

EXPERIMENTS WITH A 24-VALVE SET (See article inside.)

Popular Wireless

and Wireless Review

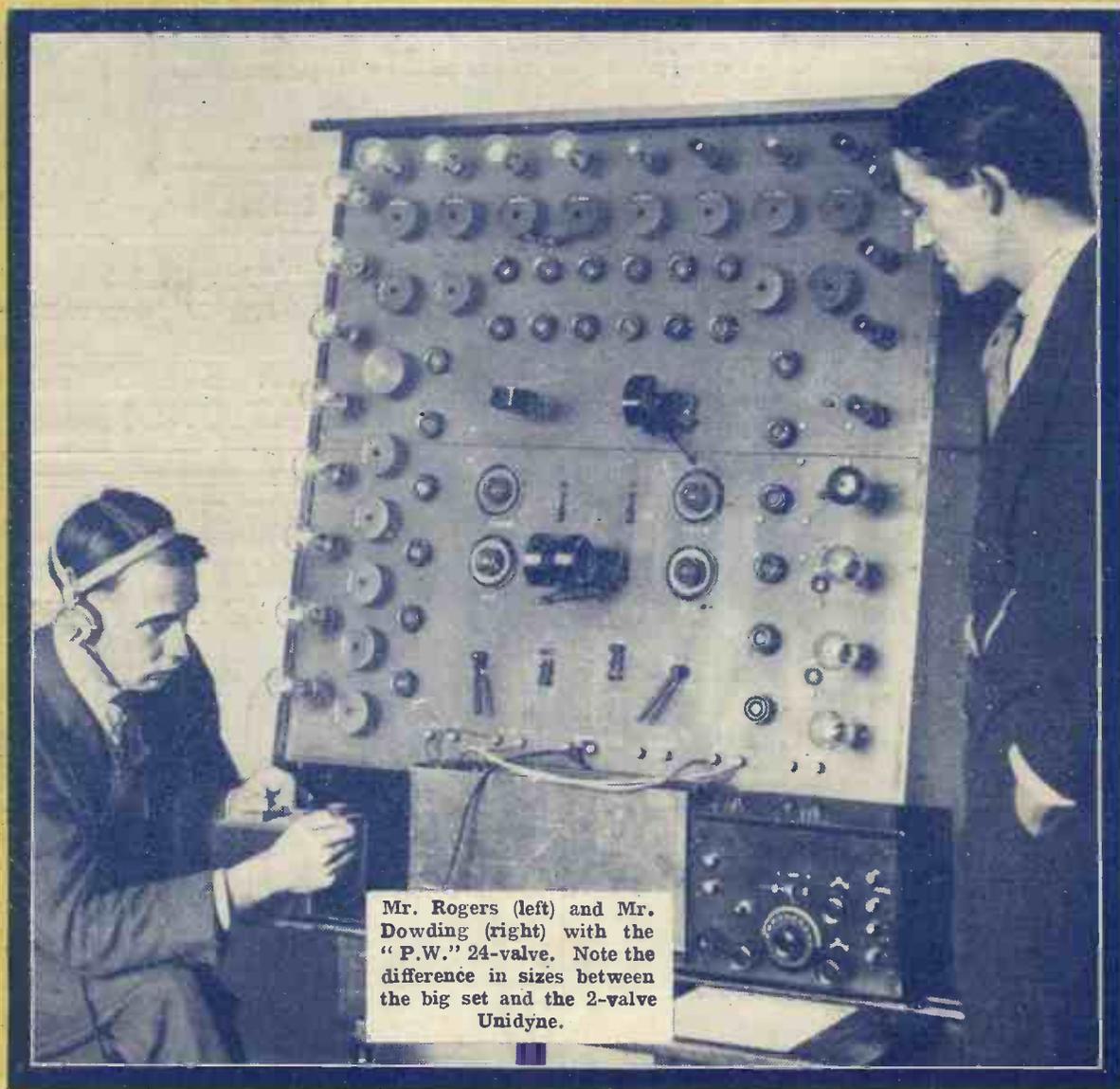
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EVERY FRIDAY.

No. 119. Vol. VI.

SCIENTIFIC ADVISER: SIR OLIVER LODGE, F.R.S., D.Sc.

September 6th, 1924.



Mr. Rogers (left) and Mr. Dowding (right) with the "P.W." 24-valve. Note the difference in sizes between the big set and the 2-valve Unidyne.

FEATURES IN THIS ISSUE.

How to Protect Your Set.
 Secrets of the B.B.C.

A Three-Valve Reflex Set.
 Sidelights on Wireless.

THE CONSTRUCTION OF A TWO-VALVE "P.W." UNIDYNE RECEIVER.
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POPULAR WIRELESS

AND WIRELESS REVIEW.

September 6th, 1924] THE RADIO WEEKLY WITH THE LARGEST CIRCULATION. [Every Friday, Price 3d.

Technical Editor:
G. V. DOWDING, Grad. I.E.E.

Editor:
NORMAN EDWARDS, A.M.I.R.E., F.R.G.S.

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Sir OLIVER LODGE, F.R.S.

RADIO NOTES AND NEWS OF THE WEEK.

The 24-Valve Set.

THE experiments made with the "P.W." 24-valve set have attracted considerable attention in the newspapers. Although Mars was not heard with the set—and the Editor was the last person who anticipated signals from Mars—the Press made a good "story" out of the experiments. But the most important thing was the success of the 24-valve set in receiving distant stations. A special article on the set appears in this issue.

An Historic Site.

VISITORS to St. Margaret's Bay have been very interested in the strange wireless contrivance on the grounds of the neighbouring South Foreland lighthouse. This is a "beam" aerial, similar to the one in use at Inchkeith Lighthouse. By a happy chance this latest development of radio science is erected on an historic site, for it was from here, 25½ years ago, that the first cross-Channel wireless communication was definitely established.

A Chance for Londoners.

LONDONERS who are interested in directional wireless have, on Mondays and Tuesdays, an opportunity of seeing the first direction-finding ship's aerials, fitted on the Royal Scot. This vessel belongs to the London and Edinburgh Shipping Company, and berths near the Tower, at Hermitage Wharf. Whilst other vessels are helpless in a fog in the Firth of Forth, the Royal Scot can confidently feel her way past Inchkeith by means of the tiny aerials on either side of her bridge.

Fife Ixe Ixe.

CAPTAIN C. A. LEWIS (Uncle Caractacus of 2 LO) has been making a tour of Continental broadcasting stations. According to the "Star" one Swiss amateur told him: "Yes; I receive all the stations very well—and, of course, your new station, 'Fife Ixe Ixe.' My heavens, it is a formidable post, that there post!" (Meaning, of course, that Chelmsford was a very fine station, and he got very good reception from it.)

A B.B.C. Appointment.

I HEAR that Mr. V. H. Goldsmith, who was second in command at 2 Z Y, has been appointed assistant secretary of the B.B.C., and will in future be attached to the London office. Before going to Manchester he was in the Royal Navy, holding the rank of Paymaster-Lieut.-Commander.

A Super Microphone.

ATTEMPTS are now being made to secure a microphone sensitive enough to use for the detection of insect larvae in fruit. Important investigations have been made along these lines by Mr. C. K. Bain, Professor of Entomology at the University

WHAT THEY SAY.

"It is extremely probable that had the aircraft on the North-West Frontier been fitted with directional wireless, accidents arising out of 'loss of direction' would have been averted."
R. TAYLOR SMITH, writing to "The Times."

"He would have, I think, a difficult task who sought to convince a judge that in installing a receiving set without the landlord's licence (assuming, as I now do, the complete absence in the tenancy agreement of any covenant bearing on the point), a tenant had committed any breach of duty to the landlord which called for damages or other remedy."
MR. FRANK S. GAYLOR (Solicitor to the B.B.C.), writing in the "Radio Times."

"We have no station yet from which we can reliably send or at which we can properly receive messages from and to such distant parts as the Pacific."
THE POSTMASTER-GENERAL (interviewed by the "Evening Standard").

"Educationally alone it is worth all the money. Add to this the undoubted pleasure it affords to listen in one's own home to a good concert, or to the news of the day, or even to the usually dismal weather forecast, and it becomes a part of life almost as necessary—as breakfast in the morning."
"CYNICUS" of the "Auto-Motor Journal."

"I'll put a girdle round about the earth in forty minutes."
SHAKESPEARE'S "A Midsummer Night's Dream."

"Wireless messages have been sent from Carnarvon to Australia in about one-fiftieth of a second."
Daily Press.

"The use of spark transmission (for amateur experimenters) is forbidden as being unnecessary now for research purposes, and causing the maximum amount of interference."
THE POSTMASTER-GENERAL.

"Broadcasting, rightly guided, developed, and controlled, may become one of the most potent world influences."
MR. J. C. W. REITH, General Manager of the B.B.C.

THE WEEK'S QUERY.

"I have received twenty-five different stations on my home-made crystal set, including the local amateurs, 0 B M and 2 L O. Is this remarkable?"

of Stellenbosch, South Africa. Ordinary wireless amplifying apparatus is used, and the presence of weevils in grain has in this way been disclosed by the microphone.

An Inspiring Thought.

IF the initial problems are overcome, the ability to hear insects eating fruit will open up new fields for the B.B.C.'s stunt broadcasting. There is something

particularly inspiring in the thought of the whole British Isles and half the Continent listening in to a maggot tackling a nice Cox's pippin at 2, Savoy Hill!

The Radio Association.

IT has been decided to open up new branches of the Radio Association shortly. The association can offer amateurs special facilities, and will be pleased to open branches in localities not yet happy in the possession of a local radio club. Interested persons should communicate with the Hon. Organising Secretary, Mr. Harrie King, F.R.A., Sentinel House, Southampton Row, London, W.C.1.

The Amused Spectator.

MOTORING recently in a remote corner of Wales a friend of mine saw two small boys heroically erecting a tall mast for an aerial. Their struggles were watched with amusement by a distinguished-looking elderly gentleman whose car was drawn up by the roadside, and the boys were obviously flattered by his interest. They might have been more so had they guessed that he was Professor J. A. Fleming, M.A., D.Sc., F.R.S., who invented the thermionic detector!

The King's English.

THE President of the Radio Corporation of America says "Wireless may make English the language of the world."

This is all very well until one reads their radio magazines and comes across this sort of report:

"3 Z X blew up his condenser, repaired that; and then shot the gap motor. Install C.W. and forget it, O.M., for it looks like a hot time in the old town this winter. 3 A C has forsaken the rock-crusher, and 3 C O has 2 tubes on the air with all the juice in the world and a beautiful aerial. How come, O.M.?"

5 I T's Aerial.

THE original aerial at 5 I T, which was of the inverted L type, has recently been removed from the main flagstaff of the G.E.C.'s works at Witton. I hear that it will probably be re-erected as an emergency aerial at Summer Lane, near the T-type cage antenna which is installed there.

Wireless Control.

THE Italian system of wireless control, to which I referred last week, seems to have been remarkably successful when demonstrated at Spezia. By its means

(Continued on page 38.)

NOTES AND NEWS.

(Continued from page 37.)

a destroyer was manoeuvred at a distance of one mile in heavy weather, and sixty different "commands," which were given by wireless, were automatically and successfully executed.

Notre Dame to Broadcast.

PARISIANS are proposing that the magnificent music of the religious services held in Notre Dame should be broadcast. This is not so much for the benefit of the general public as for the congregations of other churches, which at present are unable to maintain the standard of their music owing to a shortage of choir-boys. The chief difficulty is in securing exact synchronisation between the other parts of the service in the different churches.

5 X X in Denmark.

I AM indebted to a Danish correspondent—Mr. H. C. Jensen—for some interesting particulars of radio activities in that progressive country. He says that "5 X X is coming through brilliantly at any time," and is clear and strong in broad daylight, using detector and L.F. After dark all the B.B.C. stations can be regularly received on a single valve, which speaks well for the transmission, and volumes for the skill of Danish amateurs.

The Value of Straight Circuits.

KÖNIGSWÜSTERHAUSEN (LP) is just about as strong as 5 X X in Denmark, but the English station is three times the distance of LP from Copenhagen, so Chelmsford is a great favourite.

I think that much of the Danish success is due to their belief in straight circuits. Admirers of "stunt hook-ups" should notice that during darkness my correspondent can get every European broadcasting station north of Switzerland on detector-valve alone!

CKAC.

HAVE you heard CKAC? Last year this popular Canadian station (belonging to "La Presse," Montreal) came over very well, and during the summer its power has been greatly increased; in fact, it is now only exceeded by 5 X X.

The station is remarkable because, serving a French and English population, it has always broadcast in both languages. Now it has become tri-lingual, and announcements are made also in Ho, the international language.

News of New Stations.

BRITISH relay stations are due to be opened in the following order: Nottingham, about September 16th; Stoke-on-Trent, early in October; Dundee, in November; and Swansea, in December.

The Radio Corporation of America has opened an office in Boston, which is in

perfectly distinct, the receiver being a 4-valve set with frame aerial.

Plans are reported to be under way in Japan for the establishment of a Metropolitan Broadcasting Co., with headquarters and station at Tokio.

Three lines will link up the Nottingham Studio in Bridlesmith Gate with the transmitter at New Basford. One of these is for control, one for transmission, and one acts as a stand-by. The call sign will be 5 N G.

B.B.C. Changes.

IT is announced by the B.B.C. that "summer" broadcasting hours will be changed on September 29th, and on that date we shall revert to the original winter hours. At the same time the special light "summer" programmes will be discontinued in favour of more solid fare.

How to See the Big Set.

HAVE you seen the "P.W." 24-Valve Set on show in Oxford Street, London, W.? I understand that owing to the great public interest in this unique receiver, arrangements have been made for its display in Selfridge's windows.

Wireless "Jammer" Fined.

GREAT interest was shown by the public in the case recently heard at Hemel Hempstead, when for the first time the G.P.O. prosecuted an unlicensed transmitter for jamming the B.B.C.'s programmes.

The defendant, Arthur Charles Hart, an electrician, of Berkhamstead, was fined a total of £4, after he had admitted that two other persons were

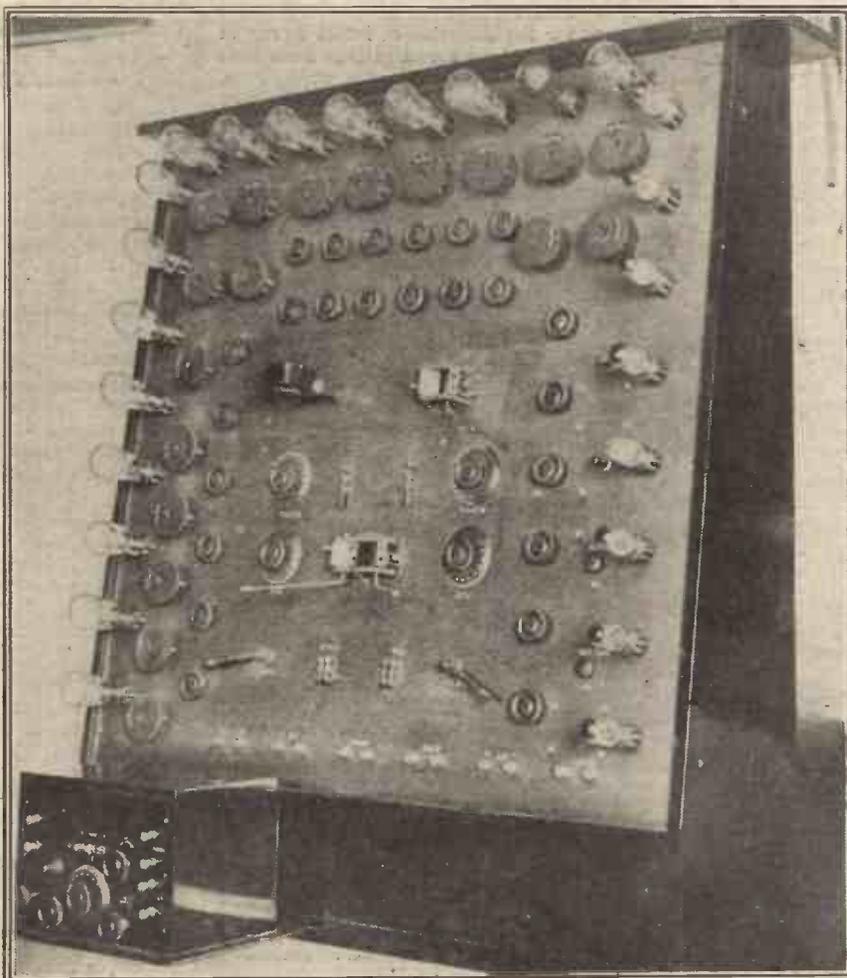
working with him in the matter.

Public Attitude.

THE chairman of the magistrates said the conditions of licenses must be kept, and public rights and conveniences not interfered with. In this attitude the whole of the radio public heartily concurs, for whatever may be said for the unauthorized transmitter he has no friends amongst the great mass of listeners in. There appears to be a pretty general feeling that the amount of the fine in this instance was influenced by the fact that this was the first case of its kind, and that subsequent offenders might be more severely dealt with.

ARIEL.

THE "P.W." 24-VALVE SET.



A special article dealing with the experiments made with the 24-Valve Set appears in this issue. Note the 2-Valve Unidyne Set in this photo, and compare the size of it with the 24-Valve Set!

communication with the Marconi Co.'s main telegraph office, 2-12, Wilson Street, London, E.C. 2.

A 1½ kw. C. W. set, a wireless direction finder, and a portable wireless lifeboat set, have been installed on the ss. Oronsay, of the Orient Line, recently launched on the Clyde.

The Julienshaab (Greenland) station is to have an umbrella aerial, which will be supported from a 250-ft. mast.

Johannesburg Station—famously known as "J. B."—has been clearly heard in the depths of a gold mine. Every item was

THE "P.W." 24-VALVE SET.

LISTENING-IN ON 30,000 METRES.

THE DULWICH EXPERIMENTS.

By THE EDITOR.

The account of the "P.W." experiments made on August 21st and August 23rd is summarised in this article. Although Mars was "not heard," some very interesting results were obtained with the 24-valve set which encourages the designers to conduct further experiments.

THE idea of listening-in for possible signals from Mars strikes one, at first sight, as not only fantastic but farcical. Yet the "P.W." experiments with the 24-valve set, which were carried out in the early hours of Thursday morning, August 21st, and during the early hours of Saturday, August 23rd, resulted, if not in any signals from Mars, in at least some very valuable and interesting data concerning the efficiency of multi-valve receivers.

But the newspapers seem to have concentrated their attention on the attempts we made when listening-in on 30,000 metres to hear signals from Mars. Opinion on this experiment is varied. Sir Richard Gregory said: "There are many explanations of the sounds received without bringing in Mars." Sir Richard Gregory is the Emeritus Professor of Astronomy of Queen's College, and he stated further that: "We all like to think that Mars is inhabited by intelligent beings, who are as anxious to establish communication with us as we are with them. But astronomers as a body are not concerning themselves overmuch with these manifestations." Sir Richard's opinion is, therefore, non-committal, and quite different from that of Professor Eddington, who characterised the experiments as "sheer nonsense."

"P. W.'s" Attitude.

Monsieur Camille Flammarion, the famous French astronomer, expressed the opinion that we should not hear any signals from Mars, but said he was quite convinced that Mars was inhabited. Sir Oliver Lodge was of the opinion that we should hear no signals, as he did not think Mars was inhabited. Professor Todd, of America, went so far as to request the big radio stations of the world to listen-in for five minutes every hour during the period when Mars would be nearest to the earth.

But Professor A. M. Low, who assisted very materially in

conducting the experiment with the 24-valve set, probably summed up our attitude better than anyone else when he said: "I do not expect to hear any signals from Mars, but I should be heartily ashamed of myself if I did not take the opportunity which this 24-valve set offers of attending experiments for listening-in to possible signals from Mars."

That has been the attitude of POPULAR WIRELESS all along. It is much easier to scoff at the idea of Mars being inhabited and that the Martians are transmitting signals than it is to keep an open mind on the subject and conduct experiments which, on the face of it, appear to be useless and farcical.

The Main Experiment.

So I want to clear away any prejudices which may exist in readers' minds as to these experiments. They had at least an element of fascination, which perhaps the general reader cannot appreciate, and which can only be understood by those who listened in at the times I have mentioned on the 24-valve set.

The main experiment was held at my house in Dulwich early Saturday morning, August 23rd. Those present included Professor A. M. Low, Mr. Dowding, Mr. Rogers, Mr. Bird, and various members of the Press. Mr. Dowding, who had repaired the slight breakdown on the set which occurred at the first experiment, was in charge of the tests. As the various wave-lengths were passed over, a most extraordinary Babel of signals was heard from the loud speaker. The noise was indescribable. It was practically

impossible to pick out the various call signs, as there were at least 20 or 30 stations working at once. But round about the higher wave-lengths were pure signals, and we could easily pick out the call signs of Bordeaux, Cairo, Cape Ray, Nauen, etc.

It is probable that some of the signals we heard were harmonics. When the wave-meter informed us that we were tuning in to approximately 30,000 metres we kept a watch on that wave-length for about forty minutes.

The Press has reported that we heard unaccountable signals. In a sense this is true. For two or three minutes we did hear a succession of dots of a harsh, unmusical tone. They were unrecognisable as Morse code signals, and, unless they were harmonics from another station—possibly sending a time signal—no one who was present at the experiment is prepared to say definitely that they came from any station on this earth. Likewise, no one at the experiment is prepared to say that they came from another planet.

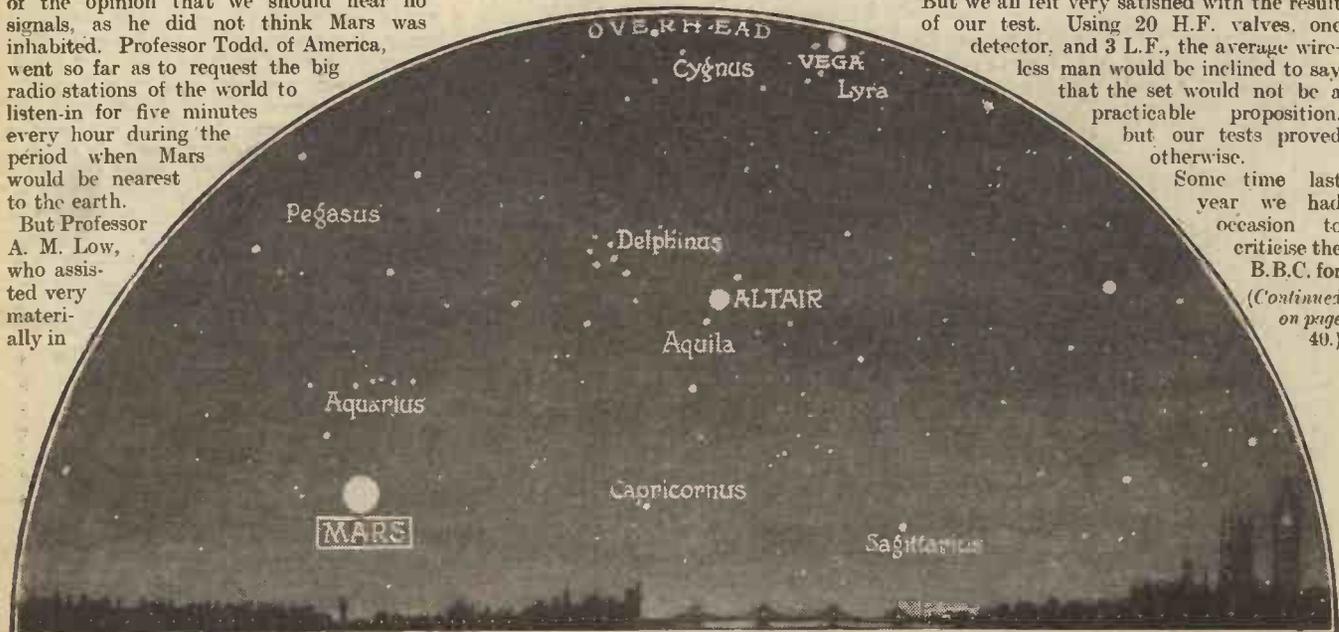
Professor Low's Opinion.

Professor Low was of the opinion that the signals were caused by a "mixture" of heterodyning and atmospheric. Personally, I am inclined to the theory that they were caused by harmonics from possibly an American station or another far distant station transmitting a time signal. They were certainly not signals from Nauen, and the note was unlike that of any high-power station I have heard by wireless.

About 2.30 a.m. our vigil came to an end. But we all felt very satisfied with the result of our test. Using 20 H.F. valves, one detector, and 3 L.F., the average wireless man would be inclined to say that the set would not be a practicable proposition, but our tests proved otherwise.

Some time last year we had occasion to criticise the B.B.C. for

(Continued on page 40.)



A chart of the heavens for August 23rd, when the "P.W." experiments were carried out at Dulwich. It will be noticed that Mars is low down in the heavens.

THE "P.W." 24-VALVE SET.

(Continued from page 39.)

using too many H.F. valves when receiving American broadcasting for relay purposes. At the time it occurred to me that interesting experiments and results might be obtained if we built a super H.F. set, embodying certain improvements on the H.F. side made by Mr. Dowding, who felt that H.F. work could be considerably improved.

Mr. Dowding, Mr. Rogers, and Mr. Bird of the POPULAR WIRELESS technical staff, designed a 24-valve set, and, after several months' hard work and much experiment, the set was finally completed. Preliminary experiments proved disappointing; but when we substituted resistance coupled transformers for aperiodic transformers and embodied one or two new ideas of Mr. Dowding's, the set functioned excellently, and it was calculated that we obtained full

efficiency from 16 H.F. valves, which, on the whole, is a very excellent average.

The experiments at Dulwich have therefore not proved in vain, and we hope that this winter we shall be able to obtain some very interesting results from America and other far-distant broadcasting stations.

Reports from America.

Readers have probably noticed in the daily Press various stories concerning strange signals picked up in America. A message from Massachusetts states that Dr. Leon Campbell, speaking for the astronomers, said: "Mars is not near enough, and probably never will be as long as the present laws of the universe are sustained, to learn anything definite." Another report says that radio operators at the Newark (N.J.) broadcasting station heard a weird succession of sounds at intervals during several hours early in the morning of August 23rd. The curious part about this story is that the signals alternated between the high wave-length of 25,000 metres and the short wave of 75 metres. They started abruptly, ceased suddenly, and were then

resumed; the sound was like that of a big bass note on the piano.

Another message from Vancouver (B.C.) stated that scientists and electrical engineers were conducting tests to determine the direction of the mysterious radio signals picked up. The possibility that they came from Mars was being considered.

The Army and Navy stations at Washington, U.S.A., were unsuccessful in an attempt to receive signals from the planet. The naval stations at Washington heard nothing; nothing was heard at Los Angeles. The Mount Wilson Observatory announced the reception of mysterious radio signals. San Francisco reported "heard nothing." Harvard Observatory reported "nothing startling." Portland, Oregon, reported "nothing heard."

Strange Signals.

A message from Ottawa on Friday, August 22nd, reported that two wireless operators at the Point Grey station heard mysterious signals—a strange group of sounds unknown to any code. All known methods of tuning up the signals were tried, but without success. The chief of the Canadian Wireless Service ridiculed the idea that these signals came from Mars.

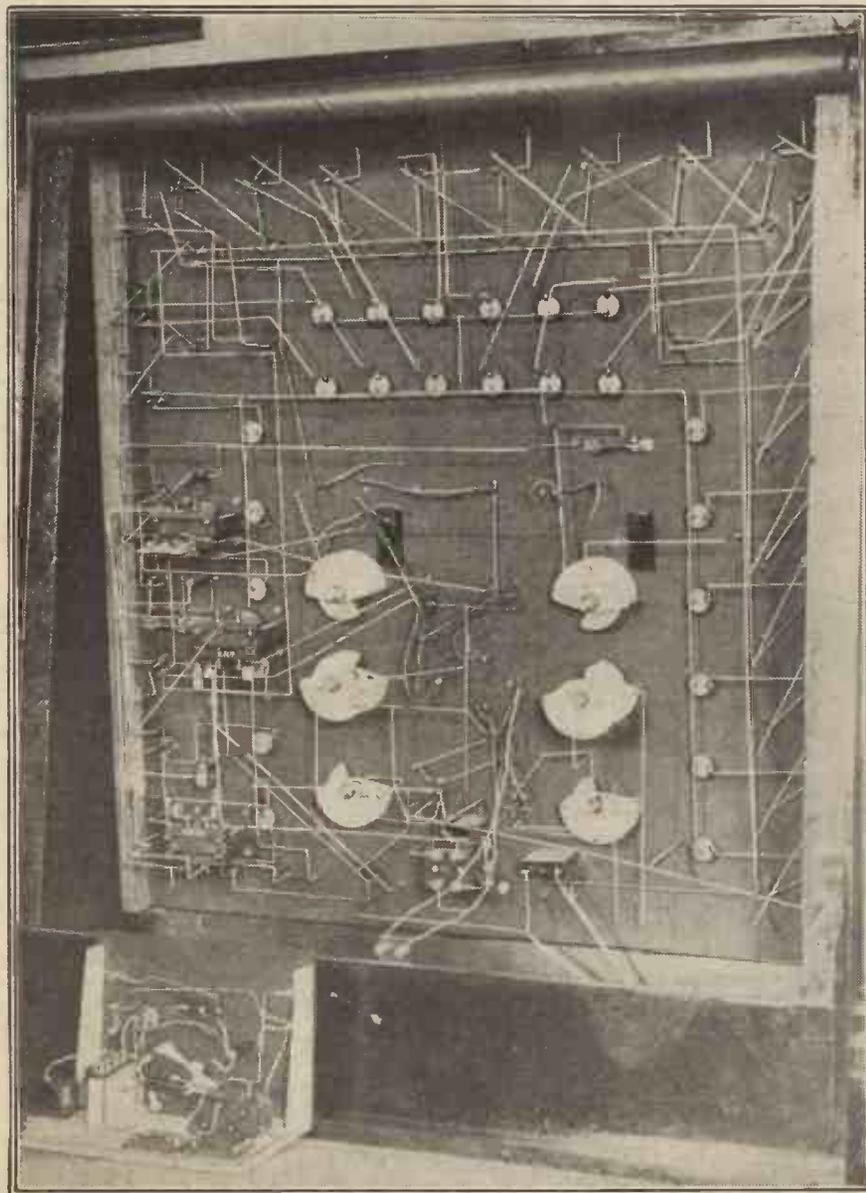
That, I think, concludes a concise summary of the attempts made this August to receive possible signals from Mars. I have not referred here in any detail—nor do I intend doing so—to the various suggestions made to me by psychic investigators. I do not consider that their suggestions come within the scope of practical wireless experiments, and, although I do not wish to give the impression that I scoff or am inclined to be sceptical at anything connected with psychic research work, I feel that this journal is no place in which to deal with the subject.

All I can say is that a very well-known investigator informed me that he had had telepathic communication with the Martians, who informed him that signals would be transmitted from Mars at stated times. I leave readers to draw their own conclusions from this statement.

Value of the Set.

Apart from some of the fantastic and somewhat exaggerated reports in the Press concerning our experiments, I should like to conclude this article by making it quite clear that the experiments have been of value, inasmuch as we have gathered together much valuable data concerning H.F. amplification and general data concerning the practicability and efficiency of multi-valve receivers.

So much interest has been aroused by this 24-valve set that I have been asked whether it would not be possible to put the set on view in some large London store, so that the public can see it. The matter is being gone into, and it is quite likely that in an early issue I shall be able to announce that the 24-valve set will be on view to the general public.



The back of the "P.W." 24-valve set. A 2-valve Unidyne set is placed near it for comparison.

Readers are invited to submit photographs of wireless interest for publication in "Popular Wireless." Every photograph accepted and published will be paid for at the rate of 10/6 per photo.

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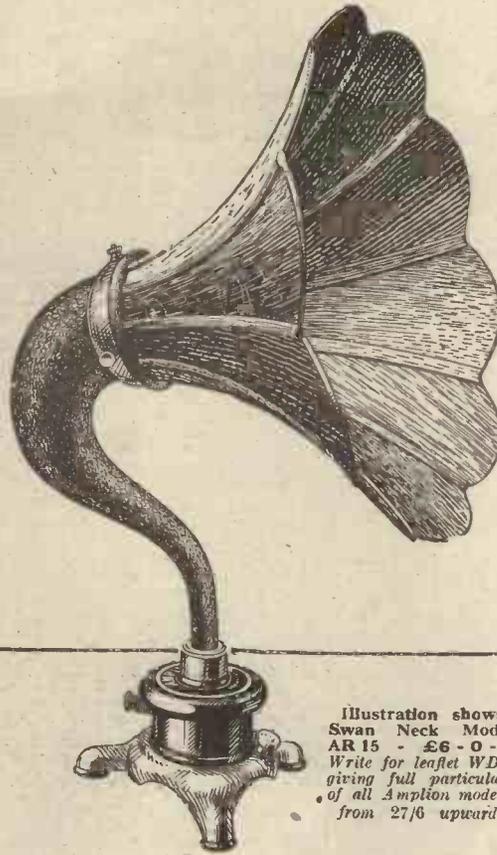


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A SELECTIVE "ALL WAVE-LENGTH" CRYSTAL SET.

By "CRYSTOR."

This receiver embodies loose-coupled circuits for which ordinary plug-in coils can be utilised.

CRYSTAL sets in one form or another have been evolved and described from time to time, usually with the specific purpose of giving good results from the local station, and in order to simplify construction have generally had a more or less limited sphere of usefulness. The set about to be described has reached its present form by stages and is a useful instrument for the experimenter.

General Considerations.

It has been designed (1) to obtain good signal strength, (2) to look presentable in the drawing-room, (3) to be selective, (4) to be reasonably cheap and easy to make. It will be observed from the photograph, Fig. 1, that a loose-coupled tuner, involving plug-in coils, has been adopted, tuning being effected by two variable condensers. Originally a single-coil holder and one condenser were used, but this arrangement was not found selective enough, as will be shown later. At this time two coils



Fig. 1. The complete receiver.

were in use, one when the local broadcasting was required, the other for the Eiffel Tower signals.

Rumours regarding the opening of the Chelmsford Experimental Station were responsible for another coil being made to tune in to 1,600 metres. Being only five miles from the local station (2 Z Y), it was found that interference was very bad. In fact, Chelmsford and Manchester could be heard at equal strength simultaneously. It was then decided to fit a two-coil holder and adopt loose-coupling.

The circuit is shown in Fig. 2. The 1,600 metre coil is used in the primary and the Eiffel Tower (2,600 metres) coil in the

secondary, and with this combination it is impossible to hear 2 Z Y even when the coils are closely coupled; moreover, Chelms-

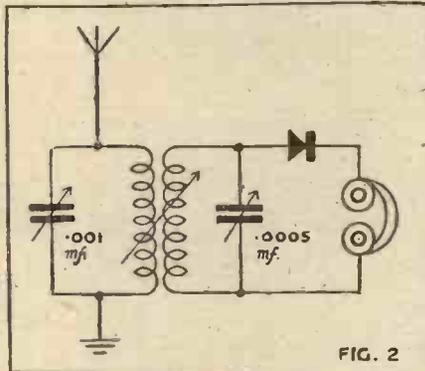


FIG. 2

ford appears to come in somewhat louder than with single-coil tuning.

At this stage another coil was made to act as secondary to the coil used for Manchester, and results with the loose coupler also improved over the single coil. It is still possible, however, to use single-coil tuning. It may be mentioned here that by winding the primary coils to suit the aerial (i.e. having the exact amount of wire on the coils for the desired wave-length), the primary variable condenser may be dispensed with.

Constructional Details.

The box is made of mahogany, stained and french-polished, and has a removable lid. It would have been preferable to make the box large enough to contain both condensers, but the two-coil tuner was not foreseen when the box was constructed. A plan view of the set is shown in Fig. 3, giving details of the wiring. The detector and terminals are mounted on small pieces of ebonite, and all wire connections underneath the panel are made with solder.

The chief point of interest lies in the coils, and it is not difficult to make these.

They have been tested against coils of well-known make, and appeared to give as

good signal strength as that of the professional articles, and there is no comparison in the cost. In winding coils by hand, advantage can be taken of the use of heavier gauge wire than is possible with machine-wound coils: For the small coils 18 or 20 S.W.G. wire was used, while the larger coils are made from 22 and 24 S.W.G. A "former" must first be made from a short length of curtain pole wood 2 in. in diameter.

Winding the Coils.

The circumference should be marked off into 15 equal divisions and two rows of nails $\frac{3}{4}$ in. apart driven in. A sketch of the former partly made is given in Fig. 4. The nails were numbered on the wood (each row from 1 to 15), and the winding started from nail 1 of either row. Proceed across to nail 8 of the other row and then on to nail 15 of the first row. Continue in this way, missing 7 nails each cross over.

Coils having 35, 50, 70, 200, and 350 turns have been found the most useful. To estimate the number of turns it should be remembered that each complete layer of wire on the coil will consist of 14 turns

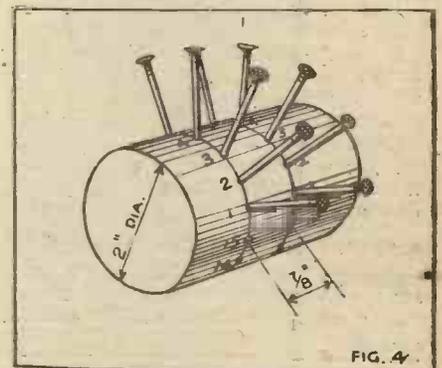


FIG. 4

(the 70-turn coil, for example, will have exactly five layers of wire). The coil is then shellac-varnished and baked in the usual way while still on the former.

Reception from 5 X X.

The nails are afterwards withdrawn and the coil carefully slid off the former, the ends of wire being secured with thread to prevent accidental uncoiling. The coil should be mounted on standard coil plugs and covered with a binding of Empire tape.

Apart from very good reception of the local station, Chelmsford at 190 miles is respectably clear. Liverpool relay station, at 30 miles, is just audible, though speech is not distinct. Morse (300 and 600 metres) is clear, and can now be separated from the broadcasting. These results were obtained on a P.M.G. aerial, the pole being 42 ft. high.

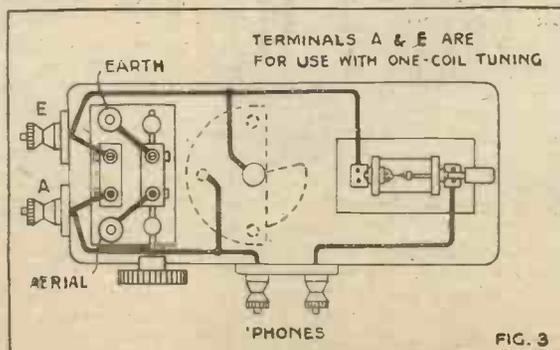


FIG. 3

Constructional Notes

Conducted by Dr. J. H. T. ROBERTS, F.Inst.P.

Coil Winding Tube.

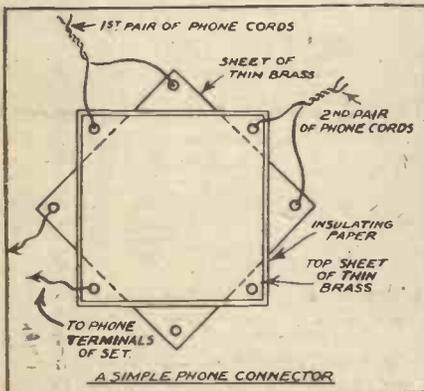
CONSTRUCTORS frequently use cardboard tubes as formers for inductance coils, but whilst these are convenient enough, they do not make a particularly neat job, and unless carefully shellacked have not the necessary insulating properties. An excellent tube can, however, be made from old photographic films. These should preferably be fairly large—up to 6 in. in width, or even 12 in. can sometimes be obtained. The gelatine should be removed by soaking in warm water with a little soda.

Having got the films clean and dry, take a smooth, cylindrical rod of the right diameter, and wind the film tightly upon it. After about two complete turns have been laid on, smear the surface with celluloid cement, and then wind on the third turn, again smearing with the cement before winding on the fourth, and so on. About six layers will be sufficient, and as little cement should be used between layers as possible. Wrap the whole tube, still on the rod, tightly in a porous cloth, such as a towel, and leave for at least 24 hours. The rod is then withdrawn, when an excellent insulating tube will be found to have been made from the celluloid.

The celluloid cement is made by dissolving pieces of scrap celluloid (scrap pieces of the film will do) in either acetone or amyl acetate. This generally takes two or three days to go properly into solution, and the solution should be stirred with a rod each day whilst making. The two solvents mentioned can be obtained from the chemist. Remember they both give off inflammable vapour.

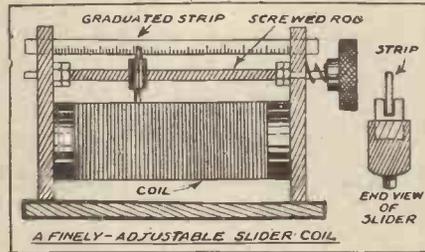
A Simple 'Phone Connector.

There are many varieties of connector for the purpose of enabling a number of pairs of headphones to be readily connected



up to the set, but probably the one illustrated herewith is as simple as any. It consists of two small sheets of fairly thin gauge metal—brass sheet—cut with a number of projecting points.

The two sheets should be cut of regular geometrical shape, and identical with one another. They are then mounted with a sheet of paper or thin ebonite sheet between them, and in such a way that any point on one comes midway between two adjacent points on the other. Small terminals are



bolted or soldered to the points. It will easily be seen from the diagram that the points taken round the circle are now respectively positive and negative, or to first and second 'phone terminals of the set. If two adjacent terminals of this device are connected to the 'phone terminals of the set, it is only necessary, in connecting up a pair of 'phones, to connect them to any two adjacent terminals. This little device is the invention of J. Joanes. (212416).

A Finely Adjustable Slider Coil.

For fine adjustment with the slider type of coil, it is very desirable to have some vernier control, and the one shown herewith is very simply made and is quite effective. Instead of mounting the slider upon a smooth or plain sliding-rod, the latter is replaced by a length of screwed rod, provided with locknuts at each end, so that it is just an easy fit between the end supports. The rod may be turned down, and thread removed, at each end, as shown, to make the proper fitting into the bearings; these need not be an accurate fit, and will suffice if merely passed through the wood without any metal bush. A control knob and spring washer are provided in the usual way.

In order to keep the slider from rotating with the rod, and to keep it in an upright position, a small piece of brass strip may be forced into a slot made in the top of the slider, this strip being shown edge-on in the drawing.

A slot is again cut in this strip, parallel to the screwed rod, and a long strip of brass is mounted into slots cut in the wood ends, as shown in the sketch, in such a way that this last strip rests in the slot in

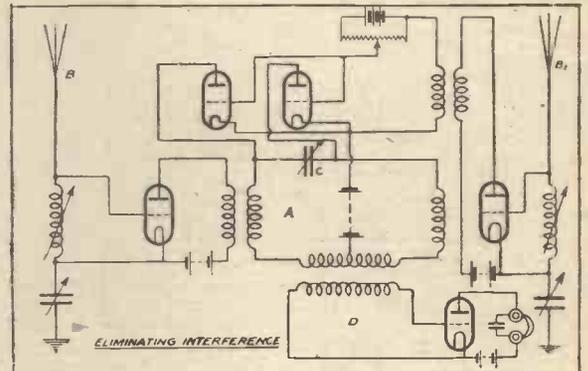
the small piece of brass strip which is mounted upon the top of the slider. It will be clear that by this arrangement, the slider, whilst free to move along the coil, is prevented from moving out of the vertical position, whichever way the control knob is turned.

If desired, the long brass strip may be graduated and marked at the positions for tuning-in various stations.

Eliminating Interference.

The following addition to the many circuits designed to overcome interference is based upon an ingenious principle, and is worth studying; it is the invention of R. H. Ranger, of the Marconi Co. Two aerials are used (B and B 1 in the drawing), one of which (B in the case shown) is used to receive the desired signals, whilst the other is a controlling aerial. The principle upon which the circuit is designed is that an oscillatory circuit will not be prevented from oscillating by short-circuit, provided the short-circuit takes place at the moments when the voltage across the condenser is zero. Short-circuits occurring at other moments will, however, suppress the oscillations. The controlling oscillatory circuit is shown by A in the figure, the signals being delivered to the inductance by the aerial B. This circuit oscillates in the ordinary way, and is coupled to the detector circuit D.

Now the aerials B, B 1 are so placed that the currents produced in them by the desired signals are 90 degrees out of phase, and two valves are included, one on each side of the condenser C. At the moment when the condenser voltage due to the desired signals is zero, these valves in turn

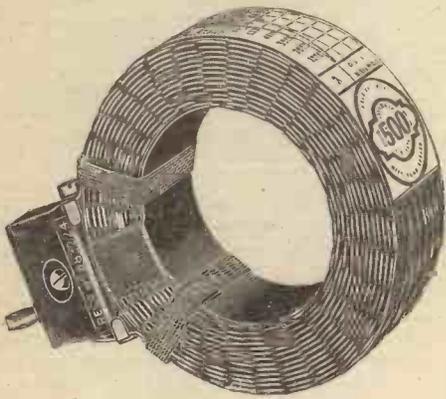


momentarily short-circuit the condenser C; consequently the reception of the desired signals is unaffected. Other signals, however; will not affect the two aerials in exactly the same manner, but will cause the short-circuiting of the condenser when the voltage across it is not zero; consequently the production of oscillations in the circuit A by the unwanted signals will be prevented. The net result is that only the desired signals can produce oscillations in the circuit A, and so affect the detector circuit D. Unwanted signals are thus eliminated without the necessity for high damping.

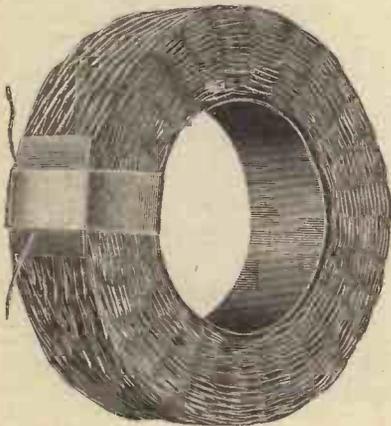
As will be seen from the above sketch, the circuit is hardly a practical one from the amateur's point of view, because of its cost and the number of components used; but it is worthy of mention on account of the interesting principle involved.

WARNING.

LETTERS PATENT No. 141344.
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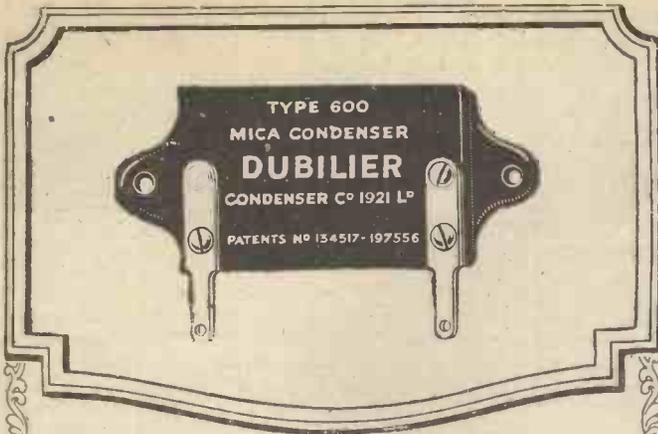
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SECRETS OF THE B.B.C.

IV.—Mr. ODHAMS, OF NEWCASTLE.

By "ARIEL."

During a recent trip to Newcastle, "Ariel" called on the B.B.C. Station Director in order to add to this interesting collection of "Secrets" a few facts and fancies about "Mr. Odhams of 5 N O."

ONE is apt to be very irritable after a very late night, especially if the train conveying one to a strange town is half an hour late and, in fact, is not due in until 1 a.m. "something." That is just how I felt on my first day at Newcastle, but did I show it? No—not a bit.

As I was bent on getting some of the most carefully guarded scandals relating to Mr. Odhams, perhaps better known as "Uncle Jim," alias

(no, we'll leave it at that), I had to be most charming—in fact, just like I usually am, you know. Even the tram conductor was most polite to me, and pointed out exactly where "The Poplars" was situated.

The first thing that struck me was that there really were several poplars within a stone's throw of the house. From experience, I should not have expected to find any poplars near the "Poplars," and had the tram conductor not directed me beforehand, I should have looked for a house in the middle of an open space with, perhaps, one gooseberry bush rampant in the front garden.

The Value of Milk.

The second thing that struck me was—I remember correctly—a brick.

When I came to I found Uncle Jim bending over me and, in anxious tones, apologising profusely. In his haste he had omitted to remove his apron, while the wiping-up cloth still stuck from his pocket. The brick by the way, must have slipped from the roof, explained Uncle, but owing to a "lapsus lingual" of a younger member of the family; I afterwards found out that I had been mistaken for the man calling for the rent again.

I was escorted to the drawing room and was given a very comfortable seat near the fire—which was out.

"Well, you know exactly what I've come for," I asked Uncle Jim.

For some reason he paled visibly at this, but I assured him that I really was from POPULAR WIRELESS, and his pallor gave place to a normal healthy colour again—like most of those uncles have.

"I go around and interview various uncles in private life and write up any little scandals I can get hold of about them," I informed him.

"Some uncles are particularly reticent, and I have the greatest difficulty in getting anything from them. For instance, I recently asked one what his hobbies were.

"None," he replied.

"Do you play the piano?"

"No."

"In fact, for every sentence I concocted I only got one word back. Even when I asked him to what he attributed his good health at such a grand old age he replied 'Milk!' So now you know why I have come to Newcastle. Please let yourself go, Mr. Odhams. 'P.W.' readers are sports on the whole (except when they ask more than three queries in one letter.—Tech. Dept.) and they won't split on you.

"First of all, which is your bath night?" My host seemed a little disconcerted by my question.

"The—er—bathroom is temporarily out of action," was the reply.

At this point Mrs. Odhams interrupted.

"Yes, he put his foot through the bathroom ceiling when erecting an indoor aerial under the roof."

"And mother was in the bath when it happened," added Joan.

His Hobbies.

Readers—you must excuse me for not having introduced either Mrs. Odhams or Joan (the eldest, I gathered) before. It certainly was a serious omission on my part, especially as it was Mrs. Odhams who first nursed me back to health after the accident (the brick, not the ceiling). But there—you know them now. Mrs. Odhams was busily engaged in knitting a jumper and such words as purl one, plain two, bother—dropped another, occasionally drifted over to my side of the room.

On the whole, I think that she must be a model wife. Never once during the conversation did she say anything, unless it was to agree with what Mr. Odhams said. Even when he told me that he used to play the violin but had given it up, not a sigh of relief escaped her lips.

"What are your hobbies?" I inquired. "Letter-writing, chiefly."

"You of course get your style from POPULAR WIRELESS. You are a regular reader, I presume?"

"Oh yes! I take in your paper every year, and it takes me in with equal regularity."

A Safe Departure.

The timely arrival of coffee at this point prevented what might have been a serious row. I have to stick up for the paper, even if I don't read it myself.

"Afraid I have no cigars to offer you," said Mr. Odhams. "But no doubt you still have a large portion of the one given you by Capt. Eckersley."

As a matter of fact, I am a confirmed friend of Capt. Eckersley's now, for that cigar has saved me from many an awkward position. If I am ever in a tight fix and surrounded by ruffians (organised attacks by the staffs of other papers always seem to be directed to me), I just take a puff or two and—hey, presto!—my enemies are suppressed.

"Say when," interrupted Mrs. Odhams.

"Just a little soda and nearly all whi—I mean, only a little milk," replied mine host, absent-mindedly.

I thoroughly enjoyed my cup of coffee and had no "grounds" for complaint.

"Have you any other hobbies besides letter-writing?" I inquired of Mr. Odhams.

"Yes. I collect stamps. By-the-way, you haven't seen a three-cornered 'Cape' with my initials in red ink on the back down London way, have you? Uncle Jeff was up here some time ago—"

"Oh, he collects china only. I interviewed him the other day. He's a comparatively respectable sort of chap.

(Concluded on page 76.)



Mr. Odhams.



The B.B.C. Newcastle Station's studio.

HOW TO PROTECT YOUR SET.

(FROM A CORRESPONDENT.)

The prevalence of an unusual amount of lightning this "summer" has again raised the question of possible danger arising from the use of wireless aerials. Readers will be interested in the details set forth in this article, which discusses the preparations necessary to protect the set from atmospheric disturbances.

IT is not strictly true to say there is no danger from lightning due to the use of a wireless aerial. The potentialities are quite unknown, in the same way as they are with telephone lines, trees, and houses themselves. As to whether it is an additional source of possible trouble is rather problematical to answer. This would depend a great deal on individual circumstances, and a consideration of all the factors involved will enable some sort of an estimate to be made.

The safest place in a thunderstorm is the interior of a submerged submarine, and our main protection against lightning generally is the million-to-one chance that it will not come our way. Beyond this, it is a case of "One never knows!"

Lightning's Uncertain Action.

Lightning is caused by a breakdown in the air insulating two electric charges of different potential. This may take place between two cloud areas, or between a cloud area and earth. Investigations by Steinmetz in America show that only one per cent. of lightning flashes strike the earth.

The electric charge dissipated by a lightning flash is probably spread over an area of at least ten square miles, that is to say, over this area on the earth is an electric charge floating about and varying in intensity with the conductivity of the ground.

Above, among the cloud banks spread over a similar area, is another charge also hovering, attracting and endeavouring to meet that upon the earth. "Hovering" very aptly describes the behaviour of these charges, and in what is technically known as ball lightning, and more generally referred to as a "fire ball," the centre of a charged area can on rare occasions actually be seen floating about.

When the air separating these charges gets to breaking strain a flash and report occur. This will be at a position where the intensity of the charge on earth is greatest and the distance shortest with respect to the charge overhead, with also the third consideration: the path of lowest resistance through the air.

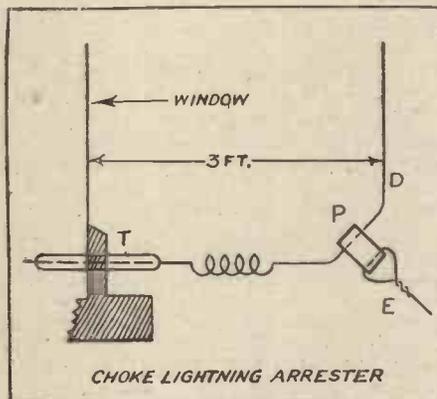
It will be seen from these observations that, owing to the vast area concerned, the varying conductivity of the ground, the shifting clouds and wind currents, it is quite impossible to forecast where a flash is going to take place.

"An Ill-fated Neighbourhood."

It is generally supposed that lightning always strikes the highest objects. This is by no means the case. Quite a large number of deaths from lightning have occurred in open fields with high trees not far away. A wet open field would be more favourable to the accumulation of an electric charge than a copse with dry undergrowth. Some

country folk still give advice which illustrates the uncertainty of the whole thing: "Never run when there is a thunderstorm, you might run into it," which is only too true, as undoubtedly the majority of deaths from this cause would have been avoided had the victims not endeavoured to escape from its vagaries.

Lakes, rivers, masses of rail and tram lines, all form localities favourable to the accumulation of electric charges and where lightning is prone to strike. The writer lives in an ill-fated neighbourhood in this respect and has made personal acquaintance with some thirty or more points struck by lightning, including the Sunday afternoon when seven people were killed on Wandsworth Common. In the latter instance, the victims were under trees near water and main railway tracks.



A point that should now be noted is that the intensity of a lightning flash is such that brick walls, window frames, and all such materials, though insulators to low voltage currents, act practically as conductors.

The Million-to-One Risk.

Returning now to our aerial, we can assume that it will only have a disposition to be struck by lightning if it is higher than other surrounding objects and in a situation where a charge may readily collect. There are few aerials of this nature. The aerial of the humble listener is usually no higher than his house, and may be said to take its chance with the house.

Let us now consider our million-to-one risk and endeavour to picture the position should the far end of the aerial be struck. The advice is given to earth the aerial. Will this safeguard the house, will the aerial lead the lightning safely to earth? In a few instances it might do so, in the majority of cases, no. The discharge will be of such magnitude that the usual aerial-earth system will not carry it.

It may fuse the aerial wire, and in any case is likely at the house end to choose some alternative path via the brickwork and

other adjacent objects. It must be remembered that the earth charge will be distributed rather heavily all round the house and especially about metal objects in the house. This can be very simply illustrated by connecting a metal tray to a gold leaf electroscope when lightning is around.

There are three ways of preventing lightning from entering and damaging a house via the aerial. The aerial-earth system can be made of sufficiently heavy conductors that will carry the discharge without question. This, to be on the safe side, is impracticable. The aerial can be disconnected, joined to a wire leading direct to earth in the garden, and thrown well away from the house—a rather crude method which may fail at a critical moment. Thunderstorms must start somewhere, and the first flash frequently comes without any previous warning. The ideal safeguard is one that is always in action, whether the set is in use or not.

A Lightning Choke.

Such a device will be explained with the aid of the diagram. D is the down lead from the aerial which passes through one end of the insulator P. This can be a piece of ebonite rod with two parallel holes drilled across it and about $\frac{1}{2}$ in. apart. (Some of the usual type of porcelain insulators are also suitable for the purpose.) It should be arranged that the earthed lead E, which must be taken direct to earth in the garden, holds the down lead D in a position some two or three feet from the house.

The distance between D and E at the insulator P must not exceed $\frac{1}{2}$ in. After passing through the insulator the down lead is connected to a lightning choke, which consists of four turns of wire sufficiently stout to maintain a helical formation without support. The turns should be 5 in. in diameter with a distance of $1\frac{1}{2}$ in. between each. The other end of this choke is taken through the lead-in tube to the set in the usual way. Lightning cannot travel round this choke and so will naturally take the more direct path to earth from D to E.

The Use of Gas Pipe Earths.

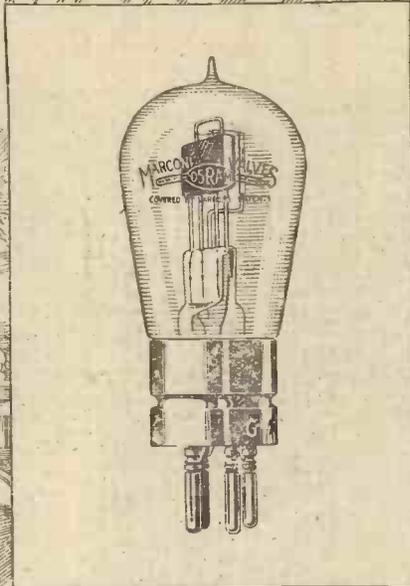
Apart from a direct hit by lightning, an aerial is subject at times to fairly heavy charges induced by lightning some distance away. For this reason a small gap of $\frac{1}{16}$ in. can with advantage be placed across the aerial-earth terminals of the receiver for the protection of the apparatus.

The alteration in tuning due to the insertion of a lightning choke is sufficiently small to be entirely ignored for all ordinary purposes. A few points with regard to gas pipe earths may be of interest. There is, of course, no danger from gas until it is mixed with air, so nothing untoward will happen unless the pipe is fractured in some way. A 1-in. gas main is of similar current carrying capacity to the best of lightning conductors, and would require an enormous current to fuse it open. Such a contingency is too remote to cause anxiety.

The conductivity of a main gas pipe, in the writer's experience, based on Wheatstone bridge measurements, is invariably perfect. The balance of scientific opinion favours iron as a material for lightning conduction, owing to its impeding or slowing down action of the disruptive discharge.



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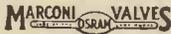
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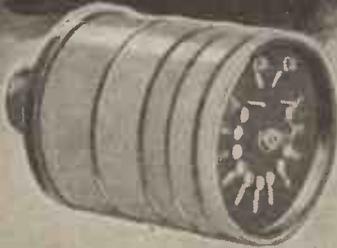
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PLUG HOLE GRIP

HOW THE AMATEUR CAN STABILISE A VALVE SET.

By O. J. RANKIN.

A special article in which the reader is instructed how to apply the various methods of controlling the valves and thus obtain efficient and distortionless amplification.

VALVES will operate in many different ways, but there is always one particular way in which they can be made to function best. Even when two valves of the same make are each tried in turn it will often be found that one will work well under conditions which are quite unsuited to the other, and it is therefore most important that the operator should know the peculiarities and requirements of

battery. This method may be satisfactorily applied to two or more stages of H.F. amplification, but it is always advisable to use H.F. transformer couplings when more than one stage is used.

The Neurodyne System.

Fig. 2 depicts another method of stabilising a H.F. valve where an anode resistance, R, which is variable from 50,000 to 100,000 ohms, is connected across the tuned anode circuit. This has a tendency to lessen the degree of amplification, but in any case it is usually necessary to do this before the valve can be made really stable and kept well off the point of self-oscillation. The easiest way to decrease amplification is to lower the values of the L.T. and H.T. current supply, but with the arrangement shown in Fig. 2 it is not necessary to resort to this method.

negative line. This method is also useful in eliminating howling and other similar troubles in the various super and freak circuits.

If the grid of a L.F. amplifying valve is allowed to become positive signals will be distorted owing to grid damping. The grid may be made negative by connecting the filament rheostat in the L.T. negative lead, and this practice should usually be adhered to. The fact that the greater the plate potential the greater should be the potential on the grid is one of those little points which is too often overlooked, and to obtain the best results the negative potential should be variable, as shown in Fig. 5, which represents the circuit diagram of a single-valve power amplifier.

Varying Grid Potential.

It will be seen that the "In Secondary" of the L.F. intervalve transformer, T1, is joined to the negative wander-plug of the battery B (which should consist of about 15 dry cells), the positive side of the battery being connected to the L.T. negative line. Normally the grid would be given the slight negative potential derived from the voltage drop through the filament rheostat, but when a

(Continued on page 52.)

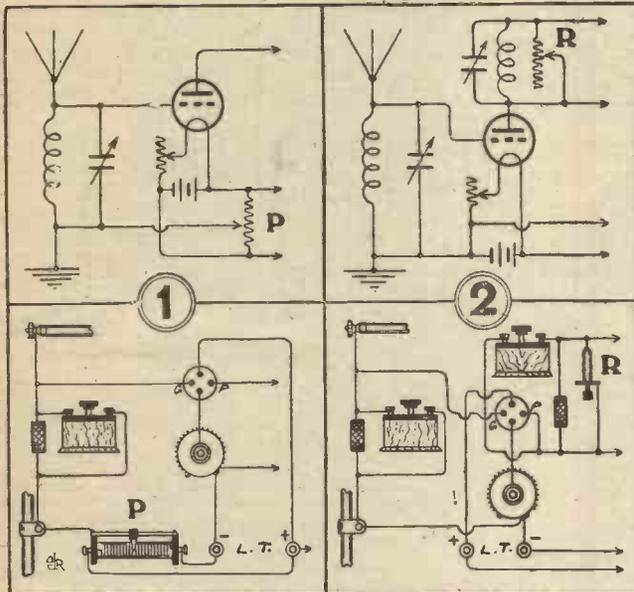


Fig. 3 shows what is probably the most efficient method of stabilising H.F. valves, this being an example of the neurodyne system. The grids of the valves are connected together through very small condensers, C, the capacity of these being about one fourth of the capacity between the electrodes of the valves in use. These are known as neutralising condensers, their function being to neutralise the inter-electrode capacities of the valves and thus minimise self-oscillation by preventing energy being fed back from the plate circuit to the grid circuit. They may be either fixed or variable, an example of the latter type being given in the pictorial diagram, where two small metal discs are soldered to the ends of small spindles which are arranged to slide through holes in two suitable supports. This method is to be recommended where more than one stage of H.F. amplification is employed. Distortion or self-oscillation is very easily controlled without seriously effecting the degree of amplification.

each individual valve in use. The only way to acquire this knowledge is to experiment, and carefully note the results.

Applying Grid Bias.

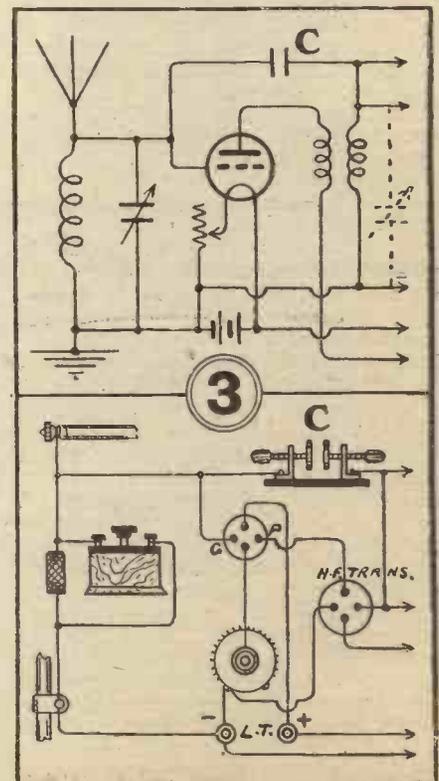
A good deal of distortion is caused through instability, which, when boiled down, means that the valve or valves are not working efficiently, usually on account of that little misunderstanding between them and their owner, and if an operator can master this problem he has little else to worry him.

Assuming that the control of a H.F. amplifying valve is the problem to be dealt with, the simple and well-tried expedient outlined in Fig. 1 might be tried. Here we are concerned with the control of grid potential; that is, the control of the positive or negative potential on the grid of the valve so that the valve can be made to work on the best point of its characteristic curve by means of the variable potential obtained by using the potentiometer, P.

In the ordinary way the earthed end of the tuning coil is connected to the L.T. negative line, but when using the potentiometer it is connected direct to the slider, the resistance winding being shunted across the L.T.

connected together through very small condensers, C, the capacity of these being about one fourth of the capacity between the electrodes of the valves in use. These are known as neutralising condensers, their function being to neutralise the inter-electrode capacities of the valves and thus minimise self-oscillation by preventing energy being fed back from the plate circuit to the grid circuit. They may be either fixed or variable, an example of the latter type being given in the pictorial diagram, where two small metal discs are soldered to the ends of small spindles which are arranged to slide through holes in two suitable supports. This method is to be recommended where more than one stage of H.F. amplification is employed. Distortion or self-oscillation is very easily controlled without seriously effecting the degree of amplification.

Fig. 4 shows a very reliable method of stabilising a dual amplification or reflex receiver where a 100,000 ohm resistance, R, is connected between the grid of the valve and the L.T. positive line. It is sometimes an advantage to use a variable resistance and also to try connecting it to the L.T.



Technical Notes

Conducted by
J.H.T. Roberts, D.S., F.Inst.P.

Reviving Dry Batteries.

IT is probably quite generally known that the so-called "dry" batteries, such as are used for flashlights and for the units of H.T. wireless batteries, are only "dry" in the sense that they are unspillable. If they were in reality dry, they would not deliver any current. The liquid electrolyte is, in fact, soaked up into a wrapping of fabric inside the zinc container of each little cell. When evaporation has taken place sufficiently, the cell becomes too dry to function effectively, and it becomes faulty.

This points to a method of reviving "dry" cells. If some of the units are found to give little or no voltage, remove them from the battery, pierce a number of small holes through the zinc cases, and leave the cells soaking for a few hours in a fairly strong solution of ammonium chloride (sal ammoniac). This will often be found to give a new lease of life to the cells. Of course, it is not an infallible remedy, as there are other causes for cells becoming faulty besides evaporation. After removing from the solution, the outsides of the zinc containers should be carefully wiped dry, and the cells replaced. The solution should consist of about a tablespoonful of the solid sal ammoniac to a pint of water. Sal ammoniac is obtainable at electricians' shops, and is very cheap.

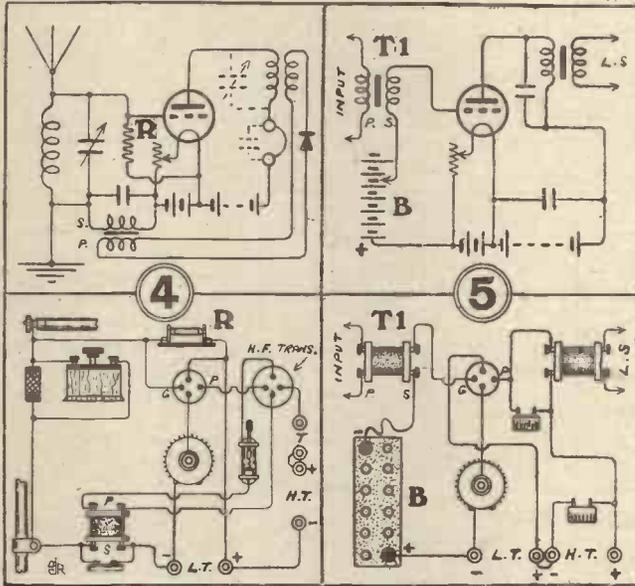
Substitute for L.T. Battery.

The remarks I made recently on the subject of a substitute for the low-tension filament-battery have brought me such a volume of correspondence from interested readers, not only in this country but also from abroad, that I am afraid it has not yet been possible to acknowledge them all. This correspondence, however, shows the immense interest which is taken in the subject, and in view of this I am going to deal with the subject very fully at an early date. As an announcement of this will be made in due course, I do not want to say any more about it at present, but my readers may rest assured that all possible information and help in this direction will be provided as early as practicable.

Dry Cells.

I have also been asked by many writers whether I do not consider that the low-tension battery problem may be regarded as solved anyhow, since dry cells may be obtained which will work dull-emitter valves for many months. It is, of course, perfectly true that there are dull-emitters specially designed for low current-consumption, taking as little as 0.06 and 0.1 amp., and dry cells which will operate such valves for periods of months under ordinary working conditions. So far as users of these valves and cells are concerned, I should personally say that there was little room left for improvement in the way of further

convenience. But it must be remembered that there is a large section of wireless enthusiasts who favour the bright-emitter type of valve, partly because it is cheaper



and much more robust, and partly because, generally speaking, a much greater volume of emission can be obtained from it. Furthermore, many of the dull-emitters, although they work at a low voltage, consume currents between 0.2 and 0.4 amp., and where several such valves are working from one battery, the capacity of the latter needs to be pretty considerable. So that, taking everything into consideration, most people would not agree that there is no problem to be solved in connection with

(Continued on page 73.)

HOW THE AMATEUR CAN STABILISE A VALVE SET.

(Continued from page 51.)

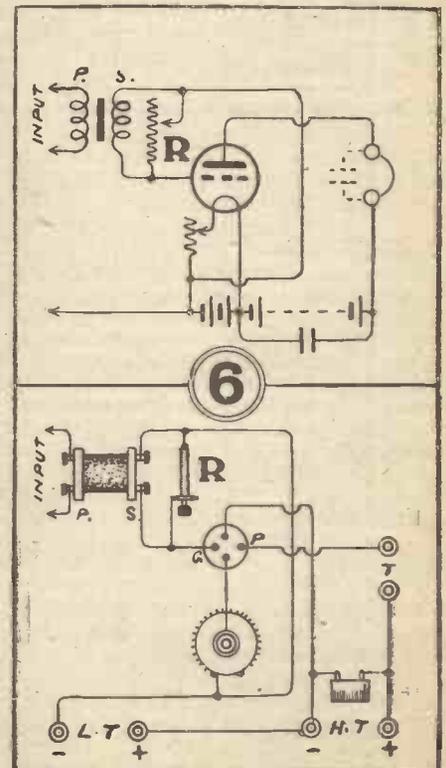
valve is operating as a power amplifier, with 200 to 500 volts on the plate, it will need a negative grid potential of some 20 volts or more, and this, of course, necessitates the use of the battery, as shown. A smaller battery may be similarly connected in an ordinary L.F. amplifying circuit. It is always advisable to connect a 2 or 3 mfd. Mansbridge condenser across the H.T. battery terminals, as shown.

In Fig. 6 we have an ordinary L.F. amplifier, minus grid battery, but with a non-inductive variable resistance, R, connected across the secondary winding of the L.F. transformer, this being a method which should be tried when the transformer is under suspicion or when it is desired to improve the tone of the signals. The resistance should be variable from 50,000 to 100,000 ohms.

Separate H.T. Advisable.

There are, of course, many other different ways in which a receiver can be made really efficient. For example, a separate H.T. current supply to the H.F., detector, and L.F. valves is almost essential, and in the

case of a two or three stage note magnifier it is well to experiment with different types of transformers in each stage and again split up the H.T. supply for each separate valve. A choke coil should also be tried in conjunction with the transformers, this being placed in the final stage. Whether the positive or negative of the L.T. is connected to the H.T. negative is usually a matter of taste or prejudice. With L.T. positive to H.T. negative, as shown in all the diagrams, a slight step up of plate voltage is obtained, whereas the joining of both negative leads results in the loss of this extra voltage, but often makes the circuit more stable.



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Normal Filament Current	0.75 ampere
Overall Diameter (approximate)	35 m/m
Overall Length (approximate)	103 m/m
Cap	4 prong

PRICE 12/6 EACH.

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This Valve, which has a vertical filament, grid, and plate, is mounted in a spherical bulb. It has essentially the same electric properties as the A.R. Valve, but the grid has a greater number of turns and is also of smaller diameter, which results in a somewhat greater amplification, with the same plate and grid voltages, than is obtained with the A.R. Type Valve.

Plate Voltage	50-100
Filament Voltage	4
Normal Filament Current	0.75 ampere
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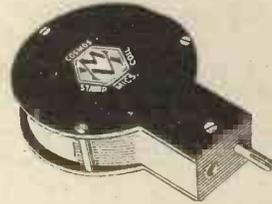
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35	50	10	145	300	425	4 6
40	100	10	200	425	600	4 9
50	150	10	245	520	735	4 9
75	300	10	340	740	1040	5 0
100	700	11	530	1130	1590	6 0
150	1000	16	640	1360	1900	6 6
175	1400	18	765	1610	2250	7 0
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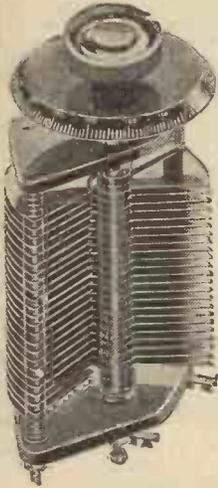
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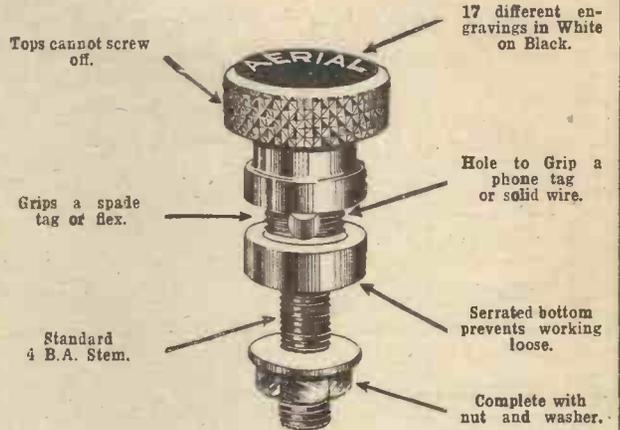
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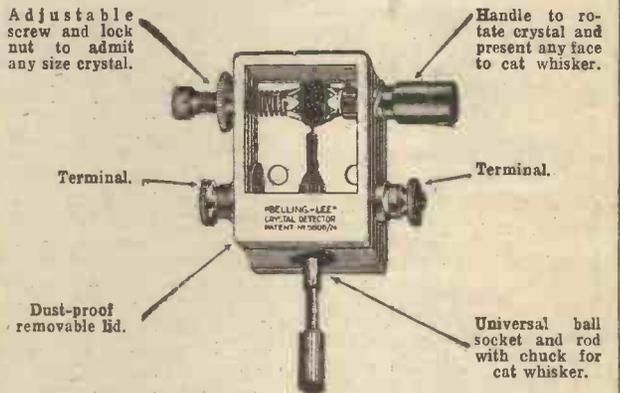
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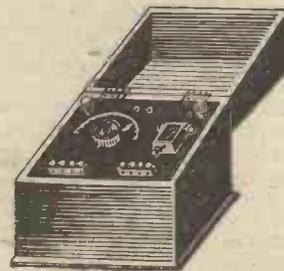
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THE CONSTRUCTION OF A TWO-VALVE "P.W." UNIDYNE SET.

By LAURENCE J. PRITCHARD
(Technical Editor of "Harmsworth's Wireless Encyclopedia").

The circuit of this receiver is practically similar to that of the detector and L.F. "P.W." Unidyne circuit previously published in this journal, but the lay-out is entirely different, and will appeal to those of our readers who prefer receivers with unenclosed valves.

FRANKLY, I must admit I did not expect this or any of the Unidyne sets to work, let alone work easily or well; but, at the same time, the proposition had points of novelty and many points of extreme interest to the wireless experimenter, and my natural curiosity suggested

switch, together with the components and the mode of wiring them, is clearly shown in Fig. 4.

The two-coil holder visible in Fig. 3 is simply screwed to the top of the panel in the left-hand corner. Two ordinary terminals were provided on the left front of the panel for aerial and earth connections respectively. The two telephone-type terminals for the L.T. battery connections, and another pair of similar terminals for the telephones, are also provided.

After the components had been fitted in their places and the set wired strictly in accordance with the diagram, the valves were inserted into their holders, aerial and earth connections made, telephones attached, and energy supplied from a couple of two-volt Ever-Ready accumulators connected in series to give four volts

across the terminals. As a preliminary, two honeycomb coils were used for the aerial inductance and reaction respectively.

Tested Under Adverse Conditions.

At this stage I must frankly admit that I was impressed by the simplicity of the outfit, which, as can be seen in Fig. 2, strikes a curious note owing to the absence of a large H.T. battery. The first attempt at tuning in 2 L O, the nearest broadcasting station, situated at a distance of approximately twenty miles, produced no results whatever. The whole of the connections were therefore tested throughout, and,

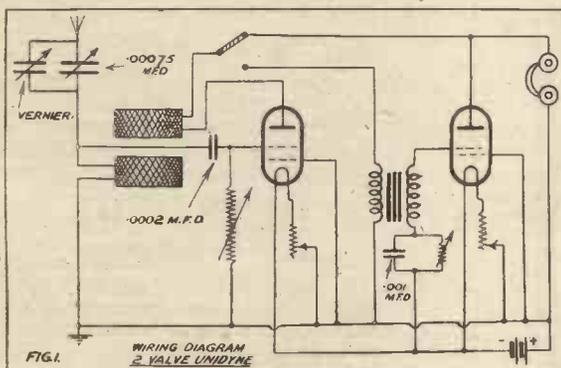
everything being in order, it was concluded that the value of the aerial inductance and probably the reaction coil were incorrect.

The aerial itself was a single wire about 75 ft. in length, located between trees, and the whole set on the side of a hill, the hill being between the aerial and 2 L O. Consequently it was considered that conditions for reception were by no means ideal. To save time, the best value for the coil was ascertained by the usual wave-meter test, when it was found that a No. 50 coil was correct, and this with about 100 deg. rotation of the condenser knob with the vernier condenser at 90, the vernier being shunted across the main condenser in the usual way. For reaction purposes a No. 75 honeycomb coil was used.

Results Obtained.

The throw-over switch was then set at No. 2 position—that is, with both valves functioning, the set thus becoming a single-valve detector with reaction, followed by one stage of L.F. amplification. As a preliminary, both the variable grid leaks had been adjusted to what was estimated to be a value of $1\frac{1}{2}$ megohms. Careful and simultaneous adjustments of the aerial tuning condenser and the reaction coupling were then made, when 2 L O was distinctly heard, this being definitely encouraging, especially in view of the fact that it was only some half an hour since the set was completed. More critical adjustments were made with the two variable resistances or grid leaks, and also to the reaction coupling and to the condenser, fine tuning being effected by the vernier.

(Continued on page 56.)



making up a simple two-valve set. The circuit diagram for this set is given in Fig. 1, and was published in POPULAR WIRELESS of June 21st, 1924.

The whole of the components, with the exception of the two valves and holders for them, were made up from miscellaneous parts which I had on hand. No particular trouble was taken in the construction of the set except that good, sound connections were made and that the components used were in perfect order and good condition. For the sake of simplicity, and also on the score of its accessibility, I decided upon a flat case with a panel sunk into a recess on the top thereof.

Assembling the Components.

The panel dimensions are 12 in. in length, 10 in. in width, and the case is of the same dimensions with a depth of 6 in. The method adopted for making the case was simply to mitre the corners of the four side pieces and glueing and screwing the bottom to them, forming the recess at the top by glueing and bradding a moulding round the outside of the case, allowing this moulding to project upwards $\frac{1}{4}$ in. above the upper surface of the case. The panel simply drops into this recess, and is secured with four small brass screws.

The components fitted to it were two filament resistances, two five-hole valve holders, two variable grid leaks, one variable air condenser with a capacity of .0075 mfd., and one single moving plate vernier condenser. An ordinary L.F. transformer and a couple of fixed condensers, as called for by the circuit diagram, completed the components. A very simple two-way switch was constructed from an old contact arm and a couple of contact studs. This

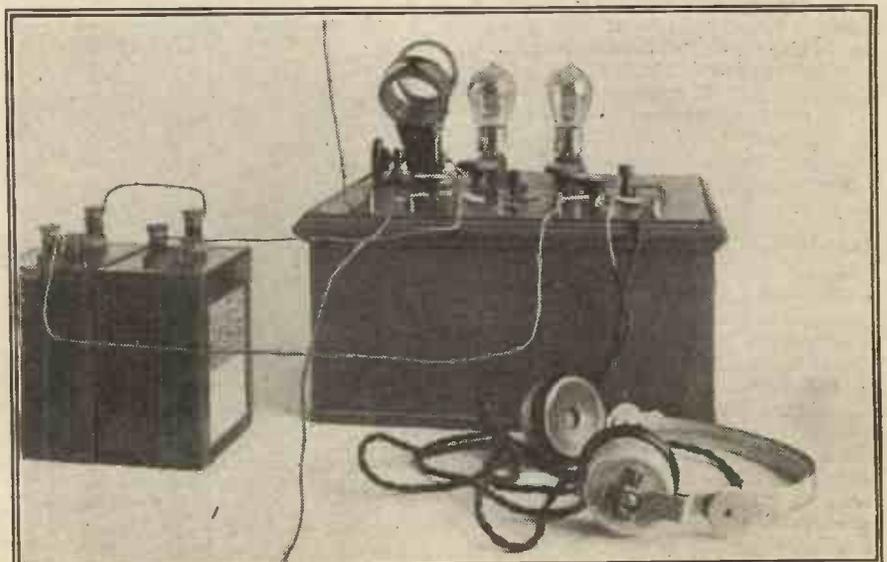


Fig. 2. The complete set ready for use. The absence of an H.T. battery is strikingly noticeable.

THE CONSTRUCTION OF A TWO-VALVE "P.W." UNIDYNE SET.

(Continued from page 55.)

This brought in 2 L O very loudly on the headphones. An experiment was then made by setting the throw-over switch so that only one valve was operative. This



Fig. 3. Note the symmetrical lay-out of the panel and the accessibility of the tuning controls.

resulted in London being heard very finely, signal strength being increased to comfortable headphone strength by fresh critical adjustment of the reaction coupling and the two condensers. The first adjustment to the first grid leak did not appear to give any material benefit, so it was decided to cut it out of circuit and substitute a fixed resistance with a value of 2 megohms. This being quickly effected, the set was again tried with quite satisfactory results, signal strength being little short of that which would be expected with an ordinary circuit employing a large H.T. battery.

On switching in the second valve, headphone results were uncomfortably loud, thus demonstrating definitely that the Unidyne principle performs in a thoroughly satisfactory manner, and that it does definitely amplify.

Loud-speaker Results.

At this stage it was decided to make tests with a loud speaker. The only instrument available at the moment was a large model Ethovox, and some doubt was felt as to the chance of its functioning, but on connecting up the telephone terminals in place of the telephones, and carefully adjusting the control wheel, quite good signals were obtained. Band pieces would be distinctly heard in a large room some 20 ft. from the loud speaker, spoken announcements and vocal items were heard with remarkable quality and with the complete absence of the hissing or growling noises which are often associated with loud-speaker work

when employing H.T. battery. In fact, for all practical purposes, in an average room this simple two-valve set was giving admirable loud-speaker results at a distance of approximately twenty miles from 2 L O, and under by no means favourable conditions.

It should be noted that signal strength was considerably improved by the re-adjustment of the reaction coupling and the condenser setting. This was to be expected, owing to the difference in resistance of the telephones and the loud speaker.

The loud speaker was then removed and substituted as before by the telephones, and other stations were sought, Bournemouth being picked up comparatively quickly at fair headphone strength. No other stations were picked up, but this was hardly to be expected in view of the distance and to the considerable blanketing to which the aerial was necessarily subjected owing to its geographical position.

By this time I was more than favourably impressed with the Unidyne principle. The set appears to exhibit many of the general characteristics of the ordinary set with H.T. battery. It was possible to throw the set into oscillation and for it to howl in a somewhat similar manner to that associated with H.T. battery sets; this howling being, of course, under perfect control and no abnormal occurrence, the set being remarkably stable and easy to handle.

These tests were repeated on several evenings with exactly the same results, these two stations coming in with fairly loud results, playing regularly at loud-speaker strength. One peculiarity was noted—that any variation to the reaction coil necessitated re-setting the aerial tuning condenser and the vernier condenser, as much as 10 deg. of variation being associated with a coupling range of about half an inch of movement between the two coils.

The Unidyne's Advantages.

The great points in favour of the principle, so far as I have been able to test it at present, appear to be the purity and clarity of the signals, the ease with which the set can be handled, its beautifully quiet reception, freedom from parasitic noises, and the very definite saving owing to the absence of the H.T. battery. It is hoped shortly to make some experiments with a multi-valve set utilising the Unidyne principle, the results of which will be communicated in due course.

In the meantime readers should certainly not hesitate to employ the Unidyne principle in favour of similar circuits using H.T. The two-valve circuit, such as has been described in this article, is particularly interesting both in performance and appearance.

READERS' QUERIES.

Readers would render great assistance to the Editor and Technical Staff if they would refrain from sending in queries of a minor character such as have been answered again and again in the columns of POPULAR WIRELESS. At the present time our Queries Department is simply inundated with questions concerning the Unidyne and other circuits, and, as wireless experts are entitled to holidays as well as other people, it will be understood that delay may take place in answering the thousands of letters that pour in on us from week to week. Will readers kindly forbear from asking "stock" questions for a few weeks, and also pardon any little delay in the answering of highly technical problems involving much checking and calculation? Thank you!

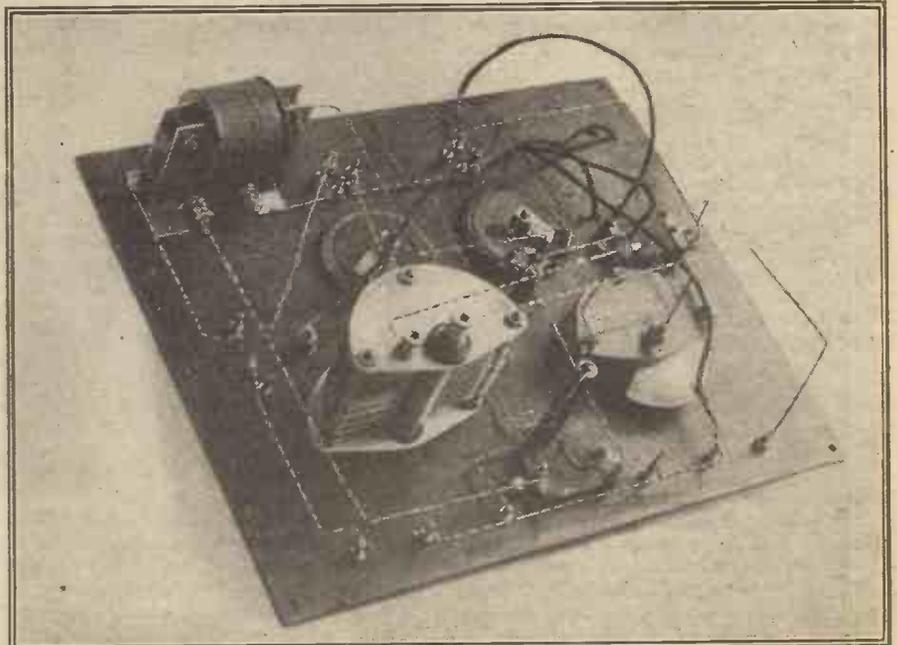


Fig. 4. From this photograph the wiring beneath the panel can be clearly traced.

SIDELIGHTS ON WIRELESS.

A NEW SUMMER SERIES FOR THE AMATEUR.

No. 6.—SOME ASPECTS OF THE ETHER.

By NORMAN EDWARDS, A.M.I.R.E., F.R.S.A., F.R.G.S.

(Editor of "Popular Wireless").

The Ether Theory is a source of continual interest, and in the following article one or two aspects of the theory are dealt with in an unconventional way which should appeal to wireless amateurs.

IF we believe in necromancy and other branches of magic, we may explain action at a distance to our own satisfaction; but as it may be taken for granted that witchcraft obtains no credence with wireless amateurs of to-day, we cannot convincingly explain the action of one body on another without introducing the need of a connecting medium.

When we listen to a brass band the medium which conveys the sound to our ears is air; when we enter a tramcar, the medium which conveys us to our destination is really the tramlines; and when we listen to a wireless station, the medium which conveys the transmitted signals through space is the ether—the ether medium about which every wireless amateur knows something.

Origin of the Medium.

The idea of an all-pervading ether probably originated when astronomers had to answer—or attempt to answer—this question: Was space full or empty? And various and strange were some of the answers given to that question. Some said in reply that "Nature abhorred a vacuum"; others said space was quite full; others, that empty space could not exist—that it had of necessity to be distended by something material; while others declared that, although the "empty" theory was unsatisfactory, the assumption was necessary in order to explain how other bodies have room to move about in.

"If space were quite full," they declared, "everything would be jammed together." In other words, nothing like free attraction or free motions of bodies could go on.

We are all familiar with the action of one body on another, with the transference of motion and energy from one body to another, and, as explained in the opening paragraphs, direct action of one body on another across space, with no means of communication, is intellectually revolting: it is unthinkable and illogical, because we automatically bar the inclusion of magic in the list of possible explanations.

History is full of instances where action at a distance is supposed to have been accomplished without a known medium, but in every case we are asked to accept the doctrine of magic in some form or another. A good deal of this magic has an affinity with telepathy and thought transference, which is not so very inexplicable after all, and which many of us are familiar with to-day.

There exists an ancient Egyptian papyrus* which records the history of an attempt by an Egyptian magician to accomplish the death of Rameses II. by magical means.

This gentleman tried to kill the pharaoh

* The Harris Papyrus, British Museum.

by making a wax model of his king, in which he plunged a steel needle, at the same time casting the image in the fire and reciting incantations of an evil nature.

The procedure is a common one, and it crops up in history time after time, notably in the reign of Catherine de Medici, who was something of a sorceress herself; and even to-day in the islands of Polynesia the ritual of the "praying death" is not unknown. In India, too, I have met *fakirs* who claim the power.

that direct action at a distance can be obtained without a medium. In the case of sound, the medium is the air; in the case of light—both visible and invisible—and in the cases of heat and wireless waves, the medium is assumed to be something which has been termed the ether.

A Formative Principle?

It is believed that the ether is a continuous connecting medium—even to be between the minute spaces existing between



Part of the transmitting gear at the Monte Grande Station, Argentina.

All this may seem irrelevant to an article on the ether, but as such cases are sometimes erroneously described as instances of "action at a distance," and are therefore considered scientifically impossible, I mention them for obvious reasons.

Action at a Distance.

The "willing" of a person to death does not necessarily mean the invoking of supernatural aid; the result can be obtained—has been obtained many times—purely by means of thought transference, the medium, in my opinion, being the ether, by which powerful thought influences are conveyed to the unhappy recipient of these unwelcome attentions. To the credulous I refer them to the records of the Psychical Society.

Disregarding the invocation of supernatural aid, it is, therefore, unthinkable

electrons and atoms—and this medium extends to the remote limits of space.

The ether appears to be a perfectly homogenous, continuous body, incapable of being resolved into simpler elements. And it is thought that ether is the primordial element—the formative principle from which all matter is built up. There are certainly strong grounds for believing that electricity itself is merely a form of ether. One might call it the protoplasm of the universe.

The ether has many extraordinary characteristics, but the one that differentiates it from anything else known to science is that it is continuous and not molecular. There is no other body of which this can be said, and therefore the ether is different from any other kind of substance or medium. In brief, the ether must be

(Continued on page 58.)

SIDELIGHTS ON WIRELESS.

(Continued from page 57.)

thought of as a continuous, directionless medium possessing inertia, and it must be regarded as the one universal medium by which all actions between bodies are carried on. Its primary function is to act as the transmitter of electro-magnetic energy.

The "effective density" of the ether is known, and, given the density, its rigidity can be ascertained, because the ratio of the rigidity to the density is the square of the velocity of transverse wave propagation—in the case of ether 9×10^{20} —the velocity of the electro-magnetic waves in free ether being 3×10^{10} cms. per second.

And the rigidity of the ether works out at approximately $\frac{1}{11}$ th.

The rigidity of steel is 8×10^{11} , beside which that of the ether is negligible. But neither steel nor glass can transmit vibrations of the speed of light because of the density of these solids.

Bound Ether.

According to Lodge* the rate at which transverse mechanical vibrations are propagated by crown glass is half a million centimetres per second; but the ether *inside* the glass transmits them forty thousand times as quick. And the ether *outside* the glass does even better—nearly thirty thousand million centimetres a second—that is, one and a half times as fast as in the glass.

The question is, why does the ether inside the glass transmit vibrations at two-thirds the normal speed in free ether?

Is the ether inside the glass *more dense* than the free ether—that is, the ether outside the glass—or is it *less rigid*? Either of which conditions would bring about a reduction in the velocity.

It would appear that the ether is affected in some way by the immediate proximity of gross matter. Fresnel considered the ether denser inside gross matter—that there is a kind of attraction between ether and the molecules of matter, which results in cementing, or binding, some ether round each atom, and that this bound ether belongs to matter, and is compelled to travel with it.

Fresnel considered the bound ether to have the same rigidity as the free ether which is at rest. Experiments have been made—notably by Maxwell, Fresnel, and Michelson and Morley—to determine whether the ether is wholly free or wholly bound.

But Fresnel's theory was that the ether is not wholly at rest or wholly in motion. The free ether, i.e. the ether outside matter, is at rest, the bound is in motion, and therefore the speed of light with the wind should be increased by an addition of $(1 - \frac{1}{N^2})$ th of the velocity of the wind.

(N = the inverse velocity ratio of light, and the density is inversely as the square of the velocity, hence the density measure is N^2 .)

Fizeau's experiments confirmed Fresnel's theory, and so did Michelson and Morley's. It was supposed that in the earth's revolution through the ether there would be an effect which could be detected by a difference in the velocity of light according to whether the light passed in line with or

transversely to the earth's movement. Michelson and Morley therefore devised an apparatus for measuring the velocity of light in both directions.

A number of rotating mirrors were arranged so that a ray of light was reflected to and fro a number of times at various angles, but it was found that there was no difference in its speed in any direction, thus disposing of the idea that the speed of the earth's motion through the ether could be ascertained.

An examination of electricity leads the student to serious consideration of the question of bound and free ether. Some kinds of matter have more electricity associated with it than others—some kinds are "electrically denser," as it were, than others, and this leads one to the question: Is ether electricity? Lodge suggests that positive and negative electricity together may make up the ether, or that the ether may be "sheared" by electro-motive forces into positive and negative kinds.

A New Theory.

There are many other aspects of the ether which I should like to deal with, but space will not permit even a brief résumé of the vortex theory, or the question of the conductivity of the ether. But before concluding I should like to draw the reader's attention to the relation between the ether

and character. None of these things are material, and yet, strangely enough, some of them have come into association with matter through the curious biological process of incarnation. For a time intelligences do inhabit material bodies which, by barely known processes, they have unconsciously constructed.

Associated with Ether?

"It is evident that there exists a formative principle, which is able to deal with atoms of matter, or, rather, with the more complex molecules into which the atoms have already grouped themselves; and thus, by aid of the energy which these molecules receive from the sun, material entities are able to manifest themselves familiarly in association with matter. So vivid is the connection that we have learnt to identify them with their material bodies of manifestation, and to imagine that they cannot otherwise exist. We do not know why they require a habitation or instrument belonging to the physical universe, but we may assume that for some unknown reason they do. My working hypothesis is that they are more closely associated with the ether than with matter, that they act primarily and directly on the ether, and only indirectly on matter, although they are able to continue in their ether habitation when the material particles are worn out and discarded.

For Future Investigators.

"In justification for this I wish to say as a physicist that most, possibly all four, actions on matter are exercised through the ether, some obviously, like propulsion by electric motors, others less conspicuously, but just as really, wherever force crosses empty space. For atoms are never in contact."

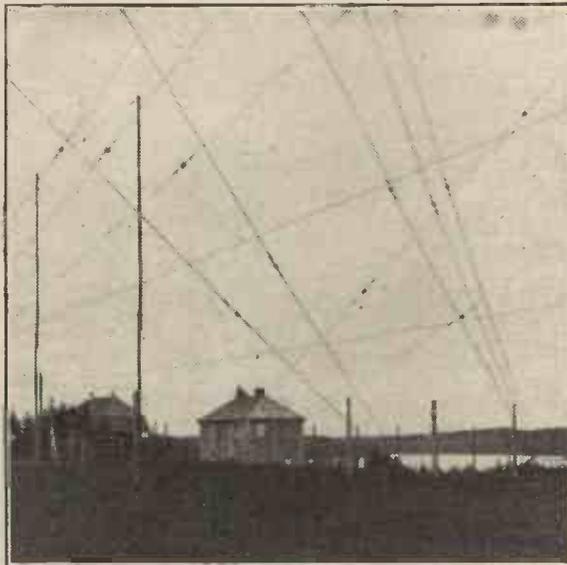
From this quotation the reader will gather an idea of a theory which may yet prove correct in explaining, from a scientific point of view, the manifestation of spirit phenomena. Continuing, Sir Oliver says:

"But we have no sense organs for the ether. To our present animal senses it is entirely elusive. Hence we shall know nothing about any personalities associated only with an ether body unless they can operate on our

senses in some way.

"To do this they must operate on matter. Let us suppose, then, that they can extract organised material and mould it as a sculptor moulds his clay or as a painter treats his pigments until they have fashioned a material representation, and which, if imbued with energy, may perform physical actions, such as the motion of objects."

The discerning reader will perceive the clue Sir Oliver has presented; and those who listened to Sir Arthur Conan Doyle's wireless talk a few months ago, when he discussed that mysterious ectoplasm, will still further perceive the relation between ether and ectoplasm, and all spirit phenomena which may yet prove a tenable basis on which future investigations will scientifically explore a subject which is still classed under the heading of metaphysics instead of physics.



A view of a section of the aerial system at the Lyngby (Denmark) Station. The hut is used as a broadcasting studio.

and psychic phenomena, and I cannot do better than quote from Sir Oliver Lodge.

I had better explain to the reader that the following is extracted from a lecture delivered by Sir Oliver Lodge on the "Possibility of Survival from a Scientific Point of View," a lecture delivered in May this year before the Society for Psychical Research. The lecture was in answer to one by Prof. Charles Richet, whose argument was against the belief of survival from a scientific point of view. The quotations I am going to make are of interest to wireless amateurs because they expound a new suggestion of Sir Oliver's in connection with the ether.

"The universe contains many things besides matter. It contains magnetism and electricity, and light and ether; it also contains life and thought, and mind and conscience, and memory and personality

* "The Ether and Its Functions," Lecture to Royal Institution, December 28th, 1882.

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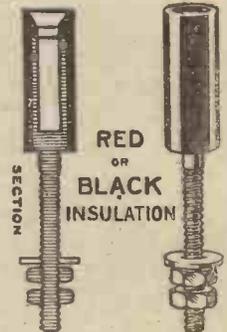
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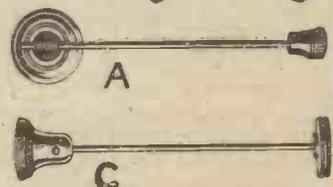


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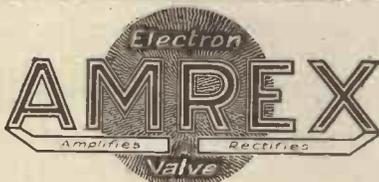
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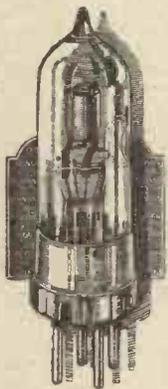


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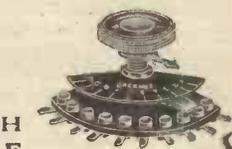


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A NOVEL VARIABLE CONDENSER

By LAURENCE J. PRITCHARD.

(Technical Editor of "Harmsworth's Wireless Encyclopedia").

A useful little instrument that presents but few difficulties in construction and will prove very useful to the experimenter.

FOR experimental purposes a novel variable condenser of the type illustrated in Fig. 3 can readily be made by the amateur. Its size and number of plates will be governed by the desired capacity, and may, for example, measure $1\frac{1}{2}$ in. in width and 3 in. in length. Its principle consists in the use of a piece of ebonite as a base on which is rested a piece of copper foil, one end of which connects to two screws on one end of the base, the other end being remote from the other pair of screws. A sheet of mica or other dielectric is then placed over the fixed plate and secured by screws.

the base and guide walls, this being most easily accomplished by using four small packing blocks of ebonite about $\frac{3}{8}$ in. thick, and mounting on top of them two strips of square ebonite rod.

Fixing the Plates.

The next step, pictured in Fig. 2, is to fix the foil to the base. It may be secured with a little shellac varnish or rubber solution, or, in emergency, with a trace of seccotine. It should be firmly pressed into contact and allowed a few minutes to set. Waxed paper or mica dielectric is then placed upon it and secured with small

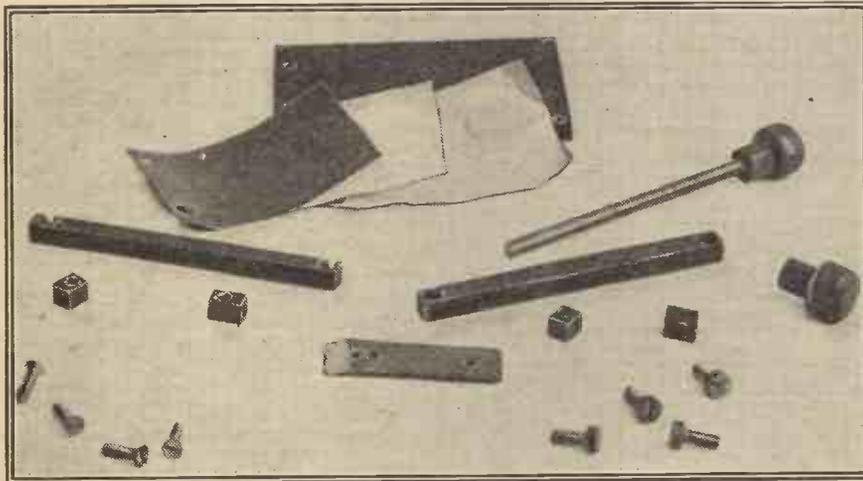


Fig. 1. The complete set of parts required.

A thin sheet of hard copper foil is secured on to the top of the dielectric by means of screws, which do not pass through the fixed plate. The copper plate is rolled so as to give it a natural tendency to spring upwards. Variations of capacity are effected by means of an ebonite rod provided with knobs at either end which pass through holes formed in the sides of the device. For rapid variation in value the rod may be pushed along, while for delicate adjustment the knob may be revolved, which will impart a small forward motion to the rod.

The necessary components for this simple form of variable condenser are clearly illustrated in Fig. 1, from which it will be seen that practically everything can be found in the average wireless experimenter's scrap box. The first step is to make up



Fig. 2. Fixing the copper foil to the base.

The rod is cut to the requisite length, leaving a small amount projecting. Each end should be screwed and provided with knobs, one of which is screwed in position, the rod passed through the walls, and the work completed by screwing the other knob on to the rod.

Convenient Mountings.

Connections are made in the usual way and wired to the screws at either end of the base, those on one end being in metallic connection with the moving metal plate and on the opposite end with the tinfoil. These little condensers are conveniently fixed to a baseboard or may be screwed directly on to the experimental bench or table.

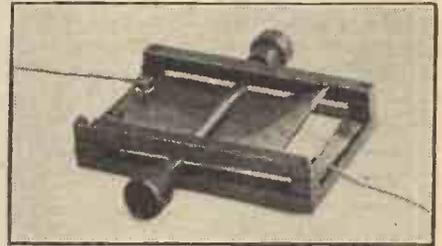


Fig. 3. The completed instrument.

THE RADIO MOVEMENT IN GERMANY.

By Erich Weferling (Brunswick),
Member of the German Radio Club
and the International Radio Club.

AT present the following radio institutions exist in Germany:

(a) With regard to radio telephony, Germany has three great radio stations with considerable capacity for extension—Nauen, Eilvese, and Königswusterhausen. Through the great Nauen and Eilvese stations, the "Transradio Akt. Ges. für drahtlosen Uebersee-Verkehr" disseminates the news for foreign countries. Furthermore, Nauen gives the time signals regularly.

The great Königswusterhausen station daily transmits news from the Wolff Telegraphic Bureau and financial information from the Europa-Radio-G.m.b.H.

(b) With regard to radio telephony, the Eildienst-G.m.b.H. sends to subscribers the official and private financial radio news (home and foreign quotations, etc.). Up to the present time more than 500 towns have given their adhesion. The radio-telephony for purposes of entertainment is organised by the "Drahtloser Dienst, Akt. Ges. für Buch und Presse" and by the "Deutsche Stunde, G.m.b.H., Berlin."

Both societies have established several subsidiary societies which transmit from different towns the literary and musical performances, cultural lectures, and news. With this object radio transmitters have been installed in Berlin, Munich, Leipzig, Frankfurt (Main), Stuttgart, Hamburg, Breslau, Königsberg, and Munster (Westphalia). The two principal societies intend also to send from Königswusterhausen station radio programmes which can be heard in halls throughout the whole of Germany and also abroad.

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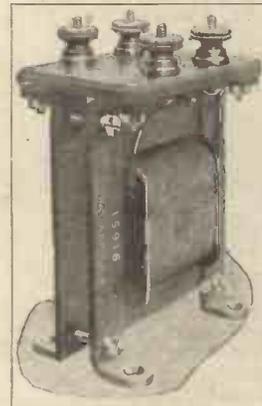


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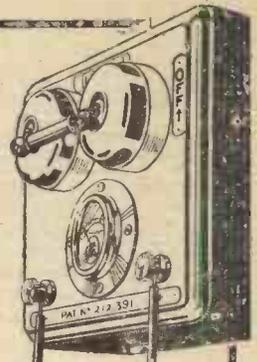
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This new 84-strand aerial costs 9/6 and is worth every penny of it, whether you are beginner or expert

50% increase over 7/22s (regular-type aerial wire) both for reception and transmission.

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Get the new "Mars" 84-strand aerial to-day—fix it indoors or outdoors—and recapture the first "listening-in" thrill.

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It sells readily at 9/6—far more than other aerials—because it fulfils those definite claims every time.

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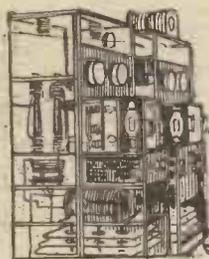
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Artistes of the Aether

By "Ariel"



Some of the artistes who have given you pleasure when listening-in.

Wireless Drama.

A GLANCE at the recent programmes shows a marked rise in the dramatic "glass," to "set to air" also, for the plays chosen have been for the most part suited to broadcasting purposes, and had the support of well-known artistes.



Mr. William Macready.

At 2 L O especially the change has been for the better, and there could be no doubt as to the success of Sheridan's time-honoured "School for Scandal," for, except for the screen scene with Lady Teazle, it is "the spoken word" that counts all along the line. The play was produced for broadcasting purposes by Mr. Frank Royde, the cast including such favourites as Miss Lottie Venne, Mr. Courtice Pounds, and Mr. Fisher White.

Humour at its Best.

That drama is strongly appreciated not only in London, but in the provinces, has been proved by the necessity to have a real dramatic company attached to the Birmingham station, and here Mr. Percy Edgar showed real wisdom in appointing no less than Mr. William Macready, the well-known Shakespearean actor.

Mr. Macready claims to have been practically "cradled" in Shakespeare, for most of his early career as an actor was spent in portraying any and every type of part.

With wireless able to give the best of our British artistes, many playgoers must have rejoiced at the announcement that Mr. Nelson Jackson would be heard. There are few great music or concert halls in which Mr. Nelson Jackson has not headed the programme. The writer has been present at the Alhambra, and seen the enormous audience moved from tears to

laughter and laughter to tears again by the sheer inimitable artistry of Mr. Jackson's characterisations. The Empire, the Coliseum, Oxford, Palladium, and

practically every London and provincial hall, one and all know his work, as well as the various members of the Royal Family, before whom he has performed both in public and in private.

A great feature of Mr. Jackson's art is his ability to suit his programme to his audience. For that reason he is as heartily welcomed in the East End as in the West.

Novelties in Accompaniment.

He has played also all over the world, including New York, of which he tells his experiences. He got what is professionally known as "the bird" in the first five minutes, the audience not understanding his work, but would Mr. Jackson accept their verdict? Not he, he simply stood over the footlights and literally "jollied" the audience back into a good humour, turning what looked at first a defeat into a tremendous success.

Most people seem to rely upon the piano as an accompanying instrument, forgetting that it is by no means ideal, for its scale is a tempered one, while the notes of the singer should be absolutely true. A discreet orchestra that tempers its power with mercy, makes a far more artistic back-ground to a good singer, and so does the harp, while another instrument which is more and more frequently being used in conjunction with the voice is the flute, but this depends much on the flautist.

It is an instrument, also, that broadcasts more perfectly than any other, and a thorough master of his art and his instrument is Mr. Frank Almgill, who has appeared at 2 L O and other stations on several occasions.

Military Music.

He is a Yorkshireman by birth, but has spent the last twenty years in London, where he is a member of the London Symphony Orchestra, principal flute of the British Symphony Orchestra, the London Chamber Orchestra, and now the London Wireless Orchestra, so it is little wonder that his work has such excellent effect.

There is a surprising humanness and sympathy in his notes that lends to their value both in the orchestra and in his solo performances.

The English public are particularly prone to military and brass bands, and one has only to note the size of the audiences at the Palladium and Alhambra when the bands of

the Royal Artillery or one of the Guards' bands are to play to realise this fact. Over the aether too, apparently, the transmission of a brass band has proved highly successful as well as popular.

The formation of the 2 L O brass band has met with success, and so also has the transmission of the full strength of 175 performers of the Royal Military School of Music from Kneller Hall, Twickenham.

Manchester.

Drama has played a strong part at Manchester also, and a clever artist who takes part both in operatic and solo performances is Miss Blanche Woodrow. Of wide experience, she is one of the early artistes to broadcast, and was heard most recently in the comic opera by Mr. Victor Smythe, "Princess Sonia." She is also a member of the 2 Z Y dramatic company, as well as The Planets, who played at the same station.



Miss Blanche Woodrow.

Bournemouth.

This great musical centre has literally scored every programme. Commencing recently with a Bach to Beethoven recital, with the great Bach pianist, Harold Samuel, as soloist, it included a Sullivan and German programme, the contrasting work of these two musicians being admirably brought out, and gave us, too, the first wireless performance of Lisa Lehmann's other song cycle, "The Golden Threshold."

A favourite young artist at Bournemouth is Miss Gladys Holland. An ex-student and prizewinner of Trinity College, she has been very successful at concerts, as well as before the microphone.

Glasgow.

The northern stations, Glasgow and Aberdeen, have given us good fare, the former some interesting excerpts from the Scots poets in the vernacular, and Aberdeen, brave city, "A Night with Brahms." Glasgow, too, got in "A Night in the Country," with Beatrice Eveline Constance Willis as soloist.



Mr. Nelson Jackson.



Miss Gladys Holland.



Mr. Frank Almgill.

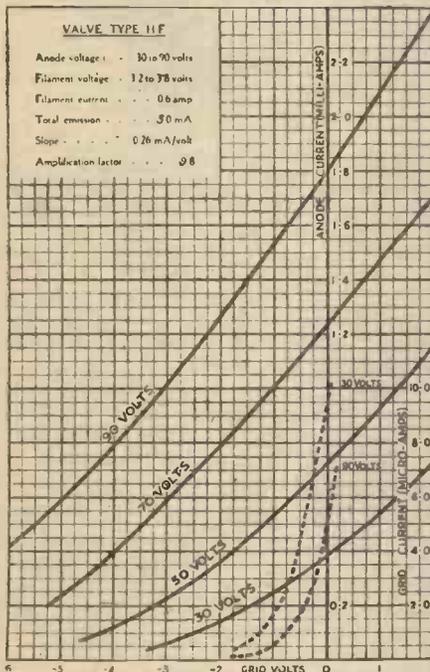


The Technical Editor of "Popular Wireless" will be pleased to receive wireless sets and component parts for test. Reports will be published under this heading.

WE have received samples of the two new types of Mullard receiving thermionic valves for test.

The new Mullard L.F. valve is specially designed for low-frequency amplification. In this valve the grid current, we find, is kept low, so that distortion of speech and loss of volume due to the presence of a

Characteristic Curves of H.F.



grid current is avoided. This permits the use of the valve without a grid bias, yet avoids the harmful distortion of speech that usually occurs under such conditions with valves possessing appreciable grid current.

The new Mullard H.F. valve is a detector and H.F. amplifier. The majority of wireless sets now employ reaction either deliberately by means of a reaction coil or, in the case of a multi-valve H.F. amplifier, accidentally due to the capacities inherent in the valve. In each case the presence of a high grid current, such as we have had proved to us exists in the Mullard H.F. valve, facilitates considerably the final adjustment necessary for best signals, and tends to stop self-oscillation. When the valve is used for grid-leak detection, it is essential to have grid current; and in the Mullard H.F. valve the grid current is sufficient to give excellent rectification even when the grid leak is connected to the negative limb of the filament.

It will be noted that the valve suitable for H.F. amplification is also most suitable for detection. This is directly opposed to the practice of combining the functions of detector and L.F. amplifier, which, it is claimed, is a fundamentally wrong principle, and in this we certainly agree.

Common to both valves are some important improvements in valve design. A cap has now been designed without the external metal cylinder that held together the constituent parts of the cap. The new cap is composed solely of insulating material and the four projecting pins. As a consequence the capacities between the electrodes are reduced, which reductions mean an improvement in all the functions of the valve.

The filament is in the form of a loop, and is under no tension, so that a "burn out" due to over-tension is impossible. It is stated that the treatment of the

filament during manufacture and the unique construction of the grid avoids all trouble due to filaments sagging on the grid, and microphonic noises are eliminated.

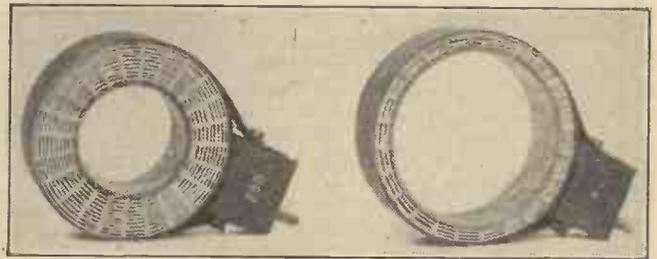
The grid is of an entirely new construction, in that the mid-portion, which is most effective as a grid, is made so as to enclose the filament more completely than the end portions.

The U-shaped and ribbed anode is remarkably rigid, and the electrode supports are so stiff that displacement of the electrodes is impossible.

Both in their appearance and in their utility these valves certainly mark a great advance in valve manufacture.

* * *

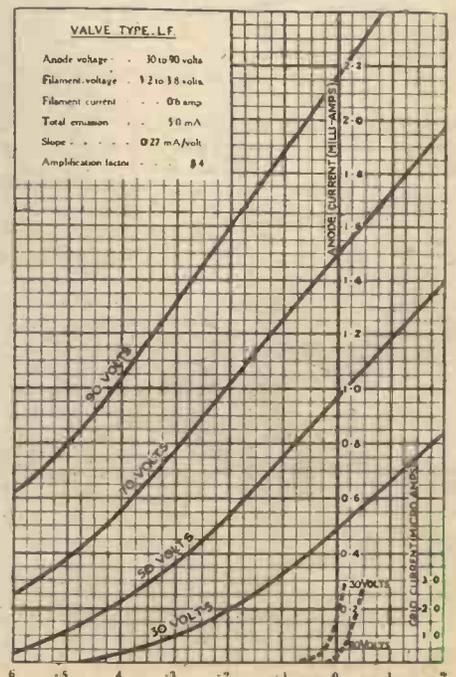
The "Duric" cellular plug-in inductance coils, manufactured by Radio Acoustics, Ltd., of 175a, Peckham Park Road, S.E., are specially designed to have very small self-capacity. They are wound in such a way that cord separators are introduced



Two "Duric" cellular plug-in inductance coils.

to provide large spacing between layers, and each turn on each layer is again spaced, so that an almost "ideal isolation" is obtained. The samples submitted to us by the above firm were very carefully tested, and provided really excellent results, both in respect of magnetic coupling and sharpness of tuning. They can certainly be placed in that limited class of coils that can be recommended.

Characteristic Curves of L.F.

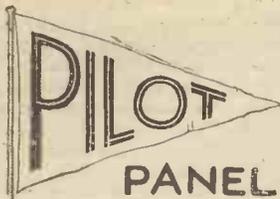


CHARACTERISTICS OF THE NEW MULLARD VALVES.

	H.F. Valve.	L.F. Valve
Filament Watts	2.0 watts	2.0 watts
Filament Voltage	3.2 to 3.8 volts	3.2 to 3.8 volts
Filament Current	0.6 amp.	0.6 amp.
Total Electron Emission	5 ma.	5 ma.
Anode Voltage	30 to 50 volts as detector	30 to 90 volts
" "	30 to 90 volts as H.F. Amplifier	
Normal Impedance	40,000 ohms	30,000 ohms
Voltage Amplification Factor	9.8	8.4

Negative Grid Bias for L.F. Valve only—Anode voltage: 30 50 70 90
 Grid bias: 1 1½ 2 3

When used as detector, suitable value of grid leak is 3.0 megohms, with .0003 mfd. condenser. The curves are appended.



Here are the first details of the new Peto-Scott PANEL SCHEME

THE following Instruments are available under the Peto-Scott **PILOT Panel Scheme**. Each is supplied as a complete set of parts, with nothing further to buy in either Type A or B, or Panels and Cabinets will be supplied separately.

The "Popular Wireless" Combination Set.

The Puriflex Receiver.

The All Concert-de-luxe Receiver.

The Omni-Circuit Receiver.

The Transatlantic Receiver.

The 3-Valve Dual Receiver.

Remember that all these Sets have been designed by experts and fully described in this and other Magazines.

EVERY experimenter—whether he be expert or novice—knows that the big bugbear in Set-building is drilling and engraving the panel and building the cabinet. Even if you possess all the tools it is quite a tricky operation to make a good job of it. The **PILOT Panel** scheme has been evolved to supply panels drilled and engraved, together with cabinets for all the principal Sets described from time to time in the Wireless Magazines.

These Receivers will be offered in a semi-manufactured state in two types. Type A will consist of panel, cabinet, and complete kit of components as specified and used by the author in his actual article. Type B is a Peto-Scott adaptation (guaranteed in every respect to be the equal of Type A) to use components of our own manufacture. Type B, by reason of standardisation and improved manufacturing facilities, will naturally show a big saving in cost.

Pilot Panels

are made from guaranteed Post Office quality Ebonite and hand finished. Each one is a perfect example of drilling and engraving. The polished cabinets are of fine quality polished oak or mahogany, fitted with sliding door at rear. Valves are enclosed within cabinet to prevent damage and to ensure long life. Every panel is guaranteed to be a perfect fit for the cabinet.

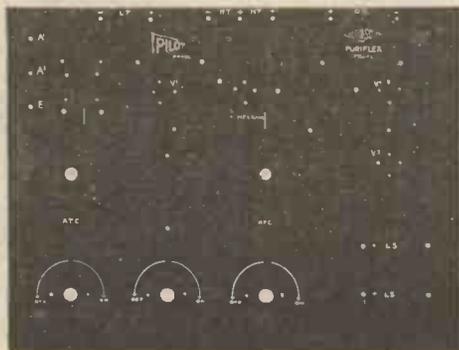


Illustration of **PILOT Panel** for "Puriflex" Set.

Pilot Panels make Set-building easy

PILOT Panels make Set-building so simple that even for a magnificent 5-Valve Set like the Transatlantic V the whole work can be done easily in a couple of evenings. All parts are guaranteed to fit together easily and accurately, so that all the experimenter has to do is to wire up according to the diagram. You know, too,

that the Set will work correctly from the first moment.

PILOT Panels eliminate waste, save money, and ensure complete success. Can you afford to build your new Set the old way? Write to us to-day and tell us which Set you are going to build, and we will show you the cheapest and best way of doing the job.

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Winding cannot be damaged by ordinary use.
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THE BEDFORD ELECTRICAL & RADIO Co., Ltd.

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One hole fixing.
Handsome nickel dial.
Phosphor Bronze contact arm.

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6 ohms
15 ohms
30 ohms

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When you want
a better
Rheostat

THE "BIG BEN" OF L.F. TRANSFORMERS

Why it is 30/-

The **LISTOLEON Transformer** is of such quality and perfection that we are able to guarantee it for a period of **two years**.

We can prove to you that reception when using the **LISTOLEON Transformer** is free from distortion, enormous in volume, and always to be relied upon.

Because:—

The coil is wound by specialists of 25 years' experience and contains almost twice as much wire as any other competitive transformer sold at 25/-.

The gauge of wire used is such that a current of 20 milli-amps. can be safely carried continuously. The **LISTOLEON Transformer** is therefore eminently suitable for use in conjunction with the biggest types of Power Valves used for broadcast reception.

The **LISTOLEON Transformer** measures 3 1/4" long by 2 5/8" over terminals, is 3" high, and weighs 2 lbs. The stampings are best Stalloy, dull blacked, and nickel-plated terminals and straps are fitted.

The **LISTOLEON Transformer** will free your reception from all harshness, whistling noises, and that raucous metallic medley of noises usually associated with loud-speaker reproduction.



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A "STRIKING" SUCCESS

RADIOTORIAL

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F.R.G.S.

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The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with

every article. All contributions to be addressed to The Editor, POPULAR WIRELESS AND WIRELESS REVIEW, The Fleetway House, Farringdon Street, London, E.C.4. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

The Editor desires to direct the attention of his readers to the fact that, as much of the information given in the columns of this paper is of a technical nature and concerns the most recent developments in the Radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and trader would be well advised to obtain permission of the patentees to use the patents before doing so.

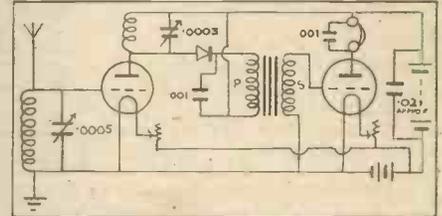
PATENT ADVICE FOR READERS.

The Editor will be very pleased to recommend readers of POPULAR WIRELESS who have any inventions to patent, or who desire advice on patent questions, to our patent agent. Letters dealing with patent questions, if sent to the Editor, will be forwarded to our own patent advisers, where every facility and help will be afforded to readers.

"CRYSTAL AND TWO VALVES" (Southampton).—What are the connections for a two-valve and crystal set where both the valves are employed solely as amplifiers and the crystal as detector? I am aware of several "dual" or reflex circuits using two valves and a crystal, but I desire to use a "straight" circuit for long-distance work. Is it possible to obtain reaction on a circuit of this kind? I have Nos. 75 and 50 plug-in coils, and a .0005 variable condenser. What other condensers are necessary?

The accompanying circuit shows how the first valve can be made to act as an H.F. amplifier on the tuned-anode principle. Across the anode coil are connected the crystal detector and primary of a L.F. transformer in series.

The H.F. impulses flowing through the anode coil set up potential differences across its ends. This



causes a current flow through the primary and crystal, so rectified impulses are passed on to the secondary of the L.F. transformer, which is connected to grid and filament of the last valve. This valve will thus act as a L.F. amplifier, with 'phones connected in its plate circuit.

The .0005 variable condenser, placed across a No. 50 aerial coil, will tune the aerial circuit over the main station broadcasting wave-lengths when connected to an aerial of average length.

A 75 coil may be used for the anode circuit, and a .0002 or .0003 variable condenser will bring this circuit in tune with the aerial circuit.

O.P. and I.P. connections are not shown, as they should be reversed until best positions are found.

The .001 fixed condenser across the primary is the

(Continued on page 69.)

Questions and Answers

A. R. L. (Saffron Walden).—What is a directional aerial, and does the end from which the lead-in is taken (in a twin-wire aerial)

have any effect upon the strength of signals received?

A directional aerial is one which transmits or receives much more strongly in one direction than in others. Most transmitting aeriels have this property in some degree, but it is not very marked in the average receiving aerial.

It will be found that a T aerial receives best in the direction along which the flat top points, especially if the flat top of the T is fairly long.

An inverted L aerial has rather stronger directional properties than the T type. In this case the lead-in should be arranged at the end which is nearest to the station from which maximum reception is desired.

If this is done, and the aerial lies so as to point in a straight line from the transmitting station, it receives the greatest amount of energy possible for an aerial of its shape, size, and height.

Something New The C.A.V.

LOUD SPEAKER

Believing that there are many wireless enthusiasts who are not satisfied with the present-day Loud Speaker, we set ourselves the task of discovering why they are not more popular, and eliminating the faults one by one. Our extensive experiments are now complete and the following models should meet the requirements of all:—

120 ohms £4 15s. 2,000 ohms £5. 4,000 ohms £5 10s.

Readers interested should obtain our illustrated folder, just published, a copy of which will be forwarded on application to:

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Wireless Exhibition—Albert Hall,
September 27th — October 8th.

STAND 112



RADIOTORIAL QUESTIONS & ANSWERS.

(Continued from page 68.)

value which generally gives best results, a similar value being used across the 'phones.

D. M. H. (Canonbury Square N.1.)—What is the name and address of the amateur transmitter whose call-sign is "6 BBC"? His station appears to be in this neighbourhood, but I cannot trace it in my list of amateurs' call-signs.

6 BBC is the call-sign allotted to the B.B.C.'s experimental station, which is situated in Hendon.

"SWITCHING-OVER" (Putney, London, S.W.)—I have one single-pole double-throw switch and one double-pole double-throw switch which I wish to adapt for use in my H.F. and detector circuit. I am endeavouring to use them so as to switch out the H.F. valve when desired, and also to place the aerial condenser in series or in parallel, but I cannot make out how this is done, and should be glad of a diagram.

See "P.W.," 116 (August 10th issue), which contains a diagram in Radiatorial showing the necessary connections.

IMPORTANT NOTICE.

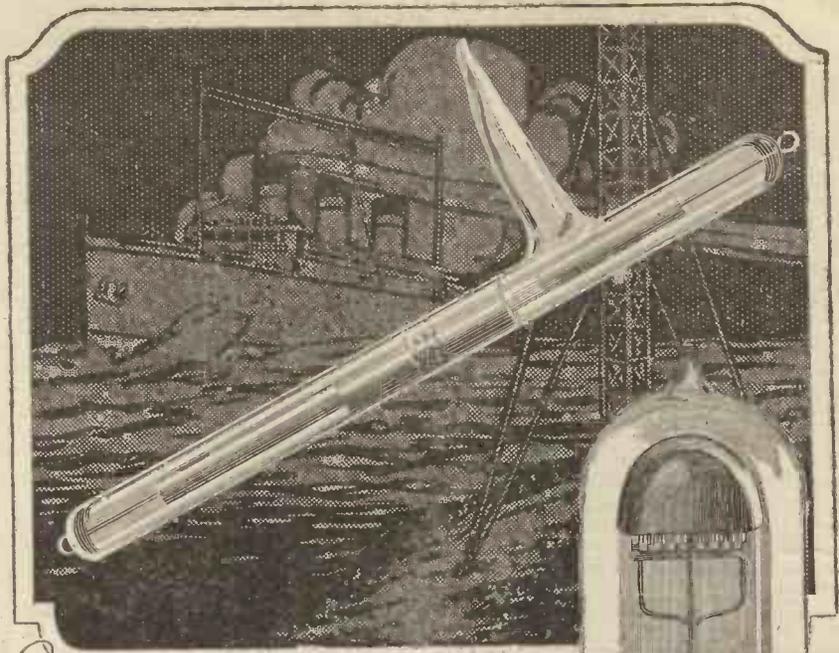
Readers are please requested to note that not more than three queries can be answered in one letter addressed to the Technical Queries Department. Owing to the extraordinarily heavy pressure on this department, readers are requested only to send in questions which they find they cannot possibly solve for themselves. On no account will more than three questions be answered in one letter, and telephone calls and personal calls at this office cannot be dealt with, owing to pressure of work on the technical staff.

A stamped and addressed envelope must accompany all queries. A copy of the questions asked should be kept by the sender, as it is not always possible to reproduce the original query when replying. Number your queries 1, 2 and 3, and answers will be given to each item.

"UNIDYNE CIRCUITS" (Dumfries).—Will you please tell me the dates upon which you published the various articles dealing with Unidyne circuits? I am a new reader and wish to obtain certain of the back numbers, but as these articles have now been running for some months I am rather at a loss as to the ground covered by them.

The Unidyne articles by the inventors commenced in "P.W." 101 (published May 3rd, 1924), and continued week by week until "P.W.," No. 113. Since then Unidyne articles have been published by other contributors, but the following list shows the numbers week by week with the principal subjects dealt with in each issue.

No. of "P.W."	SUBJECT.
101 and 102 ..	The Unidyne Principle.
103	How to Make a One-Valve Unidyne. (See also No. 112.)
104	How to Make a Unidyne L.F. Amplifier.
105 and 106 ..	How to make a Unidyne Two-Valve Set (Detector and L.F.).
107 and 108 ..	How to Make a Unidyne Two-Valve Set (H.F. and Detector).
109	How to Make a Two-Valve Unidyne L.F. Amplifier.
110	How to Convert Your Set to the Unidyne Principle.
111	How to Convert H.F. and L.F. Units.
112	A Simplified One-Valve Unidyne Receiver.
113	How to Make a Three-Valve Unidyne Set (H.F., Detector, and L.F.).
114	How to Make a One-Valve Portable Unidyne Set.
115	America and the Unidyne.
116	Developing the Unidyne.
117	How to Make a Two-Valve Reflex Unidyne.
117	How to Operate your Unidyne Set.



*Yesterday the Coherer
— to-day a Cossor.*

It is a far cry to that memorable December's day nearly 25 years ago when the first wireless signals ever sent across the Atlantic were received on a Coherer at Signal Hill, near St. John's, in Newfoundland.

Experimenters in those days had no thermionic valves to help them. Instead, we know that their apparatus was so delicate and easily put out of adjustment that reception was often more a matter of good luck than judgment. And instead of an aerial anchored to a huge kite swaying in the breezes five hundred feet above the ground, the modern wireless enthusiast can often receive strong signals from powerful land stations several thousand miles distant on a mere 20 feet of wire running round the picture moulding.

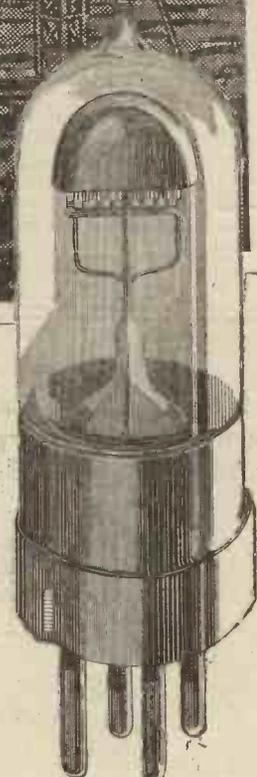
For long-distance work to-day there is one Valve universally recognised as being developed to a high pitch of perfection for this specific purpose—the Cossor P2.

To distinguish it from other Cossor Valves it has a red top. If your Set uses high-frequency amplification (practically all Receivers with more than one Valve do), then be sure that the one on the extreme left is a Cossor P.2—no other Valve can give you such results.

Cossor efficiency (whether P.1 or P.2) is due to its unique construction (patented throughout the world), for its hood-shaped Anode traps practically the whole of the electron stream. Incidentally this improved design has many other advantages. For instance, its curved filament—arched for strength like an old bridge—is self-supporting and cannot sag.

Therefore the normal life of any Cossor is considerably greater than any Valve with a long and slender straight filament.

It is the careful contemplation of such facts that has lifted the Cossor so high in the opinion of wireless enthusiasts to-day.



Manufactured in two types:
P.1 (For Detector and L.F. use) 12/6
P.2 (With Red top for H.F. use) 12/6
From all Dealers.

Cossor Valves

CORRESPONDENCE.

(Continued from page 70.)

winding the A.T.I. with heavy wire, say 20 or even 18 S.W.G.

If any of your readers require further information and will write to me direct, I will endeavour to help them out of their difficulties.

In answer to three or four readers I should say that all modern valves are fairly reliable, but that I prefer an Ediswan A.R. or A.R.D.E.

With best wishes for the continued success of our old "P.W."

I remain,
Yours faithfully,

JOHN PICKARD
(Chairman, Midlothian Branch Radio Association),
50, Fourth Street, Newton Grange, Midlothian.

THE "P.W." ULTRA SET.

The Editor, POPULAR WIRELESS.
Dear Sir,—I was greatly interested to see your article on the "P.W." Ultra Crystal Set. I shall make one up and compare the 'phone current obtained as compared with a conventional circuit.

This question of crystal set efficiency would be better dealt with in a quantitative manner. Can you suggest a means of measuring the energy in a free circuit tuned to the carrier wave of 2 L O? It may be taken for granted, I think, that this would represent the maximum energy capable of being absorbed by the tuning apparatus, aerial, and earth in use. The addition of detecting apparatus is bound to reduce the absorption. If this measurement could be taken it would give a basis for calculating efficiencies.

You may remember an article of mine early this year in the "P.W." in which it is shown that the energy in 'phone circuit may be measured by a resistance method. The following calculation may be of interest:

Distance of crystal set from 2 L O = 11 kilometres
Phone current = 30 microamps
Resistance 'phone + crystal = 16,000 ohms
∴ Energy in 'phone circuit = $\frac{C^2 R}{2}$
= $(30 \times 10^{-6})^2 \times 16,000$
= 1.44×10^{-5} watts

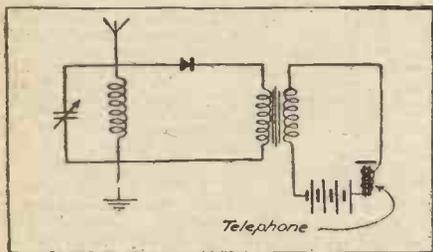
Aerial output 2 L O = 1,500 watts?
Assuming this to be radiated uniformly in all directions, at 11 kilometres the area of wave front = $4\pi \times (11 \times 10^3)^2$ sq. metres.

If efficiency of set were 100 per cent. the area drained by the aerial
= $\frac{1.44 \times 10^{-5}}{1500} \times 4\pi \times (11 \times 10^3)^2$ sq. metres
= about 14 sq. metres

Length of aerial = 30 metres
Width of band drained = 0.4 metres.
This means to say that my aerial is equivalent to a screen about 18 inches in width at least.

According to the "filter" theory of rectification the efficiency (electrical) of a crystal set cannot exceed 50 per cent. If this be true, then the screening effect must be twice as great as calculated.

Here again what is badly required is the ratio:
Phone circuit energy / H.F. energy absorbed
= electrical efficiency.

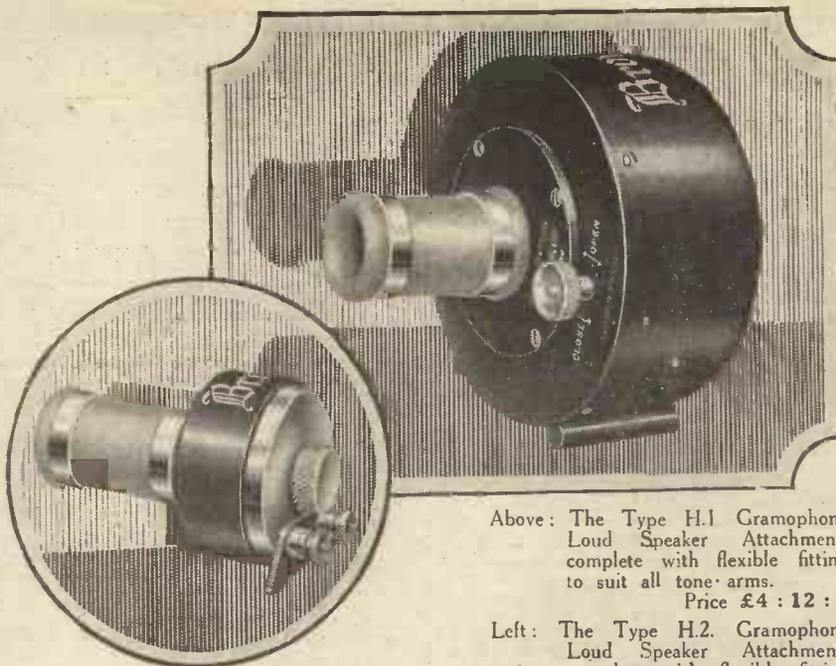


You say that coupled circuits give a step up of potential and stronger signals result. By actual measurement of 'phone current this is not the case. Moreover, no appreciable increase in selectivity occurs until the coils are so far separated that signal strength is badly reduced. If "tuning curves," such as the one reproduced in my article, be taken for close coupling and loose coupling of the coils, the shapes are absolutely similar.

A correspondent in a recent issue, Mr. H. W. Bulstrode, bears me out in this. I am of the opinion that this effect arises from the high resistance of the detecting circuit. The damping is so great that the expected potentials do not have a chance of developing. Possibly if one took an extremely large number of crystals in parallel and low-resistance phones some improvement would result.

It has always seemed to me that the weak part of wireless reception is the low efficiency of the telephones. I have read somewhere that it takes a million trombones playing together to produce one horse-power of sound energy. Put a loud speaker as

(Continued on page 72.)



Above: The Type H.1 Gramophone Loud Speaker Attachment, complete with flexible fitting to suit all tone arms.
Price £4 : 12 : 0

Left: The Type H.2 Gramophone Loud Speaker Attachment, complete with flexible fitting to suit all tone arms.
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Any Gramophone can be used as a Loud Speaker

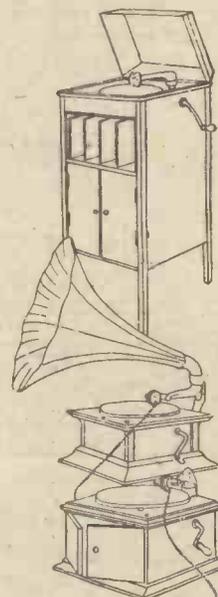
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"World's Best" Low-Frequency Transformers (Registered), 5 to 1 ratio, 10 to 1 ratio, to 4,000 to 1 ratio. Primary Winding, 800. Secondary, 4,000, 10/6 each. Post 9d. English manufacture and guaranteed by:

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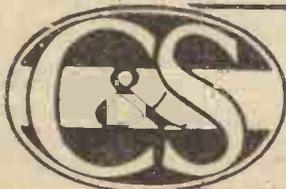
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CRAIK & SMITH,

Phone: Clerkenwell, 7346. 26-31, Eyre Street Hill, E.C.1.

CORRESPONDENCE.

(Continued from page 71.)

equal to one trombone. The electrical energy is, say,
0.02 amp × 60 volts = 1.2

746

horse-power

= 0.002 horse-power approx.

Efficiency = 1 × 10⁻⁴

2 × 10⁻⁴

= 1/2 per cent. approx.

Cannot headphones of the electro-magnetic type be devised? Some time ago I tried to increase the magnetic field during reception with ordinary 'phones in the manner shown, but no improvement was noted.

Magnetometer tests showed that for any reasonable voltage there was little increase in the pole strength of the permanent magnet.

Yours faithfully,

ERNEST C. CRAVEN.

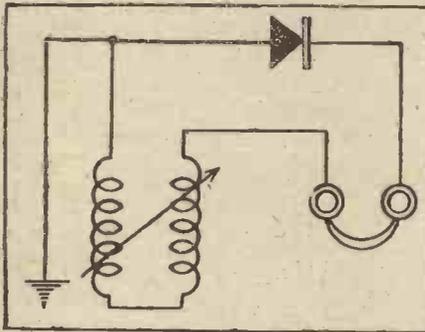
59, Southern Road, Plaistow, E. 13.

AERIAL-LESS RECEIVERS.

The Editor, POPULAR WIRELESS.

Dear Sir,—Re your correspondent's article on the "aerial-less" crystal receiver.

It may interest you to know that I made a similar receiver several months ago, the circuit being as shown. My idea was to get a compact portable receiver in order to hear the mid-day transmissions when in the City. The receiver measures about 2 in. by 1 in. by 1 1/2 in., and is tuned by means of basket coils.



Good signals are heard 3 1/2 miles from 2 L O at the address below, using only the 'phone leads as an aerial. I have recently been making experiments with a view of constructing a set using aperiodic tuning, as different "earths" affect it in the same way as different aeriels would an ordinary receiver.

Yours faithfully,

JOSEPH F. MAUNDER.

47, South Side, Clapham Common, S.W. 4.

"P.W." COMBINATION IN SCOTLAND.

The Editor, POPULAR WIRELESS.

Dear Sir,—I should like you to know the excellent results I am getting with your wonderful "P.W."

Combination Set, which I made up some months ago, roughly, without either ebonite or solder.

Unit 1 (one valve and crystal) I brought to Scotland last Saturday, and the first evening I was listening to 5 X X, at small loud speaker strength, although I only had a single wire aerial temporarily thrown over a 20-foot tree, and a poor earth.

I have since improved both, and the results astonish me; last evening I tuned in to London, then Birmingham, Newcastle, Glasgow, and Bournemouth, the latter station being the best of all, sufficient for loud speaker, with no interruption from Morse or fading from beginning to end, notwithstanding the fact that when at home in London I have never yet got this station. It seems I must come more than 500 miles north to get it. Later in the evening I had two Continental stations, one being in Paris, but the other I could not identify.

I am able, without the slightest trouble, to go from one station to another, and could easily have picked up the whole of the B.B.C. stations, which I think most extraordinary for a one-valve-crystal set, and it is certainly a revelation to my friends, who thought a three- or four-valve set necessary to get moderate results in this part, which is surrounded by high mountains, trees, and lochs, and more than 500 miles from London.

I bless the day when a friend first suggested I should make the "P.W." Combination set; and I congratulate you on evolving such a satisfactory circuit and set.

I am a regular reader of POPULAR WIRELESS, and, wishing you every success.

I am, yours faithfully,

A. MAY.

Glencoe House, Glencoe, N.B.

MORE P.W. "ULTRA" RESULTS.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have wired up the "P.W." Ultra Crystal Set, adapting it for Chelmsford, and wish to report that I have been securing excellent results.

My aerial is single Electron wire, 100 ft. in all, and about 30 ft. high.

I am rather badly screened, as the house end of the aerial is lower than the roof, and at the other end there are a number of large trees, these being at the bottom of a small hill with a large house on the top.

The London programme as relayed by Chelmsford has come in splendidly.

I must say that I consider the "P.W." Ultra Set as simple to construct and as efficient as any one could wish for.

Yours faithfully,

C. ANGELL.

13, Willoughby Road, Ipswich.

"A VILLAGE IN THE WEALD OF KENT."

The Editor, POPULAR WIRELESS.

Dear Sir,—Having completed a series of tests with crystal sets tuned to 5 X X, I can only say that reception, under varying conditions, is excellent. I am at present situated at about 90 miles from Chelmsford, and have a very badly screened aerial. Using the simplest possible single slide crystal set, with no insulation except the wooden baseboard, signals are decidedly stronger than those obtained from an ordinary broadcast set ten miles from 2 L O.

Atmospherics are sometimes troublesome, but this can only be expected. I find that a good healthy "X" can be tuned to its maximum degree of "heftiness" at 15,000 to 20,000 metres, so it is only natural to expect a little more trouble in this direction when working on a comparatively high wavelength.

I can assure you there is quite a boom in simple crystal sets in this district, the main topic in the village inn (so I am told, of course) being the new high-power station. It is interesting to note that the majority of inhabitants here had never heard of wireless at all until the generators at 5 X X began to run.

With the approaching winter thousands of our country cousins will be listening-in to the outside world and it is to be hoped that the transmissions of 5 X X will be kept up to their present degree of perfection.

Yours faithfully,

OSWALD J. RANKIN.

Southfields, Fir Toll, Pluckley, Kent.

THE "P.W." COMBINATION SET.

The Editor, POPULAR WIRELESS.

Sir,—I trust that you are always pleased to receive reports on the results attained with the circuits introduced by your journal.

I am pleased to state that, using the "P.W." dual circuit, unit one, with an indoor aerial, I can tune in Birmingham whenever it is on, regardless of the fact that I am only nine miles from 2 L O. Using an outdoor aerial, all the others are easily received with the same one valve.

A few particulars of the components used may also interest you. I use a P.2 Cossor valve, a 5-1 "Success" transformer, 4 v. 40 c. A.V. accum., and 54 volts H.T. A 0005 A.T.C. is also used.

My success has induced all my friends to convert their existing circuits into that of the "P.W."

Thanking you in anticipation, I remain,

Yours truly,

A. J. BAKER.

67, First Avenue, Bush Hill Park, Enfield, N.

TECHNICAL NOTES.

(Continued from page 52.)

The heating of the filaments in a valve set. It would perhaps surprise you to know what a large number of my correspondents express their difficulties in getting accumulators re-charged—many of them being situated in places where the re-charging is extremely inconvenient. Others describe their experiences with dry batteries, and many complain that the use of such cells, although in some ways convenient, and in many cases the only possible method, is unduly expensive.

However, this subject, as I have said, will come up for full consideration presently.

Anode Batteries.

Whilst on the subject of batteries, I should like to refer to the dry cells which are used in the high-tension batteries of the usual type, as I have had many inquiries on this subject at different times. The question is often asked as to why these go "dead," and how they can be revived. I believe I mentioned this matter recently, in a brief way, but as many readers do not seem to be quite "au fait" with the construction of these cells, I may perhaps describe them very briefly. Each of the units in an ordinary high-tension battery consists of a small Leclanché cell, the elements being zinc and carbon, with a solution of sal ammoniac as the electrolyte. The zinc is used to form a short cylinder about 2½ in. long and ¾ in. in diameter, which serves as the container. The carbon is in the form of a rod, of roughly the same length, and about ¼ in. in diameter.

Polarisation.

If these elements were used simply as stated, it would be found that the resistance of the cell would rise rapidly when it was delivering current. This effect is known as polarisation, and is due to the formation of minute bubbles of hydrogen on the carbon plate. The action of the cell depends upon the formation of zinc chloride between the zinc and the ammonium chloride (sal ammoniac) with the liberation of hydrogen; the latter, being electro-positive, travels up to the positive carbon plate. When hydrogen is adhering to the carbon, it reduces the current, for two reasons, firstly because it is a bad conductor, and secondly because the hydrogen and the carbon together form a cell of their own, so to speak, whose E.M.F. acts against the main E.M.F.

Depolarisation.

The making of a practical working Leclanché cell depends almost entirely upon providing a means of getting rid of this evolved hydrogen. A simple method, and the one which almost universally is adopted in this case, is to surround the carbon electrode with a substance which is rich in oxygen, so that the hydrogen combines with some of the oxygen and forms water, which does not interfere with the working of the cell. Such a substance is called a depolariser, and the substance generally used is black oxide of manganese, or manganese dioxide, or peroxide of manganese, all of which are different names for the same thing. The depolariser is

(Continued on page 76.)



Louden



Columbus and the egg

Missing the obvious is a fault most of us are guilty of at some time or other, and valve designers have proved no exception.

One of their chief aims has been to eliminate "mush," that roaring or hissing sound which so often spoils what otherwise would be perfect reproduction.

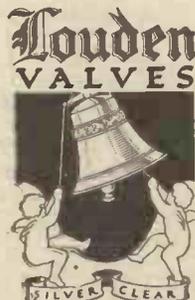
It was found that "mush" was due to objectionable charges of electricity congregating near the anode and interfering with the electron stream.

All sorts of experiments were tried. Some increased the volume but at the expense of purity; others were free from distortion but still had "mush," and so on; and we seemed as far off as ever from our ideal valve, giving ample volume, no distortion and no "mush."

Then suddenly came the obvious solution. We simply made a way of escape for these objectionable charges—we made the anode like a spiral and immediately we got silver clear reproduction, with plenty of volume.

It has been decided to put the Silver Clear Louden on the market at the extraordinarily low figure of 10/-. This represents a certain faith on our part. To justify it the Louden must sell in enormous quantities.

But we cannot pretend to be taking much risk. Once you have tried the Silver Clear Louden you will be satisfied with no other.



The Plain Louden for Detecting and Low-Frequency Amplifying. Filament Volts, 4-8-5. Filament Amps., 0.4. Anode Volts, 40-80.

10/-

The Blue Louden for H.F. Amplification. All Loudens are silver clear and free from mush. The current consumption is low and the life long.

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- Valve Sockets, plain .. 10d.
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- Moulded Knobs 1 1/2 in. 2 for 8d.
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- Double 'Phone Cords, 72 in. 1/11
- Porcelain S.P.D.T. Switch 1/11
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- Battery Clips .. doz. 10d.
- Ebonite Valve Holders .. 1/-
- Variometer 250/650 .. 2/6
- Lead-in Wire .. 10 yds. 1/6
- Twin Flex .. 12 yds. 1/11
- 100 ft. 7/22 Aerial Wire 3/9
- with four insulators
- Nugraving Titles .. 8d.
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Post 6d. each. Enclosed glass. As sketch, Ebonite Base. Brass .. 1/4 1/6 2/- Nickel .. 1/6 2/- Ebonite .. 1/6 Perikon .. 1/8 2/2 (With Zincite and Bornite)

OUR WONDERFUL MICROMETER ADJUSTMENT GLASS-ENCLOSED DETECTOR. WHY PAY MORE! POST 6d. each. 1/11

HERTZITE SHAW'S GENUINE

1/- BEATS ALL OTHER "ITES."



Coil Plug and Clips 10d. Post 4d.

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ORMOND Condensers at list prices.

BRETWOOD Var. gd. lk. .. 3/- Anode Res. .. 3/-

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H.F. PLUG-IN TRANSFORMERS No. 1. 150-450 .. 3/6 No. 2. 250-790 .. 3/11 No. 3. 450-1200 .. 4/3 No. 4. 900-2000 .. 4/6 No. 5. 1600-3090 .. 4/9 No. 6. 2200-5000 .. 4/11

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2-way Coil Holder for Critical Tuning or Rectance or Aerial Coils. Specially adaptable for M.W. Sets .. 7/9

D.C.C. WIRE S.W.G. 1 lb. 18 .. 9d. 20 .. 10d. 22 .. 10d. 24 .. 1/- 26 .. 1/1 28 .. 1/3 30 .. 1/6 32 .. 1/6 34 .. 1/6 36 .. 1/6 Post 6d. reel.

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STERLING Square Law Variable Condensers

- with Vernier. .001 .. 30/9
- .0005 .. 25/6
- .00025 .. 23/6

EDISON BELL FIXED CONDENSERS

- .0001 to .0005 .. 1/3
- .002 to .006 .. 2/-
- .01 .. 1/3
- .0003 Leak .. 2/8
- Variometer .. 10/8
- Twin Detector .. 5/9
- Post, 2d. each

GOSWELL ENGINEERING CO.

- Patent Valve Holder 1/6
- Cam operated Vernier, Two-way Coil Stand 9/-
- Ditto, with Switch 12/6

ACCUMULATORS

- BEST MAKES UNDER MY OWN LABEL
- 4 v. 40 .. 17/6
- 4 v. 60 .. 21/-
- 6 v. 60 .. 28/8
- 6 v. 90 .. 34/-
- 6 v. 100 .. 42/-
- Post 1/- extra.

LOUD SPEAKERS

- 27/6 - JUNIOR AMPLION Newest Model
- 42/- - JUNIOR DE LUXE Oak Trumpet
- 55/- - BABY STERLING Splendid Value
- ALL AMPLIONS STOCKED. BROWN BABY 48/-

RIGHT OPPOSITE DALY'S GALLERY DOOR

K. RAYMOND 27, LISLE STREET, LEICESTER SQUARE, W.C.2

HOURS OF BUSINESS: DAILY . 9 to 7.45 SUNDAY . 10 to 1

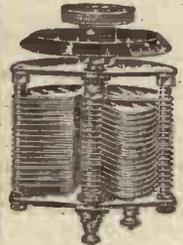
'Phone: GERRARD 4837.

No responsibility accepted on post orders unless cheques and postal orders are crossed and made payable to the firm. Moneys sent must be registered.

HULLO EVERYBODY!!

RAYMOND'S VARIABLE CONDENSERS

NEW MODEL.



Cap.	Price.	Height without connections.	ALL PARTS NICKELLED.
.001	6/11	3 1/2 in.	One hole fixing.
.00075	5/11	2 3/8 in.	Narrowest spacing.
.0005	4/11	2 in.	Aluminium end plates.
.0003	4/6	1 3/8 in.	Accurate Constant Capacity.
.00025	4/4		Rigid Construction.
.0002	4/-	1 1/2 in.	Low Loss.
.0001	3/6	1 in.	Electrically and Mechanically Perfect.
.00005 (vernier)	2/6		

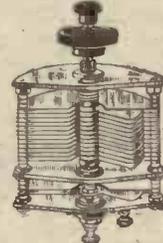
E BONITE DIAL 8d. extra.

POST 6d. SET.

Many unsolicited Testimonials.

NEW MODEL with 3 Plate Vernier at bottom. Specification as ordinary, but the Vernier allows absolutely the finest tuning possible. Very sharp and defined. They do not need varied long and technical words to recommend them. Satisfied users are the best recommendation. Assembled for panel mounting, and for a limited period. I will include **FREE** an **E BONITE DIAL** to retail customers only.

Height	Cap.	Price
4 in.	.001	8/11
2 1/2 in.	.0005	6/11
2 1/4 in.	.0003	6/6



POST 6d. PER SET PLEASE.

Complete with 2 Knobs & Dial.

VALVES.

B.T.H.		
R4 type	12/6	
B5 '06	30/-	
Power Valve	35/-	
COSSOR.		
P.1, P.2	12/6	
MULLARD.		
L.F. or H.F.	12/6	
D.F. Ora	30/-	
1 volt	30/-	
EDISWAN.		
A.R.	12/6	
A.R.D.E.	21/-	
A.R.-06	30/-	

LISSEN COILS.

No. 25	4/10
30	4/10
35 and 40	4/10
50	5/-
60 and 75	5/4
100	6/8

All Sizes Stocked.

THORPE K4.

4 Electrode Valve (5 Pin) 17/6

RADION VALVE (2 types).

Detecting or Amplifying .. 10/-
Post 6d.

KING RHEOSTATS.

With Vernier .. 5/3
Post 6d.

MANSBRIDGE (NEW) T.C.C. FIXED CONDENSERS.

.25, '05	4/6
1 MFD.	4/6
2 MFD.	5/-

Post 3d.

UTILITY SWITCHES STOCKED.

IGRANIC, EDISON BELL VARIOMETERS.

Post paid .. 10/6

VOLT METERS

0-6	4/11
0-16	5/6

High Class Goods. Post 4d.

HEADPHONES.

Sterling, 4,000 ohms	25/-
Brown, "F" type	25/-
Brown's "A" type	62/-
B.T.H.	25/-
Siemens	25/-
Gecophone	25/-
Western Electric	25/-
Brunet, 4,000	17/6
Single Brunet, 4,000	8/6
8,000 Brunet (for Crystal sets only)	19/11
Brunet De Luxe	18/11
Lightweight "K"	10/9
Dr. Nesper, adjustable	13/6
Ericsson (EV)	12/6

Post 6d. pair.

BURNDIPT

Dual Rheostat 5 to 30 ohms, for Panel Mounting .. 7/6 each
Post 3d.

FIBRE STRIP FOR COILS.

Per dozen, post free .. 1/10

GAMAGE'S "PERMANITE," 1/-

E BONITE

Cut to size.

1/2 at 1/2 square inch.
1/4 at 1/4 square inch.
Post 3d.

H. T. C.

Valve Holder	1/9
Under Panel	1/6

Post 3d.

TESTIMONIAL that speaks for itself.

July 20, 1924.
From C. Walton Esq.,
Radio Engineer, Andover.
I have tested your new variable condensers on Megger and get "INFINITY."
Yours sincerely,
C. Walton.

Raymond SQUARE LAW Variable Condenser with VERNIER OUR NEW MODEL

Orders in rotation. Other sizes shortly.

.0005 Only 12/6

Post 6d. set.



BASKET ADAPTER 10d.

Post 4d.
Two for 2/-

Extra Quality with Plug 1/3

Two for 2/8. Post 4d.

BASKET COILS.

Chelmsford (Tandco) 2/-	
Tandco 1,300/1,750 metres	1/8
Waxless set of 5. 200/2,000	1/11
Waxed set of 6. 200/3,600	1/11
Special Duplex Coil fitted on adapter for Chelmsford 2/11 (for variometer 650 metres).	2/11

Post 4d. each.

CALLER'S COLUMN. NO POST ORDERS.

Filament Dials	2 1/2d.	Ditto per doz.	10d.	Accumulator, 4 v.	16/6
Ebonite 4 1/2d. with knob	5 1/2d.	Pinscrew terminals 2 for	1 1/2d.	Midite	6d.
Copper Foil foot	2 1/2d.	Spade Tags 4 for	1d.	Gecosite	1/3
Washers, 2 & 4 B.A.	1d.	Brass Plug and Socket pair	1d.	Neutron	1/3
Nuts, 2 B.A. 2 doz.	3 1/2d.	Wander Plugs, pair	2 1/2d.	5 in packet (one gold)	3d.
Nuts, 4, 5, 6 B.A. 2 doz.	3d.	Valve Holders, 8d.	1/3	Filament Rheostats	1/3
Microstat (D.E. or E. Valve)	2/6	Ditto, extra quality	1/3	Also, 1/6, 1/9, 2/-, 2/3	
Allen Var. grid leak	1/6	Plug and Clips	6 1/2d.	Ormond Rheostat	1/9
Ditto Anode Res.	1/6	Shaped Coil Plugs	8 1/2d.	Insulated staples, 5 a 1d.	9/11
Good Fixed Condensers	9d.	Edison Bell	1/-	Lightweight Phones	9/11
Dutch Valves Tubular	4/9	Ditto, extra quality	1/6	Soft Iron Wire	8d.
Dutch "R" type	5/-	ity 6d., 7d., 8d.	1/6	6 Waxed Coils	1/8
Porcelain Switches, S.P.D.T.	1/3	72 in. 'Phone Cords	1/5	(200/3,600)	2/6
Ditto Switches, D.P.D.T.	1/11	Phillips '04	18/6	Tapped Inductance (1,600 metres)	
Insulated Pliers pair	1/-	Metal '06	18/11	Variometer and Clips, high-class, 200/600 m.	2/8
Screwed Rod, 2 B.A. foot	2 1/2d.	Studs, complete doz.	4 1/2d.	Fibre Strip for Coils	1 1/2d.
Ditto, 4 B.A.	2d.	Pointers .. 2 a 1d.	100,000 ohm res. and clips	Panel Switches (nickel), S.P.D.T.	10 1/2d.
Knobs, 1 1/2 in. 2 B.A.	1 1/2d.	100,000 ohm res. and clips	1/6	Wyers Valves	12/6
Best quality ditto	3d.	Unit Coil Plug	1/1	Adhesive Tape roll	3d.
1 in. 2 B.A.	2d.	Engraving Titles	7 1/2d.	39 v. H.T. Batt.	4/6
1/2 in. 4 B.A.	2d.	Similar Titles	4 1/2d.	60 v. H.T. Batt.	7/6
Real Ebonite Dials	1/-	Scales, 0-180	1 1/2d.	H.F. Transformers	250/700
Set of Spanners, etc.	1/3	Wyers Valves	12/6	Stand for Phone	1/3
Best Grid Leak and Condenser	2/2	Adhesive Tape roll	3d.	Coil Stands, 2-way	2/6
Grid Leaks, 2 meg.	1/1	39 v. H.T. Batt.	4/6	Ditto extension handles	3/3
2, 4, 6, B.A. machine screws	1/1	60 v. H.T. Batt.	7/6	3 Twist Drills	1/4
Easi-Fix crystal cups	1d.	H.F. Transformers	250/700	Solder .. 2d.	
Vario. Couplers	3/-	Stand for Phone	1/3	Small Screwdrivers	6 1/2d.
Vario. Crystal Sets	7/11	Coil Stands, 2-way	2/6	Polished Boxes, 8 x 6, 2 1/8; 6 x 6	3/3
Ebonite Variometer	3/11	Ditto extension handles	3/3	Basket Adapters	8 1/2d.
Valve Pins and nut	1d.	Ditto 3-way	4/9	Copper, 15 feet	5d.
Do. Sockets, nut and washer	2 for 1 1/2d.	Brunet Single, 4,000 ohms	7/11	16 Square ditto	6d.
Do. with shoulder, nut and washer	2 for 2d.	Electron Aerial, 100 ft.	1/10	18 Square ditto	5d.
Stop Pins and nut	1d.	Extra Heavy, 100 ft.	2/3	3 Twist Drills	1/4
Spade Screw terminals each	1d.	Egg Insulators	1/1	Solder .. 2d.	
		Rubber Lead-in, 10 vds.	1/3	Small Screwdrivers	6 1/2d.
		English 4 1/2 Bat-teries .. 4 1/2d. & 4d	4d.	Polished Boxes, 8 x 6, 2 1/8; 6 x 6	3/3
		Clips .. 2 a 1d.	1d.	Basket Adapters	8 1/2d.
		Sleeving .. 4d.	4d.	Copper, 15 feet	5d.
		Twin Flex, 4 yds.	6d.	16 Square ditto	6d.
		Burndipt Detector	5/-	18 Square ditto	5d.
		Variometers, 250/650	1/6	3 Twist Drills	1/4
		Raymond Trans-former	9/11	Solder .. 2d.	
		Wic-Met Detector	6/-	Small Screwdrivers	6 1/2d.
		Similar	2/6	Polished Boxes, 8 x 6, 2 1/8; 6 x 6	3/3
		Many good ones at	10d.	Basket Adapters	8 1/2d.
		Also splendid value	1/2	Copper, 15 feet	5d.
		Nickel or Brass, best	1/6	16 Square ditto	6d.
		(All above glass enclosed.)		18 Square ditto	5d.
				3 Twist Drills	1/4
				Solder .. 2d.	
				Small Screwdrivers	6 1/2d.
				Polished Boxes, 8 x 6, 2 1/8; 6 x 6	3/3
				Basket Adapters	8 1/2d.
				Copper, 15 feet	5d.
				16 Square ditto	6d.
				18 Square ditto	5d.
				3 Twist Drills	1/4
				Solder .. 2d.	
				Small Screwdrivers	6 1/2d.
				Polished Boxes, 8 x 6, 2 1/8; 6 x 6	3/3
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				16 Square ditto	6d.
				18 Square ditto	5d.
				3 Twist Drills	1/4
				Solder .. 2d.	
				Small Screwdrivers	6 1/2d.
				Polished Boxes, 8 x 6, 2 1/8; 6 x 6	3/3
				Basket Adapters	8 1/2d.
				Copper, 15 feet	5d.
				16 Square ditto	6d.
				18 Square ditto	5d.
				3 Twist Drills	1/4
				Solder .. 2d.	
				Small Screwdrivers	6 1/2d.

ACCURACY

CHEAP Instruments are misleading. Serious experimental work can only be accomplished with high-class instruments.

WE supply the world's best at a fraction of their cost price.

Example:—

ELLIOT BROS.
Standard 6 in. Dia.
Moving Coil

Laboratory
Instruments

Volt range 0-25.
Milliamps. 0-8.

For accurate cell testing and
plate current measurement.



Price £2-10-0 carriage paid.

Please send for full illustrated list.

(Special terms to trade).

F. C. HEAYBERD & Co.
9, TALBOT COURT, EASTCHEAP, E.C.3

WHY NOT?

ALL MAKES and Ex-Army 'Phones rewound.
4,000 ohms, 4/8 per pair; 8,000 ohms, 1/-
extra. Postage, 6d. Remounting, 1/- per pair.
Transformers rewound, any ratio. Lowest estimate
on receipt of instrument.
The H.R.P., 46, St. Mary's Road, Leyton, E.10.

THE NATURAL CRYSTAL

ETHITA

Trade Mark

IS SECOND TO NONE.

Sample tubes, 1/-, post free, from A. J. CONWAY,
86, Greenwood Road, London, E.8. 'Phone:
Dalston 4936. (Sole Wholesale Agent for Props.:
Bright Co., London, N.8.).

PANELITE

Will withstand 5,000 volts. Sizes 6" x 6" x 3/16", 1 1/2"
9" x 6", 2/6; 12" x 10", 2/9. Post free. Other
sizes proportionate rates. Will not fracture. Trade
inquiries invited.—RADIO PANEL CO. Dept. P.
8, Westmoreland Bldgs, Aldersgate St., E.C.1.

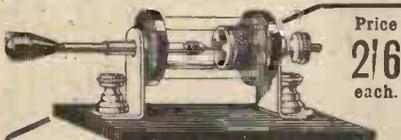
THE SUPER ONE-VALVE SET

Has received all B.B.C. and CONTINENTAL
STATIONS. Loud Speaker results possible.
Simple to operate. Marvellous range and Power.
37/6, plus Royalties. (Genuinely worth £4.)
Buy the World's Best NOW. Thousands of letters
of appreciation arriving from all parts of the country.

SATISFACTION ASSURED!

WORLD'S WIRELESS STORES, WALLINGTON

BATTERY IMPORTER has a quantity of HIGH
TENSION BATTERIES reading slightly below
full voltage, offering at sacrifice price, to clear.—
Write Box D6, Bertram Day's Advertising Offices,
9-10, Charing Cross, London, S.W.1.



Price
2/6
each.

As shown above with half Opat
glass, 2/6 each, post paid.

Manufacturers of various kinds of Detectors.
Factors & Traders, send for Lists & save money.
THE KINGSLAND WIRELESS CO.
380, Kingsland Road, LONDON, E.8.

PLEASE be sure to
mention POPULAR
WIRELESS when
communicating with
:: Advertisers ::
THANKS!

TECHNICAL NOTES.

(Continued from page 73.)

usually mixed with powdered carbon and bound round the carbon rod with cotton webbing, and the whole is inserted into the zinc container, the space between the two being filled with a gelatinous paste containing the electrolyte; the electrolyte is also soaked into the depolariser.

Why Cells Become Dead.

Now there are various reasons why cells become dead. Theoretically, they do so because the depolariser, or the parts of it to which the hydrogen has access, are all used up, or because the zinc is all consumed, or because the zinc is coated with insoluble compounds which prevent the contact of the electrolyte, or because the electrolyte is dried up. In practice, at any rate where the battery is used for the small currents required in the high-tension circuit, the usual reasons are the formation of insoluble compounds on the zinc, and the drying up inside.

This all brings us to a method of reviving the cells. It is inconvenient, and not worth the trouble, to attempt to remove such coatings from the zinc, as this means taking the cell to pieces, and as it is sealed up with hard compound, it will be, for practical purposes, destroyed in the process of dismantling.

The other trouble, however, the drying up, can be more easily remedied, and it is worth while, when some of the cells of your high-tension battery have become useless, to remove them from the battery, puncture a number of small holes through the zinc in each case, and soak them in a solution of sal ammoniac.

Re-Assembling.

The cells should afterwards be wiped dry on the outside, placed in a cardboard case, with pieces of cardboard to insulate the zinc containers from one another, the leads soldered together in series, and the lot put into circuit in series with the remainder of the original battery. I ought to remark,

SECRETS OF THE B.B.C.

(Continued from page 47.)

"Do you collect cigarette cards," I said quickly, changing the subject.

The answer was in the negative, but I realised afterwards that it was an unnecessary question. You don't get cigarette cards with Woodbines.

"No, I only collect stamps—and writs."
"And also Income Tax Forms," I suggested.

"Those I throw away—not collect them."

Having decided that I would not linger for a dance to the strains of next door's piano, which was rendering "On the Back Porch" (etc., and mostly), I bade my hosts good-night, and, barring a slight fall, owing to my tripping over the down lead which runs along the floor and up the stairs, my exit was uneventful.

Presumably, once the man has got the rent no attempt is made to retrieve it, as no brick descended upon me.

Perhaps all the little O's were asleep.

however, that this process of reviving dry cells is not very satisfactory, and you will only add comparatively little to the useful life of such cells in this way, as well as giving yourself quite a fair amount of trouble in the process. But it is well to remember that the drying is the chief trouble with small dry cells, and therefore your high-tension battery should never be left in a warm place.

Another New Valve.

A reader in Brussels writes to tell me of a new valve of his invention which has two or more filaments and two or more grids, which he says is particularly suitable for use as a detector with the grids in parallel, and also as a power amplifier and for reflex work. This valve is at present under test at the Compagnie des Lampes of Paris, and my correspondent, whose English is otherwise excellent, concludes by stating that "as soon as the experiments will be completed, the valve will be put in fabrication," from which I conclude that we shall hear more of it in the near future. I thank my correspondent for his letter, and am sure that if he has something good, readers will be only too pleased to see it on the market. I forgot to mention that the writer is President of the Cercle Belge d'Etudes Radiotelegraphiques et Radio Club de Belgique.

Manipulating Ebonite.

Although ebonite is so hard and brittle under ordinary conditions, it is very easy to manipulate if it is first warmed. The simplest way to bring it to a sufficiently high temperature, without any danger of overheating, is to immerse it in boiling water for about five minutes. On removing it from the water, it will be found quite easy to cut it by means of a knife or scissors, but the cutter must also be heated by immersing in the water. The water must be boiling, not merely hot. After removing the ebonite, the bending or cutting must be done quickly, as the ebonite soon cools and becomes brittle again. Do not attempt to force it, and as soon as you find it becoming hard again, immerse it once more in the boiling water until it is soft. If the piece of ebonite becomes bent, or otherwise distorted in the process of cutting, it can be flattened out by pressing, whilst hot, against a warm metal plate, and holding there until it has hardened.

"Rusting."

Owing to the large sulphur content, ebonite tends to "rust" after months or years, particularly if exposed to strong sunlight or certain kinds of fumes. If this should happen, and the once black ebonite becomes brownish or grey, the surface may be scoured with steel-wool and some thick oil, until the black part is exposed again, when its insulating properties will be found to have been considerably improved. Ebonite should be drilled with ordinary twist drills, as used for metal, and should be backed against a thick piece of soft wood against the lathe stock; it should never be drilled when very cold; if the weather is cold the ebonite should be gently warmed before drilling, to prevent splitting. The drilling should not be done too fast, either, as this may warm the ebonite round the drill, making it "cheesy" and giving a bad drilling.

Oh it is excellent to have a giant's strength"

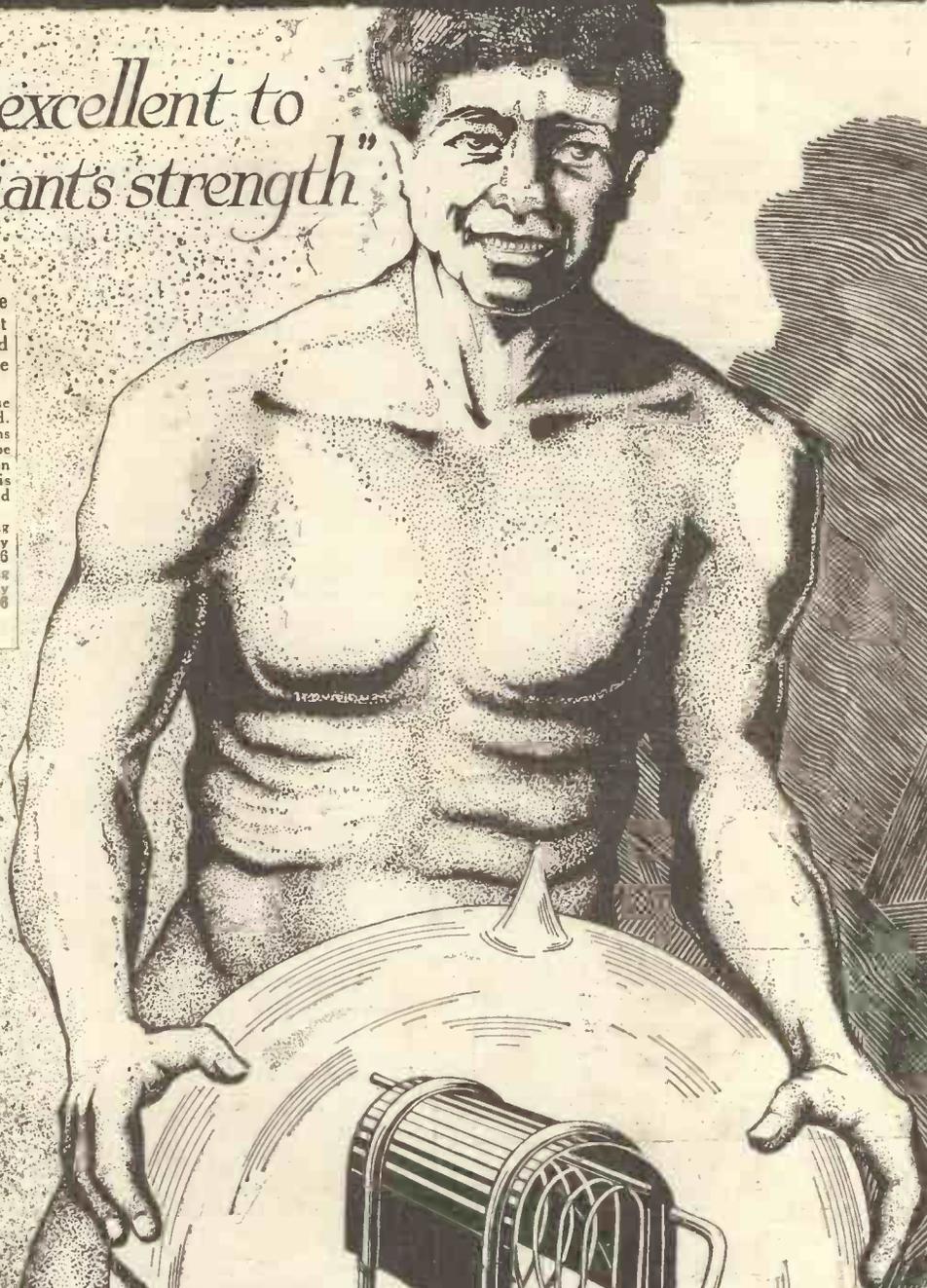
AT LAST a giant valve—a valve with giant strength, giant results and giant life but still the same neat convenient size.

You will appreciate the unique design of the Mullard Grid. Its undercurving convolutions permit no downward escape of your valuable electron emission. You can get this Master Valve in two specialised designs.

MULLARD H.F. Red Ring Valve for high-frequency amplification or detection 12/6

MULLARD L.F. Green Ring Valve for low frequency amplification 12/6

Write for leaflet V.R. 18.



MULLARD

THE MASTER VALVE

Advertisement of—The Mullard Radio Valve Co., Ltd. (P.W.), Nightingale Works, Nightingale Lane, Balham, S.W. 12.

British Empire Exhibition, Palace of Engineering, Avenue 14, Bay 13.

LISSENIUM. Parts that pull together

Sharply tuned Concerts from far away

Your valve can detect with extraordinary power—if properly controlled. An ordinary rheostat is quite inadequate for delicate tuning. Only by accurate control of critical electron emission can success in distant telephony be achieved.

Fit Lissenstat Control—it will remove the handicap under which you have laboured. The first time you use it, it will seem a revelation.

Takes only a minute to fit—and all who value the importance of fine detection are fitting it.



**LISSESTAT
MINOR**
(Patent pending)

Specially introduced to give Lissenstat Control at a popular price. Is replacing thousands of inefficient rheostats

LISSESTAT (Patent pending) 3/6
LISSESTAT UNIVERSAL (Patent pending),
with its unique protective device for dull emitters 10/6

Get more out of the valve by using unique control.

Is your leak resistance right?



With the Lissen Variable Grid Leak fitted a receiver is equipped to yield the utmost sensitivity which correct grid potential under all conditions implies.

Lissen One-hole fixing, of course, positive stops both ways

LISSEN One-hole fixing, of course, positive stops both ways 2/6
LISSEN Variable Anode Resistance, 20,000 to 250,000 ohms, same outward appearance as the Lissen Variable Grid Leak 2/6

NEW

LISSEN LINES—ready for delivery:

LISSEN L.F. Choke 10/0
LISSEN Safety Resistance 1/3
LISSEN 5-point Switch 4/0
LISSEN Reversing Switch 4/0

LISSEN LINES—nearly ready:

LISSEN Crystal Set, will sell for under £1. New and attractive features.
LISSEN Three-Coil Holder.
LISSEN Two-Coil Holder.

DON'T MIX YOUR PARTS. A Receiver built with all LISSEN parts will give results which could never be obtained with mixed parts. USE A LISSEN PART WHEREVER YOU CAN.

LISSEN LIMITED,

8-16, Woodger Road, Goldhawk Road, Shepherd's Bush, London, W.12
Telephones: 3580, 3381, 3382, 1072 Hammersmith, London.
Telegrams and Cables: "Lissenlum."

PARTS WITH HIDDEN POWER—BUILD WITH THEM.

With ordinary parts in your receiver, the first time you use the set you get the best results you will ever get.

When you buy LISSEN parts you have parts that you can put together knowing that your reception even first of all will be better than is possible with ordinary parts, but there is this difference too—the Receiver will yield continually improving results as your own skill improves—for there is a reserve of power in each essential part which outward appearance gives no indication of.

Are you using Radio Frequency Amplification?

Every set can be made much more powerful by fitting LISSEN Radio Frequency Amplification. Wave energy can be built up so that distant telephony is picked up with a certainty which was quite lacking—signals that may be deflected by "dead spots" are also built up so that any shielding effect is largely negated.

There are Three types of Lissen Radio Frequency parts—

LISSEN H.F. TRANSFORMER

There are some dual and reflex circuits where transformer coupling of H.F. valves is essential. Even where it is not essential, however, the LISSEN H.F. Transformer is very popular. It makes a receiver exceedingly sensitive, and is very stable—as many stages of H.F. as desired can be used. Blue print with each shows easy connections. Range 150—4,000 metres

19/6

LISSEN ONE-HOLE FIXING, OF COURSE.

LISSEN REACTANCE

In addition to adding sensitivity, this will actually amplify even loud signals to a great degree. It differs from the LISSEN H.F. Transformer in that, although simple to use up to two stages, beyond this number it calls for some skill. It is a very widely used coupling. Should be introduced into the anode circuit. Blue print with each shows easy connections. Range 150—10,000 metres

19/6

LISSEN ONE-HOLE FIXING, OF COURSE.

LISSEN REGENERATIVE REACTANCE

This is an unequalled first stage Radio Frequency Amplifier. It provides fully variable reaction. It should be used in the anode circuit of the first valve—it takes the place of aerial reaction, or can be used with it—it is non-radiating—replaces plug-in coils—is lower in cost than a set of coils to cover the same wide range—easier to handle, one knob controls tuning and reaction—reception is often possible with both aerial and earth connections dispensed with—cuts out any nearby station, and tunes-in the others with full built-up strength—effective on both high and low wavelengths—unbroken regeneration over the whole range 150—4,000 metres



£2 12 6

Tune always with a Vernier; preferably use the LISSEN Vernier, which is specially designed for fine tuning in H.F. circuits. Price 12/6

NOTE. LISSEN H.F. Transformer and LISSEN Reactance are self-tuned, but the aid of a Vernier is recommended and will oftentimes be found an advantage (the LISSEN Vernier is preferable).

All LISSEN Radio Frequency parts are complete with internally connected switch, so that drilling and soldering are avoided, and fitting is a matter of great ease.