

HOW TO MAKE A "CHITOS" ONE-VALVE SET

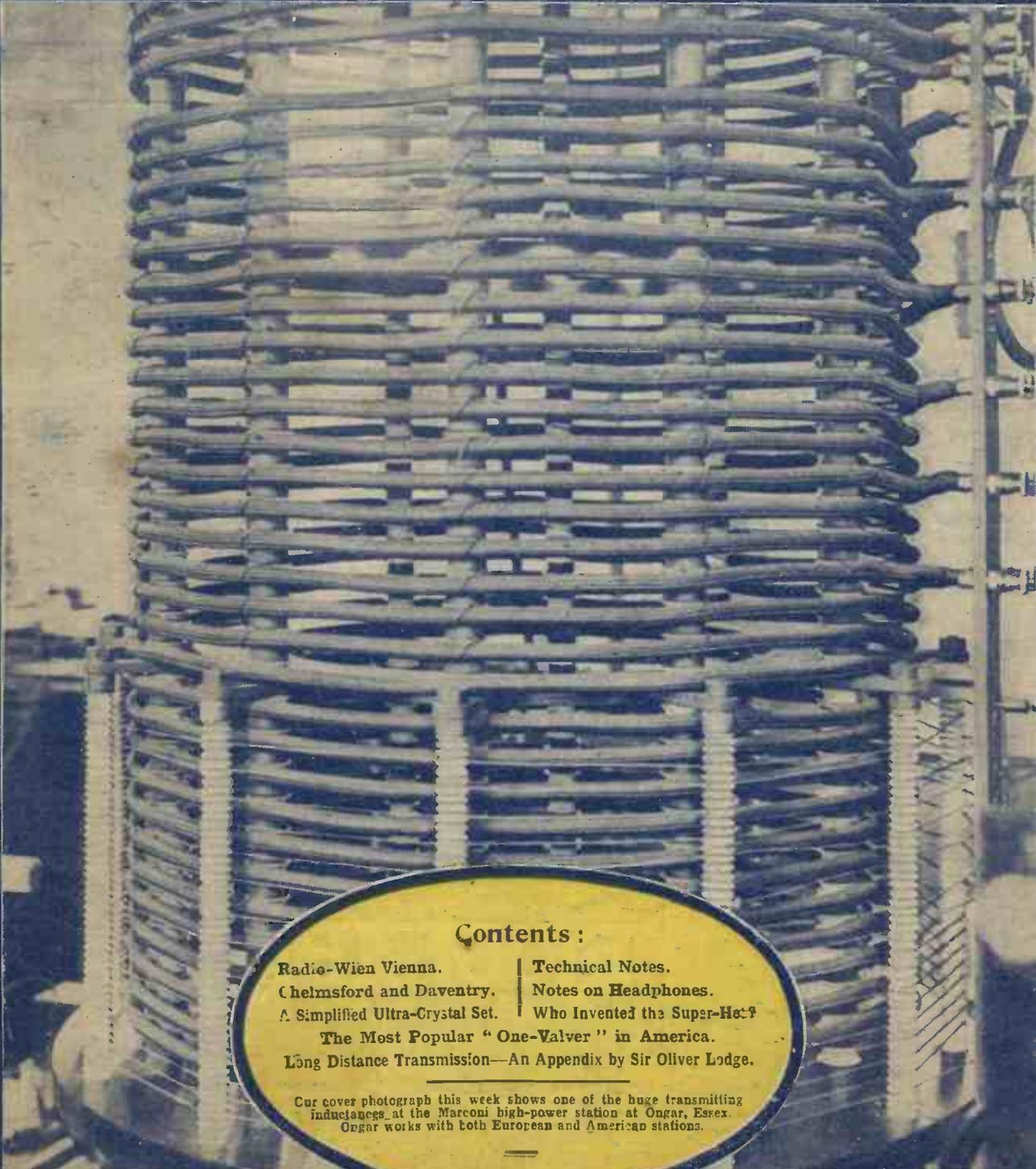
POPULAR WIRELESS

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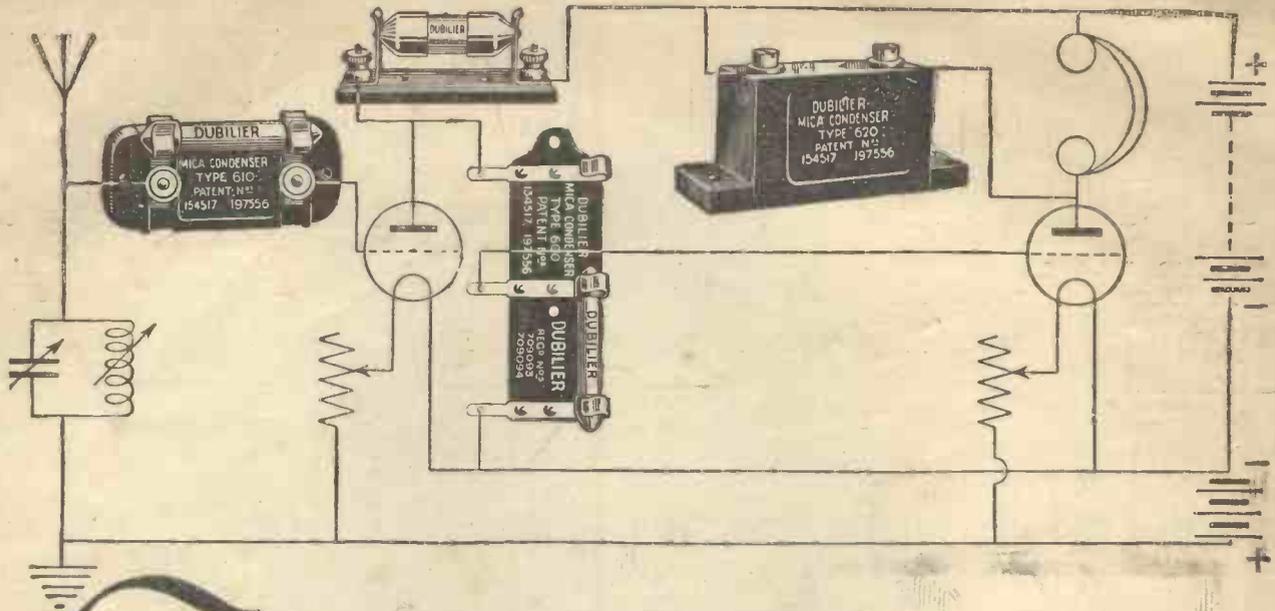
Scientific Adviser: SIR OLIVER LODGE, F.R.S., D.Sc.



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Our cover photograph this week shows one of the huge transmitting inductances at the Marconi high-power station at Ongar, Essex. Ongar works with both European and American stations.



Further Small Matters-

THE components illustrated above are small but important. They are the highly specialised products of a notable firm—one which, among other things, was responsible for the introduction of Mica Condensers. Further, these components are characterised by the now well-known Dubilier standards of neatness and finish in construction and reliability in operation.

There is the Type 600 Dubilier Mica Condenser, for example:— a fixed condenser whose capacity is guaranteed by us to be accurate within close limits that are not often met with elsewhere.

A new Dubilier Grid-Leak Attachment is sold for use with it, and is illustrated above. It enables a Grid Leak to be inserted direct between the Grid and L.T. leads simply by clipping in, making use of one of the condenser clips and the clip on the attachment.

The Dubilier Anode Resistance, again, designed for extreme stability in operation, is tested during manufacture to 200 volts, and is absolutely reliable.

The new Dubilier Type 610 Mica Condenser is also shown. It was dealt with in a previous advertisement of this series— "Little Things that Matter." It is suitable for use everywhere in receiving circuits, and is provided with screw terminals and detachable Grid Leak Clips.

For specialised products such as these, it is always easier and better to specify—

Mica Condenser, Type 600
(Also Type 600A for vertical panel mounting).

0.0001—0.0003 mfd....2/6

0.001—0.005 mfd....3/-

Mica Condenser, Type 610
(with Grid Leak clips)

(Also Type 620 for panel mounting).

0.0001—0.0003 mfd....3/-

0.001—0.005 mfd....3/6

0.01 mfd.4/-

0.011—0.015 mfd. ...4/6

Grid Leak Attachment, 6d.
(for use with Type 600).

Anode Resistance
complete with holder

20,000—100,000 ohms 5/6

Grid Leak

0.5, 1, 2, 3, 4 & 5

megohms. 2/6



DUBILIER

CONDENSER CO (1925) LTD

WIRELESS PROGRESS

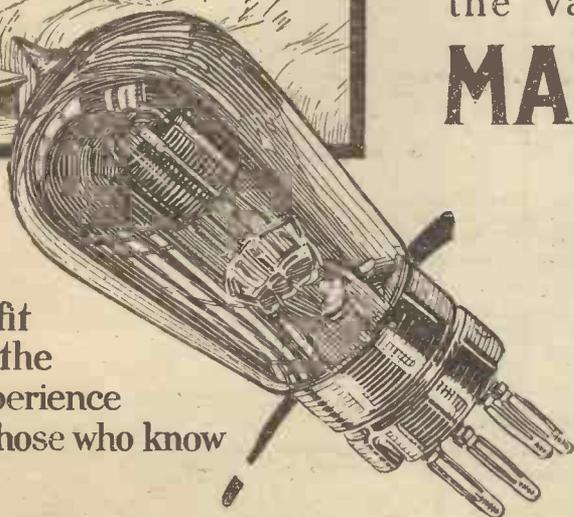


The Royal London Ophthalmic Hospital —the first to be completely equipped with wireless under the "Daily News" scheme, uses exclusively for the purpose the valves backed by the names

MARCONI & OSRAM

For volume, and clarity, for long life and maximum efficiency, you cannot improve upon the choice of the experts for your own set.

Profit
by the
Experience
of those who know



Sold by Wireless
and Electrical
Dealers, Stores, etc.

Buy the Valves backed by the names

MARCONI & OSRAM

THE WUNCELL

—a centenarian among Valves!

OUR morning mail would be exceptional if it did not contain at least one letter from some enthusiastic Cossor user commenting upon the long life of his valve. Among our most treasured possessions are these hundreds of letters—each one of which has been written spontaneously to express the writer's keen approval of the satisfactory service he has received.

Typical among them is the following from Mr. H. Hayward, of 9 Daisy Gardens, Dagenham, Essex. He writes as follows :

"On looking through one of your ads. in 'Modern Wireless' a few days ago, and noticing the claims of some of your users, I think I ought to bring to your notice the performance of one of your valves. I bought this in July 1923, and after using it practically 4 hours per night on the average, and more so during week-ends, it has just given up the ghost. I reckon the life of this valve at about 4000 hours. Can anyone beat this? I won't say any more!"

But if the Cossor bright emitter is reckoned to possess a long working life, then truly the Wuncell Dull Emitter is a centenarian among valves. Here is a valve which is fitted with an entirely new type of filament—one which can be obtained in no other valve.

A filament which, instead of being whittled down to an exceptional thinness to obtain low current consumption, is actually *built up layer upon layer* until it is practically as stout as that used in a bright emitter valve. A filament which, mounted in arch formation and further secured at its centre by a third support, will readily withstand all the shocks and abuses of everyday use. A filament, moreover, that owing to its unique method of manufacture gives off an intensely powerful electron stream when barely glowing.

Ally such a wonderful filament to the Cossor construction and you'll readily appreciate why the Wuncell gives a standard of performance which has not yet been approached by any other valve.

The essential features of every Cossor Valve—irrespective of type—are its hood-shaped Grid and Anode and its arched filament. As every wireless enthusiast knows, the action of the 3-electrode valve depends upon an effective use being made of the electron stream given off by the heated filament. Previous to the introduction of the Cossor this had always been done by means of a spiral grid and a tubular anode. But obviously such a design suffers from severe limitations on account of considerable leakage of electrons from each end of the anode. In the Cossor, on the other hand, the arched filament is almost totally enclosed by the hood-shaped Grid and Anode, and few, if any, of the electrons can escape.

The Wuncell Dull Emitter incorporates every salient Cossor feature. It functions at 1.8 volts, while its current consumption is only .3 amp.—so low as to enable the standard six-volt accumulator, with its cells connected in parallel, to last six times as long as with bright emitter valves. The man changing over to Wuncells from ordinary valves, therefore, gets an additional *five weeks' Broadcasting free of cost* every time he has his accumulator charged.

So that, not only do you get a long-life valve when you choose the Wuncell, but you effect tremendous economies as well. In the face of such incontrovertible facts can you delay buying Wuncells any longer? In two types: W1 for use as a Detector or L.F. amplifier, and W2 (with red top) for use as a high-frequency amplifier. 14/- each from all Wireless Dealers

A. C. COSSOR LTD.—Highbury Grove, London, N. 5
MANUFACTURERS OF COSSOR AND WUNCELL VALVES

Popular Wireless

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The Radio Weekly with the largest Circulation

RADIO NOTES AND NEWS.

Mexican Short Waves—Wireless Torpedoes—The Bromley Station—The 2 K F Hoaxes
—Signals from Chili—Voices of the Dead.

Radio Fire-Fighting Again.

LAST week in these columns I referred to the use of wireless as a fire-fighter in Canada, and now comes news of another interesting application of the science—this time in the Alps.

For the first time radio is being used to connect posts in the high mountain passes with aid stations, so that guides may call for assistance at any hour. Frequently a victim dies from injuries or exposure before the rescue-parties can arrive, but now it is expected many lives will be saved by timely wireless assistance. Work on the radio-rescuer has already commenced at the Margherita cabin on Monte Rosa.

Mexican Short Waves.

HAVE you heard the Mexican short-wave telephony? Several readers have reported mysterious telephony signals when searching for KDKA on his short-wave transmission, generally between midnight and 2.30 a.m. In all cases speech is reported as clear, but being in a foreign tongue it is difficult to identify. One Sheffield reader—Mr. H. Hizett, 45, Mushroom Lane—heard the call-sign given several times. But as speech was very rapid, all he could copy down was "... Zee G, Mexico." Can any other reader supply details of location, and state whether this station has been heard on telephony? Mr. Hizett, who was using a straight Det. and L.F. (power valve) is inclined to think that he has set up a record with this reception.

An Old Topic.

AFTER a few months of comparative quiet the talk about aerial-torpedoes, wireless death-planes, and similar cheery contraptions for wiping out everybody and everything, has broken out again. I hear that the Navy and R.A.F. are arranging an aerial attack upon the obsolete

battleship "Agamemnon," off Sheerness. She will cruise without a crew, controlled entirely by wireless, and twenty aeroplanes will try and hit this moving target with dummy bombs, dropped from various heights.

Wireless Torpedoes.

THEN there is the invention by a New Zealander—Capt. A. J. Roberts—of a non-interferable aerial-torpedo. It takes the shape of an ordinary aeroplane, but is much smaller, and can be filled with high-explosive and directed at hostile aircraft from the ground. Although obedient to the

cryptic line, "Three who trampled a kingdom down." "I don't know who they would be," he admitted, "unless they are Freeman, Hardy and Willis!"

The Brussels Station.

THE many readers who have remarked on faulty transmissions from the Brussels station will be glad to know that this matter is now receiving the attention of the authorities concerned. I hear that it is possible that the whole station will be transferred to Antwerp, but this would seem to be a very drastic remedy. As far as British listeners can tell, it is not the station's situation which is at fault but the fact that an extraneous humming noise spoils the modulation.

The B.B.C.'s Bromley Station.

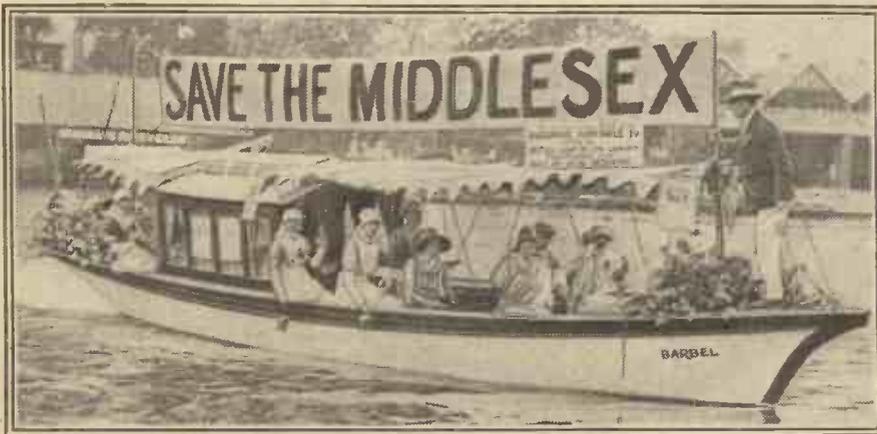
AS I have received a good many inquiries about the B. B. C.'s listening-post, I am glad to be able to state definitely that this new receiving station will be ready for service upon September 1st. It is situated at Hayes, near Bromley (Kent),

and will be used by the B.B.C. in connection with the relaying of International programmes.

What the Post Will Do.

THE three main sections of the work at the new listening-post are broadcast reception on the 300-500 metre band, very short-wave long-distance reception, and direction finding. The provision of the latter will enable interference to be checked in a way hitherto impossible. Another important function of the station will be to watch wave-lengths closely, and to prevent the dropping of a few metres and wandering from wave-lengths, which up to the present has gone unchecked.

(Continued on page 4.)



Propaganda for a good cause. A "Radio Appeal Boat" for the Middlesex Hospital now cruising on the Thames.

set controlling it from below, it is impervious to other jamming signals, and pursues its enemy with deadly persistence quite unaffected by spark, C.W., telephony, or what the enemy pilot may say!

The device is to be tested shortly in London, and a feature of the demonstration will be intentional jamming by powerful sets in the vicinity.

A Birmingham Joke.

THE musical director at the Birmingham station, Mr. Joseph Lewis, has a gift for epigram which occasionally proves too much for his audience. Once when rehearsing "The Music Makers," he was explaining the various historical references as they came along, until he came to the

NOTES AND NEWS.

(Continued from page 3)

The G 2 K F Hoaxes.

MR. PARTRIDGE (G 2 K F) asks me to print the following letter, a copy of which he has sent to various radio manufacturers:

"You may have received during the last day or two a letter bearing the address, '22, Park Road, Wimbledon,' and the signature, 'J. A. Partridge,' placing an order for a large quantity of wireless apparatus, and stating that the goods should be delivered as early as possible as they were required for some urgent experimental work at my station—G 2 K F.

"I beg to advise you that any such communications are not authentic and should be disregarded. I presume them to be the work of a practical joker or an idiot.

"Owing to the fact that I have only just received information of the circulation of such letters, bearing a signature purporting to be mine, some inconvenience may have been caused to members of your staff, and, if such is the case, I can only express my regret.

"Should you be in possession of such a letter and envelope, and care to send them to me, it may assist in the apprehension of the offender. I may add that I have placed the matter in the hands of the police."

The Savoy Bands.

THE B.B.C. has concluded new arrangements for the broadcasting of the Savoy Bands, and a schedule has been arranged by which the Orpheans and Havana Bands will take turns as follows: From Aug. 31st to Sept. 12th, Savoy Havana Band; from Sept. 13th to Sept. 28th, Savoy Orpheans; from Sept. 29th onwards (and also from now until Aug. 30th) both bands will play, but the Selma Band is "resting" until further notice.

Working F 8 Q Q.

IN an interesting letter from Weybridge, Mr. R. J. Denny informs me that he has been in touch with F 8 Q Q. This is the station—said to be an Egyptian one—that was recently working with MacMillan's Expedition to the North Pole. Apparently the correct address of the station is M. Richard James, 24, Rue des Cadourques, Colours, France, but after September 1st the call F 8 Q Q will be used from Saigon (Indo-China).

Signals from Chili.

USING his Reinartz-Wegant receiver (which was described in "P.W." some months ago), Mr. Denny has also picked up signals from the Chilian amateur, Mr. E. Guerara, who was formerly a student at Bradford Technical College. By sending radio greetings to his old school over a distance of 6,000 or 7,000 miles, the Chilian transmitter recently set up a record, which Bradford thinks will take a lot of beating.

Voices of the Dead.

WHAT did Gladstone say in '81? Whatever it may have been, the B.B.C. thinks that gramophone records of speeches, etc., need not be new to be interesting so they propose to

broadcast records upon which the voices of famous men of the past have been preserved. The British Museum has a great selection of these historical "voices," including Lord Alfred Tennyson's, but unfortunately many are defective, and would require a lot of touching up before they could be put on the air.

An Inspiring Feature.

THERE is something very attractive about the idea of these dead voices being brought to life again and speaking to Britain in a way that was impossible until a few years ago. I hope the arrangements do not miscarry, for if the technical difficulties with the cracked or mutilated records can be overcome, the celebration of anniversaries by wireless will become an inspiring feature of the B.B.C.'s activities.

The Wireless Doctor.

BY an exchange of wireless messages in mid-ocean, the surgeon on the White Star liner "Baltic" was able to prescribe treatment for a sick officer on an oil-tanker, which probably saved his life.

SHORT WAVES.

"But what broadcasting is to-day is nothing to what it may be, should be, and in all probability will be, five years hence. An invention so ingenious, so adaptable, the source of so much pleasure, and capable of such indefinite expansion, raises public issues of the first moment."—Sunday Times.

"Very few broadcasting stations (in America) are operating with any direct profit. No broadcasting station in the country is making money to-day. Some handle indirect advertising with some source of revenue; so far, I believe, no stations have been able to meet expenses with this income."—Mr. P. Crosley, at the Annual Convention of the Radio Manufacturers Association, Atlantic City, U.S.A.

"The development of the wireless industry in Great Britain has reached such a high state of efficiency that American wireless apparatus manufacturers cannot hope to compete in the British market."—American Trade Report.

There are millions of people who listen practically every day, and most of these people would welcome a brighter and more enterprising spirit in our broadcasting."—Daily Mail.

"My orchestra has not played a single note of jazz in either the concert hall, recording-room, or broadcasting station, and it never will. It is all nonsense to say that jazz is the only way to the heart of the modern young man and woman. The good old stagers among the popular classics are as welcome to-day as ever they were."—Mr. J. R. Squire, Conductor of the Celeste Octette.

The oil steamer did not carry a doctor, but sent out a radio appeal that was picked up by the "Baltic." Following a full description of the symptoms, the correct treatment was described by wireless.

Paderewski.

I am informed that it is not yet definite that this great pianist will broadcast again in the winter.

Water-Cooled Valves.

WIRELESS work is full of snags, but one of the trickiest that I remember hearing of was the one in connection with the water-cooling of the valves at 5 X X. As all good valve-users know, the plate of a valve is at a high positive potential.

And in transmitting valves it is not a mere 100 volts or so H.T., but 10,000 volts on the plate! To cool these plates with hundreds of gallons of water (which is quite a good conductor at this voltage) was a Daventry problem that required a lot of solving. The difficulty was eventually overcome by breaking up a column of water into a series of very fine jets, which resulted in making the resistance of the water column infinitely high for all practical purposes.

A Good Story Teller.

LISTENERS who remember his excellent burglar stories, will welcome the announcement that Mr. A. J. Alan—narrator of "My Adventure in Jermyn Street"—is to broadcast to all stations another of his stories on September 9th. This will be called "The Story of the B.B.I.," and I shall certainly listen in on Wednesday week to hear what Mr. Alan has to say about the B.B.I.—whatever that may be.

5 V R Calling.

THE Edison Swan Electric Co. have just been allotted the call-sign 5 V R, and experimental transmissions will commence shortly upon 23, 45, and 90 metres. Other call-signs which have been allotted recently are: 5 Z A, Mr. R. T. Wright, 2, Grove Park Terrace, Chiswick, London, W.2; and 5 I L, Mr. E. J. Pepperell, 337, Cowbridge Road, Canton, Cardiff. In all cases reports of reception will be welcomed, and 5 V R is willing to arrange special tests with anyone upon request.

A Unidyne Pilgrim.

MR. H. V. SIMPSON, of 4, Westbrook Villas, Darlington, tells me that he has been overwhelmed with letters about his Unidyne (Det. and L.F.) since his results were published in "P.W.'s" Correspondence columns recently; and one instance of a pilgrim who journeyed from afar to see the set is so remarkable that I cannot do better than tell it in Mr. Simpson's own words. After referring to the great number of visitors who had called, he says:

Some Enthusiast!

"ONE gentleman came over forty miles to hear and see my set, and he admitted that its volume was a revelation to him. Frankly, he was delighted, and although he could only stay about three-quarters of an hour—owing to limited train service—he was quite satisfied at what he had heard and seen. Some Unidyne enthusiast! Forty-four miles there and forty-four miles back to hear a set just for three-quarters of an hour!"

A Unidyne Club?

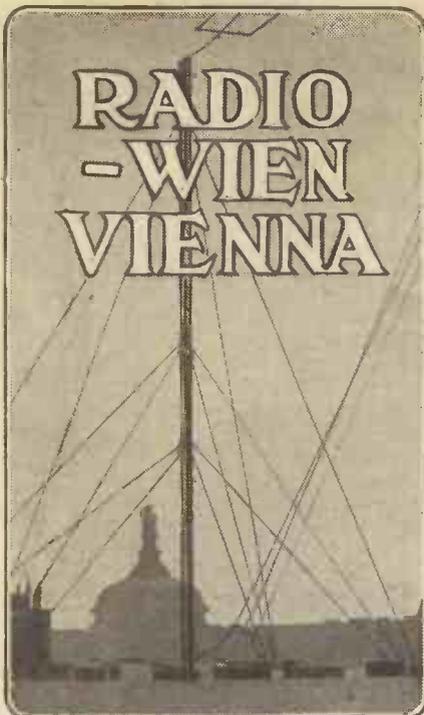
AT the end of his letter, Mr. Simpson makes a very interesting suggestion, arising out of his experiences with H.T.-less sets. "Could we not form a Unidyne society or club?" he says. "The ordinary radio clubs are in the H.T. rut, and cannot do much to help the enthusiast who uses a one-battery set. So why not form a society of our own, where Unidyne experiments may be discussed and new 4-electrode features hooked-up and tried out?"

IT was during the winter 1923-24 that the broadcasting movement first reached Austria. At this time the associated factory of the Western-Electric Company in Vienna erected a 100-watt transmitter and began to broadcast regular programmes three times weekly on a wavelength of 700 metres. This private station was provisionally licensed by the General Post Office and did pioneer work.

Two Classes of Listeners.

In July, 1924, the houses of parliament finally determined the laws and regulations for telegraphy (including wireless) in Austria, and a company, the "Radio Austria Verkehrs Gesellschaft" (R A V A G), was formed and licensed for inter-Austrian wireless communication. The government, the city of Vienna, several banks, and radio factories participate in this company. The naval station in the building of the former war office was rebuilt into a broadcasting station, as will be described later.

The latter commenced broadcasting in September and was officially opened on October 1st, 1924. The activities of the company concerning broadcasting are controlled by a board of management consisting of 22 representatives of the different district governments and corporations interested in broadcasting, of which nine are delegates of the principal amateur clubs. The listeners have to get their licences at the nearest post office, and are divided into



A Special Article by our Correspondent in Vienna,
PAUL J. GORDON-FISCHEL.

two classes. The first class of listeners with an annual income of less than £240 pay a tax of 13s. 6d. per annum, the second class £2 0s. 6d. per annum, and the radio dealers from £4 2s 3d. to £10 19s. 5d. per annum,

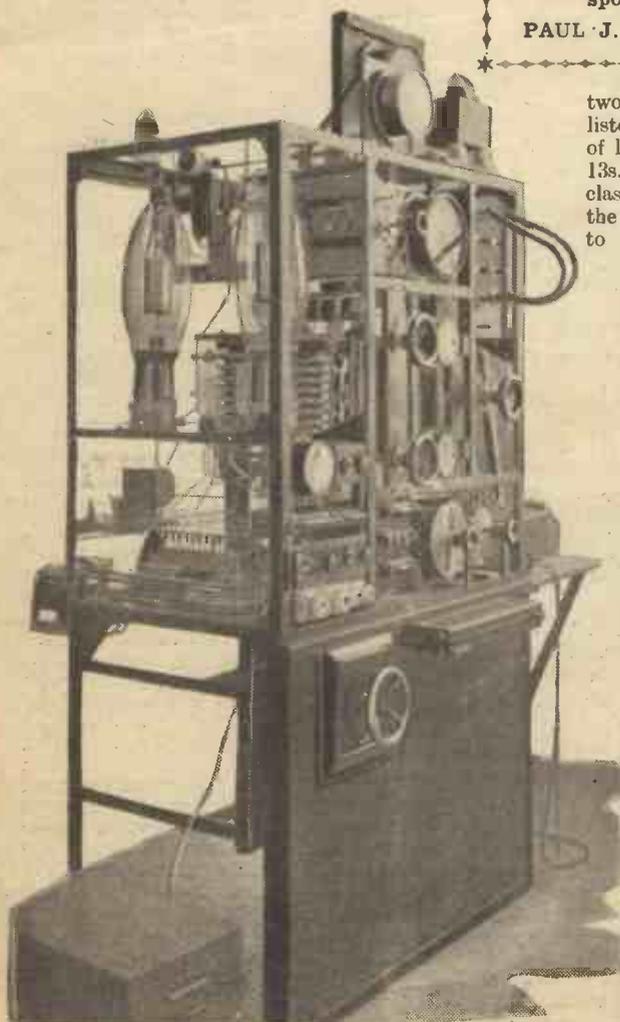
It is proposed to erect relay stations in the different parts of Austria, the first of which, a 500-watt Western-Electric set, has been built in Graz, the capital of Styria. To help crystal reception in more extended surroundings of Vienna, a high-power station is under construction in one of its suburbs. This station will be a Telefunken 20 kw. transmitter, with a modulated energy of 5 kw. for 'phone work.

The number of licensed listeners has risen between October, 1924, and May, 1925, from 38,000 to 154,000 in the first class, and from 600 to 3,100 in the second class, and of radio dealers from 400 to 750. Quite interesting is the fact that in Vienna alone the number of dealers rose from 350 in October, 1924, to 850 in December, and then suddenly dropped again to 350 in January, 1925; the expectation for a smart Christmas business in radio articles being the cause; and, in fact, the standard gift of Christmas, 1924, was a radio set. At this time one could hardly find a street in Vienna without a radio dealer; booksellers and tobacconists, drapers and pastrycooks, they all had radio parts and sets in their windows.

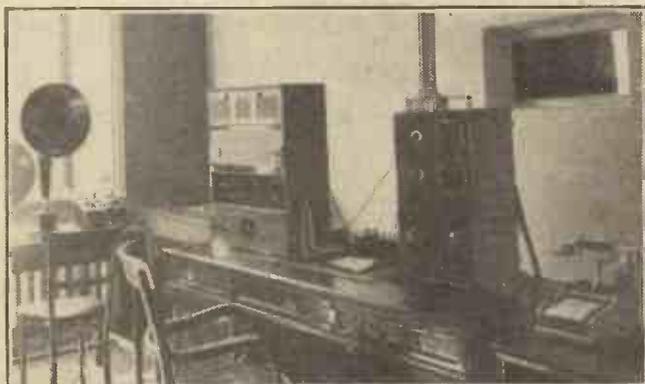
The Control-Room.

As mentioned before, the location of a former naval station has been used for the transmitter of "Radio-Wien." The two aerial masts had to be raised 33 ft. and have now a total height of 140 ft. The 230 ft. long T-aerial has a height of 130 ft. over the fan-shaped counterpoise. The installation of the transmitter is divided into six rooms on two floors. Beside the door to the control-room stands the time-signal apparatus, an arrangement of two bells which are electrically controlled by the chronometer which is to be seen through the operators' control window.

Under this window stands a table with a loud speaker and at its other side the well-known metal strip microphone of Siemens and Halske with the cover taken off. The



The main transmitting panel at Radio-Wien.



The control-room in which an engineer regulates the transmission.

according to the number of inhabitants of their town; these taxes can be paid monthly. The licences are furnished with coupons which are taken off by the radio dealer and controlled by the R A V A G when the amateur buys one of the following articles: a complete radio set, a pair of headphones, a loud speaker, a transmitting valve.

box of this microphone includes a one-valve amplifier coupled by a special transformer. On the draped wall one sees the control box which indicates to the announcer the operation of the transmitter by pilot lights.

In the control-room one sees before the window two loud speakers, one of which is connected to a receiver, enabling the operator to control the transmissions. On the writing-table stands the speech-amplifier, consisting of three stages resistance coupled L.F. amplification and using three Telefunken type B.O. valves. They may be seen through the open door of the amplifier.

(Continued on page 6.)

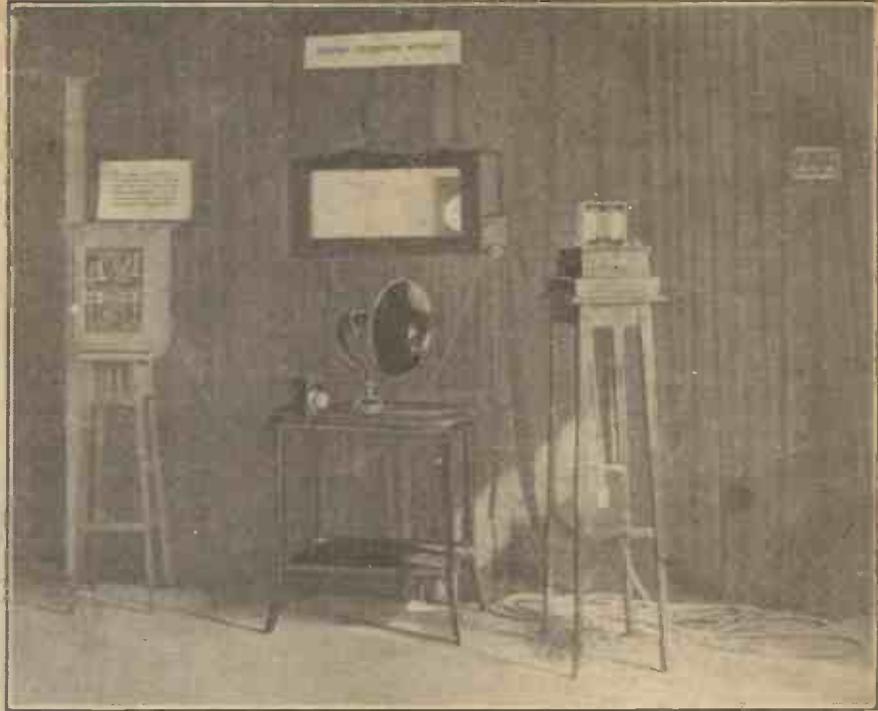
RADIO-WIEN VIENNA.

(Continued from page 5.)

In the middle of the table is the key for announcing the beginning of transmission, and beside it stands the output amplifier containing a R.V. 24 valve. It is connected by transformers and a shielded cable with the transmitter in the next floor. Under the control-window stands a telephone. Next to the control-room is a small room containing the accumulators for the different amplifiers and a staircase leading to the upper floor.

The Transmitter.

The transmitter was first built with one main transmitting tube and then enlarged by connecting a second tube of the same size in parallel. Through that the C.W. output energy was raised from 1 kw. to 1.5 kw., the modulated energy now being about 500 watts. The input transformer in the circuit is connected in the grid-circuit of the two modulator-valves which modulate the grid current and thereby change the grid-filament resistance of the two oscillator-tubes. The side view of the transmitter stand shows the two Telefunken R.S. 15



The studio, showing the metal strip Siemens-Halske microphone with its cover removed.

transmitting tubes and between them the two small modulator valves, type R.S. 55.

Wave-lengths Used.

The wave-length range of the station is from 250 to 550 metres, regular transmissions taking place on 530 metres. The oscillating circuit is tuned by fixed Dubilier-condensers, the fine adjustment being made by a variable condenser. Reaction is controlled by a variometer. The aerial circuit consists of the vario-coupler, a set of aerial-series-condensers, and a variometer for tuning.

At one side of the transmitting-room is the room for the different storage-batteries. There are two sets of accumulators, giving 20 volts, 260 ampere hours for heating the filament of the oscillator-valves, the two other sets feeding the modulator-valves with 12 volts, 60 ampere hours. Only one of each set is in use at the same time, the other being recharged.

Re-broadcasting System.

In the room at the other side of the transmitter four generating sets are located, two of them for charging the accumulators, the other two for generating the high tension for the oscillator. Each of the latter consists of three machines: the driving motor fed with 220 volts D.C., the high voltage generator with two series-coupled rotors,

giving 4,000 volts D.C. and the exciter. They are shown in the photo together with the power-control panel. Over the switch-board one sees the filter arrangement, consisting of the usual series chokes and shunt-condensers.

The station is connected with one of Vienna's greatest concert halls, and a cable to the opera house is under construction. For re-broadcasting of foreign programmes a super-sonic heterodyne receiver and a frame-aerial are used; at the frequent tests the reproduction of 5 X X was especially good.

The Vienna broadcasting station is announced as follows: "Hallo, hallo, hier Radio-Wien auf Welle 530!" It can be received in this country only with a selective set, as Berlin on 505 metres and Zürich on 515 metres are difficult to cut out.

TO OUR READERS.

In the issue of "Popular Wireless" dated week-ending September 12th, will be published the first article of

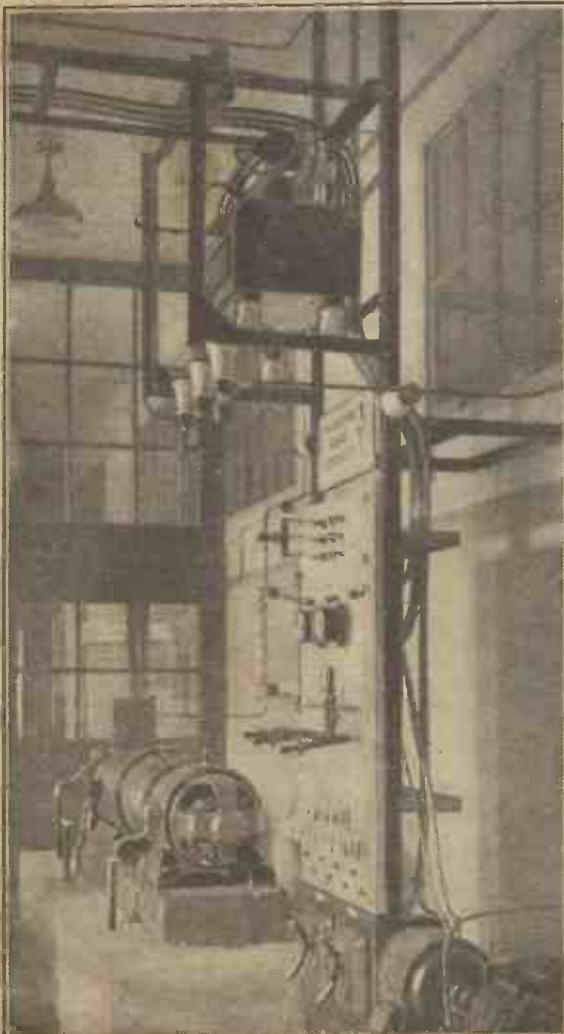
A NEW SERIES FOR THE CONSTRUCTOR.

Throughout the summer months the technical staff have been busy designing and constructing a number of new, and in many cases novel, types of receiving sets.

These receivers will be described in a series of specially written and illustrated articles. Any constructor who wants sound information about really reliable receivers will be interested in this new series, which will commence in "P.W." for week ending

September 12th.

BEAR THE DATE IN MIND
AND DO NOT MISS No. 1 OF
THIS NEW SERIES.



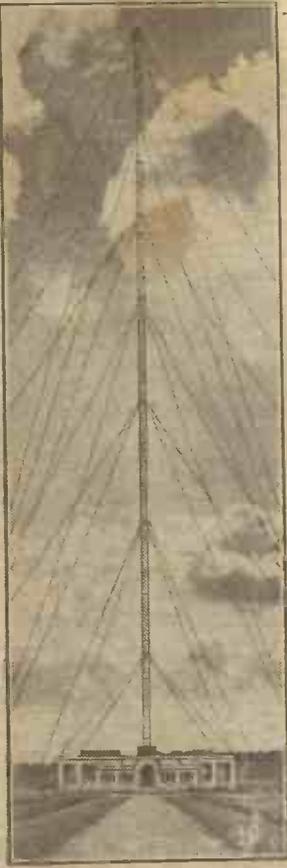
The power control panel and H.T. generators.

LONG DISTANCE TRANSMISSION.

A SHORT APPENDIX.

By Sir OLIVER LODGE, F.R.S.
(Scientific Adviser to "Popular Wireless.")

This article may be regarded as the second and concluding part to the article "Long Distance Transmission," by Sir Oliver Lodge, which was published last week. This appendix deals with the simple geometry of the Reinartz Theory of Reflection.—The Editor.



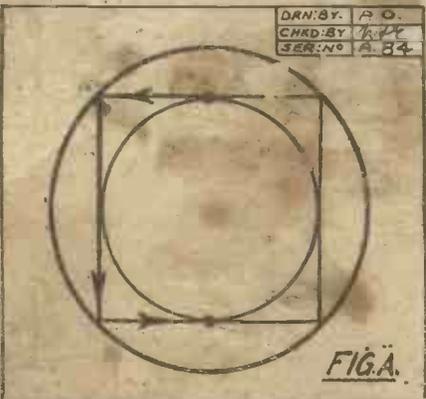
One of the thousand foot masts at the Ste. Assise Radio Station near Paris.

If we could be granted the sharp reflecting layer, concentric with the earth and at a considerable distance above it, postulated by Mr. John L. Reinartz as consistent with his admirable experimental results, the geometry of long-distance transmission would be so simple that anyone can amuse him or herself by working it out. For instance, thus:

Twenty-five Reflections.

The smallest number of reflections which will reach the Antipodes must be two, since the most effective waves must start and arrive nearly tangentially to the earth's surface. One reflection could only reach what may be called the equator, the position of the observer being called the pole—i.e. his relative pole, not the north pole.

Two reflections will reach the anti-pole—i.e. the Antipodes, if the reflecting layer is



Path of transmission from S. to R. by two hypothetical reflections from a reflecting layer at a height $(\sqrt{2}-1)R$.

sufficiently high. Three reflections will do it with a lower elevation of the reflecting layer, four with a still less elevation, and so on. To construct the paths in the different cases we may proceed thus:

(See Fig. A). Draw a circle representing the reflecting layer: inscribe in that circle a square: then inscribe in the square another circle to represent the earth. Place the observer in the middle of one of the sides. His Antipodes will be in the middle of the opposite side. The path of the waves will be half round the square, and the height of the reflecting layer above the earth will be $(\sqrt{2}-1)$ or .414 times the radius of the earth. That is to say, it will be about 40 per cent. of the radius, or rather over 1,600 miles. That is the requirement for two reflections to be effective.

Next draw another circle and inscribe in it a hexagon (Fig. B). The height of the reflecting layer in that case will be $\frac{2}{\sqrt{3}}-1$ or .155 times the earth's radius—that is, about 600 miles. That is the requirement for three reflections. I consider that it cannot be granted.

Taking one more example. To get transmission to the Antipodes by four reflections, an octagon must be inscribed in the outer circle, with the earth drawn inside it; and the height of the atmosphere in that case will be .0824 times the earth's radius, or say 420 miles.

In general we may say: To obtain the result by n reflections, the sides of a $2n$ -agon will give the path of the light; the central angle between the observer's position, and the point of first reflection will be $\frac{360}{4n}$ or $\frac{90}{n}$; and the height of the reflecting layer above the earth will be the secant of this angle minus one $(\sec \frac{90}{n} - 1)$ times the radius of the earth. The secant to the angle can be looked out in the tables; for instance, for five reflections it will be 18° , of which the secant is 1.0515, and the height of the reflecting layer 206 miles. For six reflections the angle will be 15° , the height 140 miles, and so on, without limit. In order that a reflecting layer only 80 miles high might be serviceable, the above angle would be about 31° , and the number of reflections required to reach the Antipodes would be 25.

Gradual Ray Curvature.

It must be understood that I am not supporting this simple theory of regular reflection from a sharp atmospheric layer.

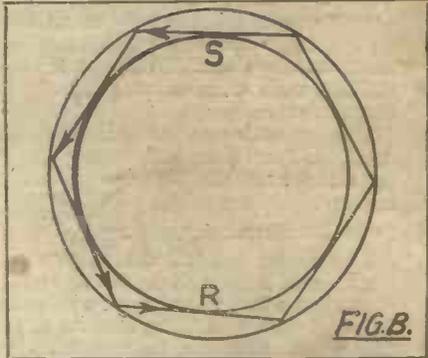
I hold that long-distance transmission must be due to a gradual curvature of the rays after the fashion of mirage, such curvature having been shown by high mathematics to be a possible and expected result from an ionised condition of the air; to which experimental physics has added the vital fact that solar radiation, and ultra-violet light generally, can ionise or decompose atoms.

No Sharp Boundary.

The ionisation, in this more elaborate but apparently truer theory, must chiefly occur in the upper atmosphere, probably in a quiescent region above the ordinary turmoil of winds; and it may still be spoken of as a Heaviside layer; though, if we speak of it as a "layer," we must remember that it is probably of a thickness to be expressed in miles, and has presumably no sharp boundary.

It is "a layer" in the sense of a limited region concentric with the earth, of maximum efficiency, bounded above and below by regions in which the ionisation is either less in amount or else less steady and efficacious.

Any such layer may, presumably get crumpled up at times, so as to interfere with its efficiency. If so, then long-distance transmission would be interfered with, as long as that condition lasted. But the upper atmosphere is known to be remarkably quiescent, owing to what is called the high kinematic viscosity of gases at low pressure; a circumstance which is explained



Path of transmission from S. to R. by three hypothetical reflections from a supposed atmospheric layer at a height $(\frac{2}{\sqrt{3}}-1)R$, which in the case of the earth is 600 miles.

in the kinetic theory of gases, and which causes the last stages of exhaustion in the production of a perfect vacuum to be so slow.

For when the total pressure is almost nothing, the differences of pressure, such as cause movement, must be smaller still; which after all is a matter of common sense when pointed out.

Individual molecules will be moving at their proper rate, depending for their average speed on temperature, but the ether waves are too big to trouble about individual molecules or ions; they will deal with them statistically or in groups, and the rate of wave transmission will be influenced not by the motion of the atoms, but by their electrical properties.

For, whether they are moving or standing still, their speed is insignificant compared with the speed of ether waves—that is, compared with the speed of light. It is as the speed of a snail to the speed of a motor-car.

Technical Notes



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

A New Super-Het. Gadget.

M. LUCIEN LEVY, who has been closely associated with the super-heterodyne circuit from the beginning, has recently produced a simple single-valve block which will enable anyone to convert an existing multi-valve set into a super-het. receiver.

The adapter is self contained, the internal circuits being arranged that the valve acts as an oscillator, producing local waves which "beat" with the incoming signals and produce a supersonic frequency. The same valve also rectifies the supersonic frequency, which appears as a wave-length of 3,000 metres in the primary of a tuned H.F. transformer contained in the plate circuit. The secondary of the transformer is brought out to two terminals on the adapter block, these being connected to the input circuit of the first H.F. stage on the existing set. The input of the adapter is connected across the aerial inductance in the ordinary way. It should be borne in mind that the Levy "converter" can only be used with an existing valve set, which contains at least one stage of H.F. amplification. It will not work when coupled directly to a detector valve.

This interesting gadget is already on the market in France, and will, no doubt, shortly be made available to amateurs in this country.

Patent Transformer Assembly.

I see that a patent has been granted for a method of making a transformer in which the coils are first wound upon a core of the "open" type, this being afterwards fitted into a thick iron case, the magnetic circuit being completed through the case. This method, or something very like it, seems so familiar that one would hardly have thought a patent could be obtained for it. It has, of course, certain drawbacks. In the first place, unless the core fits very accurately into the case, there will be a considerable increase in the reluctance of the magnetic circuit as compared with that of a closed circuit, and secondly, it is not easily possible to laminate the iron container, so that eddy-current losses will be considerable in that part of the circuit.

Protecting Valves.

I noticed a simple little device illustrated in the "Radio Digest" some little time ago, consisting of a cover for the valves of an open or baseboard-mounted set. It is well known that the valves of such a set are very liable to destruction owing to the accidental dropping amongst them of pliers or other tools. To obviate this danger, a cover is made from a short length of stiff cardboard tube (such as is used for sending drawings through the post) of suitable diameter, fitted with a circular endpiece gummed or glued in position, the tube being provided with a slot through which a view of the filament may be obtained.

Double Broadcast.

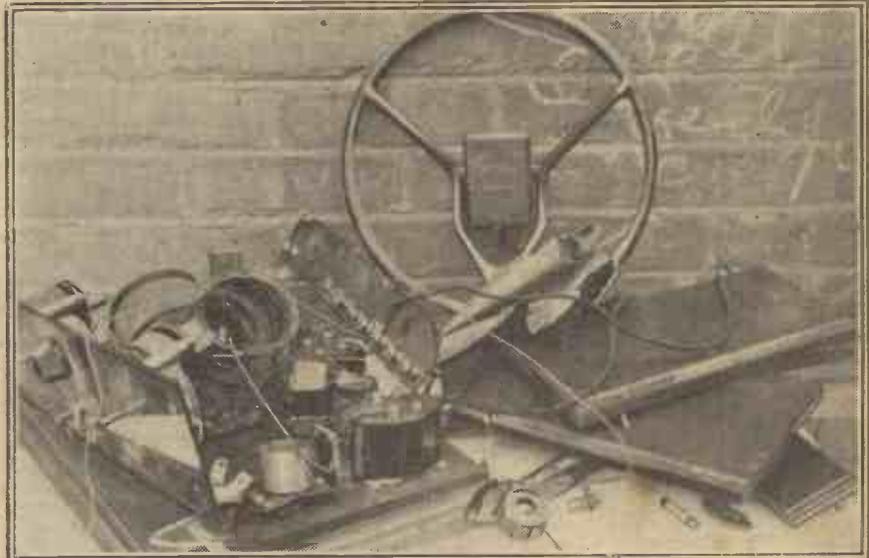
An ingenious system has been proposed by an American professor, whereby greater naturalness of tone and reproduction are to be obtained. The process consists, in effect, in "putting the broadcast into three dimensions."

The simplest way to explain the new system is as follows: It is well known that the impressions received by the two ears, when listening to a sound in the ordinary way, are not quite identical, and that it is the minute difference between the impressions received by the right and left ears that

apart equal approximately to the average distance between the human ears, and that the sounds received by these two microphones are separately and simultaneously broadcast (on different wave-lengths); two receivers may then be used for picking up the two separate impressions, a pair of headphones being connected, one to each of the two receivers, and the appropriate 'phone being applied to each of the two ears; the listener will then hear exactly what he would have heard if he had been in the studio, listening in the ordinary way. It will be noticed that reproduction through a loud speaker is useless for obtaining the desired effect, as the two impressions are combined in the loud speaker and the two ears receive the same impression. The essence of the system is that the two ears of the listener shall receive different impressions.

Not Original.

A broadcasting station equipped for transmission of this character would still be available for the ordinary listener with a



The result of lightning striking a wireless aerial. This happened in America, and even in that country, where thunderstorms are very frequent, such occurrences are rare.

enables the observer to perceive the "solid" effect, the bearing and distance of the source of sound, as well as other particulars. It seems, in fact, that the two ears do very much the same sort of thing for the hearing that the two eyes do for the vision, that is, they give the "stereoscopic" effect, or, as it is called in hearing, the "binaural" effect.

In ordinary broadcasting, the microphone picks up the sound at one particular place, and when the sound has been transmitted and received in the usual way, the listener hears precisely the same thing in the two ears; he hears, in fact, what he would have heard if his two ears had been put together and placed in the position occupied by the broadcasting microphone. In other words, the binaural effect is lost, and the result is "flat," in the sense that an ordinary photograph or an ordinary cinema picture is "flat."

Transmitting Two Impressions.

Suppose, however, that two microphones are used, located in the studio, at a distance

single receiver, for he would still be able to tune to one or other of the two wave-lengths of the station, and would simply receive the same transmission as if there were only the one microphone.

I may say that there is nothing new in all this. In fact, I believe I remember suggesting it myself in the early days of broadcasting. And even then it was not original, for it was merely a special application of a principle which had been well understood and considerably used during the War.

A Useful Alloy.

I see that a new chrome alloy has been produced, which can be applied to ordinary metals by the process of electro-deposition and which is said to give, in this way, a surface equal in hardness to that of some of the hardest steels. The coating, moreover, is rustless and is extremely resistant to acids and to corrosive agents generally. It is stated to be likely to come into general

(Continued on page 31.)

BRITISH THROUGHOUT



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A handsome new Loud Speaker possessing the same beauty of outline as the luxurious Q-type whilst retaining the full volume and sensitiveness of the well-known H1. Can be supplied either in a rich brown colour or a glossy black. Polished mahogany base with nickel-plated fittings. A superb instrument which will charm everyone with its exceptional fidelity of reproduction. Height 20 in. £6
Also in 120 and 2000 ohms.



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Standard Brown Loud Speakers

H2,	120 ohms	£2 5 0
	2000 ohms	£2 8 0
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The New H3

A new Loud Speaker embodying all the well-known Brown features. Although only 15 inches high it gives the same superb tone as the larger H1 and is equally clear on speech and music. No other Loud Speaker on the market within several pounds of its price can give such a fine volume as the H3. £3
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The new and improved horn now fitted to the Crystavox will enable this Loud Speaker to give an exceptional volume of sound direct from a Crystal Set without the use of valves. The powerful Daventry Station will permit thousands of Crystal Set users to get Loud Speaker results direct from a Crystavox. £6

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ONE of the most decisive and beneficial steps ever taken in the history of British Wireless has been accomplished by a collaboration between the world-renowned manufacturers of Mullard Valves and Philips Glowlampworks Ltd., the famous lamp and valve makers in Holland.

This outstanding collaboration secures for the British Wireless Industry—

- (1) The stoppage of all imported foreign valves into Great Britain, Northern Ireland or the Irish Free State by Messrs. Philips, the largest exporters of Radio Valves to this country.

This will mean an immediate call for **INCREASED BRITISH PRODUCTION** to meet the demands of the home market, thus producing **MORE WORK FOR BRITISH LABOUR!**

- (2) The exclusive use in Great Britain by the Mullard Radio Valve Co. Ltd. of all Philips Patents and improved manufacturing processes relating to the specialised manufacture of Radio Valves.

This means that all Mullard Valves will be produced under the combined valuable Philips and Mullard Patents and will be manufactured in Great Britain, thereby providing an enormous increase in the employment of skilled and unskilled British Labour.

- (3) The use of all machinery designs of Messrs. Philips by the Mullard Co. in connection with the manufacture of Radio Valves. These designs are extremely valuable and are exclusive for use in England to the Mullard Co.

The advantage of the very latest designs in machinery cannot be overrated. The delicate and highly-skilled work of valve manufacture will be improved and increased by the use of this modern plant, and there will be

AMPLE SUPPLIES OF MASTER VALVES FOR EVERYBODY.

- (4) The combined efforts of both the Mullard and Philips technical experts to obtain from experiments and research in their extensive laboratories all radio valve developments from time to time.

This means that Mullard Valves will carry the superior advantages of thorough research and contain the most advanced designs for **PERFECT RADIO RECEPTION.**

This gift of service to the British Wireless Industry will consolidate and preserve the high standard in the productions of Great Britain and further the endeavour for the improved

EXCELLENCE OF BRITISH BROADCASTING.

The Radio Public of this country will be the first to recognise the wonderful advantages of this Master Collaboration particularly when it means

MORE WORK FOR BRITISH LABOUR AND BETTER RADIO VALVES

Support British Endeavour and BUY BRITISH GOODS

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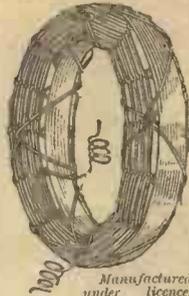




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5 X X Loading for Crystal Sets, 1/6

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The Right Resistance

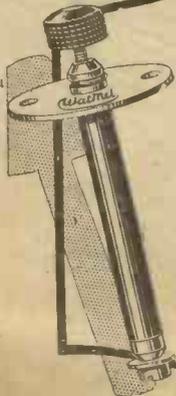
There is always just one value of the grid leak best suited to the characteristics of your detector valve. Tone quality, signal strength, good reception, all depend in no small measure upon this correct resistance being obtained—and maintained. Don't handicap your receiver—use a Watmel and make sure of obtaining the exact value. Send for descriptive folder.

GRID LEAK (Black knob) 5 to 5 megohms	ANODE Resistance (Red knob) 50 000 to 100,000 ohms
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ALTHOUGH the move of the high-power station from Chelmsford in Essex to Daventry in Northamptonshire was in contemplation for a long time, there does not appear to have been any serious attempt to show how many people benefited by the move and how many people are worse off than they were previous to the move. It is the purpose of the present article to attempt to find out these two things within the limits of the figures available.

As far as crystal reception goes, it will be assumed that 5 X X has an effective range of seventy-five miles. This is probably a somewhat conservative estimate. The writer has obtained good crystal reception from 5 X X, both on home-made sets and on commercial sets, at double that distance.

CHELMSFORD AND DAVENTRY.

A Comparison.

By OLIVER HALL, D.Sc.

Leicester, Rutland, Hereford, Worcester, Warwick, Northampton, Hunts, Cambridge, Bedford, Bucks, Oxford, Gloucester, Berks, Middlesex, London, Hertford. In addition, half of Lincolnshire, half of Shropshire, half of Wiltshire, and portions of

Warwick, Huntingdon, and the northern portions of Oxfordshire, Bucks, and Bedford. The counties which suffered the most by the move are Norfolk, Suffolk, Essex, Kent, Surrey, and Sussex. The large number of crystal users in London and Middlesex are also much the worse off for the move.

When dealing with valve reception, it is rather difficult to lay down any hard and fast rules as to range. There are so many different types of valve receivers, and the question is further complicated by the use of loud speakers in addition to telephones. Probably the best thing to do is to study some such map as that given in Fig. 2. In this figure, circles are drawn of radii seventy-five, a hundred and fifty, and three hundred miles with both Chelmsford and Daventry as centres.

Valve Set Results.

With a good aerial-earth system, it should be possible to get fair loud-speaker results from 5 X X up to distances of a hundred and fifty miles. The writer has obtained such reception at such a distance with two or three types of two-valve receivers. 5 X X should be at good loud-speaker strength with a three-valve receiver anywhere within the three-hundred-mile circles.

The chief effect of the transference of 5 X X from Chelmsford to Daventry, as far as valve users are concerned, is an appreciably greater range to the north, the west, and the south-west. Many listeners in the northern counties, in Wales, and in Devon and Somerset no doubt heard 5 X X for the first time from the new position at Daventry. Ireland must also benefit considerably by the move, as does also the south of Scotland.

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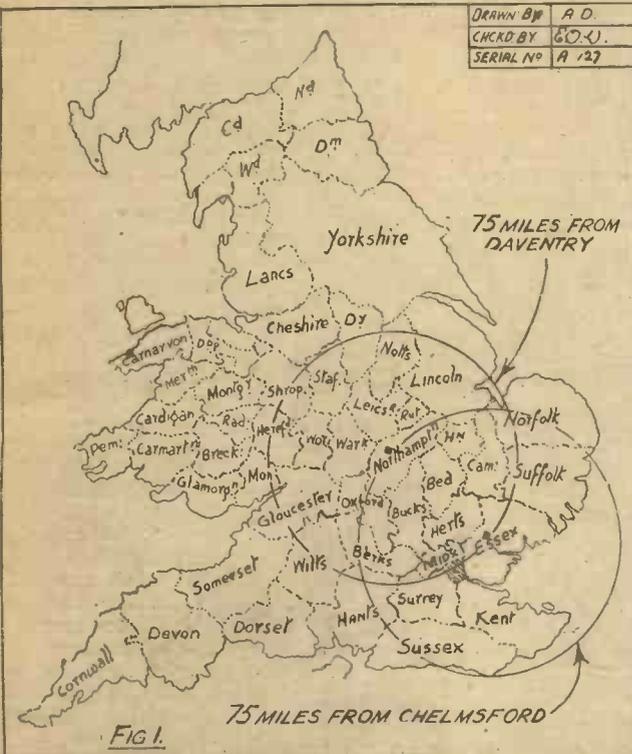


FIG. 1.

Still, seventy-five miles is perhaps the most useful average figure for our present purpose.

Fig. 1 is a map of England and Wales, on which the counties are indicated. On this map two circles are drawn, one with Chelmsford as centre and the other with Daventry as centre. Each of these circles has a radius representing seventy-five miles.

Counties Affected.

The counties which come wholly or nearly wholly within the Chelmsford circle are: Norfolk, Suffolk, Essex, Kent, Sussex, Hunts, Cambridge, Bedford, Bucks, Hertford, Middlesex, London, and Surrey. About half of each of the following counties also comes within the Chelmsford circle: Northampton, Oxford, and Berks. Working from the latest population figures for the counties named, the total population within the seventy-five-mile circle round Chelmsford must be something like twelve and a half millions.

Considering now the Daventry circle, the counties which lie wholly or almost wholly within it are: Derby, Staffs, Notts,

encloses a land area of thirteen thousand five hundred square miles—that is, a land area three-quarters the size of the land area enclosed by the Daventry circle. Within the Chelmsford circle, however, the density of population is well over nine hundred per square mile, while the density of population within the Daventry circle is only just over eight hundred per square mile.

A careful perusal of the map in Fig. 1 shows that the counties which probably benefited most by the removal of 5 X X from Chelmsford to Daventry are Northampton, Rutland, Leicester,

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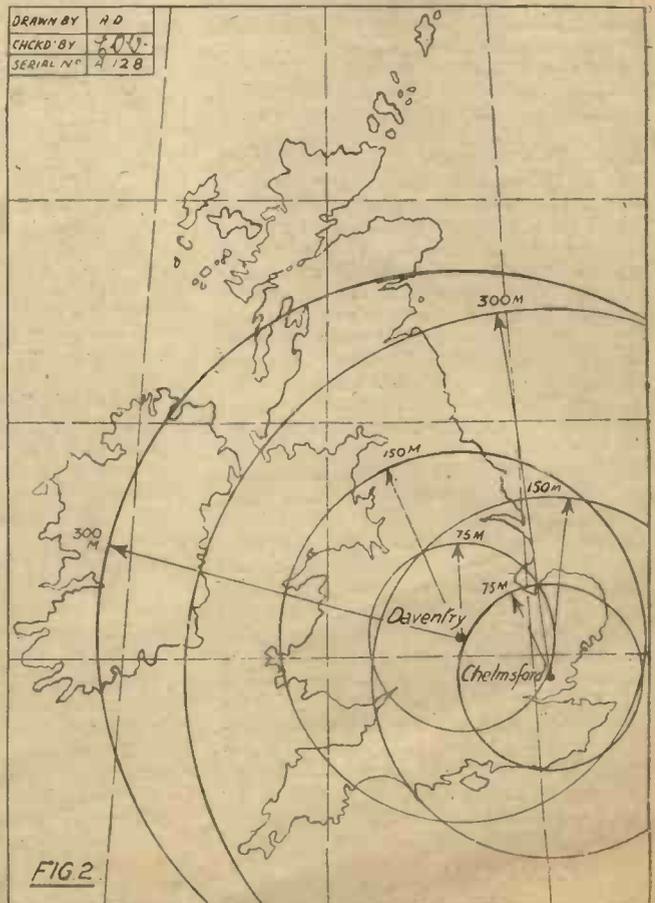


FIG. 2.

THERE seems to be a degree of mystery surrounding the proposal that some of the speeches at the League of Nations Assembly at Geneva should be broadcast.

I understand that at the invitation of the International Union of Broadcasters, of which Mr. Arthur Burrows is the manager, the majority of continental stations have decided to put out the speech of M. Briand, the first delegate of France, on September 7th. Representations were made to the B.B.C. in the hope that they would be able to join in the scheme.

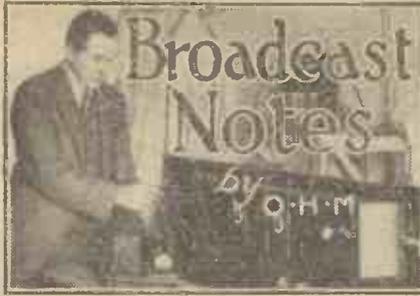
A "Border-line" Subject.

The B.B.C. liked the idea, but they suggested that they would prefer to take not only M. Briand's speech, but also that of Mr. Austen Chamberlain, the first delegate of Great Britain. This is, of course, one of those border-line subjects concerning which some people are of opinion that they are definitely Party politics. A reference to the Post Office therefore became necessary, and I understand that the Post Office have misgivings about the whole thing. I gather that negotiations are still in progress, and for the good name of British broadcasting, I sincerely hope that the official mind accommodates itself to the realities of the position. It is pointed out, however, that there is a precedent in the rejection by the Post Office of a similar proposal that was brought forward last year, in connection with Mr. Ramsay MacDonald's speech at Geneva.

Reading between the lines of various announcements that appear in the Press, sometimes obscurely, but none the less significantly, I think there is an indication of a general stiffening of attitude on the part of the Post Office towards extending broadcasting facilities. Since Lord Gainford's reference to alternative programmes in his speech at the opening of Daventry, there has been no encouraging follow up.

Alternative Programmes.

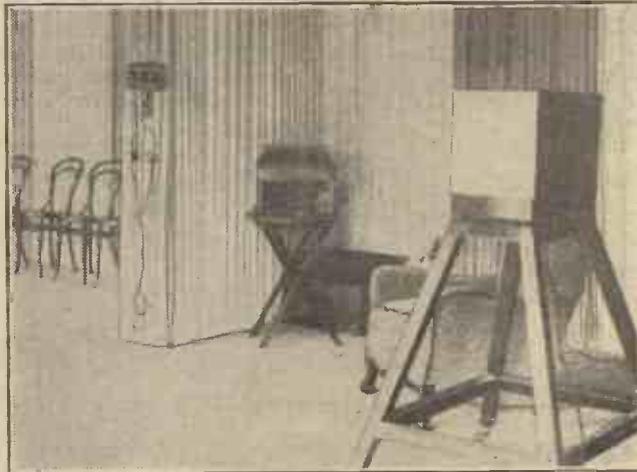
In reply to one newspaper correspondent, a Post Office official declared that the B.B.C. had never made any application for extending broadcasting facilities. This, of course, is entirely wrong, and no doubt was due to a misapprehension on the part of the official concerned. There is ample evidence that the B.B.C. has been clamouring for more facilities for many months past. Up to a certain point the attitude of the Post Office appears to have been reasonable. Their position is admittedly difficult, as they are apt to be shot at from various quarters in their effort to deal fairly with the conflicting claims of the wireless services. But since the announcement of the Government Committee on Broadcasting, the Post Office are justifying the attitude of negation on the ground that no new enterprise should be considered until the Committee furnishes its deliberations. To accept this would mean a very serious delay in meeting the really urgent requirements of the British Broadcasting system. There is really no adequate provision for alternate programmes. If facilities for alternate programmes are not put in hand until the end of this year or the beginning of next, they will not materialise until 1927. This would be altogether lamentable from the point of view of the British listener, who, not unnaturally, wonders why he is denied for so long a selection of at least two programmes.



If the official view prevails, and nothing whatever is done until early next year, I should not be surprised to see a tremendous outburst of irritation on the part of listeners in general, and this will not be without its reaction in the next session of Parliament. There is certainly not so much force as is supposed in the argument that the ether is overcrowded with signals. A very important factor, and one to which insufficient attention is paid, is the large proportion of inefficient and obsolescent apparatus in use by the commercial and government wireless services. If this apparatus were brought up to date, many of the present difficulties would disappear.

Checking Wavelengths.

Interesting and important scientific tests were made on August 17th. By arrange-



Part of the interior of the Sheffield Studio.

ment through the International Union of Broadcasters, the Eiffel Tower station checked all the wave-lengths of all the European stations that are included in the Union.

The B.B.C. made their records at Hayes, and subsequently were able to check the calibration of the wave-lengths of all their stations. This task was carried out in co-operation with experts of the National Physical Laboratory.

Co-operation with Cinema Industry.

I understand that there is a definite movement on foot to secure co-operation between broadcasting and the British cinematograph industry. It is thought that the B.B.C. should do something to encourage the home cinema industry, and also to help in the movement to improve the ideals of the motion picture generally. Some experiments are to be carried out in the simultaneous broadcasting of the

dialogue which normally should accompany the motion picture. Expert opinion is divided on the probability of the success of these experiments; but it is interesting to note the beginning of what should become an important development in the future.

I gather that members of the Government Broadcasting Committee are already being inundated with the views of those who are anxious to figure in the control of the medium after 1926.

The Broadcasting Committee.

There is no doubt that the Committee will have an arduous task to perform if it attempts to balance all the arguments put forward.

The advantages of unified control are so overwhelming that the exponents of competitive commercialised broadcasting are not likely to gain any ground. Some re-constitution of the Board is probable, but those who are anxious to exclude the wireless manufacturers are likely to be disappointed.

The experiment of the last two and a half years was certainly not unsuccessful, nor should it be forgotten that it was the wireless manufacturers who risked their money to start broadcasting in the first instance. It is quite true that through the sale of apparatus they benefited financially, but it is equally true that in practice they have allowed broadcasting to be con-

ducted fairly as a public service in the best interests of the majority of listeners.

It is quite easy to theorise about the constitution of a public trust, but it is not so easy to reduce its formula to concrete terms.

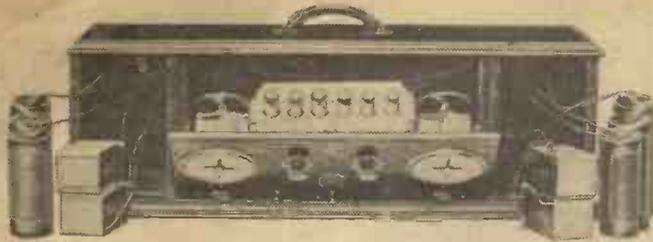
It is all very well to clamour for the additional representation of listeners; but how are you to determine representation of listeners? If it is done on a purely parliamentary basis, you would get representatives of each of the political parties with the inevitable cross currents of

jealousy and intrigue behind the scenes.

My own view is that the wireless manufacturers should be allowed to retain representation up to about 50 per cent of the Board. For the rest there should be a newspaper proprietor, a representative of literature, a representative of music, one for education, and one for the entertainment industry. If the concert industry were at all reasonable, they would be entitled to a representative on this board; but in their present truculent frame of mind, I doubt very much whether they will secure this concession. The announcement of their intention to stop broadcasting, or at least to cripple it, is not exactly a commendation.

* * *

I hear that owing to recent causes concerning which I can give no details at present, it is unlikely that Paderewski will broadcast several times during the winter season, as I reported in last week's Notes.



A six-valve Super-Heterodyne Receiver manufactured by the Radio Corporation of America.

WHO INVENTED THE SUPER HET. ? ANOTHER RADIO SURPRISE.

From a Special Correspondent.

NOW that the super-heterodyne receiver has proved its utility for long-range work combined with selectivity, the usual dispute has arisen as to who is the inventor of the circuit. The question is one of considerable importance, both to the

heterodyne principle in sets constructed at home.

It should, perhaps, be mentioned that the earliest Armstrong patent for a super-heterodyne circuit is dated in December of 1918—or more than a year later than the Levy patent under which the Western Electric Co. made their claim.

heterodyne now in common use, comprising a local oscillator and first detector followed by several stages of valve-amplification, and finally a second detector serving to rectify the audible signals.

An element of doubt has now been thrown upon both of the above-mentioned claims by a statement made by Mr. A. H. Morse, A.M.I.E.E., in the "Electrician." Mr. Morse calls attention to the fact that the first use of the fundamental principle of super-heterodyne reception is disclosed in patent specification No. 252 of January 5th, 1914, granted to two German inventors, Von Arco and Meissner. In their specification, after setting out the action both of ordinary and harmonic heterodyne, the German inventors go on to describe a method of creating an intermediate frequency, by using one or more local oscillators, combined with a final detector for rectifying the audible signals.

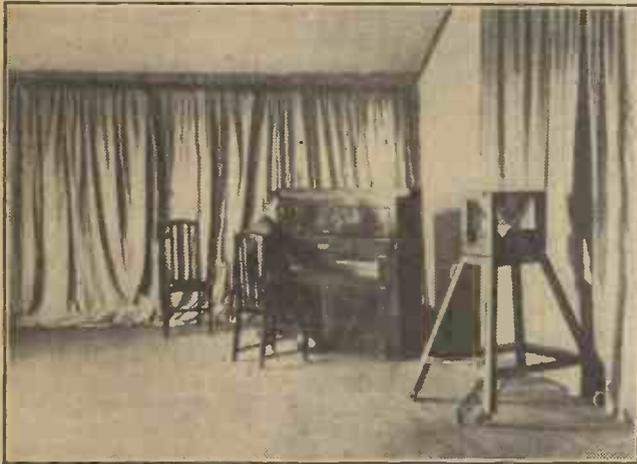
This certainly appears to cover the vital principle of double detection as now used in the super-heterodyne circuit, although it does not specifically mention the use of intermediate valves for amplifying the supersonic frequency. As matters now stand, therefore, it would seem that the super-heterodyne circuit is by no means as modern as most people imagine. If Mr. Morse's contention is correct it was invented only a year after the original discovery in 1913 of the principle of reaction or back-coupling between the grid and plate circuits of an ordinary valve.

Further Doubt.

An examination of the Armstrong and Levy patents would appear to show that M. Levy's patent is chiefly concerned with a secret method of transmission, in which, however, the principle of double modulation—one of an ultra-acoustic frequency—is employed. The reception of such super-modulated signals would accordingly necessitate the use of double detection in the manner

that is characteristic of the present super-heterodyne receiver.

On the other hand, Professor Armstrong's patent describes a receiving circuit that resembles more closely the ordinary super-



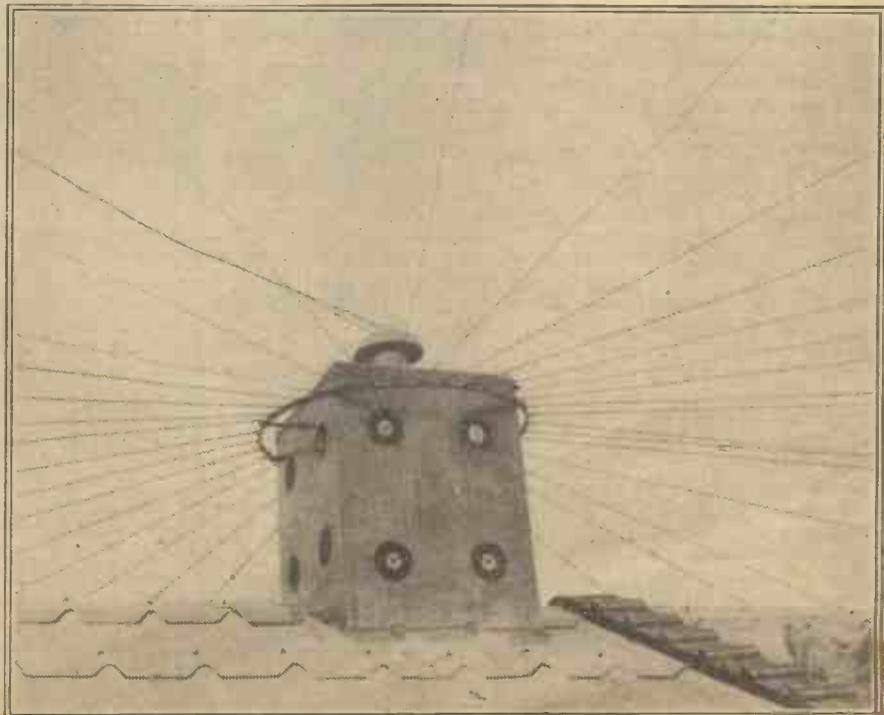
The studio of the Daventry station which is only to be used occasionally.

inventor, whose patent rights, if they can be substantiated, will be worth a very large sum of money, as well as to the general public (including the home constructor), who may be called upon to pay licence fees for the privilege of using the circuit.

The Levy Patent.

The essential feature of the super-heterodyne is the use of a local oscillator in order to convert the incoming signal waves into an intermediate frequency, which is then passed through several successive stages of amplification, prior to final rectification of the audible sounds. Until lately credit for the invention of this system was universally given, both in the technical press and in current text books, to Professor E. H. Armstrong, the well-known American radio engineer, whose name is also associated with the principle of super-regeneration and various other improvements in wireless technique.

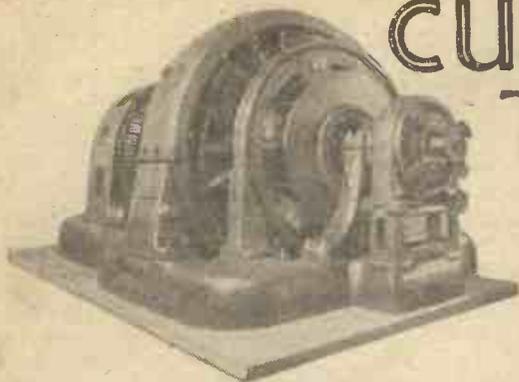
A few weeks ago, however, considerable surprise was caused in wireless circles by the publication of an announcement in the name of the Western Electric Co., in which the latter claimed to control the manufacture and use of the super-heterodyne receiver under British patent No. 143583. This patent is dated August 4th, 1917, and was originally granted to M. Lucien Levy, a distinguished French radio scientist. The notice in question warned both the trade and the amateur alike against the consequences of any infringement of the above-mentioned patent, but added that licences would be granted to amateurs, on reasonable terms, allowing them to use the super-



The aerial lead-in (centre) and the radiating earth wires at the high-power station, 5 X X, at Daventry.

CURRENT TOPICS

BY THE EDITOR



NO little publicity has been given to the announcement that Sir Arthur Stanley, President of the Wireless League, has offered a gold medal for the best radio invention produced during the next six months. One journal has gone so far as to say, "the Stanley Medal, which



The generating plant and Diesel engines at St. Assise, near Paris.

will be to wireless what the Faraday and Lanchester medals are to other branches of scientific research, is a prize of honour calculated to spur on experimenters in their investigations into the improvement of wireless communication." We understand that the award will have to be approved by the technical committee of the Wireless League—but exactly who will serve on this committee we do not know. Those responsible for the Wireless League have not issued any information on the point. Unless this committee is composed of real wireless experts, the Stanley Medal will be of no importance, and to compare it in importance to the Faraday and Lanchester medals is presumptuous. But if the technical committee consists of responsible wireless engineers, then the Stanley Medal will be worth competing for, and its award will certainly have an important significance. Meanwhile, we invite the Wireless League to be a little more explicit on the whole subject.

New Wave-length Tests.

On the night of August 31st, commencing at midnight, there will be an all-Europe broadcast test, the importance of which cannot be over estimated.

The Geneva Broadcasting Conference recently worked out a new band of wave-lengths for most of the British and Continental broadcasting stations, and these new wave-lengths are to be given a practical test on August 31st.

The Stanley Gold Medal—The Geneva Wave-length Tests—The 2 K F Hoax—The Wireless Season

The test is to last for two hours, and it is one which should prove of interest and value to any amateur. Each station will broadcast its own programme, and its call sign will be given regularly every few minutes, so listeners will have rather a unique opportunity of recognising the stations they hear, besides knowing whether the new wave-lengths minimise interference in their particular districts.

The success of this new wave-length scheme will depend on the accuracy of stations transmitting on specially allocated wave-lengths. Readers will notice in the following table that fractions of a metre are to be used; this has never been done before by the B.B.C.

Experts in Europe and Great Britain are assisting in a scheme to measure the wave-lengths to be used: The National Physical Laboratory will act for the B.B.C. The alterations in British wave-lengths are given below. Newcastle, Cardiff, and Edinburgh are not affected.

Present Wave-length		New Wave-length		Present Wave-length		New Wave-length	
Aberdeen	- 495 496	London	- 365 364				
Swansea	- 482 488	Leeds	- 346 343				
Birmingham	- 479 480	Plymouth	- 338 339				
Belfast	- 439 438	Hull	- 335 335.5				
Glasgow	- 422 420	Dundee	- 331 331.5				
Bournemouth	386 387.5	Liverpool	- 315 314.5				
Manchester	- 378 377.5	Nottingham	326 329				

The 2 K F Hoax.

The hoax played on Mr. J. A. Partridge, the well-known Wimbledon amateur, was obviously planned by a person whose sense of humour wants overhauling. The mentality of the type of person who sends out dozens of orders in the name of another person, thereby seriously annoying traders, is beyond the comprehension of the average decent citizen. But these perverted jokes are not new, although this is the first time we have heard of a wireless amateur being hoaxed in this fashion.

But it must be rather disconcerting for the hoaxer to realise that his silly little plot miscarried, and that Mr. Partridge has not suffered in the least as a result of the "joke." A prompt circular letter to the trade, and a notification to the police was Mr. Partridge's sensible rejoinder to what we can only describe as a stupid and rather caddish trick.

The Wireless Exhibition.

Before many more weeks have passed the "wireless season" will be in full swing again. The season will probably get its first real send off with the opening of the Wireless Exhibition at the Albert Hall.

POPULAR WIRELESS has decided not to be represented at this exhibition. We have decided on a rather more original course of action, but the time is not yet ripe to give the full details. But in any case we shall, in the interests of our readers and advertisers, fully review the exhibition at the Albert Hall, and our issues dated week ending September 12th and 19th will be specially enlarged exhibition numbers.

Other important schemes for the benefit of readers during the winter will be announced in the course of the next few weeks.

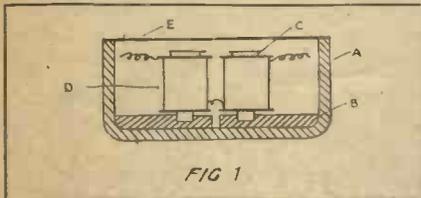


M. Caillaux, the French Finance Minister, broadcasting his gold standard appeal to French listeners.

NOTES ON TELEPHONES.

By WARING S. SHOLL, A.M.I.E.E.

TO all external appearances, the well-known headphone type of receivers are much alike. Roughly, the instruments may be divided into two types, viz., the simple diaphragm pattern, and the armature or "reed" type, in which the magnetic impulses are imparted firstly to a small, delicately pivoted armature which



is linked up to the diaphragm. This form is used in the well-known "reed pattern" telephone, and is developed further in the "balanced armature" type of design employed in some makes of large loud speakers. One great advantage of this design appears in the central pull upon the diaphragm, which avoids distortion to a considerable extent.

Resistance No Advantage.

The ordinary diaphragm type of instrument (Fig. 1 and 1a), however, works very well, and the user whose means will not allow of the purchase of the more expensive type will get every satisfaction from the less costly article. High resistance and low resistance are factors which need to be understood in the terms of electrical efficiency.

Resistance, as resistance, is a distinct disadvantage. True high resistance 'phones are wound with high conductivity wire of very fine gauge, about No. 47 S.W.G. copper, which enables a large number of turns to be got on the bobbins.

This produces a comparatively great effect, as a small current will have the same effect if sent round the pole-pieces a large number of times as a larger current which only traverses a few turns. Some makers have gone so far as to produce a "high-resistance" 'phone indeed, but wound with comparatively few turns of high-resistance wire, a thoroughly reprehensible swindle for which there is no extenuation whatever.

In choosing a set of telephones a fair test may be made, of sensitivity, by placing the instruments over the ears and putting one tag into the mouth. The other tag is rubbed gently upon a small file or a key which is held in the hand. A distinct rasping sound will be heard in the ear-pieces if the set is reasonably sensitive and in good order.

Telephones should have the leads clearly marked as to polarity, or continual use will tend to demagnetise the magnets; also the signals will not come up to full strength when the instrument is new. Far too many makers neglect this important point, and in such case the careful worker will do well to conduct the following test: Remove the ear-cap and diaphragm and place a compass near to the pole-pieces until the needle comes to rest. Arrange the 'phone so that its magnetic pull sets the needle at N.E.

Maintenance Hints.

Now place the 'phone leads on a battery and note if the compass needle comes over very slightly towards the telephone magnet. If so, it proves that the current is circulating the right way, and is tending to strengthen the magnet. If, on the other hand, the needle moves over towards north, it shows that the current is passing in the wrong direction, and that the magnets are being reduced in strength.

Having satisfied himself on this point, the user will do well to slip a piece of red sleeving over the positive tag, if of the pin type, or wind some red silk over the cord in the case of the spade type of terminal. A reference to Fig. 2 shows how to conduct the test, which has given satisfactory results in the

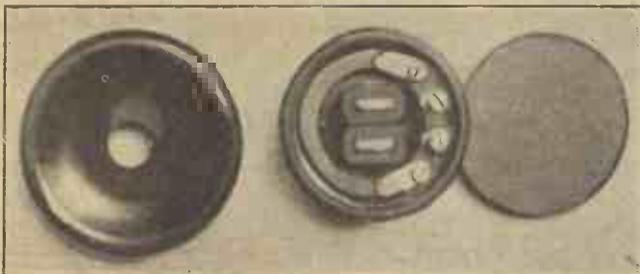
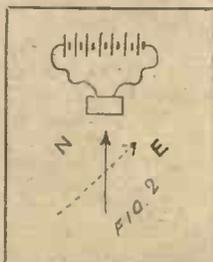


Fig. 1a. An ordinary diaphragm type of telephone receiver.

hands of the writer. After prolonged use, the ear-pieces should be wiped to avoid moisture rusting the diaphragms, and the 'phones hung up with the cords preferably straight. The method of packing the 'phones with the cords tightly twisted round the head-bands is thoroughly bad for the cords and displays a want of forethought upon the part of the makers.

Some 'phones are much improved by fitting thinner diaphragms, of ferrotype, in place of the heavier stallo. While this material is good in some cases, it is not always the best thing to use, although the word sounds very nice in advertisements. Buy the best 'phones you can afford, and then take care of them.



CONTINENTAL NEWS

From Our Own Correspondent.

A Roumanian Amateur's Adventure.

THIS is a wild sounding story, of an aeroplane escape from a private asylum and of a homicidal lunatic being recaptured owing to a small boy listening-in on his father's receiving set; the sort of story you read in cheap sensational fiction, if you do read such. But facts are often stranger than fiction.

Stephan Caspoth was, during the war, a distinguished pilot in the Hungarian Air Force. While flying over Ampezzo, he crashed down; he had a miraculous escape, but severe wounds in the head bereft him of his reason. He belonged to a rich family, so he was confined in a private asylum in the neighbourhood of Budapest. From this he escaped in 1922 and was at large for two days, during which he killed a peasant lad whom he met on the road, apparently for no other reason than the mad impulse to kill.

An Escape By Air.

On a recent Sunday, he again, through the inattention of a warder, succeeded in escaping from the asylum, and he made his way to an aerodrome five miles away, where he stole an aeroplane and swiftly vanished southward.

On the alarm being given at the asylum, his course was traced, and it was found that he had got away by air. A telephone call from the aerodrome to the Budapest Radio station induced the operator there to broadcast a call, warning all stations of this dangerous lunatic in the air; the number and distinguishing marks of the plane were given, together with a rough indication of the radius within which he might be expected to be sighted in view of the limited amount of petrol the aeroplane had on board.

That is one end of the story. The other end is at Turnu Severin, an ancient Rumanian country town on the Danube, just below the Iron Gates at the foot of the Carpathians. There is no Government radio station there; indeed there is only one radio set in the place, belonging to one of the masters at the local lycée. This amateur's small son, aged twelve, was listening in on that Sunday night on a sort of roving commission, to see what he could pick up. He caught the Budapest call, which, in addition to Hungarian, had also been broadcast in French and German. The former the boy understood. In a great state of excitement, he ran across to the near-by police station and told the chief of police what he had heard.

A Forced Landing.

Orders were immediately given for a sharp look-out to be kept in the whole district. As fate would have it, a little over an hour later, an aeroplane was seen coming over the crest of the Carpathians from the north. It volplaned gracefully down and landed on a flat piece of meadow on the left bank of the Danube, just below the remains of Trajan's bridge. A couple of officials were rushed to the spot in a motor-car, and approached the aviator, who stood rather ruefully examining his motor. They asked him whether they could be of any assistance, and he said he required petrol. They offered to give him a lift to the town

(Continued on page 32.)

RADIOTORIAL

All Editorial Communications to be addressed The Editor, POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

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

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

PATENT ADVICE FOR READERS.

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

TECHNICAL QUERIES.

Letters should be addressed to:
Technical Query Dept.,
"Popular Wireless,"

The Fleetway House,
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London, E.C.4.

They should be written on one side of the paper only, and MUST be accompanied by a stamped addressed envelope.

Queries should be asked in the form of the numbered questions: (1), (2), (3), etc., but may be accompanied by a short letter giving any necessary additional particulars as briefly as possible.

For every question asked a fee of 6d. should be enclosed. A copy of the numbered questions should

be kept, so that the replies may be given under the numbers. (It is not possible to reproduce the question in the answer.)

IMPORTANT.—If a wiring diagram, panel lay-out or point-to-point wiring is required an additional fee of 1/- must be enclosed.

Wiring diagrams of commercial apparatus, such as sets of any particular manufacture, etc., cannot be supplied. (Such particulars can only be obtained from the makers.)

Readers may submit their own diagrams, etc., for correction or for criticism. The fee is 1/- per diagram, and these should be large, and as clear as possible.

No questions can be answered by 'phone. Remittances should be in the form of Postal Orders.

Questions and Answers

NOVEL SUPER-REGENERATIVE CIRCUIT.

A. S. (Sunningdale), F. F. E. (Brookley, S.E.), P. E. (Farnham, Hants), and others, ask for the number of turns of the various coils, etc., in the Novel Super-Regenerative Circuit, published in POPULAR WIRELESS No. 162.

As a large number of readers desire to experiment with this circuit the diagram is produced herewith. The author—Mr. Norman R. Rolph, of Liverpool, not Mr. Phillip Mason, as stated originally—has kindly supplied the following additional particulars:

First it must be noted that the value of super-regeneration is in inverse-ratio to the wave-length expressed in metres; and, therefore, values for reception over the broadcast wave-band only are given.

The centre coil has 35 turns and the grid coil 75, 100 to 150 turns will be needed for the right-hand (anode) coil, but this value should be experimented with. The condenser across the grid coil is essential, as the circuit will not function without it. This may be a three-plate vernier.

(Continued on page 26.)

and so decreases capacity and other losses, and this should make it very useful for short wave work. It is retailed at 8s., at which price it is very reasonable value.

Messrs Igranic, by the way, have forwarded us a list of new prices for their famous coils. Nos. 25, 30, 35 are now 4s. 3d. each; the 75 4s. 10d., 200 8s., and these and the other reductions will form welcome news to amateurs. They inform us that a treatise entitled "Efficient Tuning Inductances as an Aid to Better Radio Reception" will be mailed free to any reader of "P.W." on request.

Samples are to hand of the new Watmel fixed condenser due to Watmel Wireless, Ltd., of 332A, Goswell Road, London, E.C.1, and there is no doubt but that it represents an entirely new departure in design. It is

(Continued on page 28.)



Traders and manufacturers are invited to submit wireless sets and component parts to the "P.W." Technical Dept. for test. All tests are carried out with strict impartiality in the "P.W." Test 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.—THE EDITOR.

A VERY ingenious component has been placed on the market by Messrs. The Igranic Co., Ltd. In fact, it is two components in one, being a Combined Filament Rheostat and Grid Leak. Quite a logical arrangement, but no less original for that, and doubtless quite a number of manufacturers gnashed their teeth when they discovered that such a simple electrical "duet" had escaped their attention.

The grid leak operates on a similar principle to the standard Igranic type, being smoothly and efficiently variable between 0 and 5 megohms. The filament rheostat with a maximum resistance of 4, 6, 8 or 10 ohms, as required, is wound with sensibly stout wire and does not heat up even when carrying full bright emitter current.

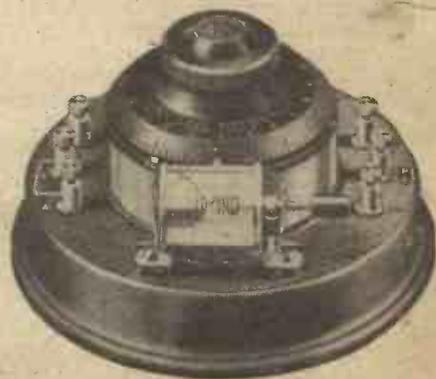
The two control knobs are arranged one

above the other, the grid leak spindle passing through the centre of that of the filament rheostat. The arrangement is a very convenient one and the complete device takes up no more room on a panel than an ordinary filament rheostat. Both movements are entirely independent of each other and both are positive yet beautifully smooth.

In workmanship and finish Messrs. Igranic have almost surpassed themselves. Seldom do we see such clean instrument work associated with medium priced wireless gear.

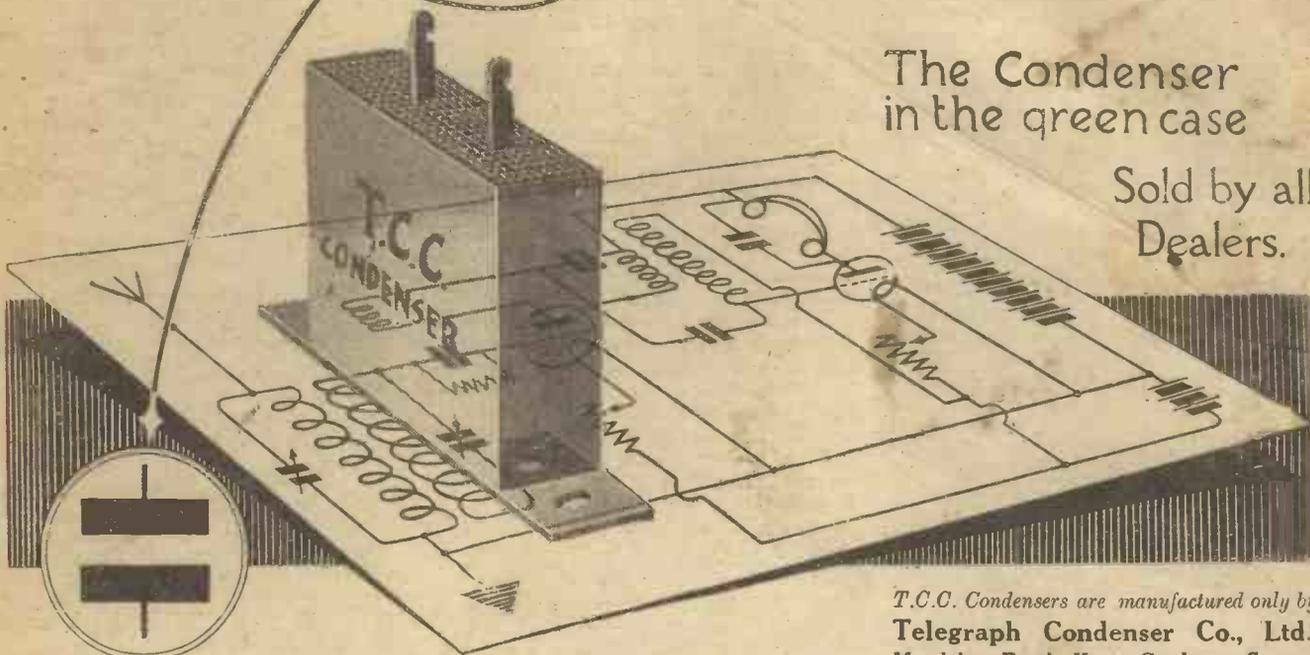
In operation the device functions very efficiently in both of its "departments."

One of the greatest advantages the Igranic combined filament rheostat and grid leak possesses is that it reduces wiring



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APPARATUS TESTED.

(Continued from page 24.)

circular in shape, and is so rigidly constructed that permanency and electrically is absolutely assured. No wax filling is employed, and this is, of course, an added advantage of no little importance. In size the Watmel condenser is unique: it has a smaller area than a penny. A hole through the centre is provided for mounting, although the connecting lugs are quite firm enough to allow it to be self supporting.



An Ediswan Jacobean Combined Cabinet 4-valve Radiophone Receiver, showing the internal arrangements.

We tested one marked .001 mfd. and found the error to be so slight as to be for practical purposes non-existent. The Watmel fixed condensers are high-class in every sense of the term.

From Messrs S. Smith & Sons (M.A.), Ltd., 179-185, Great Portland Street, London, W.1, we have received an "M.L." L.F. twin coil transformer. Several ratios are available, but the one sent us was 1 to 4, and is retailed at 25s. Its appearance is to a certain extent a departure from normal.

It is, roughly, cylindrical in shape, with circular laminations that protrude slightly above a cast aluminium base supplied with two holes for mounting, and below a turned insulated cover on which are mounted the four clearly marked terminals. Mechanically it is an excellent piece of work, and its design electrically is such that only good results could be anticipated.

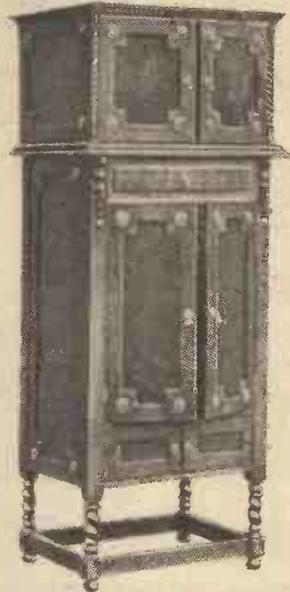
On test it functioned quite as well as was expected, distortion being inappreciable over the entire range of middle frequencies. A roughly prepared curve also proved that its efficiency in this respect extended very commendably in both directions. Transference of energy judged by resultant amplification was carried out with every indication of the transformers high order of effectiveness.

Messrs Smith are, of course, manufacturers of the well-known "M.L." magneto which has earned an enviable reputation in the motoring world, so that the initials "M.L." can be regarded almost as a guarantee of quality, and there is no doubt that the "M.L." L.F. transformer is worthy of its name.

The "Perikon" or double crystal type of detector is, in cases, superior to the cat's-whisker type. It is generally more consistent in operation, and whilst for ordinary crystal reception it may not prove always

as sensitive as the cat's-whisker type, in valve crystal receivers it very seldom gives but good results.

In view of this, the production of the "Lowdist" double crystal combination by Mr. H. M. Harte, 25 Portland Grove, Fallowfield, Manchester, and which is sold at 1s. 6d., is of interest.

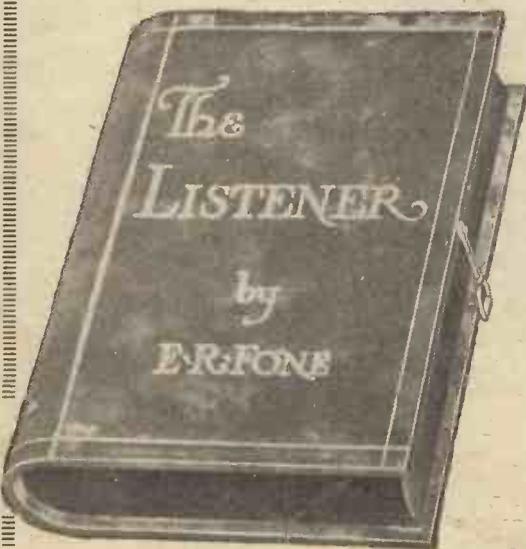


Showing the handsome appearance of the Ediswan 4-valve Cabinet Set when closed up.

A sample was recently sent us for test. We mounted the two crystals in an ordinary "Perikon" type of detector provided with screw containing cups. In an ordinary simple crystal circuit results were good; it was more stable than a standard cat's-whisker detector, but signals were not quite so loud. In a reflex circuit it worked excellently and appeared to possess a suitably high impedance, as it was placed across an anode coil and not a transformer secondary.

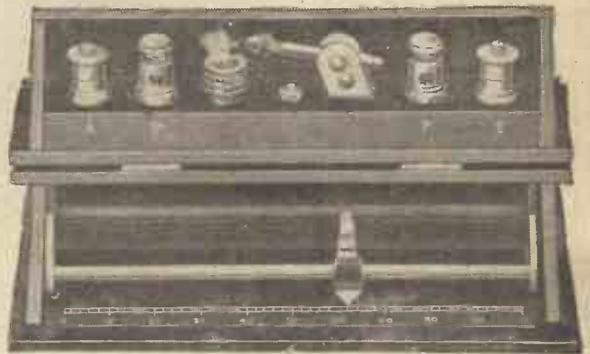
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(PATENT PENDING)



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.00075	9/-
.0005	8/1
.0003	6/0
.00025	6/9
.0002	5/8
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Vernier	4/6

STANDARD

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.0002	4/9
Vernier	4/-

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15" x 9"	5/9 5/9
15" x 12"	7/6 5/8
4" x 4"	8d. 6d.
7" x 8"	1/6 1/2
6" x 6" 1/2	10d.

Any Size Cut
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'J.B.' 'Ormond' & 'Utility' usual prices.
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Correspondence

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.

CONCERNING "CRYSTAL FALLACIES"

The Editor, POPULAR WIRELESS.

Dear Sir,—I was greatly interested to read an article entitled "Some Crystal Fallacies" in No. 167 of "P.W.," as my own experience bears out what Mr. J. E. Corringan says about the "loudness-sensitivity" and "distance-sensitivity" of crystals.

Working a small crystal set-cum-wave trap at the address below, roughly three miles and a half from 2 L.O., it is obviously no easy matter to lose him under normal conditions, especially as the crystal set is a single circuit one comprising a coil plug and .0005 variable condenser in shunt.

With a 150-turn coil inserted, London rather gets the better of Daventry; but here is the curious point.

By a careful adjustment of the cat's-whisker London can be almost silenced, while Daventry comes in quite well and with very little interference.

I may say that a little patience is required to get the necessary adjustment.

The crystal used is a well-known synthetic galena (Tungstalle), so that the question of inconsistent composition is eliminated.

Trusting this may be of interest to readers, I will conclude with the best of luck to yourself and "P.W."

Yours sincerely,

WALTER N. NOTCUTT.

99, Hungerford Road,
Holloway, N.7.

CRYSTAL RECEPTION FROM 5 X X.

The Editor, POPULAR WIRELESS.

Dear Sir,—Just one word about Daventry and crystal users. My aerial is not very good and earth is not at all good, and with plain condenser tuned crystal set 5 X X comes in beautifully.

Can be heard plainly with only one tip of 'phone lead-in terminal.

And as to a few experiments; winding 100 feet of wire' back and forward across my bed, and earth being a water-pipe in corner of room, reception was good 'phone strength. I next slung the wire across a downstairs room about 6 ft. from the ground. Reception was nearly same as with outside aerial.

Next I laid the aerial wire on the ground, and on retuning slightly 5 X X came in—music good, speech could be easily read.

Earth in last two cases was 3 ft. of one-inch pipe driven in ground.

I have formed the opinion that the new station (Daventry) comes in 50 per cent better than Chelmsford did in this spot; Daventry being about 90-95 miles, Chelmsford just less.

Have carried out many interesting multi-valve circuits tests with astonishing results, thanks to your most valuable paper.

Yours faithfully,

A. E. MITCHELL.

The Hyde Farm,
Ifield, Sussex.

RESULTS ON A "P.W." REFLEX.

The Editor, POPULAR WIRELESS.

Dear Sir,—I recently constructed a one-valve reflex set" from one of your recent journals, and I am very pleased with the results I have obtained. The following are a few of the stations I have received: Barcelona, Radio-Madrid, Radio-Paris, Ecole Supérieure, Voxhaus, Kringkastingselskapet Radio-Catalana, E A J 6 (Spain), and most of the British broadcasting stations. I am situated about ten miles from London, which station comes in at enormous strength, but I find the crystal adjustment is the most important part of the set. I find a cheap crystal of the cat's-whisker type (the cheapest that can be got) gives best results with this circuit. I have found it rather hard to cut out London; but if the cat's-whisker is so adjusted that instead of getting the usual high note whistle it is adjusted so that you get a sort of mushy sound, London can be easily cut out. A wave-trap with this set is a pleasing addition. Wishing your paper every success.

Yours faithfully,

J. P. HART.

244, Katherine Road,
Forest Gate, E.7.

A LETTER FROM MR. DUBILIER.

The Editor, POPULAR WIRELESS.

Dear Sir,—It may interest those who are continually criticising broadcasting methods in Britain to know that in this connection you are in a much better position here than we in America.

The conditions in New York City are intolerably worse than those of London. More broadcasting stations are being called for in London, I understand. That was the cry in New York also at one time. Now those who were so anxious for more stations and more variety of programme are more or less hoist with their own petard. The multiplicity of stations jammed so closely together make it practically impossible for the amateur to tune in to any one and listen-in without being subject to interference from others.

I should not like to see this happen in Great Britain, for which country I have always had a soft spot in my heart ever since your Government, many years ago, were the first to encourage me in developing my invention of the mica condenser, encouragement of a kindly nature which I have never forgotten.

I am certain that good broadcasting is the key, not only to international amity, but world peace.

Yours truly,
W. DUBILIER.

Carlton Hotel,
Pall Mall, London.

IS 5PY A FAILURE?

The Editor, POPULAR WIRELESS.

Dear Sir,—Having read your article in "P.W." dated July 25th, "Is 5PY a Failure," I take this opportunity to give you my experience with a set at Coverack, near Helston, Cornwall.

As a Londoner I have had very good results, and some friends requested me to fix them up at Coverack. I was very sure of getting good results so built a three-valve reflex (crystal) and went down with full equipment, with the following results:

Best position for aerial N. to S.

One Marconi R 5 valve and 2 Marconi Power D.E.5, 6 v. accumulator, 120 volts. H.T. Loud speaker just audible. Paris, Bournemouth, Chelmsford (fairly loud) and Swansea. The tuning was very sharp. Plymouth and London could not be heard at all.

One Marconi R 5, 2 Marconi R 4. Same stations good 'phone strength. 60 v. H.T. Could not get loud speaker to work.

Three Mullard D. '06, two dry cells. Good results on 'phones only.

Self oscillation was bad. It was very difficult to tune in the set at any time during the week of test, in fact, my friends could not manage it at all.

The crystal after the second day was dead. After this result I brought all the set back to London and I am going down again this last week in August.

Yours faithfully,

E. WRIGHT.

62 Forest Road,
Walthamstow, E.17.

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Triumph House, 189, Regent St., London, W.1.
Phone: Regent 5336.

TECHNICAL NOTES

(Continued from page 10.)

use for parts of wireless apparatus, particularly for outdoor sets and for sets to be used on shipboard, and soon. The metal parts of outdoor aerials, and the aerial wire itself, will probably be treated in this way in order to increase its resistance to weather conditions.

New Loud-speaker Horn.

A new process for the making of loud-speaker horns, developed by a Chicago ceramic expert, consists in making the trumpet of pottery clay, baking it at a temperature of just over 2,000 deg. F. for about three days, cooling for two days, spraying with metallic oxide, and finally baking again. The result is claimed to be a hard, reflecting, but non-resonant trumpet, giving a pleasing tone to the reproduction. Nothing is said about the weight, or the liability to breakage; one would imagine that a horn of this kind would be likely to be considerably heavier than the usual kind.

H.T. and L.T. from Mains.

The substitution of various devices for the high-tension battery, whereby the set may be operated (as regards the high-tension supply) direct from the electric-light mains, has been accomplished now on quite a practical basis. There appears, however, to have been great difficulty in providing similar devices for the filament-heating current owing, of course, to the much higher amperage required in the latter case. According to reports received lately, a Chicago engineer has developed an instrument whereby this can now be done.

His invention comprises a complete unit for supplying all the electrical power for the set, both high-tension and low-tension. Its use does not necessitate any change in the ordinary wiring of the standard sets (super-heterodyne, neutrodyne, or other special circuits), and it is adapted for sets using up to eight valves. It operates from either the a.c. or d.c. electric-light mains, at any voltage or periodicity.

The maximum current consumption is about 30 watts, the low-tension supply being provided at voltages from 2 to 6, and the high-tension up to 150 volts. It is stated that the principle of the device is entirely different from the well-known principles which are commonly used in high-tension battery eliminators, and the new principle has made it possible to reduce the instrument to very small dimensions. Apparatus of this kind has been on test for some months past, and is shortly to appear on the market.

Filamentless Valves.

The Schicklering "filamentless valve" has now been followed by the Schicklering filamentless electric lamp, which is claimed to be twice as efficient as the best type of filament lamp. These lamps have been made in large sizes, up to 500 watts, and also in small sizes, 2 watts, for use on motor-cars. In this latter connection, it is claimed that they have the advantage of being immune from damage by jarring. Another invention of Conrad Schicklering is a vacuum tube without filament, specially designed for the rectification of alternating current—in high-tension battery substitutes, for example.

The inventor claims that these tubes effect perfect rectification, and that the resulting direct current can readily be freed of all a.c. hum or other noises.

K. RAYMOND

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- 3-way nickel..... 4/12
- 2-way geared..... 5/18
- 2-way Shipton cam 6/6
- 3-way Shipton cam 7/6
- 2-way Polar cam... 6/1
- 3-way Polar cam... 9/1
- Vernier..... 9/1
- 2-way cam vernier 3/6
- Coil plugs, plain..... 2 for 1/3
- Shaped wedge 2 for 1/6
- Do. Edison Bell..... 1/6 for 2/1
- Do. Nickel sides..... 2 for 1/6
- Do. fitted fibre 2 for 1/6
- Ebonite do..... 4/12
- Edison Bell do..... 10/1
- Fixed Condensers: Edison Bell, 0.1 1/2
- 0.001 up to 0.005 1/3
- 0.005 up to 0.01 1/3
- Grid leak & clip 1/3
- 0.003 & grid leak 2/6
- Dubilier..... 0.001 to 0.005 each 2/6
- 0.01 to 0.06 each 3/1
- 2 or 3 meg Grid..... 2/6
- Leak..... 2/6
- Anode res. on stand 5/6
- (50, 70, 80, 100, 000 ohms)
- 2 mfd. T.C.C..... 4/8
- 1 mfd. T.C.C..... 3/10
- .25 T.C.C..... 3/8
- Screen tags, doz. 6d.
- Bus Bar, 12 ft. 1/1
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- H.T.C. over panel 1/8
- Raymond Rheostat 1/6
- R.I. Detector..... 6/1
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- Red & Black, 12 yds. 2/1
- 72in. Phone Cords 1/11
- Loud Speaker Cords 1/11
- Banika Gravity..... 6/6
- Detector..... 1/3
- S.P.D.T. Panel..... 1/3
- Lissen Minor..... 3/6
- Lissenat..... 7/6
- Universal..... 10/6
- Switch 2-way..... 3/9
- Series Parallel..... 3/9
- Anode Res..... 2/6
- Var. Grid Leak..... 2/6
- Choke..... 10/6
- Lissen L.F. T. 2 25/1
- Lissen L.F. T. 3 16/6
- Lissen Coils..... 25, 40, 55, 40, 1/4
- 50, 5/1
- 75, 5/4
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- 0.005..... 22/6
- 0.0025..... 22/6
- Non-Pong V.H..... 4/3
- Phones 20/1, 22/6
- Primax Loud Speaker..... 27 15/1

Ericsson E.V. (Continental)

- 4,000 ohms, 12/1

HEADPHONES

- British, 4,000 ohms, Sterling..... 22/6
- B.T.H..... 20/1
- Brander..... 20/1
- Brown's 'P' type 20/1
- Ericsson's..... 22/6
- Michron vernier..... 2/6
- Gambrell coils stocked.
- Paragon panels obtained.
- Watmel grid leak 2/6
- Watmel anode..... 3/6
- Watmel 10,000..... 10/1
- 100,000..... 3/6
- Bretwood leak..... 3/6
- Ditto anode..... 3/1
- Colvern Variable..... 3/6
- 0.003 20/1, 0.005 21/1
- Glazite 10 ft..... 1/2

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- One hole fixing. Ebonite ends. With Vernier Without Vernier
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- *0005..... 7/6
- *0003..... 7/1
- *0003..... 5/3
- (Including knob and dial. Post 3d. set.)

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- ORMOND No. 4..... 7/6
- ORMOND No. 5..... 5/6
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- ORMOND No. 7..... 5/6
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- ORMOND No. 10..... 5/6
- ORMOND No. 11..... 5/6
- ORMOND No. 12..... 5/6
- ORMOND No. 13..... 5/6
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- ORMOND No. 96..... 5/6
- ORMOND No. 97..... 5/6
- ORMOND No. 98..... 5/6
- ORMOND No. 99..... 5/6
- ORMOND No. 100..... 5/6

ORMOND "AMERICAN"

- Square Law Low Loss. Skeleton ends, knob and dial.
- *001, 9/1; *0005, 9/1; *0003, 7/6; *00025, 6/6 (with vernier 1.6 each ex.)

JACKSON BROS. "J.B."

- Square Law with vernier..... 13/6
- *001..... 13/6
- *0005..... 12/6
- *0003..... 11/6
- *00025..... 11/3
- "J.B."..... 8/6
- Standard..... 5/9
- *0002, 5/1
- ALL with knob and dial. Post free.

ACCUMULATORS.

- 2-v. 40-amp. 9/6
- 2-v. 60-amp. 11/6
- 4-v. 40-amp. 15/11
- 4-v. 60-amp. 19/6
- 4-v. 80-amp. 24/6
- 6-v. 60-amp. 29/6
- 6-v. 80-amp. 35/9
- All new best makes. Harts also stocked.

Goswell (quality) Mounted Coils.

- 25 1/6, 35 1/9, 50 2/1, 75 2/3, 100 2/8, 150 3/1, 200 3/2, 250 5/3, 300 6/1

2-way Panel, 3-1/2-way, 5-1/2-way, 6-1/2-way, 8-1/2-way, 10-1/2-way, 12-1/2-way, 14-1/2-way, 16-1/2-way, 18-1/2-way, 20-1/2-way, 22-1/2-way, 24-1/2-way, 26-1/2-way, 28-1/2-way, 30-1/2-way, 32-1/2-way, 34-1/2-way, 36-1/2-way, 38-1/2-way, 40-1/2-way, 42-1/2-way, 44-1/2-way, 46-1/2-way, 48-1/2-way, 50-1/2-way, 52-1/2-way, 54-1/2-way, 56-1/2-way, 58-1/2-way, 60-1/2-way, 62-1/2-way, 64-1/2-way, 66-1/2-way, 68-1/2-way, 70-1/2-way, 72-1/2-way, 74-1/2-way, 76-1/2-way, 78-1/2-way, 80-1/2-way, 82-1/2-way, 84-1/2-way, 86-1/2-way, 88-1/2-way, 90-1/2-way, 92-1/2-way, 94-1/2-way, 96-1/2-way, 98-1/2-way, 100-1/2-way

"LOTUS."

- Geared B.I. 2-way..... 7/1
- 3-way..... 10/6
- McMichael's Triple Rheostat..... 22/6
- Dual Rheostat 7/6
- H.F. Transformer..... 10/1
- (All wave-lengths) Potentiometer 7/6
- Fixed Condensers..... 12 18 2/3

BURNDETT PARTS.

- Rheostats: Gen. Purposes, 5/1; Dual..... 7/6
- Detector..... 4/1
- Rheostats 5/1, 7/6
- Antiphony H.5/1
- Success choke 10/6
- Athol V.H..... 1/3
- Athol Coil Plug 1/3
- T.C.B. 6 ohms, 4/1
- T.C.B. Potentiometer (300), 5/1
- Shipton ditto (600), 4/6
- Shipton 7 ohms, 3/1
- Shipton 30 or 60 ohms..... 3/1
- Woodhall parts stocked.
- Dubilier Variable Fixed 5/1 type.

POLAR.

- R.C.O. Unit 15/1
- Micrometer..... 5/6
- *0005 or *0003 10/6

EVER-READY.

- 108 volts H.T. 20/1
- 66 volts H.T. 12/6

YOUR PANEL DRILLED FREE WITH 25/- order (retail)

CALLERS COLUMNS ONLY

- All Post Orders from Other Columns.
- H.T. BATTERIES** (Various makers): 60-v. 5/6, 6/6, 6/11; 66-v. Ever Ready, 12/6; 108-v. 20/1; 60-v. B.B.C., 8/11; 36v..... 5/6; 16.5..... 2/9; 9v. (grid bias)..... 2/1

Accumulators

- (well-known makes): 2v. 40a..... 7/6, 8/6; 4v. 40a, 13/11, 15/11; 4v. 80a..... 17/6, 18/3; 6v. 80a..... 22/6, 23/6; 6v. 60a..... 15/1, 17/6; 6v. 80a..... 23/6; 6v. 100a..... 38/6

Square Law Variable Condensers.

- *0005, 5/1; *0003, 4/6
- Including knob and dial.
- S.P.D.T. Panel..... 17/6
- S.P.D.T. Square Law..... 17/6
- S.P.D.T. china, 1/3
- S.P.D.T..... 10/6
- Terminals, 1d.
- Nickel..... doz. 10d.
- Valve sockets, 4 for 3d.
- Stop or valve plus..... 4d.
- Washers..... 12 a 1d.
- Spade terminals..... 6 a 1d.
- Spade terminals..... 12 a 1d.
- Pintennas, 2 for 1d.
- Do. Red or Black, 1d.
- Copper foil, roll, 3d.
- Red and black flex, 12 yards, 1/6
- Aerial, 7/22 100ft. 1/11
- Battery Clips, 5 a 1d.
- Sleeving, yd., 3d.
- Wander plugs, pr. 2d.
- Contact studs com. knobs..... 2 a 1d.
- Phone cords, 6 ft., 1/3
- Knets and Dials, 10d.
- Empire Tape, 12 yds., 6d.
- Valve Holders..... 8d.
- Plug and socket, red or black..... 3d.
- 7/22 Aerial, 50 ft., 1/1
- Ins. Hooks, 2 for 1d.
- Loud speaker cords..... 4/6
- Ins. Staples..... 5 a 1d.
- Flush panel sockets (nickel and nuts), 1d.
- Rheostats, special, 1d.
- Vernier condensers, 1/9
- Tumbler switches 10 d.
- Shorting plug, 3 d.
- Egg Insulators, 4 for 3d.
- Var. Capac. 10/65
- Anticap ditto..... 10d.
- Solid rod standard 1/4
- Good quality do. 8d.
- Hank 1/16th sq. Ins 8d.
- Lead-in (10 yds.) 1d.
- Ebonite dials..... 8d.
- Unbreakable knobs 3d.
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- Tape aerial, 100 ft. 1/10
- TWIN Bell Wire, per yard..... 2d.
- BRITVET 4,000 ohm phone cord..... 1/3
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- Edison Bell..... 11d.
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- 3,000 ohm phones, 6/6
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- Enclosed detectors, 8d.
- Extra large doz. 1/1
- 20 accumulator, 1/6

THORPE K4 (Unidyne 5-pin) VALVES.

- Gen. uses, each 14/6
- 5-pin valve holder 1/3
- Set Parts (one valve)..... 46/6
- Ditto (two valves)..... 66/6
- (including valves).

"MAGNUM."

All parts stocked.

EBONITE

- Out to size. 3/16th 1/4 sq. inch 1/4 sq. inch.

"WONDER" AERIAL

- Phosphor Bronze, 100 ft. 3/1
- Indoor, outdoor or frame, 49 strands.

"UTILITY."

- 2 pole c/o knob..... 4/6
- 4 pole c/o knob..... 6/6
- 2 pole c/o lever..... 5/6
- 4 pole c/o lever..... 7/6
- Nickel 6d. ca. ex. Variable condensers at list prices.

SECOND-HAND DEPT.

- Quantities of nearly new and second-hand goods on sale. Cheap prices. Old parts bought or taken in part exchange.
- IMPOSSIBLE to advertise all lines here. Send name and address (postcard please) for illustrated folder. Special offers not obtainable elsewhere.
- IF WANTING ANY GOODS MAKE OUT LIST AND I WILL QUOTE LOWEST INCLUSIVE PRICES.
- To encourage you to use British Valves I am willing to purchase one burnt-out valve for each valve you purchase. Prices given range from 1/3 to 4/- according to valve you buy.
- Stock sizes 3/16th, 6 x 6-7 x 5 each 1/10; 8 x 6-7 x 5 each 1/12; 10 x 6-12 x 6..... 3/1; 12 x 9..... 4/1; 12 x 12..... 5/6; 14 x 10..... 5/6
- 1-in. also stocked.

CALLERS - we stock everything you require.

7 GRAPE STREET SHAFTESBURY AVENUE, W.C.2

New Oxford Street end. 1 minute Tottenham Court Road Tube. 3 minutes Holborn Tube. 2 minutes Palace Theatre.

NOTE! Grape Street is between Prince's Theatre and Mudie's Library.

DAILY 9 a.m. to 8 p.m. SUNDAYS 11 to 1 p.m. All day Saturday.

OPEN

HOURS OF BUSINESS

Daily 9 a.m. to 8 p.m. Sundays 11 to 1. Open all day Saturday. Two shops, one always open. Telephone (private line) Gerrard 2821.



H.T.3 60-v. ACCUMULATOR

End your H.T. troubles and save money



Outlasts dozens of dry cells and can be recharged for 2/6.

1/- per volt, plus 3/- for filling with acid and initial charge. 63/-

C. A. VANDERVELL & Co., Ltd. Acton Vale, London W.3.

HEADPHONE REPAIRS

Re-winding, re-magnetised and readjusted. Lowest prices quoted on receipt of telephones. Delivery three days.—THE VARLEY MAGNET CO., London, S.E.18. Phone 888-9 Woolwich. Est. 26 years.

RADIO "CROXSONIA" PANELS

Money back guarantee that each and all Panels are free from surface leakage. Meggar test infinity. 8" x 5", 1/2: 7" x 6", 1/3; 9" x 6", 1/7; 10" x 8", 2/1; 11" x 8", 2/3; 10" x 9", 2/4; 12" x 8", 2/6; 11" x 9", 2/7; 12" x 9", 2/10; 12" x 10", 3/-; 14" x 10", 3/5; 14" x 12", 4/-; 7" x 5", 1/- thick. Post Free. Callers, cut any size, and quote by Post. Sample, and prices, post free to the Trade.

CROXSONIA CO., 10, South St., MOORGATE, E.C.2

WHY USE A VALVE ?

My "D.X" Super-crystal in simple crystal set brings in Daventry at 250 miles on Loud Speaker. Also many Continental stations on phones. Many testimonials. Sample at half-price, 1/2.

JOHN NEWBIDDING, DUNS, BERWICK.

Picketts Cabinets

SENT ON APPROVAL.

Beautifully Polished Mahogany

Panel Send for Estimates
For 12 x 12...45/- Per RETURN POST.
" 12 x 15...55/- Accessories
" 12 x 18...65/- Post Free.

Panels Drilled and Engraved.

Picketts Cabinet (P.W.) Works, Bexleyheath, S.E.

Model-de-Duze
Polished



TWO VALVE RECEIVERS

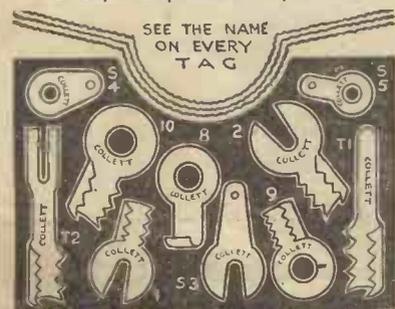
Receive most B.B.C. and Continental stations. Price (without accessories), £3 10 0. Sent on 7 days' appro. on receipt of cash. Money returned if not entirely satisfied.—Comyn, Wireless Dealer, 16, Coniston Av., West Jesmond, Newcastle.

BROAD CLEAN CONTACTS

Thin wire ends clipped into Collett Tags become broad, flat contacts; helpful in your sets. There are types for screw terminals, types for soldering, each designed to do its job well. Tell your dealer they must be Collett Tags. Ask him to show the ten types made, or send us P.O. Is. for complete sample outfit.

COLLETT'S EXCEL TERMINAL TAGS

S. H. COLLETT MFG. CO., 52/54, Hampstead Road, N.W.1.



THE MOST POPULAR "ONE-VALVER" IN AMERICA.

(Continued from page 18.)

Oscanyan of "Amateur Radio," and as his magazine caters for the more advanced amateur, mostly transmitters, it is probable that he based his vote on the fact that the Reinartz was used by so many of his readers for the reception of C.W.

I don't wish to give the impression that this circuit is no good for the reception of broadcast matter, but it is a "hefty" squealer, and without question much more efficient for the reception of C.W. than for telephony.

Adding Amplifying Stages.

In the third diagram we have the circuit recommended by Mr. Shuddt, of the "Telegram," described by him as a modification of the Ultra Audion. The only way in which this differs from the ordinary straightforward circuit is that the bottom lead of the secondary, instead of being connected to the L.T. battery, goes instead to the plate terminal of the valve. The primary and secondary coils are wound on a 3½ in. diameter cardboard former of cylindrical shape. The primary consists of 10 turns of 22 D.C.C., and the secondary of 50 turns of the same gauge wire. Both windings are side by side with a spacing of ¼ in.

The grid leak and grid condenser are of the usual capacity, and the condenser shunted across the secondary is of .0005 mfd. capacity. As regards the reflex which obtained two votes, both from very prominent radio men, I can do no better than recommend the use of the modified "P.W." Combination Set recently described in POPULAR WIRELESS, for there is no one-valve reflex in the States that can beat it.

I have endeavoured above to give brief particulars of some of the more popular American circuits, and not just to describe any single valve receivers that come into my head. With any of the above circuits, an L.F. amplifier of the usual pattern may be used, but as regards the addition of H.F. amplification, all I can say is that I have tried it and failed. This, of course, does not refer to the plain regenerative receiver described, to which H.F. may be added in the usual manner with excellent results.

CONTINENTAL NEWS.

(Continued from page 23.)

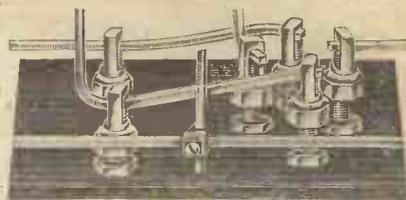
where he could get some, and by arrangement drove him to a garage where several men were in waiting who, as he entered, threw themselves on him, overpowered him and handed him over for temporary keeping to the local asylum.

Geneva—International Council Will Meet.

The council of the International Radio Union will meet in Geneva on September 23rd and 24th. The most important question down for consideration is the ratification of the new arrangements to prevent clashing between the various European transmission stations. It will be recalled that an international conference met here last month to discuss this and resolved to make certain tests before adopting final resolutions. It is hoped that the result of these tests will be known by the time the Council meets.

FIX CONNECTORS (Patents Applied for)

The device which gives a direct and complete contact without soldering.



You will be astonished at the rapidity with which you can connect up any circuit.

FIX is Reliable and Neat.

No. 1 for terminals & screws 4 BA, 5 BA, 6 BA, 2/- per doz. No. 2 for Butt & Cross joints 1/- per doz.

Your Dealer or Patentee

W. E. BOTTOM, 34, Denham Rd., SHEFFIELD

2-VALVE AMPLIFIER, 35/-

1-Valve Amplifier, 20/-, both perfect as new; Valves, 4/6 each; smart Headphones, 7/6 pair; new 4-Volt Accumulator, celluloid case, 13/-; new 60-Volt H.T. Battery, guaranteed, 6/-; 2-Valve All-Station Set, £4. Approval willingly. P. TAYLOR, 57, Studley Road, Stockwell, LONDON.

"J.G." POWER CRYSTAL.

1/6 Best for Range, Purity, or Applied Potential. Complete with Cat-whisker. Send 1/6 for sample. Selected, Tested and Fully Guaranteed.

25/6 "Jay-Gee" 3 in 1 Set fitted with above. Purest reception in the World.

51/- Complete with H.T. & L.T., 16/8 English Valve, or as Crystal Set when Valve is not required. Post Free U.K. Stamped Envelope for Particulars. J. GAUNT, Jay-Gee Works, 25, All Saints St., BOLTON.

PHONE REPAIR SERVICE

ALL MAKES OF PHONES REWOUND. 4,000 ohms, 5/- per pair; 6 ft. leads fitted. 2/- Remagnetising and adjusting, 2/-; postage. 6d. Transformers rewound any ratio, from 5/- The H.R.P., 46, St. Mary's Road, Leyton, E.10

ZIG-ZAG

ELECTRODES OR EARTH PLATES

MAKE A PERFECT EARTH.

Electrical & General Sundries Ltd
14 Victoria Street, S.W.1.

ACCUMULATOR BARGAINS.

C.A.V. & Fullers, sold, but guaranteed 12 months. Sent on approval against cash.
2v-40a ... 9/6 4v-80a ... 27/6 6v-60a ... 32/6
4v-40a ... 17/- 4v-100a ... 32/6 6v-80a ... 40/-
4v-60a ... 21/9 6v-40a ... 25/- 6v-100a ... 46/-
MADE RUBBER CO., 58, PRAED ST., W.

'PHONES STRENGTHENED!!

NEW SECRET METHOD.

of magnetising and adjusting improves new or old phones 20 per cent to 200 per cent. 2/- pair. Guaranteed results. New method of layer-wound rewinding renews useless phones and makes them better than new. 5/- pair. Every class of repair to phones, loudspeakers and transformers. All work guaranteed. Ready same day. Post, 6d. pair. Prospectus P. gratis. JOHN W. MILLER, 68, Farringdon St., E.C.4. Phone: Central 1950.

DULL EMITTERS REPAIRED

Each concert tested, 7/6. .06 Valves, 9/6. Bright, 4/9. Guaranteed quick delivery. Send remittance with valve to W. G. Eames, 15, Red Lion St., London, W.C.1. Phone: Chancery 7750.

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

HEADPHONE REPAIRS

Headphones and Transformers 5/- Valve Sets repaired and wired to any circuit. Lowest prices quoted on receipt of receivers.—A. B. BRISCOE, 24, Seaton St., Hampstead Rd., London, N.W.1.

The MICROHM VERNIER CONDENSER

for sharp and accurate tuning



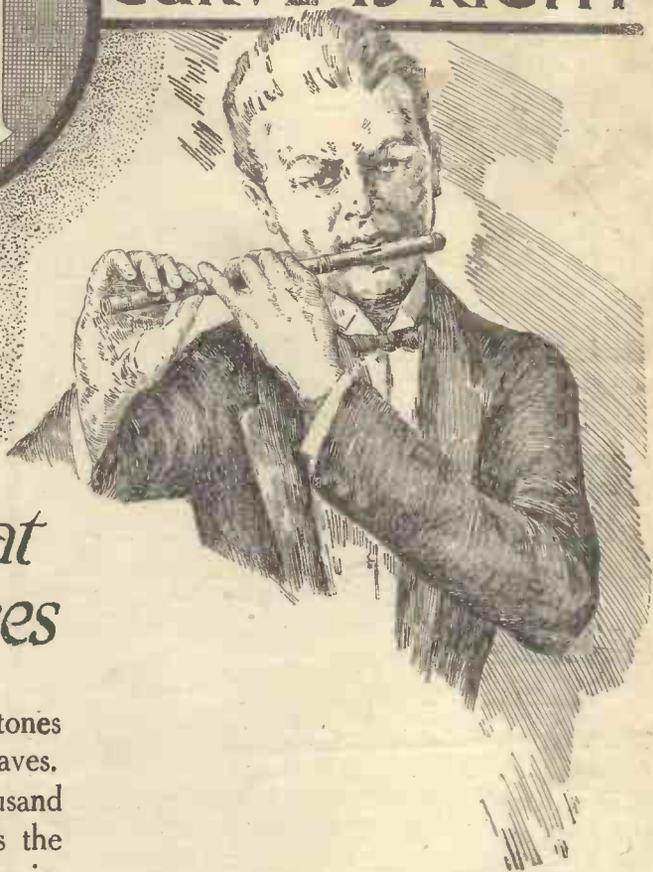
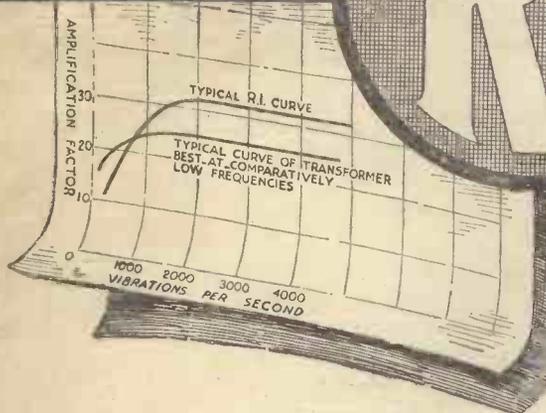
2/6

GET ONE

Postage 3d. TO-DAY

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WHY THE **R.I.** CURVE IS RIGHT



The Amplification that Preserves the Overtones

The real personality of any artist lies in the overtones that are additional to the fundamental note waves. These overtones vary in frequency from one thousand to several thousand cycles per second, whereas the frequency of the fundamental notes generally varies between 250—1,200 per second.

A transformer that is designed to amplify the fundamental frequencies only, gives characterless reproduction resulting from the elimination of the smaller but nevertheless all-important overtone frequencies. The increased amplification necessary to bring out these minute vibrations is shown by the curve of the R.I. Transformer.

The immediate increase above the frequency of 1,000 is the reason why the R.I. curve is right. The problem of the overtones has called for extensive and thorough research and the solution that maintains lifelike character in reproduction is the World's Transformer.

THE R.I. TRANSFORMER



Write for R.I. Catalogue, free on application.

Visit our Stand No. 36 at the All-British Wireless Exhibition, Albert Hall, September 12th—September 23rd.

LISSENIUM.

Build a Choke Amplifier— the LISSEN WAY— and get Loud Speaker reproduction of outstanding purity.

Owing to the careful design of the coil in the *Lissen L.F. Choke* and its low self-capacity and high inductance, uniform amplification of all audible frequencies is obtained with maximum volume. The impedance value has been chosen carefully so as to make the Lissen L.F. Choke suitable for use with standard L.F. or general purpose valves and particularly with small power valves. With the *Lissen L.F. Choke* it is practically impossible for inter-stage distortion to occur.



ECONOMY— with the LISSEN L.F. CHOKE

The total cost of a *Lissen L.F. Choke Coupling Condenser* and *Variable Grid Leak* is less than the average price of transformers. Also, when compared with the resistance capacity coupling, there is a saving in H.T., the voltage with LISSEN Choke Coupling being no greater than with transformers.

BIG VOLUME— with the LISSEN L.F. CHOKE

The desired volume can be built up without distortion with *Lissen L.F. Chokes* following one or two stages of transformer coupled L.F. or an amplifier can, of course, be built up throughout with *Lissen L.F. Chokes*.
The Lissen L.F. Choke 10/-
For pre-eminent first stage amplification, use the *Lissen T.T. Transformer*—then let the *Lissen Chokes* follow.

LISSEN FIXED CONDENSERS



The capacity of the Lissen Fixed Condenser recommended for Choke Coupled stages is .01 mfd. Price, 4/3. *Lissen Fixed Condensers* are accurate to within 5%. They never vary—never leak—they deliver all their stored up energy.

LISSEN VARIABLE GRID LEAK



When building a Choke Coupled Amplifier, it is always advisable to use a variable grid leak having a wide range of variation. The Lissen Variable Grid Leak is continuously variable from $\frac{1}{4}$ to 12 megohms.

Lissen One Hole Fixing, of course. *Lissen Variable Grid Leak* 2/6

Write for **TEXT BOOK OF LISSEN PARTS**—free to readers of this magazine.

LISSEN LIMITED

LISSENIUM WORKS, 8-16, FRIAR'S LANE, RICHMOND, SURREY

Telephone: Richmond 2285 (4 lines).

Telegrams: "Lissenium, London."

BUILD with ALL LISSEN PARTS and your receiver will give results which would never be possible with mixed parts.

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