

TELEVISION: SOME AUTHORITATIVE FACTS (See Page 7.)

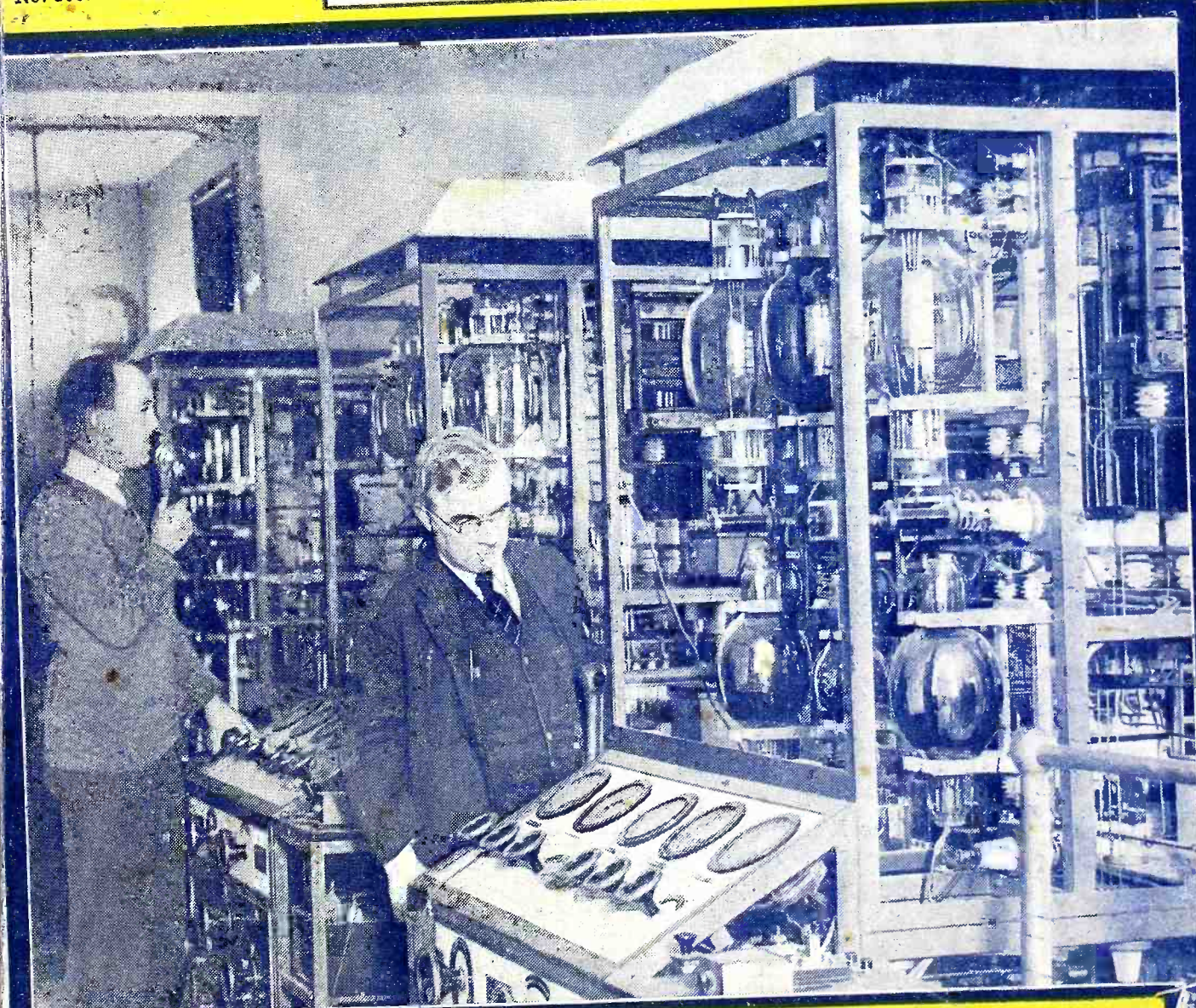
Popular Wireless

Every Thursday
PRICE
3d.

No. 300. Vol. XIII.

INCORPORATING "WIRELESS"

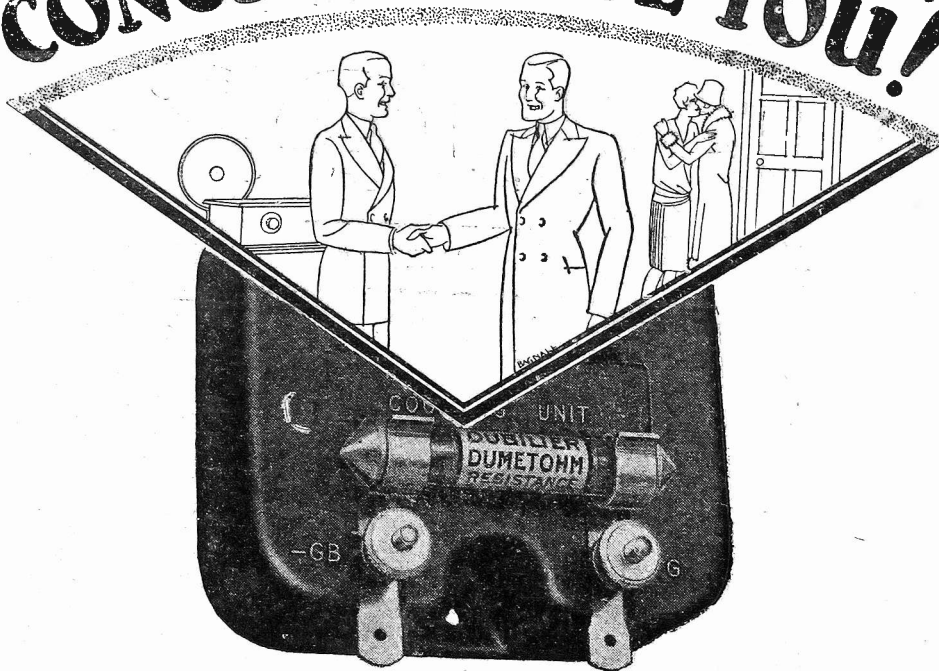
March 3rd, 1928.



Building a Home "Television" Outfit.
A WARNING TO OUR READERS.
By G. P. Kendall, B.Sc.

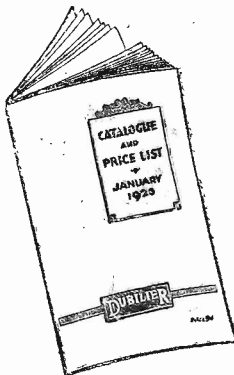
Our cover photograph shows the transmitting room at the new Air Ministry Radio Station at Mitcham.

YOUR FRIENDS WILL CONGRATULATE YOU!



—on the improved performance of your set; on its remarkably increased clarity of reception with yet sufficient volume: meanwhile they might wonder at the cause. They would be astonished if you told them—that it was due to your having fitted a Dubilier R.C. Coupling Unit to your set.

Some may tell you they have tried Resistance Capacity Coupling as the recommended means of obtaining purer amplification, but with a disappointing decrease in volume. Yet the fault lies not in the method—mostly it emanates from the various components in the set having been carelessly selected.



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Advt. of The Dubilier-Condenser Company (1925), Ltd., Ducon Works, North Acton, London, W.3. ©119

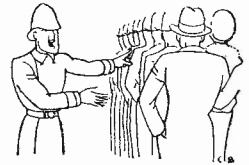
DUBILIER DICTA



No. 8

There was a man who considered himself destined to become a great singer; wherefore he dreamed of his voice moving vast crowds at Covent Garden. And as, day by day, he dreamed, he sang constantly: until a neighbour reproached him for his imperfect playing of a saxophone.

Whereupon his dream was shattered.



Nevertheless it happens vast crowds are moved by his voice at Covent Garden; for he cries to them "Move on" as he stands on point duty.



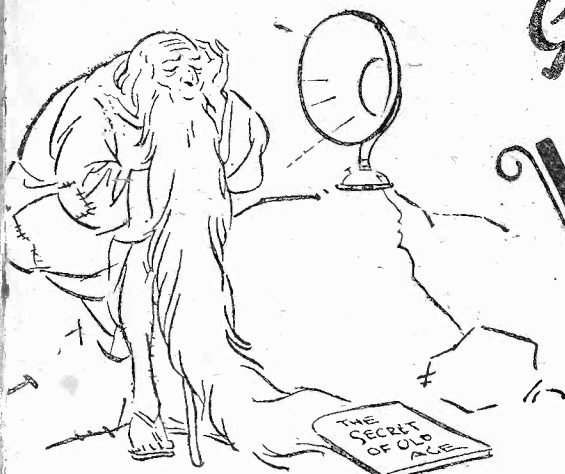
Moreover, there was a man who had a Wireless Set; and strange sounds came forth from his loud-speaker. They were not of France, nor of Germany, neither were they of Italy. Verily, thought the man, they are of Walloloo land: and the man was proud of his achievement; but a neighbour declared them to be of distortion.

Whereupon the man's dream was shattered.



Nevertheless, his neighbour prevailed upon him to fit a Dubilier R.C. Coupling Unit to his Wireless Set: whereupon its reproduction so vastly improved that the man forgot his unhappiness.

Whether the above appeals to you or not, what undoubtedly will appeal to you is the Dubilier R.C. Coupling Unit, embodying the famous Dumetohms.



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Of all the good things a Marconi Valve offers you, one of the most outstandingly good is its very, very long working life. Marconi Valves are very Methuselahs (or is it Methuselahs?) for age. And they are one hundred-per-cent bullmen for work. Read this for instance, Mr. E. Revill, Radworth, writes, Feb. 9th, 1928.

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Price 12/6
Fil. volts - 2.0 max.
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With the Met-Vick 5, it is at last possible to obtain a wireless receiving set which will always give the satisfaction that only comes from really brilliant performance, and which will remain a constant source of pleasure and interest to all who hear it.

Ask your dealer for a copy of Brochure
7117/9, or write to the makers.

Those who are content with the alternative programme of their Local and Daventry Stations, but who desire the advantage of Mains operation cannot do better than obtain the Met-Vick 3 Mains Set fully described in List 7117/10.

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BY THE WONDERFUL

COSSOR

"Melody Maker"

Advt. A. C. Cossor, Ltd.
Highbury Grove, N.5.

Popular Wireless

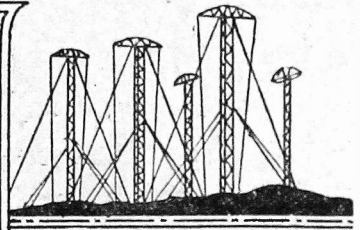
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RADIO NOTES AND NEWS.

Kalundborg—The Latest Marvel—A Record Meeting?—Cologne on a Crystal Set!—France
Breathes Again—Safety First—Royal Listeners.

"Merrie England."

WHAT did you think of those two performances of "Merrie England?" Is not this opera a delight? The B.C. should repeat it six times a year, and do the same with Liza Lehmann's "Song Cycle," and Gounod's "Faust."

Kalundborg.

UNDER a recently-published photograph of the Kalundborg station we mentioned that we had not received many reports of its reception. Our readers promptly remedied the matter, writing in overwhelming numbers. Please accept our thanks for all the letters; it is difficult to pick out any for special mention. They all agree that this station is a "star," some report slight fading and Morse interference; unanimously agreed that but for this and a few other Continentals, the B.B.C. would lose a lot of licence money.

The Latest Marvel.

TALK about the genie in the bottle! It's come true at last. A Glasgow paper, describing Mr. Baird's transatlantic experiments, says, "Meanwhile, wireless communication in Morse was being kept up between the chemists at 8s. and 7s. per bottle, or direct, post free, from," etc. I am surprised that a Scotsman should buy bottled Morse when such a large free supply is available. Why doesn't the B.B.C. bottle Chamber Music and sell it as weed-killer? It's a long time since they branched out into a new business.

The Broken Promise.

I AM reminded by a reader that when 5 G B was put into service the B.B.C. promised that its programmes should be free from "Talks," but that these have at last begun to creep in. Too bad! Enough to give one the heebie—G B's! Will the B.B.C. kindly overhaul its records relating to this matter, and, as Captain Cuttle would say, "When found, make a note of?"

A Record Meeting?

NOT all British learned societies are old-fashioned and conservative, for surely the very successful joint-meeting of the British Institution of Electrical Engineers in London and its

American counterpart in New York, held by means of the wireless telephone service, was bang up-to-date. All went without a hitch, and speeches and votes of thanks were exchanged; loud speakers were used for reception. Pretty good, eh? Three thousand miles of water, or thereabouts, and twelve hundred miles of land line!

New Valve Test.

JUDGING by the trend of science, the best way to test a valve is to put it under a steam-hammer. The Edison Swan Electric Company states that they gave a railway porter a case of 50 Edison valves (P.V. 2) to test. Instinctively he threw the case on the line in front of an express train. The valves were then collected and taken to the mortuary; 41 sat up and asked for a cigarette—quite O.K.; 4 were past hope; 2 had broken filaments; 2 were distorted but had intact filaments, and 1 was like the eleventh little nigger-boy—not there. Why not use triplex glass? And did they search the station-master for the fiftieth valve?

Cologne on a Crystal Set!

THIS is not one of those yarns so beloved of the Ancient and Honourable Order of Cat's-whisker knights, but a pretty way of putting what the B.B.C. may make possible this month, during its experiments with Continental relays. The first attempt will be on March 11th, 10.5 p.m. to 10.30 p.m., when the Legia Choir from Liège will be relayed by 2LO and 5XX; the second on March 12th, 8.0 p.m. to 9.0 p.m., when the same stations will relay an opera or concert from Cologne. "Where is that lovely music from?" says the wife. "Oh—de Cologne."

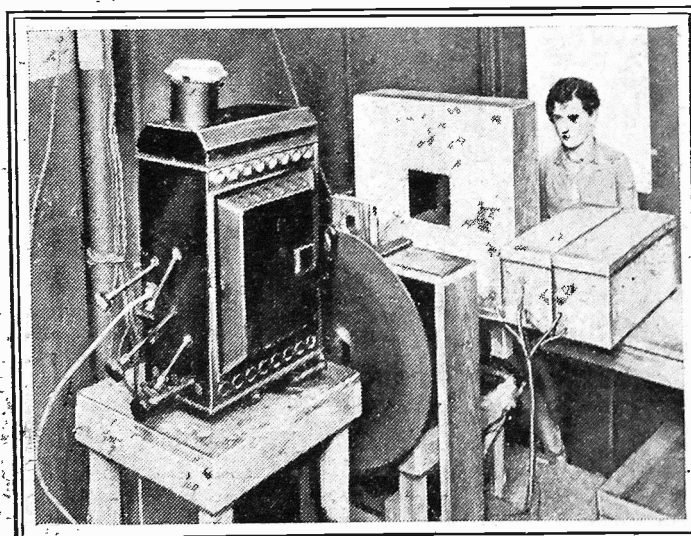
PCJJ.

WE are informed that PCJJ will transmit, until further notice, on Tuesdays and Thursdays, from 15 to 19 G.M.T., and on Saturdays from 14 to 17 G.M.T.

Amateur Transmitter.

MR. D. E. PETTIGREW, 20, Hollin Park Mount, Oakwood Lane, Roundhay, Leeds, asks me to say that he hopes to be transmitting before long on 150-200 metres, under the call-signal G 2 D P. He is fully licensed. But—

AMERICA'S "TELEVISION" PROGRESS.



This is the "Television" transmitting gear used in the recent demonstration staged by Dr. Alexanderson, the Research Engineer of the American General Electric Co. Backed by a mighty organisation, this scientist has been unable to show that true "television," or, shall we say, useful television, is, as yet, even a remote probability.

The Over-Ruling Passion.

IT is sad to read about the Rochdale lad, aged 21, who having been denied a transmitting licence in 1925, was discovered in 1927 to be sending like one o'clock. Cautioned and ordered to discontinue, That was in June, but in October he was found to be in full blast again. Now somebody has had to find £10 5s. 0d. to satisfy the law, and

(Continued on next page.)

NOTES AND NEWS.

(Continued from previous page.)

the gear is forfeited. One cannot condone his law-breaking, but nevertheless a youngster with an enthusiasm like that ought to be encouraged by the issue of a licence.

More Shakespeare.

There was an old monk of Medina,
Who tried to get Stoke on galena,
Though he listened and prayed
Till his ears were quite frayed

Fill in the missing line. No prizes!

Wireless Classes.

I HAVE pleasure in drawing further attention to two series of radio classes which are being held by Captain Jack Frost, on Tuesdays, 7.15 p.m., at the Streatham and Tooting Literary Institute, Bee Secondary School, Beechcroft Road, S.W.17, and Putney Literary Institute, Putney Secondary School, West Hill, S.W.15, on Wednesdays, at 7.15 p.m. These classes, which are really nothing but jolly and interesting club meetings, are crying out for more members of both sexes. Fee: 2s. to Easter, or 4s. to Midsummer. If you want more details before you enrol in person, please write to either of the Institutes.

France Breathes Again.

THE decree forbidding any private station except Radio-Paris to broadcast came as a blow to the French people and to many in this country. Luckily, however, it was recently decided that the matter is one for the Council of Ministers and the French parliament, and so the decree has in effect been quashed. Whatever may be the disadvantages of the B.B.C. monopoly, our method certainly saves our nerves from shocks due to the threatened closure of all our stations while the Government thinks.

His Majesty, the Customer.

QUITE a lot of interest has been shown by readers in the various kinds of treatment meted out by traders to customers, and I have under my hand sufficient libellous material to blow up the Law Courts. One of the funniest letters was from a Scot, who was plainly scandalised to the point of apoplexy. He bought a—a sort of a coil, which wouldn't behave; complained to the seller; seller said: "Coils reversed", and connections must therefore be reversed, but "if you do not feel disposed to do this, return the coils and I will wind 'em properly." Mon! I tell ye! Return the coil and lose a week's broadcasts for which I can get no rebate from the B.B.C.? Hoot!

A New Idea.

THE radio trade shows no lack of enterprise and ingenuity, and my post generally contains a lot of "literature" which is well worth perusal. Only to-night, for instance, I have received from Harlie's a neat folder with illustrated descriptions of some components which make the coins burn holes in one's pocket, and in this folder is a "log," giving names, call-signs and wave-lengths of stations, with spaces for dial settings and notes. A handy thing for the radio man. For discriminating set builders the Harlie components are well worth examination.

A Present for a Good "Ariel."

TALKING of "trade" literature, which I have to study in the interests of "P.W.'s" ten million readers, I thankfully acknowledge the gift of a copy of "The Rag Bag," an Annual produced by the University of Manchester. It proved to be, as the donor hoped, a revival. From cover to imprint it is a colossal "skit," exceedingly witty and laughter-provoking. How I wish the Editor would issue a "P.W." Annual on the same lines. Even the ads. in this tonic are humorous. I quote one gem from the text. "What is at the bottom of the Manchester Ship Canal?" Answer: "Lancashire." I am always open to such refreshers, including complete sets of Hardy, Conrad and Bennett.

Scientific Note.

A PUZZLED "P.W."-ite sends me a clipping from some of the aforementioned "trade literature," wherein an H.T. battery is advertised as providing "pure D.C. current," and asks what kind

SHORT WAVES.

SIMPLIFIED.

Teacher: Johnny, how do you spell Schenectady?

Johnny (without hesitation): W G Y.
"Radio News."

REACTION—The morning after that bachelor night party.

A SLIGHT DIFFERENCE.

"Is your neighbour's set portable?"
"No, insupportable."

Bold Fellow: The B.B.C. announcer who said: "Good-night, everybody. I'll see you all later at the night clubs."—"Sunday Pictorial."

Broadcasting is still in its infancy; that is why we hear so much howling.

LOCATION UNSUITABLE FOR RECEPTION.

Mouse No. 1: Why aren't you going to be married here at Station 2 L O P. Don't you think this nice basement is suitable for the wedding?

Mouse No. 2: No, indeed! I don't think any self-respecting mouse should marry beneath her station.

An enterprising housewife puts the clothes-horse in front of the loud speaker whenever political speeches are broadcast.
A novel method of drying the washing by hot air.

THIS EVOLUTION.

As a culminating effort in the history of broadcasting talks the B.B.C. has acquired a parrot which is being trained to appear before the microphone.

Thus culture broadens slowly down from precedent to precedent.—"Daily Herald."

A Radio Announcer named Bevan was out motoring with his family of seven. When his steering gear broke
He said to his folk—
"We're now changing over to Heaven."

of current is that? Answer: We have hitherto demanded only voltage from our H.T. battery. The current is thrown in as a gift. D.C. current is a sort of cousin, twice removed, to L.F. frequency; bred from A.C. current out of H.F. frequency. Very sporting!

Royal Listeners.

AMPLIONS tell me that the mother of the King of Roumania has acquired one of their cone loud speakers. "Radiomania in Roumania," eh? This firm is to fit up the Melbourne Motordrome with twenty loud speakers. So Britain still has a shout coming.

Tonsorial Note.

MY revelation a few weeks back about my red whiskers has evoked a number of letters, mostly sceptical. Being now a marked man I am looking for a good permanent dye. I saw some of my talkative co-lunchers again last week and observed their ill-concealed nervousness as one of them described a most wonderful circuit. But I had the danger-signal tucked into my collar.

"Safety First."

I WAS telling a friend about the little flash-lamp gadget mentioned in my Notes of February 18th, and he said, why not connect the lamp permanently in series with the filament, so that it can act as a safety-fuse? The idea looks good, especially for sets entirely operated from the mains.

The "Variocycle."

WHAT'S this about the alleged new wonder-unit designed by a Worthing man? I gather that it is a component which takes the place of the aerial tuning condenser, coil-holder and coils. This knowledge, plus the name, points to an improved type of variometer. Bare wire is wound off one threaded drum on to another, which is made of ebonite; "dead end" effect is said to be absent. May be very efficient but does not sound novel, and I myself prefer good plug-in coils. A reader who draws my notice to this, says he cannot often get 5 G B at full L.S. strength on his 4-valve set at Willingdon, near Eastbourne. For goodness sake, why not? Friend, you need a radio doctor, not a variocycle. Are you screened by the Long Man of Willingdon?

The Business Touch Again.

I CAN see that if Britain is to increase its trade it must encourage the colonies to migrate to our shores, for some of them appear to be populated by a race of hard-bitten bargain-biters. Here is a letter, just received from a certain coral strand. "Dear Sir, dear sir or madam, advertising to the adverts in your esteemed advert columns you are hereby requested to enrol my name and address as agent for only best engineering houses in realm. Principals required to send numerous samples, returnable if not sold presently, and quote highest discounts to guaranteed Br. Citizen, vaccinated and passed 2nd class Freehand Drawing." Yes, sar!

Radio, Rain, and Heat.

DORLAND Advertising, Ltd., have sent me a pamphlet called, "Climate and Commerce." The idea is that with this to guide him the British trader will know when to export his goods. I fancy the radio trader does not care a hoot about rainfall so long as he gets his cash. I have, however, taken the trouble to analyse the figures. If you make umbrellas you should export to Bombay in July, it is the rainiest place on earth then, with Rangoon a good second. On the other hand, if you make refrigerators you should try the Nagpur (India) market in May, when the average temperature is 94°46' degrees.

TELEVISION

SOME AUTHORITATIVE FACTS

BY DR. J. H. T. ROBERTS

F. Inst. P.

Below we publish an article on the problems of Television by our Scientific Consultant. Dr. Roberts is one of the most distinguished of the younger generation of British scientists. He has been connected with three British Universities, and has been engaged in scientific research for over ten years with conspicuous success, having collaborated with some of the leading scientists in the world, such as Sir J. J. Thomson and Sir E. Rutherford. Dr. Roberts worked at the world-famous Cavendish Laboratory of the University of Cambridge, and after numerous academic honours and various important scientific posts he has specialised in the commercial and industrial applications of science. Dr. Roberts has marked characteristics of moderation and caution in all his opinions, and, therefore, we think his views on Television should be of peculiar interest and value to the public.

THE EDITOR.

A view of the interest which has lately been aroused by the phrase "seeing-by-wireless," I have been requested, as Scientific Consultant to this journal, to set out some of the facts as to what has already been accomplished in this direction and, as the likelihood of further progress in the near future.

The idea of seeing-by-wireless, on a screen, a moving picture of events taking place at the same moment many miles away, certainly one to seize the imagination and, therefore, it might be expected that any suggestion that such a thing was an accomplished fact would give rise to considerable interest in the public mind. People have now become so accustomed to the representation of moving events as shown by the cinema that they are probably ready to believe that similar representations of simultaneous moving events may be possible by means of radio.

What Has Been Accomplished?

If you could go into a cinematograph theatre and see on the screen the same kind of pictures that you are used to seeing at present but with the added knowledge that the events portrayed were actually taking place at that moment miles away, you would indeed feel that a wonderful aid had been given to mankind.

When the public hears the phrase "seeing-by-wireless" there is little or no doubt that something along the lines I have just sketched is what arises in their minds. If they are told that "seeing-by-wireless" is an accomplished fact they quite naturally expect—without giving any serious thought to the matter—that they are going to see something more or less equivalent to what

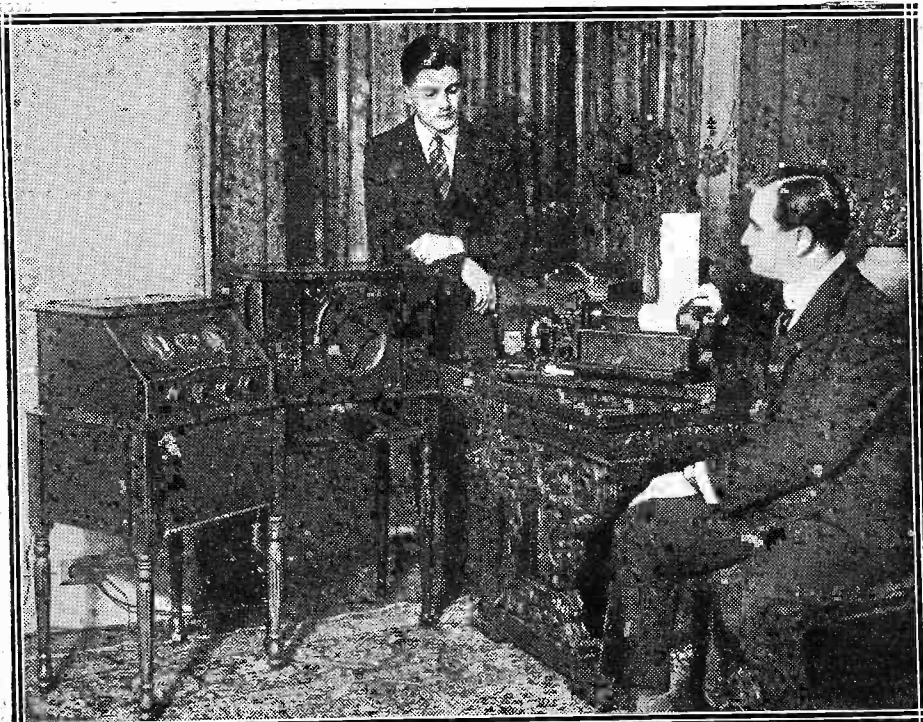
they see in their ordinary daily experience, or what is put before them at a cinematograph theatre.

Now let us turn to the question of what has actually been accomplished by television. The subject of television (seeing-by-

wireless) is one which has engaged the attention of experimenters in several parts of the world for some years past. The best-known investigators in this field are probably Dr. Alexanderson, the Chief

(Continued on next page.)

SENDING PHOTOGRAPHS BY RADIO.



By means of the apparatus shown above, photographs sent from Fifth Avenue, New York, via the Bellmore (Long Island) broadcasting station, were picked up in the home of a New York scientist. After reception they required developing and fixing, just like an ordinary photograph.

TELEVISION.

(Continued from previous page.)

Consulting Engineer to the General Electric Company, New York; Dr. Ives, of the American Telephone and Telegraph Company; Mr. C. Francis Jenkins, United States; Mr. J. L. Baird, of London; and Mr. Mihaly, Germany.

Most of these investigators claim to have demonstrated television in a more or less rudimentary form over distances ranging from a few miles to a couple of thousand miles (across the Atlantic), and hopes have been expressed that the quality and "definition" of the transmitted pictures will be improved in the near future.

As to the actual transmission of crude moving representations, there is no reason to doubt the claims made by various investigators. Indeed, it is a comparatively simple matter to send, either by line-conductor or by radio, crude representations of a simple object such as a face or a hand. But I do not think the most optimistic sponsor of television would pretend for a moment that television is out of its infancy, or that (unless enormous improvements be made in the quality, detail and recognisability of the transmitted images) it is of much service beyond that of a scientific toy.

Distance No Real Difficulty.

In passing, let me remark that the transmission of a moving representation by radio over a considerable distance (2,000 miles across the Atlantic) is a matter of scarcely more difficulty than the transmission of representations over a distance of two yards, although in the former case it is obviously much more spectacular. The point I want

are sent, but in the improvement of the quality, recognisability and "detail" of the moving pictures received. Up to the present, television transmissions have been confined to simple objects such as a face or hand where, even in the absence of "detail," it is possible to recognise the object. If television can be so improved that objects can be transmitted which require for their recognition enormously greater detail than television will be entering the realm, so to speak, of practical politics.

Take, for instance, a view of the interior of a room, which is the kind of scene so commonly forming the background of a cinematograph picture. Here the objects upon which interest centres, namely the actors, occupy a comparatively small part of the whole picture area and, consequently, very much greater detail is necessary in the picture as a whole in order that the details of objects, themselves small compared with the whole picture, may be faithfully brought out.

An Enormous Difficulty.

I will show by a more detailed examination of the *modus operandi* of present-day television systems that the step from the transmission of a simple object, such as a face, which occupies virtually the whole of the picture, to the transmission of a view of a distant scene or of the interior of a room, or even to the transmission of a face in any close detail, is a step of enormous difficulty.

My readers may think that, although this step may be one of great difficulty, it is not necessarily insuperable when we have regard, as we must do, to the way in which the seemingly insuperable difficulties in other directions have been surmounted. At one time aviation by heavier-than-air machines seemed impossible, and, indeed, it might well have remained so had it not been for the invention of the internal combustion engine which completely revolutionised the science of aeronautics. Radio telephony (as used in broadcasting) might have been impossible but for the invention of the thermionic valve. Moreover, as a scientific man I should be the last to assert that anything was absolutely impossible, even flying to the moon, or perpetual motion.

But if by "television" we mean the transmission and reproduction of something equal to, or even comparable with, an early cinematograph show, then it seems to me that the technical difficulties are so enormous as to

constitute as near as may be an insuperable obstacle to any progress very much beyond the present achievement, unless some totally new principle or system be discovered.

In order to appreciate what are the technical difficulties involved in this problem, let us consider for a moment the technique of television.

When we look at an object by the eye in the ordinary way, we receive rays of light from the *different parts* of the object and these rays are focussed upon different parts of the retina of the eye in corresponding positions. The rays of light from the various parts of the object are received *simultaneously*, and consequently the vision of the whole object is simultaneously perceived.

It is a very simple matter to transmit moving pictures if we rely on rectilinear propagation of radiation as with ordinary light rays. But when we attempt to ge

"Progress has been held back in all these systems I have mentioned, however, by the fact that it is extremely difficult—impossible, some will tell you—to construct a mechanism to achieve a speed and accuracy necessary for television. To have any appreciable detail, a picture made up of dots, squares or patches, as television pictures are, should have at least 10,000 dots. When the picture is flashed on the screen ten times a second to give it the appearance of continuous movement, that means that 100,000 dots of light and shade have to be 'seen' separately and in exact order, and transmitted every second—which needs mechanism more delicate than most."

"Professor Max Dieckmann, whom I met in Munich, has scrapped his apparatus which depended on mechanism. His receiver uses streams of electrons, like that of M. Holweck, and now he is trying to make use of electrons at the sending end."

"I shall watch Dieckmann. All the other men will make progress during the year, but unless they discover some revolutionary new idea, any machine they bring out will not be able to approach detail of cinema pictures."

(Extract from an article on Television by Wm. J. Brittain, in "The Review of Reviews.")

away from the use of directional radiation (as used by Nature in the faculty of vision) and to send out radiation more or less at random (as in broadcasting), which radiation carries, impressed upon it, features which are characteristic of the picture, and which are capable, with appropriate appliances, of being transformed back into a representation of that picture, then we enter an entirely new field of technique.

It is obvious—or, at any rate, it seems to me obvious, and I think it is universally agreed—that for transmission of pictures by line or by radio it is necessary to convert the picture, so to speak, into a *series* of effects, which effects are transmitted in a chronological or time-succession; in other words, *one after another*. These effects—which, to be more particular, we may now call "impulses"—are received at the receiving end in the appropriate way, and are built up to re-form the reproduction of the original picture.

Present "Television" Systems.

In television systems the method employed by all investigators, so far as I am aware, is to "explore" the object—a picture, a face, or whatever it may be—by means of a spot of light, or by the focus of an optical system, or by some equivalent. Let us suppose, for simplicity, the object is explored by a small spot of intensely bright light, and let us also suppose, for simplicity, that the "object" is a picture 10 in. square. The exploring spot of light may start at the top left-hand corner and travel rapidly downwards along the left-hand edge until it reaches the lower left-hand corner, after which it commences again at the top, but a little bit to the right, and follows a second path close and parallel to the original one. In this

(Continued on next page.)

RADIO AID TO ART.



"When something lively comes on I imagine horses moving, and that makes me want to draw them," says this twenty-three-years-old Surrey workman, who has had an oil-painting accepted for exhibition in the Dublin Salon.

to bring out is that, having accomplished radio-transmission of moving pictures at all, the increase in the distance between the sending and receiving stations involves comparatively little further technique.

If television has any real future it lies, in my opinion, not in the increase of the distance over which moving representations

TELEVISION.

(Continued from previous page.)

may it rapidly traverses a series of parallel lines, starting at the left-hand edge and progressing across the picture, and finishing at the right-hand edge. Of course, instead of moving always from top to bottom, it may vibrate up and down, and the motion may be from right to left, or the lines of exploration may be of a circular character, and so on.

The amount of the light which is reflected from the picture will obviously depend upon whether the exploring spot is passing over a dark or a light portion of the picture. If it is passing over a dark portion, less light will be reflected, and conversely, the reflected beam thus varies in intensity

200 tracks across the picture in 1-25th of a second, or it makes one passage across the picture in 1-5,000th of a second.

Now let us see what is going to happen when the spot is passing over a fairly small detail of the picture. Let us suppose that the detail in question is a man's eye, and that it occupies an area of 1-20th of an inch square in the picture. The exploring spot will travel over this feature (since it has to travel 10 in. in 1-5,000th of a second) in 1-1,000,000th of a second (one millionth of a second).

The variation of the intensity of light in the picture which is to be transmitted is sent out as a modulation upon a radio carrier-wave. If we use a wave-length of about 100 metres (which is about the kind of wave-length that investigators in this field have used) we have a carrier-wave frequency of approximately 3,000,000 vibrations per second. Therefore, we have to impose upon

"I do not wish to be unduly sceptical," says our Scientific Consultant, "nor do I seek to minimise in any way the efforts and achievements of those who are studying this problem.

But, at the same time, I feel that the obstacles in the way of any appreciable further progress are so enormous that undue optimism ought not to be indulged in."

strength in accordance with the features of the picture as the exploring spot passes over them.

Now it will be evident that the exploring spot will be unable to pick out objects or details of the picture which are smaller than itself. Therefore, in order that fair detail may be picked up from the transmitted picture, it is essential that the exploring spot be at least as small as the details which are to be brought out.

Analysing the Picture.

Let us take, as a very rough notion, a square spot 1-20th in. square. When this spot has travelled down the picture at the left-hand edge, and is making its second journey, it will be clear that its second path should as nearly as possible be edge-to-edge with its first path, without either overlapping or leaving a space. If perfect conditions are secured, the exploring spot must make 20 excursions in the space of an inch along the upper edge of the picture; or, if the picture is 10 in. wide, a total of 200 excursions in order to get across the picture. The whole picture must be explored in this way in a period of time which is smaller than 1-16th of a second, as the whole system depends upon what is known as the "persistence of vision."

Here are the "Snags."

It has been found that if the eye receives a number of separate but slightly differing impressions at the rate of not less than about 16 per second, they are not distinguishable as separate impressions, and the brain receives them as a continuously-moving effect. As a matter of fact, although 16 pictures per second must be sent, the actual time for the exploration of the picture is considerably less than 1-16th of a second; and, to put the most favourable construction on it, we may put it down as 1-25th of a second. It has even been estimated by some experts in America as being 1-80th of a second. However, let us take it as 1-25th of a second for the moment.

The exploring spot, then, has to make

It must also be remembered that the exploring apparatus at the transmitting end and the corresponding apparatus at the receiving end are basically mechanical, and it is not difficult to appreciate that extreme mechanical refinements are necessary properly to explore a picture in a manner to correspond to a "screen" of even so coarse a grade as 50 to the inch.

More Difficulties.

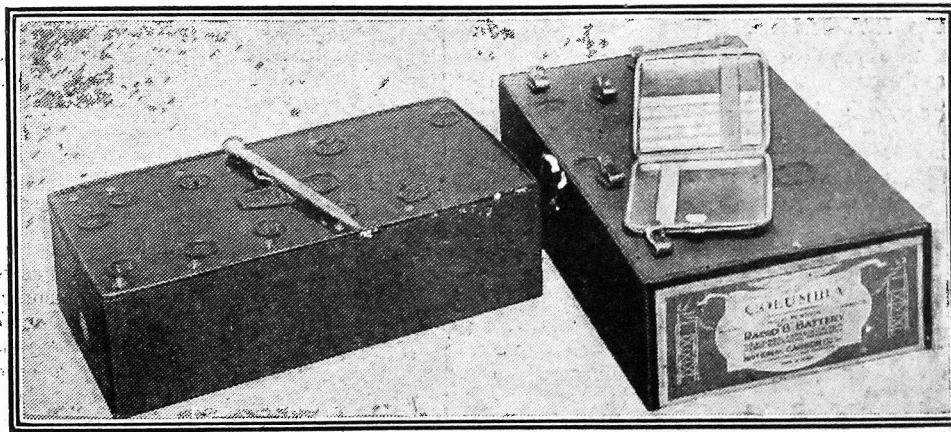
But this is by no means the only difficulty involved. At the transmitting end, the light received from the exploring spot must be made to operate a light-sensitive device, such as a "photo-electric cell." This device must be able to respond to variations in the strength of luminosity, which may in any case be feeble in average strength, and, furthermore, it must respond faithfully at the enormous speed of variation which has been indicated above. Television experimenters have, as a rule, maintained secrecy with regard to their photo-electric pick-up devices, but from my general experience of this subject (and I think other scientific men will have no hesitation in agreeing with me) it seems exceedingly unlikely that a photo-electric device, capable of responding to variations in an already feeble illumination and at a rapidity represented by a change in 1-20,000,000 of a second, will be forthcoming in the near future.

In thus outlining the main difficulties involved in television, and in stating, in effect, my opinion that television, so to speak, "has a very long way yet to go," I do not wish to be unduly sceptical as to the prospects of development, nor do I seek to minimise in any way the efforts and achievements of those who are studying this problem in different parts of the world. But at the same time I feel that the obstacles in the way of any appreciable further progress are so enormous that undue optimism and pious hopes ought not to be indulged.

It may be that some totally new principle will be discovered, but at present that appears to be extremely unlikely.

So far as I am concerned, I can only say that if anyone can reproduce, by television, moving pictures even remotely comparable with those shown by the present-day cinema, and if they can do this within the next ten years, they will have accomplished something which is entirely beyond my humble expectation or the expectation of any of the distinguished scientific friends with whom I have ever discussed this matter.

DON'T DO IT!



A sure way to spoil an H.T. battery is to short it. This can be easily done by carelessly putting a metal pencil, cigarette-case, or similar object on the battery. This is a sure way to spoil a battery that might with fair treatment have lasted months longer.

BUILDING A HOME "TELEVISION" OUTFIT!

In the first issue of "Television" the constructor is invited to build a home television outfit and, as we have always made it our business to advise amateur constructors, we publish below an impartial but critical review of the instructions given.

By G. P. KENDALL, B.Sc.

MY own attitude towards this televisior is that of the keen constructor exploring for the first time what seems superficially a most fascinating field for experimental work. Naturally, one's first impulse is to inquire what results will be forthcoming when the apparatus has been built, and, after reading the whole article carefully, it was realised that the instrument seemed to be of the nature of a working model rather than a practical equipment for reproducing images transmitted from a distance. All that should be expected, apparently, is that simple objects placed in one part of the apparatus will be reproduced in outline at another point in the same instrument.

An Expensive Valve.

One's next thought is obviously as to the cost of the outfit, and at first sight this does not seem likely to be very heavy. On looking into the point a little more closely, however, two features are discovered which put a very different complexion on the affair. First, it is to be observed that the last valve of the L.F. amplifier "should be of the transmitting type (for example, a Mullard O.40)."

Now, the O.40 valve costs £2 15s., according to my list, and requires an 8-volt accumulator large enough to supply its filament with the necessary 2.4 amps, which means a pretty big battery (remembering that there are four other valves as well). In some cases it may be possible to run this filament with A.C. from a step-down transformer, but there are considerable difficulties.

The other financial point concerns the H.T. supply, and here one learns that "As much as 600 to 700 volts may be necessary on the circuit shown to give a bright image." (NOTE.—No circuit is shown in this article.) At this point it becomes obvious that the cost is going up by leaps and bounds. Where is one to get a 600-volt direct-current supply capable of running a valve as big as the O.40?

The H.T. Problem.

The problem is a familiar one to the amateur transmitter, who realises its difficulty. One of the simplest and most satisfactory solutions is to use a high-tension motor generator running either from the mains or a 12-volt accumulator of considerable size, but the cost of such a machine will be in the neighbourhood of £20 to £25, unless one is very lucky in getting an ex-Government outfit really cheap. Again, it is possible to make a rectifying and smoothing apparatus to work from A.C. mains with a step-up transformer; but even so the expenditure will be heavy, and the job is most emphatically one for a really experienced experimenter who is familiar with the risks.

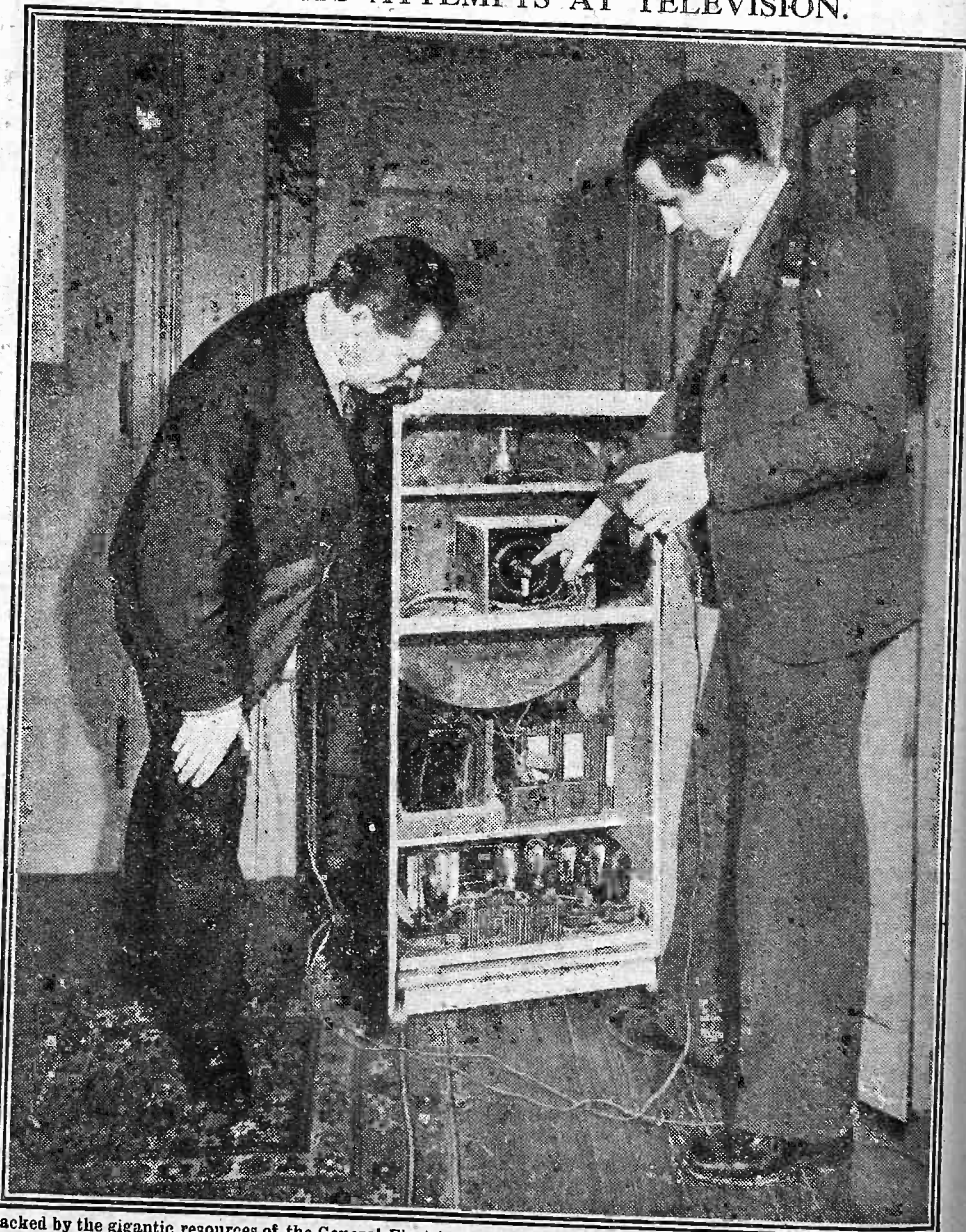
So much for "What will it do?" and

"What will it cost?" Now comes the final question, "Will it be easy to make and operate?" Here again my first impression on looking over the design and considering its construction was that nothing very difficult was involved. Certainly, the actual constructional work seemed such as any reasonably handy man with a few tools could tackle successfully, but on turning to the operating side I was very greatly surprised (I choose my words carefully) to find that no less than FIVE stages of TRANSFORMER-COUPLED L.F. amplification are recommended in quite a matter-of-fact fashion.

A Grave Danger.

Finally, what about the difficulty of handling the "600 to 700 volts" which is advised for the H.T. supply to the last valve? Having had some experience of high-power amplification work for moving-coil speakers, the first thing which strikes me here is the very serious danger involved in the use of voltages like this without far more elaborate precautions than any ordinary constructor is likely to think of taking, unless he is most solemnly warned and unless appropriate safety devices are explained in detail. The risk is a very grave one. Such voltages are quite capable of administering a fatal shock.

AMERICA'S ATTEMPTS AT TELEVISION.

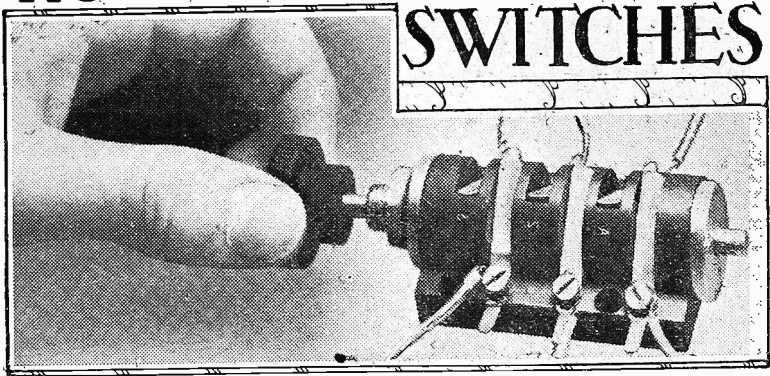


Backed by the gigantic resources of the General Electric Company, Dr. E. F. W. Alexanderson is tackling television problems at Schenectady, N.Y. He is shown above (left) inspecting an outfit designed for television in the home.

BARREL switches combine some of the advantages of lever-operated panel switches with those of the open switchboard type. A barrel-switch can have quite heavy contacts, and yet it can be mounted behind the panel, operated by a single knob in front of it. The switch shown in the photograph was made to carry fairly heavy currents, while neatness of the exterior of the apparatus was a consideration.

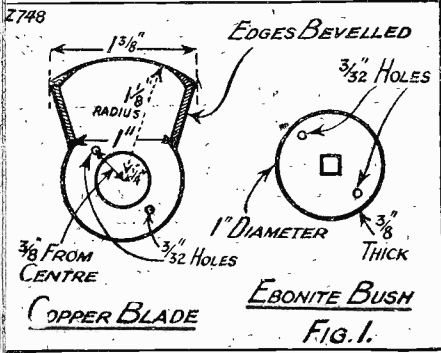
The component shown provides for a 4-point double change-over, but by making the shaft longer or shorter switches may be made on similar lines of any required size. The minimum length of shaft required between the blades of the switch is $\frac{3}{4}$ in., to allow clearance between the contacts. To lower the capacity between the contacts, the distance between the blades $\frac{1}{4}$ in. in the switch illustrated.

HOW TO MAKE PANEL SWITCHES



A little patience, very little skill, and some pieces of "junk," are the main ingredients of a neat, efficient, double-pole, double-throw, push-pull type of switch.

By A. V. D. HORT.



The shaft is a variable condenser spindle, which has a squared portion in the middle. Ebonite bushes are "keyed" on the shaft by means of square holes through their centres, and the switch-blades are mounted in the bushes, so that they are insulated from the shaft. Fig. 1 gives the dimensions of the parts needed for one blade and its bush. The blade is cut out of No. 20 gauge copper sheet. A $\frac{3}{8}$ -in. hole is drilled through the centre of the bush, which is cut from $\frac{1}{2}$ -in. ebonite rod.

Mounting the Blades.

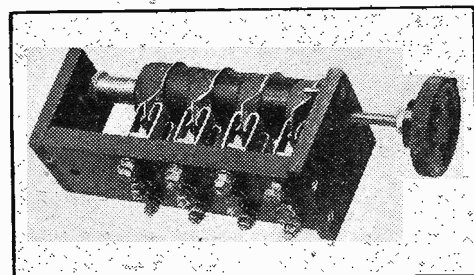
Then the shaft is heated, and the squared portion is pushed through the hole to cut its own "keyway." Do not have the shaft too hot—just hot enough for it to burn its way through slowly is sufficient, or the bush will be damaged. Drill the $\frac{1}{8}$ -in. hole in the blade, and the two smaller holes outside this.

Place the blade on the bush, with its

large hole concentric with the square hole in the latter, and mark on the ebonite the centres of the small holes. Drill them about $\frac{1}{4}$ in. deep, put on the blade again, tap in two pins of No. 14 S.W.G. wire, and file them off flush with the surface of the blade. The blade is then ready for mounting on the shaft.

Constructing the Frame.

Put on one end of the shaft a nut, a flat washer, a $\frac{1}{8}$ -in. thick ebonite bush, and the blade and $\frac{3}{8}$ -in. bush, in that order. Prepare the next bush and blade, but do not mark the centres of the pinholes in the bush yet. Assemble the second blade on the shaft



Here is the completed switch. The one shown in the heading photograph is a commercial type of barrel switch.

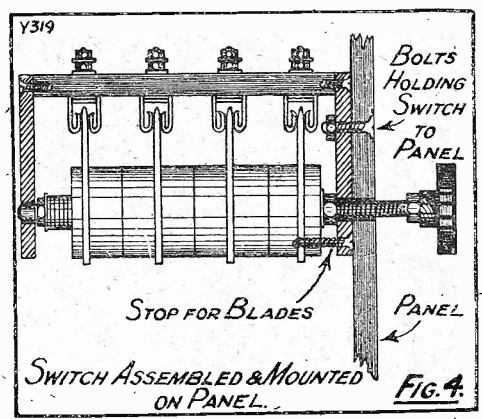
with its bush, and align the edges with those of the first blade. Slide off the blade and bush together, taking care not to separate them, and mark the centres of the pinholes on the ebonite. This procedure ensures that the blades are correctly aligned when the switch is assembled.

If the shaft is too long for the blades, the "spare" part of the squared portion may be filled with large condenser spacing washers, the whole assembly being clamped with nuts at each end. In the switch shown extra $\frac{3}{8}$ -in. bushes

are placed between the blades to space them.

The frame of the switch is constructed as shown in Figs. 2, 3 and 4, the top and ends being screwed together. Small spacing washers are let into the ends, as bearings for the shaft. When the completed shaft is in the frame, mark the positions for the rows of contact clips. Three clips are needed for each blade, bolted through the top of the frame. On assembling the switch, the blades should pass smoothly in and out of the clips, the bevelling of their edges assisting this motion. To prevent the blades from passing right out of the clips, stops are fitted in one end plate.

The switch is most conveniently mounted with bolts through the panel and the front end of plate. The shaft projects through the panel, and a knob is fitted for operation.



B.B.C. BREVITIES

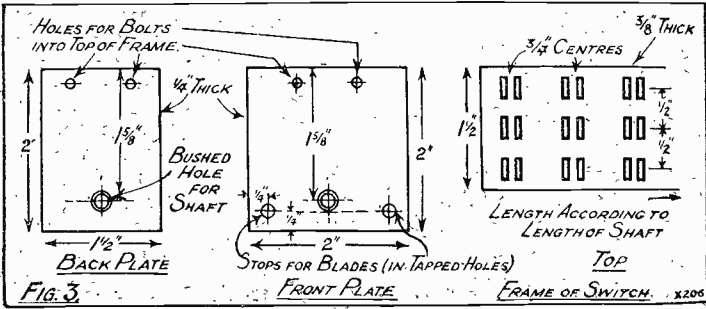
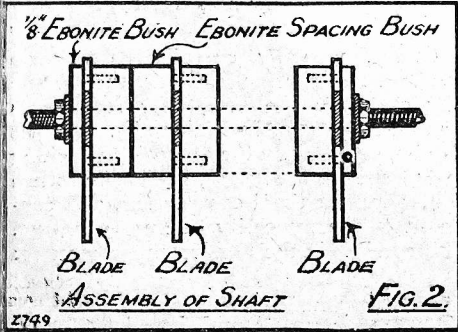
2 L.O., the London Station, was opened on October 14th, 1922.

The Birmingham Station began broadcasting on November 15th, 1922, and the Manchester Station started on the same day.

It was on Christmas Eve, December 24th, 1922, that the Newcastle Station called the British Isles for the first time.

Cardiff commenced its official broadcasting career on February 13th, 1923.

Glasgow gave its first programme on March 6th, 1923.



TECHNICAL NOTES.

By Dr. J. H. T. ROBERTS, F.Inst.P.

METHODS OF AMPLIFICATION

THE "LIGHT" SPEAKER—LIVES OF RADIO SETS—SUPPLY DEVICES.

Methods of Amplification.

THE amplification of gramophone record reproductions by means of pick-ups is usually effected by simple low-frequency amplification of the electrical impulses received from the pick-up device. According to one system, however, the electrical impulses from the electrical pick-ups are used to modulate the high-frequency oscillations in a self-excited oscillatory circuit, the energy from which is then transferred to the high-frequency input side of the receiving circuit (usually to the detector) by means of a plug-jack or alternatively by a throw-over switch. The receiving circuit may thus be connected either to the aerial (for reception of broadcast) or to the oscillator circuit which, as already mentioned, is modulated by the electrical signals from the gramophone pick-up.

Quite good results can readily be obtained by means of an electro-magnetic pick-up, the making of which is within the scope of the home constructor, and a number of constructional articles dealing with this component have already appeared.

In view of the great popularity of wireless receivers, it seems to me that the method of electrical reproduction from the gramophone is likely, in course of time, to supersede altogether the direct method of reproduction from the record as used exclusively in the gramophone of a few years ago.

"Light" Speaker.

There have been, during the last couple of years, all kinds of artistic devices incorporating loud speakers, the ornamental exterior taking the form of figures, vases, lamp-shades, ships and so on; the "ship" variety seems to be having quite a run of popularity in the 'States at the present time.

I see that a rather ingenious form of combined ceiling lamp and loud speaker has been designed by C. A. Volf, a well-known American radio engineer, and is known as a "light" speaker. It is designed so that any standard reproducer unit may be used with it.

Apart from the shell of the device being in the form of a lamp, it has the rather novel feature that it includes both a horn and a cone loud speaker. There are two separate reproducer units, the sound from the upper one passing up a vertical tube, then being reflected downwards, whilst the lower unit is directly connected by means of a driving pin to the centre of the cone, the latter being in a horizontal position and forming the lower external part of the whole device.

The horn type of loud speaker is generally better for the reproduction of higher-pitched tones, whilst the cone speaker is adapted for the reproduction of lower notes; by the use of these two together it is claimed that faithful reproduction of the whole of the audio scale is obtained.

Lives of Radio Sets.

How long should a radio set last? This is a question which is often asked by beginners or those contemplating the purchase of a set, although the question seems rather a curious one to the experienced experimenter since, in the ordinary way, apart from the valves and the batteries, there is nothing in the set itself to wear out. It is hardly like a motor-car where, in the course of normal use, there is definite wear and tear.

It would probably be true to say that with ordinary care the essential components of a radio receiving set should last indefinitely, and the receiver should only die of "old age" in the sense that the circuit or the components might become obsolete.

Of course, with any carelessness in the

handling of the set, or even with an accident that may happen to the most cautious user, such a thing as a burnt-out transformer or condenser may result, but it is a simple matter to replace a component of this kind at relatively small cost.

The valves naturally have a limited life, but even these, especially if of any of the better-class modern makes, should last for a very long time with careful handling. Of course, the real maintenance cost of a set relates to the high-tension and low-tension batteries, particularly the former.

Supply Devices.

If one of the various electric supply devices is used for the H.T. and L.T., there is really no appreciable wear and tear or deterioration of the receiver, except in regard to the valves, and here again, as I have already indicated, the improvement in valve manufacture has been so rapid during the past two or three years that the present-day receiving valve is a remarkably stable and long-lived component. A receiver equipped with high-grade valves and provided with an electric supply device operating from the mains for the H.T. and L.T. and grid bias, is just about as near a no-trouble outfit as can reasonably be expected.

"MIKE" AT AN ELECTION.



Are you in favour of broadcasting politics? Opinion seems very sharply divided on this question, some considering it would be very boring. Meanwhile, "Mike" is peacefully penetrating into election campaigns, and, as shown above, is invading village greens in these causes.

NEWS FROM SAVOY HILL.

FROM OUR OWN CORRESPONDENTS.

A REMARKABLE PLAY.

MISS CABLE ON TIBET—BELFAST NEWS—A NEWCASTLE EVENT.

A Remarkable Play.

Here is something about "Rampa," the important four-act play by Max Mohr, which has had a great success as a stage production, and which Mr. Cecil Lewis has translated and adapted for radio. It is the story of a man, who after the death of his partner in the frozen Northern wastes, becomes friendly with bears and other animals until eventually, using only their language, he loses the power of real speech. Later, when rescued, he is bought by the proprietor of a travelling circus, manacled

and exhibited in a cage as a "beast man."

Subsequently he becomes the property of a doctor, who by experiments restores him to a natural human being, though the only gratitude the benefactor receives is that the man goes off with his wife. We last see him, standing on the quay-side watching boats leave for the North, longing to return to his former animal companions, and convinced of the hypocrisy of human nature. "Rampa" is in the London programme for Wednesday, March 7th.

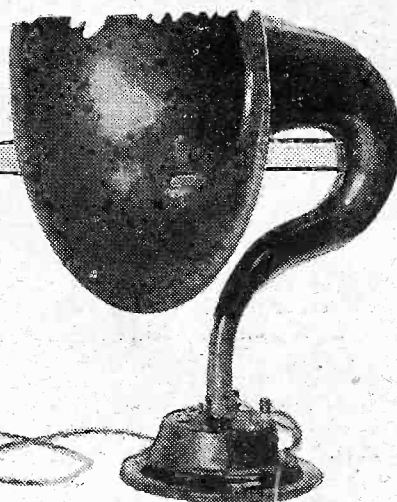
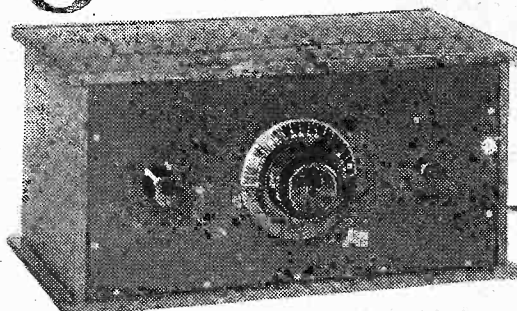
(Continued on page 38.)

The "Handyman" Two

PART II.

Embodying the ever-popular "Det. and L.F." circuit, this home-made receiver is efficient on both long and short waves. In this article the final details are given, including the method of constructing coils for Sydney (N.S.W.), East Pittsburgh, and the other short-wave stations.

By G. P. KENDALL, B.Sc.



CONTINUING the general description of the "Handyman," it is to be noted that in addition to the usual features detector circuit, there are two devices

setting which gives you the smoothest reaction control combined with the loudest signals. As a rough guide it may be mentioned that this is usually about two-thirds

ing the constructional work, which can otherwise be followed out from the diagrams and photos. The reaction condenser used in the original set was an Ormond, and this has two sets of fixed plates, and one of moving. To obtain the full capacity the two sets of fixed plates are joined together, whereas in most other types only one connection would be made. This point is mentioned lest someone using an alternative

POINT-TO-POINT CONNECTIONS.

One filament socket of each valve holder to one side of each respective rheostat.

Remaining sides of rheostats joined together, to one end of the potentiometer winding and to one side of the L.T. switch.

Other side of L.T. switch to the L.T. terminal.

L.T. to H.T. terminal, to the G.B. plug via a flexible lead, to the remaining end of the potentiometer winding, to the remaining filament contacts, on the valve holders, to the earth terminal, to the extreme right socket on the 4-socket base for the aerial coil unit, and to the moving vanes of the reaction condenser and the secondary tuning condenser.

Fixed vanes of the reaction condenser (there are two sets of fixed vanes, and they should be joined together by a piece of wire) to the right hand reaction socket on the aerial coil unit base. The socket is the second from right looking at set from back of baseboard.

Remaining reaction socket to one tag of the .001 mfd. fixed condenser.

Other side of .001 mfd. fixed condenser, to the plate of the 1st valve holder and to one side of the H.F. choke.

Other side of H.F. choke to the IP of the L.F. transformer.

OP to the H.T.+1 terminal.

Grid of the 1st valve holder to one side of the grid-leak holder and to one side of the .0003 mfd. fixed condenser.

Other side of .0003 to the left-hand socket on the aerial coil unit base, and to the fixed vanes of the secondary tuning condenser.

Remaining side of grid-leak holder to the handle (or slider) on potentiometer.

OS of the L.F. transformer to the grid of the 2nd valve holder.

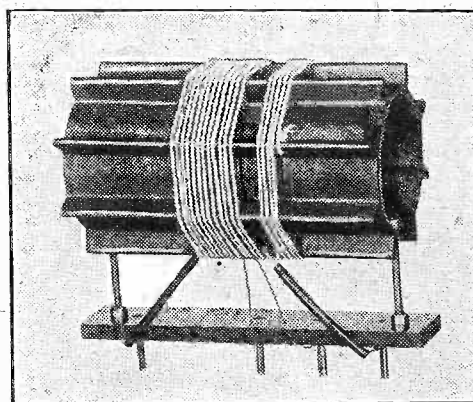
IS to the G.B. plug via a flexible lead.

Plate of 2nd valve holder to the L.S. terminal.

L.S. terminal to the H.T.+2 terminal.

Aerial A1 terminal to one side of the two plate air condenser.

A2 terminal to the remaining side of the condenser and to the aerial coil tapping clip via a flexible lead.



This is the coil for stations working on 45 metres. The tuning with this coil will go up as high as 60 odd metres for K D K A, etc.

make should be puzzled by the extra connection on the wiring diagram.

Operating the set is simple. For the detector a valve of the H.F. type is advised, with a small power or L.F. valve in the other socket. (If you are very near to your
(Continued on next page.)

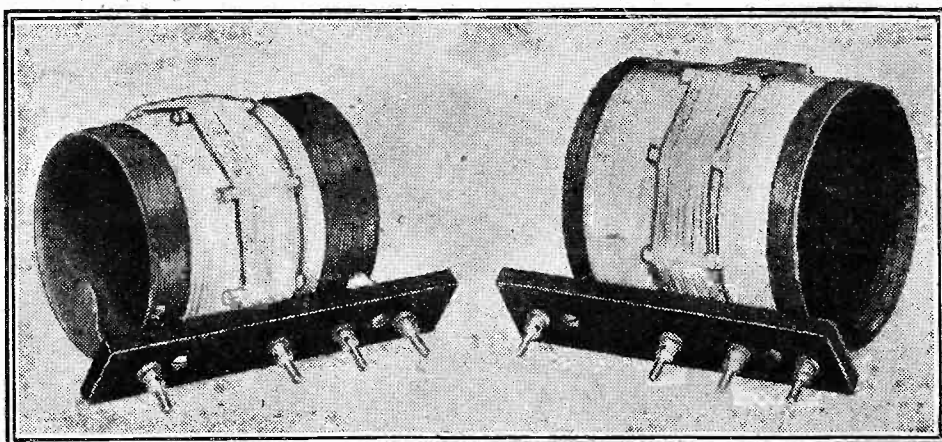
Short Wave Features

This condenser is exactly the same as the one used for the same purpose in the "Sydney" Two, and consists of two pieces of copper sheet mounted horizontally with a slight space (about $\frac{1}{8}$ in. at first; adjust by bending) between them, on a strip of ebonite. A detailed diagram of this condenser will be given in "Radiatorial" next week for the use of readers who do not possess "P.W." No. 284.

The other point is the use of a potentiometer to adjust the grid potential of the detector valve (through the grid leak), and this is a very useful feature on all waves. A very little experimenting with the position of the slider will enable you to find a

of the way from the positive round to the negative end of the potentiometer.

Just one point calls for mention concerning



To the left is the coil for your local station and others below 600 metres, whilst to the right is that for Daventry, 5 X X, Hilversum, Zeesen (Berlin), and the other excellent long-wave transmissions now "on the air."

THE "HANDYMAN" TWO

(Continued from previous page.)

local station and get very strong signals a power valve is most desirable). The H.T. on the terminal H.T. +1 should be about 60 volts, or perhaps a little less, for most valves. At least 100 volts is desirable on H.T. +2 for loud-speaker work.

One other point. Do not forget to try the tapping clip on each aerial tapping point in turn.

The coils used in the "Handyman" are exactly the same as those employed in the "Reinartz One Valver," described in "P.W." No. 273, but the specification will be repeated for the benefit of those who may not possess this issue, commencing with the unit for the ordinary B.B.C. waves.

It is wound upon a piece of insulating tube, 3 in. in diameter and $3\frac{1}{2}$ in. long, and consists of three separate windings. The largest is the secondary, consisting of 50 turns of No. 24 double cotton-covered wire in a single layer, the ends being secured by passing them through small holes in the tube in the usual way. The beginning of this winding is half an inch from one end of the tube, and the finish is about an inch and a quarter from the other end of the tube, leaving a space upon which the reaction winding will be placed. This consists of 30 turns of No. 32 double-silk-covered wire in the same direction as the secondary.

THE AERIAL COIL.

Over the top of the finishing end of the secondary is wound the aerial coil, consisting of 25 turns of No. 24 D.C.C. in the same direction as the secondary. This winding is supported away from the secondary by a simple scheme. Eight pieces $1\frac{1}{2}$ in. long are cut from one of the sticks used as stiffening in a packet of "Glazite," and equally placed round the coil, being held by a rubber band until gripped by the winding. Tapping points are made at the tenth, fifteenth, and twentieth turns as winding proceeds by twisting up a small loop in the wire which is subsequently scraped bare, so that a tapping clip may be attached. The end is also fastened off and left projecting to the extent of about half an inch for the same purpose.

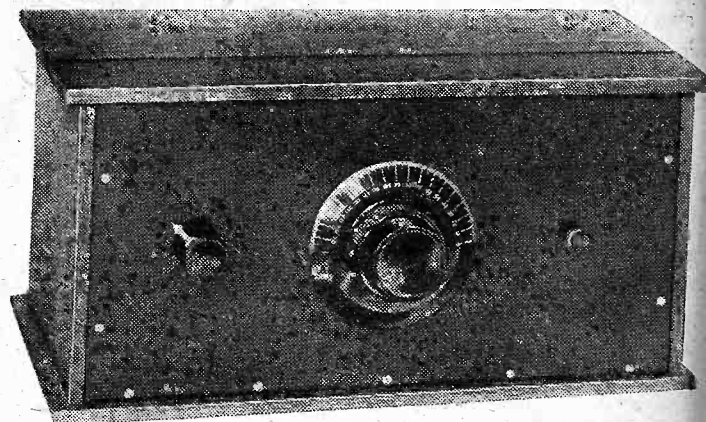
The coil is mounted upon a strip of ebonite $5\frac{1}{2}$ in. long and 1 in. wide, carrying four "Ealex" plugs. It is attached by two brass screws and nuts, and spaced away from the strip by means of two of the insulating sleeves which are supplied with the plugs, and which are not otherwise required. These are slipped over the screws, between the ebonite strip

and the coil former. The screws, of course, are placed near the ends of the former.

The base or socket into which the coil plugs consists of another strip of ebonite 6 in. long and 1 in. wide, carrying four "Ealex" sockets, and fastened to the baseboard by means of two screws passed through two more of the insulating sleeves, so supporting it just clear of the wood. Looking at the wiring diagram, the spacing between these sockets is 1 in., 1 in., 2 in.

The connections are as follow. With the coil placed in the set, imagine that you are looking at it as it would be seen in the wiring diagram. Then to the right-hand pin is connected the finish of both aerial and secondary windings. The other end of the secondary goes to the left-hand pin. The reaction coil is connected to the two middle pins, the end nearest the secondary going to the right-hand pin,

The "Handyman" Two complete. The cabinet is a home-made one, built from a set of parts, and full details of this part of the construction at work were given in last week's issue of "Popular Wireless."



and the end furthest from the secondary to the left-hand pin.

The coil for the Daventry range is made in exactly the same way, but on a $3\frac{1}{2}$ -in. diameter former, and the details are as follow: Aerial, 80 turns of No. 34 S.S.C. wire (with a tapping at 60); secondary, 170 turns of No. 34 S.S.C. wire; reaction, 60 turns of No. 34 S.S.C. wire.

Until quite recently the reception of short waves was decidedly a hobby for the ultra-enthusiastic amateur, who was often so keen on the subject that he took only a passing interest in ordinary broadcast reception. We have all heard his favourite theory to the effect that the only correct procedure is to have one set for broadcast reception, and another very special one for short waves.

As a "counsel of perfection" this is all

of the special short-wave coil follow, but first some notes should be given on short-wave working in general.

The first thing which you must realise is that the tuning and reaction adjustments are both much more critical on the lower waves, and a lighter touch must be cultivated in consequence. You must learn to turn the tuning dial *very* slowly and carefully, lest you miss stations altogether, and to adjust reaction very delicately.

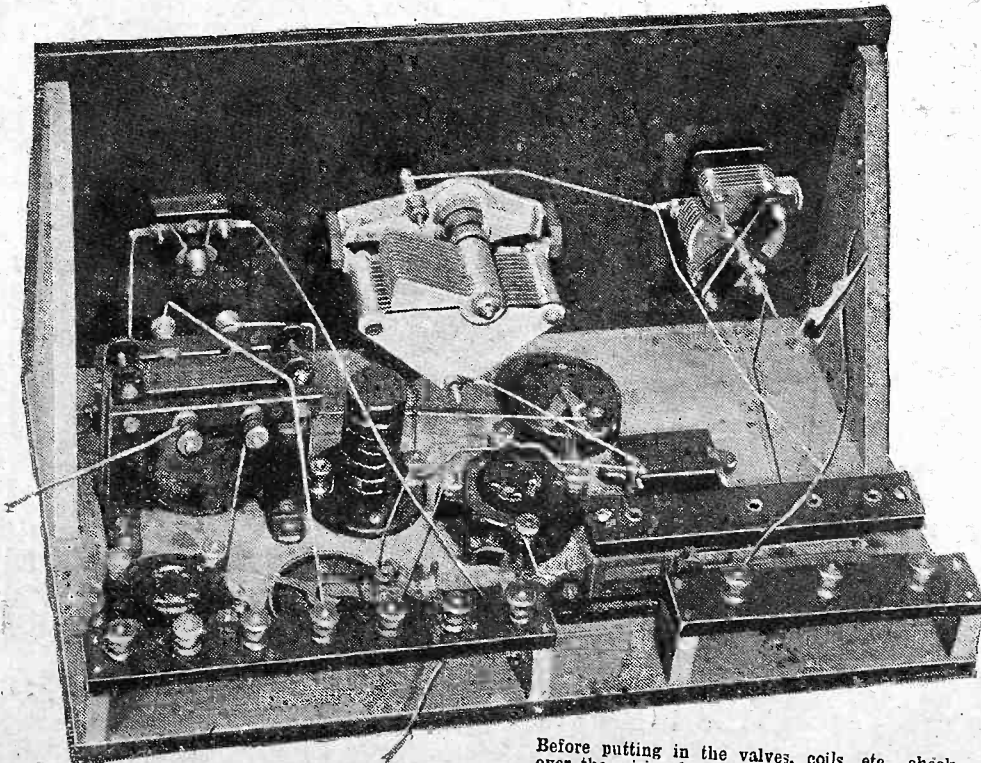
Again, you must adjust the set very carefully so that the smoothest possible reaction control can be got, and this is done by trying different voltages on H.T. +1, and adjusting the position of the potentiometer slider. You will probably find that reaction becomes smoother as you take the slider towards the negative end, but if you go too far strength of signals will suffer.

The Valves Recommended.

Now as to valves. In all the well-known makes the H.F. type will enable you to get plenty of reaction, but the use of cheap foreign valves (especially 2-volters) may lead to trouble, and it may then be necessary to use one of the power type as detector to get the set to oscillate.

The short-wave coil is wound on a standard Redfern former, 5 in. long, 3 in. diameter, with 8 ribs. The windings for a unit to cover about 35 to 70 metres are as follows. Secondary, 12 turns No. 24 gauge wire (bare or covered) spaced out to occupy about 1 inch. Aerial winding (primary), 5 turns of the same wire, with a tapping loop twisted up at the third turn. Reaction, 6 turns of No. 34 D.S.C. wire wound in a saw cut in the ribs immediately underneath the end of the secondary nearest the aerial winding, and in the same direction as the secondary.

To enable you to get down to the stations working between 20 and 35 metres (2 X A F, Sydney, etc.) you will need another unit with 6 turns secondary, 4 primary (tap at 2), 5 reaction, made in the same way.



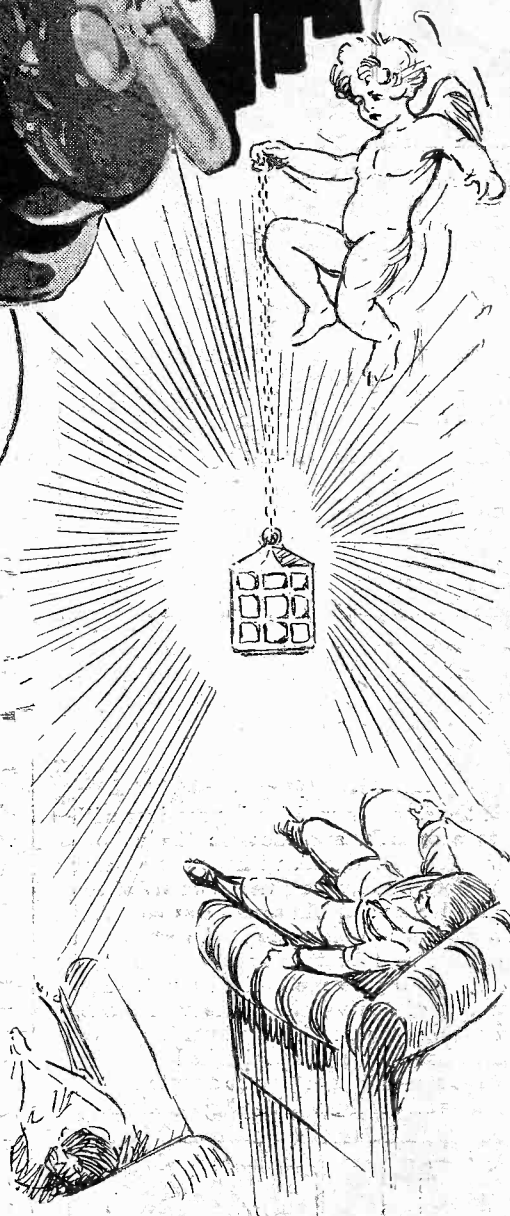
Before putting in the valves, coils, etc., check over the wiring by the list of connections given on the previous page.

Exquisite Music- on Headphones!

WHENEVER you want to hear a fine piece of music hear it on these LISSEN headphones. Tune your set to the right degree of loudness and then sit back in your chair with real enjoyment. Pick out every instrument in the orchestra—hear every note of the singer crystal clear—listen to a fine opera with all the thrill of the actual performance. You can sit for hours with these LISSEN headphones on—they're so light you will hardly know they're there.

Every lover of fine music should possess at least one pair.

Cords will not twist or tangle but will always hang straight down no matter how the head may be turned or twisted. The two ear-pieces are extremely sensitive and are exactly matched in impedance. They settle at once into comfortable positions and may be secured there by a single movement of a special ball joint.

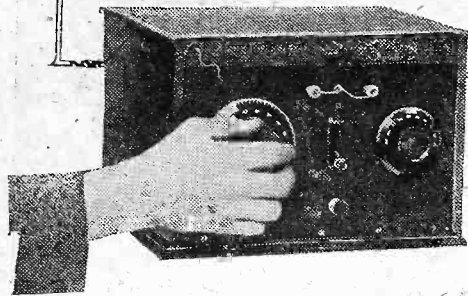


8'6

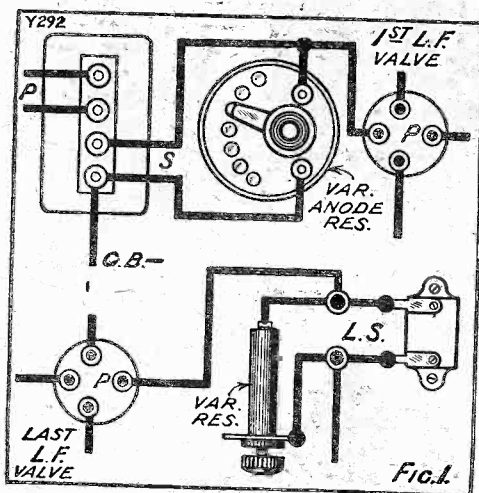
LISSEN HEADPHONES

LISSEN LIMITED (Managing Director: Thos. N. Cole), 8-16, FRIARS LANE, RICHMOND, SURREY

HOW TO CONTROL VOLUME



VOLUME control means the regulation of the degree of sound from the loud speaker. This is usually effected by switching L.F. amplifying valves in or out of circuit, but, owing to the almost universal use of the modern "point one" dull-emitter valve, such a method is becoming less popular, and it is becoming more usual

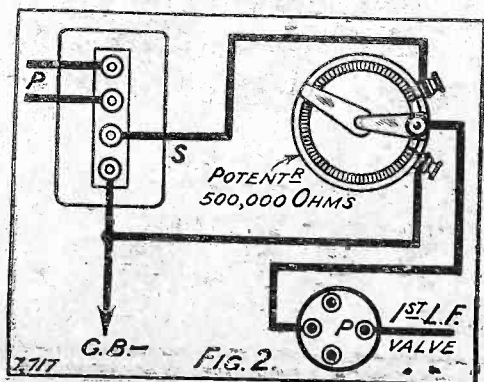


to dispense with complicated switching systems and employ the more simple and practical method of inserting a variable damping resistance in a suitable part of the circuit.

An Easy Method.

In the case of a multi-valve receiver with a stage of H.F. amplification the volume may often be reduced, without introducing distortion, by dimming the filament of the H.F. valve, and it will sometimes be found advantageous to place the H.F. rheostat on the panel so that it may be adjusted, if necessary, to give the desired effect. The rheostat, of course, should be well made, and capable of smooth adjustment.

It is, however, a great mistake to imagine that the same method may be adopted when no H.F. valve is used. Dimming the filament



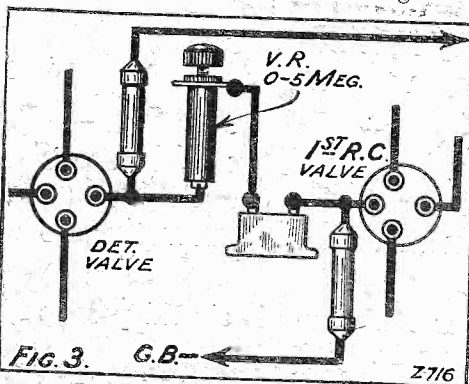
Correct and incorrect methods compared and explained in an interesting manner.
By O. J. RANKIN.

decreasing the H.T. battery current; and (3) altering the value of the grid-bias battery. With the first mentioned it is sometimes possible to obtain a decided decrease in volume with very little distortion, but the two latter methods can, for obvious reasons, only result in failure, distortion being unavoidable.

Use of Potentiometers.

Other common mistakes are illustrated in Fig. 1. In the upper sketch a variable resistance (usually a tapped anode resistance having a value of from 15,000 to 100,000 ohms) is connected directly across the secondary winding of the first L.F. transformer, and in the lower sketch a variable resistance (having a similar value) is shunted across the loud-speaker terminals. Both methods are incorrect, and should be avoided at all costs.

Fig. 2 shows the correct method of connecting a variable resistance across the secondary terminals of the first (low-ratio) L.F. transformer. Here the resistance consists of a 500,000 ohms potentiometer, and it will be seen that the "ends" of this go direct to the transformer and the arm to the grid of the L.F. valve. This is the only method whereby the input to the grid of



the first transformer-coupled L.F. valve may be controlled effectively without impairing the purity.

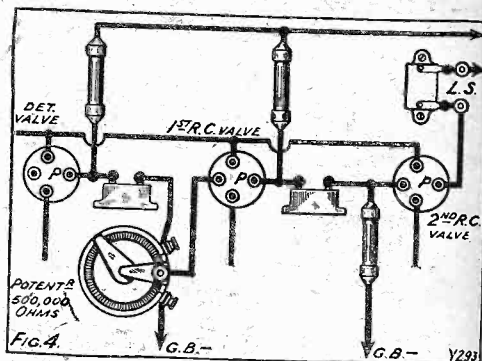
In the case of a detector valve followed by one or two resistance-capacity coupled amplifiers, good results are often obtained by placing a variable grid leak in series with the plate of the detector valve and the first coupling condenser in the manner shown in Fig. 3. The maximum value of the leak should be 5 megohms, and if arranged to short out at the zero position the volume may be adjusted from full strength down to one-tenth full strength without causing distortion.

Generally, however, the arrangement shown in Fig. 4 will be found more satisfactory. Here the first coupling condenser is connected to the plate of the detector

of a detector valve will cause distortion, as will also the dimming of the L.F. valve filaments.

Three common make-shift methods, often tried but seldom adopted, are: (1) Detuning the aerial circuit;

valve as usual, but the first grid leak is replaced by a 500,000 ohms potentiometer, one side of which is joined to the other side of the first coupling condenser, the other side to the negative grid-bias wander-plug, and the moving arm to the grid of the first L.F. valve. This gives a perfectly smooth control without affecting the purity, and the method can be highly recommended for use in conjunction with resistance or choke-coupled amplifiers.



TELEPHONE EXTENSIONS.

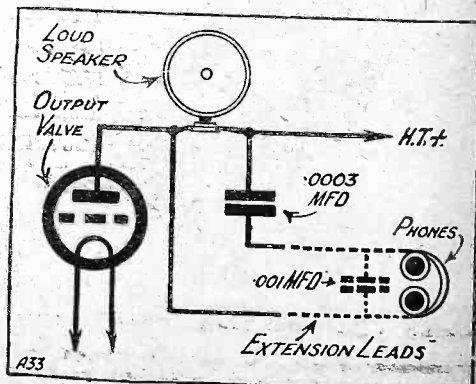
NO doubt many of us, at some time or another, have wished to run a 'phone extension to another room, perhaps to an invalid in bed, and have also wished to work the loud speaker direct from the set at the same time. Now, in the ordinary course of events, the volume at the end of the extension would be loud-speaker strength, at any rate far too great for ordinary listening on 'phones, but there is a method by which the volume can be cut down to comfortable 'phone strength, and yet in no way affect the loud speaker.

A Simple Scheme.

All that need be done is for a fixed condenser of fairly small capacity, say .0003 mfd., to be inserted in series with the extension lead joined to H.T.+, the capacity determining the volume; if desired, a miniature variable condenser, such as the Formodenser, could be used, and this would act as a volume control. The diagram should clear up any difficulties.

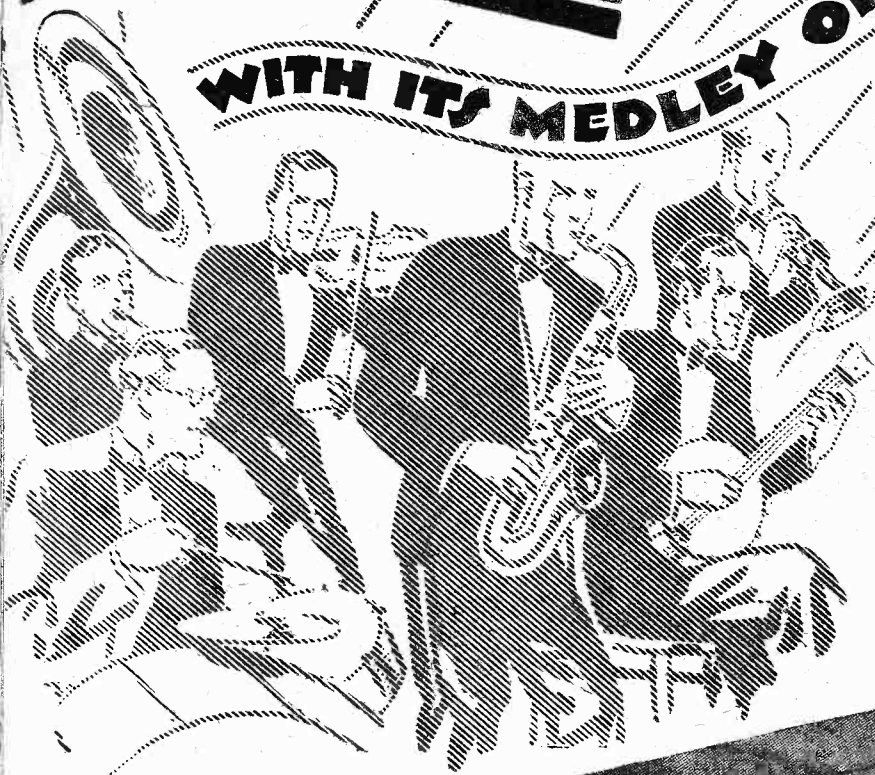
Should reproduction be inclined to be in any way coarse, a .001 mfd. fixed condenser shunted across the 'phones may modify the tone favourably.

An additional advantage is the fact that no H.T. current wanders through the leads to cause any voltage drop.



JAZZ

WITH ITS MEDLEY OF INSTRUMENTS



but they make a wonderful harmony of the medley. And you catch the real spirit of jazz when you have a Lissen New Process Battery in your set. Your valves, like its power, never distort, and you get that clear reproduction without which jazz loses its infectious gaiety. The pure D.C. current of the Lissen Battery is flowing always so noiselessly, so smoothly, and so abundantly that every instrument is clear and distinct, every note and every word is clear and loud. The oxygen content of the cells, due to the new process and chemical combination known only to Lissen, is so great that throughout the longest programme your loud-speaker utterance is natural and true from first to last. You get months and months of use out of the battery and delightful reproduction all the time. You can buy a Lissen Battery at 10,000 dealers. Ask for it in a way that shows plainly you want it and will take no other.

60 volts (reads 66) 7/11. 100 volts (reads 108) 12/11. 3 volts (Grid Bias) 1/6. 60 volts (reads 66) Super Power 13/6.



LISSEN

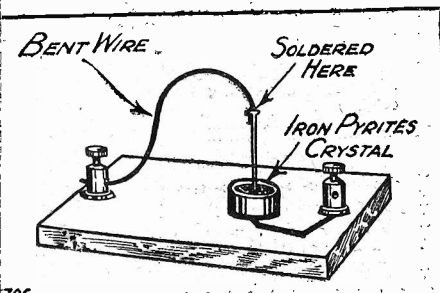
New Process

BATTERY



has often seemed to me to be a strange fact that the use of iron pyrites never really "taken on" in this country. Probably, of course, the reason for this may be looked for in the comparative scarcity of the mineral in good sensitive condition in the British Isles, and in the superabundance of the galena mineral which is shipped over here from mines in France and in Spain. But is iron pyrites exactly

scarce over here? Vast quantities of the mineral are shipped to England from Italy for the purpose of manufacturing sulphuric acid; but, quite apart from this fact, there are regions up and down England in which specimens of the pyrites may be picked up on the roadside or hammered out of barries, and, very often, quite 60 per cent of the mineral so obtained provides an excellent material for crystal-set working. I am still more than ever confirmed in this opinion by the fact that from time to time readers send me specimens of sensitive minerals which they have picked up in



This simple detector is all you need to get good results with iron pyrites.

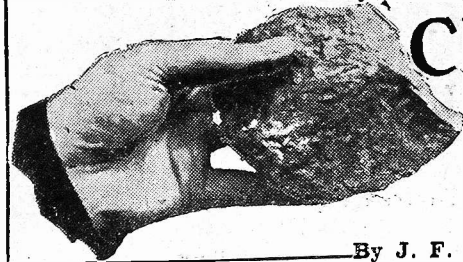
various districts, such crystals almost invariably turning out to be composed of iron pyrites.

The great characteristic of iron pyrites as a radio rectifier is the high degree of tonal purity which it produces in the reception. For this reason, the pyrites not only makes an excellent rectifier for crystal-set use alone, but it is also very well adapted for use in crystal-valve receivers. Used in sets of the latter description, a crystal of iron pyrites often removes "mush" and extraneous noise from the reception, and, should a loud speaker be employed in conjunction with the set, the tonal purity of the reception will often be startlingly improved in consequence.

Extremely Simple to Make.

Iron pyrites can be used as a rectifier in many ways. Generally, however, it is best employed with a fairly rigid cat's-whisker contact. The exact nature of the metal contact is not very material to the results obtained, though it is probably true that a brass, phosphor-bronze, or a steel contact gives rather better results than any others. An ordinary pin or needle used in contact with iron pyrites, in the manner illustrated in the diagram (Fig. 1), will give excellent results, despite the crudity of the arrangement. A fairly heavy contact is necessary, although, of course, such a contact must not be as heavy as that obtainable in the case of a zincite-tellurium or similar "perikon" type of rectifying contact.

A NEGLECTED CRYSTAL



Iron Pyrites can be picked up in certain parts of the country or it can be made quite easily by the experimenter. And it is a most excellent rectifier.

By J. F. CORRIGAN, M.Sc., A.I.C.

Iron pyrites, again, will rectify well when used in a perikon or semi-permanent type of detector in contact with a fragment of tellurium. The volume obtained from such a contact is generally less than that derived from the lighter type of contact; but nevertheless the rectifier so formed is a stable and enduring one, and it will therefore commend itself to the attention of valve-crystal enthusiasts.

A word now as to the nature of the mineral. Iron pyrites, as is more or less well known among wireless amateurs, consists for the most part of iron sulphide (FeS_2). Generally it is admixed with natural impurities, which influence its sensitive properties to a very considerable extent. Perfectly pure iron pyrites is hardly a rectifier at all.

Detectors for Nothing.

Quite a number of the specimens of iron pyrites which can be found up and down this country in rocks, quarries, on the roadsides, and, very often, on the seashore, contain as much as 2 per cent by weight of selenium. Other specimens, also, contain a little tellurium. Other iron pyrites specimens, again, are contaminated with copper, manganese, and other metals; whilst quite a large number of specimens coming from Australia contain gold.

Iron pyrites exists in many different forms, but in almost every case its colouring is identical. You can at once recognise a specimen of the pyrites by its bright lemon-yellow colour. Generally, too, the surface of the mineral has quite a polished appearance, although this is not the case with every specimen.

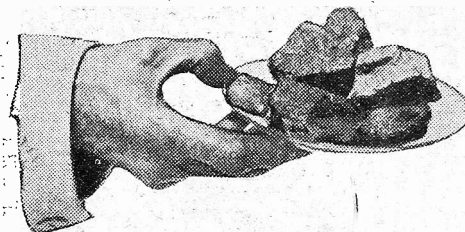
The pyrites is found (in England) sometimes in the form of irregular-shaped masses

of mineral which do not show any particular crystalline formation. Nevertheless, on breaking up such lumps of mineral, they will often be found to exhibit good sensitive properties. Again, iron pyrites often occurs in the form of single crystals, or clusters of cubical crystals which present the appearance of having been fused together in a furnace. As a matter of fact, such has actually been the case, for their crystalline

formation has taken place when the earth's surface was still molten, and the cubical crystals have resulted from the very slow cooling of the molten mass.

It is for such reasons that cubical iron pyrites crystals are sometimes found adhering to the surface of soft rocks, the mass of crystals illustrated in the photograph (Fig. 2), being an example of this type of crystalline formation of iron pyrites.

Contrary to the general opinion, iron pyrites in a fairly sensitive form may be



These specimens of iron pyrites, all of which rectify well, were collected in Derbyshire during the course of one afternoon.

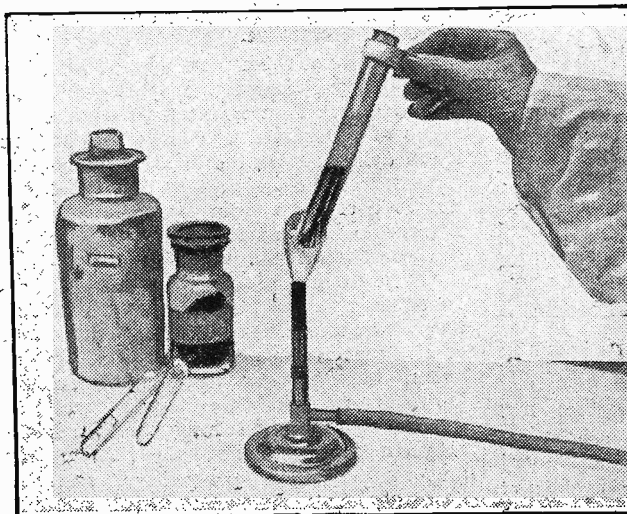
prepared artificially, and with a minimum of expense and trouble. The material necessary for the process comprises merely a handful of iron filings, and a similar quantity of powdered sulphur.

Construct Your Own Crystals.

Mix two parts of the sulphur with one part of fine iron filings, and stir them intimately together, so that they form a yellow-grey mixture, and heat it strongly in a non-luminous gas or spirit lamp flame. A chemical reaction will take place within the tube. The contents of the tube will glow red hot, even when the tube is removed from the flame.

After the red glow has finally died down, the tube should be left to cool. Afterwards, it should be broken, and the contents extracted. They will be found to consist of a grey, coke-like porous mass, having, sometimes, a yellow-greenish cast about them. Careful testing of this material will prove it to possess considerable rectifying powers if used with an ordinary cat's-whisker contact.

In fact, a perfectly synthetic or artificial form of iron pyrites will have been prepared. Amateurs interested in the simple preparation of this substance should experiment with varying relative proportions of sulphur and iron pyrites before they arrive at the final form of the pyrites most satisfactory for crystal use.



The heating of the mixture of iron filings and sulphur in a test tube, which is a process in the simple method of preparing synthetic iron pyrites described by Mr. Corrigan.

TELEVISION.

"In view of the fact that apparatus for making home television sets is now obtainable . . . we are forced to take a more serious view of what we have, perhaps, regarded hitherto as the natural excitement and optimism of certain parties interested in recent television experiments."

By THE EDITOR.

STATEMENTS in connection with television have been made in this journal and in "Modern Wireless" and the "Wireless Constructor," in an endeavour to provide our readers with a truthful account of the progress made, and an accurate explanation of the problems which confront television experimenters—and, further, an explanation of the reason why certain known television systems are faced with such definite limitations that true television can only be realised by the discovery of a new system.

These statements, and the various explanatory articles we have published would, we hoped, at least provide our readers with information which would enable them to judge the television problem in right perspective—necessary in view of the hys-

SIR OLIVER LODGE'S VIEW.

"It should be emphatically pointed out to the public that Television is still very much in its infancy, and still requires time and careful scientific investigation."

"The idea of transmitting the Boat Race with any degree of success by wireless according to any known system is absurd."

"And as for the idea of placing Televisor receiving sets on the market at the present time, with Television in its present undeveloped stage, this is too optimistic."

terical and exaggerated reports which have been so current of late in connection with television.

"Carping Critics."

However, in view of the fact that apparatus for making home television sets is now obtainable, and certain information has been published instructing the amateur how to make these home "television" sets, we are forced to take a more serious view of what we have, perhaps, regarded hitherto as the natural excitement and optimism of certain parties interested in recent television experiments.

In the first issue of a journal devoted to television we find the following statement:

"There is no doubt about it that television is an accomplished fact in spite of the verbose statements to the contrary which have been made in certain quarters, and in spite of the pseudo-scientific arguments, designed to prove the impossibility of its achievement, which have been loudly voiced by carping critics. Mr. Baird has publicly demonstrated it in this country innumerable times, and according to a recent newspaper announcement has lately transmitted between London and New York."

And in the same issue this statement:

"In the meantime we, from our own knowledge of this new science, would strongly advise the public to take no heed of the irresponsible remarks of ignorant critics; for it must not be overlooked that the actual knowledge of these same carping critics is but little greater than that of the 'Man in the Street,' and their practical achievements in the field of television, nil."

"The Baird Company, secure in the knowledge of the results which it has already obtained, will, we feel sure, treat such worthless criticisms with the supreme contempt which they deserve, and continue to work steadily towards the realisation of the plans which it has made."

In the above extracts we find reference to "pseudo-scientific arguments" and to carping critics with knowledge very little greater than the "Man in the Street." And the hope is expressed that the Baird Co. will "treat such worthless criticisms with the supreme contempt which they deserve," etc.

Scientific Views.

All perfectly good journalists and quite amusing if regarded as such, but remember there are shareholders in the Baird Co., besides many hundreds of thousands of people deeply interested in television, who might be persuaded by such statements that the criticism which points out the real facts about television may be biased, and further, based on "pseudo-scientific" knowledge, etc., etc., and consequently not worth considering.

And so, although we feel sure that the majority of our technical readers clearly understand the technical problems of television, and the criticisms we, among others, have made with regard to television, we feel it only fair to the readers of POPULAR WIRELESS, and to all those who are interested in television, to provide them with the views of some of the eminent scientific authorities with whom we have consulted on the question of television.

In this issue we include the views of our Scientific Adviser-in-Chief, Sir Oliver Lodge. A wireless pioneer and a scientific authority of wide-world fame, such as is Sir Oliver, needs no further introduction, nor does Dr. J. H. T. Roberts, F.Inst.P., whose scientific experience, based on years of research work at the Cavendish Laboratory, Cambridge, with Sir J. J. Thomson and Sir Ernest Rutherford, and whose inventive genius was fully demonstrated during and after the war, is more than well known among those privileged to judge what is "pseudo-scientific" and what is not.

The Right Perspective.

The views of these two eminent scientists are published elsewhere in this issue, and we intend, in future issues, to publish the views of other scientific authorities, for it is our definite intention to keep our readers informed of the facts about television, and not to encourage them by optimistic and inaccurate statements about the possibilities of television.

We have, as we have stated many times, admiration for the work done by Mr. Baird, and we realise—none more fully—the value of his pioneer work.

But that pioneer work must, in the interests of scientific truth, and in the interests of the large public interested in television, be judged accurately and in the right perspective, and we can only hope that Mr. Baird will not countenance the exaggerated impressions which have been current of late with regard to the progress of television and in par-

ticular with regard to the prospects, scientific and otherwise, of his particular system.

"In view of the recently reported transmission of pictures between London and the United States, it may be as well to point out that television is hardly a practical matter yet. The transmission is an important event, but it does not denote that the problem of television has been solved."

"A face can be seen by a few spectators, and might be recognised if the subject is well known, but detail is missing. This is due to the fact that no practical method has yet been evolved to transmit more than a somewhat blurred image, and to the fact that sufficiently effective apparatus for transmitting light into electricity is yet unknown."

"The picture cannot be sent as a whole, but has to be sent in a multitude of pieces with such rapidity that the succession of pieces may affect the eye as a complete picture. Breaking up the image in this way is technically known as 'searching.' When the pieces are unduly large, a blurred representation results. The limit to the smallness of the pieces is governed by mechanical considerations in the transmitting apparatus."

"Due to the lack of a highly-sensitive photo-electric cell, intense light has usually to be used, and only the parts so lighted can receive adequate representation."

(From the "Yorkshire Post.")

"It was satisfactory to find so much had been achieved in the fifteen or sixteen years' work. It was disappointing to find that Baird still pins his faith to his mechanical system of splitting up the image into the points requisite for television, for no wheel can revolve at the rate which would be needed to give the fine points requisite for clear vision."

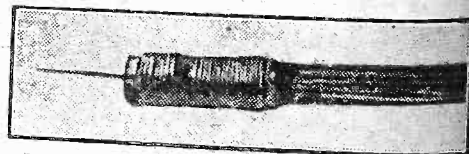
(Extract from an article by the Wireless Correspondent writing in the "Leeds Mercury.")

A SIMPLE SCRIBER.

A SCRIBER for the purpose of marking out ebonite panels before cutting can very easily be made, as the accompanying illustration depicts.

Procure an ordinary pen-holder and, with the aid of a sharp knife, carefully split one end of it for a distance of an inch or two. Squeeze a little seccotine, or other form of liquid glue, into the slit thus made, and then insert a strong needle into the slit so that it projects into the wood for a distance of at least an inch.

Bind the end of the pen-holder with a number of turns of thin but strong cord or string, as shown in the illustration, and finally give the turns of cord a rubbing



A photograph of the complete scriber.

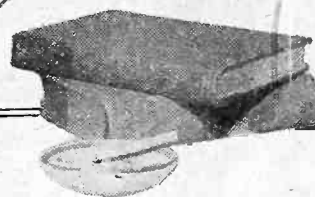
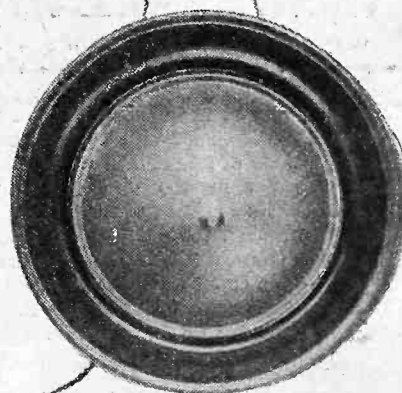
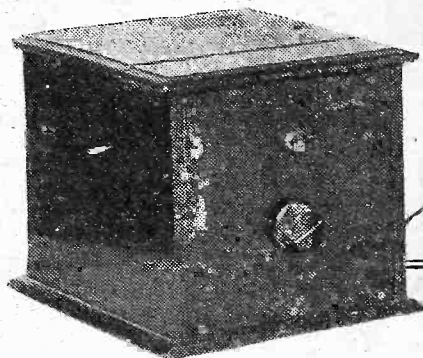
over with the liquid glue so as to hold them tightly together. Allow the glue to harden over a period of twelve hours, after which the scriber will be ready for use.

Such an implement will not only be useful for the purpose of marking out ebonite sheets, but it will also serve a purpose in picking out sundry pieces of dirt which have been allowed to collect in an out-of-the-way corner of the set. In fact, the scriber made as above can be put to all sorts of uses.

The "POPULAR" ONE-VALVE AMPLIFIER

Here is an efficient L.F. amplifier suitable for attaching to any sort of set. Next week the same circuit will be incorporated in "flat-panel" design for those who prefer this arrangement. Designed and constructed by the "P.W." Research and Construction Department.

Described by
A. JOHNSON-RANDALL.



DO you sometimes sigh for that little bit of extra power on distant stations?

Perhaps you have wished that your set, which gives you such good telephone strength, would work a loud speaker, and thus enable you to listen to the broadcast programmes in greater comfort. If so, here is a simple and efficient single-valve amplifier which will enable you to realise these hopes.

This unit can be joined up to any existing crystal set, valve set, or, in fact, to any receiver not already employing two

actual circuit and most of the components are identical. The reason for these two entirely different lay-outs is to enable the constructor to choose which of them better matches his existing set. Some reader may have one of the older pattern flat-panel receivers. If so, the second lay-out will be more suited to his needs than the one which incorporates the vertical panel and baseboard. On the other hand, the possessor of a more recent design will prefer the American type of lay-out, as described in this article.

Now let us look at the vertical panel

amplifier. You will see that there are two knobs on the panel. One is fairly large and the other is a simple push-pull switch. The idea of the larger knob is to give you a control of volume so that you can adjust the strength of the signals to suit your own requirements. For instance, if the station you are listening to is overpoweringly strong a slight adjustment of the knob will tone down the signals to a comfortable strength.

The L.F. Transformer.

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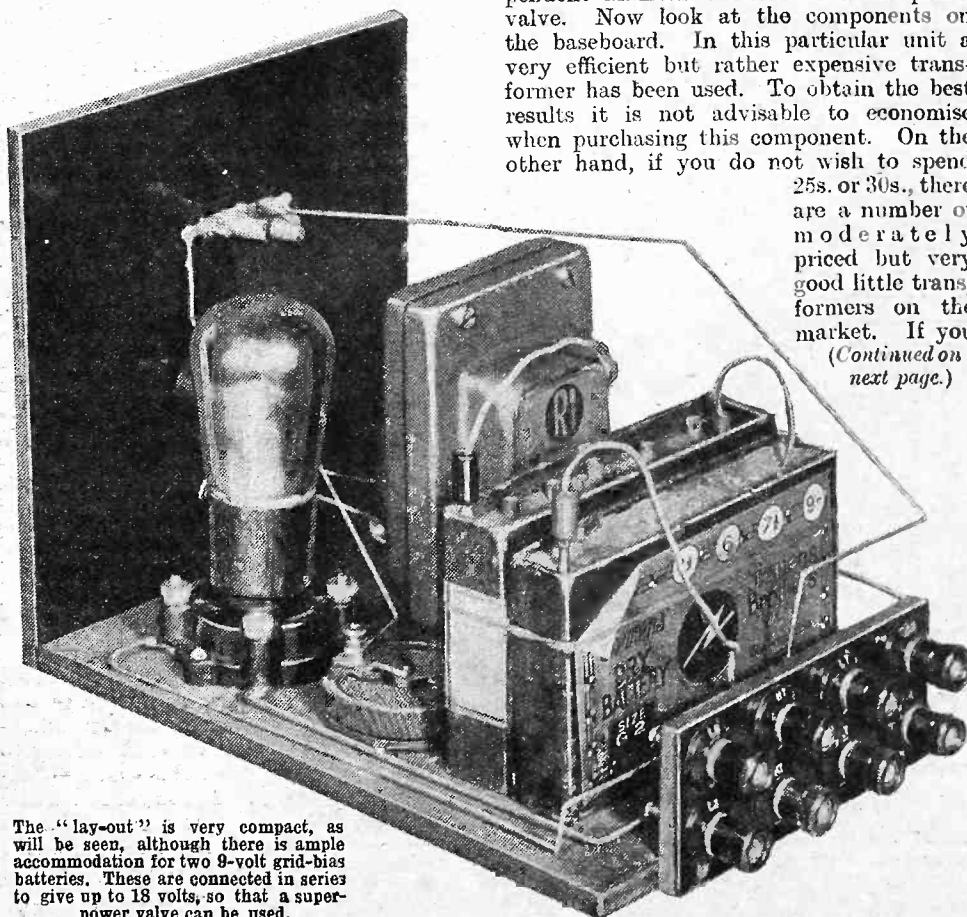
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TELEVISION.

"In view of the fact that apparatus for making home television sets is now obtainable . . . we are forced to take a more serious view of what we have, perhaps, regarded hitherto as the natural excitement and optimism of certain parties interested in recent television experiments."

By THE EDITOR.

STATEMENTS in connection with television have been made in this journal and in "Modern Wireless" and the "Wireless Constructor," in an endeavour to provide our readers with a truthful account of the progress made, and an accurate explanation of the problems which confront television experimenters—and, further, an explanation of the reason why certain known television systems are faced with such definite limitations that true television can only be realised by the discovery of a new system.

These statements, and the various explanatory articles we have published would, we hoped, at least provide our readers with information which would enable them to judge the television problem in right perspective—necessary in view of the hys-

SIR OLIVER LODGE'S VIEW.

"It should be emphatically pointed out to the public that Television is still very much in its infancy, and still requires time and careful scientific investigation.

"The idea of transmitting the Boat Race with any degree of success by wireless according to any known system is absurd.

"And as for the idea of placing Televisor receiving sets on the market at the present time, with Television in its present undeveloped stage, this is too optimistic."

terical and exaggerated reports which have been so current of late in connection with television.

"Carping Critics."

However, in view of the fact that apparatus for making home television sets is now obtainable, and certain information has been published instructing the amateur how to make these home "television" sets, we are forced to take a more serious view of what we have, perhaps, regarded hitherto as the natural excitement and optimism of certain parties interested in recent television experiments.

In the first issue of a journal devoted to television we find the following statement:

"There is no doubt about it that television is an accomplished fact in spite of the verbose statements to the contrary which have been made in certain quarters, and in spite of the pseudo-scientific arguments, designed to prove the impossibility of its achievement, which have been loudly voiced by carping critics. Mr. Baird has publicly demonstrated it in this country innumerable times, and according to a recent newspaper announcement has lately transmitted between London and New York."

And in the same issue this statement:

"In the meantime we, from our own knowledge of this new science, would strongly advise the public to take no heed of the irresponsible remarks of ignorant critics; for it must not be overlooked that the actual knowledge of these same carping critics is but little greater than that of the 'Man in the Street,' and their practical achievements in the field of television, nil."

"The Baird Company, secure in the knowledge of the results which it has already obtained, will, we feel sure, treat such worthless criticisms with the supreme contempt which they deserve, and continue to work steadily towards the realisation of the plans which it has made."

In the above extracts we find reference to "pseudo-scientific arguments" and to carping critics with knowledge very little greater than the "Man in the Street." And the hope is expressed that the Baird Co. will "treat such worthless criticisms with the supreme contempt which they deserve," etc.

Scientific Views.

All perfectly good journalese and quite amusing if regarded as such, but remember there are shareholders in the Baird Co., besides many hundreds of thousands of people deeply interested in television, who might be persuaded by such statements that the criticism which points out the real facts about television may be biased, and further, based on "pseudo-scientific" knowledge, etc., etc., and consequently not worth considering.

And so, although we feel sure that the majority of our technical readers clearly understand the technical problems of television, and the criticisms we, among others, have made with regard to television, we feel it only fair to the readers of POPULAR WIRELESS, and to all those who are interested in television, to provide them with the views of some of the eminent scientific authorities with whom we have consulted on the question of television.

In this issue we include the views of our Scientific Adviser-in-Chief, Sir Oliver Lodge. A wireless pioneer and a scientific authority of wide-world fame, such as is Sir Oliver, needs no further introduction, nor does Dr. J. H. T. Roberts, F.Inst.P., whose scientific experience, based on years of research work at the Cavendish Laboratory, Cambridge, with Sir J. J. Thomson and Sir Ernest Rutherford, and whose inventive genius was fully demonstrated during and after the war, is more than well known among those privileged to judge what is "pseudo-scientific" and what is not.

The Right Perspective.

The views of these two eminent scientists are published elsewhere in this issue, and we intend, in future issues, to publish the views of other scientific authorities, for it is our definite intention to keep our readers informed of the facts about television, and not to encourage them by optimistic and inaccurate statements about the possibilities of television.

We have, as we have stated many times, admiration for the work done by Mr. Baird, and we realise—none more fully—the value of his pioneer work.

But that pioneer work must, in the interests of scientific truth, and in the interests of the large public interested in television, be judged accurately and in the right perspective, and we can only hope that Mr. Baird will not countenance the exaggerated impressions which have been current of late with regard to the progress of television and in par-

ticular with regard to the prospects, scientific and otherwise, of his particular system.

"In view of the recently reported transmission of pictures between London and the United States, it may be as well to point out that television is hardly a practical matter yet. The transmission is an important event, but it does not denote that the problem of television has been solved.

"A face can be seen by a few spectators, and might be recognised if the subject is well known, but detail is missing. This is due to the fact that no practical method has yet been evolved to transmit more than a somewhat blurred image, and to the fact that sufficiently effective apparatus for transmitting light into electricity is yet unknown.

"The picture cannot be sent as a whole, but has to be sent in a multitude of pieces with such rapidity that the succession of pieces may affect the eye as a complete picture. Breaking up the image in this way is technically known as 'searching.' When the pieces are unduly large, a blurred representation results. The limit to the smallness of the pieces is governed by mechanical considerations in the transmitting apparatus.

"Due to the lack of a highly-sensitive photo-electric cell, intense light has usually to be used, and only the parts so lighted can receive adequate representation."

(From the "Yorkshire Post.")

"It was satisfactory to find so much had been achieved in the fifteen or sixteen years' work. It was disappointing to find that Baird still pins his faith to his mechanical system of splitting up the image into the points requisite for television, for no wheel can revolve at the rate which would be needed to give the fine points requisite for clear vision."

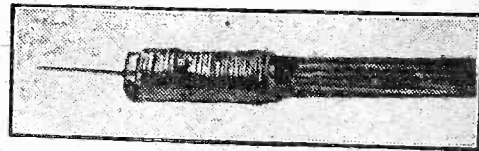
(Extract from an article by the Wireless Correspondent writing in the "Leeds Mercury.")

A SIMPLE SCRIBER.

A SCRIBER for the purpose of marking out ebonite panels before cutting can very easily be made, as the accompanying illustration depicts.

Procure an ordinary pen-holder and, with the aid of a sharp knife, carefully split one end of it for a distance of an inch or two. Squeeze a little seccotine, or other form of liquid glue, into the slit thus made, and then insert a strong needle into the slit so that it projects into the wood for a distance of at least an inch.

Bind the end of the pen-holder with a number of turns of thin but strong cord or string, as shown in the illustration, and finally give the turns of cord a rubbing



A photograph of the complete scriber.

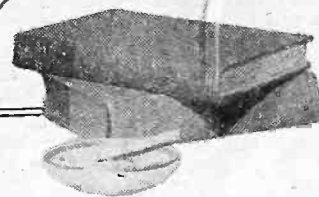
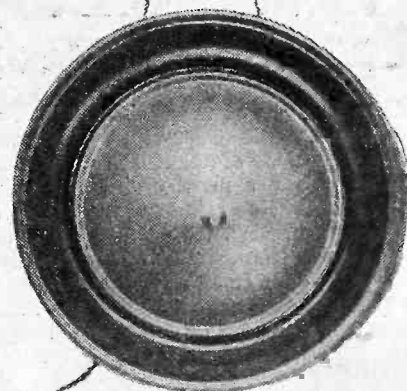
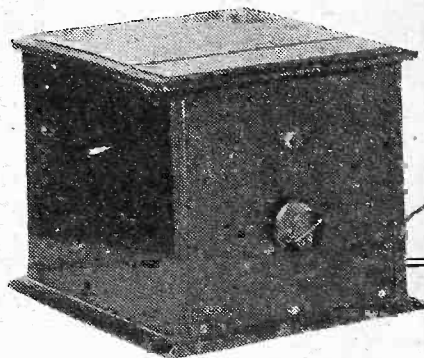
over with the liquid glue so as to hold them tightly together. Allow the glue to harden over a period of twelve hours, after which the scriber will be ready for use.

Such an implement will not only be useful for the purpose of marking out ebonite sheets, but it will also serve a purpose in picking out sundry pieces of dirt which have been allowed to collect in an out-of-the-way corner of the set. In fact, the scriber made as above can be put to all sorts of uses.

The "POPULAR" ONE-VALVE AMPLIFIER

Here is an efficient L.F. amplifier suitable for attaching to any sort of set. Next week the same circuit will be incorporated in "flat-panel" design for those who prefer this arrangement. Designed and constructed by the "P.W." Research and Construction Department.

Described by
A. JOHNSON-RANDALL.



DO you sometimes sigh for that little bit of extra power on distant stations?

Perhaps you have wished that your set, which gives you such good telephone strength, would work a loud speaker, and thus enable you to listen to the broadcast programmes in greater comfort. If so, here is a simple and efficient single-valve amplifier which will enable you to realise these hopes.

This unit can be joined up to any existing crystal set, valve set, or, in fact, to any receiver not already employing two

actual circuit and most of the components are identical. The reason for these two entirely different lay-outs is to enable the constructor to choose which of them better matches his existing set. Some reader may have one of the older pattern flat-panel receivers. If so, the second lay-out will be more suited to his needs than the one which incorporates the vertical panel and baseboard. On the other hand, the possessor of a more recent design will prefer the American type of lay-out, as described in this article.

Now let us look at the vertical panel

amplifier. You will see that there are two knobs on the panel. One is fairly large and the other is a simple push-pull switch. The idea of the larger knob is to give you a control of volume so that you can adjust the strength of the signals to suit your own requirements. For instance, if the station you are listening to is overpoweringly strong a slight adjustment of the knob will tone down the signals to a comfortable strength.

The L.F. Transformer.

The push-pull switch is just an independent filament control to the amplifier valve. Now look at the components on the baseboard. In this particular unit a very efficient but rather expensive transformer has been used. To obtain the best results it is not advisable to economise when purchasing this component. On the other hand, if you do not wish to spend

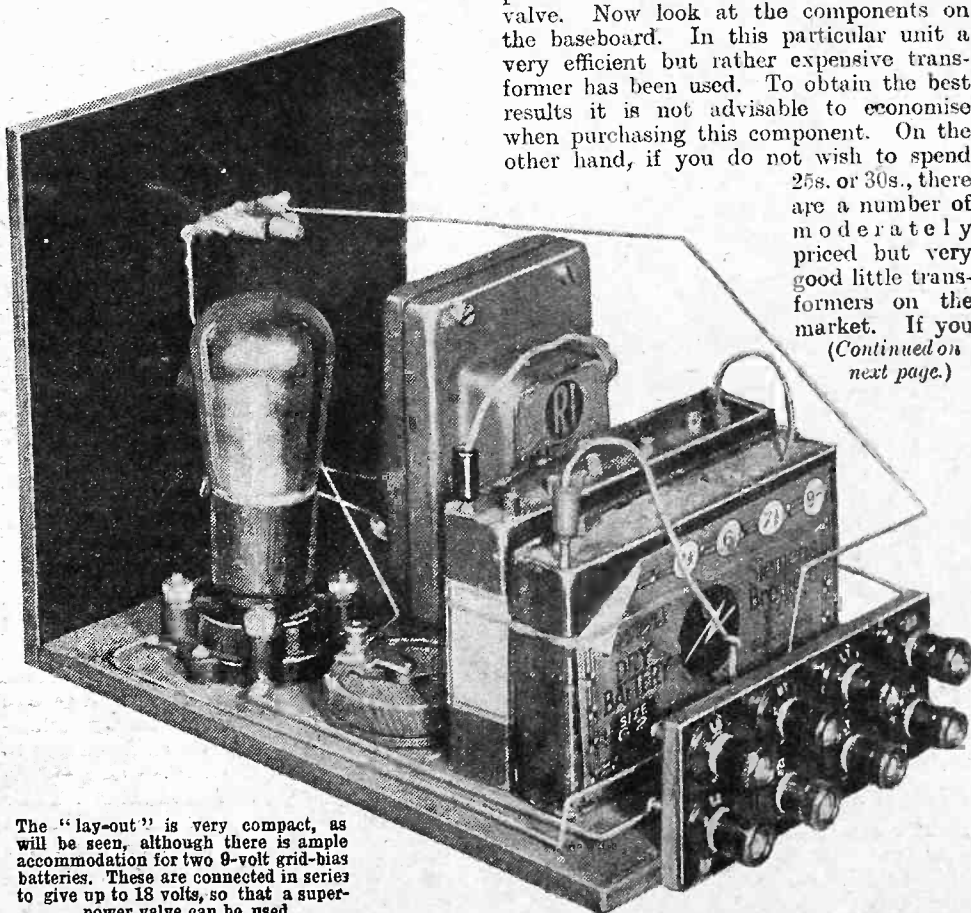
25s. or 30s., there are a number of moderately priced but very good little transformers on the market. If you
(Continued on next page.)

- 1 Ebonite Panel, 7 in. x 7 in. x 1/4 in.
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- 1 Baseboard variable resistor (Lissen).
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- 1 .0005 fixed condenser, and base (Igranite), only required for R.I. transformer.
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- 1 500,000-ohms potentiometer (Centralab, Rothermel Radio Corporation).
- 8 terminals marked as follows: H.T.+, H.T.-, E.S.+, L.S.-, L.T.+, L.T.-, and two marked "Input."
- 1 Terminal strip, 4 1/2 in. x 2 in.

transformer-coupled stages of L.F. It is particularly suitable for sets which give very loud telephone strength, but not quite enough volume to operate a loud speaker. Perhaps you will wonder why a transformer has been chosen instead of a resistance. The reason is that a transformer amplifier has a much more universal application than any other type and, in addition, will give greater magnification.

Different Designs.

In this, and in the continuation next week, you will see two apparently different designs. One of them utilises the popular American vertical panel and baseboard scheme. The other makes use of an ordinary flat-top panel, all the components being mounted on the panel itself. In each case, however, you will see that the



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THE POPULAR ONE-VALVE AMPLIFIER.

(Continued from previous page.)

decide to buy one of these cheaper instruments, then I would suggest that you choose one having a ratio of about 3 to 1.

The transformer in the unit has connected across its primary terminals a .0005 fixed condenser. This will not be necessary with transformers of other makes and if you prefer to use some other type, then you will not need to include the fixed condenser in your list of components.

Constructional Details

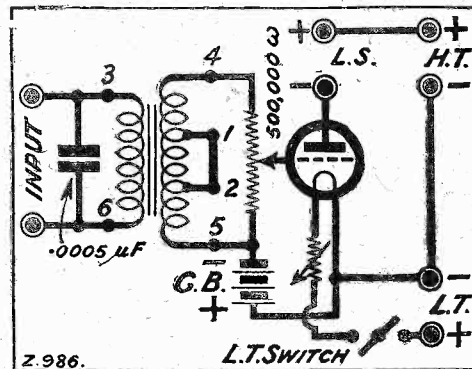
The actual construction of the amplifier is very simple and there is no reason why the whole of the work should not be completed in a single evening. Drill the holes in the panel first. For the filament "on-and-off" switch and the volume control you will need a $\frac{3}{8}$ -in. twist drill. You will also require a small terminal strip which can be screwed to the back of the baseboard. The terminal holes can be arranged in two tiers of four, and it is usual to space them 1 in. apart.

This strip may be a piece of $\frac{3}{16}$ or $\frac{1}{4}$ in. ebonite, $4\frac{1}{2}$ in. long and 2 in. high.

The transformer connections which are shown apply only to the R.I.-Varley straight-line super transformer. For makes

having the more usual method of marking the terminals, the two "input" terminals would be joined to OP and IP. IS would go to G.B.—and that side of the volume control which is shown connected to terminal 5 on the R.I. transformer. OS would be joined to the other side of the 500,000-ohm potentiometer.

The actual wiring up is so very simple



that it is difficult to find any points which need explanation. It is a matter of individual choice as to whether bare tinned-copper or covered wire shall be used. Some constructors may prefer to employ one of the insulated wires, such as Glazite. This certainly forms an effective guard against accidental "shorts" and is probably to be advised in the case of the beginner. On the other hand, bare wire is easier to handle and, provided fairly stiff "busbar," say, 16 gauge, is used there is very little danger of any of the leads touching, especially if they are well spaced. Do not forget to leave sufficient room for the grid-bias batteries on the baseboard.

Connections

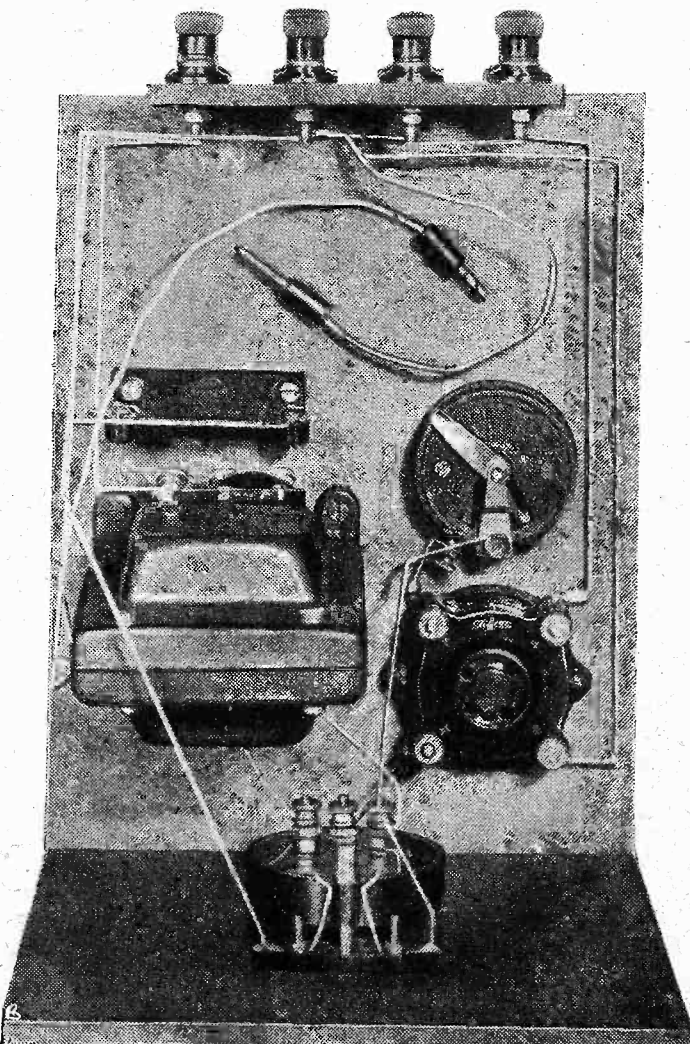
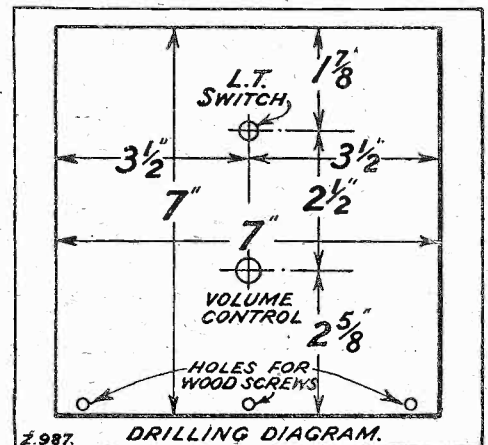
There are two shown in the photograph. Each battery has a value of 9 volts and the two are joined in series. You will only need two batteries if you intend to use a super-power valve.

The method of connecting up the unit to the existing receiver will be as follows. The two input terminals should be joined to the existing "output" or telephone terminals in the set. H.T. + will be connected inside the set to one of these 'phone terminals. Take the top input terminal to this telephone terminal which is joined to H.T. +. L.T. + and L.T. — will be connected to a lead which goes to your existing accumulator or alternatively to the L.T. + and — terminals on the set. There is no need to join the H.T. — lead from the H.T. battery to the H.T. — terminal on the

existing set, because one lead, namely, that to H.T. —, on the unit will suffice, provided a common H.T. battery is used throughout. Plug in a lead from H.T. + on the unit to the 120-volt tapping on the H.T. battery and join up your loud speaker to L.S. + and —.

Valves and Grid Bias

As stated previously, the grid-bias battery is placed on the baseboard, and the value of this battery will depend on the type of valve you intend using in the socket of the amplifier. If signals are not extremely powerful an ordinary small power-valve, such as the Marconi or Osram D.E.5, Cossor 610L.F., B.T.H. B4, Mullard P.M.6, etc., can be used in this socket. On the other hand, if signals are very loud indeed, then perhaps you will prefer a "super"-power valve. If you employ an ordinary small-power valve you will only need about $7\frac{1}{2}$ volts grid bias and a single 9-volt battery will be adequate. If you think that you will prefer one of the super-power valves then about 16 volts grid bias will be required, and you will have to purchase two 9-volt batteries, placing them in series by joining the positive



You can see the three connections to the potentiometer volume control in this view of the amplifier, which will also help you to position the components correctly on the baseboard.

socket of one to the negative socket of the other. In this way you will be able to obtain any value of grid bias from $1\frac{1}{2}$ to 18 volts.

If your set does not already include an L.F. stage it is very unlikely that a super-power valve will be required. A super-power valve does not give louder signals, but it is designed to handle great volume. Hence it is only in those cases where the signal strength is big that such a valve is necessary. I mention this because it is sometimes thought that replacing a power valve with a super-power valve will bring about an increase in volume. This, of course, is incorrect, and you should only purchase the latter if you find that your power valve will not deal with the volume you require, without distortion.

Alternative Components

I have said nothing about the suitability of 2-volt valves for use with this unit. The 2-volt type are quite satisfactory, and any small power valve in this class can be employed. Another point which may puzzle the constructor concerns the value of the baseboard filament resistance.

For 6-volt valves when used in conjunction with a 6-volt accumulator, or 2-volt valves employed with a 2-volt cell, this resistance may have a maximum value of 5 or 7 ohms. You will only need a small

(Continued on page 25.)

YOU GET MORE FROM MARCONIPHONE L.T. ACCUMULATORS

It is the *plates* that mean most in any accumulator. How strong they are—how long they can resist the incessant attack of the acid. That's where a Marconiphone scores. The immensely strong plates are made from a new and *improved formula especially to resist acid attack*. How well they do so is proved by the immensely long and useful service they give. All parts of Marconiphone Accumulators are protected by an electro-lead deposit against sulphuric fumes and there is a host of other features that ensure un-failing service under even the severest conditions. A glance below will show you six good reasons why "You get more from Marconiphone."



The Plates—the heart of every accumulator—specially constructed to resist the attack of sulphuric acid.



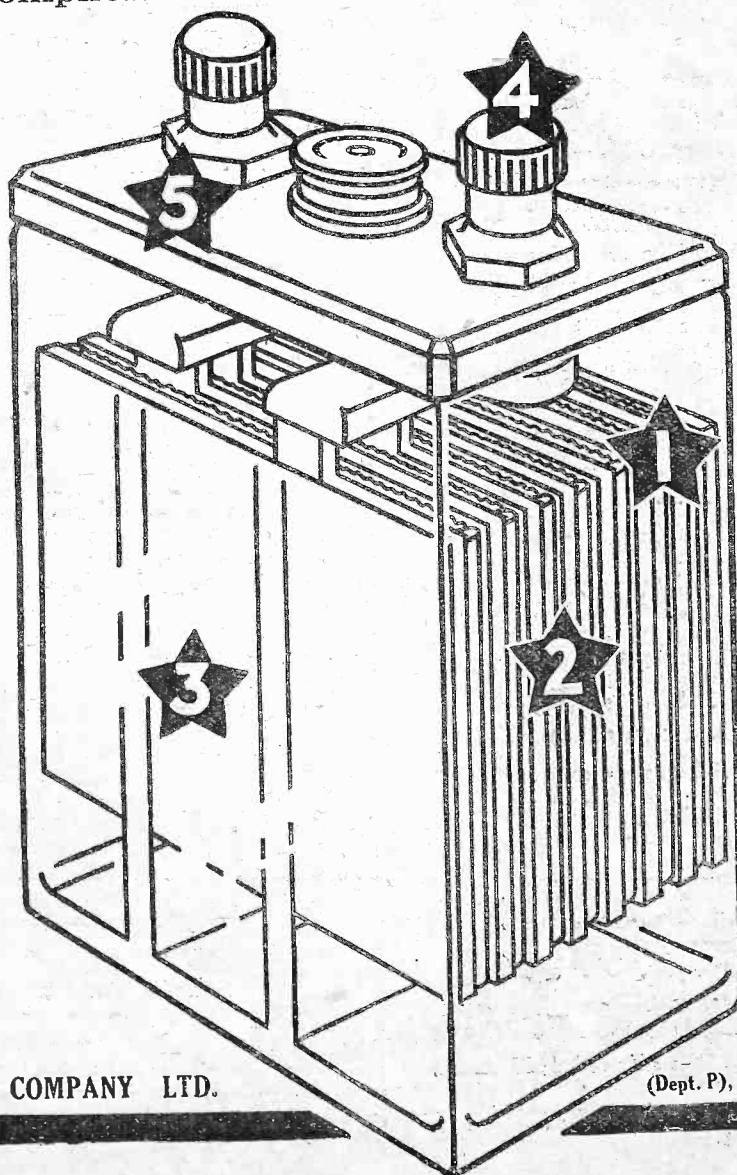
The Separators, made from the finest ebonite, thus eliminating the impurities frequently encountered with other material.



The substantial Container, made from the finest quality celluloid, allows easy inspection of acid level.

PRICES:

2 volt.	30 amp. hours.	13 6
2 volt.	40 amp. hours.	16 0
4 volt.	30 amp. hours.	£1 7 0
4 volt.	40 amp. hours.	£1 12 0
6 volt.	30 amp. hours.	£2 0 6
6 volt.	40 amp. hours.	£2 8 0



The Terminals are shrouded in bakelite—the finest insulating and acid-protecting medium.



The Flush Top can be cleaned in a moment after recharging.



It is a guaranteed Marconiphone product, built entirely at our modern Dagenham factory.

Send

now, mentioning "Popular Wireless," for Publication No. 438, fully describing the complete range of Marconiphone Wireless Apparatus.

THE MARCONIPHONE COMPANY LTD.

(Dept. P), 210-212, Tottenham Court Rd., W.1.

PLUG IN FOR POWER



FOR YOUR
COSSOR
"MELODY
MAKER"

CONSTANT—ECONOMICAL—SAFE

CONSTANT. Power from the mains is even, steady and silent. Entirely dispenses with run down battery annoyance and H.T. crackle.

ECONOMICAL. Power from the mains costs less than a penny per day. No more recharging expenses.

SAFE. An H.T. Eliminator built the T.C.C. way is a unit of proved reliability. Using T.C.C. 600 volt Condensers, it is safe.

The T.C.C. book "How to build your own H.T. Eliminator" will convince you how simple it is for you to build this efficient unit. It is free—of course.

Write for it to-day and—

GET YOUR POWER FROM THE SWITCH

T.C.C. CONDENSERS

I enclose 1d. stamp. Please send a copy of "How to build your High Tension Eliminator for A.C. or D.C." to:

Name

Address

P.W., Mar. 3

SEND COUPON TO-DAY

To Telegraph Condenser Co., Ltd., Wales Farm Rd., N. Acton,
London, W.3.

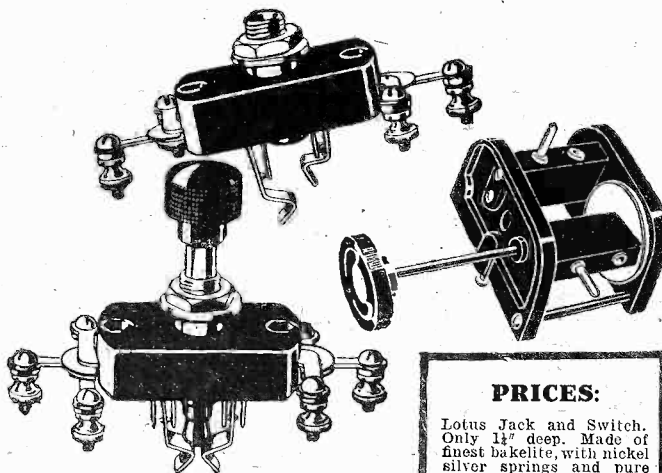
© 1961

NO MORE JACK TROUBLES

NOW you can eliminate the old, messy soldering troubles when fixing Jacks and Switches. The famous Lotus Jacks and Switches are being made with terminals instead of soldering tags. The terminal makes as good a permanent connection as the most expert soldering job.

Lotus Jacks and Switches are made of finest bakelite, with nickel silver springs and pure silver contacts. To establish reliable connections in any set you make, choose Lotus Jacks and Switches. They occupy the minimum space—only 1½ in. behind the panel.

The Lotus Coil Holder holds the heaviest coil in position. The moving block cannot fall. Prevents fading away of volume. Vernier movement reduces speed of moving coil block by eight times. For left or right hand.



LOTUS

JACKS·SWITCHES·PLUGS

Made by the Makers of the famous
Lotus Remote Control and Lotus
Buoyancy Valve Holder.

PRICES:

Lotus Jack and Switch. Only 1½" deep. Made of finest bakelite, with nickel silver springs and pure silver contacts. With terminals. Jack No. 3, 2/6; others from 2/- to 3/-; Jack Switch No. 9, 4/-; others from 2/9.

Lotus Jack Plug. Spring sleeve fitting supplied. Can be used with any Jack. Bakelite mouldings, nickel-plated brass parts. Price 2/-.

Lotus Coil Holder. 2-way, for outside panel mounting, 7/-; 3-way, 10/6; for inside baseboard mounting, with 6-in. handle, 8/-; 3-way, 12/6.

GARNETT, WHITELEY & CO., LTD.,
Broadgreen Road - LIVERPOOL.

THE POPULAR ONE-VALVE AMPLIFIER.

(Continued from page 22.)

portion of the total resistance in circuit for 2-volt valves, say, approximately 1 ohm. For 6-volters about 4 ohms will be necessary, or roughly one-half of a 7-ohm winding. Only use one H.T. lead, because if H.T.— is joined to L.T.+ in the set the L.T. battery will be short-circuited. Therefore, leave the H.T.—terminal on the set blank, unless you intend to use two separate H.T. batteries.

NOTE.—The list of components on the first page indicates the parts actually used in the set. It is, of course, understood that components of any good standard make can be chosen throughout. For example, in the case of the valve-holder the following good alternative makes are available, Ashley, Benjamin, Bowyer-Lowe, Burndept, Burne-Jones, Lotus, Pye, W.B. For the fixed condenser, the usual range of Clarke, Dubilier, Lissen, Mullard, T.C.C., etc., are available, and so on.

POINT-TO-POINT CONNECTIONS.

Join L.T.+ to one side of filament "on-off" switch.
Other side of filament switch to moving arm of baseboard resistor.
Other side of baseboard resistor to one filament terminal on valve holder.
Join L.T.— to H.T.— and to remaining filament terminal on valve holder.
Join top "input" terminal to terminal 6 on L.F. transformer, and to one side of .0005 condenser.
Join other "input" terminal to remaining side of .0005 condenser and to terminal 3 on transformer.
Join terminals 1 and 2 together. Connect terminal 5 to one side of volume control, and terminal 4 to other side of volume control.
Connect centre terminal on volume control to G of valve holder.
Join H.T.+ to L.S.+ and L.S.— to P on valve holder.
Join flexible lead for G.B.+ to L.T.—.
Join other flexible lead for G.B.— to terminal 5 on L.F. transformer.

DO YOU KNOW THAT—?

Eight motor-cars, with portable sets, are maintained by the Canadian Government, to investigate cases of interference with broadcasting caused by power, lighting, or other electrical apparatus.

A gang of thieves in Berlin were recently tracked down

down the offenders and discovered accidentally that the apparatus had been stolen.

The best-equipped radio hospital in the world is at Miami Beach, Florida. Every patient has a complete radio set for himself with a separate aerial, so that he may tune in any programme he pleases instead of listening to the same programme as the other patients, as in most hospitals.

According to reports from Russia there are now fifty-six broadcasting stations in the Soviet territories, five being situated in Leningrad and nine in Moscow.

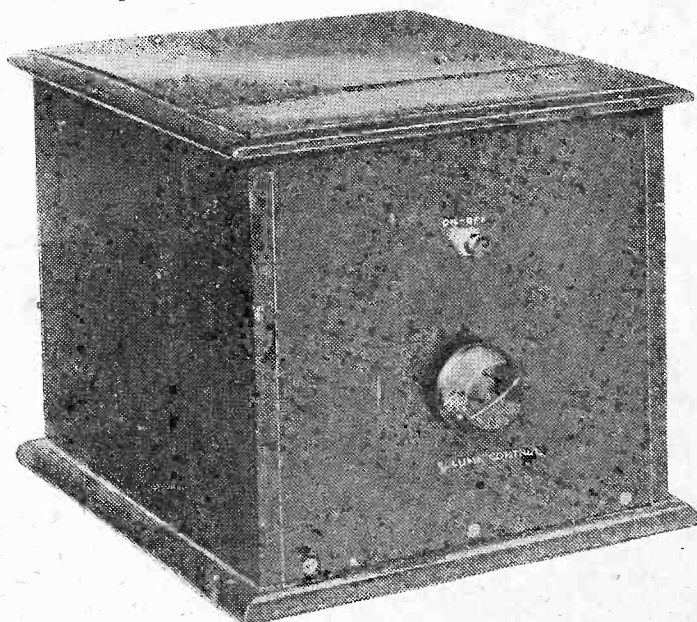
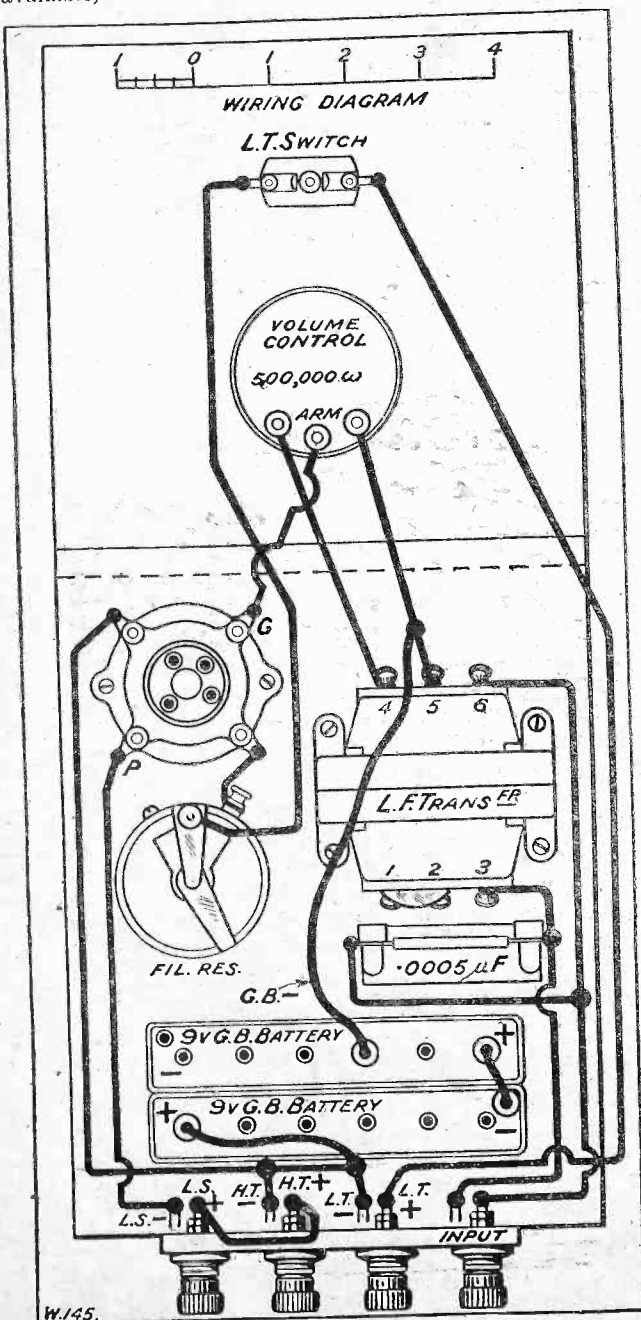
Dr. J. A. Fleming, of University College, London, took out the original patent for the thermionic valve-detector on November 16th, 1904.

New Zealand is reputed to be the long-distance listener's paradise. Owing to the extraordinarily good conditions, a New Zealand listener has been able in one day to re-broadcast Holland in the morning, listen to W G Y Schenectady for two hours in the afternoon, and finish by tuning in the Tokio, Japan, programme on the loud speaker for an hour in the evening.

The Irish Free State issues free receiving licences to blind persons.

To enable them to film outdoor scenes in which many actors are concerned, the Paramount Famous-Lasky Corporation has been licensed to operate a portable radio telephony transmitter in California. By this means the director of the picture will be able to communicate with actors beyond the range of his megaphone.

Unlike most modern broadcasting stations



In its American style of cabinet the little amplifier makes an attractive addition to any modern receiving set equipment.

by the police as a result of a wireless set which they had stolen being unskillfully handled and allowed to oscillate, thus spoiling the programmes of a detective who lived near! He tracked

the new Copenhagen transmitter has not been placed in a country site, but is erected in the centre of the city.

Microphones are being installed in the Danish Houses of Parliament so that the speeches can be broadcast.

RECEPTION OF KALUNDBORG.

The Editor, POPULAR WIRELESS.

Dear Sir,—I see in this week's issue of POPULAR WIRELESS that you have not received many reports of reception of Kalundborg in this country, and am therefore sending you the following in the hope that it may be of some interest to you.

I can receive the above station any evening at sufficient strength (loud speaker) for a medium-sized room, in fact, at certain times I have to detune slightly in order that the volume shall not become uncomfortable.

My set is a straightforward three-valver, Det. and 2 L.F. (transformer coupled), and being now over two years old, would probably cause some of the present-day experts (R.C.C., etc.) to turn up their noses in contempt. However, I have built some, and heard most of the up-to-date receivers and cannot yet find anything to touch the above for either volume, range, or purity of tone.

I can get from 25 to 30 stations on the loud speaker, including, on the long waves, Hilversum, Radio-Paris, Daventry, Kalundborg, Zeelen, and Motala, and on the broadcast band such distant ones as Vienna, Prague, Breslau, San Sebastian and Barcelona. Not so bad for an old-fashioned set. Also, on the only occasion on which I sat up for America, I received Schenectady, New York, at splendid headphone strength.

My aerial is quite an ordinary one, single wire, 60 ft. long, 31 ft. at free end and 24 ft. at lead-in end, while the valves are all Mullard, 2-volts.

May I also say how much I have enjoyed your recent sarcasm at the expense of Chamber Music and Symphony Concerts. The programmes contain a disgusting amount of this heavy, depressing, absent-minded sort of stuff.

By the way, what about asking the Technical Staff to give us some more short-wave circuits? I have now got practically all I want on the longer waves, and having built the "Sydney" Two, am looking for some more short-wavers to try my hand on.

Wishing you and "P.W." every success, I am,
Yours faithfully,

HORACE L. CLARKE.

Wolverhampton, Staffs.

The Editor, POPULAR WIRELESS.

Dear Sir,—You ask for reports of reception of Kalundborg.

It is one of my best quality and most reliable stations.

I have two sets of my own design and construction, four- and six-valvers; on the former Kalundborg gives good loud-speaker results after dark, fair in daylight. On the six-valver first-class loud-speaker

CORRESPONDENCE.

RECEPTION OF KALUNDBORG

BOMBAY AT L.S. STRENGTH—THE COLOMBO STATION.

Letters from readers discussing interesting and topical wireless events, or recording unusual experiences, are always welcomed; but it must be clearly understood that the publication of such does in no way indicate that we associate ourselves with the views expressed by our correspondents, and we cannot accept any responsibility for information given.—EDITOR.

results all day and requires a "Losser" in A.T. circuit at night.

Hilversum I get better quality than Daventry, which is supposed to be our best station.

I wonder if the B.B.C. realise that a regional station on the lower broadcast band will be utterly useless on the South Coast owing to terrific spark interference? There must be a million inhabitants there bound to the long waves.

Yours faithfully,

WM. A. LUCAS.

Hastings.

BOMBAY AT L.S. STRENGTH.

The Editor, POPULAR WIRELESS.

Dear Sir,—My attention has been drawn to the Indian note published in your issue of January 7th, 1928, on page 948. It appears that the writer of the note doubts my statement which appeared in the report of my interview by the "Broadcaster" that the Colombo station is received in "Bombay at loud-speaker strength on a five-valve set."

I have to say that my statement is absolutely correct, and it is not my own experience but the experience of several hundreds of other set owners who have received Colombo on loud-speaker strength on five-valve sets, and very often on a four-valve set also. If my statement has been properly read by the writer of the note in your magazine, he would

have noticed that it was in reply to a question about the reception conditions in India that I gave this fact as an illustration.

The reception conditions in India are sometimes so favourable that even on a two-valve set very often stations as far away as 1,000 to 1,200 miles have been heard at 'phone strength. That is to say, recently my own experience on a two-valve Bowyer-Lowe Short-Wave receiver which was adapted to receive broadcast band reception on a home-made coil was interesting.

As you know, this set is not designed for medium wave-length reception, and still it received in Bombay Calcutta programmes on two valves. You may be aware that the Calcutta station is of 3 kw. and the distance between Bombay and Calcutta is nearly 1,200 miles. Of course, this is an exceptional instance, but there are several instances on record that on a three-valve set Calcutta and Colombo have been received at 'phone strength.

Hoping the above may be of interest to you.

Yours faithfully,

for Bombay Radio Co., Ltd.,
ABDULLA FAZALBHAI,
Managing Director.

Bombay, India.

THE COLOMBO STATION.

The Editor, POPULAR WIRELESS.

Dear Sir,—With reference to page 946 of your issue of 7th instant, under subheading "Indian Note," the particulars given regarding the Colombo Wireless Broadcasting Station are not quite correct.

The official power of the transmitter is 1.75 kw. and crystal range at least 25 miles round Colombo.

The Colombo Broadcasting service is an excellent one and developing steadily among a people who are entirely unaccustomed even to the idea of broadcasting.

With regard to your surprise at Colombo being heard in Bombay on five valves, it may be interesting to you to know that in Colombo, Bombay can be heard well at strong telephone strength on a single valve set of a certain design, and also on a two-valve (det. and 1 L.F.) short-wave receiver of Simmonds' design with suitable coils. The distance is 900 miles (approx.) from Colombo.

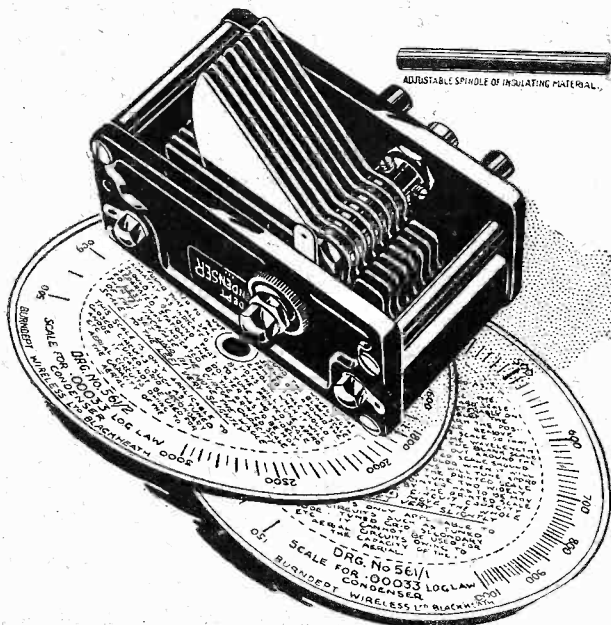
Calcutta, on the other hand (1,200 miles away), is not a success from Colombo on these sets, probably due to hill screening. It is, of course, easily heard on multi-valve sets further inland to the east.

Yours faithfully,

J. S. DINWIDDIE,
Member of Committee,
Ceylon Amateur Radio Society.

Colombo, Ceylon.

Build your set on a solid Burndept foundation —



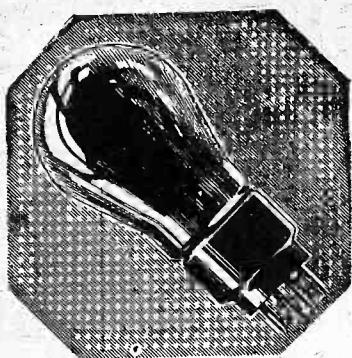
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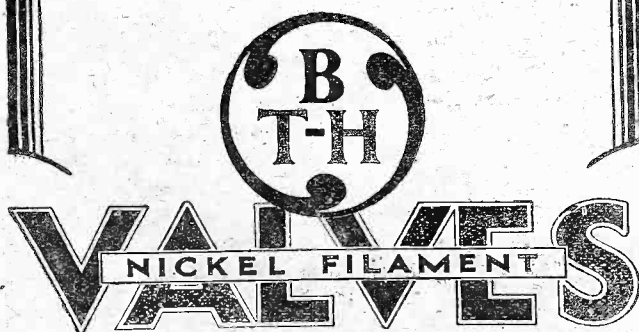
When you change over to B.T.H. Nickel Filament Valves—as you are bound to do, now or later—you won't have to listen carefully for the promised improvement. It will be immediately and obviously apparent.

These remarkable new valves have a greater emission than other 2-volt valves of corresponding types, and they give a greater volume and better quality of reproduction. Moreover, they give these results for a longer period than other valves.

You owe it to your set to equip it with B.T.H. Nickel Filament Valves.

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R.C. and H.F.	General Purpose	Power
Fil. Volts . . 2	Fil. Volts . . 2	Fil. Volts . . 2
Fil. Amps . 0.10	Fil. Amps . 0.10	Fil. Amps . 0.15
Max H.T. V. 150	Max H.T. V. 120	Max H.T. V. 120
10s. 6d.	10s. 6d.	12s. 6d.

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I have acted as father and adviser to thousands of others. I give advice free, and when I do so I feel the responsibility of a father, either in advising a career or in guiding our students to success. Having been the self-constituted father and adviser to thousands of others, it is possible I may be able to help you and guide your footsteps so that you may make a success of your life.

Thousands of people think they are in a rut simply because they cannot see the way to progress. This applies particularly to Clerks, Book-keepers, Engineers, Electricians, Builders, Joiners, etc. They do not realise that in these particular departments the demand for the well trained exceeds the supply, also they do not realise that about rs. per week will pay for all necessary books and tuition, and that by studying in spare time they can qualify for the higher and better paid positions. In Technical trades and in the professions employers are frequently asking us if we can put them in touch with well trained men. Of course, we never act as an employment agency, but it shows us where the shortage is. In nearly every trade or profession there is some qualifying examination, some hall-mark of efficiency. If you have any desire to make progress, to make a success of your career, my advice is free; simply tell me your age, your employment and what you are interested in, and I will advise you free of charge. If you do not wish to take that advice, you are under no obligation whatever. We teach all the professions and trades by post in all parts of the world, and specialise in preparation for the examinations. Our fees are payable monthly. Write to me privately at this address, The Bennett College, Dept. 106, Sheffield.

J. Bennett

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1930 CIRCUIT in 1928!!! "P.P.V." Forges Ahead with the "1930/Three."

THE "1930/THREE," the simplest 3-valve "P.P.V." circuit, yet gives power of average 5-valve set. Just two fixed home-made basket coils, and a dozen connections, bring these reports: "Sit in my chair and hear America on speaker in comfort." "Receives 34 stations on speaker." "Eleven loud-speaker stations on indoor aerial in London." "Receives Glasgow on speaker in London." "Berlin far too loud for comfort"—and hundreds of others. The "1930/THREE," best 3-valver by "P.P.V." Designed by B. Bartram exclusively for "P.P.V." The simple, absolutely selective "build-it-in-two-hours" circuit. Just ordinary parts, obtainable anywhere. Blue prints, full size, copious instructions. Price 3/- (Royalty included). Send P.O. for 3/-, or send for further particulars, also lists of "P.P.V." circuits advertised in "P.V." since 1924. Write, wire, phone or call for lists and a bagful of wireless literature.

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TWO GECOPHONE ACCESSORIES—RIPAULTS H.T. DRY BATTERY—DIONOID ACCUMULATORS—THE STEWART-WARNER REPRODUCER.

Traders and manufacturers are invited to submit wireless sets and components to the "P.W." Technical Department for test. All tests are carried out with strict impartiality in the "P.W." testing-room, under the supervision of the Technical Editor, and the general reader is asked to note that this weekly article is also intended to provide a reliable and unbiased guide as to what to buy and what to avoid.—EDITOR.

TWO GECOPHONE ACCESSORIES.

THE attractive feature of an alliance of the radio-set with the gramophone is that however old-fashioned the latter may be it can be made to give results equal to the most expensive modern instrument. All the gramophone has to do is to provide a turntable which will rotate at certain definite speeds. The rest of the work is left to the radio outfit and to that important link, the "pick-up."

Providing your set has two stages of low-frequency amplification it can be linked to a gramophone. The pick-up replaces the sound box on the tone arm of the gramophone, and the two leads which come away from it are joined across the grid and filament of the detector valve. This, broadly speaking, is all that has to be done, although refinements, such as transformers, pitch controls, and so on, can be introduced by the more advanced amateur if he requires to

operate a moving-coil loud speaker with complete faithfulness.

Quite recently the G.E.C. people sent us one of their B.C.1660 new type gramophone pick-ups. It is a neat little piece of gear and with its bright aluminium and steel has a very business-like appearance. It appears to be moderately light on records.

New "Modern Wireless" Feature.

With a moderately heavy needle (half-tone) there is a very little chatter and the damping appears to be thorough. Nevertheless, it gives a very bright reproduction and faithfully follows all variations from the highest to the lowest notes. It feeds into the set an input much better than the average set and loud speaker is capable of handling.

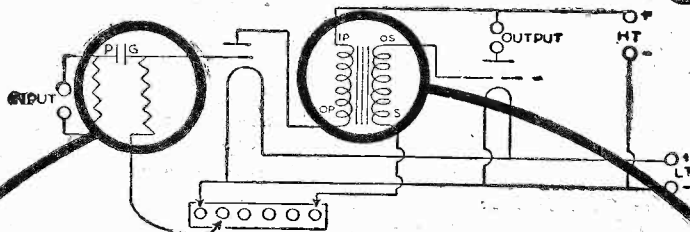
To appreciate its real efficiency one requires to employ a first-class outfit, including a moving-coil loud speaker. Nevertheless, with a device such as this you would be able to operate your set with results equal in every respect, and perhaps even better than, the broadcast reception. And, by the way, if you desire to learn something about "Radio and the Gramophone" and its advantages, and obtain practical hints and tips, we would advise you to read the new section starting in MODERN WIRELESS dealing with this modern and interesting subject.

We have also had a Gecophone cabinet cone loud speaker on test. It is a handsome instrument. A special feature is the deep and rigid cone, and this probably contributes in no small measure to the good results the loud speaker gives. It handles

(Continued on page 39.)

MARCONIPHONE

FOR MODERN L.F. AMPLIFICATION



Marconiphone Amplifying Devices build up whispers into voluminous sound, yet never do they sacrifice tone purity for the sake of volume—harshness and distortion have no place in a receiver built from Marconiphone components—especially if Marconi Valves are used.

For the first L.F. stage use one of the new Marconiphone R.C. Units. Remarkably compact, they maintain their stated value under all conditions with absolute silence. There are two types: Type "A" for valves of medium impedance, 8s. Type "B" for high magnification valves, 7s. 3d.

Follow this with the famous "Marconiphone" Ideal Transformer—proved distortionless throughout the musical scale and guaranteed against electrical and mechanical defects for twelve months. In ratios 2.7 to 1, 4 to 1, 6 to 1, 8 to 1, 25s. each.

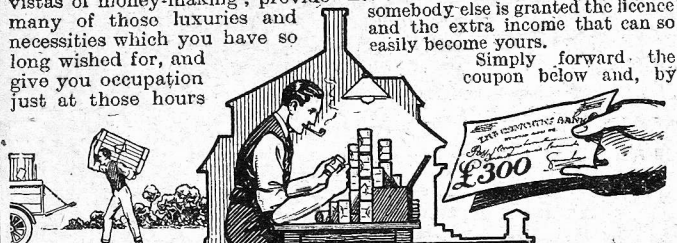
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when time is apt to hang heavily on the hands. Others are doing this by working my enormously successful patents. Why not you? It costs you nothing to write for full particulars, and you can then see for yourself exactly what you can do. My patents are in very great demand in the field of wireless and electricity—so much so that I GUARANTEE your profits, and further guarantee to protect you against any in-

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Print your name and address boldly in capital letters on a plain sheet of paper and pin this coupon to it. "Popular Wireless," March 3rd, 1928



THE lights are dimmed, the fire is glowing red, and the cat is curled up on the rug before it. You lie back in your fatherly old chair, pipe between your teeth, to be thrilled for an hour by the music of your Brown Loud Speaker.

What more would ye, my Masters?

This Brown H.3. Loud Speaker is as much a stickler for the truth as are the more expensive Brown instruments. Yet it only costs 60/-.

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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 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 constructional articles which appear from time to time in this journal are the outcome of research and experimental work, carried out with a view to improving the technique of wireless receivers. As much of the information given in the columns of this paper 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.

QUESTIONS AND ANSWERS.

A TUNING "PUZZLE."

A. L. (Westhoughton, nr. Bolton, Lancs.).—
"May I join my congratulations to other readers on the capabilities of the 'Sydney' Two? Every night for a month I have been able to listen to K D K A from 11 p.m., sometimes as loud and clear as the local station 15 miles off.

"One thing has puzzled me, and that is the position of the earth clip, and I am sure other users have been likewise at a loss. I have never been able to tune in anything lower than 40 metres, not a whisper of 2 X A D or 2 X A F. Looking at the coil from the front I receive K D K A with A clip on the fifth turn from the left, G clip on last turn, and earth clip on the extreme right. I am sure other users of the 'Sydney' Two would welcome enlightenment on the point."

"I have also a three-valve Unidyne which I would not change for all the super and ultra sets ever issued.

"List of stations I log on any good night on the loud speaker, using one-valve Unidyne and 2 L.F.: Manchester, Dublin, Liverpool, Milan, Prague, Frankfurt, Toulouse, Langenberg, Vienna, Brussels, Radio-Paris, Huizen, Hilversum, Koenigswusterhausen, Kalundborg, Breslau, Hamburg, Stuttgart, also Mersey dockboard lightships."

We do not quite understand your difficulty with the "Sydney" Two, A. L., unless it is that you have not read the instructions in the article properly, and you are not varying the positions of all the clips correctly. You say that you have picked up K D K A any old night from 11 p.m. onwards at good strength, but have never received a whisper from 2 X A D or 2 X A F.

As a matter of fact, 2 X A D and 2 X A F have been coming over not only as well as K D K A but considerably better, and it would appear, therefore, that the reason you have not received them is that you are not tuning properly. If the earth clip is placed on the extreme right of the coil the wave-length to which the set will tune is chiefly determined by whether the grid clip G is on the last turn of the coil or is put at some intermediate point between the two.

If you are keeping it on the last turn you will not tune down much below 40 metres, because even with the condenser all out the inductance which you have in circuit is sufficient to cover that wave-length. But move the G clip down towards the earth clip and immediately in effect you have a smaller tuning coil, consequently you tune down lower and the stations previously outside your tuning range will come romping in.

(Continued on page 32.)

The CHLORIDE ELECTRICAL STORAGE CO., LTD.,

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THAT THEY RECOMMEND
"CLIX" PARALLEL PLUGS
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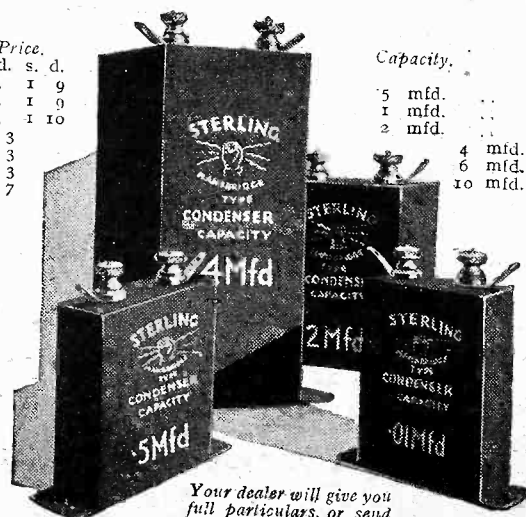
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In Sterling Condensers unquestionable quality and reliability are bought at an extremely low price. In a Sterling Mansbridge Type Condenser the dielectric is protected against dielectric breakdown, is tested to 300 volts and enclosed in a strong metal case. For trouble free condenser efficiency under all conditions, specify "Sterling."

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2.5 mfd. . . .	2 3
3 mfd.	2 3
4 mfd.	2 7

Capacity.	Price.
s. d. s. d.	
5 mfd.	2 7
1 mfd.	2 10
2 mfd.	2 10
4 mfd.	7 6
6 mfd.	11 6
10 mfd.	18 0



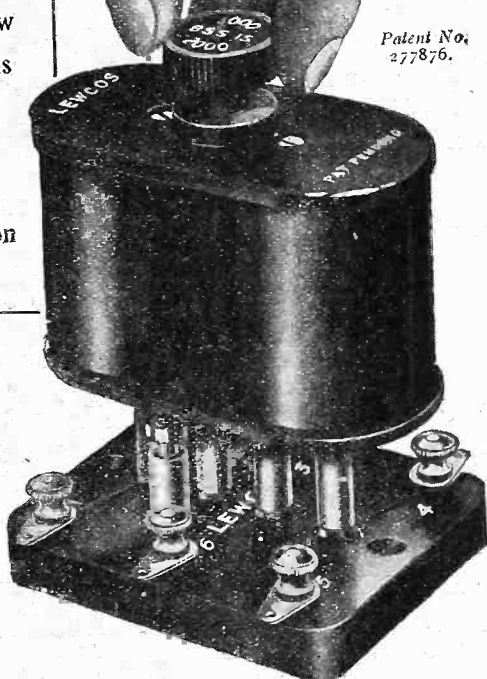
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P.R.2	2	0.06	25,000	12	4.3	Det.
P.R.3	2	0.06	18,000	8	4.4	L.F.
P.R.4	2	0.06	120,000	40	3.3	R.C.
P.R.5	2	0.15	40,000	20	5	H.F.
P.R.6	2	0.15	30,000	15	5	Det.
P.R.7	2	0.15	12,000	6	5	L.F.
P.R.8	4	0.06	23,000	15	6.5	H.F.
P.R.9	4	0.06	19,000	9.5	5	Det.
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OUR GUARANTEE

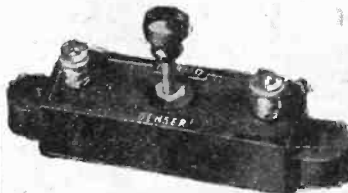
All valves despatched by return of post under guarantee of Money Back in full if not satisfied. All valves are carefully packed and breakages replaced.

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5 Capacity ranges, and each in Baseboard and Panel models.
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FORMO-DENSER

A sound variable condenser which fills a long-felt want. Specially designed to take the place of the hitherto generally used Fixed Condenser. For use as:

Neutralising Condenser
Aerial Condenser
Grid Condenser
Reaction Condenser
Phasing Condenser
Tone Control Condenser

BUY FORMO HANDBOOK. Practical Circuits Blueprints of two sets, etc., 1/-

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 30.)

Remember that the amount of coil in use is the amount between the earth clip and the G clip, so that the nearer these two are together the lower is the wave-length to which the set will tune. (Thanks for your report upon the reception with your Unidyne receiver. It is certainly extremely good, for regular results.)

AN ADAPTABLE CRYSTAL SET.

R. H. W. (Leeds).—"Can I have a crystal set that I can experiment with? I should like to try loose coupling and all sorts of different circuits, but I can't keep building new sets all the time, so I want one I can change over and try different circuits with. (But crystal, not a valve, because here in LS (Leeds), £ s. d. is scarce.)"

Just the set for your purpose is described in the March issue of "Modern Wireless." It is called the "Centurion" Crystal Set, because there must be about one hundred ways of connecting it up. Very cheap to build, too!

TUNING THE "PROGRESSIVE" TWO.

W. W. M. (Sunbury, Middlesex).—"Since writing you last I have completed the 'Progressive' Two, and after some little trouble have got it to work fairly well."

"Am using a 60 Lewcos centre-tapped coil, two P.M.5X valves with 40 volts H.T. I find that using the second tapping from the bottom of the coil, as you suggest, I can hear practically nothing; the fourth seems to be best. Have tuned in about 20 stations and they all come in on the top half of the tuning condenser dial (Ormond S.L.F.), e.g.:

Station	Reading
5 G.B.	177
2 L.O.	147
Dublin	132
Not identified	92

"Also, the A.T.C. comes down to zero for best signals at about 120 on the tuning condenser, after that it seems to be no further use."

"Should I be satisfied with this, or do you think a change in the aerial coil would improve matters?"

"Aerial is a good 100 feet long and about 29 feet high."

Although you have succeeded in tuning in about twenty stations the set is very heavily handicapped because the two tuned circuits are now "out of step." Instead of the A.T.C. being set to zero when the other condenser is set to 120, both dials should read the same, or about the same. At present your two condensers are right out of step, and we should certainly not be satisfied with this state of affairs.

Near the end of your letter you say the "aerial is a good one hundred feet long," and that, W. W. M., is where you have "missed the boat." By having an extra long aerial you have in effect mistuned the circuit and, consequently, you should either shorten your aerial or use a much smaller aerial coil. As a matter of fact, we should be inclined to do both; that is to say, we should first of all shorten the aerial to a maximum of about 70 feet, including the lead-in, and then try also the effect of a smaller aerial coil.

You will find that the tuning of the H.F. circuit will be unaltered, but the aerial-tuning-condenser will now read an approximately equal number of degrees. Consequently, both condensers will be set near the top of their readings for 5 G.B., both will be round about 132 for Dublin, and below that the aerial tuning will be just as critical as that of the other condenser. When both circuits are tuned correctly the stations will come tumbling in on the lower half as well as on the upper half of the scale. If it is not convenient to shorten your aerial or reduce the aerial coil as suggested, you can do it electrically by means of a series condenser. Get one of the little "00025 mfd. variable condensers, as used in the "P.W." Standardised Wave-trap, and set it nearly "all out," after which it will not require readjustment. (You will find the best setting for it very easily in practice.)

RADIO AND THE GRAMOPHONE.

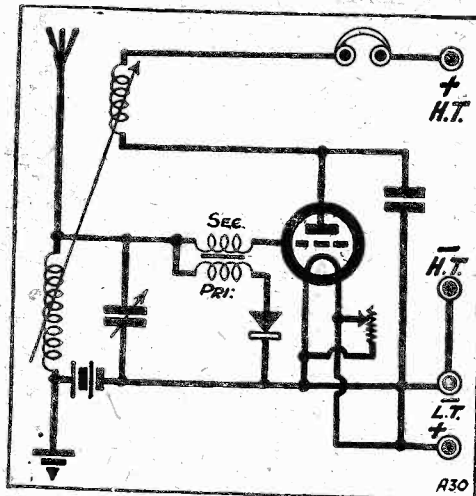
"COLUMBIA" (Cheltenham, Glos).—"This working a loud speaker by gramophone is just the thing I have been looking for. Where can I get details of a three- or four-valve set on these lines?"

Popular Wireless, March 3rd, 1928.

You will find many interesting details about gramophone pick-ups in the March number of "Modern Wireless," now on sale. In this March issue, also, is a full description of "The Radio-Gram" Four, a powerful set suitable for broadcast or gramophone reproduction.

(Continued on page 34.)

WHAT IS WRONG?



The above diagram is supposed to represent the connections of a one-valve Hale receiver. But it is wrong, and would not work properly.

Next week the correct diagram will be given, and, to test your skill, we shall continue to publish every week a diagram in which a mistake (or mistakes) has been inserted. The correction will be published the following week.

No prizes are offered, but by following this series and trying to solve the problems, week by week, the reader cannot fail to learn a lot about radio circuits.

REFUSE IMITATIONS!



Standard Size panels supplied in three finishes, Black polished, Black Mat, and Grain polished, carefully packed in attractive cartons. Every panel and piece of ebonite guaranteed and made by British hands.

Apply for particulars of our new foot-proof 4 and 6 contact Former with bases ready for winding, directions and fully illustrated booklet, Price 6d.

ORIGINAL PRIZE-WINNING
"BECOL" LOW LOSS FORMER,
No. 5. 3 inch diam. overall.

Insist on a Becol Low Loss Former, the Former "with a reputation," incorporated in sets that have taken four first prizes and gold medal, a proof of their superiority. Supplied in cut lengths, 3 in., 4 in., 6 in., packed in cartons, and standard lengths of 3 ft.

Specify

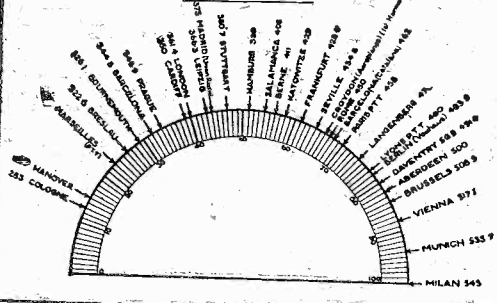


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The "Modern Three"

BUILD THE "MULLARD MASTER THREE" WITH RIDLEY PARTS

2 Terminal Strips, 2 1/2" by 2" by 1/4"	Free
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1 Coil Base, 6-Pin	1 0
1 .0005 Condenser S.L.F.	3 9
1 .0003 Condenser S.L.F.	3 6
1 H.F. Choke	4 6
3 Valve-holders	3 0
1 Cabinet	1 0
1 Pair Brackets	0 8
1 6-Pin Coil, B.B.C.	7 6
1 2 v. Accumulator D.F.G.	8 6
1 P.M. 1 A Valve	10 6
1 P.M. 1 L.F. Valve	10 6
1 P.M. 2 L.F. Valve	12 6
1 100 v. H.T. Battery	8 6
1 Grid Battery	1 0
1 R.C. Unit, Lissen	4 0
1 L.F. Transformer, Lissen	8 6
1 Cond. and Leak, Fixed	2 0
1 Switch, Benjamin	1 0
2 Spade Terminals	0 2
8 Wander Plugs	0 8
1 Panel, 18" by 7" by 4"	2 6
3 Yds. Red and Black Flex	0 5
	£5 15 0



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Batteries for your Wireless!
RIDLEY'S
price **4/11**
60 volts

Postage 6d.
I sell more Batteries than every other Wireless Dealer in the district combined I think, simply because the **M.A.L.** stands pre-eminent for long life and good service.
60 volts **4/11**
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The finest value obtainable, full size, well finished, gives perfect reproduction. **25/-**. Carriage 1/-.

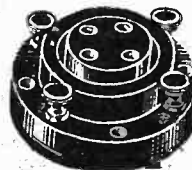
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Everything sold by this House is guaranteed to give entire satisfaction, or money will be refunded in full. This covers you against dissatisfaction. If your requirements are not included below—write giving details.

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72-yd. COILS RED AND BLACK FLEX, usually 10/6. **My Price**, 6/9.

Devicon Variable Condensers, .001, 2/- each.
Catwhiskers, 10 a 1d.
Miniature Ebonite Switches, 9d. each.
4 1/2-volt Flash-Lamp Batteries, 3/6 per doz.
Neutron Crystals, 11d. each.
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.0002 Devicon Variable Condensers, 3/6.
4-volt Frelat Valves, 3/- each.
4-volt Frelat Power Valves, 3/- each.
Murray Valve-holders, 6d. each.
Antimicrophonic Valve-holders, 10d. each.



Ebony Antimicrophonic **VALVE-HOLDER**. Cheapest on the market, considering quality. Base-board mounting.
Leather Accumulator Carriers, 1/3 each.
Single Circuit Plugs and Jacks combined, 3/-.
H.T. Voltmeters, 0-130, 4/3 each.
Bretwood Var. Grid Leaks, 2/- each.
Cleartron 6-volt Valves, 2/6 each.

30-ohm and 6-ohm Rheostats, 9d. each.
Mans. Fixed Condensers, 5, 6d. each.
Fixed Condensers, .25, 6d. each.

JACKS AND PLUGS
Single Circuit Jack, open, 1/3.
Double Circuit Jack, closed, 1/6.
Filament Jack, Single, 1/9.
Filament Jack, Double, 2/3.
Plugs, 1/6, 2/- and 2/9 each.
S.P.D.T. Switches, 6d.
D.P.D.T. Switches, 9d.
.0005 S.L.F. Condensers, 3/6.
Push-pull Switches, 9d.
Baseboard Rheostats, 11d.
8-in. Panel Brackets, 6d.
Bars Solder, 3d. each.
Fluxite, per tin, 4d.
Back-of-Panel 2-way Coil-holder, geared, 2/6 each.
Valve Windows, 6d. each.
Transfers, per packet, 3d.
Voltmeters, single reading, 2/-.
Hydrometers, 2/- each.
Grid Leaks, 6d. each.
"Sovereign" Coil-holders, 9d. each.
Brown H2 Loud-speakers, shop-soiled, usually 50/- Offered at 35/-
Basket Coil-holders, 9d. each.
China Valve-holders, 41d. each.
.0003 Condenser and Grid Leak, 2/- each.
Scrap Ebonite, 8 square inches a 1d. (in 5/- parcels only).

ADDITIONAL OFFERS

Electron Aerial Wire, 100-ft. coils, 1/8 each.
Superial Aerial Wire, 100-ft. coils, 2/6 each.
Edison Bell Fixed Condensers, .0001, .0002, .0003, .001, 1/- each.
Benjamin Rheostats, 6 and 30 ohms, 2/9 each. Lissen panel type, 7 and 35 ohms, 2/6 each.
Microstats, baseboard type, 3/- each.
Resistance Capacity Coupling Units, Ediswan, 7/-; Lissen, 4/-; Cosmos (unit only), 8/-; with Valve-holder, 10/-.
Coil Plugs, wedge type, nickel connections, per doz., 4/-.

Coil-holders, Lissen 2-way, 4/6.
Mansbridge Condensers, 1 mfd., 2/6; 2 mfd., 3/6.
Edison Bell Low Loss Coil-holder for baseboard mounting, 1/-.
Benjamin Filament Switch, 1/- each.
Colvern 6-pin Bases, 1/6; Formers, 4/-.
Basket Coil-holders, 9d. each.
Neutralising Condensers, Colvern panel type, 3/6; baseboard, 3/6.
Grid Leak Holders, 6d. each.
Panel Brackets, 6 in. and 9 in., per pair, 9d. and 1/-.
Edison Bell H.F. Chokes, 4/6 each.

CABINETS

10" x 8" Mahogany, 14/6 Oak, 12/6
16" x 8" Mahogany, 17/6 Oak, 15/-
21" x 7" Mahogany, 25/- Oak, 20/-
18" x 7" Real Oak, 22/6
Add 1/- carriage.

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"RADIO HOUSE," MIDDLESBROUGH

Phone: 1366 M'bro.

BUILD THE "COSSOR MELODY MAKER" WITH RIDLEY COMPONENTS

2 S.L.F. Variable Condensers, .0005	8 0
2 Slow Motion Dials	5 6
1 .0001 Fixed Condenser	1 0
1 .0003 Fixed Condensers	2 0
1 .002 Fixed Condenser	1 6
1 .001 Fixed Condenser	1 0
1 2-microfarad Condenser	2 3
2 Grid Leak Clips (Lissen)	1 0
1 Grid Leak, 4 megohm (Lissen)	1 0
1 Grid Leak, .25 megohm (Lissen)	1 0
1 Grid Leak, 3 megohm (Lissen)	1 0
3 Valve-holders	3 0
1 Lissen Transformer	8 6
2 Panel Switches	1 6
1 Variable Resistance for B.B. mounting	1 0
9 Terminals	0 9
Connecting wire, insulated	1 3
1 yd. Systoflex Covering	0 3
1 Black Panel, 21 in. by 7 in.	3 6
1 Black Terminal Strip, 21 in. by 1 1/2 in.	1 6
1 Cabinet, 21 in. by 7 in.	1 0 0
1 210D "Cossor" Valve	10 6
1 210RC "Cossor" Valve	10 6
1 210P "Cossor" Valve	12 6
	£5 0 0

WONDERFUL OFFER OF COSSOR MELODY COILS!

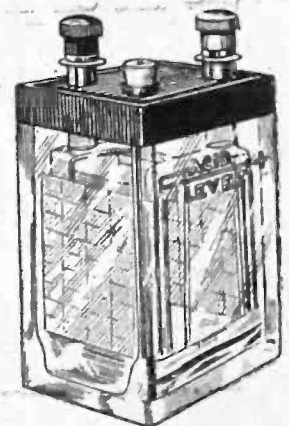
Remarkable value, price **4/6** each.

Insulated Name Terminals, 3d. each.
2-way Geared Coil-holders, long handle, 2/6.
Also back-of-panel 2-way Coil-holders, 2/6.
Croix Transformers, 2/6.
Dundas Transformers, 5-1, 4/6.

Crocodile Clips, 2d. each.

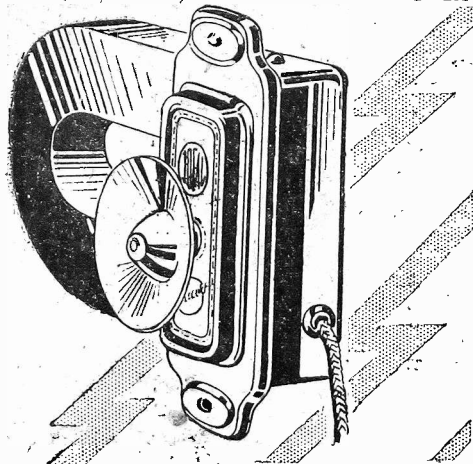
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A customer writes us: "It is indeed an 'Ideal' Unit."

It is ideal because the results obtained are perfect. The Unit is of the Patent balanced Armature type, a special steel is used for the magnets, which makes it extremely sensitive. Further, the Armature is carefully damped to cut out all resonances which are liable to distort reception.

The Unit is complete with padded felt washers to receive your own cone.

A wireless critic writes: "At a cost of under 30/- it makes one of the best cone loudspeakers anyone could desire."

Price 25/-

The "Ideal" Blue Spot Cone Loudspeaker (Model No. 44)

at £2:2:0 complete, includes this famous balanced armature unit. It is fitted with a 16-in. free-edge cone which is capable of taking great volume of sound without blurring. It reproduces both the upper and the lower tones with faithfulness, it requires **no adjustment of the driving unit** whatever the power of the volume being used.

Can be supplied in the form of Home Constructor's Kit.

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204-206, Great Portland Street,
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Telegrams—"Distancing, Wesdo, London."

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—so we labelled it

BLUE SPOT

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 32.)

THE LODGE "N" CIRCUIT.

H. J. (Harold Wood, Essex).—"A friend of mine who lives in Cape Town has written to ask where he can get particulars of the famous 'N' circuit invented by Sir Oliver Lodge. He wants full particulars of how to build a two-valve set which is not capable of causing interference with neighbours. And he tells me that this 'N' is the only set of the kind in the world. Can you let me know where I can get an envelope or a book dealing with the constructional details of a set?"

Full particulars for constructing a two-valve Lodge "N" circuit are given on the "P.W." Blue Print No. 21. This can be obtained from the Technical Query Dept. (price 6d., postage extra).

IMPROVING CRYSTAL-SET RECEPTION.

D. A. J. H. (Finchley, N.).—"My little son has been so delighted with the 'Lo-Cost' Crystal Set which we made from the instructions in your paper that I feel I must write to thank you at once. It gives amazingly good reception from London and has actually received 5 G B, the Daventry Experimental Station. Is there any way of increasing its strength on 5 G B, I wonder?"

Unfortunately the strength of a crystal set is strictly limited. However good and however sensitive it may be—and the "Lo-Cost" is both good and sensitive—there is a definite limit as to the strength of signals it can give in the telephones. Unlike a valve set, in which batteries and other forms of local power are utilised, the energy that works a crystal set is derived directly from the broadcasting station which is being tuned in. In this particular instance there is a great deal of energy developed by the Daventry Station.

THE TWO METHODS.

This enormous electrical energy is radiated outwards and upwards and downwards from 5 G B's aerial in the form of electro-magnetic waves, travelling in all directions with the speed of light. At very short distances from the Daventry aerial these waves are strong, so that, although an aerial within, say, ten miles of 5 G B's aerial would pick up only a tiny proportion of the total energy being sent out, even this fragment would be quite enough to give tremendously strong telephone signals. At distances farther away from the transmitting aerial the area covered by the fast travelling signals becomes so tremendous that only a very small proportion of the energy radiated can be picked up in an aerial. Thus you will readily see that at your own distance from the Daventry station it must be only an incredibly minute fraction of the power passing into space from Daventry's aerial that reaches your own aerial, and works your little "Lo-Cost" receiver. Yet that very small fraction so truly represents the total energy, that the voice which is controlling the latter is reproduced with such fidelity by your set, that anyone knowing it would be able to recognise the speaker! Looked at in this way the marvel is not that the signals are rather weak but that there are any signals there at all. Yet it is quite natural to want to make them as loud as possible, and in order to do this you will see from the foregoing that there are only two possible methods in which this can be done. The first method is to increase the amount of energy picked up. Obviously the only way to do this is to have a good aerial so that you pick up as much of the energy that is being radiated as possible.

AVOID LOSSES.

The second way in which you can increase strength is to make sure that there are no losses anywhere. Remember that the little currents of the aerial are travelling through your set to earth, and it is in this journey that they work the receiver. If, therefore, you bring the lead-in near to any earthed object there will be a tendency for the energy to hop away to earth across the intervening space instead of passing to the set. Naturally energy which is bypassed in this way represents so much energy lost, and therefore it behoves you to get the aerial and earth system as efficient as possible in order that all the energy that is being put into the aerial should actually pass through the set, and work the telephones. By taking every care to get the highest possible efficiency you can conserve the energy and thus ensure that your little crystal set is working at its maximum efficiency. If even then there is not sufficient power for your requirements, the only thing to do will be to utilise the latent power that lies in a battery or dry cell, harnessed to that modern miracle—a valve.

THE WAVE-TRAP CRYSTAL SET.

"WIRY" (Friern Barnet, London, N.).—"I see that on page 1231, 'P.W.' 298 (February 18th), it says the wire for the Standard Wave-trap is No. 26; but in the description of the trap in 'Radiatorial' it says 28 wire should be used. Which is right?"

The number of the D.C.C. should have been 28, not 26.

"THE NEARER THE BONE . . ."

S. J. (Bradford, Yorks.).—"We used to live about four miles further out and then I could not hear Bradford at all well. But now we have come closer in I can hear it as plainly as anything. Why is that?"

Although wireless is the newest science, it obeys the old laws of distance. Every yard that you move farther in towards the broadcasting station is a yard towards perfection. And in broadcasting as in carving, "The nearer the bone the sweeter the meat."

POSITIVE AND NEGATIVE LOUD- SPEAKER TERMINALS.

G. W. (Beeston, Notts.).—"My loud-speaker terminals are not marked positive or negative. Can you tell me the best means of ascertaining one from the other?"

It is not easy to tell which is the positive and which the negative terminals, although it can be done. The usual method of determining this depends upon the fact that if a small current is run through the loud speaker the magnetism resulting from this current will either assist or oppose the permanent magnetism of the loud speaker, according to whether the battery supplying the current is connected correctly or incorrectly.

In practice the experiment is generally carried out as follows. The horn and its support are removed from the loud speaker and the latter is suspended at a convenient height with the permanent magnet exposed to view. Leads are connected to the loud-speaker terminals and taken to a battery, which can be cut in or out at will by means of a switch. Then the magnet is magnetically "loaded" by pins or other small objects, the idea being to attach a load to it as heavy as it can magnetically bear. When the magnet is fully loaded, the battery should be switched in and the effect upon the load should be noted. If the switching-in appears to have no effect upon the load reverse the battery terminals and switch in again. Should the load fall off when the battery connections have been reversed, this will indicate that the battery connections are now the wrong way round, and that its magnetism is opposing instead of assisting the permanent magnet. By careful manipulation it is possible so to load the magnet that every time the battery is reversed the load falls off. When the correct position for holding the load has been definitely ascertained in this way, mark the loud-speaker terminal which is connected to the positive of the battery with a plus and that which is connected to the negative of the battery with a minus mark. This will ensure that the plate current of the valve, which flows from the H.T. positive will be connected to enter the loud speaker at its positive terminal and leave at its negative.

WHAT IS RE-RADIATION?

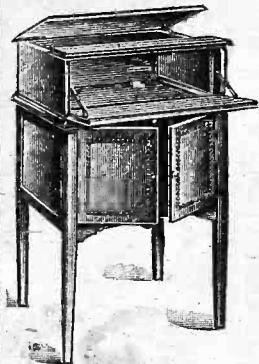
D. W. (Chatham).—"I picked up Hamburg quite clearly on the crystal set, but when I told my neighbour (who has a three-valve set) he said he was tuned to Hamburg at the time, and I was only getting 're-radiation.' What does that mean?"

Re-radiation from a valve set often occurs when reaction is used. What happens in such cases is that the valve set picks up some of the weak signals from Hamburg, and by means of reaction it *strengthens its own input*. Consequently the originally-weak signals are magnified till they are quite strong, and if this process is carried far enough the valve-set receiving aerial may actually commence to transmit some of Hamburg's signals to neighbouring aërials! This is called re-radiation. If your aerial is close to the other one it is probable that you were picking up Hamburg via next door by re-radiation.

IS NEUTRALISING WORTH WHILE?

T. W. A. (Dundee).—"I find neutralising is a difficult and troublesome job, and as the set seems to work O.K. without being adjusted exactly I am wondering if it is really necessary?"

It is a shame not to neutralise a set which is supposed to be neutralised, for it means losing several distinct advantages. For one thing the correct adjustments and handling of the set is easier when once it has been neutralised, and it does not then cause interference with neighbouring sets. Quite as important is the effect upon sensitivity—a long-distance set that is badly neutralised will not bring in half the stations which it is capable of getting when the neutralising adjustment has been made properly.



The Sign of Expert Workmanship.

The productions of V.C. Bond of which this beautiful wireless cabinet is an example, have already achieved the renown they deserve.

This cabinet is only one of a large range of styles and sizes all made by experts in our workshops. Individual designs receive prompt and experienced attention.

Another example of Vee Cee Bee workmanship is provided by this bedroom chair and trouser press which serves a double purpose as a piece of furniture and as a silent valet.

Write to-day for free illustrated particulars to

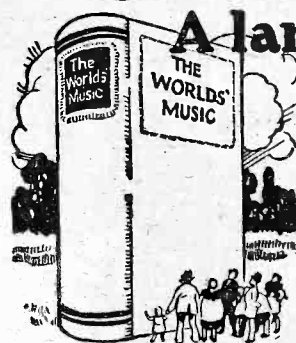
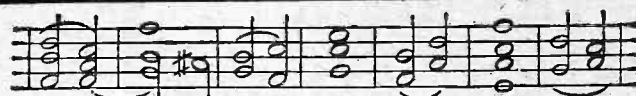
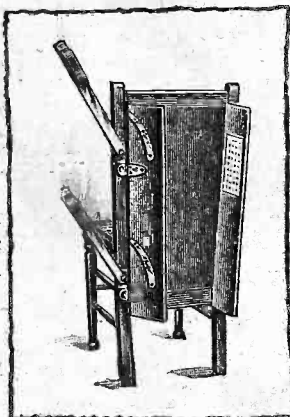
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A large volume of sound!

You get full volume from the "Gem"—not a breathless whisper. It is a full-sized Speaker to which you can listen without strain. It treats the music kindly, too, being careful not to burr the edges.

The only small thing about the "Gem" is its price—the Trade is amazed that it can be made and sold for 30/-

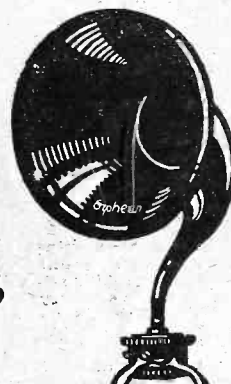
Orphean "GEM"

Be kind to your ears by having the "Gem." Send for List and Name of Dealer who will demonstrate.

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LONDON, S.W.19

Telephone: WIMBLEDON 4658
S.D. 18-4



FULL SIZE
30/-
ONLY

Every user says
"MARVELLOUS"

Good News for Set Builders!

In response to the urgent demand for a first-class 4-valve set for family use, Mr. PERCY W. HARRIS, M.I.R.E., has now prepared

The WIRELESS CONSTRUCTOR ENVELOPE No. 2

In this envelope—obtainable at all bookstalls, price 1/6—will be found full constructional details of a magnificent and inexpensive receiver, called

"THE CONCERT FOUR"

Made of standard parts, all easily obtainable, it is a highly-sensitive long-distance set, giving powerful reproduction of wonderful quality. Covering both long and short wave-lengths, with a switch for 3 or 4 valves, it is essentially a set to enjoy, both in building and operation.

The WIRELESS CONSTRUCTOR ENVELOPE No. 2

NOW ON SALE. PRICE 1/6

By post, 1/9, from the Amalgamated Press, Ltd., Bear Alley, Farringdon Street, London, E.C.4.



BY
**TIMELY
MENDING**
WITH

**SAVE
MUCH
SPENDING**



FLUXITE
it simplifies soldering

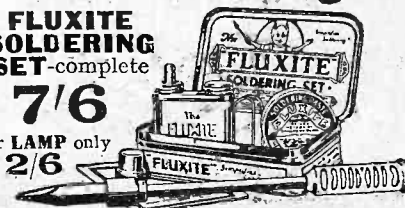
All Hardware and Ironmongery Stores sell FLUXITE in tins, price 8d., 1/4 and 2/8. Another use for Fluxite—Hardening tools and Case Hardening. Ask for leaflets on improved methods.

FLUXITE LTD.
Dept. 324, Rotherhithe,
S.E.16

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SOLDERING
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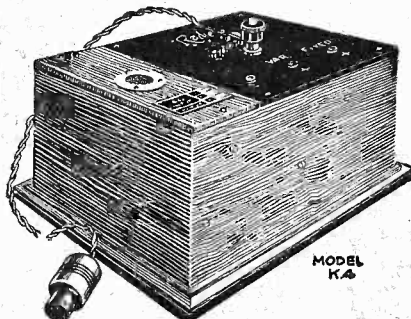


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H.T. SUPPLY UNITS
THE A.C. MODEL K4.

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Complete with "PHILIPS" 506" Valve.
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The Model K4, with output of 15 m.a. at 125 volts, is a very efficient, full-wave rectifier giving ample current for sets using up to four ordinary or three ordinary and one power valves. On A.C. Mains the employment of a "Radielle" Battery Charger (£3.10.0) in conjunction with a "Radielle" H.T. Supply Unit forms an excellent and practical method of obtaining both H.T. and L.T. from the mains. The Battery Charger is connected permanently to the Accumulator in use on the set, and can be left on charge whilst the set is in use.

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18a, Haverstock Hill, Chalk Farm, N.W.3.

(Facing Chalk Farm Tube Stn.)

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ILLUSTRATED LIST POST FREE.

SHORT-WAVE NOTES.

APPARENTLY the transatlantic telephone has at last forsaken its old pitch and started up on short waves. On about 19 metres, one half of it may be heard, the other half being on about 20 metres, although sometimes I have heard them both in the neighbourhood of 16 metres. Since the British station and the American are almost the same strength, it appears that the only reliable way of telling which is which is by the strong accent generally noticeable on one "half"!

A really sensitive short-wave receiver has a most disturbing habit of picking up all sorts of "transmissions" other than those for the reception of which it is intended. A few days ago I had been carrying out some tests with a new microphone, and left it lying loose on the bench, with its long flex leads simply trailing along and then dropping on to the floor.

Judge my astonishment when, on running my fingers along the edge of the table, very loud rustling noises, obviously due to the microphone, were heard in the headphones. When someone spoke quite a foot away from this microphone (which was lying face down on the bench) very clear and intelligible speech in the 'phones resulted.

Peculiar "Strays."

Annoying sounds in a short-wave set may often be traced to such improbable causes as tools rubbing together on the table, or even bits of wire making intermittent contact at quite a considerable distance from the set. A friend informed me once, in all seriousness, that he had to keep his box of "stray" wires of all shapes and sizes outside the room. If it were brought anywhere near the set, a lorry passing down the road caused all the wires to shake, and produced quite a severe storm of atmospherics in the receiver!

It is well worth the little time spent to try the effect of supporting your receiver on boxes or small ebonite legs, not with any motive of insulation, but simply to ensure that the coils are really well above the level of the table.

I always prescribe this simple alteration in cases where the owner of a short-wave set is having difficulty in getting his receiver to oscillate right down in the lower ranges, and it generally has a beneficial effect. On my own, which is always supported by three valve boxes, the action of removing them and lowering the whole thing to the table level has the effect of raising the minimum wave-length of a given coil and condenser from 14 metres to nearly 16 metres!

A long, low aerial is very often found to give really excellent reception, particularly in cases in which the main aerial is somewhere near a source of artificial interference, such as electric trains or trams.

I sometimes use my transmitting counterpoise as a receiving aerial, and interference certainly is considerably lessened. The one trouble that I have not yet succeeded in overcoming is the persistent trouble on 20 metres, or thereabouts, from L.G.O.C. bus magnetos, which are more or less selectively tuned to that wave!

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COMPONENTS
GIVE UNEQUALLED SERVICE

Order from this List and save money.

Orders 5/6 value, carriage paid.
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For Panels 7" high
Width 8" Hinged
lid. Oak, 12" 17"
14" 17/8; 18" 18/6;
Mahogany 1/- ex.

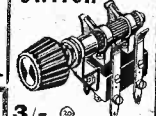
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One-hole fixing 1/-

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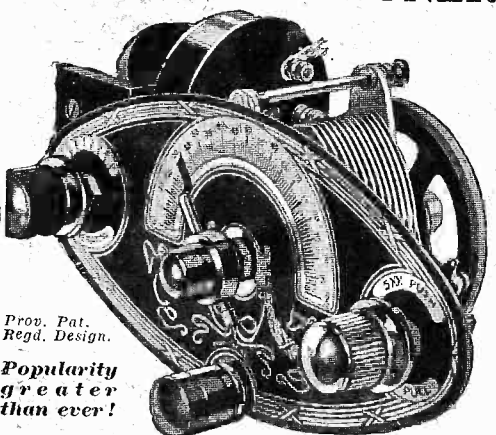


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Self position. Self
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BASEBOARD NEUTRALISING CONDENSER	3 6
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PANEL PLATE TUNER



Prov. Pat.
Regd. Design.

Popularity
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In itself half a set, no ebonite panel is required. No coils to change. Can be fitted to any form of Cabinet. Black and Gold or Silver finish. Supplied with diagrams for building 2 or 3 valver, assuring final efficiency.

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This is just one of our attractive lines — there are many others. Enquire of your dealer or write us.

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BEST RADIO

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Representatives for London and Southern Counties:—
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Mutiny
ON THE BASEBOARD!

When your set gets out of hand, take the one vital step that ensures the perfect balance necessary to secure harmonious, distortionless reception—fit a Sifam Meter and tune with your eyes on the dial. FREE leaflet "Distortion" from (Dept. F, S.I.F.A.M., 10a, Page Street, Westminster, S.W.1.)

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RADIO METERS

WET H.T. BATTERIES
Solve all H.T. Troubles.
SELF-CHARGING, SILENT, ECONOMICAL.
Add (waxed) 3" x 4" sq 1/3 doz
INCS newtype 11d doz SACS 1/2 doz
Sample doz (18 volts), complete with
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AMPLIFIERS, VALVE 1/-, VALVE 80/-
2-VALVE A.C. STATION SET £3.
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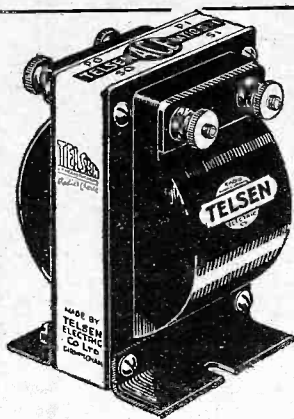
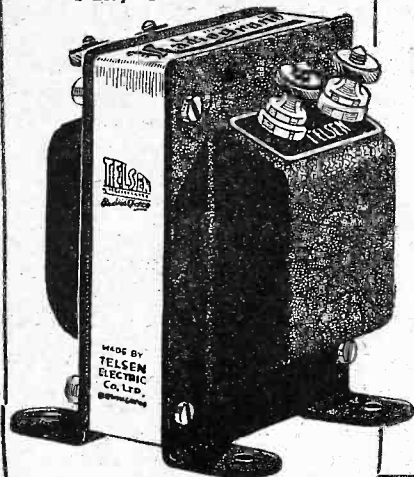
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results are obtained from circuits embodying our L.F. Transformers which are British made throughout.

The "RADIOGRAND"

is a component of the very highest quality typical of a firm that has specialised in one particular instrument and achieved a reputation for outstanding excellence. Though moderately priced, design, materials and workmanship are such that these Transformers stand unrivalled for general efficiency.

12/6 RATIOS
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"ACE" 8/6

Ratios 5-1 and 3-1.

This is a smaller instrument built to give first-class results, yet of a size and weight that render it particularly suited for Portable Sets where compactness is an essential feature.

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Radio's Choice

If unable to obtain write

TELSEN ELECTRIC Co., Ltd.,
Head Office & Works: 207 ASTON RD., BIRMINGHAM.
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Your dealer will supply on 14 days' free trial.
Every Instrument guaranteed 12 months.

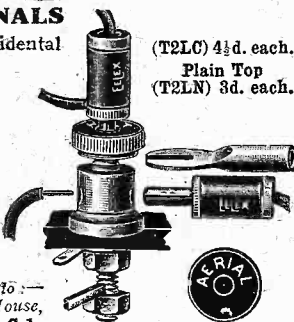
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TREBLE-DUTY TERMINALS

and the danger of a wrong or accidental connection is practically impossible. Any wire or tag, spade or pin, can be securely held; wires need not be soldered, as shaft is slotted at the end and a nut supplied. You can make at least six connections to each terminal if you wish. Terminal parts are standard EELEX fittings, and can be used for other purposes. 36 varieties of indicating tops and also 6 colours.

Write to-day for your copy of Catalogue T31 to:—
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(T2LC) 4d. each.
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1928 EDITION 192 PAGES ENTIRELY REVISED

First edition of this book was issued 18 months before broadcasting commenced. We originated drilled panels, we eliminated soldering, and our latest sets are as much in advance of others as they were in 1921. Read this book and you will know more about wireless than many who are now posing as "experts" and "radio engineers," and you can build the finest sets obtainable.

FULL INSTRUCTIONS, with clear wiring diagrams, are given for making CRYSTAL AND SINGLE VALVE-SETS, ONE- AND TWO-VALVE AMPLIFIERS, THE FAMOUS SAXON 4-VALVE TUNED ANODE SET, also an EXTREMELY EFFICIENT FIVE-VALVE RECEIVER.

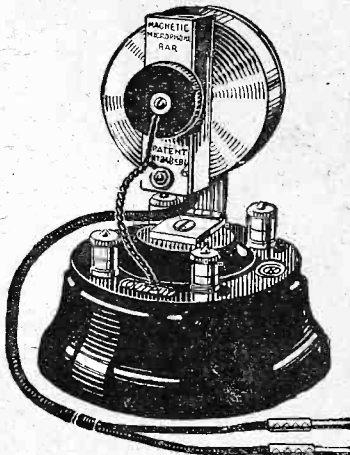
Particular attention is drawn to our latest 1928 TWO- and THREE-VALVE LOUD-SPEAKER SETS which eliminate coils entirely and cover all wave-lengths from 200 to 2,000 metres by merely turning a knob. Any beginner can make these sets in 192 PAGES. two or three hours.

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NO CRYSTAL SET USER SHOULD BE WITHOUT THE NEW NON-VALVE MAGNETIC

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(Patent No. 246581/25.)



which operates a loud speaker direct from any crystal set up to six miles or more (according to strength of original reception) from main Broadcasting Stations; or makes weak reception loud and clear in headphones under any conditions. A great boon to deaf persons. May be used with small valve sets.

Works perfectly on one or two dry cells; no other accessories required.

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2 Dry Cells (lasting 3 months) 4/-

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"ALL THE FUN OF LONDON FAIR"

NEWS FROM SAVOY HILL.

(Continued from page 12.)

Miss Cable on Tibet.

Even in these twentieth-century days, when explorers are discovering hitherto unknown tribes and unearthing buried cities of the past, comparatively little is yet known of Tibet, the "Forbidden Land," as it is called, beyond the vastnesses of the snow-capped Himalayas. There will thus be something unique in the missionary talk which Miss Mildred Cable is giving at 5.30 p.m. on Sunday, March 4th, in the London studio entitled "The Dancing Rituals of the Tibetan Lamas."

Miss Cable, with the Misses Eva and Francesca French, has had considerable experience in China with the China Inland Mission, and a few years ago lived for some time in the far North-West of the isolated province of Kanzu, making preparations to undertake the dangerous and wonderful trek across Central Asia to Siberia. The privilege they had of entering Tibet, the country closed to travellers, except to the few who can approach it from the Chinese border, was almost unprecedented and their experiences, which listeners will hear this afternoon, are certain to be of the greatest interest.

Belfast News.

A running commentary on the ceremony of the reopening of the Parliament of Northern Ireland will be broadcast at 11.45 a.m. from the Belfast Station on Tuesday, March 6th. During the same evening the Ulster Station is paying a tribute to its neighbours across the water by giving an all-Scots programme, the chief feature of which will be a one-act play entitled "The Lost Piper," which deals with an old Scots legend of the eighteenth century. The play is founded on a tradition that a subterranean passage extends from Musselburgh Sands to Edinburgh, through which many years ago a certain piper wagered he would walk playing his pipes the while.

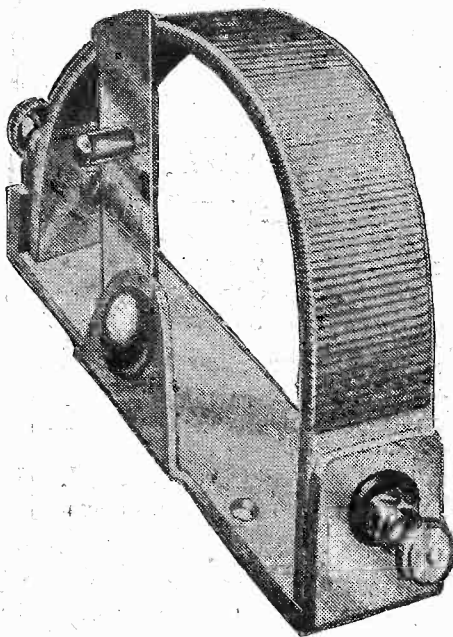
A Newcastle Event.

Songs and choruses, some of them devoted entirely to the North Country, are included among the contributions of the Wallsend Male Voice Choir, in a programme they are giving under the direction of Mr. George W. Danskin, in the Newcastle studio on Monday evening, March 5th. Two short sketches entitled respectively "All Square" and "The Healing Herb," which Mr. E. A. Bryan, of Gateshead, has specially written for broadcasting, will be performed during the same evening, the cast being drawn from the Repertory Company.

Talks—A New Departure at Cardiff.

Dr. Olive Wheeler, Professor of Education at the University College, Cardiff, who is to give a talk on "Psychology for Parents—Early Developments" on Tuesday, March 6th, has lectured in many parts of Great Britain on educational psychology. She is the author of various books and papers on this subject, on which she is a great authority.

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The "PEERLESS" VARISTOR stands up on the baseboard, taking only a fraction of the usual space. It can be fitted on an already crowded panel. The adjustable phosphor-bronze arm is easily accessible. The windings are of best-quality resistance wire, wound tightly on insulating fibre. Terminals are fitted in the most convenient position. You can buy 5 types—3, 6, 10, 15 and 20 ohms. The "Peerless" Varistor is fine for the Cossor "Melody Maker."

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1/3

Popular Wireless, March 3rd, 1928.

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How often can you put your finger on the culprit? the faulty part that mars reception. The panel, perhaps the greatest offender, is often the least suspect because its faults are hidden.

Trouble free reception is based on an efficient panel. To obtain one—the only one—worthy of your confidence, insist on—

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"24 HOURS CUT PANEL SERVICE."

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1973

THE LITTLE CELLS THAT SATISFY.
Eton Primary H.T. Battery P.I. Porous
Pot Cells, S1 and S2 Sac Cells. All complete.

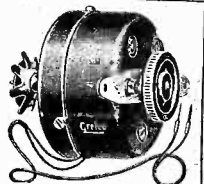
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and NOT to the Editorial or Publishing Offices.

APPARATUS TESTED.

(Continued from page 28.)

both the high and the low notes successfully, and although it is probably more than usually sensitive it can deal with heavy inputs. It is the kind of speaker that looks well in any room, whatever its furnishing, and will give pleasing results with practically any type of receiver.

RIPAULTS H.T. DRY BATTERY.

It will probably be remembered that a few weeks ago we mentioned that we had received a "self-regenerative" type H.T. dry battery from Messrs. Ripaults for test. It is claimed for this type of battery that internal resistance has been entirely overcome and that the capacity output and life has been increased to a considerable degree. The actual battery we have had under test is the triple-capacity type, model H.M., a 90-volter which sells at 29s. 6d. The maximum discharge advised for this battery is 18 milliamps. The approximate life in hours is stated to be 335 hours at a 20-milliamp discharge rate. At 100 hours per month aggregate use this gives a life of three and a third months approximately.

The sort of modern set with which it could be used is a five-valve receiver employing power valves. On the test we gave it we exceeded the maximum discharge advised and after delivering a current of 21 milliamps for well over 300 hours the battery is still capable of doing somewhat lighter work probably for some time. It will be seen that Messrs. Ripaults have not overrated their battery and have, in fact, given a conservative estimate of its life.

We have also carefully tested one of the smaller types and find this similarly satisfactory. The term "self-regenerative" as applied to these Ripault H.T. batteries does not mean that they are capable of living for ever and ever, but that they quickly depolarise and give consistent and long service.

DIONOID ACCUMULATORS.

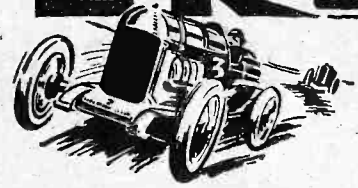
We have recently had the opportunity of examining and testing an accumulator manufactured by the Dionoid Battery Co., Ltd., of Prince of Wales' Road, Darnall, Sheffield. The accumulator is of special construction and has many points of interest.

It has, for instance, a removable metal carrying handle, while the glass container is enclosed in a thick, protective casing, a window being provided to enable the acid level to be checked. Very strong precautions against the effects of acid attacks on the various parts have been taken by the use of a special enamel. This appeared to us to be a particularly sound battery, and one that should give long and reliable service.

THE STEWART-WARNER REPRODUCER.

We have had on test a loud speaker due to the Cooper-Stewart Engineering Co., Ltd. It is a very heavy instrument, and its main construction is an imposing metal casing. But it is very nicely finished in antique bronze-green, ornamented with attractive tracery in a kind of Grecian style. If the projection is somewhat restrained, speech is clear and the speaker's register is wide. The price of this accessory is £6 15s.

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Sure-a-lite batteries are the most powerful because their cells are larger, more efficiently designed and more carefully assembled than those of other makes.

That is why Sure-a-lite H.T. batteries possess recuperative powers to a very considerable degree. That means that they have exceptionally long life and maintain their rated voltage for remarkably long periods.

They are the batteries *par excellence* for high efficiency, long life and silent working.

The new Sure-a-lite "Supra" marks the latest advance in battery construction, and now incorporates Grid Bias tapped every 1½ volts to 6 volts at the old price of 7/11. It is supplied sealed and with a deep dust-proof cover.

Rely on the battery experts—and ask your radio dealer—he knows!

SURE-A-LITE

BRINGS MOST IN — GIVES MOST OUT

REGISTERED TRADE MARK

"SUPRA,"	66 volt	7/11
	100 volt	14/3
"GIANT,"	66 volt	10/6
"	100 volt	17/6

These incorporate Grid Bias tapped 1½ volts to 6 volts.

The Battery Company,
92, Hurst St., Birmingham



CONDENSERS of QUALITY!

No mass production methods are employed in the manufacture of Camden Condensers. Every Condenser is stamped with a Serial No., and accompanied with a guarantee of 6 months' real service. Telegrams: KAMELCO, Telephone: Runcorn 109.

Send for list and prices to
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HEADPHONES REPAIRED.

Rewound and re-magnetised 4/- per pair. Loud Speakers repaired 4/-. Transformers rewound 5/- each. All work guaranteed and tested before delivery. Write for Trade-Prices. Phone: Clerk. 1795. MASON & CO., 44, East Rd., City Rd., N.1.

NO VALVES!

The "NEW MAGNO" Micro Amplifier is GUARANTEED to amplify crystal (or valve) reception 5 to 10 times. For 2/6 we supply blue prints giving full-size constructional details and diagrams, together with ample length of sensitive Electrode, Reed and Screws for making micro part. By fitting these to a spare phone, anyone can cheaply make an efficient amplifier, without H.T., Buttons, Valves, etc. Worked by 1½v. dry cell only. Agent: L. Cook, 182, Cranston Road, S.E.23.

The HOME for your WIRELESS SET

OUR STANDARD CABINETS

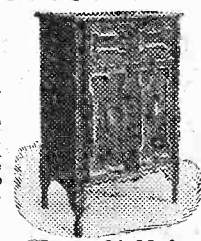
are DUSTPROOF and house the whole apparatus, leaving no parts to be interfered with. All you do is

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Made on mass production lines, hence the low price. Provision is made to take panel up to 30 in. wide and baseboard 20 in. deep. Carriage paid and packed free England and Wales. Thousands supplied with full satisfaction.

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10x 9, 2/4	12x 9, 2/10
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14x 12, 4/-	16x 9, 3/8
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THE DIX-ONEMETER. The 55 Range "Rolls-Royce" of Radio. An instrument of exact precision reading, 40 micro-amp. to 20 amps., 2 millivolts to 2,000 volts. Measures Crystal Signals or Resistances from 50 ohms to 50 megohms. Instrument De Luxe, 55/-; Multipliers, each 6/6. New A.C. Model ready. (See leaflet.)

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WAVEMETERS. Large stock of all ranges at greatly reduced prices. Townsends from 35/-.

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ELECTRADIX RADIOS,

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TECHNICAL NOTES.

(Continued from page 12.)

L.F. Amplifiers.

A low-frequency or audio amplifier may be considered satisfactory if it amplifies the signals impressed upon it sufficiently to operate a loud speaker with adequate volume, and if it does so without distorting the signals to an extent sufficient to become noticeable in the output from the speaker. Proper performance in this respect can only be obtained when the amplifier has been correctly designed and, what is perhaps even more important in practice, when it is properly operated.

The overall characteristic of an amplifier is often quite different from the characteristic of any individual stage, and this is particularly true of transformer-coupled or impedance-coupled amplifiers. It is probably due, in some cases, to coupling in the plate-supply, whereby regenerative effects are produced which induce changes in the overall frequency characteristic of the audio system. Effects of this kind are also present sometimes in resistance-coupled amplifiers, and give rise to the effect which is referred to as "motor-boating."

Peculiarities.

The solution of difficulties of this kind is to design the amplifier so that it has a flat characteristic, or else to design two units to have a flat characteristic, and then to arrange the circuit carefully so that regenerative effects shall not be present to any appreciable extent. This usually necessitates feeding of the grid and plate circuits through resistances or choke coils, and by-passing the circuits with suitable condensers.

Limits of Transmission.

In some modern transformers the design is such as to cut out audio frequencies much above 5,000 cycles per second. This has the effect of excluding various extraneous valve noises, high-frequency heterodyne whistles and so on, which are usually above the figure mentioned. In any case, it is known that frequencies much above about 5,000 do not add appreciably to the quality of the reproduction and can, therefore, be eliminated without loss. It is doubtful, indeed, whether the majority of broadcasting stations really transmit notes of more than about 5,000 cycles.

Many amplifiers have a tendency to oscillate at high audio and supersonic frequencies, but if the amplifier is designed to give little or no amplification to frequencies of this order, the tendency of the amplifier to oscillate will be counteracted.

Sound Characteristics.

The characteristics of the human ear in relation to atmospheric sound-waves have become increasingly important with the advent of broadcast receivers and many other modern acoustical devices and have, therefore, received much greater attention than formerly from scientific investigators during the past few years. Some very interesting and remarkable facts have been discovered. It is evident that there is a minimum intensity below which the average ear ceases to be conscious of any sound and there is, in the same way, a maximum

intensity, but in the latter case, if the intensity exceeds a certain value, the ear becomes conscious of a sensation of pain rather than of sound.

The upper and lower limits of pitch of sounds are well-known, the lower pitch being about 30 cycles per second, and the upper limit varying with the individual between about 15,000 and 40,000 cycles.

The number of separate types or sensations of sound which the ear can appreciate and distinguish is large; it has been found to be upwards of 300,000.

Pressure-Changes.

One of the most striking observations relates to the great difference in pressure-change which can be appreciated by the ear. If we take the minimum pressure-change which occurs in a sound only just audible and the pressure-change in a sound which is becoming unbearably loud, we find that the latter is about 100 million times greater than the former. The energy-ratio of these two quantities is actually ten million million.

The sensitivity of the ear to variations in loudness is, on the other hand, very poor. With weak sounds, a change of about 25 per cent in loudness is necessary to be properly distinguishable, whilst with louder sounds a change of about 10 per cent is detectable.

The appreciation of slight differences in pitch varies considerably with the individual, but generally it is found that at medium and high frequencies a change in frequency of about 0.2 to 0.3 per cent can be detected, whilst at low frequencies a change in frequency of about 1 per cent is necessary.

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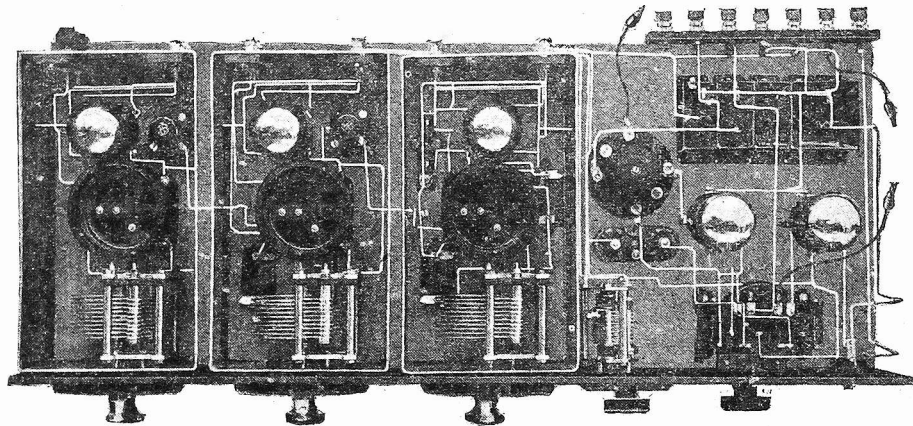
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Imagine how much greater one's radio enjoyment would become if possessed of the Raleigh P.M. Once and for all radio from the Continent would find a welcome with all the members of your family. Their prejudice against "foreign stations" which you have almost despaired of ever breaking down, would vanish during your first half-an-hour's test. Think of the untold pleasures to which you will be able to treat them and your friends.

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is believing. On the long waves one journey round the dial's brought in eight stations; most other sets satisfy themselves with four.

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It must not be assumed that a large set is difficult to handle because it employs a large number of valves. The true state of affairs is rather to the contrary. A group of stations may be tuned-in on the Raleigh P.M. which by comparison almost place a slightly lower-powered valve receiver into the category of the crystal set.

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Radio Paris	71	68.5	65.5
Daventry	64	59	58
Berlin	44	44.5	44
Unidentified	34.5	35	36.5
Unidentified	31	32	33
Unidentified	26.5	29	28
Hilversum	25	24.75	25
Budapest	94.5	92	93
Munich	88	89	89
Vienna	85	86.25	86
Brussels	83.5	85	85
Daventry (5G3)	81	82	83
Langenberg	77	78.5	78.5
Oslo	75.5	77	77
Rome	73.25	75	75
Breslau	71.5	73.5	73.5
Frankfurt-on-Main	69	71.25	71
Cracow	68	70	70
Berne	65	68	67.5
Glasgow	63	67.5	67
Plymouth	62.5	66	66
Hamburg	62	65	65
Toulouse	60.75	61	61
Manchester	58.5	62.5	62.5
Stuttgart	58	62	62
London	56	59	57
Koenigsburg	45.5	50	50
Bournemouth	44.5	49	49
Paris	44	48	47
Dublin	43.5	47.5	46.5
Ereslau	42	47	45.5
Newcastle	41	45	45
Belfast	38	44	42
Nuremberg	37	43.5	40.5
Liverpool and Hanover	36	41	41
Innsbruck	34.5	40	39
Edinburgh	34	37.5	38
Stuttgart and Cassel	31.5	35.5	32
Lille	28	31	29.5
Toulouse	27.5	28.5	27.5
Bremen	26	27.5	25
Gleititz	25	26	25
Muenster	23	23	20
Orebro	22.5	20.5	19
Halmstad	19	8	8

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R/R