faults. As is the case with all radio components, it proves cheapest in the end to buy earphones of good quality and reputable British manufacture.

Finding the Polarity.

One of the first essentials is that the telephones should have the leads clearly marked as to polarity, or continual use with them wrongly connected, will tend to demagnetise the pole pieces. If the 'phones are connected wrongly in a valve circuit, the "permanent" or "residual" magnetism will in time be destroyed, and although signals will continue to be heard, they will be considerably weakened. Many makers mark the positive 'phone cord with a red tag or a red thread in the braiding, but if this has not been done the user can ascertain which is the positive lead by the following simple method.

Detach one earpiece from the headbands and remove its cap and diaphragm. Stand it on edge, and bring a compass needle near the poles of the magnets in such a manner that the needle comes to rest pointing north-east or north-west. On passing a current through the 'phones from a battery, a movement of the needle towards the north indicates that the connections to the 'phones are wrong; while if the deflection of the needle is towards the magnets the connections are correct. If necessary, reverse the connections, and when a movement of the needle in the right direction is obtained, note which 'phone lead is connected to the positive terminal of the battery; that lead must in future be connected to the positive 'phone terminal of the set.

Points to Watch.

When this matter has been disposed of there are still many points needing care. The earcaps should be kept tightly screwed on, otherwise loose diaphragms will result; while to prevent the latter rusting the earpieces should be wiped dry after prolonged use on any one occasion. If a type of telephones having adjustable diaphragms is used, the controlling screws should be interfered with as little as possible, since

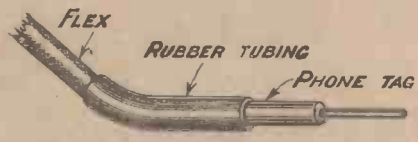


Fig. 1.—Showing how to connect the rubber to prevent fracture at the tag joint.

the reed supporting the diaphragm may easily be broken by "over adjustment."

Causes of Damage.

Hard knocks of any kind will tend to damage the 'phones in two ways: by weakening the magnetic properties of the poles and by injuring the fine wire forming the windings round the magnets. Sudden high-voltage impulses, such as may be caused by lightning or shorting across a battery of high voltage, are possible dangers, although many of the breakdowns attributed to "burn-outs" are due to mechanical damage to the wire arising from the 'phones being dropped or otherwise maltreated.

The Leads.

'Phone cords are frequently very troublesome, and should be suspected when rustling noises accompanied by temporary reductions of signal strength are heard. The most likely sources of trouble are the tags, which through constant use become electrically disconnected from the flex. Short lengths of narrow-bore rubber tubing slipped over the ends of the 'phone leads so as to cover the joints where the tags and wire meet will prevent this annoying fault (Fig. 1).

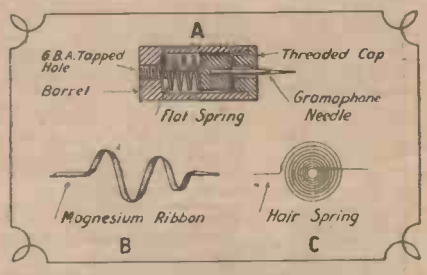
Kinks are harmful to the leads, which should be kept as straight as possible, and a neat device for removing kinks and twists is now marketed. It is better to hang the 'phones on a hook with the cords hanging freely than to pack them away in a drawer with twisted leads.

To sum up, buy telephones of a good brand, see that they are correctly connected to the set, and, above all, treat them carefully if consistently good service is expected.

CATWHISKERS

Three useful suggestions for uncommon types of catwhiskers are described in this article, illustrations of which are shown in the diagram. The first type (A) is somewhat complicated mechanically, but may easily be made by those who possess a lathe. It will be seen that the complete article consists of a brass barrel bored out to receive a spring and plunger. One end of the barrel is tapped to suit a standard detector arm, and the other end is threaded to receive a screwed securing cap. The spring is of the flat spiral type. A gramophone needle is embedded in the plunger, as shown. The second type (B) is much more simple to construct. Ordinary photographic magnesium ribbon is bent to shape as shown. No sharp bends should be made as the ribbon is of a brittle nature. The contact end is brought to a sharp point by means of clipping with a pair of scissors.

For the third type (C) the hair spring of a clock or watch is used.



Various types of catwhisker which are easily made.

This makes a very efficient catwhisker, needing practically no shaping and giving when in use a very fine degree of tension.

B. R. A.

HOBBY-WIDOWS

By our Irresponsible Correspondent.

I IMAGINE that the first hobby-widow lived in the dim ages of the past when the lads and lasses of the village provided themselves with spring suitings by the simple process of boiling down woad and laying it on with a paint brush made from the tail-whiskers of a brontosaurus. All was very well with married life until some fellow had the inspiration of fastening a chunk of stone to a stick, and, thus armed, sallied forth and killed something in a manner that has since become traditional upon such occasions. Instead of being affectionately

". . . *Bored to extinction* . . ."

caressed with a club on his return home, the lady was bored to extinction by his interminable talk about his prowess with the new weapon. After a few days she went about the place telling all her friends that she was a stone-hatchet-widow, and thus was born a joke which has survived in various forms for countless centuries.

The stone-hatchet-widow was soon succeeded by the fishing widow; we can be quite certain of this, since fish-hooks have been found amongst the earliest human remains, and when the menfolk go a-fishing they always fail to land the biggest one and tell the story of its loss evening after evening to their unfortunate spouses.

The Golf Widow.

And so through the ages we have the knight-errant widow, the hawking widow, the archery widow (who knew only too well what drawing the long-bow meant), and a whole string of other varieties. Some may think that nowadays the most pathetic of semi-widows is one whose sad state is due to "golfitis" having attacked her husband. Her sufferings are not confined to listening to the story of how he did the seventh in three, and how he missed the two-foot putt at the seventeenth. These tales are apt to be accompanied by devastating demonstrations in the drawing-room with driver or mashie. He places upon the floor a Crown Derby saucer to represent the hole. Just as he is about to make the shot the telephone bell rings, and on his return from the instrument he treads upon the saucer. At other times he pulls a shot through the glass doors of a priceless cabinet, cuts divots out of the carpet or shatters the chandelier whilst giving a demonstration of the correct backswing.

Still, the golf widow's lot is not really a very hard one. She can train

. . . *Pulls a shot through the china cabinet* . . .

her subconscious intelligence to such a point that she may give her whole attention to a cross-word puzzle whilst hubby is talking, saying "Yes," "No," "Rotten" or "Splendid" automatically at appropriate points. The mess made, too, is of the kind that is fairly easily cleared up. Her fate is a happy one compared with that of

(*Continued on page* 98.)

HOBBY-WIDOWS

(*Concluded from page* 97.)

the most modern of all types, the wireless widow.

The Drawing Room.

For some inexplicable reason every real wireless man, even though he owns a perfectly equipped workshop, finds it much more convenient to do his constructional work in the drawing-room. This habit naturally entails a certain re-arrangement of the furniture of the room. Silly little tables are cleared away, and something solid is installed in their stead. A gas ring is naturally required for heating the soldering iron. The decoration of the room undergoes a gradual alteration as blobs of solder splash upon the hearthrug, and blobs of flux upon the floor, walls and even, in extreme cases, the ceiling; whilst the mantelpiece is soon adorned with those brown furrows which betoken forgotten cigarettes. Meanwhile, hubby prattles without end of condensers, and rheostats and kilocycles and inductance and hysteresis and impedance and heaven knows what.

Sulphur.

The poor lady's case is made worse and worse by fellows like myself who write articles in the wireless papers telling hubby how to do things. We show him how to make his own crystals by baking concoctions of sulphur in the gas oven. Hubby lunches in the City and dines at the club for the next month, whilst his widow must endure joints and puddings and pies and cakes and vegetables that taste of sulphur and sulphur and sulphur! We tell him how to wind coils, whereupon the drawing-room begins to look like a wire entanglement after artillery preparation. And she must either turn the former whilst he feeds on the wire, or hold the spool whilst he does the winding.

. . . Her shoes are filled with B.A. nuts . . .

We show him how to make a heap of little gadgets, and when the wireless widow rises from her chair she leaps into the air with a scream of pain, because her shoes are filled with 4B A. nuts. When he comes to make a complete set she must sit in an atmosphere thick with the smell of sawn ebonite, of frizzled flux and of burnt human flesh. When he tackles the cabinet which is to house his set, these odours are replaced by the luscious scents of glue, size and French polish.

A Forlorn Hope.

She sighs whilst all these preparations are toward, thinking that before long the set will be finished and that then all her troubles will be at an end. Alas, poor wireless widow! If she but knew it, they have not really begun.

Innocence.

She does not realise that he will bash holes in the wall for his lead-in tubes, that he will plump his aerial mast in the midst of the tulip bed that was once the pride of her heart, that he will spill acid on the carpet, or that he will sit for hours in silence with the 'phones about his ears, turning round with an angry scowl if she dares to cough or to rustle the pages of the evening paper. No golf widow has to endure such things as being awakened at three o'clock on the coldest morning of the year and hauled downstairs to a fireless room to hear the nasal accents of a gentleman in New York who is talking through mush and spark signals on the subject of the perfect marriage.

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