WIRELESS, incorporating "Wireless Weekly," JULY 31, 1926.

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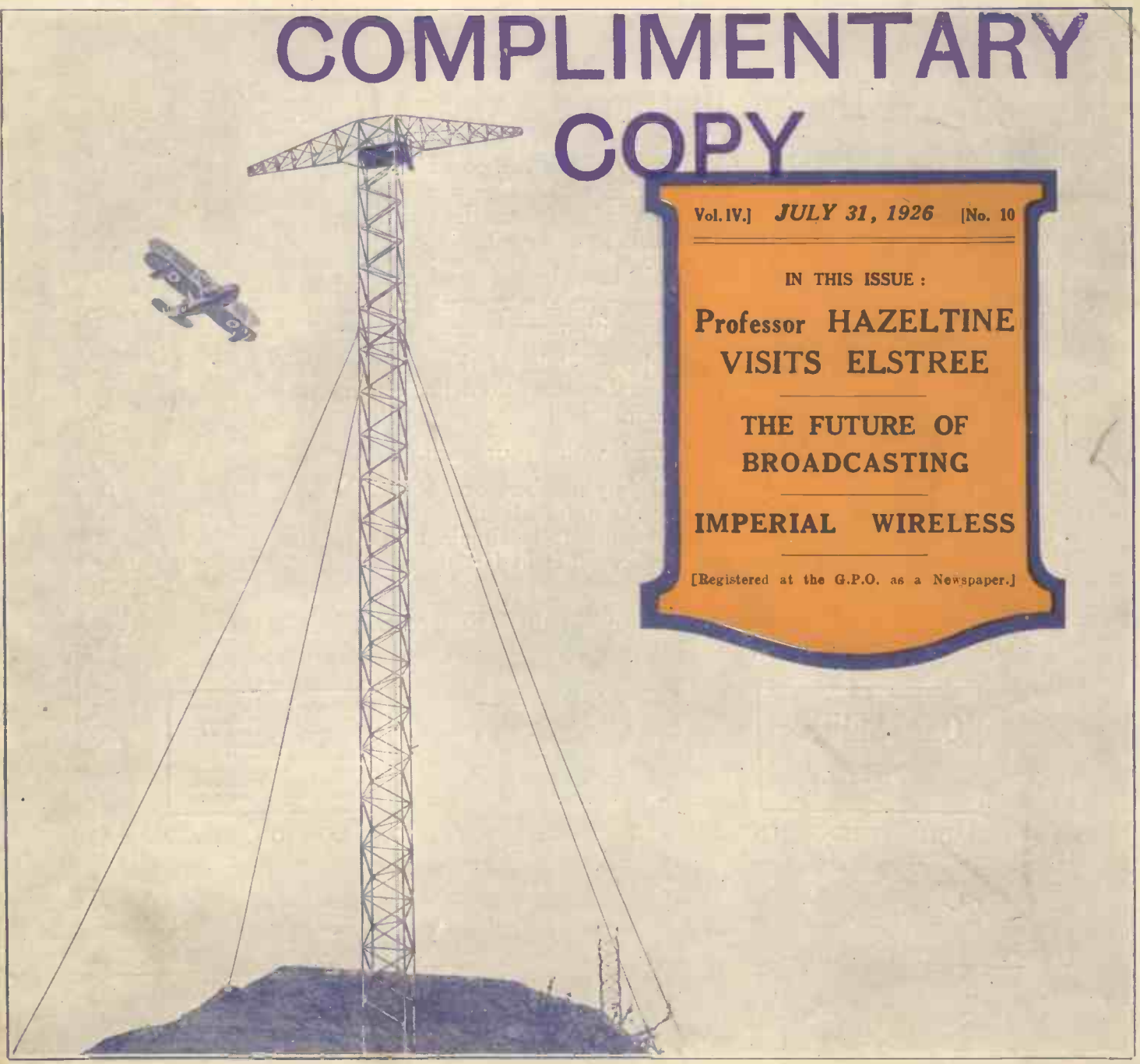

Vol. IV.] JULY 31, 1926 [No. 10

IN THIS ISSUE:

Professor HAZELTINE VISITS ELSTREE

THE FUTURE OF BROADCASTING

IMPERIAL WIRELESS

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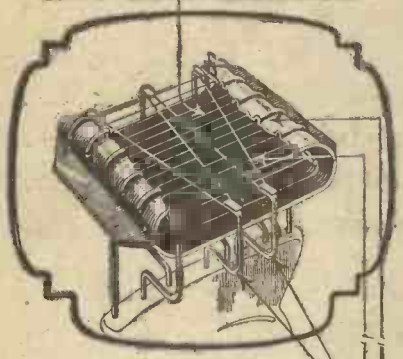
LOOK



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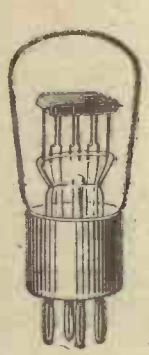

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THIS WEEK'S NOTES AND NEWS

Enterprise

A GOOD example of Australian enterprise is that of the "Wireless reporter," Mr. H. Marks, who, by the way, is now in London. Mr. Marks is to the Sydney broadcasting station what the sports reporter is to a daily newspaper. He carries his radio equipment with him (a portable transmitter), and sends through his descriptions of any notable events to the Sydney station, where they are "put straight on the air." Mr. Marks is also sports manager to the Sydney Grammar School.

Standard English

THE decision of the B.B.C. (not yet the British Broadcasting Corporation!) to set up a standardised pronunciation for its announcers is one of great importance. It has appointed a committee to decide upon uniform pronunciation of "doubtful" words, on which figure such prominent personages as the Poet Laureate, Mr. George Bernard Shaw, and Sir Johnston Forbes-Robertson. I am wondering whether the B.B.C. will have the ultimate effect of abolishing all dialects, and keeping the whole of Great Britain to "perfect English," which is, of course, at present spoken by no one.

Beginning at Home

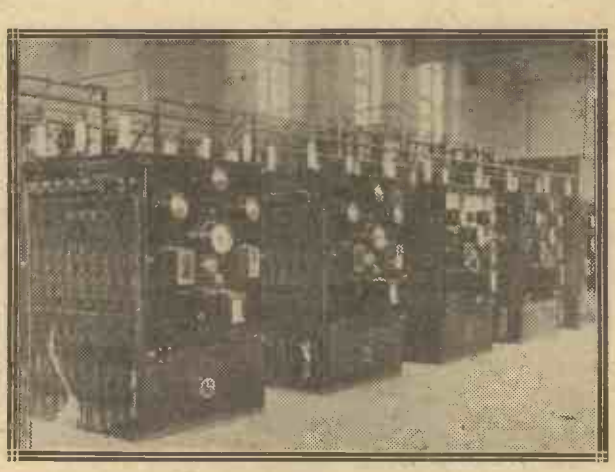
I WONDER how many of my readers realise the great amount of truth in Captain Eckersley's recent remark that "the severest critics of the B.B.C. are within the walls of 2, Savoy Hill"? Those who criticise the programmes from outside may not always realise this!

"To Encourage the Others!"

WHO shall say that Glasgow is not a knowing city? One man was recently fined £5 there for working a wireless set without a licence, and it came to light that as a result of a previous prosecution 200 persons had taken out licences within two days!

Rail Tests

MORE tests in the direction and operation of goods trains by radio have just been very successfully carried out in the U.S.A. In one series the engine and the guard's van were both equipped with 115-metre telephony transmitters, and communication was kept up for five hours, through rainstorms, thunderstorms, under bridges, power lines and every conceivable obstacle. I understand that the next series of tests will be carried out between two moving goods trains.



An interesting article appears elsewhere in this issue dealing with the Empire's Wireless system. This view shows the main valve panels at Rugby.

Wireless to the Rescue Again

ONE short wireless message recently saved the lives of a party of starving men, marooned at Fox Channel, north of Hudson Bay. One member of the party had managed to reach the trading post at Southampton Island, whence a message was sent southward, which reached the Canadian Government stations. As the result of this, a broadcast "SOS" was sent nightly from the Springfield, Mass., station, and was heard by another party of trappers, who were able to save the marooned ones just in time.

An Old Friend

WHEN the station at The Hague starts up again, I understand that the call-sign and wavelength will be those used when the station closed down in 1924, *i.e.*, PCGG and 1,150 metres.

Doubtful

A WELL-KNOWN wireless expert has expressed the opinion that the huge Rugby station will be obsolete in two years' time, on the grounds that short-wave low-power wireless will supersede the long-wave stations. I very much doubt, however, whether the shorter wavelengths will be found reliable enough for a useful *regular* service to be maintained. Any amateur transmitter will tell you of the whims of the short waves in different kinds of weather. Those "depressions over Iceland" generally result in depressions of another kind over Great Britain.

A Dangerous Occupation

THE need for caution in handling even the carefully laid out broadcast apparatus of to-day was shown a week or so ago, when Mr. Lester Wolfe, the announcer at the Beach Hotel, Chicago, station, was killed through omitting to switch off the power before replacing a fuse.

The Sooner the Better

I HEAR that broadcast listeners may expect much more music and many fewer talks this next winter. Educational talks will in particular be

(*Continued on next page.*)

THIS WEEK'S NOTES AND NEWS

(*Continued*)

shortened and reduced in number. But why not start it *now*, while we have some fine weather?

The German Exhibition

THE German Wireless Exhibition, held in Berlin, takes place this year at the same time as our own "show," and it is expected that it will be possible to throw open the more important radio factories in Germany for inspection by British visitors.

Reports Wanted!

ON October 1 there is to be a world-wide determination of longitude by means of radio signals. Listeners who find that the longitude of Greenwich has changed are asked to report immediately to this office!

A Bach Celebration

AN anniversary Bach programme will be given from 2LO to-morrow (July 28), and will include solos by Mr. Horace Stevens and numbers by the wireless orchestra and chorus.

Don't!

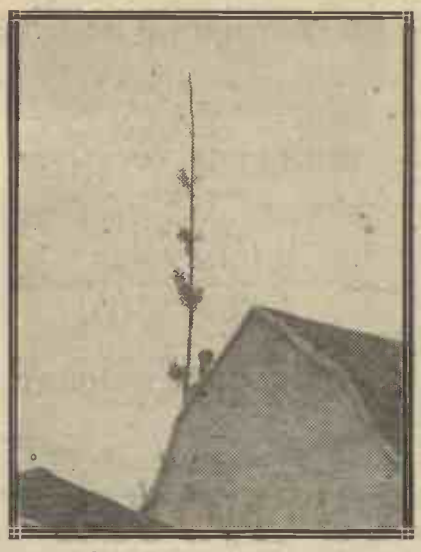
I DO *not* advise my readers to follow up a suggestion which, curiously enough, reached me from two separate sources last week. It is as follows: "When you take out your portable set, don't carry about weighty high-tension batteries, but camp out by the nearest electric railway. Most of them use 600 volts D.C., and that is enough to work a power amplifier quite well." Yes, I *think* so!

The World's Worst

WHAT is the world's most boring spectacle? A little while back I used to think it was a professional billiards match; after that I changed my mind to a crowd of people playing patience in a club, but now—you know what is coming—I am certain that it is the lounge of a hotel filled with people all sitting in strained attitudes with headphones reposing upon their craniums (or is it crania?) in various uncomfortable positions.

Slander!

ALTHOUGH a famous humorous paper recently gave us a picture of the old lady who wanted to know "whether it was a saxophone or a deep depression over Iceland," I have only just met a person who says that the disadvantage of wireless will always be that all musical instruments sound the same. And he uses a crystal set!



Did your aerial mast sprout? This one, erected near Colchester, did.

The Berne broadcasting station is one of the very few which possesses a real station building of its own.

Lt.-Commander Kenworthy refers in his article on "Imperial Wireless" to the giant valves used at Rugby: Here one of them is being compared with a receiving valve.

The German "Show"—"Juice" for Portables—The World's Worst

Retirement of a Pioneer

I HEAR that Dr. J. A. Fleming, the inventor of the thermionic valve, has retired from his position as Professor of Electrical Engineering at London University, after 41 years' work. This "grand old man of wireless," as he is often called, will no doubt enjoy his well-earned rest. Many specimens of his original valves may be seen in the Science Museum at South Kensington.

A Good Example

I HEAR that M. Sacha Guitry has given to charities the sum of 50 guineas that he received for his recent broadcast. Let us hope that many of them will follow his example!

Easy!

A CORRESPONDENT in a contemporary asks "Is it possible to work a loud-speaker from a crystal set at 20 miles from Daventry with sufficient strength to fill a medium-sized room?" Yes, certainly. The only additional apparatus needed is a really good two-valve L.F. amplifier.

A New Station

A NEW commercial station is, I hear, to be erected by the Tanganyika Territory Government at Dar-es-Salaam during this year. It will not be used for the purpose of broadcasting however.

Wavelengths

ALL European wavelengths are to be revised during the second week in September. I have now heard officially that Geneva has allotted Great Britain nine exclusive wavelengths under the new scheme, so that I think I may say that we shall be certain of receiving at least *one* B.B.C. station clear of interference!

Seaside Programmes

THE B.B.C. is already negotiating with several popular seaside resorts with a view to securing a full night's programme on the lines of that recently given from Brighton. Incidentally, the "slogan" craze is in great danger of spreading to seaside towns.

CALL-SIGN.

WHO INVENTED THE NEUTRODYNE?

"We should in England call it the Scott-Taggart Neutrodyne"

—Professor Hazeltine

NEW FACTS ABOUT A GREAT INVENTION

How it Came to be Sold to America

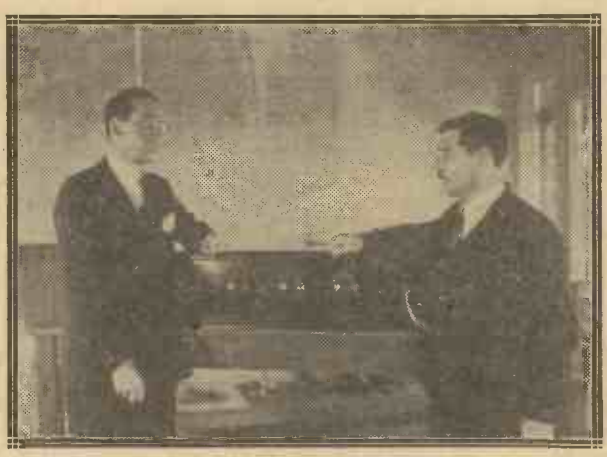
THE utmost interest is being shown in the whole question of the neutrodyne circuit. Although such circuits have from time to time been incorporated in various receivers, the extraordinary success of the "Elstree Six" has persuaded the wireless public that for selectivity, range, signal strength and non-radiation the neutrodyne stands supreme. The work done at Elstree by the Radio Press engineers, headed by Mr. Scott-Taggart, has been of such an important and far-reaching character that the designs which will emanate from the Radio Press journals will be the ones to be followed by home constructors all over the country. Although in America the manufacturers and public immediately appreciated the merits of the neutrodyne, yet neither have hitherto fully done so in Great Britain. The wide publicity and dozens of demonstrations of the "Elstree Six"—described in the June and July issues of *Modern Wireless*—have, after three and a-half years, made the neutrodyne "catch on."

Inner History

As regards the wireless trade, special interest in the neutrodyne has been aroused not only by the work of the Radio Press engineers but by the importation of American receivers using this invention. The interest of the trade was increased still further by an article by Mr. H. T. P. Gee, the Patent Agent, in the June issue of *The Wireless Dealer*. This article disclosed some extraordinary facts about the inner history of the neutrodyne. Mr. Gee explained that the neutralised circuit as used in the modern receiver was first invented by Mr. Scott-Taggart in this country and embodied in his British Patent 217971, dated January 2, 1923.

The Simultaneous Invention

In the spring of 1923, after the filing of the Scott-Taggart patent, Professor Hazeltine, an eminent scientist, disclosed his neutrodyne invention, which was practically identical with the Scott-Taggart patent. Each inventor working independently and separated by 3,000 miles had evolved the same idea. This is not the first time a great invention has been simultaneously developed in Great Britain and the United States. A similar state of affairs occurred in the case of reaction in 1913; in Great Britain we accord the credit to Mr. C. S. Franklin, of the Marconi Company, and his patent is the master patent in this country. In America, however, the credit goes to E. M. Armstrong. The question of giving credit to an inventor is not simply a question of national sentiment but the priority of patents. The Scott-Taggart Neutrodyne Patent 217971 is dated January 2, 1923, while the earliest date of the Hazeltine patents (Nos. 222895 and 223181) is April 5, 1923. Scott-Taggart, therefore, precedes Hazeltine in this country by three months—a short period but one of great legal and general importance when it is a question of "who was first?"



The independent inventors of the Neutrodyne in Great Britain and America respectively: Mr. John Scott-Taggart (left) and Professor Hazeltine (right). The receiver in the background is the "Elstree Six," made possible by the Neutrodyne invention.

Wide Scope

In America the position is different, although it is interesting to note that the early Hazeltine patents did not contemplate a wireless receiver. Professor Hazeltine, who is now in this country, himself states that his idea was to use neutralising for land-line telephony and his patents show iron-core transformers in his circuit. It was only later that he developed the idea of using the principle in a wireless receiver. The Scott-Taggart patent, as granted by the British Patent Office, is extremely wide in its scope, and covers every modern type of neutralised circuit, whereas the Hazeltine patents, both in America and Great Britain, are much narrower in scope.

American Appreciation

Scott-Taggart's priority of invention in this country was appreciated by the Hazeltine Corporation — the company which owns the Hazeltine patents in America and licences some dozen leading manufacturers to use the invention—when they found that they were anticipated. They did the obvious thing and approached John Scott-Taggart and offered to buy the British, American, and Canadian patent rights. The approach was made through a British patent agent who declined to reveal who the intending purchasers were.

Prior to this the Scott-Taggart patent had been published in June, 1923, in *Wireless Weekly*, and the British industry was fully aware of the inventor's claims, but not a single firm approached the owner of the patent. Ultimately Mr. John Scott-Taggart himself endeavoured to interest the trade in the neutralising

(*Continued on next page.*)

Who Invented the Neutrodyne?—*continued*

system, but his patent did not arouse interest and no offer to purchase was made. This perhaps is not to be wondered at; as recently as a year ago probably the largest manufacturer of broadcast receivers declared publicly that the neutrodyne was dying out in America and that it would never become popular in this country.

tion that a British invention and a British patent of the first magnitude has been sold to America, and that now that manufacturers are beginning to appreciate the great merits of the neutrodyne, they are witnessing the importation of sets from America which are actually licensed under the Scott-Taggart patent, the vital importance of which they failed to realise!

neutrodyne. The value of the invention was appreciated from the first, and America's enterprise is in striking contrast to our own. The neutrodyne receiver in America has had a colossal success. No other invention has had such an extraordinary vogue. Up to date $35,000,000 (£7,000,000) worth of licensed neutrodyne receivers have been sold. Professor Hazeltine and his associates in the Hazeltine Corporation draw patent licence fees to the extent of £120,000 per annum.

The Claims of the Scott-Taggart Patent, No. 217971 of January 2, 1923, which is Prior to the Hazeltine Patents, Nos. 222895 and 223181.

1. A radio-frequency amplifier in which the currents are amplified by a plurality of stages of amplification involving a plurality of tuned circuits, a condenser, or condensers, being connected so as to produce a reverse reaction effect to counteract the tendency of the amplifier to generate oscillations.

2. A wireless receiver in which the incoming waves produce radio-frequency currents which are amplified by a plurality of stages of amplification involving a plurality of tuned circuits, a condenser, or condensers, being connected so as to produce a reverse reaction effect to counteract the tendency of the amplifier to generate oscillations.

3. A wireless receiver in which the incoming high-frequency currents are amplified by a plurality of valves in cascade, a plurality of the intervalve coupling arrangements comprising circuits tuned, or approximately tuned, to the incoming wavelength, and in which the amplifier circuits are maintained in a stable non-oscillating condition by the connection of a condenser, or condensers, to produce reverse reaction effects.

4. A wireless receiver in which the incoming high-frequency currents are amplified by a plurality of valves in cascade coupled together in two cases at least, by the aid of circuits tuned, or approximately tuned, to the incoming wavelength, and in which condensers are used, in the case of at least two valves, to feed back output currents of the valves to their respective input circuits so as to lessen the natural reaction effect in the valves concerned.

5. A wireless receiver in which the incoming high-frequency currents are amplified by a plurality of three-electrode valves in cascade coupled together, in two cases at least, by the aid of circuits tuned, or approximately tuned, to the incoming wavelength, and in which a condenser is connected across the grid of an amplifying valve and a point on the anode output circuit or circuits such that the potentials at this point tend to neutralise the self-oscillation tendency of the valve, this stabilising connection being made in the case of at least two amplifying valves.

6. A wireless receiver in which the incoming high-frequency currents are amplified by a plurality of three-electrode valves in cascade coupled in at least two cases by means of a radio-frequency transformer having tuned primary and/or secondary, a condenser, in the case of each of the amplifying valves, being connected across a point on the secondary of each transformer and a point on the grid circuit of the valve in front of the transformer.

7. A wireless receiver as in the preceding claim in which the secondaries only of the transformers are used.

8. A wireless receiver as in any of the preceding claims in which two of the intervalve couplings involve a tuned circuit, the connections between each grid circuit and its corresponding anode circuit being such that there is a point in the circuit associated with the anode where the potentials at any given moment are of opposite sign to those at the anode of the valve, such a point being connected through a condenser to an appropriate point in the grid circuit of the valve.

9. A wireless receiver as in any of the preceding claims in which two of the couplings consist of single tuned anode circuits, the connections between each grid circuit and its corresponding anode circuit being such that there is a point in the tuned anode circuit where the potentials at any given moment are of opposite sign to those at the anode of the valve, such a point being connected through a condenser to an appropriate point in the grid circuit of the valve.

10. A wireless receiver as in the preceding claim in which a tapping is taken from a point intermediate between the ends of the tuned anode inductance to the positive terminal of the high-tension battery.

11. An amplifying system using a thermionic valve in which the natural capacity coupling between anode and grid circuits is supplemented by a condenser, another condenser being used to balance out, or partially balance out, the reaction.

12. A wireless receiver in accordance with Claim 8 in which, in the case of two valves, each anode circuit has associated with it a tuned circuit, an inductance being coupled to an inductance directly in the anode circuit to obtain a phase reversal, one end of the first mentioned inductance being connected through a condenser to the grid of the valve.

13. A wireless receiver comprising a valve in which opposing potentials from, or beyond, the output circuit are conveyed to the grid circuit by two condensers, one passing potentials tending to produce a reaction effect and the other passing potentials tending to produce a reverse reaction effect.

Irony!

Immediately after the British trade had "turned down" the Scott-Taggart patent it was bought by the Hazeltine Corporation, although the inventor only knew he had sold his patent to an agent without knowing who were the actual purchasers. Meanwhile we have the ironical posi-

Big Figures

Meanwhile Professor Hazeltine and his business associates exploited his corresponding patents in America to the full. The Hazeltine Corporation was formed and fourteen leading manufacturers were licensed to use the

Anticipated

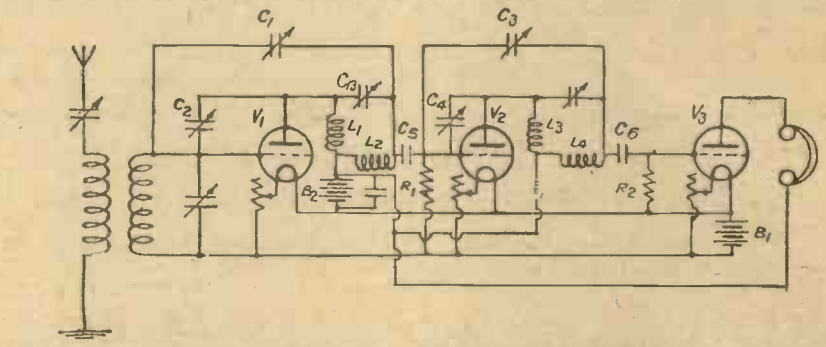
Having achieved such remarkable success in the U.S.A. the Hazeltine Corporation turned its attention to

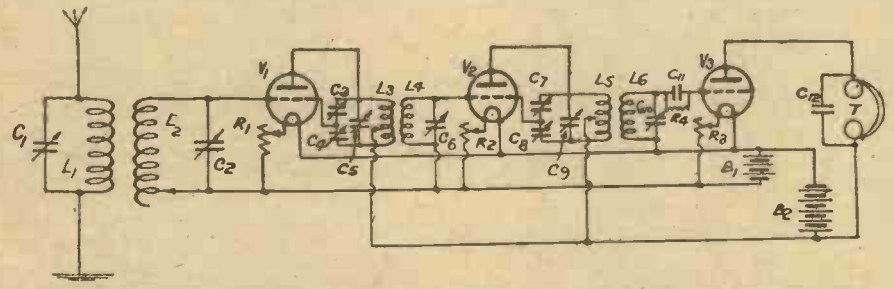
Remarkable Facts about a Key Invention

Great Britain. They found, however, that their own patents were anticipated by the Scott-Taggart patent. The importance they attach to the latter is indicated by the annual report of the Hazeltine Corporation which has just been published, and which was the first news Mr. Scott-Taggart had that he had unknowingly sold his patent to this powerful American concern. The report to the shareholders states: "Your company is also the owner of the John Scott-Taggart patent in Great Britain and corresponding patents in the United States and Canada. These patents are of great importance, particularly in Great Britain."

Two Important Actions

Such is the story outlined by Mr. H. T. P. Gee, and since his article appeared on June 15 last further evidence has come to light. In America two patent actions have just





been concluded which indicate the novelty and merit of the neutrodyne. One action was by the Hazeltine Corporation for infringement of their patent rights. This action they won, and the judge paid very generous tribute to what he regarded as a pioneer invention. The other action was one taken by the Radio Corporation of America against a manufacturer of the neutrodyne. The Radio Corporation claimed that the neutrodyne infringed earlier patents of their own, particularly one covering an invention of Rice. The Radio Corporation lost their case and the judge held that the Rice patent in its broader claims was invalid. This two-faced legal victory for the neutrodyne has given added importance to the invention. At the conclusion of this litigation Professor Hazeltine has come over to England, and in an interview in July stated: "The Scott-Taggart invention is the master patent on the neutrodyne in this country. It is the keystone of the position."

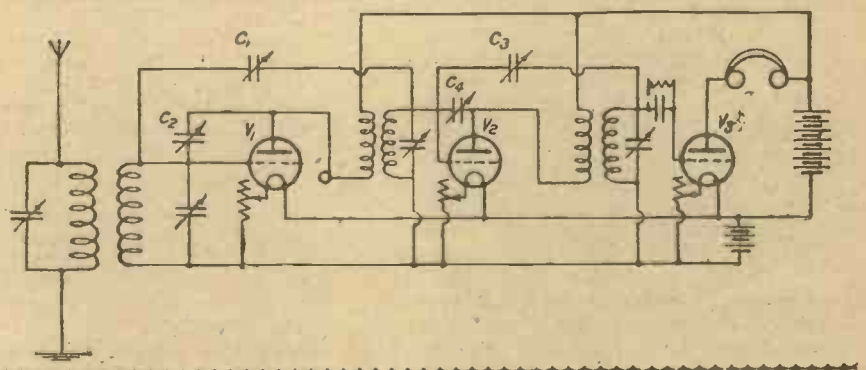
A Generous Tribute

At the recent luncheon at the Savoy Hotel, London, Professor Hazeltine paid a generous tribute to the work of Mr. John Scott-Taggart before a gathering of nearly a hundred guests representing the British radio industry.

In his speech outlining the outstanding inventions leading up to the modern receiver he stated: "I had done some work along those lines generally and the result was the receiver that is known as the neutrodyne. Similar work was being done along the same lines by Mr. Scott-Taggart, and I feel that while we in America call the receiver the Hazeltine Neutrodyne, we should in England call it the Scott-Taggart Neutrodyne."

Scope of the Patent

Readers who are interested may care to read the claims which are extracted from the Scott-Taggart master patent. It is required by law that the inventor should state precisely what his invention covers, and this is done by making a series of claims. If a wireless receiver comes under the description in any of the claims, it will infringe the patent. It will be seen that practically every modern receiver comes within the scope of the patent. In addition to the claims we are publishing the circuits given in the Scott-Taggart patent merely as examples of his neutrodyne invention. We may mention incidentally that the word "Neutrodyne" is a registered trade mark belonging exclusively to the owners of the Scott Taggart patent.

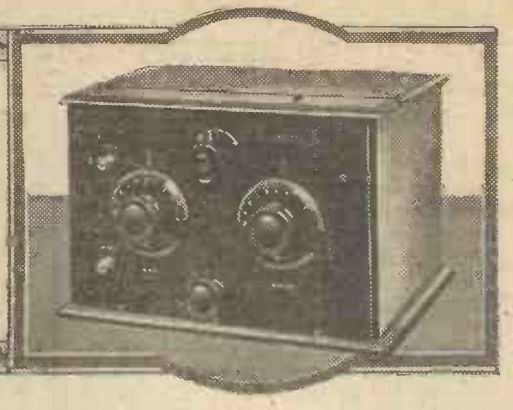


The three circuits illustrated on this page are reproduced from the Scott-Taggart Patent 217971.

NEXT WEEK

Another Special Article on Condensers by Mr. Reyner.

AN "ALL-WAVE" SINGLE-VALVE SET

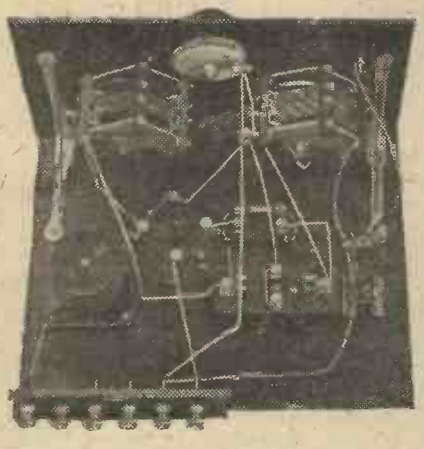


By L. H. THOMAS

AT the present time it is generally acknowledged that with the greater variety of components readily obtainable it is more feasible to make one receiver to serve all purposes than it has ever been before. A year or so ago, when the shorter waves were first brought into use, it was considered impracticable to use one set for ordinary broadcast reception, as well as an occasional bout of listening on short waves, and perhaps a "fish round" now and again among the long-wave commercial stations, for the purpose of receiving weather reports, time signals, etc., or often simply on account of the fascination of listening to Press messages and shipping traffic.

The Chief Difficulty

The chief objection was that practically the only method of covering all these ranges was to use coils of the "plug-in" variety. It was necessary to accumulate rather a large stock of them, and if one receiver were to be used for *all* wavelengths, it was generally found that the reaction was harder to handle as the wavelength went down. "Swinging-coil" reaction is generally considered more difficult to handle efficiently than some of the capacity-controlled forms, especially on the lower wavelengths.



The leads from the plug-in single-coil-holder are carried out with flex.

The single-valve receiver described in this article may be regarded almost as an "all-purpose" set, as the reaction control has been found to function quite efficiently and smoothly on all wavelengths from about 18 metres to 1,600 metres, and even higher. In addition to this, different degrees of selectivity may be obtained with very slight alterations, and, as far as can be ascertained on test, with very little effect upon the sensitivity.

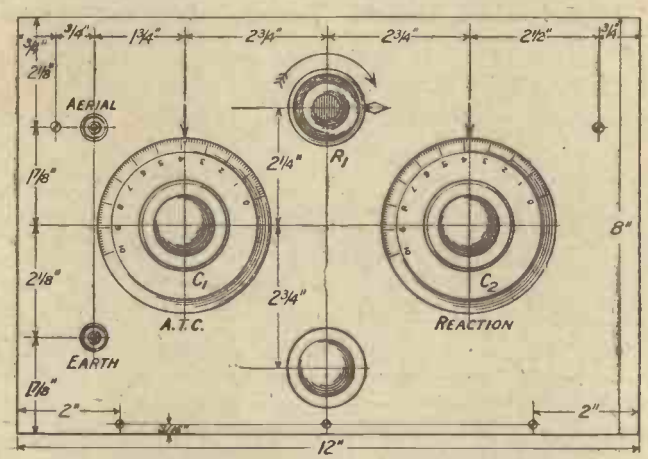


Fig. 1.—The small knob below that marked R_1 is a "remote-control" for the aerial tuning condenser C_1.

The Circuit

The circuit diagram shows that quite a straightforward "Reinartz" arrangement has been employed, a centre-tapped coil being used for the grid and anode circuits, and the aerial being coupled to the set either by connecting it straight on to the anode end of the centre-tapped coil or by using inductive coupling, the latter being arranged by means of a standard plug-in coil.

A variable condenser across the "grid" half of the centre-tapped coil controls the wavelength, while the reaction is controlled by means of the other variable condenser.

Slow-Motion Control

A form of slow-motion control has been provided on the condenser C_1, the knob by which it is adjusted being that at the bottom of the panel, under the filament resistance. The make of condenser employed is supplied with provision for "remote-control," and full particulars for fixing this will be found in the box in which these components are supplied. This is another feature which makes the set readily adaptable for all wavelengths, as all hand-capacity troubles are entirely eliminated, the control knob being right away from any of the points in the circuit that are at high-frequency potential above earth. The reduction ratio, being about 10:1, also simplifies the handling of the set considerably.

To simplify the construction of the set, no note-magnifier has been incorporated; it will, of course, be realised that the addition of an amplifier, should one be desired in order to obtain loud-speaker results, etc., will in no way interfere with the performance or operation of the receiver.

Materials

The actual components used are listed below, together with the manufacturers' names, although they need not be strictly adhered to in every detail.

One "Mahoganite" panel, 12 in. by 8 in. (American Hard Rubber Co., Ltd.).

One cabinet to take above, with baseboard 9 in. deep, and two panel brackets (Camco).

One .0005 slow-motion variable condenser and one standard .00025 variable condenser ("Cosmos," Metro-Vick Supplies, Ltd.).

One 6-ohm filament resistance ("Atlas," Clarke).

One "Clearer-Tone" valve-holder (Benjamin Electric, Ltd.).

One "Success" H.F. choke (Beard & Fitch, Ltd.).

One base for "Dimic" coils, with coils to cover the desired range of wavelengths (L. McMichael, Ltd.).

One base-mounting coil-holder (Burne-Jones & Co.).

One 7-terminal strip (Burne-Jones & Co.).

Short- or Long-Wave Stations on One Set

One .0003 fixed condenser and 2-megohm "Dumetohm" grid-leak (Dubilier Condenser Co.).

Various brass bolts, wood screws. Glazite, two terminals, etc.

Coil Mountings

In order that the requisite amount of coupling may be obtained when a loose-coupled circuit is employed in this receiver, the "Dimic" coil base has been raised from the baseboard by means of two of the smallest type reel insulators. The aerial coil is then coupled to it by means of a standard base-mounting coil-holder, screwed to the baseboard at *one* point only, so that the degree of coupling may be varied roughly to suit the constructor's needs. A short length of Glazite, with the insulating covering stripped off, is attached to the terminal of the socket which is connected to the aerial, and a similar length to the anode end of the "Dimic" coil-mount. The flexible lead from the aerial terminal (on the front panel) ends in a clip which may be attached to either of these points.

It should be noted that when the aerial is inductively coupled to the set, no provision has been made for tuning the aerial circuit, which is therefore "tight-coupled." This arrangement gives good selectivity, and at the same time does away with the necessity for an extra control.

WIRING INSTRUCTIONS

Join aerial terminal to a clip by means of flex.

Join earth terminal to L1 coil socket (pin connection) by flex wire, and then join this point to L.T.+ and moving arm of filament resistance (R1).

Join to remaining connection on L1 coil socket a short length of bare wire.

Join right-hand terminal of split-coil base to grid condenser and leak (C3, R2) and to fixed plates C1.

Join remaining side of grid-condenser and leak (C3, R2) to G terminal of valve-holder.

Join centre terminals of split-coil base together, and thence to moving plates of C1.

Join moving plates of C1 to one side of R1 and to one filament contact of valve-holder.

Join left-hand terminal of split-coil base to moving plates of C2; also to split-coil base terminal secure a piece of bare wire.

Join fixed plates of C2 to A terminal on valve-holder and thence to one side of H.F. choke (L3).

Join remaining side of H.F. choke (L3) to one phone terminal.

Join remaining phone terminal to H.T.+.

Join remaining filament contact on valve-holder to L.T.—.

Join H.T.— to L.T.+.

Construction

With regard to the actual construction of the receiver, the only part needing comment is the "remote-control" mounting for the variable condenser. The writer placed this knob below that of the filament rheostat, not simply to give a symmetrical panel lay-out, but also with due regard to the position which made for the easiest operation. Care should be taken that the manufacturers' instructions for the mounting of this component are followed in every detail, otherwise the control may not be as satisfactory as it should be. The spring belt (which may be clearly seen in the back of panel photographs) should be drawn just sufficiently tight to get rid of any tendency to slip; if it is attempted to tighten it further than this, a rough, jerky control may result.

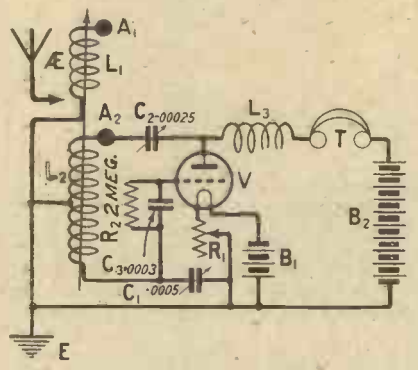


Fig. 2.—The coil L3 in this circuit diagram is an H.F. choke.

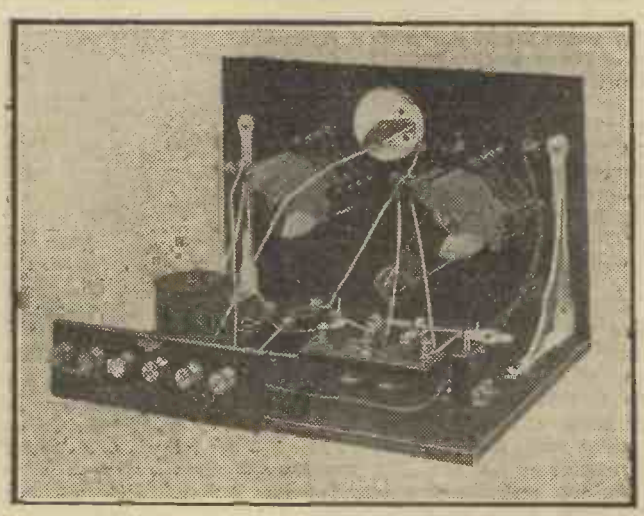
Reaction Control

The reaction condenser gives a perfectly smooth control of oscillation, and one which may be used without necessitating retuning the station that is being "operated on." That is to say, the receiver may be brought up nearer to the oscillation point without the need of retuning the grid (secondary) circuit by the condenser C_1.

As the circuit is one employing "parallel feed," *i.e.*, the H.T. is fed direct across plate and filament, an H.F. choke being inserted in the positive lead, no by-pass condenser is provided for the telephones. This

(*Continued on next page.*)

A back-of-panel view of the complete receiver in which the coils and valve are in position.



To obtain a swivelling movement, the single coil mount seen on the right of the baseboard is only secured by one screw.

An "All-Wave" Single-Valve Set—*continued*

should, of course, be borne in mind when adding an L.F. amplifier, as it sometimes happens that a by-pass condenser is desirable across the primary of the first L.F. transformer, and should be added if the amplifier seems unstable.

The Shorter Waves

When using the set for reception on the shorter wavelengths it should be remembered by those readers who have had little experience of this fascinating branch of reception that special care is needed in the handling of the controls. As is well-known, the number of stations that can work without interference within a band of about five or even three metres (say between 45 and 48 metres) is extremely large. This is because the "frequency-band" between 45 and 48 metres is enormously broader than a similar band between, say, 360 and 363 metres, although the "wavelength-bands" may be said to be the same.

Why It Is

Actually, the frequency corresponding to 360 metres is 833.3 kilocycles, and that corresponding to 363 metres is 826.4 kilocycles. The band may thus be said to be 6.9 kilocycles wide. Now, taking the case of the band between 45 and 48 metres, the frequency at 45 metres is 6,666.6 kilocycles, and at 48 metres 6,250 kilocycles. The width of this band is thus 416.6 kilocycles. Two stations, to be quite clear of one another, require to be separated by at least 10 kilocycles; therefore we see that there is not really room for *one* in the 360-363 metre band, whereas in the 45-48 metre band there might be forty-one stations working! It is quite evident that tuning will need to be carried out with considerable care, or stations may be passed completely, without the slightest indication that they are there.

Care Needed

With the slow-motion drive provided on the condenser actually used, however, all that was necessary was to turn the control knob extremely deliberately and slowly, and, on account of the stability of the set, and the complete freedom from capacity effects, short-wave signals were received very well.

The aerial was coupled to the short-wave "Dimic" coil by means of a single turn of No. 16 wire fixed to a standard coil-plug and inserted in the socket for L_1. The coupling used was fairly tight, but this will, of course, vary for different lengths of aerials. It was also found advisable to use as low a value of high-tension as possible,

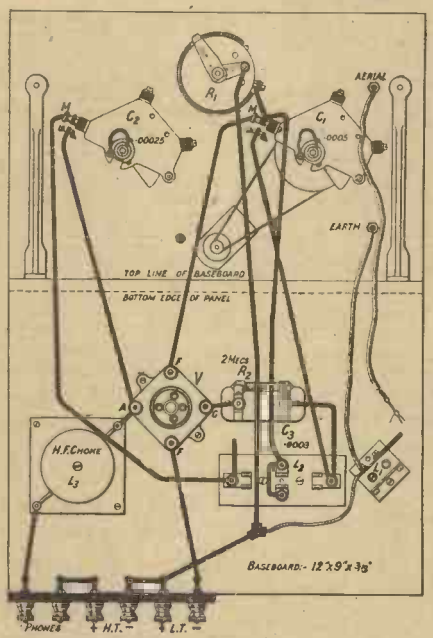


Fig. 3.—The disposition of the components on the baseboard may be gathered from this wiring diagram.

as this gave the smooth reaction control that is even more desirable on short waves than on the broadcast band, although it is rather more difficult to obtain.

Earthing

In some of the tests a counterpoise was used in place of a direct earth, but the only effect of this was slightly to lessen interference from a nearby electric railway. This is, however, well worth remembering in the case of readers in a similar position to the writer.

The wave-bands below the normal broadcast wavelength which will be found most interesting are as follows: 20-25 metres (amateur work), 30-48 metres (amateurs and commercial stations, also WGY), 60-120 metres (commercials and KDKA), and 150-200 metres (amateurs, chiefly using telephony). It should be remembered, of course, that the lowest band of all is chiefly a "daylight wave," but American stations may be received on 20 metres all through the night, when conditions are favourable.

Results

The writer has been using this set both for ordinary broadcast work and for short-wave "DX" reception for some time now, and has found it equal to a "specialised" set for either purpose in every way. 2LO, at a distance of about six miles, is received quite audibly on the loud-speaker, sufficient to fill a fairly quiet room. Using the aerial direct on the anode end of the coil, 5IT is received absolutely clear of London, and 6BM with just a trace of "background." By tight-coupling the aerial (with the coil L_1 as close to the centre-tapped coil as it can be arranged) Bournemouth may be received without interference from London and at quite a fair strength. With any of the amplifiers described in WIRELESS two weeks ago this set would work a loud-speaker on 5IT and 6BM very easily.

Above and Below

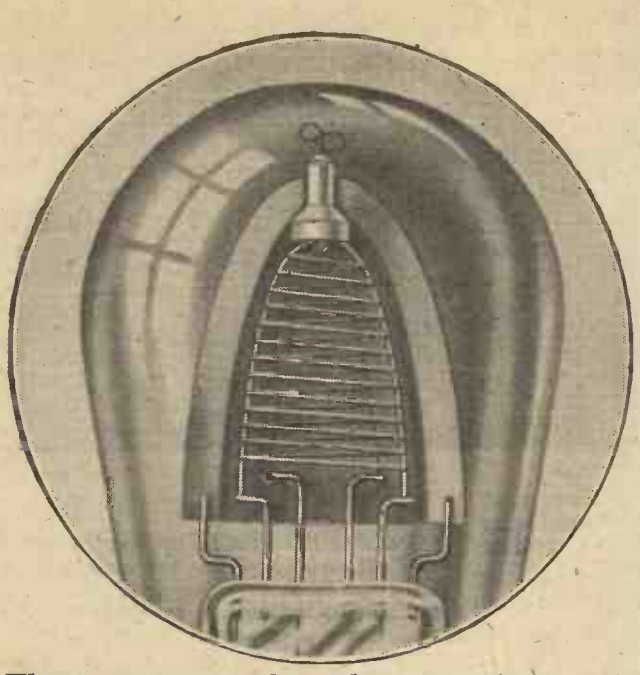
On the shorter waves Australia, New Zealand and Brazil, as well as several United States amateurs, were heard on the single valve only, and the operation of the set was found quite reasonably easy. KDKA was also heard on 65 metres, but as atmospherics were particularly bad on all the nights on which he was tuned in the programme was not exactly enjoyable, and was not really given a fair chance.

Daventry and Radio-Paris may be received with a No. 3 or 3A Dimic coil, the aerial always being coupled directly for these longer waves.

Further notes on the operation of the set will appear in a later issue.

AT THE "WIRELESS" LABORATORIES

This group was taken on the occasion of Professor Hazeltine's visit to our laboratories. Left to right: Mr. Percy W. Harris, Mr. John Scott-Taggart (holding "Mu"), Prof. L. A. Hazeltine, and Mr. J. H. Reyner.



Co-axial Mounting

—described by the Technical Press as "one of the greatest developments in Valve construction during recent years."

AS the old adage says, "Necessity is the Mother of Invention." The congested traffic conditions of to-day necessitated the invention of four-wheel brakes to ensure the greatest possible measure of safety. And in like manner to-day's wireless conditions have forced the successful development of Co-axial Mounting in order to ensure the greatest possible uniformity between valves of the same type. This in turn obviously means a big increase in efficiency in any Receiving Set using two or more stages of high frequency amplification. Greater sensitiveness—improved stability—better tone.

Co-axial Mounting introduced a few weeks ago by Cossor will exert a far reaching influence upon Valve design. For the first time there is available a method of construction which during the whole life of the valve automatically ensures perfect alignment between the filament, the grid and the anode. All three of these elements are permanently secured to each other at the top of the valve by means of a seonite insulator. Not even the hardest knock can displace their relative positions.

Co-axial Mounting permits a far higher degree of uniformity being attained than ever before. The importance of this will be instantly realised by all those using such multi-valve sets as Neutrodynes and Super-Heterodynes where the exact matching of valves makes all the difference between success and failure.

It is safe to prophesy that the forthcoming season will witness —with the aid of these new Cossor Point One Valves—the shattering of all records for long distance reception.

Three reasons for the amazing efficiency of the new Cossor "Point One" series of Valves

1. Absolute Uniformity

If a number of valves were made with identical filaments, grids and anodes without due regard to the exact spacing of these elements, considerable variations in performance would result. True uniformity in Cossor Point One Valves is achieved through Co-axial Mounting—a method which secures the three elements to each other at the top and infallibly holds them in exact alignment for all time.

2. A Shockproof Filament Suspension System

The filament in the Cossor Point One is arched and retained in position by a fine wire which is secured to the seonite insulator immediately above it. It is not held under tension. The fine wire provides just that degree of elasticity which enables the filament to withstand the sharp blow which would shatter the filament in an ordinary valve.

3. Current Consumption Cut to One Third

The new Cossor Point One sets a new record for economy. It requires only one tenth of an ampere at 1.8 volts. That means that a Super Heterodyne using seven of them would still consume less current than a little single-valve set using one Bright Emitter. A Cossor Point One will work satisfactorily as low as 1.2 volts with a current consumption of .07 amp.—thus being suitable for use with dry cells when required.

Available in three types :

COSSOR POINT ONE

Black Band: For Detector or L.F. - - - - 15/6
(Consumption .1 amp.)

Red Band: For H.F. use - 15/6
(Consumption .1 amp.)

STENTOR TWO

Green Band: For power use - - - - 18/6
(Consumption .15 amp.)

All operate at 1.8 volts.

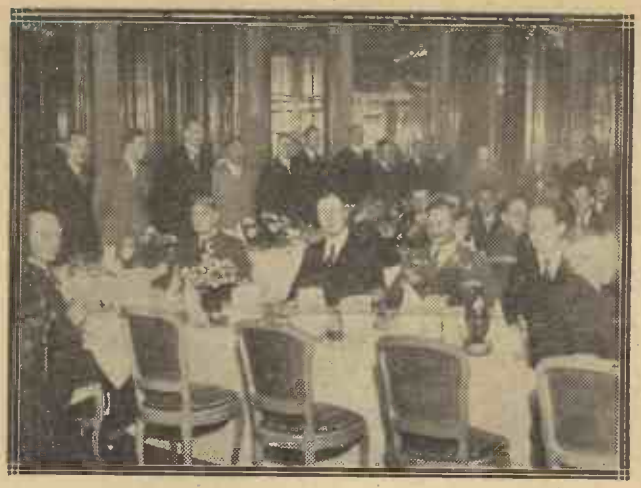
Cossor Point One

Issued by A. C. Cossor, Ltd., Highbury Grove, London, N.5.

Gilbert Ad. 5538

PROFESSOR HAZELTINE ON THE RADIO ART

IMPORTANT SPEECHES AT "THE WIRELESS DEALER" LUNCHEON



ON Thursday, July 15, 1926, a luncheon was given at the Savoy Hotel by the proprietors of *The Wireless Dealer* to Professor L. A. Hazeltine, and a large company were present to meet him. The guests, who numbered nearly one hundred, included Professor L. A. Hazeltine (the guest of honour), Mr. Willis, Mr. H. Taylor (of the Hazeltine Corporation), Sir Edward Marshall Hall, K.C., Captain Ian Fraser, M.P., Captain P. P. Eckersley, Captain H. J. Round, Lieut.-Commander Kenworthy, Lieut.-Colonel Eric Ball, the Press, and a very large number of representative members of the industry.

The Speakers

The chair was taken by Mr. Percy W. Harris, and after a speech of welcome by the Chairman, Professor Hazeltine replied in an important speech outlining the progress of the radio art. This speech is reproduced below. Following this, Colonel Eric Ball proposed the health of the B.B.C., and Captain Eckersley replied on behalf of that Company. The toast of "The Industry" was proposed by Captain Ian Fraser, M.P., supported by Commander Kenworthy, M.P., and replied to on behalf of the industry by Mr. Joseph Joseph.

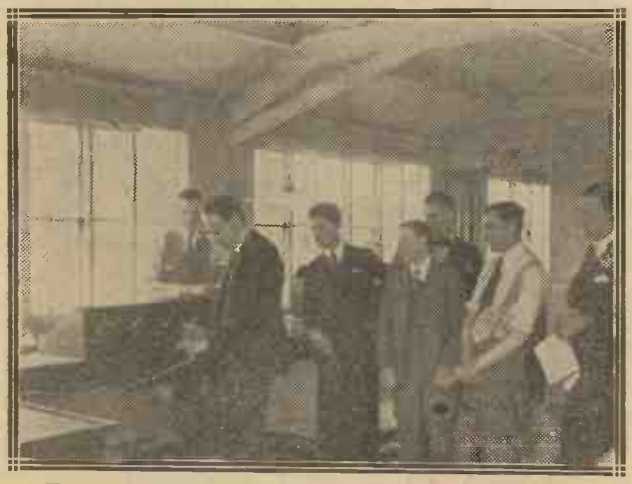
Professor Hazeltine's Speech

Mr. Chairman, Gentlemen: I feel awed by this august assemblage of the wireless men of Great Britain. To be the guest at such a luncheon is an honour which I did not anticipate and for which I am quite unworthy.

The Chairman's reference to the warm welcome which he received on his visit to America can already be echoed; for yesterday, my first day in London, I was immediately taken in hand by Mr. Scott-Taggart and Mr. Harris and given my first impression of the fine development work being carried on in England in the field of wireless.

Home!

On my arrival I was asked how long it was since I had last visited England. My reply was, Three hundred years! (Laughter.) I was thinking of the time when my father's family emigrated from England to America. We of America are accustomed to think of early English literature, science, culture, as being ours as much as yours. Perhaps it was this feeling, perhaps it was the fact that my mother was born a British subject, a Canadian, that made me feel when I first saw the coast of England that I, too, had come home! (Cheers.)



This picture was taken at one of the many trade demonstrations of the "Elstree Six" at the "Wireless" laboratories.

Before I really start the subject of my talk I must express regret that I have such an early place on the programme. It was my hope to at least be preceded by Captain Eckersley, for the inspiration afforded by his characteristic wit. When I met him a couple of years ago at Secretary Hoover's Radio Conference in Washington it was to listen to the best speech made at that gathering.

A Review

Perhaps it might be appropriate on this occasion to review the steps that have led to modern wireless. I shall confine my attention to those steps that have represented a permanent advance.

The most conspicuous element of all modern wireless systems, both transmitting and receiving, is that of *tuning*. The introduction of this element is largely due to that world-famous scientist and pioneer in wireless, Sir Oliver Lodge. (Cheers.) It is a keen disappointment to me that at the last minute he found it impossible to be present at this luncheon and that I was denied the opportunity of paying my homage to a man from whose writings I have received instruction and pleasure since my student days.

Another essential element in modern wireless is *rectification*, by which a modulated high-frequency current is converted into a modulated direct current. This element appears to have first been proposed by our American scientist, Dr. Pupin.

A third element now almost universal—to become quite universal before wireless can have its full development—is the use of continuous waves, first accomplished by Prof. Fessenden, also on our side of the Atlantic.

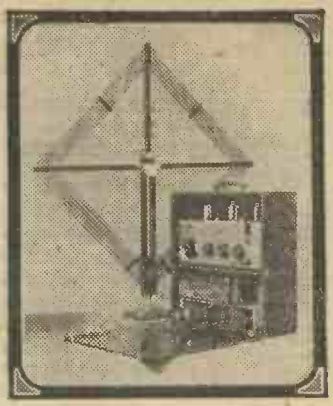
The Key

The subsequent development of wireless is almost entirely centred around the thermionic valve. The experimental discovery by Edison of thermionic conduction in a vacuum tube was first applied to wireless by your Prof. Fleming, who thus gave us the Fleming valve. Then our Dr. de Forest introduced the third electrode and opened up a new field with the possibility of amplification.

I have been rapidly skipping back

(*Continued on page* 346.)

A TALK ABOUT . . . . FRAME AERIALS



By Captain H. J. ROUND, M.C., M.I.E.E.

Frame aerials are apt to be regarded as somewhat of a difficult subject by the novice, but the very clear explanations which Captain Round gives in this article will enable even the beginner to use a frame understandingly and so obtain better results.

RECENTLY I talked about the more ordinary type of aerial and the questions involved in its efficiency. This week I will describe in detail the action of that very fascinating arrangement called the frame aerial.

I think a very crude analogy will show quantitatively what a frame is doing. Fig. 1 shows a view of a water wave, and C represents a cork bobbing between the position C and C_1. If we are watching C with a telescope fixed on the ground, then we may say that C C_1 represents the strength of the signal, but if instead of one cork C we have two corks D and E joined together by a rigid connection of small length compared with the length of the wave, and we can imagine that our telescope only notices the difference in height between D and E, then we can see that the difference is quite small compared with the distance C C_1.

One point to be noticed is that D and E are moving relatively to one another, but their centre of gravity is moving in the same way that C is moving. I shall note the electrical analogy of this point shortly.

The Electrical Case

Take a loop of wire, say a single turn of wire one metre square, and let us act on it by a wave of 400 metres. If we draw out a wave curve with 400 metres represented from A to B (Fig. 1), and measure the height C C_1 and the difference of height between D and E spaced one metre apart when they are tilted at a maximum, we shall find that these heights are in the ratio of 1 to .015. This ratio is the ratio of the voltages applied to an aerial of 1 metre height and a frame of 1 metre height with one turn.

In the case of the aerial we are using the whole voltage of the wave, whereas with the frame we are only using the difference of the voltages acting on the two sides. Fortunately, the case is not quite so bad as this, because we can use many turns to our frame. For instance, with a metre-square frame we can use 10 turns quite easily, and this improves our ratio to 1 to .15. But, of course, an aerial 1 metre high is rather a poor aerial, so taking one of 6 metres in height our voltages are in the ratio of 6 to .15 (or 40 to 1).

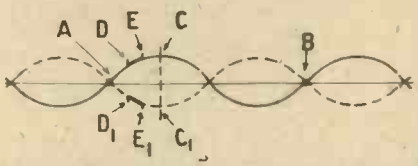


Fig. 1.—Captain Round uses a simple water-wave analogy to explain his points.

A Compensating Advantage

We shall have to do something very drastic somewhere to put the receptions anything like equal, and we are partly helped by the fact that a frame is of very low resistance—it is quite easy to produce one about 3 ohms in resistance. An aerial and its tuning coil are liable to be as high as 40 ohms, and 15 ohms will be quite good, so that the resulting currents in a 6-metre aerial and a frame are in the extreme case likely to be—

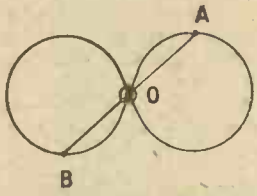


Fig. 2.—In this "polar diagram" distances such as OA give the strength of the signals produced by waves travelling across the frame in that direction.

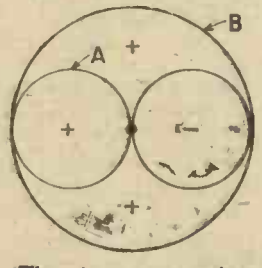


Fig. 3.—This is a comparison of the polar diagrams of a frame (A) and an open aerial (B).

	Resulting currents.		
	Induced volts.	40-ohm aerial.	10-ohm aerial.
Aerial	40	1	4
Frame	1	.3	.3

No tricks will enable us to gain much more, and we are now really unfair to our aerial, because if we attempt to reduce the resistance of the frame by reaction we should get too sharp a tuning, resulting in muffled speech and music, whereas the aerial resistance could be reduced by reaction to a figure nearly as low as the frame.

Without, however, allowing ourselves this benefit for the aerial, a frame pans out as a little more than 1 H.F. valve down on the aerial, and this is what experience shows.

Directional Properties

We can easily see by reference to Fig. 1 that if the two corks form a line in the direction of the wave track they get the maximum tilting effect, whereas if their line was at right angles to the direction of the wave track there would be no relative motion. With a frame in general if its plane is on a line with the direction of wave track the signals are at a maximum, and at right angles to this the signals are zero.

The effect is usually represented as a "polar diagram" (Fig. 2), where the radius from the centre of the diagram represents the strength of signal when the frame is pointed in the direction of that radius.

This effect of a frame is a very powerful one, as it enables us—

(1) To determine the line in which a station lies.

(2) To cut out interfering stations in certain cases.

(3) To minimise atmospherics.

With regard to (1) it is fairly obvious that alone this arrangement will tell us the line, but not the direction, in which the station lies.

(*Continued on next page.*)

A Talk About Frame Aerials—*continued*

Combining an Aerial and a Frame

A very pretty principle is involved in the idea of combining the effects of the frame and an ordinary aerial.

Fig. 3 shows on a polar diagram A the reception of a frame, B the reception of an aerial, adjusted to the same maximum strength. The reception of the latter is obviously equal all round. Now the voltages induced into a frame are obviously the same, whichever one of two opposite directions it is pointed in—but the voltages are of opposite sign or phase, whereas the aerial receives the same phase from all directions.

The result of adding, if the voltages are equal, is that in one direction the signals are doubled—and in the opposite direction they are brought to zero, and the result all round is shown in the curious so-called "heart-shaped diagram" (although kidney-shape would be more descriptive) of Fig. 4, which kidney is reversed into the dotted position if the signals come from the opposite direction.

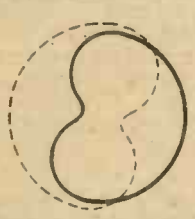


Fig. 4.—"The result of adding, if the voltages are equal, is that in one direction the signals are doubled—and in the opposite direction they are brought to zero, and the result is shown in this curious so-called heart-shaped diagram."

This arrangement is used very extensively.

(1) In getting the direction of a station.

(2) For eliminating interference from behind one.

A Difficulty

To make the arrangement work is not quite so easy as it seems because of another point. In our water-wave diagram (Fig. 1) it can be seen that the position C, where the single cork is moving at a maximum, is the position where if our double cork was placed the double cork would be least tilted. In technical language, the tilting motion and the simple up-and-down motion are 90 degrees out of phase.

And so with the frame and the vertical aerial—the applied voltages are 90 degrees out of phase, and to add and subtract them properly we must put this phase right. One simple way to do this is to receive on the frame and aerial separately and then to induce through a loose coupling into the frame from the aerial, taking off the signals from the frame to the receiver. If both frame and aerial are in tune with the signals to start with the currents are at 90 deg. phase difference. Now, when one circuit induces into another one it applies a voltage which is a maximum when the current is at the maximum change position, *i.e.*, 90 deg. away from the current maximum—so that by this process we get our signals added in the right way.

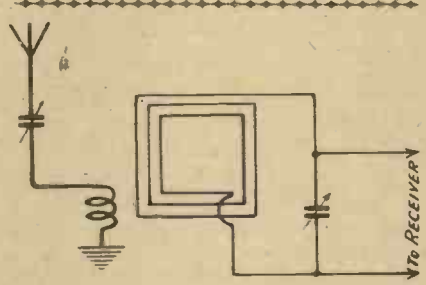


Fig. 5.—A small standard tuning coil fixed to slide on a rod at the corner of one's frame will give plenty of coupling, but the frame connection of Fig. 7 will be preferable to the above.

A Useful Device

I advocate this to all those using frames as a method of increasing signals in the direction required and reducing them to zero from behind, as the apparatus is very simple, and is shown in Fig. 5.

As a usual thing a small standard tuning coil fixed to slide on a rod at the corner of one's frame will give plenty of coupling, and to test the efficiency of the scheme the frame should be turned in the direction of the local station and an attempt made to get a good minimum of signals—an absolute zero if near by will be difficult to get.

Just as the double cork system of Fig. 1 not only tilts but bobs up and down, so our frame is not only getting a voltage induced in it as a frame, but it is as a whole trying to act as an aerial, and if allowed to do so the frame curve will be liable to be spoiled.

Fig. 6.—Incorrect combination of a frame and an outside aerial will give distorted polar diagrams like these.

Don't Do It

One good way to spoil a frame diagram is to connect the receiver right across the frame, particularly if the battery is earthed. The frame not only acts as a frame, but is very nearly in tune as an ordinary aerial. The two results will be badly mixed, and receiving polar diagrams like Fig. 6 will be produced. To absolutely prevent this action the best method is to connect our receiver between the centre turn of the frame and one end, leaving the other end blank—as the valve grid capacity can usually be neglected, although in very accurate work it would pay to add a dummy valve to the other end (Fig. 7).

The frame still gets acted on by the up-and-down wave motion, but this induced voltage acts on the two halves of the frame in opposite directions, thereby inducing no current in the frame. The tilting action can still, of course, go on.

An analogy in our corks case is given by fixing the half-way point between D and E on a pivot. D and E can still rock, but cannot move up and down.

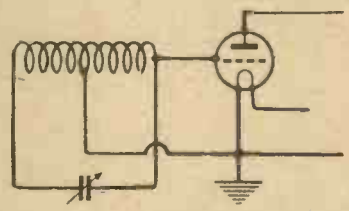


Fig. 7.—In this diagram the winding represents that of the frame, the scheme depicted being one designed to secure a more perfect frame diagram.

The Windings

Just a word before I finish regarding frame windings. These windings are the only ones we have in which plenty of space is permissible, so we should make use of it, and we need to make use of it, firstly to get maximum voltage applied to the aerial, and secondly, to get maximum current from that voltage.

The first consideration is given by getting the maximum number of turns on the frame. The self-induction of the frame per turn wants to be kept down, the self-capacity kept down, and the losses kept down. All these points are met by spacing the wires and winding them on a framework with the minimum amount of support. The maximum number of turns is then settled by the lowest wavelength you want to get.

Cylindrical frames are preferable to radially-wound ones, because it is easier to find the mechanical centre.

I HAVE NOT BEEN ASKED

By C. P. ALLINSON
A.M.I.R.E.

An amusing parody of a popular feature of "Wireless"

What is a wireless set?

It is a piece of apparatus provided with three or four little glass bulbs which light when the set is working. It is also provided with a number of knobs, dials, swinging coils and similar gadgets, while batteries and loud-speakers litter up the surrounding furniture.

What is the purpose of the glass bulbs or valves as they are called?

To light up the dials when they need adjusting.

What is the function of the dials?

Their function is to enable a selection of ear-splitting yells, squeals and squawks to be produced at will by the operator. Occasionally when inexpertly handled fragments of distorted music may be heard.

What is reaction?

Reaction is that which causes half the howls and squeals heard in the loud-speaker. It is always used to excess by one's neighbour, so that it becomes necessary to increase it oneself, thus "learning him" what it sounds like.

Does the effect of excess reaction carry far?

Anything up to 3 miles.

May it disturb everyone within that radius?

It may.

What conditions are most favourable to wireless reception?

The most favourable conditions are those when no one else is present. At such times it is frequently possible to receive America on the loud-speaker with one valve.

Have you any explanation for this fact?

No. It is one of the phenomena of nature that has as yet not been explained.

What other conditions are favourable to reception?

Reception is most easily carried out when telephones (or loud-speaker) batteries, aerial and earth leads are all connected to the set in the correct manner, the aerial preferably not being earthed.

Why is this?

I don't know. Practical experience has shown it to be so.

What is an aerial?

It may be a spring mattress, a bucket, an old umbrella frame or a bird cage. Occasionally it is a length of wire stretched between two trees or poles.

Which is best, an outdoor or an indoor aerial?

Yes.

What is the mystery of wireless reception?

It is the mystery by which signals are still heard even when the high tension battery is disconnected, the aerial lead is lying on the roof and no coils have been plugged into the holders. It is also frequently found that the high-frequency valve is not alight and the detector valve is not functioning.

(To be concluded.)

NEXT WEEK
Another "Cartoonigraf" Competition

A CRYSTAL SET FOR THE BLIND

A simple-to-make and easy-to-operate crystal receiver.

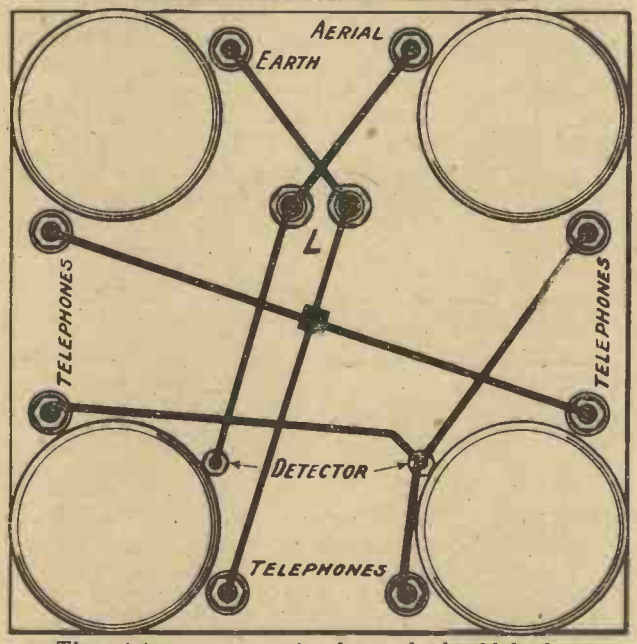
By STANLEY G. RATTEE, M.I.R.E.

THE chief merit of the receiver illustrated is that of simplicity in operation, its design being governed by the fact that it was made for a lady who is blind. A semi-permanent crystal detector is employed, while tuning is carried out without the aid of a variable condenser. This latter operation is made possible by utilising a special commercially-made component which is, in fact, a complete tuner in itself. This component may be seen in the photograph, and by turning the knob situated in the centre of a coil the number of turns in circuit may be varied, in much the same way as a slider may be made to vary the turns used in sets utilising cylindrical coils.

Constructional Details

The constructional requirements are of the simplest, while the demands upon one's pocket for components are not serious. In the original set it will be seen that no cabinet is used, the panel, made of ebonite, being secured to four wooden feet.

In order that a number of telephones may be employed when more than one person wishes to listen, the set is fitted with three sets of telephone terminals, all connected in parallel. The wiring for these, together with the remainder of the connections, is carried out beneath the panel, the four wooden feet giving sufficient clearance to prevent the leads touching the table.



The wiring is very simple, and should be kept close to the underside of the panel.

Components and Materials

Readers desirous of building a set of this type will find below a complete list of the materials and components required. It will be seen that the names of the manufacturers are given in certain cases, in order that those who wish to duplicate the original set may do so without further inquiry.

Other suitable components may, of course, be used, and a variety of suitable components will be found in the advertisement pages.

One ebonite panel measuring 6 in. × 6 in. × ¼ in. ("Camco").

Four wooden feet as illustrated ("Camco").

Semi-permanent crystal detector (Brown's Wireless Co., Ltd.).

One "Nick-o'-Time" tuner (Tunometer Works).

Eight terminals, marked "aerial," "earth" in two cases, the remaining six being plain (J. J. Eastick and Son).

Quantity No. 16 "Glazite" or other connecting wire.

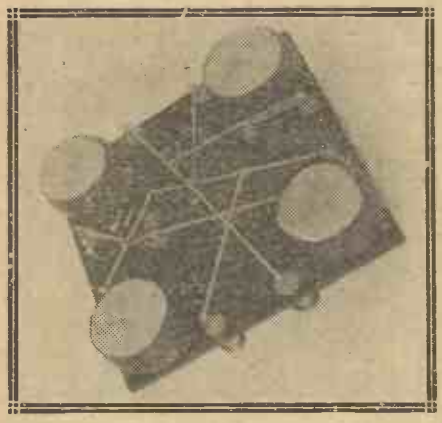
A No. 25 or 35 plug-in coil and a No. 200 coil if it is desired to receive 5XX.

The Panel and Wiring

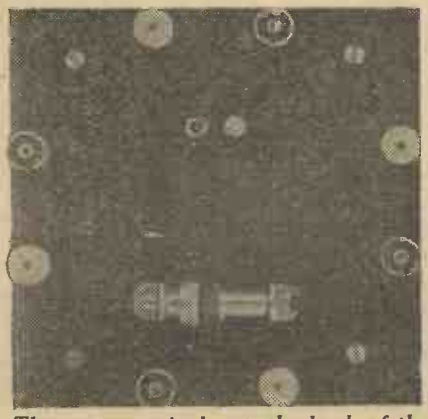
The panel should be prepared as shown in the panel layout, whereupon the various components and terminals should be mounted. The panel should then be secured to the four wooden feet by first placing these in suitable positions upon the table, placing the panel upon them so that each corner of the latter is supported by a wooden foot and then secure by means of wood screws.

The wiring beneath the panel should be kept flat, that is, the wires should run as near the panel as possible.

This work of wiring near to the panel will be greatly facilitated if the depth of the wooden feet is taken as a guide, and the distance between the panel and the wires kept within the limit.



Wooden feet are fitted to the panel so that the set may stand upon the table.



The two terminals at the back of the panel are for the aerial and earth, the other pairs being multiple 'phone terminals.

Anyone Can Operate this Receiver

Operating the Receiver

When the constructional work is all complete, the receiver is ready for use, but before connecting the aerial and earth check the wiring against the details given in the practical wiring diagram. Having satisfied oneself upon this point, connect the aerial and earth to their appropriate terminals, and connect a pair of telephones to any one pair of the three provided.

The "Nick-o'-Time" tuner, it will be found, is provided with a socket for a loading coil, and into this should be plugged a No. 25 or 35 coil before the tuner is itself plugged into the socket provided upon the panel.

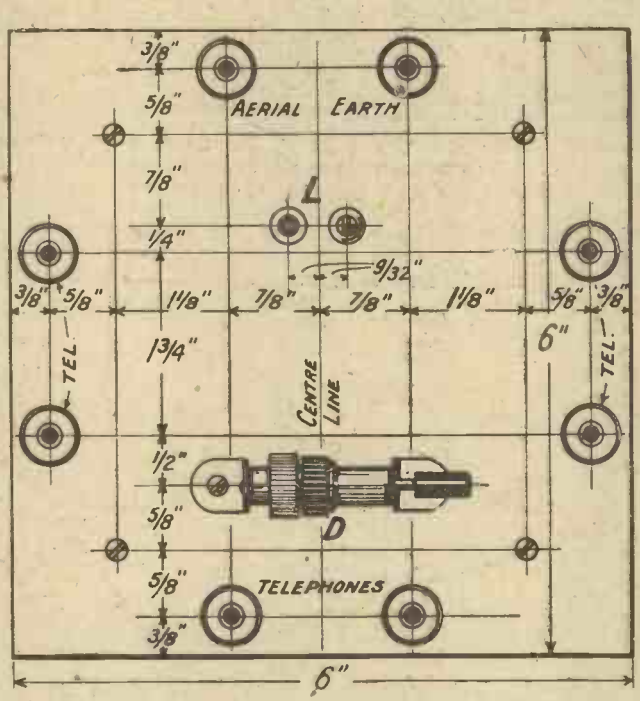
The reason for using the loading coil lies in the fact that 2LO appears to be tuned in on my aerial only when the majority of the turns of the tuner are in circuit, therefore in cases where the local station uses a wavelength of, say, 495 metres it is possible that a small loading coil will be necessary, except with large aerials.

Tuning for the First Time

At a time when the local station is working, the crystal detector should be adjusted so that the two contacts or crystals are touching, and starting with the whole of the tuner windings in circuit, the knob should be turned in an anti-clockwise direction until the local station is heard at good strength.

The crystal detector should now be given a correct adjustment for the loudest results, and a further adjustment made to the tuner if necessary.

For the reception of the long-wave station, the No. 25 or 35 coil should be removed from the tuner and the No. 200 coil inserted instead, whereupon the same procedure as before should be gone through until 5XX is received. If difficulty is experienced in finding Daventry a loading coil a size larger or smaller should be tried.



An ordinary pin and socket mounting (marked L) is provided for the tunometer.

Results Obtained

The receiver was used on the occasion of the simultaneous transmissions from Oxford Street and Marconi House, and it was found that these two stations could be received without any appreciable mutual interference at a distance of about 10 miles.

By the word "appreciable" it is meant that either programme could be faithfully followed though the other station was audible during the silence of the louder station.

So far as the long-wave station is concerned, it can be received in the same district at quite good telephone strength, the operation of tuning, as in the case of the local station, being extremely easy.

With an Amplifier

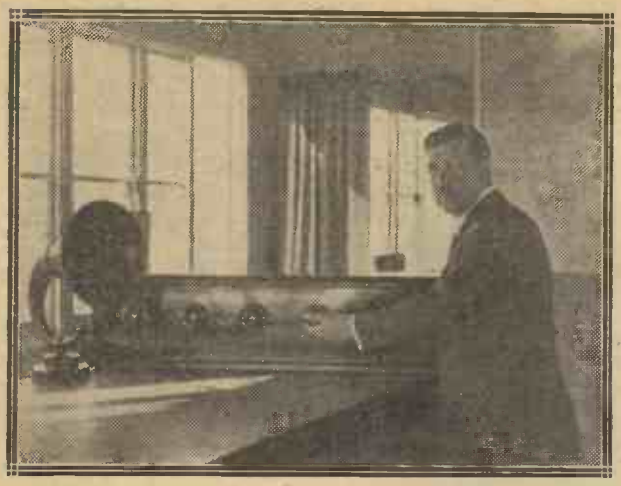
The receiver, as shown in the photographs, was used for some time in conjunction with the *Wireless* Transformer Coupled Amplifier, described in the July 17 issue, when it was found that really satisfactory loud-speaker results were given both from the local station (2LO) and the long-wave station (5XX).

Very good quality of reproduction was obtained when careful adjustment of high tension and grid bias had been carried out.

NEXT WEEK
"Molly-Coddling the B.B.C."

NEXT WEEK
Another Special Article by Captain Round

No. 41. **Circumstances Alter Cases!**



PROFESSOR HAZELTINE AT ELSTREE

SPECIAL INTERVIEW WITH A :: DISTINGUISHED VISITOR ::

Note.—In this exclusive interview Professor Hazeltine (seen in the photo above) renowned throughout the world for his contributions to the art, gives "Wireless" readers his impressions of the "Elstree Six," together with his opinions on several phases of American radio.

"WIRELESS" readers will be interested to hear that within a few hours of his arrival in England, Professor Hazeltine, the great American inventor, availed himself of the opportunity to visit the Radio Press Research Laboratories at Elstree, and expressed the greatest interest at what was shown to him there.

The Mystery Circuits

Professor Hazeltine was received at the Laboratories by Mr. John Scott-Taggart, Mr. J. H. Reyner, and Mr. Percy W. Harris. After being shown some of the new "Hush-hush" receivers now being prepared for publication in Radio Press journals, the Professor turned his attention to the now famous "Elstree Six," upon which a number of stations, both main and relay, were immediately tuned in on the loud-speaker during broad daylight. Included were Cardiff and Manchester (completely clear of London), Bournemouth, Newcastle, Aberdeen (badly jammed by morse), and Nottingham.

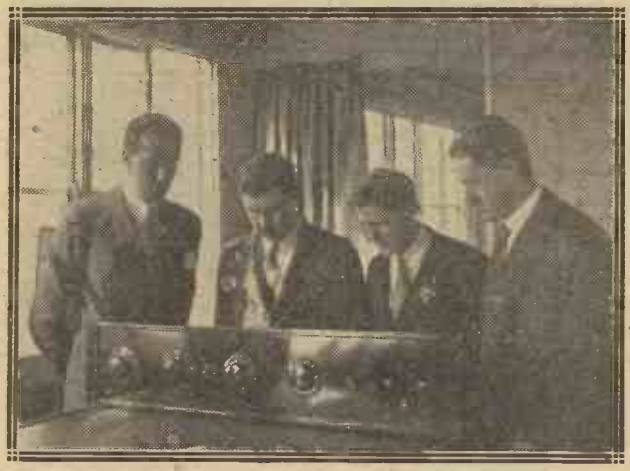
After examining a map to show the positions of the stations tuned in, Professor Hazeltine expressed his great appreciation of the sensitivity of the receiver, and after further tests, in which he handled the instrument himself, he turned to Mr. Scott-Taggart and gave his opinion: "This is certainly equal to the best I have heard in America!" exclaimed the Professor. "I should imagine the selectivity is as great as it is possible to get without cutting off side bands and introducing distortion."

Professor Hazeltine was very much impressed by the set being able to separate London from Cardiff clearly, and said the problem of separating them was greater than the similar problem in New York. When asked his opinion of the quality of reproduction of the "Elstree Six" he remarked "Excellent!"

More Valves

"What is the trend of development in broadcast receivers at the present time in the United States?" the Professor was asked.

"Listeners are demanding more and more sets with a number of valves," was the reply. "Five-valve sets are very popular, but there are a number of six-valve receivers being marketed, the sixth valve being an additional stage of high-frequency amplification. This demand is probably due to the increasing use of radio sets in apartment houses, or blocks of flats, as you would call them here. In such cases an outside aerial cannot be used, and listeners are naturally anxious to get long-distance stations with only a frame aerial or "loop," as we call it. In such cases the additional stage of high frequency is of great value."



Professor Hazeltine takes a keen interest in the interior lay-out of the "Elstree Six." Left to right: Mr. Scott-Taggart, Prof. Hazeltine, Mr. Reyner, and Mr. Harris.

Quality

"Are listeners becoming more critical on quality?"

"Yes, decidedly. The time has passed when they were prepared to put up with any kind of reproduction, so long as it came from a distant station. I think I may say that at the present time great attention is being turned to the production of good quality, and big improvements have resulted from this demand."

"What is your opinion of the relative merits of resistance and transformer coupling?"

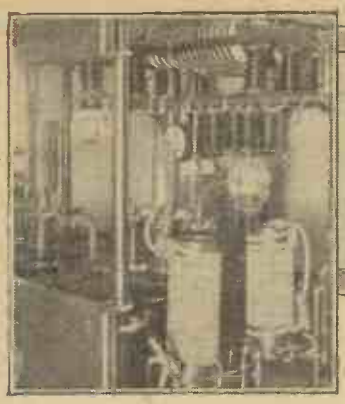
"Personally I would vote for the transformer method every time," replied the Professor. "With a well-designed modern transformer, it is possible to get a straight line reproduction of the audio-frequencies over a very wide band, and it is impossible to detect by ear the difference between the results with good transformer coupling and those with resistance coupling. In any case, the loud-speaker still introduces an element of distortion greater than that given by good transformers, and this is sufficient to mask any differences there might be between the two forms of coupling. In these circumstances why put up with the decrease in volume resulting from resistance coupling? The lower plate voltage required with transformer coupling is another great point in its favour."

Using the Mains

"How are Americans progressing in the use of their electric mains as a source of high-tension and low-tension supply?"

"A great deal has been done in this direction, but it cannot be said that

(*Continued on page* 352.)



IMPERIAL WIRELESS

A Review of the Empire's Communications

By Lt.-Comdr. the Hon. J. M. KENWORTHY, R.N., M.P.

In this special article Lieut.-Commander Kenworthy presents a fascinating account of the growth of the Imperial wireless system.

SOME matters of great importance are everybody's business, and because of this they are apt to be nobody's business. So it has been with wireless and the Empire. Twenty-five years ago Senatore Marconi successfully signalled to Newfoundland from Cornwall. It was at once obvious that a chain of wireless stations could be erected so as to give complete communication to all parts of the Empire from Britain and from the great Dominions themselves to each other and that this chain would be of great Imperial value.

What Might Have Been

This would have been technically possible any time from about 1904 onwards, and yet we have done nothing but talk about it up till about a year ago. Everybody recognised the importance of Imperial communications by wireless, and if the work had been got on with before the War such communications would have been of great strategical value. For a wireless chain cannot be cut like a submarine or land cable, and the only way to interrupt it is to capture the stations themselves.

Wireless Advantages

The very nature of our widely scattered Empire makes good communications of great importance. Wireless communication is cheaper than, and nearly as reliable as, cable communication. Moreover, it is impossible for us to communicate by cable with all parts of the Empire without being dependent upon outside countries, through whose territories parts of the cable must pass. Anything which will improve the transmission of news, despatches and ideas between different constituent parts of the Empire will help to knit the Empire closer together, besides assisting our Imperial trade.

Delays

Up to the outbreak of the War this great project was held up through political party bickering. The Liberal Government of the day, under the premiership of Mr. Asquith, as he then was, brought out a scheme for such an Imperial chain. The work was to be contracted for by the Marconi Company, but the official Opposition hampered this proposal by criticism and obstruction. There were rival wireless schemes in the air, and the fact that Senatore Marconi is an Italian was seized upon by the ultra-Nationalists as a reason for having some other system.

Then there was the political scandal of the Marconi shareholdings of certain prominent members of Mr. Asquith's Government. This led to nearly a year of bickering and delay, including a Select Committee to look into the whole question of the ownership of these particular shares. And such a comparatively trivial matter, long since forgotten, hindered the great work. Then came the War, and all further progress was held up.

A view of the principal machines in the generator room at the "Beam" station at Bodmin, Cornwall.

The High-Power Stations

We have, fortunately, not been entirely idle during this time, and to-day, in addition to Poldhu, in Cornwall, the original station, high-power stations working with the vacuum wireless valve have been erected by the Marconi Company at Carnarvon, and by the Post Office at Leafield, Northolt and Rugby. The Rugby station is now being greatly enlarged, and deserves a few words of description.

Rugby will be the largest and most powerful wireless station in the world, and it is expected that it will be able to communicate with ease with the whole Empire. Its area alone covers nearly a thousand acres, and eighty large transmitting valves are used in the equipment. The energy consumed by each of these is many thousand times that of the ordinary wireless receiving valve with which amateurs are familiar. Twelve great steel masts, four hundred yards apart, and each one six times as high as the Nelson Column in Trafalgar Square, are being erected. Inside each mast is a lift to take workmen up to the masthead when required, and twenty-five miles of wire will be suspended between the masts. This station will, of course, be able to transmit by telegraph or telephone.

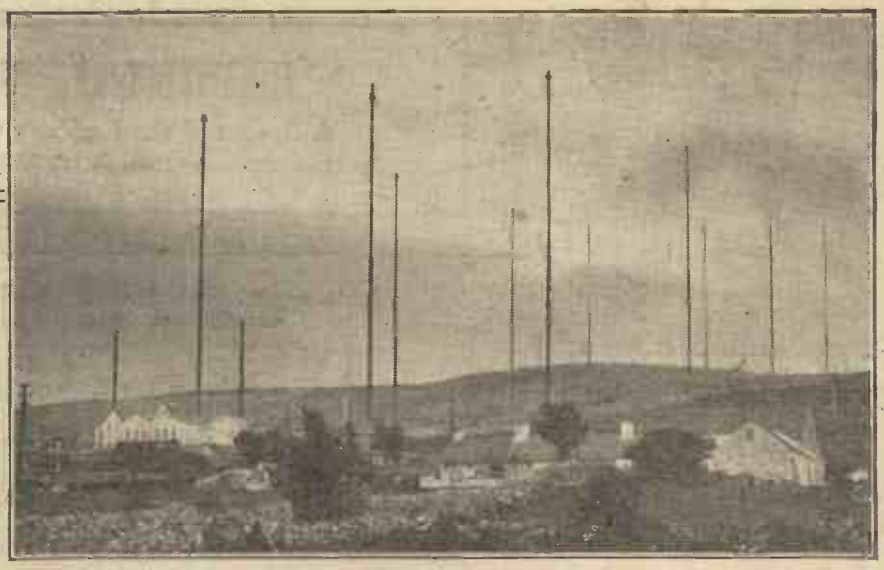
The Beam System

Now, since the original project, the science of wireless telegraphy has made very great strides, and in a way it has been of advantage to have delayed till now the completion of a wireless chain. Let me explain: the Beam system has been invented, which requires, for equal distances and equal reliability and clarity, less power, smaller stations and less costly equipment. The Beam system is directional, that is, by this marvellous invention the wireless

(*Continued on next page.*)

IMPERIAL WIRELESS

(Continued)



Carnarvon is a good example of the older type of high-power station as distinct from the "Beam" type.

waves can be sent in a particular direction and a greater concentration of power projected through the ether towards the station required.

Secrecy

This leads, naturally, to greater economy, and is effecting something like a revolution. Also, it is not so easily tapped by other and possibly hostile stations off the line of direction. In fact, only stations inside a certain restricted zone can receive the signals at all, and this increases the privacy and secrecy of communication, for although all important messages are sent in code, every code can in time be solved. The absolutely secret code has not yet been discovered, and if wireless enthusiasts wish to render a great service to the country they might experiment to find a code which cannot be deciphered.

Furthermore, by the Beam system shorter wavelengths are used, and this means that the speed of transmission and reception can be very much greater. Still another great advantage of the Beam system is that "atmospherics" do not interfere so much as with the older systems.

Dominion Enterprise

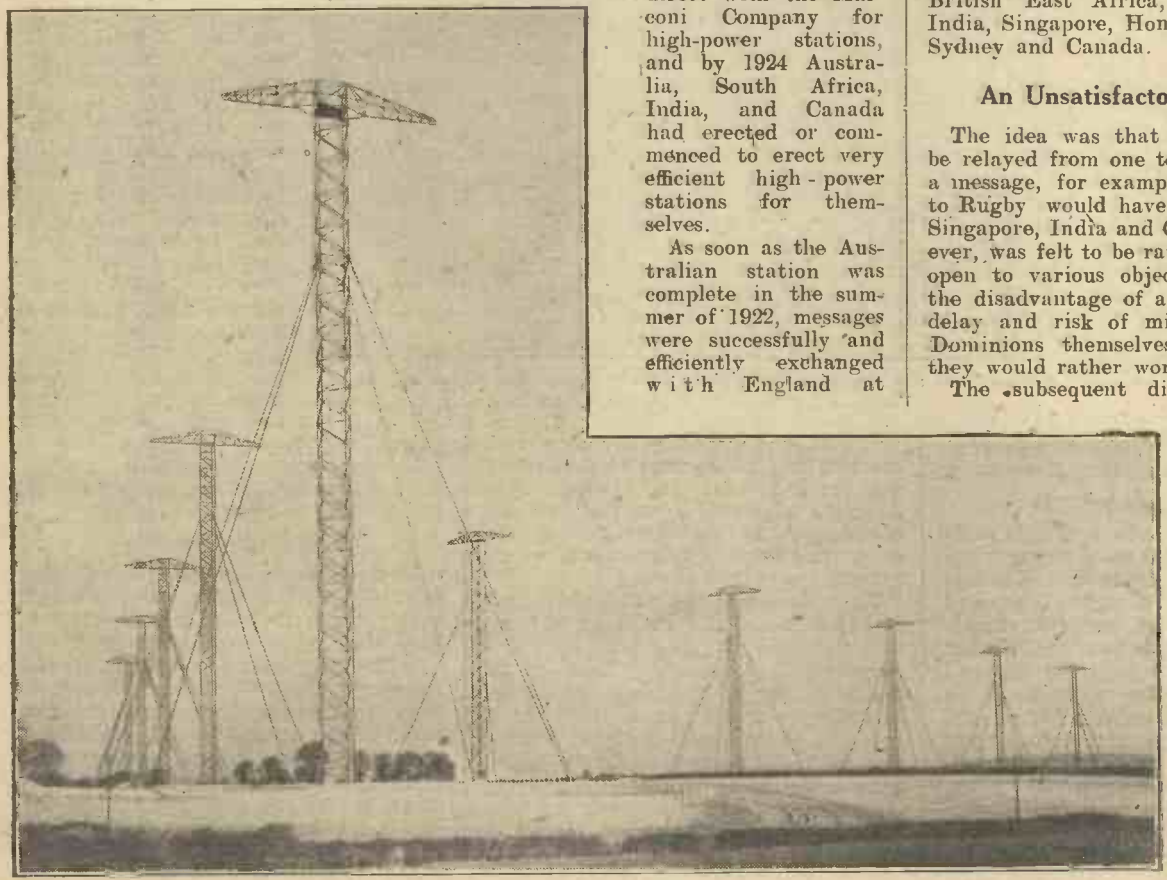
Now, after the War there was a good deal of agitation for the long-delayed wireless chain to be commenced and proceeded with. Fortunately, the Dominions themselves, disgusted with the procrastination of the Post Office authorities under successive Governments, have made contracts direct with the Marconi Company for high-power stations, and by 1924 Australia, South Africa, India, and Canada had erected or commenced to erect very efficient high-power stations for themselves.

As soon as the Australian station was complete in the summer of 1922, messages were successfully and efficiently exchanged with England at night, using short waves, and, after further experiments at the beginning of 1923, satisfactory transmission was made to Sydney in the daytime, using a modified Beam system. The Government proposals in 1922, as the result of the work of a special Parliamentary Committee to examine into the whole question, were that a series of high-power stations should be erected every two thousand miles or so, starting in England and situated in Egypt, British East Africa, South Africa, India, Singapore, Hongkong in China, Sydney and Canada.

An Unsatisfactory Scheme

The idea was that messages should be relayed from one to the other, and a message, for example, from Sydney to Rugby would have been by way of Singapore, India and Cairo. This, however, was felt to be rather clumsy, and open to various objections, especially the disadvantage of a slightly greater delay and risk of mistakes, and the Dominions themselves declared that they would rather work direct.

The subsequent discovery of the



Bridgwater is another of the "Beam" stations. This view shows two of the aerial systems intended for working with Canada and South Africa.

A Review of the Empire's Wireless System

Beam system will now enable this to be done. A special Beam station is being erected in Dorsetshire to work with New York and South America, and in Lincolnshire for working with Australia and India. Another station is being erected in Devonshire for transmission to Canada and South Africa with a receiving station at Bridgwater. These are being erected by the Government, and will be worked by the Post Office.

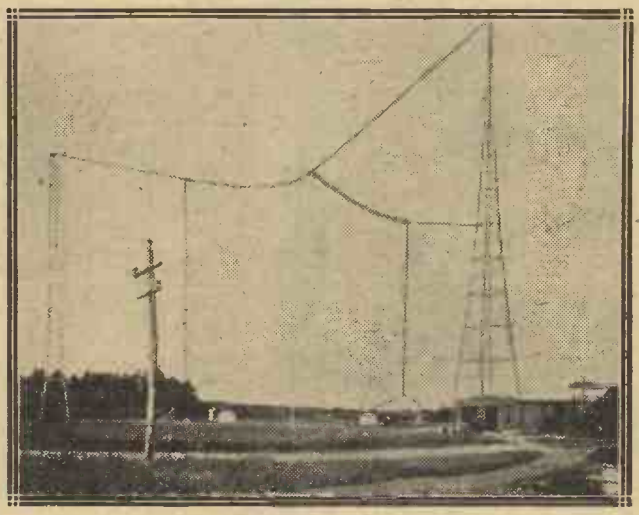
Economy

When completed they will all operate on the Beam system at considerably lower rates than the existing cable charges. These stations will work on short wavelengths, and it will be possible for messages to be sent all round the Empire at nearly one hundred words a minute. The existing high-power stations will remain for the broadcasting of Empire messages and news, and for communication with other countries, and with far distant men-of-war or merchant vessels to whom it may be required to send messages. So at last, after many delays and disputes, we are well on the way to the establishment of the great Imperial wireless chain foreshadowed twenty-five years ago.

In the Future

The day is not far distant when the British Prime Minister in Downing Street will be able to telephone a message over the land wires to the Imperial stations and speak simultaneously to the Prime Ministers of all our Dominions and the Viceroy of India, and they will be able to talk back. It will be easier in future for the head of the Government in Britain to communicate with the head of the Government in Australia than it was for Mr. Gladstone to get a message through to the Mayor of Poplar or the Chief Constable of Maidstone.

SCHENECTADY



One of the first stations to investigate the possibilities of high power on short waves was the experimental station of the General Electric Company.

PROPAGANDA !

The American newspapers were quick to realise the indirect propaganda value of the broadcasting of news bulletins from their offices. The illustration shows the plant first installed by the San Francisco "Examiner."

A NEUTRALISING HINT

WITH high frequency amplifiers using a neutralising system of any description, it is sometimes found that no proper balance point is obtainable, even if the neutralising condenser is placed at a minimum. If such is the case it indicates that the capacity of the electrodes of the valve is lower than the minimum of the condenser.

Remedies

The trouble may be cured in two ways. Firstly, by reducing the effective capacity of the neutralising circuit, or secondly, by increasing the anode-grid capacity of the valve. A cure may therefore be effected by the rearrangement of the wiring in some cases, but should this not be so either of the two following methods may be employed.

Try placing a small fixed condenser .0001 mfd., which is the lowest capacity commercially made, or another neutralising condenser, in series with the standard one.

Another Method

If this is not satisfactory, a small fixed condenser made by twisting two pieces of Glazite together may be connected across the anode and the grid of the valve, thus increasing the capacity in this side of the circuit. The two pieces of Glazite may be about three inches long, and care must be taken to see that when the wire is twisted the insulation is not broken, thus causing a short circuit. The two bare ends of the wire, of course, must not be allowed to touch each other.

□ □ □

IN ADVANCE

Sunday, Aug. 1.
2LO Popular Classics.
6BM Symphony Concert.

Monday, Aug. 2.
2BD Russian Songs and Scenes.
5IT Metropolitan Works Band.

Tuesday, Aug. 3.
5IT "Mainly from the Operas."
5SC Old Scots Songs and Melodies.
2ZY Listeners' Requests.

Wednesday, Aug. 4.
6KH Sketches and Music.
5NO Harton Colliery Brass Quartet.

Thursday, Aug. 5.
5SC Mozart Programme.
5WA "The Valve Set" Concert Party.

Friday, Aug. 6.
2BE Grand Opera.
2LO Sing-Song from the Duke of York's camp.

Saturday, Aug. 7.
2LO Radio Follies.
5SC Ballad Concert.
2ZY Dance and Dialect.

Professor Hazeltine on the Radio Art—*continued*

and forth across the Atlantic. Now I will have to achieve the still more difficult feat of straddling the Atlantic, for the great advance of introducing reaction into the three-electrode valve was taken independently and almost simultaneously by Armstrong in America and Franklin in England. This permitted the ready production of oscillations of all frequencies and powers and a marked increase in the sensitivity of receivers.

Negative Reaction

With the earlier forms of valve it was often a problem to produce osoillations. As valves improved the problem changed to the prevention of oscillations due to natural reaction. The first person to introduce means for providing negative reaction appears to have been Captain Round, than whom no one has done more consistent and continuing work in perfecting wireless apparatus and methods. And it is characteristic of Round that the means which he introduced was the most logical and effective, a coupling capacity connected in a reverse way so as to oppose the natural coupling capacity of the valve.

The same problem was met by Hartley in America, on the occasion of the famous experiments when wireless telephony was first accomplished from Arlington, near Washington, to the Eiffel Tower in Paris and to Honolulu. Hartley's solution was by a reversal of the reaction coil in the anode circuit of the valve, so as to give negative reaction.

The First Neutralising

The complete neutralisation of capacity coupling between two tuned circuits, one the input circuit of a valve, the other the output circuit, appears to have first been accomplished by Mr. G. M. Wright, of the British Marconi Co., although Wright was attacking a different problem, the reduction of interference.

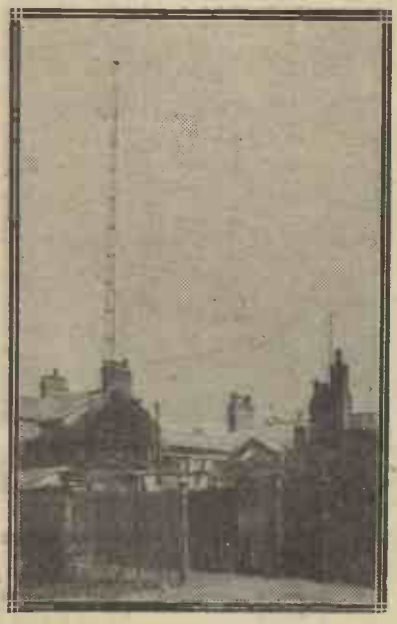
Later Rice in America employed a capacity to oppose oscillations, but in a circuit differing from that of Round.

The Simultaneous Invention

For the last step in the neutralisation of capacity coupling in valve circuits, we shall have again to straddle the Atlantic, for Scott-Taggart in England and the speaker in America almost simultaneously developed a stable tuned high-frequency amplifier, a type which has made a profound impression on the wireless art and which no less an authority than Captain Round has strongly endorsed.

I feel that while we in America call the receiver the Hazeltine Neutrodyne we should in England call it the Scott-Taggart Neutrodyne. (Cheers.)

6ZP



Mr. G. Pailin (6ZP) is experimenting on the control of electrical switchgear by radio. The above photographs show his apparatus and the aerial system in use.

You will have noticed that in this brief outline I have not needed to go outside of England and America. With the many able and active workers in both countries it is not unreasonable to expect that we together may hold the pre-eminent position which we have attained in the advance of the wireless art for the benefit of the peoples of the world. (Cheers.)

Points from Captain Eckersley's Speech

"I think there should be no great fear of a change of the constitution of the B.B.C. After all, it had been a specific recommendation that the staff should continue as before."

"The biggest critics of the company are to be found within the walls of Savoy Hill."

"I want to plead the cause of monopoly—let us call it unity of control, if you like, but I plead this cause, and thus the national system of broadcasting, because I believe that it is only in that way that it can be carried on. In the first place, if you have a national service, the service is conceived in the first place for the public and secondly for the public. If you have private enterprise, the station must be erected first for the person who erects the station and afterwards for the public. That seems to be the whole situation. Broadcasting must be a big national public service."

Wavelengths

Referring to the question of wavelengths, Captain Eckersley said that an organisation had been formed with the idea of clearing up wavelengths in Europe. There were 200 stations who wanted to work and there was room for 100 in the wavelengths allotted. It was a difficult problem, but it was gratifying to learn that at a recent meeting in Paris he had received the welcome news that during the second fortnight in September a new plan of wavelengths will be put into operation. That has been agreed upon by 90 per cent. of the nations in Europe. Britain would have something like 10 exclusive wavelengths; at any rate, the great point was that some decision has been come to and a new plan of wavelengths had been decided upon, and it was hoped that although it would bring certain dislocation to some listeners, there would be less interference from broadcasting stations abroad than heretofore.

□ □ □

An "O.B."

On August 6 a sing-song will be relayed from the Duke of York's camp, New Romney. Public schoolboys and factory lads take part in the same sports and spend their vacation together at this camp.

From my Armchair

BY EARL RUSSELL.

In these columns Lord Russell expresses each week his own personal views on matters of interest to "Wireless" readers.

The New Authority

After a long silence the Postmaster-General has announced the Government's decision on the composition of the new authority. It is not, of course, to be a commercial company, nor is it to be the Commission suggested by Lord Crawford's Committee, but it is to be a body incorporated by Royal Charter. The object of this difference is to leave it as free as possible from the interference and control of the State in its operations, other of course than the control which the Postmaster-General will necessarily exercise as the grantor of the licence. In other respects Sir William Mitchell-Thomson said that the Government accepted the recommendations of the Committee. It is interesting to learn this much before the holidays, but we shall probably not be fully informed before the autumn.

Diagrams and Values

When one looks at many diagrams of different kinds one is struck by the similarities of the values of some of the components, and still more by the occasional dissimilarities. Take first of all the grid condenser, for which the almost invariable value is .0003. I don't know what established this particular value, and I don't know why much larger condensers, even up to such values as .05, should not work better, but in the majority of circuits they do not. Then, again, there is the value of the grid leak, which is always conventionally given as 2 megohms, but I am quite sure that in many circuits this is too much, whereas in others 5 megohms would not be excessive. Of course, many of these values have been arrived at empirically by trial in different sets, but they do not necessarily apply to modern circuits. There are many features in which modern circuits differ quite distinctly from those of two years ago. Fortunately, the wireless experimenter is no slave to theory.

Other Components

Of course, such things as the size of a frame aerial or the length of the ordinary overhead aerial, or the value of a choke are much less standardised, and are recognised to depend on the peculiarities of each circuit and the frequency of the waves it is desired to receive. Variable condensers are another matter in which the usual practice has changed somewhat, the tendency now being to give smaller maximum values, and it is only quite rarely that one finds a .001 condenser specified.

Some Portables

The papers are full again of pictures of people camping or sitting in their cars with a portable receiver at hand. I think I have said before that, personally, I am satisfied with the sun and the trees without these artificial aids, but I dare say in that I am old-fashioned. I am interested, in looking at some sizes and weights of portable receivers, to see that my three-valve set compares very favourably with commercial instruments. The sort of average size I see is 15 in. × 11 in. × 9 in. or 18 in. × 12 in. × 6 in., while my set is 11 in. × 10 in. × 6 in.

I HAVE BEEN ASKED....

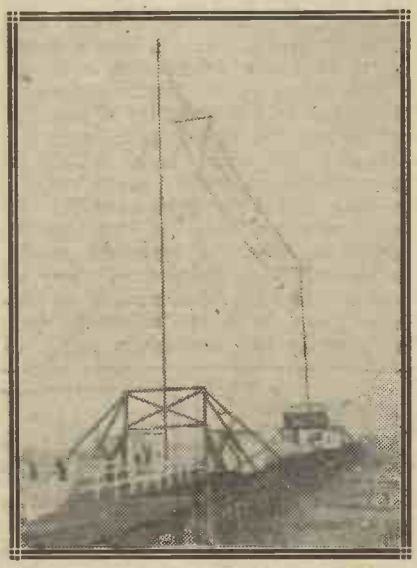
I have constructed a supersonic-heterodyne receiver, not to a design in one of your publications, and find that I cannot obtain reaction effects by employing the split frame method. On certain wave-lengths I do obtain certain spasmodic reaction effects, but the control is poor and useless. Can you tell me why this is and how to rectify it?

Upon examination of your theoretical circuit diagram the reason for your trouble is at once apparent. To obtain reaction effects with the first detector by the split frame method it is essential that a radio frequency choke or its equivalent be provided in the plate circuit of this valve. We note that the primary of your filter is shunted by a .001 fixed condenser, and this accounts for your trouble. A way of overcoming this difficulty is to place one of your intermediate frequency transformers in the filter position and to shift the filter transformer to the position vacated by the transformer. By so doing the filter will function, in that it will sharpen up the tuning, which is its object, whilst the primary winding of the intermediate transformer which you have shifted will in all probability act as an effective choke and allow you to obtain reaction effects.

Two years ago I constructed a 4-valve receiver from Simplex Chart No. 3, and have had excellent results from it, but I now desire to use two power valves in the L.F. stages, with higher H.T. than the H.F. and detector valves, and if necessary I do not mind sacrificing the switching, although I would prefer to be able to cut the last note magnifier out of circuit when not required. Can you give me the necessary circuit to effect these alterations?

To carry out the alterations you require the 3-way switch may be retained, but only for the purpose of cutting out the last note magnifier, the first note magnifier valve remaining permanently in circuit. Reference to the figure will give you the necessary connections, from which it will be observed that the H.T. + 1 terminal supplies the H.F. and detector valves, whilst that marked H.T. + 2 is for both note magnifiers. With the switch in the left-hand position and the last valve alight, all four are in circuit, whilst with it in the right-hand position and the last valve extinguished on its own filament resistance the 3-valve arrangement is obtained.

IN FLORIDA



The Palm Beach, Florida, broadcasting station is built on the pier.

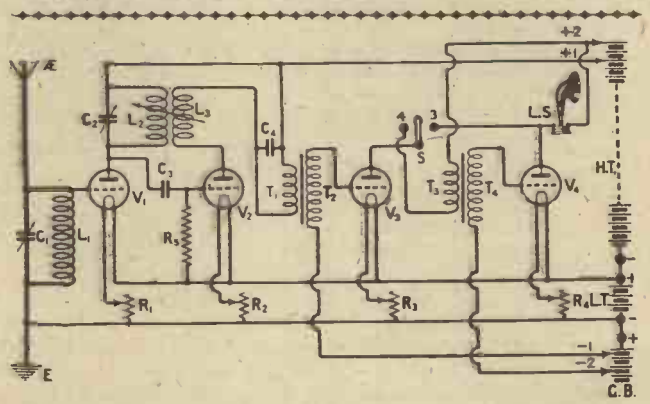


Fig. 1.—By using the 3-way switch and connecting it as shown in this diagram, the last note magnifier can be cut out of circuit at will.

With extra H.T. applied to the plates of the note magnifiers it is advisable, on both the score of obtaining pure reproduction and of limiting the demand upon the H.T. battery, to incorporate provision for grid bias. In the figure two separate tappings are indicated, but if the two power valves are of the same type, one tapping will prove suitable, the filament ends of the two L.F. transformer secondaries being joined together and taken to the grid bias battery, of which the positive terminal is joined to low-tension negative.

I have constructed a receiver incorporating a detector and two transformer-coupled note magnifiers, and am troubled with what I can only describe as serious "atmospherics." When I turn the first rheostat off the noise still persists, although reception stops. When either of the other valves are turned off the set is absolutely silent. Why should the noise persist when the first valve is off?

The symptoms given indicate a probable breakdown in the primary winding of the second L.F. transformer. Even though the first valve is switched off the second transformer primary is in circuit, which would account for the noise persisting when the detector is extinguished. Switching off the second valve would prevent any current flowing through the primary, which has an intermittent break, and hence silence would be obtained. Similarly with the last valve switched off there would be no current through the telephones or loud-speaker, so that the crackling would not be heard, even though the second valve was alight.

Can I get Daventry on a variometer-tuned crystal set by adding a loading coil, or should I get better results with a variable condenser?

By employing a loading coil alone you should be able to obtain Daventry, although it may not be possible to tune this transmission to its best. The inductance of an ordinary variometer for the lower broadcast wavelengths, when compared with the inductance of a loading coil, is a comparatively small quantity, so that the variation which the variometer will give is limited. It may happen, therefore, that although you hear Daventry you cannot tune this transmission in properly. If by adding a loading coil, therefore, you cannot tune Daventry definitely we would suggest that you connect a .0005 variable condenser across aerial and earth terminals. For the loading coil a number 150 coil should be satisfactory, and this should be connected between one side of the variometer and the aerial terminal, which latter point should still be left connected to one side of the crystal detector.

INVENTIONS AND DEVELOPMENTS

A NEW AMPLIFYING DEVICE

In this feature, conducted by Mr. Reyner, appear from time to time details of some of the latest developments.

AN interesting product has recently been made up in Germany by Dr. Loewe, of Berlin. This consists of a detector and two-stage resistance-coupled note magnifier, all included in one glass bulb. Modern methods of construction enable the resistances and condensers necessary for passing on the energy from one valve to the next

This view shows one of the new valves described by Mr. Reyner with the bulb removed to show the inner assembly. It is a complete detector and resistance-coupled amplifier unit.

to be made up in a very small and compact form. If this is possible, therefore, it is really only one stage further in theory to place the actual components inside a glass bulb which also contains the filament and anode of each of the various valves required.

All in One Bulb.

Naturally, the actual problem is not as simple as it seems on the surface, but after some considerable research Dr. Loewe appears to have overcome the difficulty in a very satisfactory manner. The photographs accompanying this article show the actual construction of the unit in question. It will be seen that there are really three valves all mounted upon the same stem. On the top of the stem is the filament, grid, and anode for the detector valve. Just under this, one on each side of the central stem, are the two elements for the note-magnifier.

The resistances and condensers for coupling the various stages together are also mounted in the same assembly.

Evacuation Details

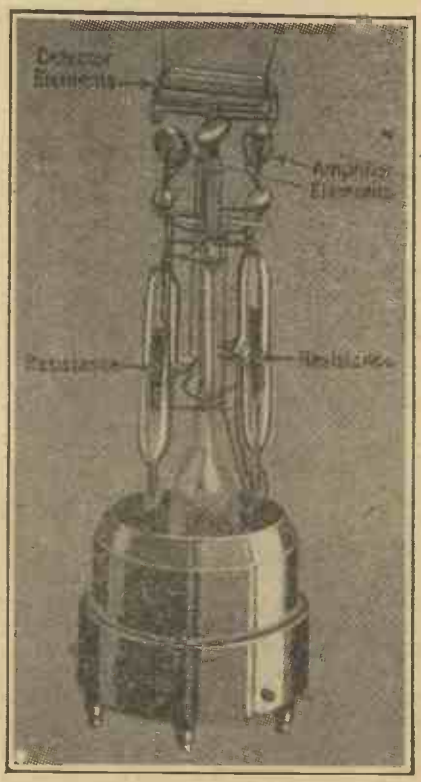
One of the difficulties to be overcome is that which has been encountered and overcome in the construction of ordinary valves. Any metal parts inside the valve tend to absorb gases to a certain extent, and these are not evacuated by the normal processes. Special arrangements have to be made, therefore, to warm up the electrodes and induce them to part with this "occluded" gas, as it is called.

Naturally, with so much extra material in the bulb, this difficulty had to be dealt with specially, and to this end the condensers and resistances are enclosed in separate glass tubes of their own. This also prevents any leakage due to the presence of wandering electrons inside the glass bulb. With the particular construction of the electrodes of the three valves controlled as shown in the photos there is no appreciable interaction between the various elements, although naturally difficulties were encountered at first.

A Disadvantage

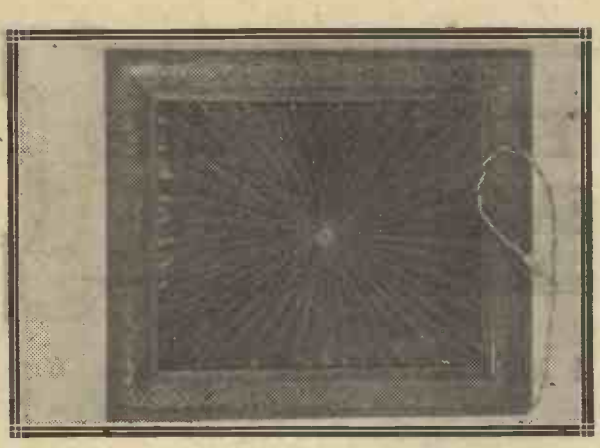
These types of complete valve amplifiers have been made up in this country, but have not yet made their appearance on the market. They suffer from one disadvantage, namely, that should any one of the filaments burn out, the whole arrangement is useless, but with the long life experienced with the modern valve this is not a serious defect.

Whether these units come into vogue remains to be seen. One of their principal advantages lies in the fact that all the leads connecting the valves and the resistance-capacity coupling units are very short, and this enables the



One of the problems of the development of these valves was to deal with the gases "occluded" in the various components. Finally, the parts were sealed into glass tubes.

units to be used for amplification at high frequencies as well as low. No definite figures, however, are given showing relative efficiencies of amplification at high or low frequencies, so that it is impossible to say whether this is a really satisfactory method.



A PICTURE FRAME LOUD-SPEAKER

Full constructional details of a loud-speaker which all can build

By E. LUSBY

POSSIBLY the most successful loud-speaker for the amateur to make himself is of the pleated paper type. There are, however, two faults in many of those which I have seen.

(1) They are all circular of varying diameters and therefore very monotonous as a decoration.

(2) Being circular, all the pleats are of one length, and a correct diameter in ratio to the thickness of the paper is necessary if good results are to be obtained, and can only be determined by experiment.

A Rectangular Diaphragm

To overcome these two points a rectangular shape has been tried with success. A picture frame chosen to one's taste and hung across the corner of the room (vertically or horizontally), or hinged to the set, or even fixed to a stand like a Cheval glass, settles the first fault mentioned. What is even a greater improvement is the fact that a rectangle cannot produce more than four pleats of the same length, therefore we have pleats graduating from half the width to half the diagonal of the opening in the frame chosen.

Preparing the Paper

The intending constructor is strongly recommended to prepare the paper to be used as suggested in WIRELESS for March 13, 1926, for the reasons stated in that article. It is impossible to give many dimensions, as they are dependent upon individual requirements, but the details to be given will prove to be sufficient. Nevertheless, first make sure that the material is large enough by making a rough setting out, and if it is impossible to obtain the complete length of paper required, the shape can be made in two parts.

Making a Template

Assuming the material is now ready, set out on a piece of spare paper an oblong a quarter of an inch wider all round than it is intended the finished diaphragm is to be, as illustrated in Fig. 1. We have then a template from which all our dimensions can be obtained.

To commence the setting out proper, draw a line on your material along its whole length and about one inch from the bottom and mark an "O" at each end. About half an inch from the left-hand side of the paper put the

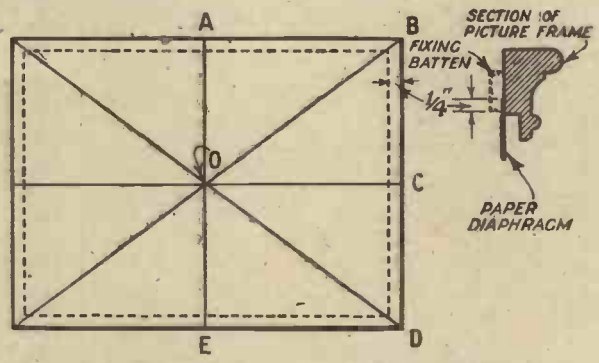


Fig. 1.—By marking out a template similar to this, all dimensions for making the diaphragm are easily obtainable.

vertical line AO. By reference to your template in Fig. 1 AO can easily be found. Parallel to OO draw the line AF, Fig. 3. Now take the depth OB, Fig. 1, and, as shown in Fig. 3, draw the line XX. The next horizontal line, ZZ, is the distance OC in Fig. 1. You should now have four horizontal parallel lines.

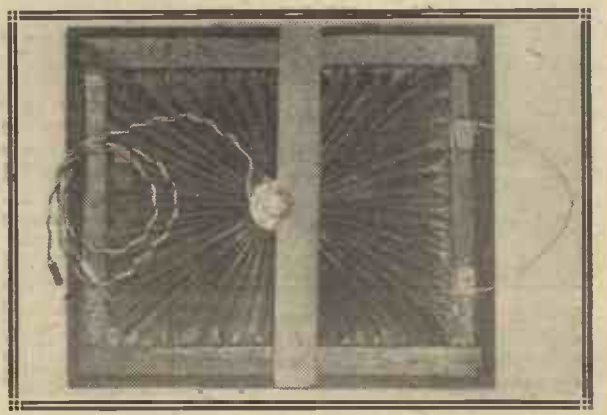
Marking Out

To proceed with the zig-zag line take the distance AB (Fig. 1) on a strip of paper, marking it very carefully; place one mark made on this slip at the point marked A (Fig. 3), and swing it round until the other mark cuts through the point B on the top line XX and produces the vertical line OB. In a similar manner take the distance BC and place one end on the point B (Fig. 3) and swing round to the point C in the next horizontal line below and mark the vertical line CO. The line DO is the same distance from CO as BO is. The line E, again, is the same distance from DO as AO is from BO. This may all sound very complicated, but, as a matter of fact, as the work proceeds, it is really very simple.

Join together A B C D E and half the shape is drawn, and it is only necessary to duplicate the shape already obtained to complete this part of the work. The reader can choose for himself whether the whole shape shall be in one or two pieces, according to the size of paper he can get. It may have been gathered already that the zig-zag edge is that which becomes the outside of the rectangle.

Preparing for Pleating

The next step is to mark the lines for pleating, and most likely it will be found that the distances between the vertical lines already obtained are not necessarily distances that can readily be divided into half inches. This, however, is overcome in the following way. Place one end of your rule or tape measure on the edge of one line, as shown in Fig. 3, and move the other end upwards until the nearest



The screws holding the batten which carries the earpiece should be screwed home very tightly, otherwise rattling may occur.

A Picture Frame Loud-Speaker

(Continued)

half inch meets the next vertical line, between which the divisions are being made, tick off each half inch, and similarly between the rest of the main lines until the whole shape is marked for pleating.

The Centre Hole

If you refer to Fig. 3 once more you will see a dotted line a quarter of an inch above the line OO; put this in and remember this is the line to cut along, the portion below being removed to allow for the centre fixing.

Also in Fig. 3 you will see that an additional half inch is allowed beside the line OF; this is for joining when pleated. If the shape is being made in two pieces, remember to allow a similar joining piece at the side of the line E.

Cutting Out

Cut out the shape, *i.e.*, along the zig-zag lines, down the line AO, along the dotted line a quarter of an inch from the base, and leaving the joining strip beforementioned. Now pleat the shape very carefully, bending the paper first one way on the first line marked and then in the opposite direction on the next, and so on until the whole is pleated.

Finishing the Diaphragm

The constructor should now try out the shape, remembering the long straight line is to become the centre. If all is in order, join the end AO with the strip at the opposite end, left on for that purpose, and leave the whole in the form of a pleated cylinder to set for several hours.

To obtain the final shape, stand the diaphragm " to be " on its zig-zag end, on a fairly smooth surface and gently press the top end inwards; when flat insert a cork (¾ in. long and ½ in. diameter, well treated with Seccotine) into the hole formed in the middle, and place a weight on the top and leave to thoroughly set and harden.

Fixing to the Frame

To secure the diaphragm to the frame apply a little Seccotine along the edge and attach to the frame in the position required, and further secure it by four small battens screwed to the back, as shown in Fig. 2.

A Brown " A " type earpiece has been used to operate the diaphragm, the earpiece being attached to a hardwood batten and the batten eventually screwed to the frame in the required position.

Fixing the Earpiece

For connection between diaphragm and reed the author has found nothing to equal a small " Rawl Plug " inserted into the cork centre and secured by a little Seccotine, no other connection being made with the earpiece, except by contact. The Rawl Plug should be slightly longer than is required for contact, so that the batten carrying the earpiece does not have to be screwed down to the frame tight, but leaves a little freedom for varying the pressure, which should be worked in conjunction with the earpiece adjustment itself.

It should be mentioned that the screws holding the earpiece batten should fit very tightly, otherwise rattling may occur.

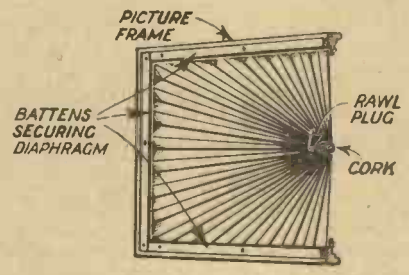


Fig. 2.— For connection between diaphragm and reed, the author has found nothing to equal a small Rawl Plug.

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News in Advertisements

There is little doubt that the vogue of fixed resistors for filament control is increasing steadily. Particulars of one of the latest of these, the " Tempryte," are obtainable from Sydney S. Bird and Sons, and brief mention of these components will be found in their advertisement elsewhere in this issue.

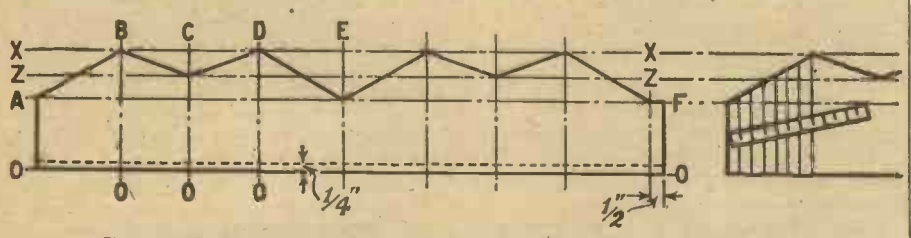
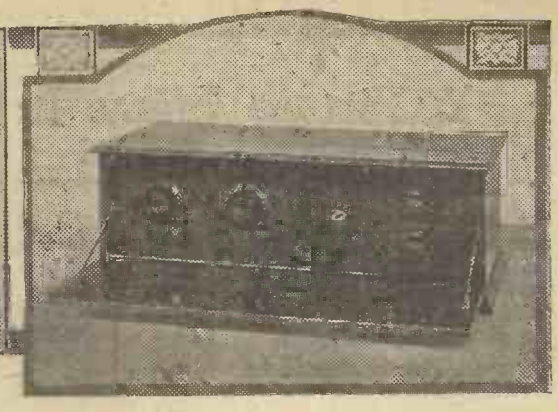


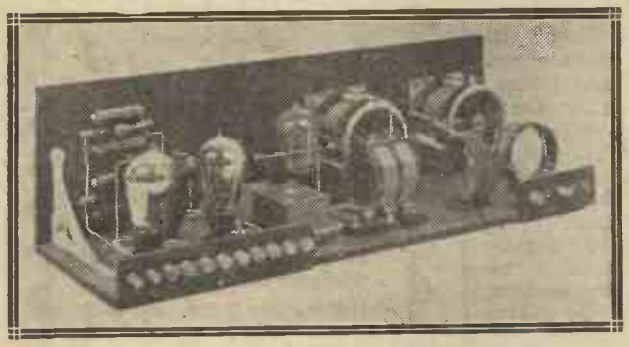
Fig. 3.—To obtain the dimensions AB, AO, and so on, reference should be made to the template.

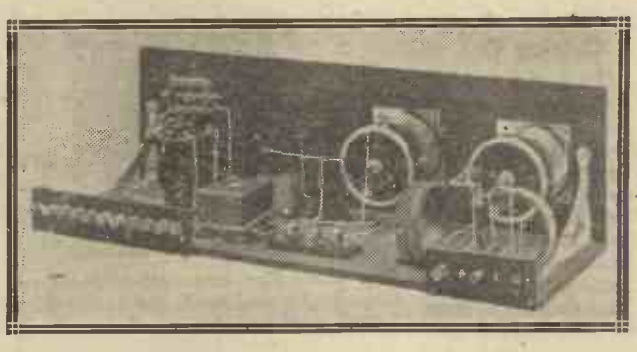
Operating Notes on the "Cockaday-Hartley" Three-Valve Set



By JOHN W. BARBER

THE adjustment of the aerial coupling will best be carried out by listening to a fairly weak signal, and altering the tapping until it is decided which gives the best signals. This can be left alone thereafter, and excepting for wide differences in wavelength, will be found satisfactory. If the receiver does not appear to give good signals on a particular station, the dial setting for which is somewhat different from that at which the adjustment was made, it may be advantageous to try the effect of a readjustment of the aerial coupling turns. Those who are familiar with the shape of the aerial turns—signal strength curve for this particular form of coupling will realise the necessity for readjustment of the turns when moderately large changes in wavelength are effected.





The receiver, which was described in our last issue, employs two special home-constructed coils in addition to the split coil seen on the right of the L.F. transformer.

Tuning-in on the Loud-Speaker

It will, in general, not be necessary to employ telephones for tuning purposes, although some may prefer to do so, especially at this time of the year, when daylight lasts so long and when conditions are generally unfavourable to long-distance reception. Birmingham and Bournemouth were tuned-in directly on the loud-speaker with no difficulty, while with a little care Newcastle, Glasgow, Hamburg and San Sebastian could be brought in in the same manner.

Simultaneous Use of Dials

The tuning is carried out upon both dials, the "Neutrovernia" condenser being employed for reaction purposes. It will be best to work all the time with the set just below the point at which oscillation commences, and this is easily effected by careful adjustment of the reaction condenser. The two dials, in the receiver described, have almost the same settings for the various stations, the intermediate closed circuit condenser actually reading a few degrees behind the grid circuit condenser.

The slow motion drive will be found necessary in all cases other than when receiving the local station at a few miles, and some such control should be provided upon the condensers employed, if different from those specified.

The Coupling Coil

The small coil which effects the coupling between the intermediate tuned circuit and the grid circuit of the detector valve is mounted by means of a piece of ebonite secured to the ebonite ring upon which the coil is wound, a single screw passing through the flat piece of ebonite into the baseboard. The whole coil is thus enabled to rotate, and thus the optimum coupling may be obtained. In the receiver described this coil consisted of five turns of No. 36 d.s.c. wire, and the coil was inclined at about 35 degrees to the Dimic coil in the grid circuit. In any case, the best position should be ascertained by actual trial.

The selectivity of the receiver will appeal to those who are troubled with interference, and who want to receive broadcasting free from unwanted signals, with simple apparatus at a reasonable cost.

PROFESSOR HAZELTINE AT ELSTREE

(Continued from page 342)

perfection has yet been attained," replied the Professor. "I have tested a very large number of these devices, and while in general the results are good, I still prefer to use batteries for high-tension supply. But good progress is being made, and in the future I think the electric light mains will be used almost exclusively, particularly as the tendency is towards the use of valves which take a large high-tension current."

The Howling Problem

In further conversation Professor Hazeltine expressed surprise that we have not yet succeeded in solving the problem of the howler in this country. After carefully examining the crystal-controlled wavemeter which has proved so useful a part of the equipment of the Elstree Laboratories, the Professor complimented Radio Press, Ltd., on the whole equipment and the work that was being carried out there. "The Laboratories are very well equipped for the work they have to do," remarked the Professor, "and both listeners and the trade should be very grateful to Radio Press for the work they are doing in serving the art."

The WEEK'S DIARY

MR. REYNER has just been telling me how relieved he was to find that the burglars who recently visited Elstree and succeeded in getting away with a number of sets and valves, were unable to steal the plans of the remarkable series of sets now under preparation. They failed, as has already been announced, in their attempt to remove the "Elstree Six," for it was screwed down and by no means rapidly detachable from the bench. The way drawers and cupboards had been opened reveals that the intruders were obviously searching for something they were unable to find, and it would indeed have been a calamity if the vital figures and calculations relating to some of the new designs had disappeared at the same time as the sets which were taken. While, of course, such information is ultimately replaceable if stolen, the large amount of data carefully collated in the series of experiments would not have been easy to re-assemble.

* * *

SOME time ago I mentioned in these columns that I had installed a crystal set for an elderly relation at Bournemouth. The good lady in question, as I previously stated, had no experience whatever of wireless receivers, and still stands in awe of them. It speaks well for the reliability of the modern permanent crystal detector that the adjustments have remained untouched since Whitsuntide, when I personally readjusted the crystal to see whether I could get any louder signals (I couldn't!). The set was put in at Easter, so that from that time until now the crystal detector has been touched only once, and then only out of curiosity.

* * *

THERE are some exceedingly good advertisements of the telephone now appearing in the daily papers. If you examine them you will see that they are issued by the Telephone Development Association and not by the Post Office, as you might at first imagine. The Telephone Development Association is really a combination of practically all the manufacturers of telephone instruments, who, realising that by boosting the telephone they will ultimately benefit themselves quite considerably, spend each year a good deal of money in popularising this means of communication. There are still many thousands of people to whom the advantages of broadcasting have not yet been brought home, and a similar publicity for radio has been frequently advocated in the past by Radio Press journals. I understand that a movement is now on foot to put these suggestions into effect.

A sketch of Sir Harry Lauder autographed for the "Wireless" Cartoonist by the famous comedian who broadcast recently.

THE criticisms that have been levelled at the Government's proposal to adopt the Broadcasting Committee's report have apparently had some effect, for I see that the Postmaster-General took great pains to impress upon the House that the new scheme was not to be "governmental control." In any case, the matter has still to be fully discussed in the House, and as a lot of people have very definite opinions on the subject, which no doubt they will communicate to their Members of Parliament, I should not be at all surprised to see important modifications to the proposals before they become law.

PROFESSOR HAZELTINE'S reputation for modesty has been still further enhanced since his arrival in this country. Everyone who has had the privilege of meeting him has been struck by his most retiring disposition, which is quite different from that of many inventors who have contributed far less to the art.

The Professor's name, by the way, is pronounced Hazeltine with a long "a," and not as if it were spelt Hazzletine, the final syllable being pronounced "teen" and not "tine." The Professor is proud of his English ancestry, and told me the other day that so far as he had been able to trace the history of his family, it is all English, or, rather, British, for his mother was partly English and partly Scotch.

* * *

AMONG the important people who have visited this country in company with Professor Hazeltine must be numbered Mr. Willis H. Taylor, Counsellor at Law and Vice-President of the Hazeltine Corporation. Mr. Taylor is, perhaps, the greatest Patent Lawyer in the United States at the present time, and has acted both for Professor Hazeltine and Mr. Armstrong when the latter fought his famous case to establish his right to the invention of reaction. The story of Mr. Taylor's association with radio reads almost like a romance, for he was originally one of Professor Hazeltine's pupils, and was the first to realise the immense importance of the invention associated with the Professor's name. I believe, too, the actual word "Neutrodyne" was coined by Mr. Taylor, who, by the way, is still in the early thirties! Radio is truly the young man's profession.

* * *

CAPTAIN ECKERSLEY was in great form at the recent luncheon to Professor Hazeltine. In elaborating his arguments for the alternative programme scheme, he pointed out the advantages of having two programmes to grumble at instead of one. "I know the programmes are rotten," said Captain Eckersley, "but of course I am not personally responsible for them." (Cheers.) "My brother is!" (Loud cheers.)

It was interesting to see so many people in radio making acquaintance

(*Continued on next page.*)

The Week's Diary —*continued*

for the first time or renewing them after a lengthy interval. After lunch a little group consisting of Captain Round, Captain Eckersley, Professor Hazeltine, Mr. Taylor and Mr. Reyner were found in a corner eagerly discussing all kinds of schemes until long after the rest of the guests had distributed themselves over London; when they finally concluded the discussion they found the tables completely cleared and that they were standing in what was otherwise an empty room!

I noticed Sir Edward Marshall Hall, who sat next to Mr. Taylor, spent most of the lunch time in animated conversation with the latter gentleman, apparently discussing differences in the law between the two countries, while Commander Kenworthy found himself next to a Member of the United States Consulate who was well acquainted with American Naval affairs. This led to some interesting interchanges of naval experiences.

* * *

AS one who realises his responsibilities as a diarist and the awful results which may arise from an incorrect statement, I hasten to don sackcloth and ashes and to beat my forehead on the ground preparatory to the statement that I have done an injustice to an important member of the Radio Press Laboratories.

Writing last week I described Mu in such a way as to give the impression that she was a member of the fair sex. I hasten to apologise; Mu is a member of the unfair sex, and in the accompanying photograph he is seen dictaphoning an energetic protest to the Editors.

* * *

AMONG the many interesting developments in radio which have had important effects on other arts must be mentioned the development of pure reproduction of sound and the elimination of unwanted echoes due to our progress in the development of acoustics. It is an open secret that the big gramophone companies have all drawn upon the experience gained in the wireless art for the improvement of their methods of recording, and now I see the suggestion has been made that the problem of acoustic defects in the Council Chamber of the Middlesex Guildhall should be tackled, or, rather, circumvented by the installation of microphones as has been done in the House of Lords. The acoustics of the particular Council chamber have always been bad, and previous attempts to remedy matters have failed hopelessly.

* * *

A WIRELESS expert whose name is known to every reader of this journal remarked to me the other day that when any man said "wireless was in its infancy" he felt a strong desire to resort to personal violence. He certainly has my sympathy. It is one of those stultifying phrases which lead the uninitiated to believe the art is not by any means so advanced as it actually is. The first wireless tele-

An unconventional method of tuning-in! This snake, who appears to be a privileged person, seems to use his tail for the purpose.

phony signals were transmitted at least twenty-six years ago. How long is it since we first saw moving pictures publicly exhibited? As far as I can remember, twenty-six years ago London had no picture palaces of any kind, yet for some reason or other nobody troubles to remark that the moving picture business is "in its infancy."

This question of "in its infancy" also suggests another phrase. "the advent of a new era" in this or that direction. I see that several papers are referring to some recent tests in America on the direction and operation of goods trains by radio telephony. This, of course, is hailed as "the advent of a new era in goods operation." If the paragraphists in question had troubled to look into the matter, they would have found that communication by radio telephony with moving trains was effected on the Lackawanna railroad many years ago and was prominently "stunted" at the time in both American and British newspapers. Since that time the experiment has been repeated on other railways, and last year saw some very successful tests carried out in this country. The whole question is not whether it is possible to communicate by radio to a moving train—any wireless expert can tell you of a dozen ways in which it can be satisfactorily effected—but whether it is really a practical business proposition. In the recent tests a report says that "conversation between an engine and a guard van was carried on for five hours during a severe electrical and rain storm." Very interesting, no doubt, but what was the real practical advantage to justify the expense?

* * *

WHATEVER other difficulties I have to contend with in preparing this diary each week, thank goodness I do not have to read it in public, or I might be involved in the present discussions on the correct way to pronounce various words. I see that Dr. Bridges, the Poet-Laureate, has been appointed Chairman of the Committee to standardise the pronunciation of the announcers of the British Broadcasting Company, and I wish him all success. The trouble is that while you and I may be excused for differing in our pronunciation of certain words, we all assume that linguistic experts agree upon the pronunciation of all the words which are likely to be used by the announcers. In point of fact, they do not!

"Mu" dictaphones a protest to the Editors!

Whatever the constitution of the Committee appointed to carry out this standardisation, I can easily imagine that the most heated arguments will take place. The pronunciation at Cambridge differs from the "Oxford manner." In the North Country, too, the vowels are given a different value. In any case, the high standard of pronunciation at present adopted by the announcers is not generally realised. I only wish the people who tell us the names of the items played by the various jazz bands could speak English half as well! By the way, I notice Sir Landon Ronald prefers "pianofort" to "pianoforty."

WAVE-TRAP.

COMPONENTS WE HAVE TRIED

Conducted by the "Wireless" Laboratories, Elstree.

Combined Wavetrap and Filter

WE have received from Messrs. Claude Lyons, British Agents for the General Radio Co. of America, a combined wavetrap and filter.

This instrument comprises a small geared condenser to the terminals of which a special coil is connected. This coil is provided with two windings, one of which is tuned by the condenser, and the other of which acts as a coupling winding and is tapped with a small switch. The aerial circuit is connected to the coupling winding, which may either be arranged as a series rejector, or shunted across the receiver.

The combined wavetrap and filter submitted for test by Messrs. Claude Lyons, British Agents for the General Radio Co. of America.

The condenser is calibrated in wavelengths when used with the appropriate coil, and on test this calibration was found to be accurate over the whole of the range. When employed as a wavetrap, it was found to assist the selectivity to a considerable extent, although it was not quite as good as the tapped auto-coupled arrangement which is very commonly employed. The instrument is very well constructed and attractively finished. The calibration of the condenser scale renders the device particularly suitable as an absorption wavemeter (one of the purposes for which it is intended), while the trapping action is quite up to standard. We can thoroughly recommend this component for use.

Etherplus Anti-Vibro Valve-Holder

THIS valve-holder, which is constructed on low-loss principles, is designed for baseboard mounting. The insulating material is placed some distance away from the valve-sockets, the sockets themselves being mounted through a rubber base, which is claimed by the manufacturers to be non-deteriorating. Connections from the sockets to the terminals are made by means of springy strips of metal, this springy action assisting in obtaining the necessary amount of anti-vibratory movement. Soldering tags and terminals are provided.

The component was tested in a receiver and was found to function quite satisfactorily, and to damp out microphonic noises to a large extent. When a valve was inserted, it proved a good fit. The manufacturer of this holder is Mandaw.

C.A.V. Multiple Fixed Condenser

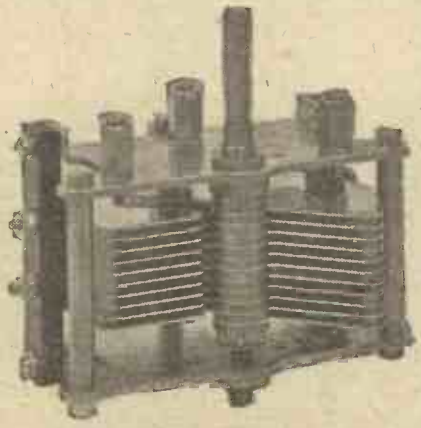
A CONDENSER unit capable of giving 14 different values of capacities according to the method of connection has been forwarded to us for examination by Messrs. C. A. Vandervell & Co., Ltd.

When using the component one terminal which is marked .000 always forms one connection, and the other connections may be taken to any of the points marked 1, 2, 3, 4 or 5, which will give a value of .0001, .0002, .0003, .0004 or .0005 respectively. If higher capacity values are required it is necessary to join the terminal No. 5 to any of the other terminals, and take the connection from either of the two so joined—thus 5 and 1 joined together will give a value of .0006.

When tested at our Laboratories the capacities were found to be .0001, .00015, .0002, .0004 and .0005.

Cardwell Variable Condenser

A NEAT and well-manufactured accessory is to be found in the Cardwell variable condenser which has been sent to our Elstree Laboratories by the Rothermel Radio Corporation of Great Britain.



In the Cardwell condenser the now familiar method of "floating" the fixed plates has been adopted.

The plates are manufactured from aluminium, while two ebonite strips insulate the metal frame from the fixed plates, connection being taken from terminal points which are made through the ebonite strip to the fixed and moving plates. The instrument has a very smooth motion, is rigidly constructed, three-hole fixing being provided for.

The rated capacity is .0005, and on test this reading was found to be correct.

The Postmaster-General, Sir W. Mitchell-Thomson.

THE FUTURE OF . . . . . BROADCASTING

By Lt.-Comdr. the Hon. J. M. KENWORTHY, R.N., M.P.

In this specially-prepared article will be found an account of the policy of the Government as regards the future of broadcasting in this country as disclosed in the Postmaster-General's speech recently, with Commander Kenworthy's trenchant comments thereon.

AT last we have some light from the Postmaster-General on the Government's intention with regard to broadcasting. It is probable that but for the action of WIRELESS in urging listeners in the country to demand some statement of the Government's intentions we should have been fobbed off with no information at all from the Postmaster-General until the House rose at the beginning of August, not to meet again until next November.

An Ancient Custom

I will now let the readers of WIRELESS into a little Parliamentary secret. A certain number of Supply days, when Estimates are discussed, have to be allotted in every Parliamentary Session. These Supply days are the opportunity for Members of Parliament to exercise their ancient right of discussing grievances before voting supplies of money. And by long usage the subjects for discussion are chosen by the Opposition. The subject for discussion on Wednesday, July 14, was the Post Office Estimates, put down at the request of the Labour Party, and primarily for the purpose of bringing up certain grievances of the Post Office servants.

A Vote of Confidence

It is unusual to vote against the Post Office Estimates, as they are very complicated, and also because the Post Office is a revenue-producing Department and brings a good deal of money into the Treasury. Furthermore, it is very difficult to carry a vote against the Government on "Supply," as a hostile vote against the Government on Supply must inevitably mean the Government's resignation.

Every Division on the Estimates, therefore, is looked upon by the Government as a vote of confidence.

No vote, therefore, on the Government's intentions with regard to broadcasting could have been effective on the Post Office Estimates. Nevertheless, the intention of the Government Whips was to sandwich a discussion on broadcasting in and amongst the other subjects raised on the Post Office Estimates, and they would then have said that this was an opportunity for the House of Commons to discuss the Government's proposals and that no further debate was necessary. This would have meant a "blank cheque" for the Postmaster-General. But, fortunately, the vigilance of a few Members prevented this, and Mr. Ramsay MacDonald himself, the official leader of the Opposition, pointed out that the Vote had been asked for with no reference to broadcasting, and primarily in order to raise regular Post Office matters on the floor of the House.

A Tactical Victory

The Government Whips gave way, and we are now promised a full opportunity for debate before the new broadcasting organisation takes over the plant, broadcasting stations, programmes, experience and goodwill of the old British Broadcasting Company. This further opportunity will take place in the autumn, and it will be possible for Parliament to insist on certain safeguards for the listeners to which I shall refer presently. With a little pressure the Government may be induced to take their Whips off and allow free voting on their proposals.

By way of showing how inadequate the opportunity was last Wednesday to discuss this vitally important subject, of interest perhaps to 5,000,000 listeners in the country, I might mention that only three Members of Parliament, including myself, spoke on broadcasting, not counting the Postmaster-General and his assistant; and the other two were both members of Lord Crawford's Committee, whose report is being adopted by the Government.

B.B.C. Success

The Postmaster-General told us that 1,900,000 licences were taken out in 1925. In July, 1925, 1,387,000 licences were in force, and on July 14 of this year the number had risen to 2,076,000. I am informed that the number of wireless receiving sets in use by the far larger population of the United States of America is between three and four millions. I have no knowledge, nor, I suppose, has anybody else, as to the number of receiving sets in use in this country in excess of the current licences. But it is certainly considerable, as 300 people have been prosecuted for not taking out licences while in possession of receiving sets during the last six months. I should say at a rough guess that at least two and a quarter million receiving sets are in use in this country, and, compared to the United States, this means a greater number of sets per thousand of the inhabitants than in America. As we are a much poorer country, this in itself is a tribute to the success, so far, of the British Broadcasting Company.

It was rumoured that Lord Reading was to be the chief of the new B.B.C., but this has been denied.

A Significant Statement

The Postmaster-General's statement boiled itself down to his announcement

The Future of Broadcasting—*continued*

that the Government proposed to accept the findings of the Committee which sat last year under the Chairmanship of the Earl of Crawford and reported this spring. We are promised no interruption of the service, and the Postmaster-General used the following significant words:

> **"If broadcasting is to live in this country, I am certain that its vitality will be increased directly as you can succeed in divorcing it from political activities."**

If the Government lives up to its own professed intentions of not interfering unnecessarily, this is satisfactory. But I shall show later that there is need for extreme vigilance if this policy is not to be departed from.

Statute Limitations

The Postmaster-General then examined the different methods by which the new broadcasting authority could be set up. He rejected the idea of making a statutory body. The reason for this is that experience in the Law Courts has shown that all the powers of a statutory authority must be strictly confined within the limits of the words of the statute, and for this reason a statute should be avoided. The Postmaster-General did not say so, but I presume he was thinking of the great developments of broadcasting which may be confidently expected in the future.

For example, it will be possible in a very few years' time not only to broadcast words and music, but even moving pictures by wireless. And it might be held in a Court of Law that the statute of the new authority did not empower it to take advantage of this presently-to-be perfected invention.

The Postmaster-General then stated that a Company could be formed under the Company Acts. He rejects this proposal because in order to maintain control, the Government would be forced to acquire or to hold shares, and this he considers undesirable.

By Royal Charter

The action proposed, therefore, is to apply to the Privy Council to grant a Royal Charter to an incorporated body which will be known in future as the *British Broadcasting Corporation.* This body will hold its licence under the Postmaster-General for ten years. Parliamentary sanction will have to be sought either by legislation, which means an Act of Parliament, or by Supplementary Estimates. In any case we are promised a draft of the petition to be laid before the Privy Council and all other relevant papers. These documents will be laid before Parliament previous to the discussion next autumn. This is a considerable concession to Parliament as representing the electors generally, and listeners in particular, and is something like a triumph for those who have carried on a campaign for a popular voice in any decision come to.

Finance

The Rt. Hon. William Graham, who was Financial Secretary to the Treasury in the Labour Government, and one of the members of Lord Crawford's Committee, pleaded that the accounts of the new Corporation be audited by the Comptroller and Auditor-General, and then come before the Public Accounts Committee of the House of Commons. This would give a good deal of control over finance to Parliament, and is an excellent suggestion. But Viscount Wolmer, M.P., the Assistant Postmaster-General, who replied for the Government before the debate ended, declined to be drawn on this point.

It was announced that the British Broadcasting Company has now been given authority to construct an experimental station at Daventry, using 20 kilowatts of power, and to work on a 300-500 metre wavelength.

Oscillation

The Government also made some sympathetic remarks about the oscillating nuisance, and declared that their inspectors had been calling on known oscillators and warning them, with good results. This is satisfactory so far as it goes, but one could not help wishing that the neutrodyne receiver were in general use in this country, and that the great invention of Mr. Scott-Taggart and Professor Hazeltine were more easily available for listeners in this country. When every licence-holder in Great Britain has a neutrodyne receiver there need be no more "howling."

Power and Wavelengths

I myself raised the question of the broad lines of future policy, referring to the need of six high-power wireless stations, giving alternative simultaneous programmes instead of the eighteen or twenty existing stations. This would have been the policy of the old British Broadcasting Company if it had been allowed to continue, with perhaps a three years' licence, renewable or otherwise at the end of that period, as advocated by the Radio Association in its evidence before Lord Crawford's Committee. But the Assistant Postmaster-General was careful to avoid this subject, and we shall have to wait for a more detailed statement of policy until the autumn.

Nor was any satisfaction given to the plea put forward for a wide wavelength band for broadcasting in this country. I am being forced to believe that if the progress of broadcasting is not to be checked in the next few years a broad band of between 300 and 3,000 metres, with gaps in it reserved for service purposes, must be placed at the disposal of broadcasting.

What Must be Done

That, then, is roughly the position. Now it remains for listeners to bring pressure to bear on their Members of Parliament to support certain safeguards which will be proposed in the interests of listeners when the Government's detailed plan comes before Parliament in the autumn.

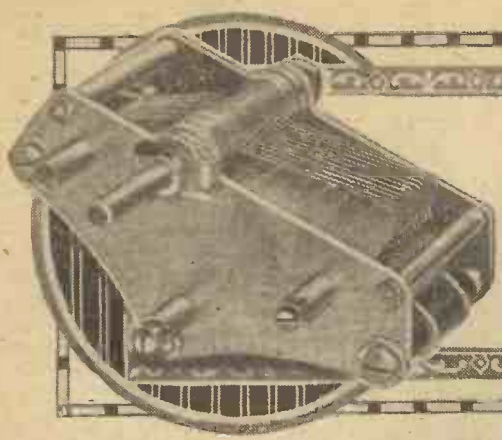
> **First and foremost we want financial freedom.**

The extraordinary proposal of Lord Crawford's Committee that the surplus of broadcasting should go to the State must be stamped upon by Parliament. It must be made absolutely clear that the proceeds of the licences go to the improvement of the service and the programmes.

(To be concluded.)

CONSPIRACY!

Some members of the Chinese National Party in Los Angeles once used a radio set to keep in touch with their friends in San Francisco.



"S.L.W." OR "S.L.F."?

By J. H. REYNER,

B.Sc. (Hons.), D.I.C., A.C.G.I., A.M.I.E.E., Joint Editor

In this article Mr. Reyner explains clearly the characteristics of the "straight-line-wavelength" and the "straight-line-frequency" condensers and their uses, and foreshadows an important development in condenser design.

ABOUT two years ago the craze for square-law condensers invaded this country, and the result is that the great majority of variable condensers in use at the present day are designed to have a square-law capacity curve giving a more or less linear relation between the dial reading and the wavelength. Indeed, the older pattern of semi-circular plate condenser has practically disappeared from the market.

New Developments

New developments are constantly being made, and it is interesting to consider whether, in view of the present state of radio, the square-law condenser is best suited to our purpose. Some twelve months ago the straight-line-frequency condenser was introduced in America, and received a welcome which gave the impression that it was the only type of condenser that was of any use. Such condensers have been made up in this country, but their use has not become general practice so far.

Let us consider briefly what happens with the various types of condensers, and how the shaping of the plates affects the tuning. The simple semi-circular plate type of condenser gives a directly proportional relation between the dial reading and the capacity of the condenser. That is to say, if the dial reading is doubled, then the capacity of the condenser is also doubled. There may in practice be slight departures from the true proportionality due to small secondary effects, but these are not serious and do not enter into the present discussion.

Capacity and Wavelength

Now a condenser of this type has certain disadvantages when used in a wireless circuit. This is due to the fact that the wavelength of a wireless circuit does not depend upon the simple value of the capacity, but upon the square root of this quantity.

If we have a given coil and we tune it with a given capacity, then the circuit will respond to a certain wavelength. If we double the value of the capacity, the wavelength to which the circuit will respond is not increased to twice its former value, but only to $\sqrt{2}$ times the initial wavelength, ie., about 1.4 times as great as it was before. If we wish to double the wavelength to which the circuit will respond we must increase the capacity in the circuit four times.

Wavelength Allocation

In this country (and in fact in Europe generally) the various broadcast stations have more or less been allocated on a wavelength basis. That is to say, there are more or less equal intervals of wavelengths in between the various stations. Consequently, if we are to obtain easy tuning, some arrangement which will give a more or less equal spacing of the wavelengths around the tuning dial is to be preferred.

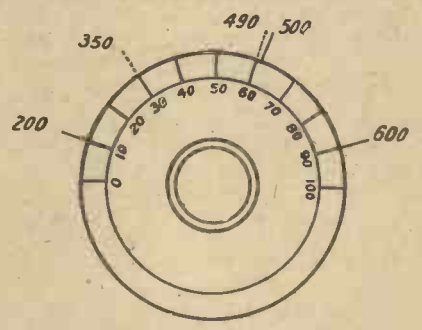


Fig. 1.—With the plain semi-circular plate type of condenser the wavelengths are unpleasantly crowded at the lower end of the scale.

Now from what has just been said it will be clear that a semi-circular plate condenser will not give the required separation of the stations, but will tend to crowd the stations at the bottom of the scale.

An Example

Let us take a practical example. Let us assume that towards the bottom of the condenser (say at 10 divisions on the dial) we tune to 200 metres. Suppose we now increase this capacity three times, so that the dial reading is now 30 instead of 10. The wavelength to which the circuit will tune will be 200 multiplied by $\sqrt{3}$, which is 350 metres.

If we increase the capacity by an equal amount, so that the dial reading is 60, the wavelength will be 200 × $\sqrt{6}$, which gives 490 metres. Finally, by increasing the capacity by an equal amount once again, so that the capacity is 9 times the original value, we tune to a wavelength of 200 × $\sqrt{9}$, i.e., 600 metres, corresponding to a reading of 90 on the dial.

Crowding

These positions are indicated in Fig. 1, from which it will be seen that while the last 20 degrees on the scale only cover a wavelength of less than 100 metres, the 20 degrees between 10 and 30 cover a wavelength of 150 metres. In other words, the wavelengths all tend to crowd towards the bottom of the scale, which renders tuning very difficult.

It was to overcome this disadvantage that the square-law condenser was introduced. This type of condenser is so arranged that the actual capacity in circuit is proportional to the square of the dial reading. Thus if the dial reading is doubled, the capacity in circuit is four times the original value.

This is an example of the shape of plate used to give a "square-law" or "straight-line-wavelength" effect.

"S.L.W." or "S.L.F."?—*continued*

Special Plates

To achieve this result it is necessary to have specially shaped plates such that the capacity increases in the desired relation to the dial reading. There are many ways of accomplishing this, but for the purposes of this article we need only consider one. The diagram in Fig. 2 shows a common type of plate employed. This, of course, is the moving plate, the fixed plates being similar in form, but with suitable provision to allow them to be mounted up into a bank. With such a condenser equal changes of dial reading produce equal changes of wavelength, and tuning becomes very much easier.

A Frequency Basis

This type of condenser is useful therefore for stations separated by equal wavelength intervals. What actually determines the separation permissible between the various stations, however, is not really the wavelength, but the *frequency difference* between the stations. If the stations are too near they heterodyne each other and produce the continuous whistle which is unfortunately only too well known. Moreover, for a given frequency difference the wavelength separation is smaller on the shorter wavelengths. Two stations 5 metres apart at 300 metres would not interfere with each other, whereas if they were only separated by 5 metres at a wavelength at 600 metres there would be a risk of interference, because the frequency separation in the latter case is only half as much as it is in the former case.

This has led in America to the spacing of stations by frequencies rather than by wavelengths. With such an arrangement even the square-law condenser tends to crowd the stations at the bottom end of the dial, because they are no longer arranged on an equal wavelength separation.

A Solution

The obvious solution in a case like this is a condenser which will give an equal frequency separation on the dial, or, as it is called, a straight-line-frequency condenser. This type of condenser has been described before, and therefore need not be dealt with in great detail. It will suffice to say that such condensers must be designed to give a very small variation of capacity per degree at one end of the dial and a very large change at the other end. A common type of plate is that shown in Fig. 3.

This renders the design of such condensers somewhat awkward, it being a matter of great difficulty to arrange a sufficiently large maximum capacity to cover the broadcast band without making the condenser very large and unwieldy. In the common form of square-law condenser plate, as shown in Fig. 2, the spindle is not placed in the centre of the condenser, but more to one side. With a straight-line-frequency condenser this eccentricity has to be still further exaggerated, with the result that when the plates are all out the instrument takes up a large space on the panel.

Other Methods

This is a difficulty which can be overcome to some extent by different

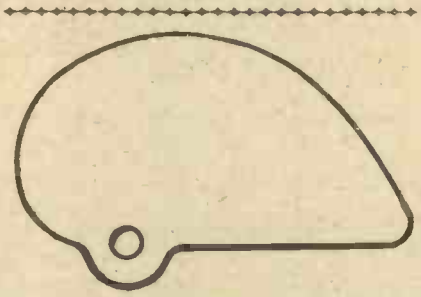


Fig. 2.—This diagram was drawn by tracing off the outline of one of the plates of a standard "square-law" condenser.

methods of construction. To mention two examples, Messrs. Peto-Scott and Bowyer-Lowe have both made up a condenser which takes up only a little more room than an ordinary semi-circular type, and yet which gives a variation of capacity such as to give a straight-line-frequency relation with an ordinary coil. In any case the

Fig. 3.—This is an outline of a plate from a straight-line-frequency condenser.

space occupied is a matter which can be tolerated if an S.L.F. law is desirable.

Is It Necessary?

There are many people, however, who consider that the use of a straight-line-frequency condenser is *not* desirable, particularly on this side of the Atlantic. A reference to a list of stations in order of wavelength will show that the stations in this country and in Europe are still more or less uniformly spaced as regards wavelength.

Moreover, the straight-line-frequency condenser, with the very large variation of capacity required at the top of the scale, tends to produce a very sharp tuning effect on the longer wave stations. Although the tuning is not actually any sharper, it feels so owing to the very uneven capacity scale of the condenser.

There is an undoubted advantage in separating stations at the bottom of the scale, but having regard to all points of view, the advantages and disadvantages are fairly evenly distributed.

Another Aspect

There is another aspect of the question, however, which has not yet been put forward, and yet which is one of considerable importance at the present time. This is the question of matching various tuned circuits, so that the dial readings shall all be alike. If this can be arranged the tuning is very much simplified and "gang-control" may even be a practical proposition.

If the dial readings are all to read alike then accurate matching of the various coils in use is essential. Moreover, the coils must be similarly wound so that their self-capacity shall be the same, and all the condensers in use must have exactly the same characteristics. To fulfil all these conditions simultaneously is a very difficult matter.

If they are fulfilled approximately then we get reasonably matched dial readings, which facilitate tuning, but if we are to adopt a gang control, that is to say, if we operate all the condensers from one spindle, then the conditions just laid down must be complied with exactly, or else some special balancing arrangements must be provided.

A New Condenser

When considering this problem several interesting points come to light, and I propose to discuss these in the next instalment of this article. The actual capacity curve of the condenser in question has a considerable effect upon the latitude which is permissible. In fact, there is one definite type of condenser, different from all those which we have just discussed, with which it is possible to balance up the various circuits by a simple zero adjustment on the condenser itself. I shall discuss this form of condenser, which is termed the logarithmic type, and compare it with the other existing patterns in my next article.

(*To be concluded.*)

NEXT WEEK
"Molly-coddling the B.B.C."

Amateur Transmitting Notes

QRA's Wanted

GZ-2B, MOS, 77LJ, FA-8RGS, FE-8VX, G-6ZQ, XU-2RV, BZ-SQ5, SME, SS-2SI, UR, SI1.
LA-1J, FA-8IP, FM-8MA, S-2BG, PI-CD8, PCPP, B-82, SSB-F2, FL1.
G-6IH, G-6JN, LA-2X.

QRA's Found

G-2BAV: A. R. Gardner, "Ashleigh," Abbots Langley, Watford, Herts.

R-FC6: J. Julio Hiver, San Martin 166, Santa Fé, Argentina.

R-FF9: Eugenio de Lamorte, Francia 64, Santa Fé, Argentina.

I-1BK: R. Spinotti, Piazza Vittorio Emmanuele N.5, Udine, Italy.

I-1FC: Carlo Forti, Via Galleria 9, Trieste, Italy.

LA-1X: J. O. Berven, Melandsgtn. 14, Stavanger, Norway.

O-A4Z (new address): J. S. Streeter, "Wood Green," Liesbeek Road, Rosebank, Cape Town, S. Africa.

G-6XF: C. Powell, 33, Bridge Street, Toll End, Tipton.

G-6ZP: 1472, Ashton Old Road, nr. Openshaw, Manchester.

New Call-signs Allotted

G-2CS: Norman Guy, "Roseneath," Elm Park Road, Pinner, Middlesex.

G-6TA: C. D. Abbott, 120, Cavendish Road, Balham, S.W.12.

G-6ZF: H. Ramsden, 15, Albert Avenue, Urmston, Manchester.

Cards Held

We shall be glad if the following stations, whose QRA's are unknown to us, will claim cards that we hold for them: BE-1AX, SS-8LBT, A-5KN, D-PK7, RRP, GCA, G-3WK, R-DD7, X-6XI, G-6EP, G-6CM, D-7XU, X-GB2, U-1XV, TPXX.

"GET ON WITH IT!" Some Readers' Comments

SIR,—I am certain that Mr. John Scott-Taggart is quite correct in all the points he puts forward in his article entitled, "Get on with It!" The B.B.C. is evidently pandering to someone, and by doing so is holding back the entire radio industry in this country.

What do the G.P.O. and the B.B.C. gain by dragging along as they are doing at present? Are they waiting until December 31 before any more work is done? They should both remember that America's present prosperity is largely due to the slogan, "Do it Now."

Yours faithfully,
F. L. SCOTT.

Burnham.

SIR,—I think it little short of a disgrace that the user of a valve receiver in several parts of the country can receive no more than two programmes (one of them from 5XX) well enough to be enjoyable. Until the B.B.C. wakes up and increases its power all round the radio world will not only stagnate, but fall backwards.

All thanks to Mr. Scott-Taggart for his article last week. Let us hope that someone will take his advice.

Yours faithfully,
M. CANE.

Oswestry.

SIR,—Mr. John Scott-Taggart's article, "Get on with It!" in the July 24 issue of WIRELESS, sums up my views on the position of the B.B.C. at the moment most admirably. It has been demonstrated that alternative programmes can be provided for crystal users even within three miles of the broadcasting station, but shall we hear any more of it? I think not. Until the B.B.C. pushes up the power of all its stations and wipes out all interference we shall move no farther forward in this country.

Yours faithfully,
J. M. WALTER.

Lincoln.

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Published by Radio Press, Ltd., Bush House, Strand, London, W.C.2, on Tuesday of each week, and printed for them by The Avenue Press (L. Upcott Gill & Son, Ltd.), 55-57, Drury Lane, W.C.2. Address for Subscriptions and Editorial Communications :—Bush House, Strand, London, W.C.2. Address for Advertisements :—Advertisement Manager, Wireless, Bush House, Strand, London, W.C.2. Registered as a newspaper and for transmission by Canadian Magazine Post. Subscription rates :—13s. per annum, 6s. 6d. for six months, post free. Sole Agents for Australasia :—Gordon & Gotch (Australasia), Ltd. For Canada :—Imperial News, Ltd. For South Africa :—Central News Agency, Ltd.