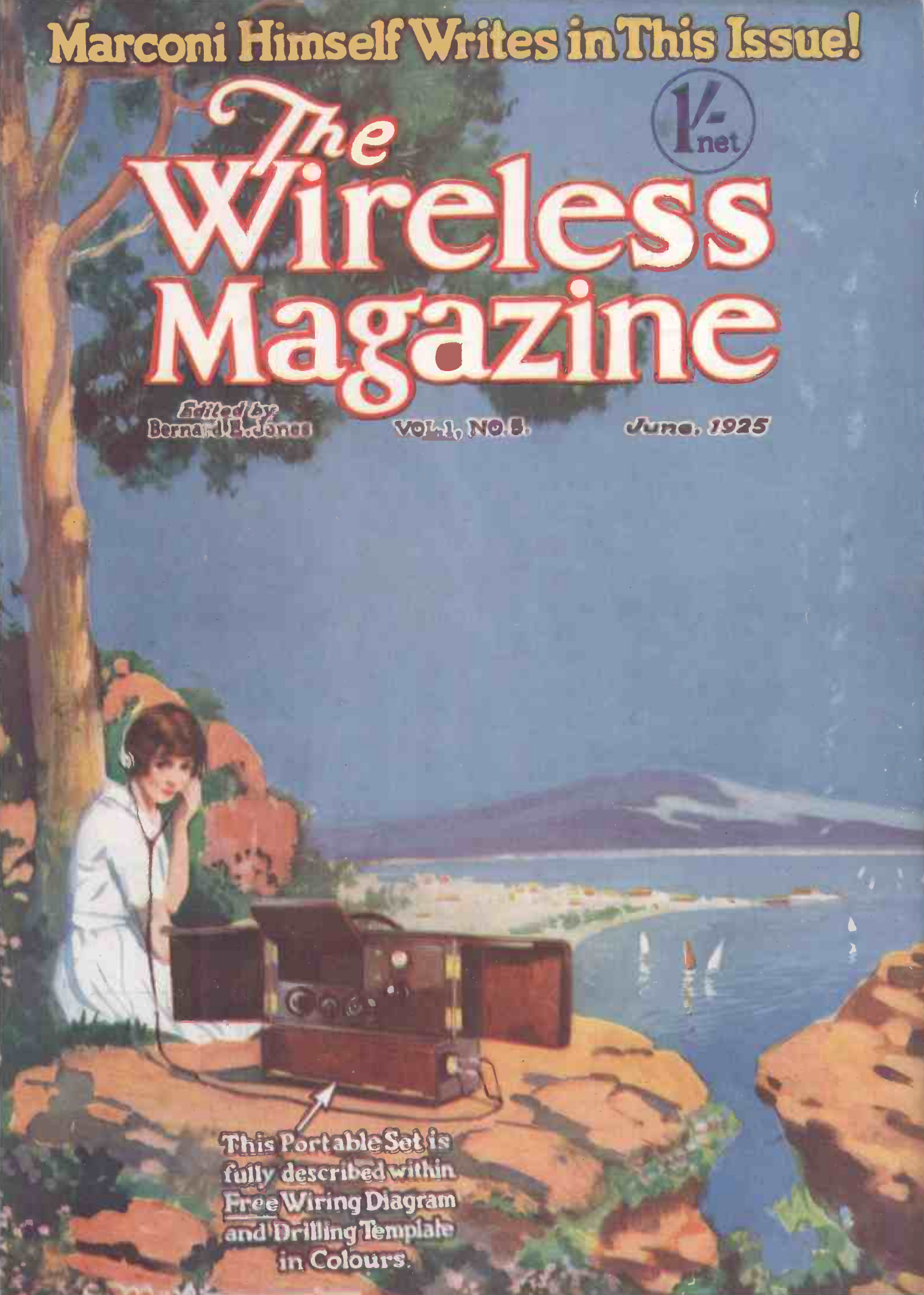
Marconi Himself Writes in This Issue!

The Wireless Magazine

1/- net

Edited by Bernard E. Jones

Vol. 1, No. 5. June, 1925



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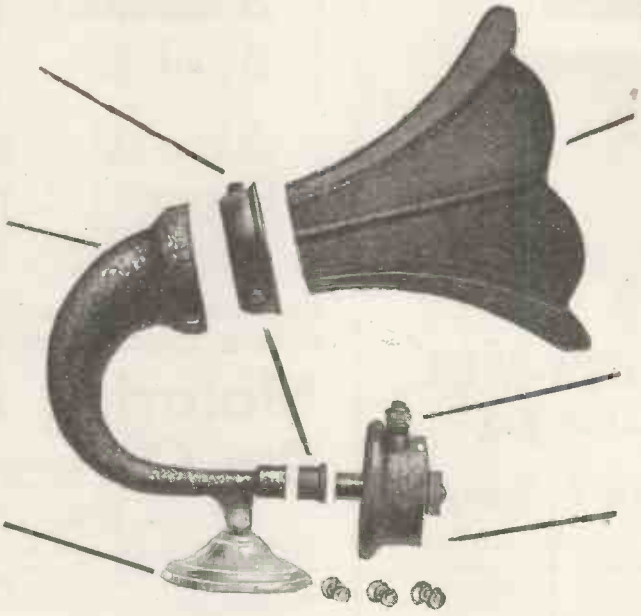

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Yours faithfully,
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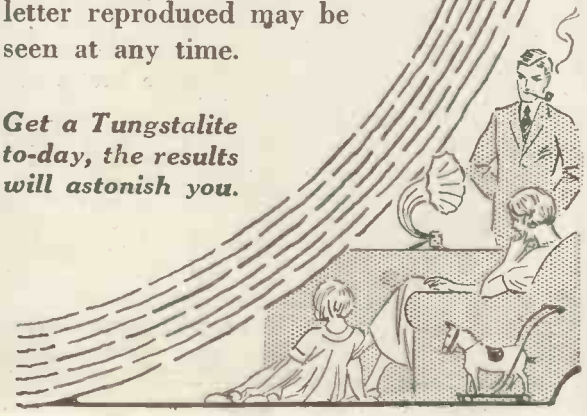

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The Wireless Magazine

June, 1925

Contributions, accompanied by stamped and addressed envelopes, are invited. All editorial communications should be addressed to The Editor, THE WIRELESS MAGAZINE, *La Belle Sauvage, London, E.C.4.*

HOME-CONSTRUCTOR SETS IN THIS ISSUE

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"THE COUNTRY CALLING"

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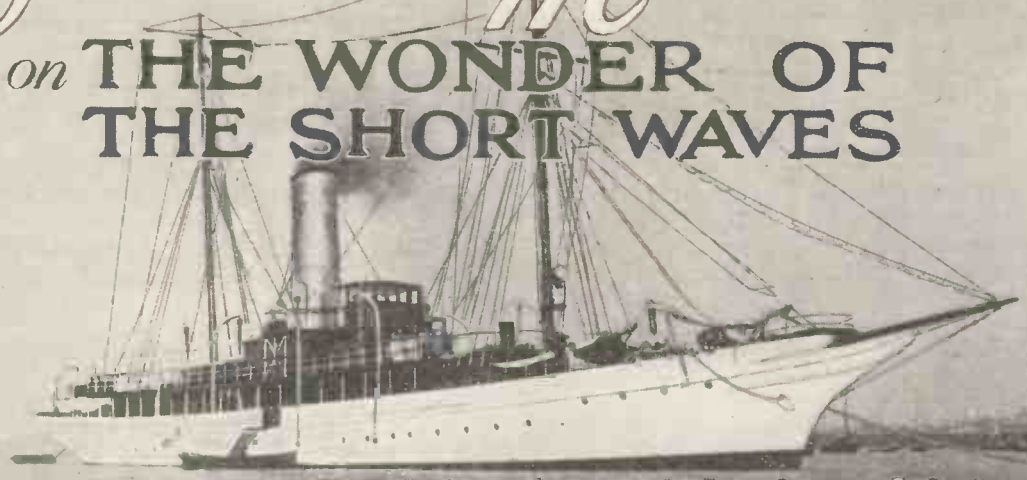
Registered at the General Post Office for transmission by Canadian Magazine Post.

Exclusive to "The Wireless Magazine"

Senatore Marconi

on THE WONDER OF THE SHORT WAVES



A Signed Article in which the Senatore Himself gives a simple account of His New System of Transmission.

THE art of radio communication might well adopt as its motto, paralleling a well-known Roman saying about Africa, "Ex radio semper aliquid novi," or, to put it in the vernacular, "Out of radio we are always getting something new."

Present Practice

For many years all the important radio communication enterprises of the world have been engaged in building bigger and more powerful stations, employing many hundreds of kilowatts in order to be able to send forth into the ether stronger and longer electric waves, which have, in some cases, reached a length of about fifteen miles, and all along, had a little more time been devoted to a systematic investigation of short waves, produced by a power equal to merely a fraction of that used in all the big stations of the world at present, the discovery might have been made that a modest 100-ft. wave, utilising only some 15 kilowatts or 20 h.p., could successfully travel from England to Australia and South America, even during daylight, and there reproduce easily decipherable telegraphic signals.

But most experts, basing themselves on theories which had not been thoroughly tested or on insufficient experimental data, had made up their minds as to what short electric waves could or could not do, and it was reserved for the years 1923 and 1924 to show conclusively that such short waves could and did perform efficiently and reliably most of the things which the experts had considered until then either impossible or impracticable.

Revolution in Methods

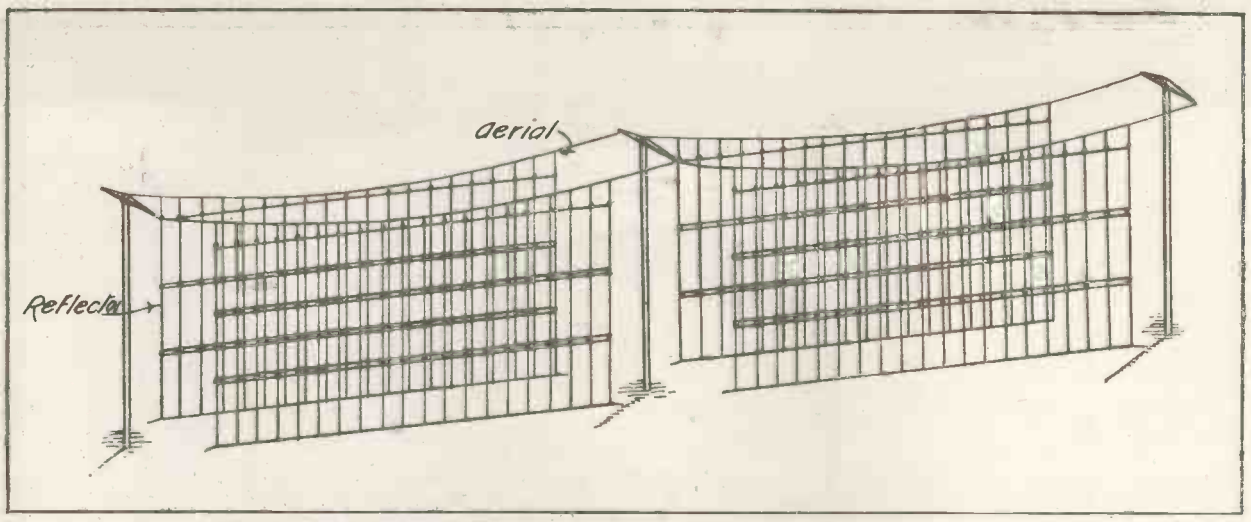
I think I am justified in saying, as a result of the experiments which I have carried on for a number of years and which culminated in 1923 and 1924, that a combination of short electric waves with what is known as the "Beam System" is likely to bring about what amounts to nothing less than a revolution in the methods of commercial long-distance communication.

The use of short electric waves is as old as the discovery of the waves themselves. Hertz made use of them in his first classical experiments, and he proved that they obeyed the same laws as the infinitely shorter light waves in regard to speed of propagation, reflection, refraction, and diffraction.

Twenty-nine Years Ago

In my own first experiments, too, in Italy and shortly afterwards in England, some twenty-nine years ago, I used short waves in combination with metallic reflectors, and curiously enough I was then able to transmit signals with them over a distance of one and three-quarter miles, while with the elevated antenna and much longer waves, that is, using the same system as is to-day used in all the high-power stations of the world, I could only manage to communicate at a distance of half a mile.

It is perhaps regrettable that the subsequent rapid development of the long-wave system, which in three or four years achieved such spectacular results, drew away the attention of most people, not only from the possibilities of the short



One form of Aerial, with Reflecting Screen, used for Beam Transmission.

waves, but also from the use of suitable reflectors to concentrate them into a beam in a definite direction, this being capable of accomplishment only with short waves.

I never quite abandoned the idea, however, of utilising the latter, and in addition I always realised the importance of evolving a practical directive system of radio communication.

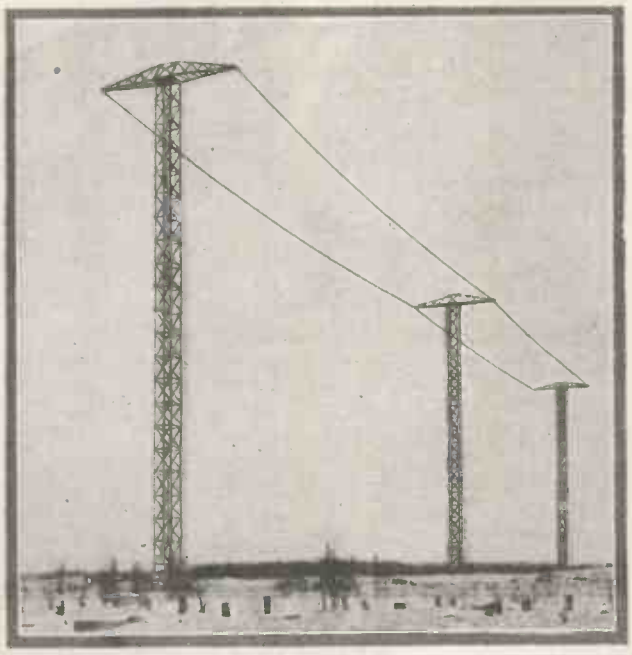
Valuable Waves

I believe it is generally admitted now that electric waves are far too valuable to be always allowed to spread out in every direction when it is desired to communicate with only one particular place. If a station in Great Britain wishes to communicate with one in the United States, for example, there seems to be no good reason why, if it can be helped, what it has to say should be heard in Siberia and Egypt, as well as in Nicaragua and India.

Naturally, non-directional stations, which scatter their waves in every direction, are of great utility for many naval and military purposes, and of course for broadcasting, where the very soul of the process lies in the fact that the waves are scattered all around to be picked up by anyone with a suitable receiving set.

But it has always seemed to me that, if possible, the right thing to do would be to concentrate the whole of the radiated energy into a beam directed towards the locality with which it is desired to communicate, just as the beam of light waves from a searchlight are thrown in one direction by means of reflectors.

Such a result is greatly desirable on many grounds, such, for example, as the low cost of installation and economy of upkeep entailed by the much lower amount of energy required, the reduction of interference with other stations, and the comparative secrecy which can be obtained.



Masts of the Canadian Beam Station being erected at Drummondville, near Montreal.

Economy of energy is a matter which is instantly translated into pounds, shillings, and pence. If we consider a high-power station such as the one lately built in the Argentine, for communication primarily with Europe over a distance of about 6,000 miles, every time the operator depresses the key and sends a signal flashing through the ether, some 800 kilowatts (about 1,100 h.p.) is expended, although in the case of these long waves only a small fraction of the power is radiated from the aerial, an aerial which, in this case, is supported by ten steel towers each 690 ft. high.

Decreased Cost

It is evident that if a signal as easily readable can be sent with 30 or 40 kilowatts (about 50 h.p.), and by means of an aerial supported by much lower and fewer masts, there will be not only a greatly decreased cost of installation of the station, but also a great reduction in the cost of operating.

With regard to the question of interference with other stations, it should be remembered that the number of available wavelengths is, after all, far from being unlimited.

For instance, if Brazil wishes to let New York know the prices of coffee and rubber on a certain wavelength, it would seem useless and in certain cases perhaps undesirable to broadcast the same information over

SENATORE GUGLIELMO MARCONI, G.C.V.O., D.Sc., LL.D. Born at Bologna April, 1874. Established communication across the English Channel in 1899. Transmitted from Poldhu, Cornwall, to St. John's, Newfoundland (a distance of 2,100 miles) in 1901. In 1902 establishment of communication between Canada (Cape Breton) and England announced. Invented his directional system in 1905.

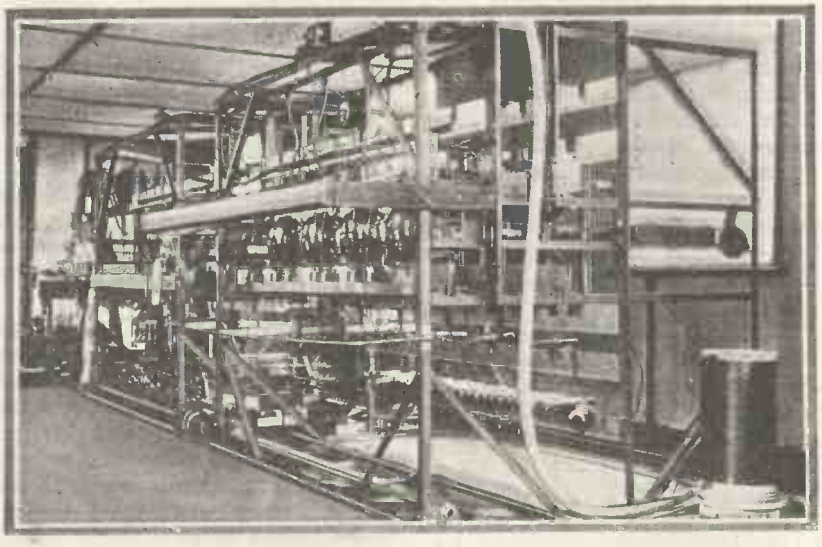
Guglielmo Marconi

Africa, Europe, the Pacific Ocean and probably a large part of Asia.

Secrecy

As regards secrecy, the beam system possesses a considerable advantage in so far as only places situated within a certain angle or sector of the beam are able to receive. This comparative secrecy or privacy, which cannot be obtained with any other system of radio communication, might prove of the greatest possible value in war time, and moreover, as has already been said, by reducing mutual interference, it will increase the number of stations that can be operated within a certain area.

During the early stages of the War I became convinced that we had allowed ourselves to get into a rut by permitting our attention to be monopolised almost exclusively by long waves, and I decided to take up the systematic study of short waves in combination with arrangements for directing them in any given direction.



A view of the Interior of the Short-wave Transmitting Room at Poldhu.

First Experiments

My first experiments along these lines, which were carried out in 1916, first at Genoa and then at Livorno, showed me that good directional working could always be obtained with properly constructed reflectors, and with the apparatus then available a range of six miles was obtained.

Further experiments, carried out by my assistant, Mr. C. S. Franklin, between Carnarvon, in Wales, and Ireland, and subsequently between Hendon, near London, and Birmingham, increased this range to nearly a hundred miles, and strong radiotelephonic speech was received with the use of a power of only 700 watts (less than 1 h.p.).

A very important result of these last experiments was the ascertaining that, when suitable reflectors were used at both ends, that is, one reflector to concentrate and project the waves in a beam and the other to focus them at the receiving end on the receiving aerial, the energy so received was some 200 times greater than when no reflectors were used.

The success of these experiments led me to carry out a series of tests between a small experimental transmitting station at Poldhu, Cornwall, and a receiver installed on my yacht, the *Elettra*, which would enable me to vary the distance between the transmitting and receiving ends at will.

Daytime Range

Until then most technicians were under the general impression that the range of short waves during daytime was variable and short, and though their night range was, as a rule, much greater, it was far too unreliable to be of any use for practical commerical work.

In addition it was thought that any considerable mass of land, especially if it were of a mountainous nature, would very materially reduce the working range.

My experiments, which were carried out chiefly with waves of about 100 metres in length and with about 12 kilowatts (about 16 h.p.), served to disprove a considerable portion of these beliefs and theories.

Long Waves

I knew, of course, like every other experimenter, that short waves, or at any rate short waves of the length I was then using, had much shorter ranges during daytime than at night. This fact was first observed by me in February, 1902, and my subsequent discovery that waves of the order of several thousand metres would on the average work as well by day as by night was one of the main contributory causes to the development of the use of long waves for long-distance communication.

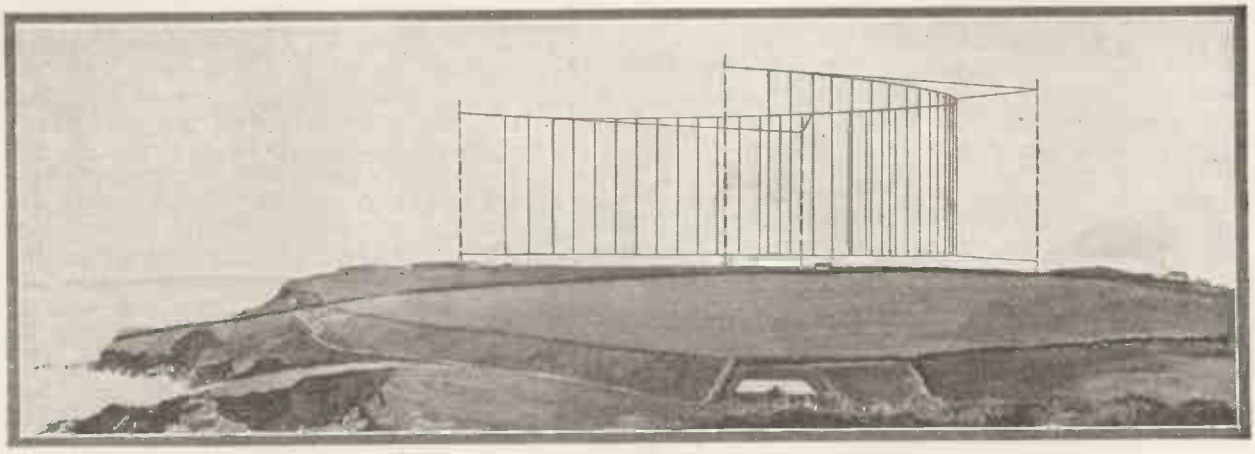
In the 1923 experiments with the *Elettra*, however, I found that the day ranges were reliable and of quite a respectable magnitude, that the night ranges were much greater than anyone, including myself, had expected, and that intervening land and large portions of continents, mountainous or otherwise, did not prove any serious obstacle to the propagation of short waves.

"Day-range" and Sunlight

I found also, which was extremely interesting and important, that "day-range" is not quite an accurate term, as the strength of the signals received varies definitely and regularly in proportion to the mean altitude of the sun over the space between the two communicating stations. That is to say, the "day-range" depends on the particular time of day.

We started off from Falmouth, and even when we reached Seville and were anchored in the Guadalquivir River, a very unfavourable position for reception, as the banks of the river are high and covered with trees and buildings, we found that the night signals were almost as strong as they had been in Falmouth Harbour, twelve miles from Poldhu, although at Seville the whole of Spain, consisting of over 300 miles of high and mountainous land, intervened between the sending and receiving stations.

When we reached the Moroccan coast at Casablanca, I gave instructions that the reflectors at Poldhu should be set up, and we then proceeded to the Island of



Parabolic Reflector at the Marconi Experimental Beam Station, Poldhu.

Madeira and finally to St. Vincent, in the Cape Verde Islands, where, at a distance of 2,230 nautical miles, we continued to receive the night signals with such strength that it was nearly always possible to do without an amplifier or to disconnect the aerial or put it out of tune.

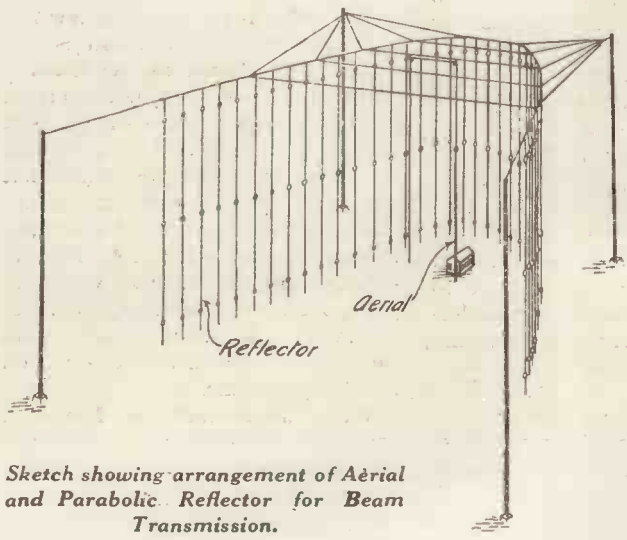
In fact the signals were so extraordinarily strong that we never experienced the slightest trouble in consequence of atmospherics.

Low Power

The power then being used at Poldhu was about 12 kilowatts and the reflector so concentrated the energy in the direction of the Cape Verde Islands that the strength of the signals was such as would have required 120 kilowatts at Poldhu without the use of reflectors.

As I was obliged to return to England without going any farther, I gave instructions to diminish this power gradually and found that with only 1 kilowatt (about 1½ h.p.) the signals were still stronger than would have been required to carry on commerical work at night at that distance.

It is interesting to note that these night signals, received at St. Vincent, even when Poldhu was using only 1 kilowatt, were much stronger than those which could be received from the high-power station at Carnarvon or the British Government station at Leafield (using 200 to 300 kilowatts) or from any of the other European or American high-power stations.



Sketch showing arrangement of Aerial and Parabolic Reflector for Beam Transmission.

Further Tests

In view of these rather encouraging results, further tests were made early in 1924, between Poldhu, using some 17 kilowatts of power and waves of 92 metres, and a special receiver installed on the White Star liner *Cedric*.

The result showed that during the daytime signals could be received up to 1,400 nautical miles, and confirmation was obtained that their intensity was dependent on the mean altitude of the sun at all times.

Advantage was taken of these tests to ask engineers of our associated companies in Australia, Canada and the United States to attempt to listen to these transmissions from Poldhu, and, rather to my surprise, it was reported to us from Australia that they could be heard every day perfectly well in Sydney from 5 to 9 p.m. (Greenwich time) and again from 6.30 to 8.30 a.m., and this with what might be called an improvised receiver.

If we consider the position and the altitude of the sun, the preference of short waves for travelling over regions not illuminated by the sun was made manifest, for it appeared quite obvious that during the morning period the waves travelled between England and Australia in a westerly direction across the Atlantic, America and the Pacific, over about 12,000 miles, while during the evening period they must have travelled in an easterly direction across Europe and Asia, over the shortest distance, which is about 9,380 nautical miles.

No Waiting

I was, however, by no means satisfied, as one of the essentials of a good telegraph system, whether it be with or without wires, is to be able to transmit the messages as soon as they are handed in, and therefore the limitation of the period of working to practically the night hours constituted an undoubted disadvantage. And that this was so admitted of no doubt, so far as I had then gone.

For example, although the signals sent from Poldhu were received with great strength at New York, Rio, and Buenos Aires when darkness existed over the whole or the greater part of the track followed by the waves, no signals at all were ever received when the same

track, or the greater part of it, was exposed to the light of the sun. Even an increase of power, or the use of reflectors, only augmented the working hours very slightly.

I had the impression of being faced with conditions analogous to those produced by a fog on the transmission of light. If the fog be thick enough, no matter now much the luminous intensity is increased, the light waves fail to penetrate it for any considerable distance.

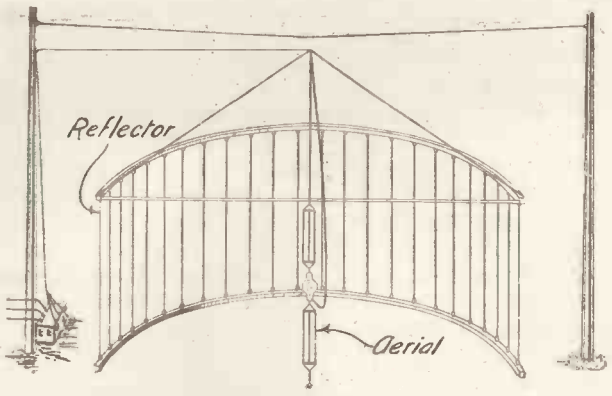
I therefore resolved to make further experiments between Poldhu and the *Elettra*, to see if some means could not be found of overcoming the limitation of working hours caused by daylight.

Decreasing Wavelength

I tried the effect of still further decreasing the wavelength, reducing it to 60, 47, and finally to 32 metres, and found that the "opaqueness" of space during daytime diminished rapidly as the wavelength decreased.

While during these tests, which were carried out in August and September of last year, the 92-metre wave could not be heard for many hours at Madeira at a distance of 1,100 miles entirely over the sea, at Beyruth in the Mediterranean the 32-metre waves were regularly received all day although the distance was 2,200 miles, practically all over mountainous land.

This discovery was so extremely interesting and satisfactory that I thought it wise to confirm it over still longer distances, and in October and December of last year, with only 12 kilowatts of power at Poldhu, it was found possible immediately to transmit signals and messages to New York, Rio, and Buenos Aires when the whole of the track separating these places from Poldhu was exposed to daylight, and also that

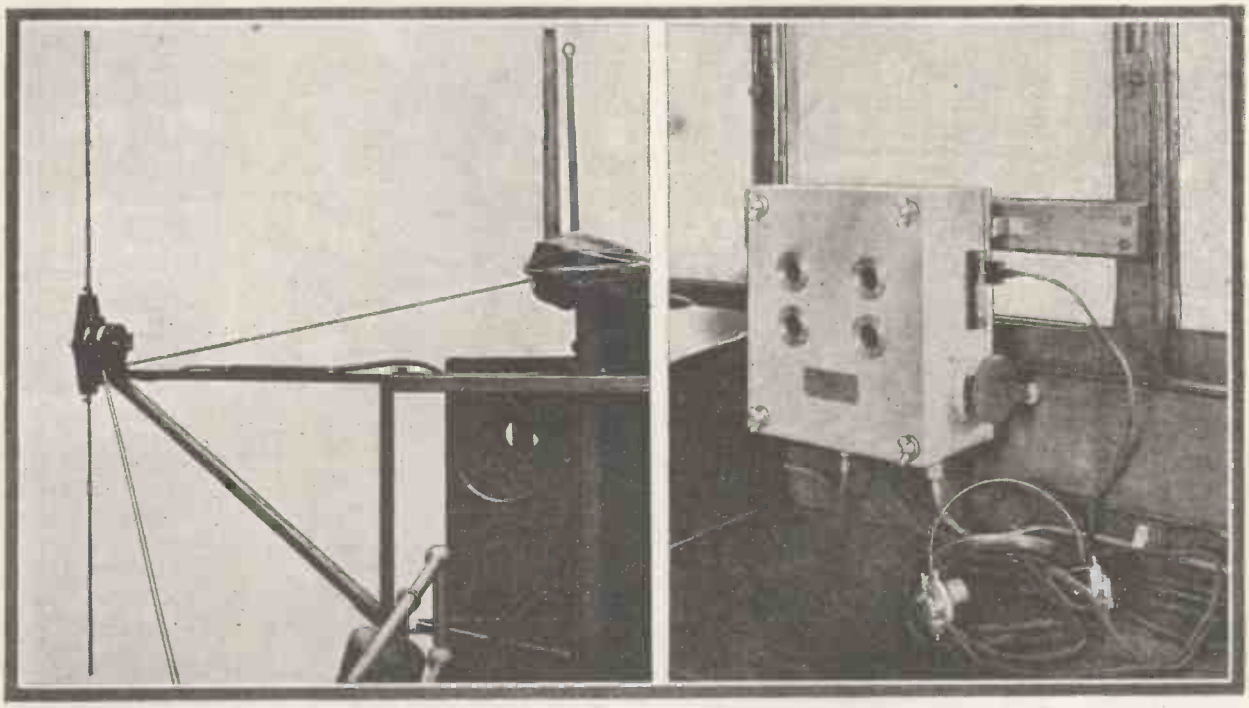


Another form of Aerial and Reflector for Beam Transmission.

Poldhu was able to communicate with Sydney, in Australia, for a period of twenty-three and a half hours out of the twenty-four.

Conclusion

To sum up the impression produced on my mind by all these experiments, I can say that I am now firmly convinced that the day is fast approaching when beam stations, using short waves and employing a fraction of the power utilised in the present high-power stations, and with much lower and fewer masts, will be able to carry on communication at practically any time between any two points of the earth's surface and at much higher speeds than is now possible. For it should be mentioned here that very high speeds appear to be possible only with short waves, and therefore even if only a portion of the twenty-four hours were utilised a much greater number of words



A Beam Receiving Aerial as used on the s.s. "Royal Scot." The Aerial is a vertical copper rod, and a special connection is taken to the receiver.

The Marconi Beam Receiver on the s.s. "Royal Scot." The only adjustment needed is the rotation of the handle on the right of the box.

could be transmitted than would be possible with the slow-speed long-wave service even should it be found capable of working during the whole of the twenty-four hours.

It should also be borne in mind that although communication at great distances has been obtained without the use of reflectors, still I am of opinion that these will be found essential for the carrying on of commercial high-speed services: because, apart from their directive effects, they enormously increase the effective strength of the signals, thus minimising the effects of what is known as "fading" and also increasing the margin of readability of the signals.

For some time the practical technical side of radio has been far in advance of the theory of the subject. We have known a great deal about the methods of producing electric waves and about the various methods of receiving such waves, but our knowledge of the conditions that govern their propagation through space is far from exact.

Otherwise, as I have said, we might have known long ago that it was possible to send messages to Australia throughout the twenty-four hours on a 30-metre wave with only 10 or 12 h.p. of energy in the aerial.

However, now that this has been ascertained and confirmed by numerous experiments, I have no doubt that the development of short-wave beam stations will be more rapid than that of the old super-power stations, and it is my firm personal opinion that these latter will, sooner or later, be found to be uneconomical and comparatively inefficient.

One final point remains to be mentioned in connection with these newly-discovered properties of short electric waves. We may be on the threshold of a day when broadcasting, that application of radio which interests the whole of the civilised world, will have its range enormously increased.

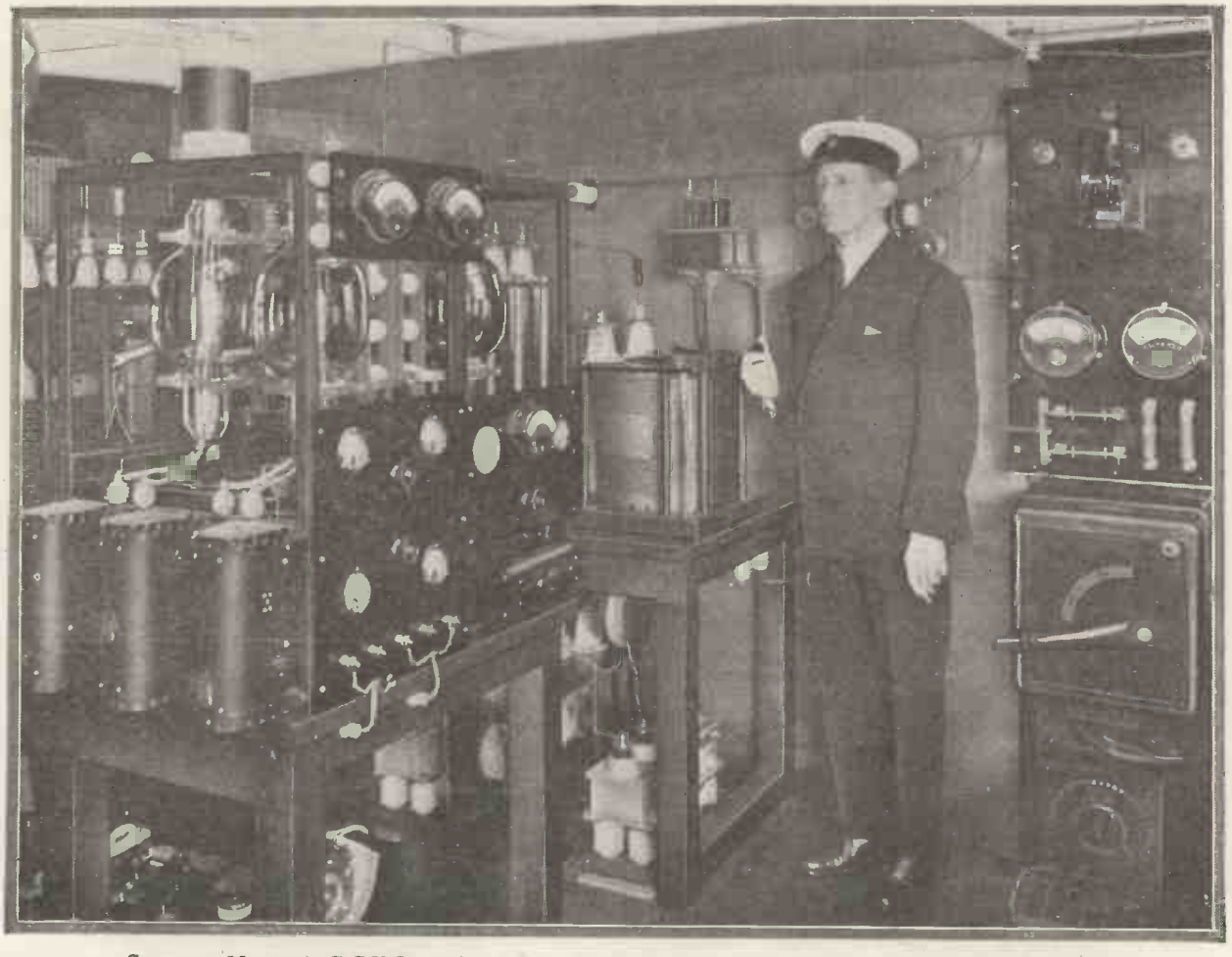
Within a year or two, the voice of the King of England, for example, may be easily and clearly heard by millions of his subjects in places as far apart as India, Australia, Canada, and South Africa.

A service in Westminster Abbey, with its sermon, choral and organ music, may be clearly heard in Cape Town.

It may become as easy to listen-in for the Metropolitan Opera of New York in London as it would be in Philadelphia.

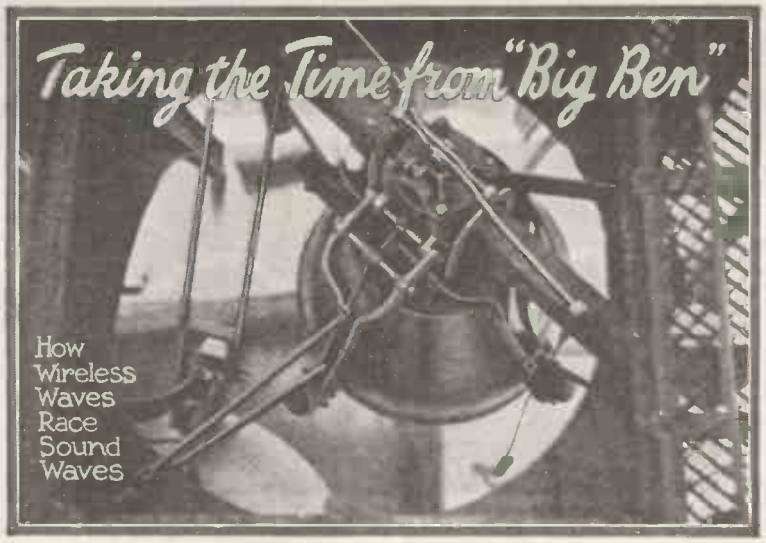
Perhaps the voice of the short wave will be able to accomplish for human brotherhood and our common civilisation what has not yet been done by the better-known long waves, although radio is already one of the most powerful agents in the linking of mankind into one great whole.

G. Marconi



Senatore Marconi. G.C.V.O., D.Sc., LL.D., in the Transmitting Room on his yacht "Elettra."

Taking the Time from "Big Ben"



MOST of us wireless folk now take our time from "Big Ben," no matter where we may live, and newspaper paragraphs told us recently that the clang of "Big Ben" had been heard in far-away America.

We have also been told, and rightly told, that few people can see "Big Ben," the name being given to the big bell hung in the tower of the Houses of Parliament, and not to the clock, as many people are led to suppose.

And another rather puzzling paragraph told us that many people near London could hear "Big Ben" by wireless and afterwards go out of doors and hear the very same strokes again, as indeed they may.

"Big Ben's" History

The first "Big Ben" was put up in 1856, but it was never a success, as it was damaged in its journey from Norton, Stockton-on-Tees, where it was made, to London, and after serving for a short time it was taken down and broken up.

The present "Big Ben" was cast in Whitechapel, from the same metal as was used for the former bell; it was put in its place during October, 1858. The tone is E, and its weight about 14 tons. The clapper or hammer which strikes the bell weighs 12 cwt.

The bell gets its name from Sir Benjamin Hall, First Commissioner of Works, who was in office at the time of the hanging of the bell.

It is, however, the problem of sound, and the hearing of the same hour of seven struck twice, that interests most listeners-in, but the explanation is simple enough.

It should be understood that there is a wide difference between the ether waves which carry wireless sounds and ordinary air waves that carry sound.

Ether waves (wireless) are practically instantaneous, and you hear "Big Ben" through your receiver at the precise moment of the clash, no matter what the distance may be—in this country at any rate.

Ordinary sound waves (that is, without the help of wireless) travel through the air at the approximate speed of one mile in five seconds.

How far the sound of "Big Ben" will travel by ordinary air waves is a debatable point, the distance depending upon several factors, chief being the direction of the wind.

TABLE 2

Clock and Wireless.	*1 mile.*	*5 miles.*	*6 miles.*
1st stroke .	0 secs.	5 secs.	25 secs	30 secs.
2nd " ...	4½ "	9½ "	29½ "	34½ "
3rd " ...	9 "	14 "	34 "	39 "
4th " ...	13½ "	18½ "	38½ "	43½ "
5th " ...	18 "	23 "	43 "	48 "
6th " ...	22½ "	27½ "	47½ "	52½ "
7th " ...	27 "	32 "	52 "	57 "

Sentries at Windsor Castle, however, are said to hear the striking of "Big Ben," and of the clock at St. Paul's Cathedral, on quiet nights, and Windsor is twenty miles distant.

The seven o'clock chimes, however, are not likely to carry so far because of the rival noises of a working world.

TABLE 1

Place.	*Wind.*	*Distance in miles.*	*Time, in secs.*
Highgate ..	S	5	25
Tottenham ..	S	7	35
Wimbledon ..	N E	7	35
Croydon ..	N	9	45
Woolwich ..	W	9	45
Ilford ..	S W	9	45
Bromley, Kent	N W	9	45
Chislehurst ..	N W	10	50
Enfield ..	S	11	55
Waltham ..	S	14	70
Watford ..	S E	16	80
Weybridge ..	N E	17	85
St. Albans ..	S E	19	95
Windsor ..	E	20	100

The above table (1) gives the names of a few places around London, their distances "as the crow flies," the most suitable wind to carry the sound of the bell, and the time taken for the sound to travel.

There is an interval of 4½ seconds between each stroke of "Big Ben," and knowing this—and the rate the sound travels—calculations can easily be made.

Blackfriars Bridge, Vauxhall Station, and the Elephant and Castle, are each exactly one mile from "Big Ben" and, obviously, at any of these places the last stroke heard can be heard by wireless at the open window 5 seconds later, while at King's Cross the stroke would be heard 10 seconds later, because it is exactly two miles distant.

At no point less than six miles from Westminster could the same striking of the hour of seven be heard twice over, as is proved by Table 2, which gives the times for the seven strokes and their passages through space.

We see by this that the striking of the hour of seven takes 27 seconds. Therefore at five miles a listener-in would miss the first clash coming in the ordinary way of sound, and would get the 2nd clash in 2½ seconds (29½ seconds after the real or wireless sound), the others following at intervals of 4½ seconds.

Repeat Performance

At six miles, however, the striking, *via* wireless, would be finished in 27 seconds, and we could listen at a window for a repeat performance, the first stroke being due 3 seconds after the seventh stroke by wireless, actually 30 seconds after "Big Ben" did really strike.

If it were possible for ordinary sound waves to carry the striking of "Big Ben" as far as Edinburgh, the listeners-in of the Scottish capital would hear the first stroke about 24 minutes after hearing the seven strokes by wireless.

P. R. S.

A CONTINENTAL listener says that the English programmes are much in demand in Belgium. But if the Belgians expect to hear the same sort of English as was taught to them by British soldiers during the war, they will be disappointed.

A FOOLPROOF REFLEX SET

for Volume

for Selectivity

Designed, Built & Tested in "THE WIRELESS MAGAZINE" Workshop

DURING the last two or three years many circuits have been produced which, for some unaccountable reason, have not earned the popularity they deserved.

The theoretical circuit shown here is a good example of what is meant. Here is seen a system of "reflexing" in which all the advantages of the crystal rectifier —its clarity and faithful reproduction — are retained while a greatly added sensitivity is obtained by the inclusion of a valve in the crystal-detector circuit.

How the Set Works.

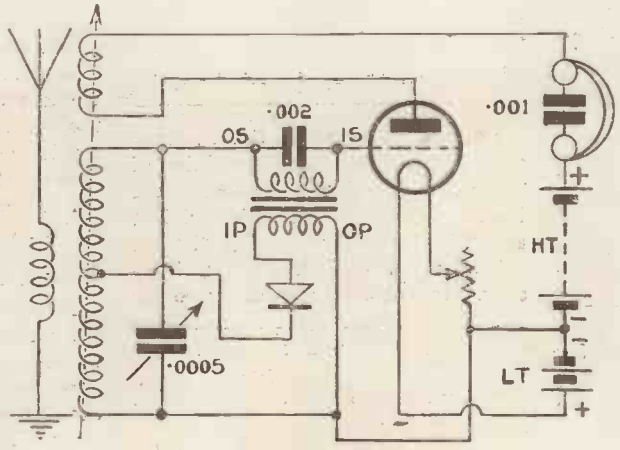
The greatest defect of the crystal detector is its inability to bring in distant stations. In this set, the crystal detector is connected to the centre turn of the grid coil, enabling H.F. currents induced in the grid coil by the aperiodic aerial coil to reach the grid of the valve. These H.F. oscillations are slightly amplified and fed back through the reaction coil to the grid coil again.

A great increase in sensitivity is thus obtained. The same valve acts as a low-frequency amplifier, magnifying the oscillations detected by the crystal.

The selectivity of the set is particularly good and is controlled by the selection of the point on the grid coil to which the crystal detector is connected.

Components Required

For building the set the following components will be required :—



Circuit Diagram.

1 Radion ebonite panel, 13 in. by 7 in. (American Hard Rubber Co., Ltd.).

1 ·0005-microfarad square-law variable condenser (Peto Scott).

1 L.F. transformer, having a ratio of 4 or 5 to 1 (Radio Instruments).

1 ·002-microfarad fixed condenser (Lissen).

1 ·001-microfarad fixed condenser (Lissen).

1 valve holder (Athol Engineering Co.).

1 filament rheostat (Burndept "Dual").

8 terminals.

1 ebonite terminal strip.

1 crystal detector (Portable Utilities, Ltd., "Eureka Gravity").

Nos. 18- and 26-gauge d.c.c. wire for coil winding.

1 wood baseboard, 11 in. by 7 in.

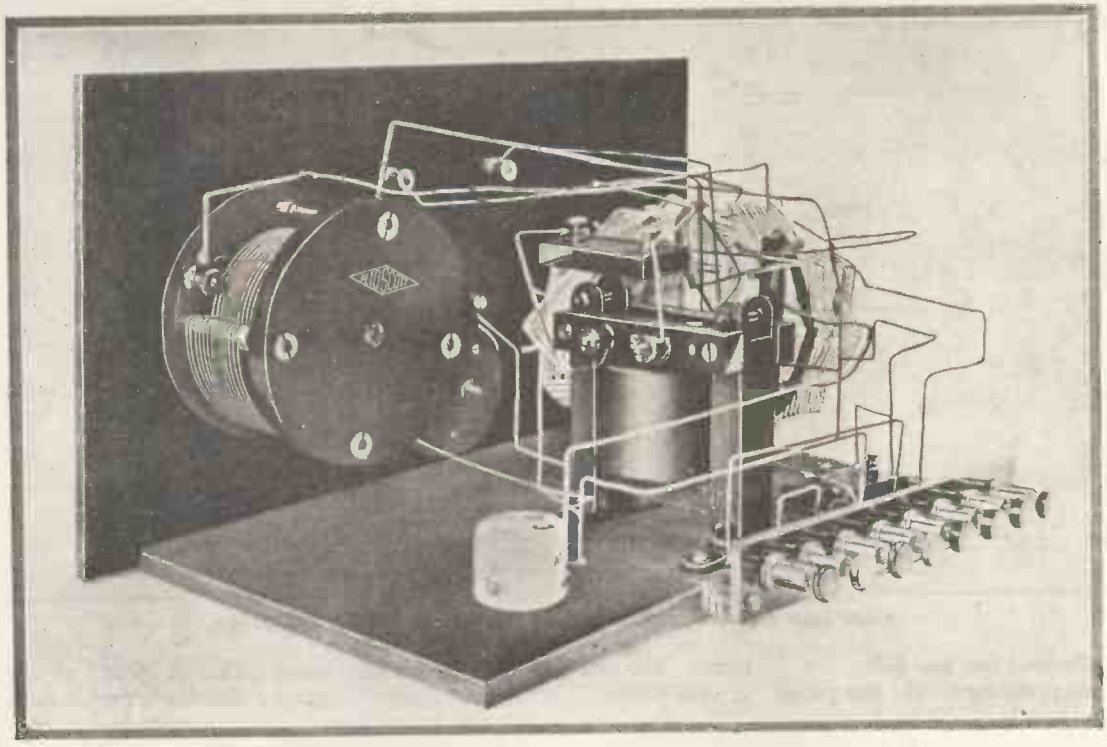
1 ebonite indicating dial complete with 2 B.A. screwed brass rod, 6 in. long, spring washer and lock-nuts.

Panel and Baseboard

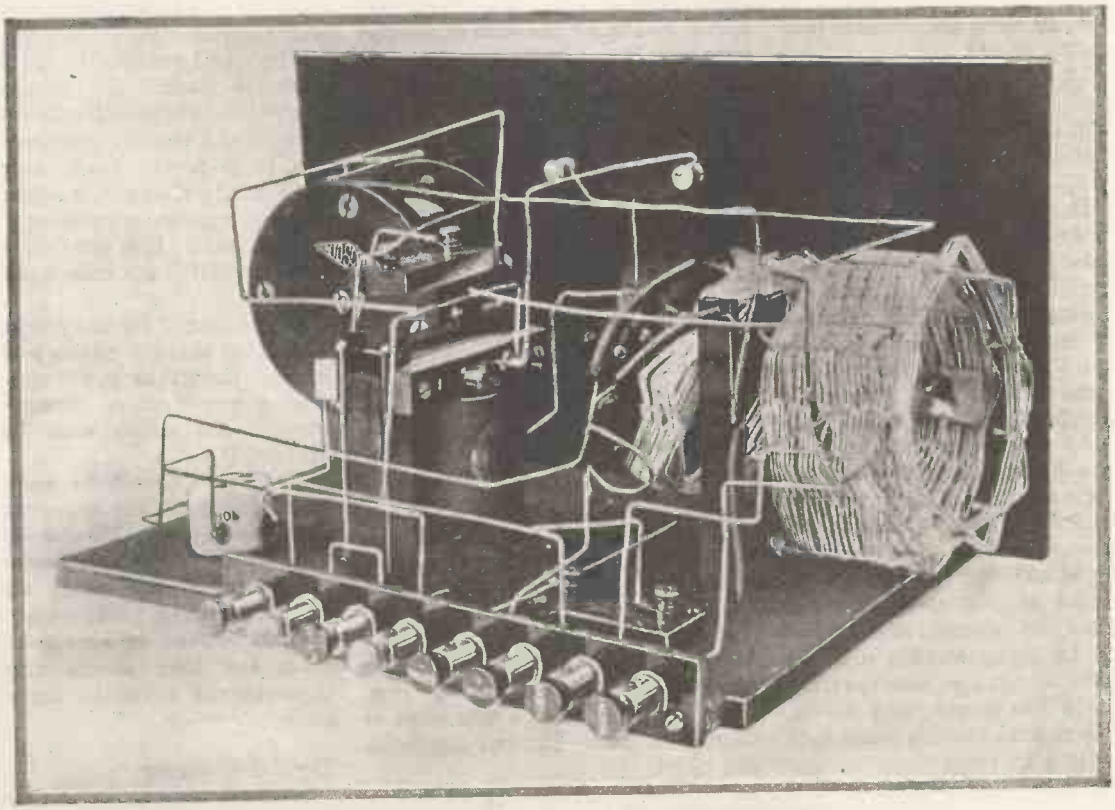
The bottom of the panel is fixed to the baseboard by means of three countersunk brass screws, ¾ in. in length. On this baseboard is mounted the valve holder, transformer and the fixed condenser, while at the back edge of the baseboard the ebonite terminal strip is mounted.

In this manner all external connections are made to the back of the set, giving the panel front a clean

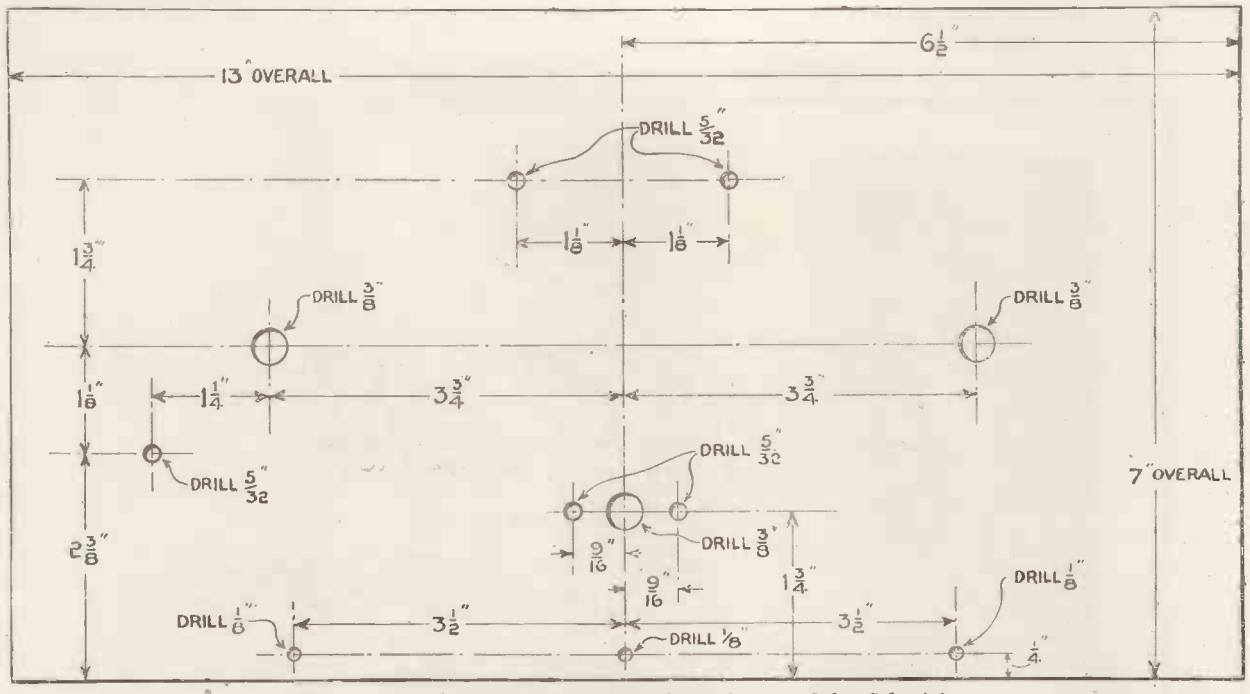
(Continued on page 488)



View of Back of Reflex Set showing Disposition of Components.



Another View of the Set showing Details of the Coils.



Panel Layout of Foolproof Reflex Set for Volume and for Selectivity.

(*Continued from page 486*)

and neat appearance. On the panel itself the variable condenser, crystal detector, filament resistance and the grid and reaction coils are mounted. With the exception of the three coils, the construction of which is yet to be described, all these components may be mounted on the panel and baseboard.

Winding the Coils

A suitable former for winding these highly efficient low-loss coils is shown in the photograph, with a coil partly wound on. A piece of ¼ in. thick ebonite, 5 in. square, and 9 screwed 2 B.A. rods, with 18 2 B.A. nuts are required. On the ebonite mark out a circle 4 in. in diameter.

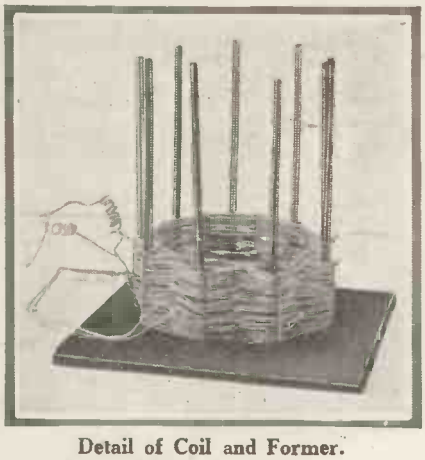
The circumference of this circle must be divided into 9 equal divisions. At the 9 points 2 B.A. clearance holes, through which the rods are pushed and clamped by a nut at each side of the ebonite, are drilled.

The grid coil, comprising 40 complete turns of No. 18-gauge d.c.c. wire may be wound first. Start winding by going outside one rod and inside the next, outside the third and inside the fourth, and so on. At the 20th turn leave a small loop of wire for a tapping.

Before removing the coil from the former it should be bound with stout cotton at each cross-over of the turns. The coil will thus be bound in nine places.

The aperiodic aerial coil consists of 8 turns of the same gauge wire wound in a similar manner.

The reaction coil need not necessarily be wound on the "low-loss" principle, but for the sake of appearance it is better to do so. Between



Detail of Coil and Former.

30 and 40 turns of No. 26-gauge d.c.c. copper wire are required.

Bind the aerial and grid coils together and fix them to the panel by means of a countersunk 4 B.A. screw and nut, using a thin piece of ebonite to clamp the coil rigidly to the panel.

The reaction coil is taped to the spindle in such a manner that it can swing towards or away from the other coils. A glance at the photographs will show what is meant.

Wiring Up

No difficulty should be experienced in wiring up the set if reference is made to the wiring diagram and the photographs.

The usual practice of spacing the wiring—especially the plate and grid leads—should be followed out. All connections should, wherever possible, be soldered. Until the set has been finally tested it is advisable to make temporary connections to the reaction coil. It is possible that the reaction coil leads may have to be reversed.

It is essential for the proper functioning of this set to use a suitable valve. On actual test it was found that a power valve gave the best results, the valve used being a Mullard D.F.A.1.

The valve should be worked on that portion of the curve where it does not rectify. This is done by suitably adjusting the potential on the plate of the valve, and the filament current.

Other valves, of course, may be used, but they should possess a characteristic curve having a good straight portion.

Crystal Detector

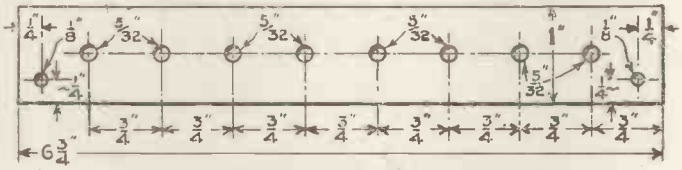
We have used in this set a crystal detector designed on unique lines. The crystal itself is contained in a

Constructing a Foolproof Reflex Set

small drum which is capable of rotation on an horizontal axis.

When in search of a sensitive spot the drum is slowly rotated, causing movable points or catwhiskers to fall down on to the crystal, one at a time, under the force of gravity.

Any good crystal detector may be used, provided it is sensitive. The one described, however, is practically foolproof and is extremely simple to operate.



Layout of Terminal Strip.

Using the Set

A little practice by the operator will soon make him efficient in the operation of this receiver. As already stated, the selectivity of the set may be controlled by selecting the point on the grid coil to which the crystal lead is attached.

If the connection is made at the same point from which the grid lead is taken the resultant signals will be loud, but the tuning of the set will be very broad. This is not a disadvantage in remote parts of the country where much interference is not experienced.

As the crystal-detector connection is moved farther away from the grid lead the selectivity is increased, but there is a slight decrease in signal strength. The best position is a matter of experiment, but the middle turn of the coil will give good results.

Polarity of Reaction

Having connected up the aerial, earth and batteries, the first thing to do is to test for correct polarity of the reaction coil. This is done by tightening the coupling between the grid and reaction coils.

If signal strength is not increased, but actually diminished, the reversal of the two reaction-coil leads is necessary. For maximum sensitivity the reaction coil should be so adjusted that the set is just off the oscillating point.

On a test aerial situated near London, 2 L O was received at fair loud-speaker strength. Other stations received on the phones were Birmingham (very strong), Cardiff, Bournemouth, Manchester, Newcastle, Glasgow (rather weak), Le Petit Parisien, Postes et Telegraphes, Hamburg (on the weak side) and Madrid.

A photograph of the completed set is given on the next page.

Cabinet

So far, it will be noticed, no reference has been made to a cabinet for the receiver, the design of a suitable case being left to the discretion of the constructor.

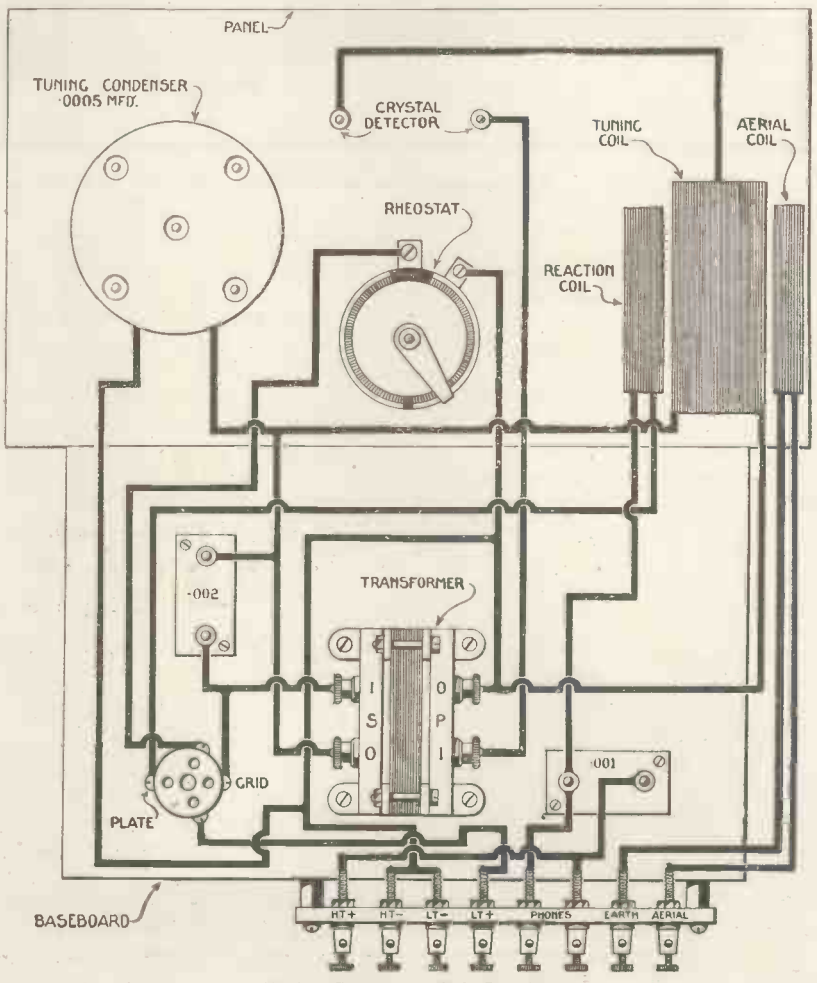
To take full advantage of the design of the set it is desirable to have some form of cabinet into which the whole baseboard and panel can be easily slid. In this way adjustments can be quickly carried out, a point of some moment when first using the set.

Alternatively, if it is not desired to construct a special cabinet, use can possibly be made of some discarded piece of furniture in the house.

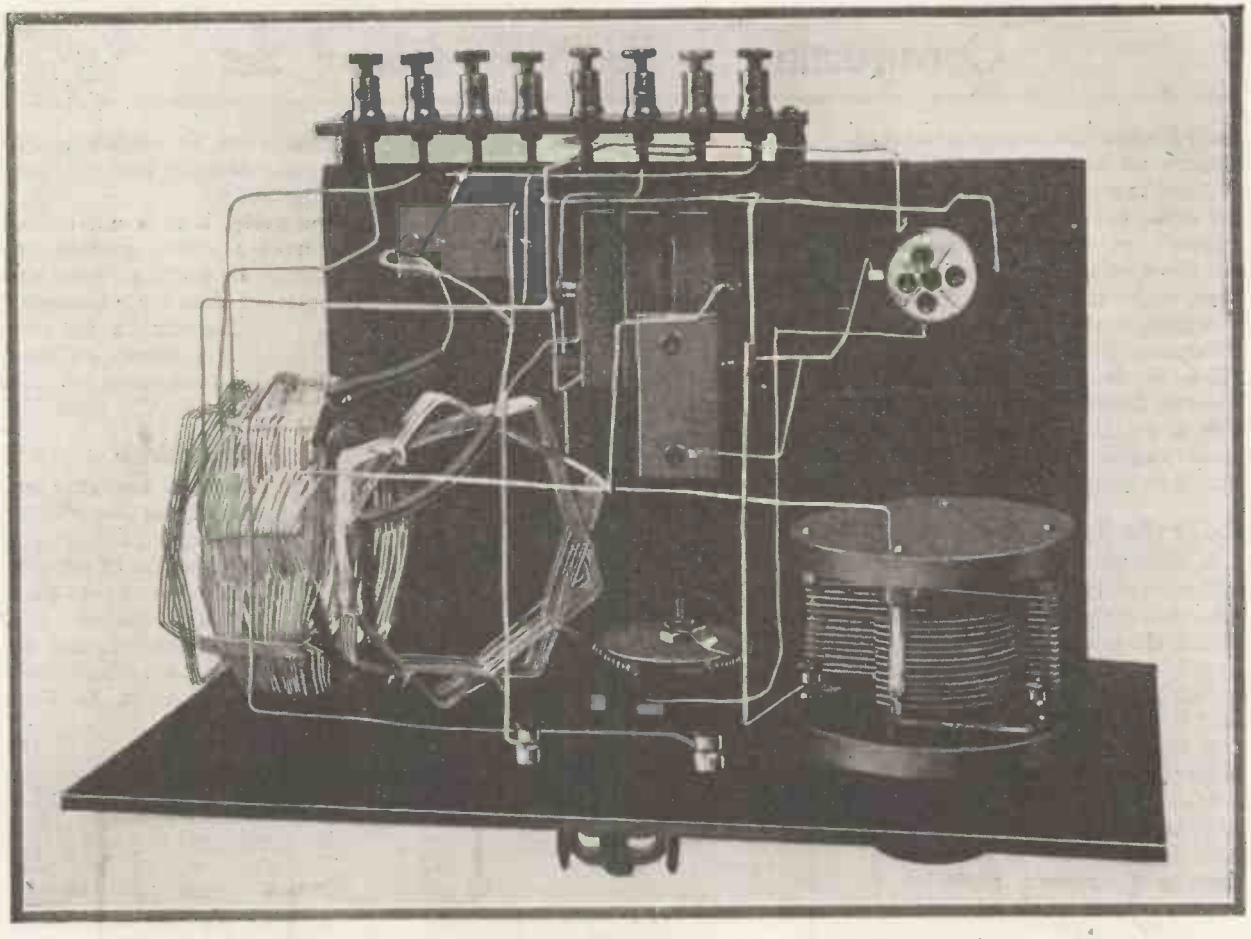
Suggestions for suitable cabinets on these lines are given on later pages in this issue.

Free Advice

Should you have any difficulty in constructing or operating this set you are invited to make use of our free information bureau. Send your questions (not forgetting to enclose a self-addressed stamped envelope and the coupon on page 583) to : The Editor, THE WIRELESS MAGAZINE, La Belle Sauvage, London, E.C.4.



Wiring Diagram of Reflex Set.



Photographic Plan of Foolproof Reflex Set *(see four preceding pages).*

RIPPLES

IN the land of loops, grounds and antennæ, "valves" are "wireless tubes." Hence the following:—

Toothpaste, cold cream, tyre cement and wireless programmes can be squeezed out of tubes. In town millions of people are squeezed into tubes — morning, noon and night.

Tubes may be of lead, glass, brick, iron, steel and cement. Some tubes are made by the mile and sold by the ride, whilst other tubes are made by the piece and sold for many pieces of change.

Tubes can be made to carry electrons, water, oil and gas—in both its illuminating and conversational forms. Wireless tubes are peculiar in that the less there is in them the more they cost.

When an ordinary tube bursts you call in either the plumber or a receiver, but when a wireless tube burns out you say good-night.

Q.—I am just cranky about wireless, and have often seen the term "arc" in text books. What does this mean?—Claude Watteau (High-on-the-Hill, Ely).

A.—This was the first non-wireless-equipped vessel, owned and operated by Noah & Co. (strictly Ltd.). It was used for low-loss navigation through eddy currents during a heavily-damped period.—GRID.

* * * * *

The family was listening-in to a special programme.

"It seems faint," suggested mother.

"But think of the extra people listening-in to-night," said Billie.

* * * * *

If Paul Reverre lived in these times, instead of galloping through the night he would send a C Q by morse;

Columbus would be in great demand for wireless travellogues;

Lady Godiva would broadcast a lecture on "First Lessons in Bareback Riding";

That bout between David and Goliath would be broadcast direct from the scene by an eye-witness;

Nero would call attention to his fiddling by burning the filaments in a wireless transmitter instead of burning Rome.

* * * * *

This is the tale of William Bundy.

Bitten on Monday,
Crystal Tuesday,
Valve on Wednesday,
Two valves Thursday,
Reflex Friday,
Super Saturday,
Broke on Sunday.

That was the end of William Bundy.

* * * * *

"I do like this opera *Faust* they're transmitting to-night."

"What d'you mean? That isn't *Faust*, that's *Carmen*. They don't broadcast *Faust* until next Thursday.

"H'm—wonder if I can get something else?"

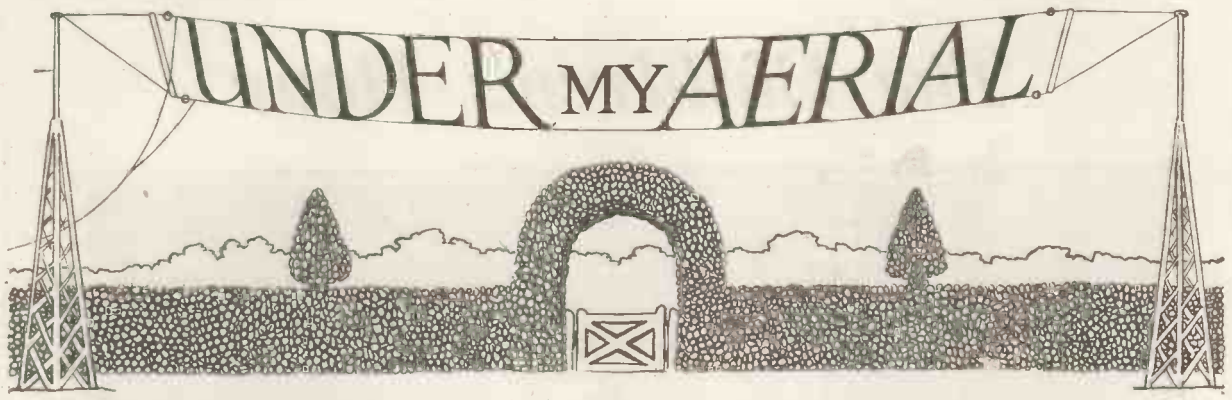
The Children's Hour

Photograph by Miss Janet Allan.

THE room is silent, faces rapt, intent,
Gaze into space; the Children's Hour is here,
That hour of wonder, joy and glamour blent,
Which brings the world of "make believe" quite near.

Music that fills young hearts with keen delight,
Marvellous tales of which they never tire—
When Fancy takes her most alluring flight—
Come floating, floating down the magic wire!

Verses by Miss Leslie M. Oyler.



When Wireless is a Nuisance

THERE are occasions when I wish that I knew nothing at all about wireless. Last Saturday noon I was hurrying home to a meal which I knew would be awaiting me, when I was stopped by a man to whom I had never spoken before.

"Excuse me," he said, "but I should esteem it a great favour if you would tell me what is wrong with my four-valve set."

"What is the trouble with it?" I asked.

"Well, I have recently re-wired it and I can only get Chelmsford with it now. None of the low-wavelength stations come through at all."

"Do you use plug-in coils?"

"Yes, the usual standard sizes."

"What kind of a set is it?"

"An A.C. set."

"An A.C. set? Does it hum?"

"Not just now."

"With knobs on?"

"Yes, with knobs on."

"Brass fittings?"

"No, nickel terminals."

"That explains it."

"But it doesn't. I had the same terminals before, when it worked so well."

"Yes, with knobs on."

"The set is an A.C. set, is it not?"

"It is."

"Have you ever tried a D.C. set?"

"No."

"What does A.C. stand for in your case?"

"All country."

"I see. How many high-frequency valves has the set?"

"One."

"What kind of high-frequency coupling do you use?"

"Tuned-anode."

"Just you take out your H.F. valve and connect the aerial to the grid and plate sockets of the H.F. valve holder. You can do it with a piece of bent wire and a couple of spent matches."

"But there is a switch to switch out the H.F. valve."

"Oh! really, though, I must not stop any longer. Send me your circuit diagram and your address and I will come round and look at the set one night next week."

"Right you are, many thanks."

When I arrived home, there was one small piece of a steak and kidney pudding waiting for me and that was cold. Wireless is a real nuisance at times—meal times for example.

Oh, Hull!

I hope that you listened-in to the "Dream of Gerontius," sung by the Hull Vocal Society, and broadcast from the Hull relay station not so very many weeks ago. I *didn't*, and I got into trouble for not doing so.

A member of my family, an important member, lives in Hull, and is a member of the Hull Vocal Society, as well as being a member of my family. I had strict orders to listen-in to the "Dream of Gerontius," and I had orders to invite as many members of the family as my house would hold, to help me to listen-in that night. But I did none of these things.

Hull has a wavelength not so very different from one or two main broadcasting stations, to say nothing of a number of powerful continental stations. I suppose that it would be a wireless impossibility to pick up Hull where I happen to live just now.

I have explained all this to the family but I am afraid that they have lost a little of their confidence in me as the family wireless wizard.

Pretty bad luck, isn't it? Next time Hull does something good and I am expected to pick up one voice specially out of a chorus of a few hundreds, I must get the B.B.C. folk to do a bit of simultaneous broadcasting for the family. Oh, Hull!

New Coils

Looking through the current number of an American wireless magazine the other day, I came across what were to me two new names for coils. I could scarcely be sure that the *designs* of the coils were new, but the names were certainly new.

The first coil was called the "Pickle-Bottle" coil. I could not see where the name came from at first, but a careful scrutiny of the illustration of the coil revealed the fact that the coil must have been wound on an eight-sided former.

Pursuing my clue into the grocery cupboard, I lifted down a pickle bottle of American origin, one of the fifty-seven varieties as a matter of fact, and I examined it carefully. The bottle was eight-sided. I wonder if you already knew that an American pickle bottle was eight-sided.

A pickle (re-) coil.

Pickle-bottle coils would not attract me for I am not very fond of pickles. If you were to offer me jam-pot coils, I might possibly be tempted, especially if the jam happened to be strawberry.

The second type of coil I noticed with a new name in this American magazine was one called a "Paddle-wheel" coil. Although the name was new, the type of coil was quite familiar. Imagine a small, broad paddle-wheel having six broad "spokes" radiating from a central hub and you have a rough idea of the shape of the former on which this coil was wound.

In these broad "spokes" were cut a series of parallel radial slits. The wire was wound into these slits, the effect in the end being to make a set of flat, single-layer circular coils connected in series.

There used to be a similar type of coil years ago made by fixing a series of flat slab coils centrally on a cylindrical axis. Such a coil would be looked on with disfavour to-day as one causing "high losses."

Fireproof

I wonder if there was much illness amongst *your* wireless friends during that abnormally cold weather in April. My wireless friends suffered badly, but it is an ill illness which does not bring a good story along with it.

Here is a story of two of my wireless friends. If you have heard the story before, all I can say is that good stories travel with a speed approximating to that of wireless waves. Anyhow, the incident is a perfectly true one. It *did* happen here.

Friend Gryd was ill and feeling downright miserable. Friend Leek went to call on him with the idea of cheering him up. Leek took with him one or two new component parts and showed them with some degree

Cheering him up.

of pride to Gryd as he lay in bed. Poor Gryd did not appear to take much interest in the exhibits.

"Shall I get your set fixed up here for you?" asked Leek.

"If you like," replied Gryd in a weary tone.

Friend Leek fixed up the set in the bedroom, but friend Gryd took little interest in the proceedings.

"What station would you like to listen-in to?" asked Leek.

"None of them," replied Gryd from the bed.

"Is there anything you want then?" asked Leek, a little nettled.

"Yes, what I want is a floral torus," said Gryd.

"Whatever do you mean by that?" asked Leek.

"A wreath," came the mournful reply from the bed.

"All right, I'll get you an asbestos one," said Leek in the drawling fashion of speech he adopts when being funny.

Pretty good, wasn't it?

Improving Loud-speaker Reception

I have improved my loud-speaker reception wonderfully this last week and I am feeling very pleased about

A big and little loud-speaker.

it. The improvement was more or less the result of an accident, but that does not take away any of the pleasure of the achievement.

I had purchased a new loud-speaker, one of the large modern types, and I wished to test it against others in my possession. After carrying out a few very satisfactory tests, I thought it might be well worth trying the new loud-speaker in combination with a small 120 ohms resistance loud-speaker.

When the large 2,000 ohms resistance loud-speaker was connected up in series with the small loud-speaker, the results were the best I have yet obtained in loud-speaker reception. With the small loud-speaker there was a telephone transformer, the primary having a resistance of 120 ohms and the secondary a resistance of 2,000 ohms.

With the series connection, the secondary of the telephone transformer was in series with the large loud-speaker, across which I had placed a ·002-microfarad fixed condenser. Perhaps it was this secondary coil which improved the tone of the big loud-speaker.

If your ambitions should soar above the small loud-speaker you now possess and you decide to buy a bigger loud-speaker, don't sell the little fellow for a mere song. Keep him and try him along with the new one and you will doubtless get the good results I got with my big fellow and little fellow in series.

Mush

Do you ever feel like saying something really emphatic when that awful "mush" from high-power wireless-telegraphy stations makes reception of Birmingham and Aberdeen almost impossible?

I am afraid I have often said some very inappreciative things of those government transmitting stations which still persist in "mushing up" the broadcast ether with harmonics from their Poulsen arc generators.

If you want to know all about the Poulsen arc and its parent the "Duddell singing arc," you will find the whole story set out in any good text-book on wireless telegraphy, but I doubt if you will find there the origin of the word "mush." Funny little word, isn't it? I wonder who first used it in wireless.

You may reasonably ask if the word "mush" is used by the best people, and if it has found its way yet into our newest dictionaries, and you may be surprised when you are told that the word has been in our dictionaries quite a long time. In one of my dictionaries "mush" is defined as a "food of maize meal." In addition to this, my encyclopædia informs me that Mush is a town in Armenia, and that this town Mush was the scene of much fighting between the Turks and the Russians during the late war.

If you do not care for either of these sources of origin for the word

Mush.

you must take it that mush comes from the mush in mushroom, an edible fungus which blends very well with bacon.

Wireless in the School Workshop

Educational authorities in many places seem to be looking upon wireless as a useful means for providing practical exercises for the school workshop. It is one of the

happiest moments of a schoolboy's life when he can turn his newly acquired knowledge to practical account. Hitherto his efforts have been confined to the construction of articles for the school and the home.

There is, of course, a good deal of

A schoolboy's happiest moments.

pleasure to be derived from the making of a set of bookshelves for the school library or a clothes-horse for mother, but a boy gets the most pleasure out of making something for himself.

When a boy takes to wireless, there are numerous things he can make for himself in the school workshop. I have recently seen a very useful range of such articles in a secondary school in the Midlands. Apart from cabinets of various shapes and sizes, there were accumulator carriers, racks to hold a series of plug-in coils, loud-speaker stands and small wireless tables.

I was very taken with one of the latter, a wireless table to hold a three-valve set and the attendant batteries. The design was extremely well thought out and the construction was excellent. The work was done by a boy of fourteen and he had received little help from the teacher.

Schoolmasters have no need to fear that wireless will impede the progress of their pupils if they will only make every possible use of wireless in their science and handwork teaching.

Queries

Of all the people connected with the everyday rush and tumble of wireless, I have a very soft corner in my heart for the expert whose task it is to answer queries by post. I have had sufficient experience of that kind of work to know how difficult it can be at times.

Personally, I find it hard enough to answer queries when the questioner is before me in the flesh and I can make sure of my ground by asking *him* questions.

I think, though, that the technical expert whose work it is to answer queries by post from unknown and unseen "questioners" sometimes gets a little amusement out of his work, and I think the expert's correspondents do not always realise that he has been indulging in a little leg-pulling.

I have just seen a good example of sly humour on the part of one of these expert wireless correspondents in one of our daily newspapers. It ran something like this :—

> STRANDED (Juicetown).—I am afraid you are quite helpless as regards your diminished signal strength since it is caused by the neighbours on either side of you having put up aerials and having started to use valve sets in connection with those aerials. If your neighbours have single-valve sets then you must use a two-valve set. If they have two-valve sets, you must use a three-valve set and so on, the number of valves in your set being one

Sly humour.

> more than the number of valves in either of your neighbours' sets. This is the only way by which you can get back you lost signal strength. Good luck to you.

Summer is Icumen In

By the time these lines appear in print, summer will be upon us. Even as I write, seated in my armchair before a cheerful fire, there comes to me the harsh, intermittent, grating noise of my neighbour's lawn-mower. I doubt if he really ought to be cutting his grass so early in the season. I shall certainly not get at mine for another week or two yet.

Still, it is no good denying it, summer, the wireless close season, is upon us. Why summer should be the slack wireless season, I never could quite see. To me the long, warm days of summer promise quite as much with regard to wireless as the long, dark winter evenings.

The neat and ingenious portable wireless receiver belongs essentially to summer. I know of no more fascinating work in wireless than that to be done with a portable set when on a holiday tramp.

Two of my wireless friends, one a dentist and the other a postman, started experiments with a portable receiver last summer, and they were so taken up with the work that they have carried on with it right through

A dentist and a postman.

the winter. Early in January they were investigating the effect of height on wireless reception. They had a small portable two-valve set, and they made excursions to various high points in the district in the dentist's car. Weather did not deter them. They went out in rain, hail, snow or shine.

Apart from work with portable receivers, what can be nicer than loud-speaker reception on a tennis lawn after a hard tennis tournament ?

There is any amount of interesting wireless work to be done in the summer time. This summer will be exceptionally interesting, for it will see the inauguration of the new high-power station at Daventry.

My meteorological friend tells me that we shall have a jolly good summer this year. How does he know ? Well, of course, he doesn't know, but if he had said we were in for a bad summer, I should not have believed him, so there you are.

Aerial Trouble

We comparatively insignificant broadcast listeners and wireless experimenters may perhaps find reason for a chuckle or two in the fact that the big pots of the B.B.C. have had trouble with some of their transmitting aerials these last few weeks.

Have we, the wireless small fry, ever had trouble with *our* aerials ? Have we ever set out manfully to make a *certain* improvement in our aerial-earth system only to find on completing the improvement that reception was a little bit *worse* than before ?

I expect you thought as I did that, when 2 L O got its new aerial fixed up in Oxford Street, everything would be improved beyond measure

and that the listeners who rely regularly on 2 L O would be as jolly as a crowd of sandboys.

Yet the B.B.C. engineers seem to have struck one or two pretty hefty problems in connection with the new 2 L O aerial, problems which, like some of the problems of our schoolboy days, refuse to yield an answer no matter how hard you try.

Well! Well! Well! All I can say is that wireless seems to me to get more and more like the weather about which my meteorological friend once said in an unguarded moment: "The more you learn about it, the less you seem to know."

You would scarcely have expected the new 2 L O aerial to throw a badly shielded area to the south-east, would you? Yet if you draw a line on your map from London to Deal and another from London to Folk-es-stony, as Vivian Foster calls it, those two lines and the south

Big pots in trouble.

coast between them enclose an area over which reception from the new 2 L O aerial is nothing like so good as it was from the old one at Marconi House.

Fallen Aerials

The collapse of the aerial at the Liverpool relay station prevented part of an organ recital being transmitted from Liverpool that afternoon.

The aerial fell 250 feet from the chimney stack to which it was attached.

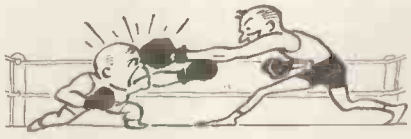
The Liverpool B.B.C. engineers found the aerial down when they returned from lunch. Being in good stomach for work, they immediately set about the task of raising the fallen aerial.

After an hour and a quarter's work, the aerial was jury-rigged to the plinth of the chimney stack. The engineers without the aid of steeplejacks could not get the aerial higher than this.

The transmitting apparatus was re-tuned, the Saturday afternoon concert was resumed and, according to the accounts I read, reception was almost normal from the low aerial.

What do you think of that now? A transmitting aerial comes down a couple of hundred feet and the loss in efficiency is nothing to write to THE WIRELESS MAGAZINE about.

I am reminded of an incident



An extra foot makes all the difference.

which befell a wireless friend of mine whose aerial was the pride and envy of the neighbourhood in which he lived.

This aerial, of the inverted L twin-wire type, was slung between a mast on my friend's house and a second high mast erected in a field near the house. I think the height of the horizontal portion of that aerial was nearer fifty than forty feet.

One very windy night, the rope by which the aerial was hoisted to the mast in the field blew loose and that end of the aerial came down to remain suspended about ten feet above the ground.

The aerial remained in this position for some days and I eventually could not resist asking my friend why he did not hoist it up.

"Oh! I'm in no hurry," he replied, "I am getting pretty nearly the same results with it down as I got when it was at the top of the mast."

Yet every text-book on aerials implores us to get our aerials as high as we can possibly get them and the experts all say that even an extra foot of height will make a difference.

Queer, isn't it?

A Lament

An important member of my family has recently come to the conclusion that wireless is a snare and a delusion, in fact, that it is jolly well no good at all. Perhaps I had better give the whole story in the words of the writer just as it was given in a letter which reached me a day or two ago.

"Wireless," wrote this important member of my family, "I have no use for it. What do you think that

Wireless "deception."

horrid landlady of mine did last night? You know I have just bought myself a new hat. Of course you don't know really, but anyhow I have recently bought a new hat, a jolly one, the best I have ever had except the one I had for Jim's wedding.

"Last night, that horrible Mrs. Thingome, my *old* landlady, she is fifty if she is a day, gave me the phones to listen-in to something good on the wireless. I listened-in for about twenty minutes. What do you think the old cat did while I was listening-in? She had the impudence to go upstairs to my bedroom and try on my new hat while I was fast with the wireless set. Did you ever hear of such a thing?

"Just imagine the artfulness of it, getting me interested in one of the wireless programmes while she sneaked off upstairs to try on my hat, my precious, new hat. Next time the old cat asks me to listen-in, I shall go upstairs and lock up all my hats and dresses before I put on the phones."

HALYARD.

What's in a Name?

There May be Three Guineas in Yours.

Please take a glance at the coloured diagram presented free with this issue.

It is a panel-drilling template, layout diagram and wiring diagram—all in one. Our Technical Staff designed it.

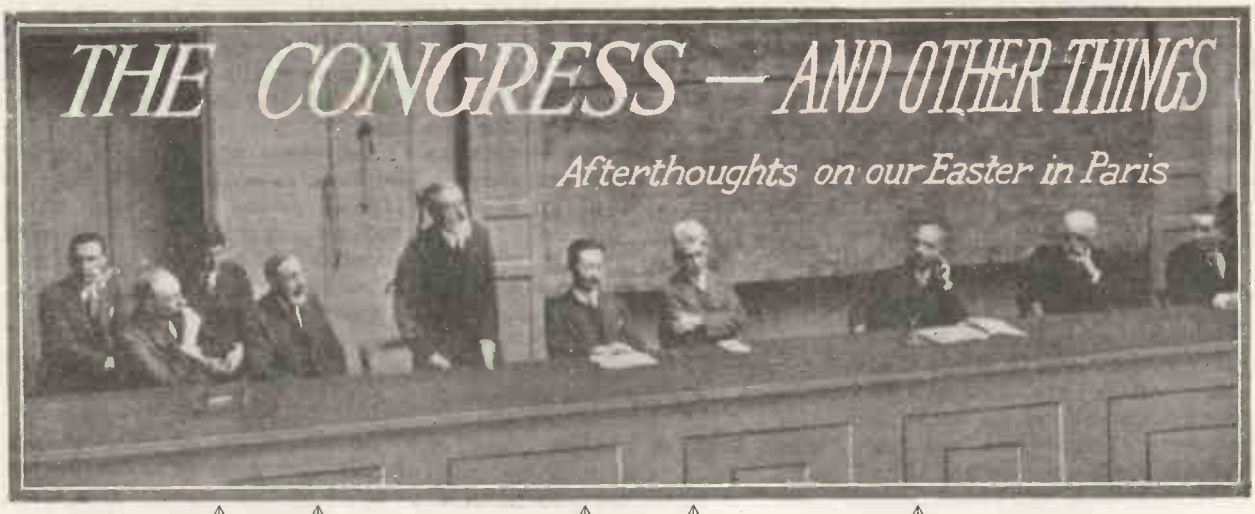
We want a good name for this time-saving diagram. Can you think of one?

We offer Wireless Goods to the value of ***Three Guineas*** *for the best suggestion received not later than* ***Saturday, June 20.***

A Great Competition

THE CONGRESS — AND OTHER THINGS

Afterthoughts on our Easter in Paris



Mr. Marcuse M. Tirmont M. Deloy Mr. Hiram Maxim M. Belin

WHILST credit is due to the organisers of the first International Conference of Radio Amateurs, which met in Paris at Easter, for their success in gathering together more than two hundred delegates from twenty-one different countries, we feel that the actual results achieved by the meeting fell somewhat short of anticipation.

This is due to two causes, we think. In the first place the delegates devoted themselves almost wholly to the interests of the private transmitter, and practically ignored broadcasting and the vast body of enthusiastic amateurs who find their chief pleasure in broadcast reception. That was a mistake.

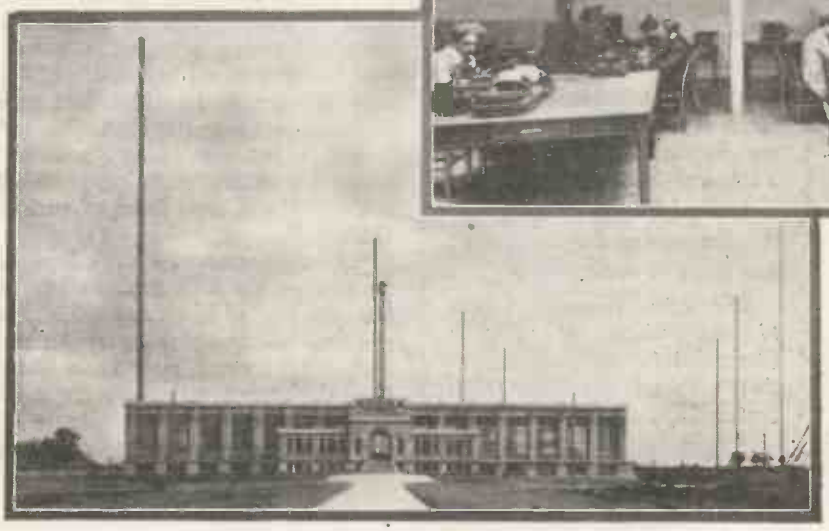
A strong union representing listeners as a body might do very useful work in collaboration with the New Geneva Board of Control. There is much interference and overlap between existing stations, of which the listener is the best judge. Also it should be possible to organise and carry out a series of special programmes of international appeal, to arrange for an interchange of the best artistes, and generally to stimulate a wider outlook in this direction.

At the conference, however, so far as we could gauge the feelings of the delegates during the course of the discussion, they appeared distinctly hostile to broadcasting as a whole.

It must, of course, be admitted that the experimental transmitter constitutes the cream of wireless amateurs, and that he has made many valuable contributions to the technique of wireless science. Also he is entitled to organise an International Union.

Nevertheless we fail to see the justification for that Union to assume the broad title of the "International Amateur Radio Union" unless it intends to embrace and safeguard the interests of the amateur and experimenter in reception —broadcast or otherwise.

The second handicap upon the labours of the delegates arises, we are sure, from the fact that the Conference as a body had no executive powers. Apart from the task of drafting the Articles of Association of the new Union, and electing its



Above.—The Automatic Transmitting Room at the Paris Office of the Sainte Assise Station.

Below.—The High-power Station at Sainte Assise, showing Aerial Masts.

officers, the work of the meeting was limited to the framing of pious resolutions to be submitted for the consideration of the various Governments concerned.

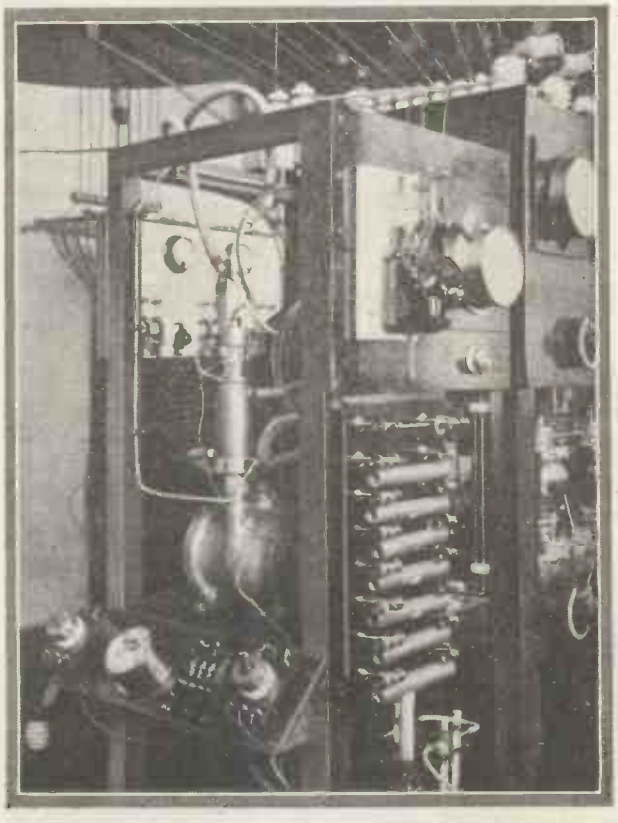
This was admittedly an inherent difficulty in the circumstances, but we must point out that such resolutions would carry considerably more weight if they represented the wishes of many millions of listeners instead of those of a few thousands of transmitters.

The first resolution to be adopted was a schedule of wavelengths recommended for allocation to the amateurs of the countries mentioned, for experimental work in two-way communication. This was as follows:

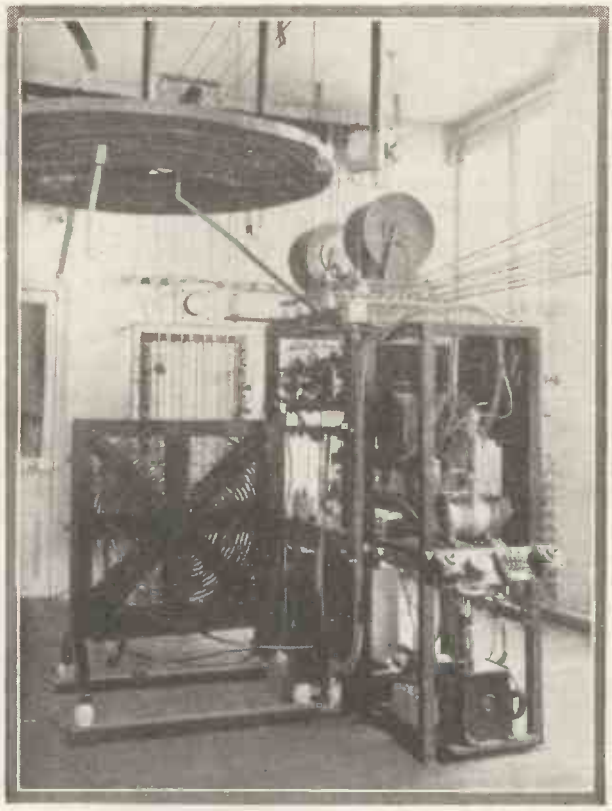
	Metres	*Metres*
Europe	115-95	77-43
United States ..	85-75	41·5-37·5
Canada and Newfoundland	120-115	43-41·5
Other countries ..	95-85	37·5-35

For the sake of those interested it may be mentioned that Mr. Hiram Maxim, the Vice-President of the A.R.R.L., announced that a representative of the Radio Relay League had been given facilities by the U.S. Navy to carry out long-distance experiments on board one of their warships now located in the Pacific. This amateur would be glad to co-operate with any European colleague who could succeed in getting in touch with him on a wavelength of 23 metres, using the call-sign NRRL.

A second resolution recommended the use of Esperanto as the official international language for world-wide amateur working. We thought it strange that the strongest opposition came from the Norwegian and Swedish delegates, who advocated the use of English for this purpose, on the ground that it was a far easier language for them to learn!



The Holweck Power-valve at the Malmaison Station.



M. Belin's Experimental Transmitting Station at Malmaison (8 B O).

A special section of the Conference devoted its attention to the consideration of legal questions arising from the use of the ether by private citizens. We know that the law in this respect varies considerably in different countries.

In America, for instance, the use of the ether is practically free. No licence is necessary for reception—and no fee or tax is levied to pay for the service of programmes.

As regards the transmission of messages, a licence is required in every country, but for low powers there is much less difficulty in securing a permit, either in America or France, than in this country. At the present time there are nearly 18,000 private transmitters in America alone.

A Legal Point

Another legal point of interest concerns the question of copyright in broadcast works. In the ordinary way a playwright is legally entitled to be paid a royalty on every public performance of his play, just as a composer is entitled to a fee for each rendition of his musical score. In each case, however, the performance must be in a theatre or some similar place at which a charge is made to the public for admission.

The point as to whether the act of broadcasting complies with this last requirement has not yet been satisfactorily settled.

On these points the following resolutions were adopted by the Conference for submission to the International Conference at Berne:

(1) The ether is free, apart from that right of regulation which naturally belongs to each State. This freedom must not, however, be so used as to

General Ferrie.

infringe public order, or to threaten or attack the State, or to interfere with S O S or other life-saving messages, or to clash with commercial communications.

(2) No commercial exploitation may be made by the receiver of any message other than that person for which it was destined.

(3) The advantages of copyright apply to broadcast transmission, and no original work may be so radiated without the consent of the author.

We cannot resist the temptation to remark that the atmosphere of the proceedings was enlivened from time to time by some characteristic incidents. On one occasion a French delegate moved a resolution affecting the order of procedure. His wording was a little obscure, and the English interpreter's version decidedly more so.

It took the combined efforts of the Chairman, the official interpreter, and a dozen unofficial assistants, two hours hard work before the rest of the Anglo-Saxon contingent could be persuaded that they understood the proposal sufficiently well to trust themselves to vote for it.

A Personal Statement

The next day we saw a distinctly Gallic touch. At the close of the afternoon's session an eloquent French delegate arose to make a personal statement. He had discovered a plot against his personal honour. Certain of his colleagues had asserted that he was in the pay of the Minister of Postal Services, and consequently a traitor to the cause of amateurism. This he declared to be an infamous and abominable mis-statement of fact.

Visions of pistols for two and coffee for one on the following morning were happily dissipated by a tactful speech from the Chairman, M. Belin, who stated his firm conviction that all the delegates, without exception, were men of honour and therefore incapable of making any such aspersion.

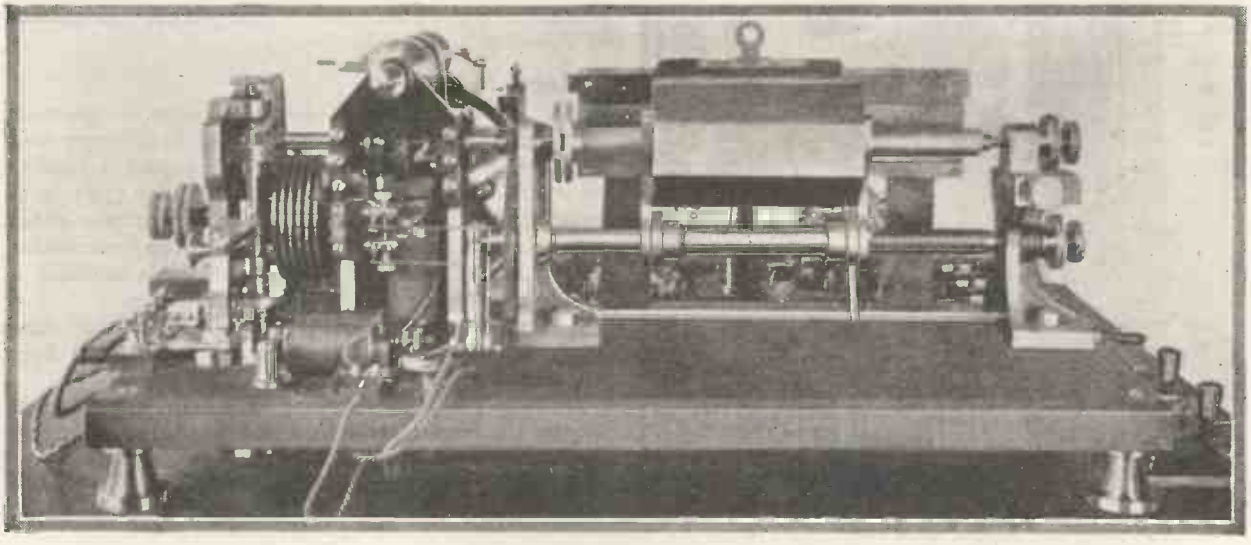
We found a third incident even more dramatic. After the Union had been officially declared in being, a German delegate made the suave suggestion that it should approach the Governments of the Occupied Territory with a request to allow more freedom to the wireless amateurs in those districts.

M. Belin (Chairman of the Conference).

This touched French susceptibilities on the raw. The Chairman vehemently declared the motion to be of a political nature and therefore out of order. He added that if it were persisted in he would resign forthwith from the Conference.

For some considerable time feeling waxed high until a diplomatic Britisher suggested that perhaps, in the circumstances, the German

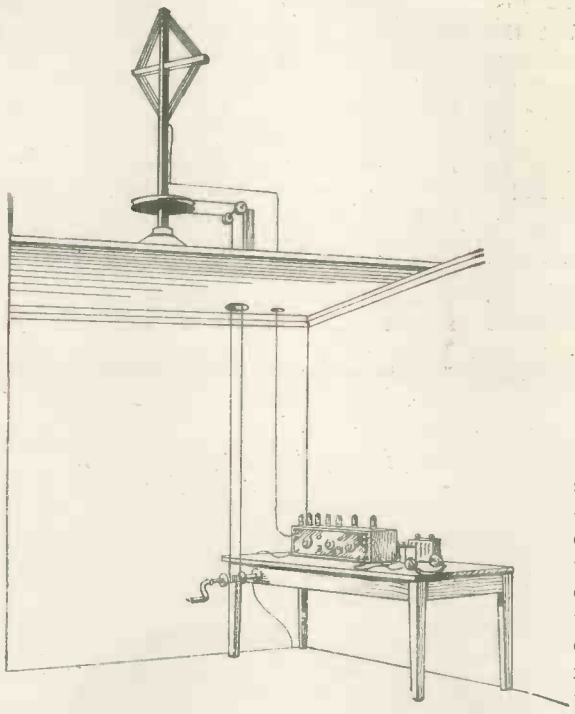
(*Concluded on next page*)



The Belin Picture Transmitter.

TRACKING THUNDERSTORMS WITH A FRAME AERIAL !

ALL possessors of receiving sets are only too familiar with those unpleasant "clickings" and "hissings" known generally as "atmospherics." In fact, ever since wireless has come into general use, and more so since broadcasting became popular, trouble has been caused by these "nature's jammings," so to speak, and at the present time many experiments are being made to discover ways and means of ridding wireless reception of this great drawback.



Useful Atmospherics

Even so, however, it has been found that these phenomena, annoying as they are to the ordinary listener, have their uses, and the chief of these is the tracking of thunderstorms.

The cause of atmospherics can easily be understood if we suppose them to be the distant "reflections" of the sound of the peals of thunder of a distant storm, in the same way as what we term "sheet-lightning" is the actual reflection of distant "forked-lightning." This reflected lightning can be seen, of course, only during the hours of darkness (but then over one hundred miles away), whereas the greatest distance thunder can be heard normally is about twenty miles.

As daylight hours exceed those of darkness in what may be termed the "thunderstorm season," it is difficult to locate the direction or distance of a storm in the daytime. This is where wireless comes to our aid.

Distant Storms

It must not be supposed, however, that wireless can be employed for tracking thunderstorms only in daylight hours. It can be used to locate storms that are much too far away for the most vivid lightning to be seen on the horizon.

We know that an electric spark will cause a disturbance in the air; if, then, the cause of this perturbation is very great, as in the case of a lightning discharge, the accompanying noise, which we call thunder, will be considerable. Again, we know that the cause of a thunderstorm is the meeting of two currents of air, both heavily laden with moisture (and incidentally electricity) and that lightning and thunder are the result of such a meeting, the latter being merely the noise caused by the former in the same way as the report of a gun follows the flash at the muzzle.

Method Used

The method of tracking thunderstorms is simple. A frame aerial is necessary and coils should be used that will tune to a wavelength of about 30,000 metres. With these coils the operator is listening for atmospherics only and does not expect to be able to receive morse, or hear any kind of speech or music, since nothing of this kind is transmitted on this particular wavelength.

When we are listening for atmospherics, we wait until we hear a strange rumbling noise, which is, of course, the distant thunder, and count the number of these noises heard in a minute. The frame aerial is then given another setting, in other words, it is turned carefully through a known angle, and the number of atmospherics is then again noted.

This process is continued until the point is arrived at where the greatest number of "rumbles" is found, when the exact direction of the thunderstorm is then duly located. The aerial is now kept steadily in position whilst the compass direction is fixed, when we get the direct bearing of the storm —for example, S.S.W.

Distance Calculated

In addition to this, by means of finely-adjusted instruments the actual distance of the storm can also be calculated. The direction in which the storm is travelling can also be discovered by taking, at intervals, further observations, and thus its movements can be traced practically from start to finish.

D. W. H.

THE CONGRESS— AND OTHER THINGS

(Continued from preceding page)

delegate would postpone his motion for the present.

After the charter of the International Amateur Radio Union had been agreed upon the following officers were elected: Mr. Hiram P. Maxim (America), International President; Gerald Marcuse (England), International Vice-President; M. J. G. Mezger (France), and F. Bell (New Zealand), International Counsellors. For the present the headquarters of the Union will be at Hartland, Connecticut, U.S.A.

Some of the accompanying photographs illustrate the magnificent private station of M. Belin, the inventor of telephotographic transmission, at his establishment at Malmaison.

Another trip we took was to the transcontinental transmitting station at Sainte Assise, some 25 miles outside Paris. The corresponding receiving station is located at Villecresnes, 15 miles away.

John Henry Talks About

I WAS born in the year—— But this interests no one but the heirs for whom I am endeavouring to accumulate a vast fortune. Blossom says—— Another pause, as I have faithfully promised that, in this article, no mention shall be made of my director. Ah, well!

"Simple but Blameless"

Until the outbreak of war I had led a simple *but* blameless life. It's of no use referring to the Newgate Calendar or to back numbers of the *Police Gazette*; my past records are not inscribed on those rolls of fame.

In August, 1914, when the bugle call rang out I was in Canada, attached to the staff of the *Montreal Star*. Like thousands of others, I decided to enlist at once. My reason for so doing was because Blossom —— (Remember your promise.—ED.)

Anyhow, I felt that my military bearing would greatly influence the general course of events in Europe. The "Brass Hats" thought otherwise.

Five times did I present myself at the recruiting office, and five times was I summarily rejected on account of defective eyesight. This was all wrong, and I cudgelled my brains for a plan by which I could readjust such an error of judgment on the part of the authorities.

I discovered one. With friends I visited the drill hall on various occasions, and by hook or by crook—I fancy it was by crook—I secured a copy of the eyesight test-card. In a very short time I had memorised those weird combinations of letters and figures you have all seen in opticians' windows.

I learnt them backwards and forwards, up and down, until I could almost recite them, as a poem, in my sleep. On the next day I "went up," without glasses, and passed most brilliantly.

I joined the Army in November, 1914. Whether I was considered a valuable acquisition to the 2nd Canadian Division I know not—my innate modesty compels me to refrain from comment on the subject; but I served with them overseas until 1919, by which time I had attained the giddy and exalted rank of company sergeant-major. (This, contrary to expectations, does not appear to have unfavourably influenced the course of the war.—ED.)

Blossom poses for "The Wireless Magazine."

Before joining the Army I had had but little experience as an entertainer. It is true that, for some time, in Montreal, I had organised and managed a small pierrot troupe, but our services had always been given for charitable purposes, and although our efforts had met with public approval, we were far from considering ourselves full-blown professionals.

The experience, however, which I had gained in this respect was very helpful—as was also my training as a journalist. Entertainments in barracks and billets were a necessity both in Canada and France, and some of my friends called upon me to write sketches and parodies for these occasions.

Our small show soon attracted wider attention, and my name became well known to the Division. Greater calls were made on my services, and soon I found myself organising entertainments for the Y.M.C.A. To my great surprise, in 1917, I was sent for by Divisional Headquarters and ordered to form a Divisional concert party. That day saw the birth of the "See Toos."

"Liquid" Appreciation!

I was so pleased with the idea of running this show, and so many (liquid) marks of appreciation were showered upon me by the scratch company I had gathered together, that by "Lights out" I felt convinced we ought to have been called the "See Fours."

We all worked hard, "and though I sez it as shouldn't," no one harder than the promoter and manager. Anyway, we were a success. Our captain was Edmond Burke, the great baritone of Covent Garden and Metropolitan Opera House fame, and our orchestra included, amongst many others, Bob Merchie, the well-known flautist.

Himself—but not Blossom!

Curiously enough, I again recently met him at the 2 L O studio. Those were (relatively) happy days. We wrote, composed, organised and gave shows in very many villages and towns of France, Belgium and later occupied Germany, and the experience gained from these entertainments proved later of great value to me.

A Good Talker!

I should add that I speak fluently French, German and Italian, apart from Yorkshire, which happens to be my native tongue.

In 1918 our party came to London, and for two weeks we showed at the Coliseum. During this time I signed a year's contract with Fred Karno, which I fulfilled as soon as I was "demobbed." Further engagements followed, which kept me on tour for another twelve months or so, but as the music halls were then beginning a critical period I decided to abandon the stage until conditions were happier, and obtained an appointment at the Board of Trade.

When I am relating my domestic troubles to the microphone I would like my unseen audience to bear in mind that they are listening to an ex-Government official! This sounds well, and, to my mind, should command both sympathy and respect.

As Blossom once said to Joe Murgatroyd—— (We cannot admit hearsay evidence in these pages.—Ed.)

On more than one occasion I have talked to you about my wireless set. Well, one evening I listened-in and decided that—at least, in my opinion—I could do as well as the people I heard. Taking my courage in both hands, I strolled up to 2 L O and, as luck would have it, secured an audition. For those who do not know Italian, this is French for "voice trial."

Well, I managed to make Uncle Jeff laugh. I don't know whether this is a recognised test for humour, but you can take it from me that when he laughs he makes almost as much noise as when he plays the piano in the Children's Hour.

I've been told that his laugh has been heard in California, Mesopotamia, and in the suburbs of Timbuctoo. Presumably that must have decided my fate, as since then I have worked fairly constantly for the B.B.C.

John Henry as he appeared to "The Wireless Magazine" photographer.

But I really must tell you all about my first experience of the microphone—I mean my début (more foreign!).

It was horrible. I followed Dame Ellen Terry, and when I point out to you that she was very nervous, you can guess what condition I was in. Everybody buzzed about the studio, which appeared to be overflowing with journalists and Press photographers. Can you imagine how I felt whilst awaiting my turn?

A visit to the dentist, in comparison, would have been a humorous interlude. A sort of fellow-feeling welled up in my heart for the criminal in the dock.

How I struggled through my first item I barely remember, but I can recall that my mouth felt as if it had been stuffed with cotton-wool. I am sure I was not funny on that occasion, and if my audience felt as I did, they had not a fragment of a laugh in them.

The "dose," according to prescription, was repeated later in the evening, but this time I had the presence of mind to soak my handkerchief in water, so that I could moisten my lips. From what I could judge my first "turn" at 2 L O could not have been very successful, as I heard no more from the B.B.C. until I rang them up and asked for another engagement.

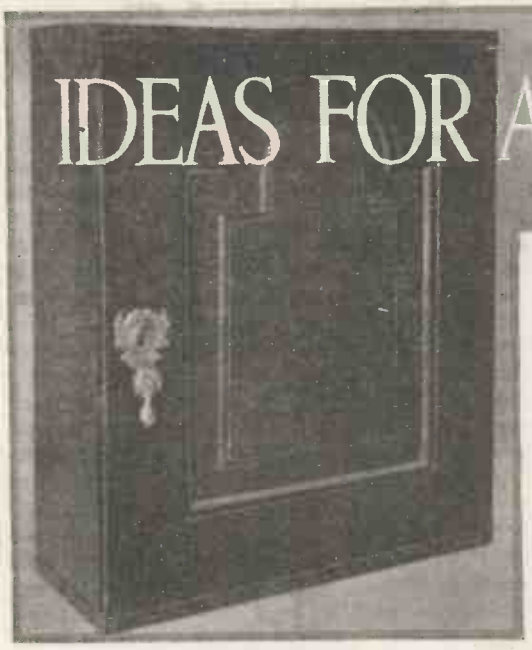
Instrument of Torture

Apparently I had not been as bad as I imagined myself to be, and on the next occasion I faced the microphone I seemed to get on somewhat better.

The microphone is an instrument of torture to which you must become accustomed. It is unresponsive, cold and haughtily silent. Now, to an entertainer, an audience is essential. If a joke is well received, if he hears a laugh, if he sees faces broaden out

(Continued on page 512)

IDEAS FOR ANTIQUE CABINETS



Queen Anne Spice Cupboard.

WHEN a man begins to collect old furniture, he first of all buys a chest, because they are fairly plentiful and fairly cheap. If he has too many, now is the time to use the smaller ones as cabinets for the family wireless set.

Converting a Chest

A small one is not difficult to convert—it simply means having its front panel hinged and its legs shortened a little.

Then to complete the picture the listener-in will sit on the stool made in the time of Shakespeare, wondering between whiles what he would have written as a speciality "to be broadcast only."

Corner cupboards of all kinds are very adaptable, either glazed like the two in the illustrations or with the usual panel, for they only require the aid of the electrician.

An old desk, so reminiscent of our schooldays, is also about to be transformed into a cabinet and this, too, will need very little attention other than the removal of a few pigeonholes.

The Victorian chiffonier seen in the picture could tell a tale of domestic strife, for it was bought by a reckless husband at a sale, and labelled by his wife as "the ugliest thing she had ever set eyes on." And it was promptly relegated to the unfortunate man's study, where it looked most absurd with its embroidered panels amongst his leather chairs.

Many a time I have looked at the old rosewood cupboard and roared with laughter at its latest history.

Now, however, I hear it is going into the drawing-room with its top transformed into a receptacle for wireless, so at last it will be on speaking terms with the rest of the world.

A little bookcase of mine is about to undergo a third transformation in its history. It was originally just a box, next it became a bookcase on a new stand, and now it is to be a wireless cabinet.

In another house I saw the set fixed into an inset bookcase in a charming low-ceilinged old room into which no one would have dared to put the ordinary ugly little cabinet.

Another friend of mine has put his instrument into the top of his old bureau bookcase, which only needed the removal of a few shelves and in no way injured the piece.

Old Spice Cupboard

Rather a rare and interesting little piece of old furniture is shown in the heading—a Queen Anne spice cupboard, originally made to hold those spices so beloved by our forefathers, which were brought to Europe in the 17th century by the Dutch East India Company—who proved themselves unexampled profiteers.

One has to remember that spices were a luxury and were in demand at every great feast, where the seat next the spice box was the seat of honour.

Inside this little cupboard are various drawers which can be taken out and saved, in case wireless becomes too dull or is superseded by—who can tell? H. NELSON.

Old Oak Chest and Stool.

DUNDEE has been transmitting "On the road to Moscow." This must be reaction from the days when Winston Churchill was its M.P.

GERMANY has made its mark in wireless manufacture, says a trade expert. The Germans, if we know anything of them, would make their marks anywhere.

SOME of the supposedly entertaining stories told over the wireless have cat-whiskers on them.

A Good Set Deserves a Good Cabinet

Nowadays the tendency is for the home wireless set to be looked on more and more as a useful piece of furniture. The building of a set does not end with the arranging and wiring of components on a panel.

There is more in it than that, for the appearance of the finished instrument depends almost entirely on the cabinet.

In nearly every home there is at least one attractive but little used piece of furniture that would make an ideal cabinet. Here are some examples.

A desk (an attractive example is shown on the left) makes a very convenient cabinet. The lid serves the useful purpose of keeping out the dust, and, when it is locked, may save expense by keeping little fingers from turning filament-rheostat knobs too far when Daddy is not about!

The removal of a few pigeonholes usually provides room for a set built up on a baseboard with a vertical panel, which can be easily slid in and out when required. Coils and spare valves can be kept in the drawers.

An advantage of using a chiffonier (right) is that the cupboards can be utilised for housing the batteries, spare valves, plug-in coils, phones, etc.

In the case of a piece with perforated panels, it might be possible to keep a loud-speaker permanently inside one of the cupboards.

Perhaps an old bureau bookcase (above) makes even a more useful cabinet than a desk. A vertical panel can be easily accommodated, and the boring of a hole and the use of extended leads make it possible to keep the batteries in one of the drawers.

Such a cabinet is invaluable to the experimenter, for the desk portion can be utilised as a bench for experiments.

Of course, the bookcase portion makes the operator's file of "The Wireless Magazine" easily accessible.

Where there are kiddies about a corner cupboard (left) may be placed high enough up on the wall to keep the set free from "accidental" damage, which usually is not really unexpected.

By placing the loud-speaker on top of the cupboard it is in a good position without the use of extensions, which are sometimes unsightly and often a real nuisance in a room used by a large family.

A few hooks placed underneath the cupboard would be invaluable for hanging up headphones not in use.

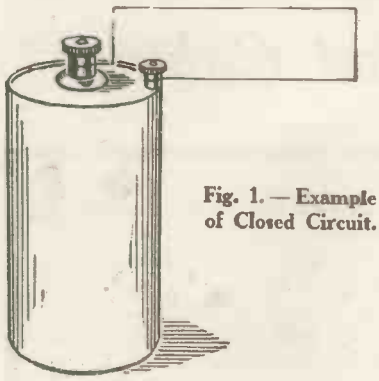


Fig. 1.—Example of Closed Circuit.

What Your Condenser Does

WHAT *does* happen in a condenser? Does it allow an oscillating current to pass through it or does it not? Most wireless folk have probably puzzled over questions of this kind at one time or another, and recently some diametrically opposite opinions have been expressed by different authorities. Let us see if we can sift out the truth of the matter in the form of a simple explanation of the action of a condenser.

What is a Flow of Current?

It will be best if we can obtain first of all a perfectly clear understanding of what we mean when we speak in a general way of a flow of current. In Fig. 1 is seen what is called a closed circuit. Here a conductor in the form of a wire is connected between the positive and negative poles of a cell.

A conductor differs from an insulator in that each of the atoms of which the former is composed contains one or more electrons that are loosely bound to the nucleus or proton. An electron starting from the negative pole of the cell seen in Fig. 1 rushes at enormous speed into

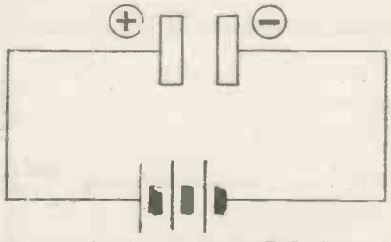


Fig. 2.—Condenser Across D.C. Source.

the first atom that it meets in the wire. Such is the force of the impact that the atom's own free electron is driven out, its place being taken by the newcomer.

The displaced electron charges into a neighbouring atom, forcing its free electron away and adopting its orbit. And so the process continues throughout the length of wire, the net result being that for each electron that enters from the negative pole of the cell one electron leaves the far end of the wire, where it meets a positive ion, that is, an atom lacking one electron, with which it combines.

This kind of electron flow is known as a conduction current. It cannot

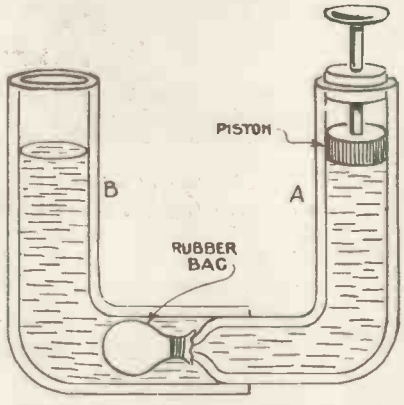


Fig. 6.—Water Analogy of Condenser.

normally take place in an insulator, for this is a substance in whose atomic system all the electrons are so tightly bound that they cannot be driven from their orbits except by some terrific electrical pressure.

Perfect Insulator

The perfect insulator would contain no free electrons whatever. Actually there are always a few of these, and we know of no perfect insulator. Our best insulators are really nothing more than very high resistances through which a tiny current does flow under great electrical pressure. If you had an instrument fine enough for the purpose, you would be able to detect the presence of minute currents flowing between every pair of connections at different potentials upon the panels of your receiving set.

The condenser consists of two plates or sets of plates made of conducting material and separated from each other by an insulating substance known as the dielectric. Now let us see what happens when a condenser is placed across the poles of a source of direct current as shown in Fig. 2. At the negative pole of the battery we have an excess of electrons which is exactly counterbalanced by a similar excess of positive ions at the other. The wires attached to the terminals of the battery, and the condenser plates to which they lead, may be regarded simply as extensions of the poles.

Charged Condenser

As soon as the connections are made there is a stream of electrons from the negative pole to the plate with which it is connected and a stream of positive ions from the positive pole to the other plate. This stream continues until the potential across the condenser is the same as that across the terminals of the battery. As soon as this point is reached the condenser is stated to be charged. In this condition one of its plates contains an excess of positive ions and the other an excess of electrons.

No further appreciable current can flow from the battery, for the dielectric between the plates refuses to convey any but the minutest amount across the intervening space. We

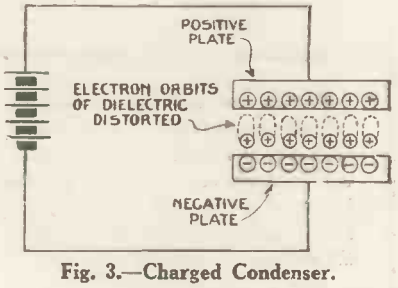


Fig. 3.—Charged Condenser.

may thus say that a condenser offers a complete barrier to the passage of direct current.

We have seen that upon one of the plates of the condenser there is an array of positive ions, whilst a similar army of excess electrons is collected upon the other. What is the effect of this state of affairs upon the

dielectric? Fig. 3 shows diagrammatically what is happening. The attraction exerted by positive ions collected upon the upper plate puts the electron orbits of the atoms of the dielectric under a tremendous strain.

Leakage

If the dielectric is a poor insulator a certain amount of them will be actually wrenched away from their atoms, and leakage will take place through the condenser. The worse the quality of the dielectric the greater will be the losses due to leakage. If we disconnect the condenser from the battery it should in theory retain its charge indefinitely. Actually we shall find that at the end of a certain number of hours it will have discharged itself by leakage, no matter how good the dielectric may be.

With oscillating currents the process is as follows. The positive half of an incoming wave causes an excessive number of positive ions to assemble on the plate which it reaches. The orbits of the atoms of the dielectric are strained as before, the electrons themselves being attracted towards the positively charged plate and the nuclei repelled from it.

Positive Half-wave

On the other plate an excess of electrons collects which balances exactly the positive ions on the first plate. These electrons are drawn from the plate of the condenser and from the wire attached to it. The effect is that a positive half-wave brings about the movements of the electrons and positive ions shown in Fig. 4 in the wires attached to both plates of the condenser; that is, a flow into plate A will cause a corresponding flow out of plate B.

In Fig. 5 the result of the arrival of the following negative half-wave is seen. Here the flow of current is reversed, but again the movement of electrons and of positive ions which takes place in plate A and the wire attached to it produces a similar movement in plate B and its wire. We see, then, that an oscillating current reaching plate A will be reproduced in exactly similar oscillations of current in plate B and its leads. The net result is that a condenser behaves exactly as if it passed oscillating currents.

We may make the position perfectly plain by taking a simple analogy with water. In Fig. 6 is seen a piece of apparatus which reproduces very well the action of a condenser. A is a glass tube whose lower end is bent round and shaped to form a nozzle. Over this nozzle

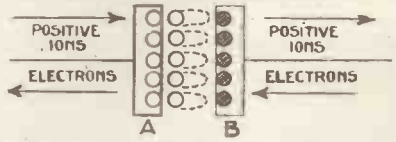


Fig. 4.—Effect of Positive Half-wave.

is fixed a small rubber bag. The tube itself is provided with a tightly fitting piston. Tube B, which is of the same diameter throughout, is sealed to tube A, as shown in the drawing.

Both tubes are now filled with

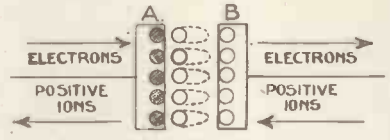


Fig. 5.—Effect of Negative Half-wave.

water until the level in each is the same. When the piston is thrust down water is forced from tube A into the rubber bag, which expands, and by displacing water in tube B causes the level in that tube to rise. No atom of water can pass from tube A, for the rubber bag, which represents the dielectric, prevents any such movement. But the strain upon the bag is transferred to the water in tube B, which is caused to alter its level.

Pressure and Equilibrium

When the piston is depressed the two tubes are in the same position as the charged condenser. So long as pressure is kept upon the piston the water level in both will remain unaltered. If, however, the piston is released, the water in both will proceed to find its own level by a series of oscillations or swings before it comes to rest.

This is just what happens when a condenser is discharged. To represent an oscillating current the piston must be worked rapidly up and down. It will be found that every stroke produces a movement in the water in tube B, though actually no water passes from one tube to the other. This is what happens in a condenser under the influence of an oscillating current.

J. H. R.

COIL NUMBERS

TO all beginners, and to many who have passed beyond the "beginner's" stage, there is a certain amount of mystery attached to the numbers with which sets of coils are marked. Enthusiasts everywhere talk glibly of No. 50's in the aerial circuit and No. 75's in the anode circuit without having any idea of what the numbers signify.

The number on any particular coil represents the approximate number of turns that it contains. Further than this, it is also a rough indication of the wavelength range covered by a coil, for this is nearly the same for any coils bearing the same number within quite a wide range of diameters and widths.

Wavelength Ranges

For all practical purposes honeycomb, basket or cylindrical coils containing the same number of turns cover approximately the same wavelength ranges. These are as follow:

Number of coil	*Wavelength range (aerial circuit) with ·001-microfarad condenser in parallel.*	*Wavelength range (aerial circuit) with ·0005-microfarad condenser in series.*
25	—400	—350
50	200—700	200—550
75	250—1,000	250—800
100	300—1,500	300—1,000
150	400—2,500	400—2,000
200	600—3,000	600—2,500
250	800—4,000	700—3,000
300	1,000—5,000	1,000—3,500

The values in this table are the averages for a number of series of coils of different makes at present on the market. It should be noted that the minimum wavelength to which a coil will tune is greatly affected by the capacity of the aerial-earth system.

Ratios of Coils

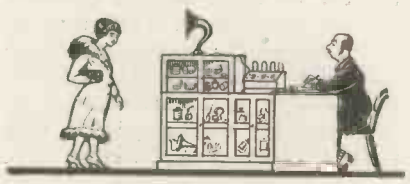
In choosing coils for any particular circuit it may be taken as a rough guide that the secondary (tuned with a ·0005-microfarad variable condenser) should be a size larger than the aerial coil, the reaction coil a size larger than the aerial coil, and the tuned-anode coil (tuned with a ·0002- or ·0003 - microfarad variable condenser) two sizes larger than the aerial coil.

G. W.

The Salesman Explains — AND GETS A SHOCK!

AT the sound of the light tripping step, the salesman looked up sharply. "Good morning, miss," he said, pleasantly, flicking a little dust from the cuff of his jacket, "delightfully spring-like weather?"

"It is indeed," the young lady replied, flashing the dazed man a soulful glance from the brightest



"Good morning, miss"

eyes he had seen for a long time. "What a nice shop this is!"

At the back of his mind, the salesman glimpsed a reflection of himself at twenty-five. Leaning gracefully against the shelves at his back, he thrust his hands into his jacket pocket and endeavoured to "come back."

"As wireless shops go, I suppose I have—what?—the finest selection of high-class stuff in the trade! Of course, the display—the general effect, the *tout ensemble*, as our Continental neighbours say—would naturally appeal to a lady. I was ever a slave to method and system! Might I ask which particular effect gave rise to your flattering remark, miss?"

"Oh, I think it was the lovely bright knobs and the funny little lamps and things," replied the daintily-dressed girl, vaguely. "How tremendously clever you must be to understand how all the things work! It must have taken you years and years to learn to make the little lamps talk, and yet you can do it by just lighting them and turning knobs, can't you?"

The salesman smiled indulgently, and changed his position to the counter, against which he leaned in an attitude of abandon much favoured by certain film stars.

"My dear young lady," he said, "we all have our gifts—artistic, musical or scientific. For myself," and he shrugged his shoulders carelessly and coughed modestly, "science could not withhold her secrets from *me!* Why, that framed certificate that you see over there was presented to me by His Majesty's Science and Art Department in—er—hum, some years ago, when I was little more than a lad!"

The fascinating stranger tripped over to the certificate (a second class in elementary chemistry!) and, having read it carefully, turned to the salesman and regarded him with admiration.

"How nice it must be to be able to answer any question stupid and ignorant people like myself ask you," she murmured, archly. "Now, I am really ashamed not to know such a very simple thing, but would you mind telling me just what a condenser condenses? Surely it can't be milk? And I should so much like to know what an accumulator accumulates! My brother often talks about starting-price accumulators, but I suppose they are not the same as the wireless ones? You scientific gentlemen are so splendid at explaining—you make

"Matters were remedied"

things so clear! Then there is another thing which puzzles me; what is a dry battery? Maurice—my brother—was in a battery in the artillery in Flanders, and I asked him whether it was a dry battery?"

The young lady paused to take breath, and with a view to putting off the severe task of answering the questions as long as possible, the salesman expressed a keen desire to be made acquainted with the gallant soldier's response.

"Maurice said that his battery was dev—decidedly dry when in the forward line, but that matters were remedied to a great extent when in the rest camp!" the damsel replied, resting her elbows on the counter, and her face in her hands, and looking up at the salesman with a tantalising expression.

"Ha! ha!" laughed the salesman," a good answer indeed; but of course, my dear young lady, not a strictly scientific one. The replies to your questions are quite simple; a condenser condenses electricity by eliminating extraneous particles and compressing the ultimate atoms; the accumulator, or storage battery, as the Americans call it, stores volts and amps for subsequent use. The volts being employed in trapping wireless waves and the amps, as the name implies, in amplifying them.

"The word volt is derived from the name of the celebrated old accumulator maker, Voltaire. Dry batteries require the addition of water to make them wet, when they are, of course, quite unsuitable for the purpose for which they were made. It has been truly said that the gift of exposition is vouchsafed to but few, but I do not seek aggrandisement on that account.

"If, however, I can solve any other little difficulties for you, you have but to command me. You may be thinking of going to the wireless exhibition, perhaps? If so, I should be delighted ——"

"Henry!" called his wife, from upstairs.

"Yes, my dear!" replied the salesman, meekly.

"There's a girl of the name of Wiggins coming at twelve o'clock in reply to my advertisement for a maid. Send her up as soon as she comes, will you?"

"Certainly, my dear," said the salesman, turning to the girl with an air of depression, "I'm afraid I've been wasting your time, miss; what can I show you?"

"Oh! your wife expects me," replied the girl, demurely; "my

He collapsed on a heap of ebonite

name's Wiggins. I'm the new maid!"

The salesman had just strength enough to motion the way upstairs before he collapsed on a heap of scrap ebonite, his eyes rolling wildly.

ALFRED HEARD.

"The Country Calling!"

The Picnic Set

A Fully Constructional Article by J. Sieger, on a New Self-contained Portable One-valver

A holiday photograph, showing the New Set, taken by the Editor.

BEFORE designing the portable receiver about to be described the opinions of various people were obtained as to which were the ideal points a small portable receiver should possess. The following are a summary of the opinions expressed: (1) It should be self-contained in all respects. (2) Of minimum weight and size. (3) The operation should be very simple. (4) The appearance of the set should be such that it may be taken into the most exquisitely furnished room without looking out of place.

Armed with these "points" the design of such a set was undertaken.

Circuit

The circuit was the first thing tackled. A number of reflex arrangements were tried, but trouble arose with the crystal detector, so attention was turned to plain reaction circuits.

The Reinartz was next tried (as shown on p. 509), but the reaction condenser did not control reaction to the fine degree required, and, moreover, the circuit was too unstable, due to the low losses in the frame aerial.

Reaction

The reaction turns were then taken off and the condenser brought direct to the end of the frame. This arrangement worked perfectly, so it was decided to make use of it.

If the set fails to oscillate, two turns of fine wire (No. 26 d.c.c.) round the frame will remedy matters.

The cabinet is made from mahogany. The doors which cover the controls close flush with the box so that there are no jutting pieces to make the case awkward to carry.

The phones are carried in the small compartment in the top left-hand corner. This compartment has a hinged flap which protects the phones from dust. Two flaps are also provided for easy access to the batteries. These latter flaps are ordinarily screwed down (see p. 511).

Making the Case

In making the case $\frac{3}{8}$-in. mahogany is used throughout, except for the back, which is made of 3-ply mahogany to lighten the case.

Inside the case a framework of 3-ply wood is fitted. This carries the frame aerial and also the compartment for the phones.

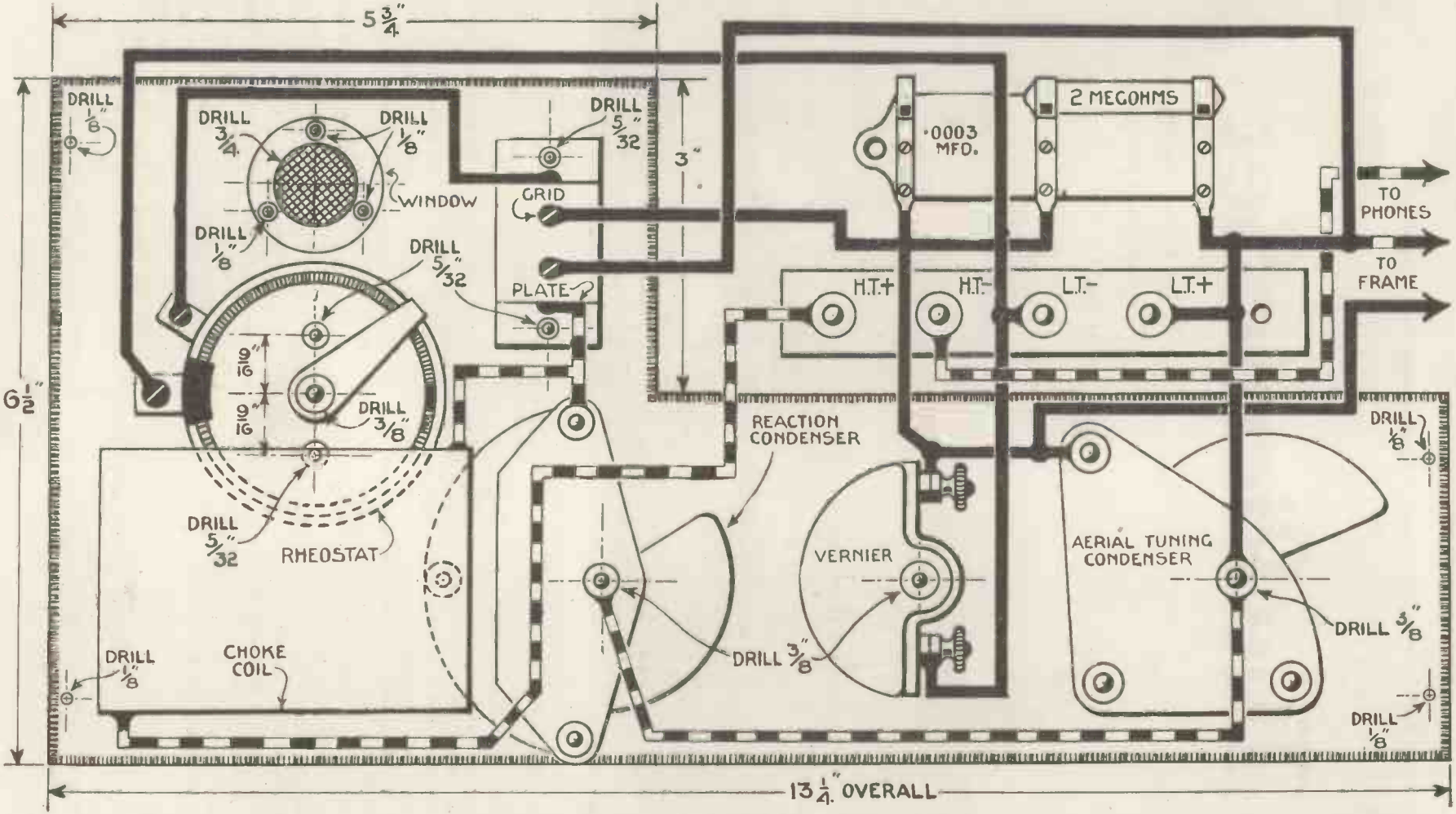
The dimensions of the case are given on p. 509. The corners are nailed together with thin pins $\frac{1}{2}$ in. long. When finished the framework should slide into the case with $\frac{1}{8}$ in. clearance all round.

For those who do not wish to

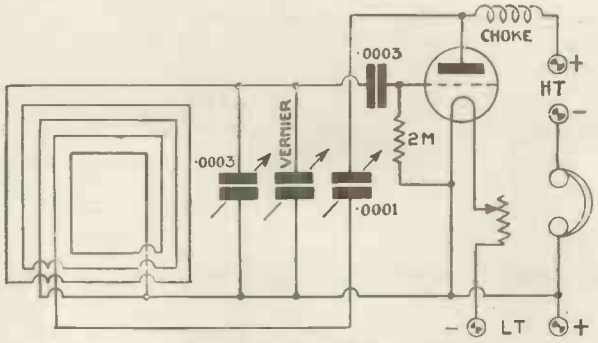
Reduced Reproduction of Our New-style

COMBINED DRILLING TEMPLATE AND LAYOUT AND WIRING DIAGRAM

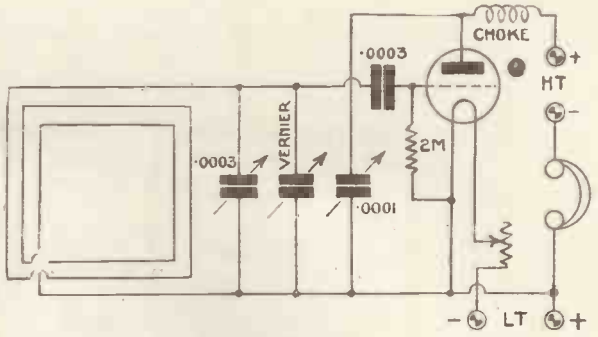
Printed in Colours and Presented Free with This Issue



This combined template and wiring guide, originated by the Technical Staff of "The Wireless Magazine," marks a step forward in the construction of sets. In a compact form it gives all the advantages of a separate blueprint drilling template and a separate wiring diagram—and it is full-size. We want a name for this new-style diagram, and on p. 495 we are offering a prize of wireless goods to the value of £3 3s. 0d. for a suitable one.



First Circuit Tried.



Improved Circuit.

go to the trouble of making one, the whole case, including frame aerial, may be obtained from the British Radio and Portable Case Manufacturers, of 16, Market Street, Curzon Street, Mayfair, W.1.

Aerial

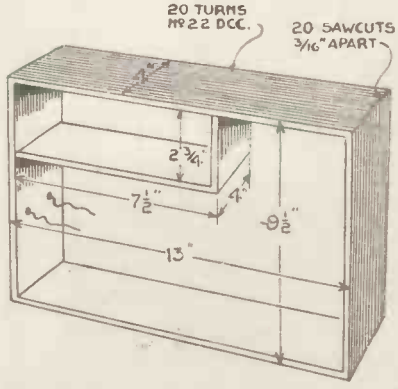
The aerial is wound on the framework as shown below.

Twenty saw-cuts $\frac{3}{16}$ in. apart are made in each corner of the frame and 20 turns of No. 22 d.c.c. wire are wound on. The ends of the wire are fastened on the frame by threading them through two small holes.

Apparatus Required

In making the set the following components were used:—

1 Mahoganite panel, 14 in. by 7 in.
1 Strip of mahoganite, 5 in. by $\frac{7}{8}$ in.
1 Variable condenser, ·0003 microfarad.
1 Variable condenser, ·0001 microfarad.
1 Colvern condenser, with fine-tuning adjustment (Collinson's Precision Screw Co., Ltd.).



Details of Inner Case and Frame Aerial.

1 Dubilier grid leak (2 meg.) and condenser, ·0003 microfarad, with extension.
1 Cardboard tube, $2\frac{1}{2}$ in. by $3\frac{1}{2}$ in.

The Self-contained Portable One-valver in Use.

1 Valve holder (Aermonic).
1 Valve window.
1 Dual filament resistance (Burndept).
3 Mahoganite dials (two 3 in., one 2 in.).
4 Terminals.
2 oz. No. 32 d.c.c. wire (for H.F. choke).
$\frac{1}{2}$ lb. No. 22 d.c.c. wire (for frame aerial).
Tinned copper wire (No. 18 gauge).
1 36-volt H.T. battery.
1 3-Volt L.T. battery (Ever-ready, type 2062).
1 Dextraudion (·06 ampere) valve.
1 Service phone connector.

Drilling the Panel

The panel should first be cut to the correct size and drilling should be carefully carried out, use being made of the special coloured plate given free with this issue.

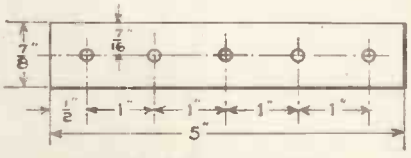
The mounting of the components is a simple operation, but there are one or two points which require explanation.

It will be noticed that the reaction condenser has part of its end plate cut away. This is to enable the H.F. choke to be mounted closer to the panel. A hole is made in the end of the tube and the coil is fitted over the screwed rod of the condenser and clamped down with a nut.

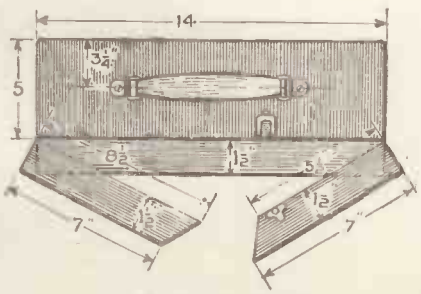
Terminal Strip

The terminal strip is drilled as shown below. This is also clamped down by the nut on the tuning condenser. These methods of fixing are clearly seen in the photographs.

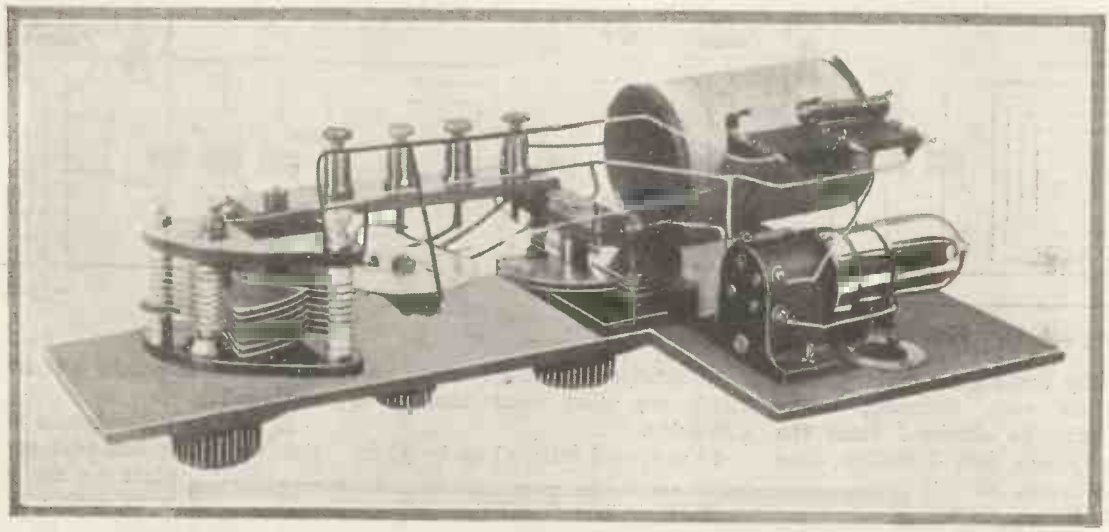
The high-frequency choke coil, comprising 250 turns of No. 32 d.c.c. wire, is wound on a former $2\frac{1}{2}$ in. in diameter and $3\frac{1}{2}$ in. long. The ends of the wire may be fastened by piercing

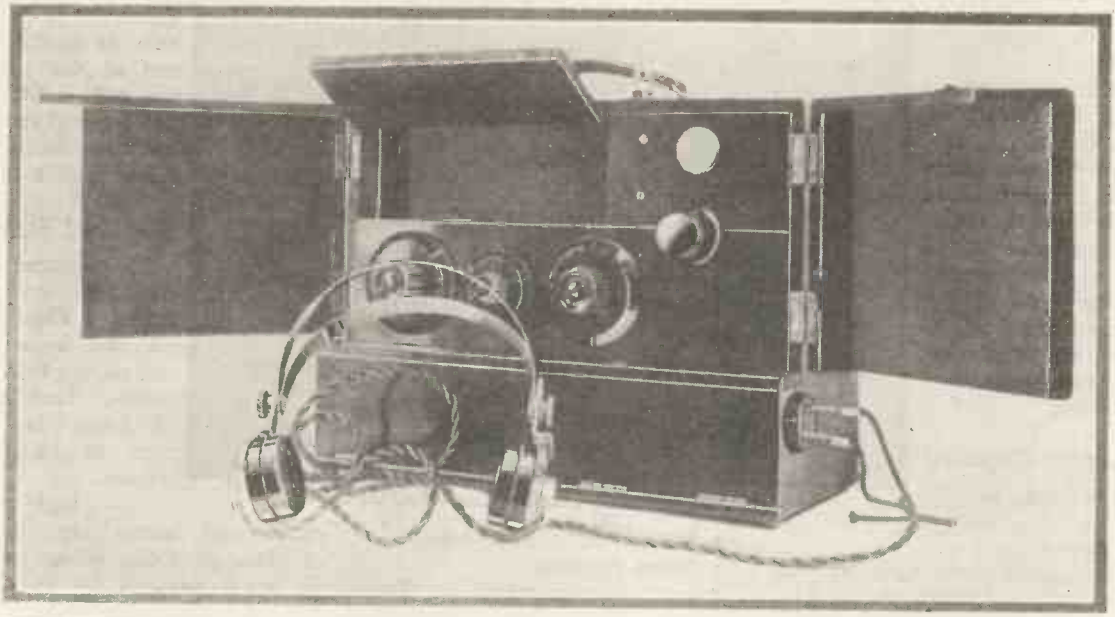


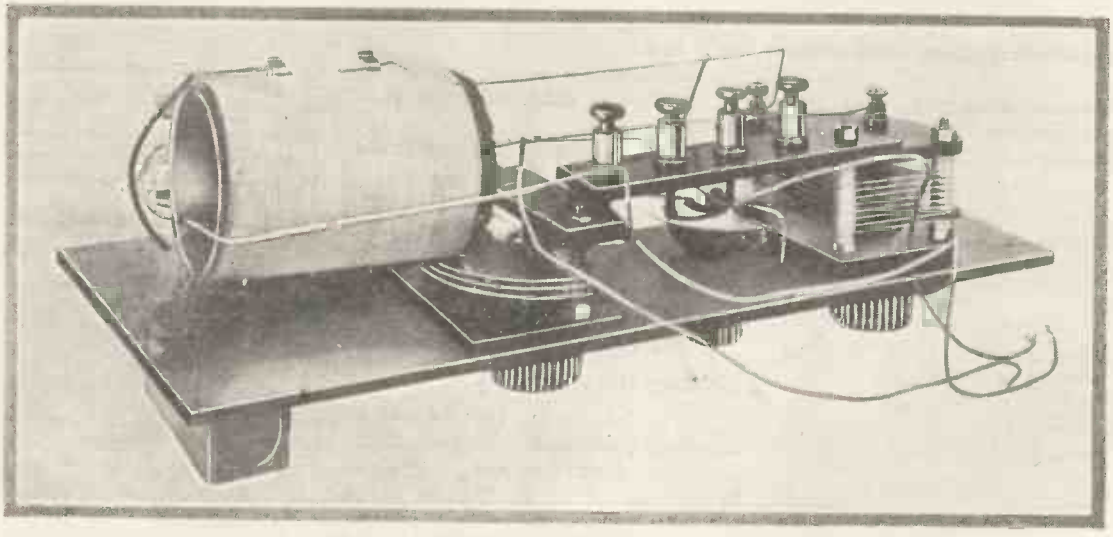
Details of Terminal Strip.



Construction of the Case.







Three detailed photographs of the Picnic Set.

Another holiday photograph taken by the Editor. The Technical Staff of "The Wireless Magazine," with a little feminine assistance, testing another set in the country.

two small holes at each end of the tube and threading the wire down through one and up through the other.

In wiring the set make sure that all joints are properly soldered, otherwise there will be a risk of the joints coming loose when the set is carried.

Flexible leads are taken from H.T. negative and L.T. positive to the phone connector.

Fixing the Panel

The connector is fastened to the side of the case by two bolts which also serve as connections. When the panel is complete and wired it should be brought near the case and the two leads from the frame aerial soldered to the two terminals of the tuning condenser (if reaction turns are used there will be three leads). The batteries should afterwards be put in the bottom of the case and leads from them taken to their respective terminals.

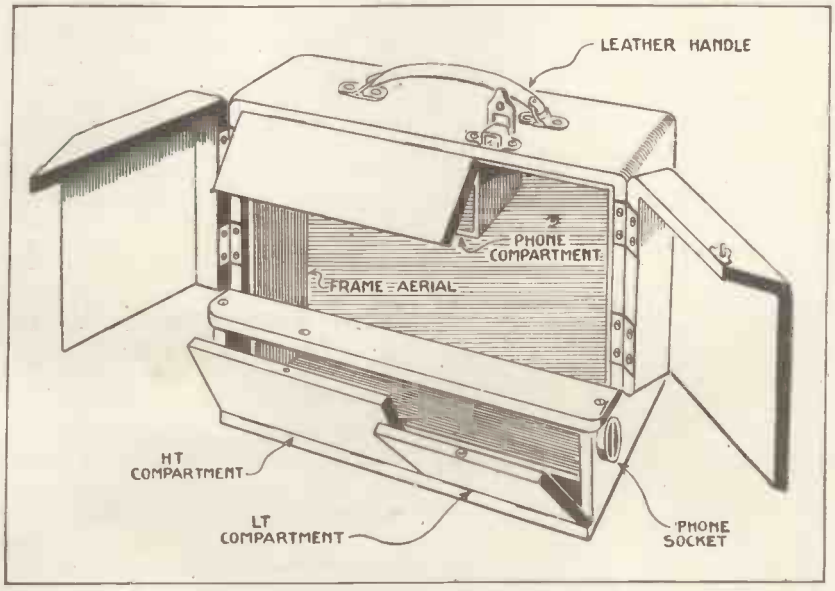
When this has been done put the valve in the holder and fit the panel into the case, securing it with ½ in. countersunk brass wood screws.

The piece of wood which fits across the front and forms a ledge may now be screwed down.

Switch on the valve, by turning the filament-resistance knob; if a hiss is heard when the reaction condenser is varied, the set is quite ready for working.

The new Dextraudion ·06 valve is used in this set, but if a different type of dull-emitter is used an advantage may be gained by reversing the L.T. leads.

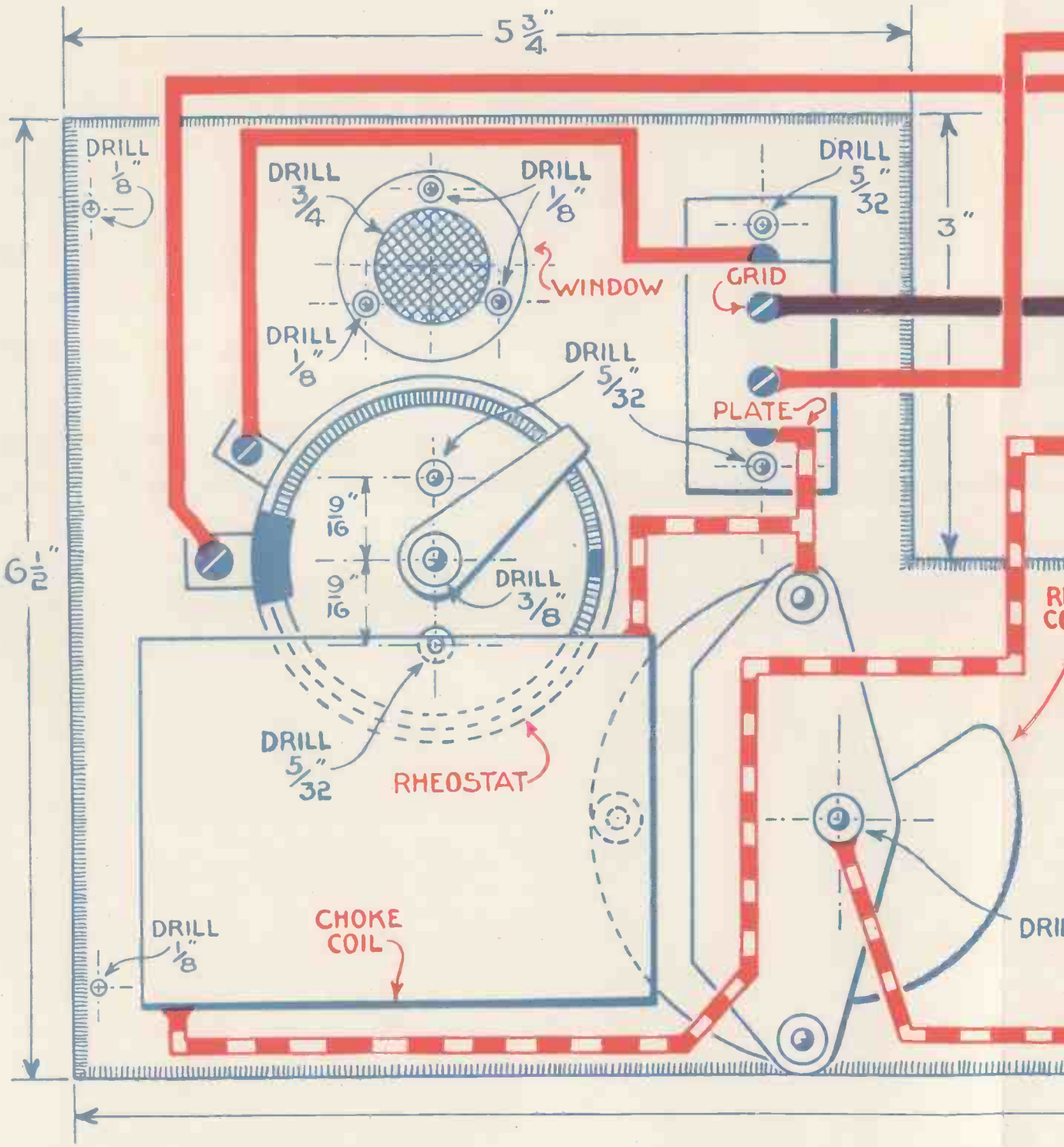
With the Dextraudion valve excellent results were obtained using only one flashlamp battery (4½-volts) as H.T., but the full amount (36 volts) is required for the valve to work at its best rectifying point. Very little microphonic noise is experienced from this valve.



Sketch of the Case with Panel Removed.

SELF-CONTAINED PORT

Combined Drilling Template and Full-si

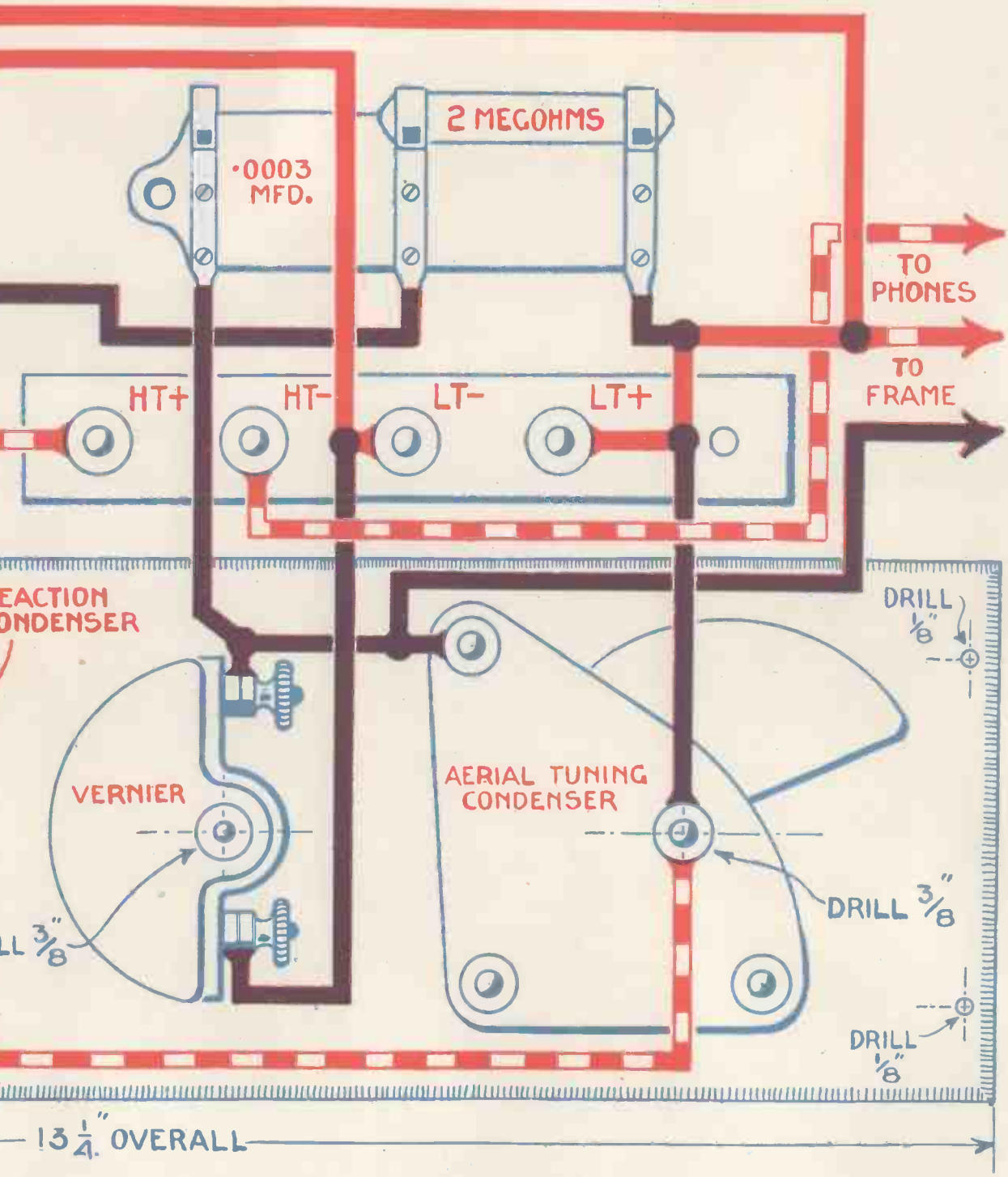


HOW TO USE THIS DIAGRAM :—The blue shaded outline indicates underside of panel; all blue lines r centres *pricked* through, the template thus serving many times if so required, and being retained for use *red-and-white* lines, the H.T. or plate circuit ; and *black* lines, the grid circuit. *For Full Particulars see an*

CASSELL & CO., LTD., London, New Yor

TABLE ONE-VALVER

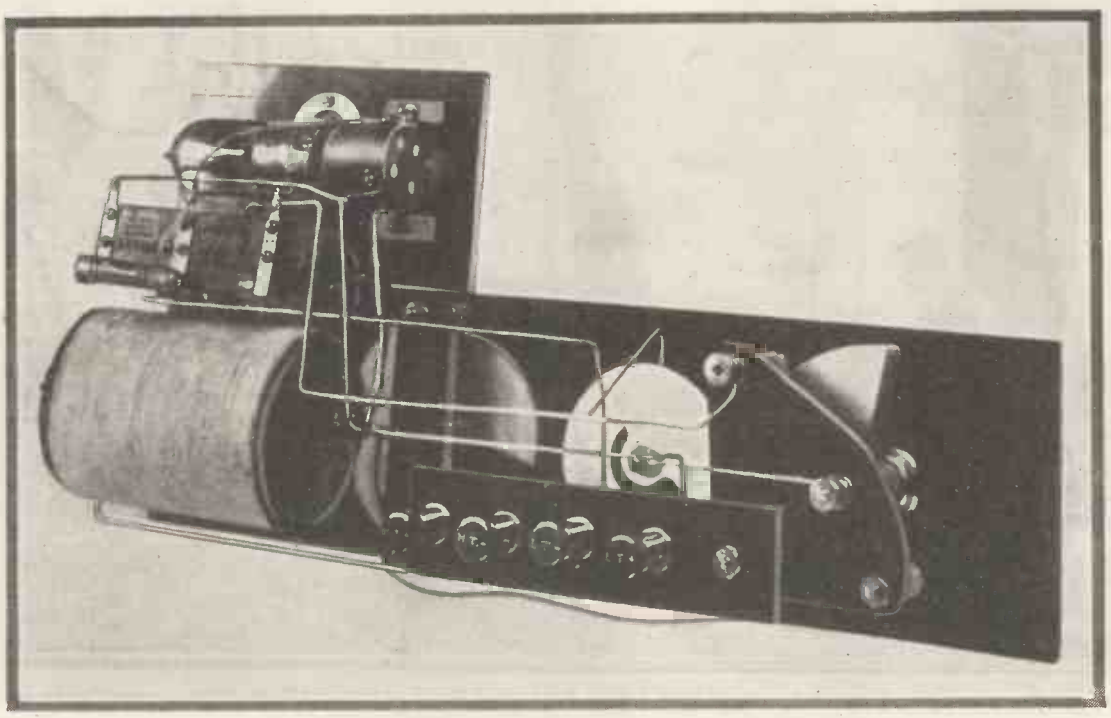
ze Layout and Wiring Diagram



elate to either panel or components. This template should be laid on the panel and the drilling as a layout and wiring diagram, in which the *red* lines indicate the filament-lighting circuit ; *Article "The Picnic Set" in "The Wireless Magazine" for June*, 1925.

k, Toronto and Melbourne.

THE PICNIC SET (Continued)



Arrangement of Components on Back of Panel.

Operating the Set

To operate the set turn the main condenser knob gradually until a carrier wave is heard. Then tune to the silent point and decrease reaction, retuning with the fine-adjustment condenser.

Lift the set and turn it until the signals attain their maximum volume.

The set is not critically directional, so that a station may be tuned in without the frame aerial pointing in the direction of the station. The set should, however, be turned in the correct direction afterwards.

Results

Results with this set have fully justified the care taken in design.

At Eastbourne the set was taken on to the beach and London, 65 miles away, was heard faintly. Bournemouth, 120 miles away, came in strongly on the phones during daylight.

In the evening, Newcastle, 340 miles away, was received on two pairs of phones, every word of the announcer being audible.

Le Petit Parisien has also been heard distinctly in London. It is interesting to note that in London Bournemouth can be received any evening with no interference from the local station.

Recently the receiver was taken to Hindhead where London and Bournemouth were received, quite good signals being heard in broad sunlight.

It was also taken into the vault of a bank in Kensington (40 ft. below ground and partly covered in with steel). 2 L O was received here loud enough to operate three pairs of phones.

John Henry talks about Himself, but not Blossom!

(*Continued from page 501*)

into large smiles, he knows that his humour is appreciated, and such tokens of encouragement strengthen his confidence and back up his efforts to "go one better."

On a stage the humorist has much to help him, but the microphone does away with his appearance, his gestures, his make-up, and thus robs him of a big percentage of his personality. For this reason alone, to put jokes "over the ether," to convey humour by the mere inflections of the voice, can only be acquired by experience.

Army Songs

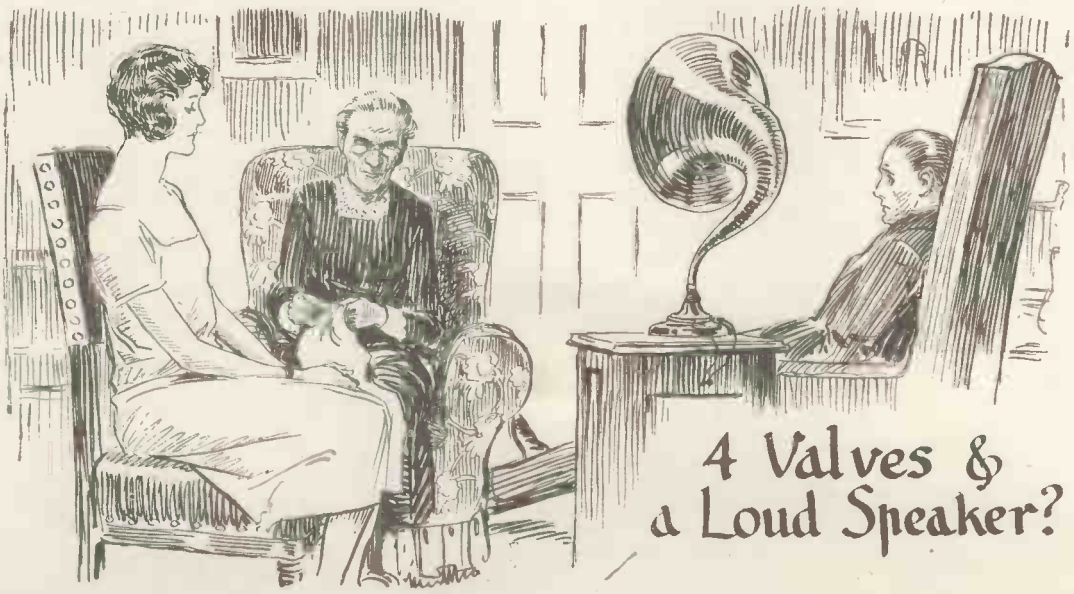
To those ex-soldiers who may have known and heard me in the Army, and who have not recognised me in the rather different style of work I have adopted, let me tell them that some of my most popular songs were "Shirts," "The Sergeant had Hold of my Hand," "I'm shy, Sergeant-Major," and "To cheer a Lonely Soldier on his Way."

One of these days I may resurrect some of these old favourites at 2 L O. That is, if they allow me to sing. Blossom has definitely vetoed "The Wheelbarrow."

John Henry

Which Would You Rather?

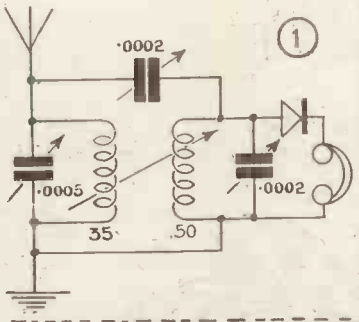
A Crystal Set
or



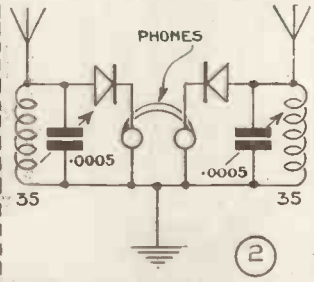
4 Valves &
a Loud Speaker?

Drawings by C. Fleming-Williams.

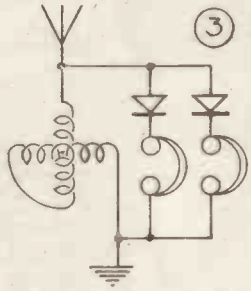
Crystal Circuits You Should Try



1 (*left*).—*A circuit employing a novel form of coupling; very suitable for those troubled by interference. The coupling is controlled by means of the variable condenser and the distance between the two coils. The coupling condenser must have a small minimum capacity. The two coils can be mounted in an ordinary two-coil holder if it is desired to interchange them.*

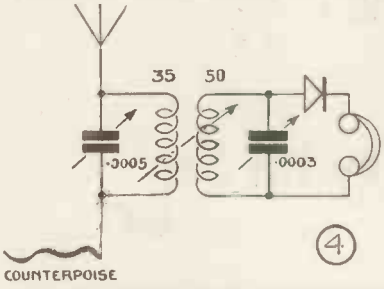


2 (*above*).—*A circuit showing two condenser-tuned crystal sets in which each set serves one earpiece. Two separate aerials are used and one common earth. If each set is tuned to the wavelength of the transmitting station an appreciable increase of signal strength is obtained.*

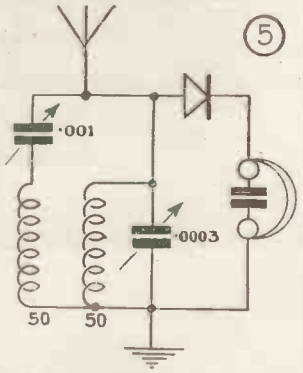


3 (*right*).—*A method of using two or more pairs of headphones without the usual loss in volume experienced when several pairs of phones are connected to an ordinary set.*

4 (*below*).—*A loose-coupled crystal circuit in which a counterpoise is used in place of the usual earth connection.*

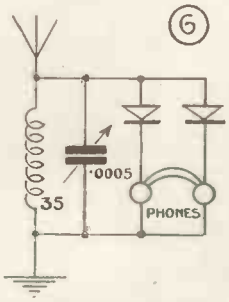


5 (*right*).—*A double-circuit crystal receiver, consisting of an "acceptor" and a parallel "rejector." Such a circuit is valuable for cutting out interference, and often improves the strength of the desired signal. To get the best possible results tuning should be carefully carried out.*



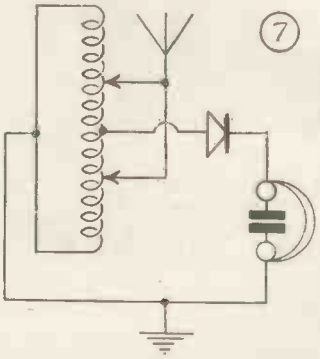
6 (*right*).—*A simple method of increasing signal strength in the phones. Instead of the two earpieces of a pair of phones being connected in series with one detector, the wiring is separated, and a separate crystal detector used with each earpiece.*

Care should be taken to get both detectors properly adjusted.

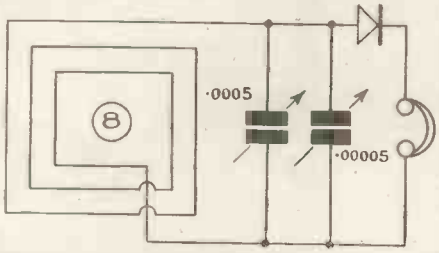


8 (*below*).—*A simple frame-aerial circuit. Using a fairly large aerial quite good reception may be obtained up to 3 miles from a main station; above this distance it should not be attempted.*

NOTE.—*All the coil numbers in these circuits are for broadcast wavelengths, that is from 300 to 500 metres.*



7 (*left*).—*A neat method of utilising an old slider coil for the construction of an efficient crystal set. A tapping is taken from the approximate centre of the winding, while two sliders—both mounted on the same slider bar, or on separate bars, if the latter are connected together—are used for tuning.*



ANGUS WESTON ~ SOLITAIRE

A Story by
FRANCIS ROBERTS

Illustrated by
CHARLES CROMBIE

"What is that?" he asked, pointing to the foot of the panel. "I don't see what you mean," Weston answered, innocently bending down to look.

THERE'S no thrill in life to the wireless amateur like the one he feels when, searching the ether, he hears a puny voice give a distant call sign, and knows he has hit on something new. That was how Angus Weston felt when he heard New Zealand for the first time.

"Z 4 A B C D," he heard, almost incredulously.

"I am 5 Z Y X W," he signalled.

The stranger was equally excited.

"Are you really English?" he asked. "I've been trying to get an English station for weeks."

"I am Angus Weston, of Ebbsfleet, Kent," Weston said. "Who are you?"

"Martin Wray, Rorikiki, New Zealand."

The two men, moved by the wonder of their conversation, leapt into intimacy. In a few minutes they felt like old friends.

The talk was the first of many. Weston developed a commendable habit of early rising; he was at his transmitter every morning, eager to exchange news with Wray. At first they spoke chiefly of wireless, but after a while they grew more confidential, and in time each knew the other's family history.

Weston was a fine sportsman, an old Blue who could play anything from polo to squash racquets, and had won cups and trophies all over the world. But he was growing old, and had had to give up everything but golf. In his disconsolate state wireless seemed to him an attractive hobby: he experimented with it, and gradually became an enthusiast.

He lived near St. Augustine's golf-links, in a little house at Ebbsfleet. Women came there to work during the day, but at night his only companion was a manservant named Betts.

Martin Wray managed a large sheep-farm in a remote district, and only wireless connected him with the world.

One morning Wray's voice was almost unintelligible with excitement.

"Old man," he said, "I'm coming home! They've given me six months' holiday. We shall see each other at last. I'll take the first boat."

At intervals during the voyage Wray managed to get a message through to Ebbsfleet. As a rule the ship's wireless operator transmitted for him, but occasionally he himself was able to speak to his friend.

"We're a day out from Colombo," he would say, "nearing home now." Then it was "Half-way up the Red Sea," "Gibraltar," and finally "Coming up the Channel."

"You must come and see me the very first night," Weston urged.

"I'll be only too glad," Wray replied. "I don't know a soul in England. I've got a few relatives, but I haven't met any of them. I've been in New Zealand since I was three."

II

On the night Wray was coming to see him Weston sat at a front window, watching for the visitor as eagerly as a child. The time consequently passed as slowly as it would to a child. He could not even go to meet him, because Wray was coming by road. At last, however, a little runabout scrunched up the gravel drive, and he hurried to the door and held it open. The two men clasped hands, both rather embarrassed.

"May I leave my car in your drive?" Wray asked. "You haven't a garage, I see. But I wish you'd ask your man to fetch my suitcase, I think it would be safer in here."

—he was as proud as most solitaires. Wray was not quite the man he had expected to see. He was pleasant and well bred, and yet the talk was not of the congenial character he had hoped. His friend's face, too, was a disappointment. Nothing definite displeased him, but there was an almost furtive look in the man's eyes, very different from the picture he had formed of a frank colonial. His voice was the greatest surprise.

It had always seemed bluff and hearty to Weston, but now, heard at close quarters for the first time, it was almost effeminate. Weston concluded he must have qualified the voice to match the same ideal figure. Finally, he decided that both of them were ill at ease and not at their best.

Wray was standing at the cabinet of trophies, lovingly examining the Amritsar Polo Cup, queen of the collection for many years.

"Have you fixed up for the night, then?" said Weston. "I thought you were going to stay with me."

"Thanks very much, old chap, but I've promised to go on to Dover."

"You have some friends in England, after all, then?"

The newcomer hesitated a moment. He seemed curiously disconcerted. Then he replied: "Some people I met on the boat. But I'll see you again soon."

The manservant removed Wray's coat and hat and brought his suitcase into the hall, while his host took him upstairs. In a few minutes the dinner-gong sounded.

The two men sat late over their meal, talking on every subject but wireless. Wray asked his host to save that up until they could visit the library and inspect his transmitting station.

Weston, on his part, was vaguely disappointed. The incident of his rejected invitation had annoyed him

"Serve the coffee in the library, Betts," Weston told his servant, "and then you can go to bed. We shall probably be very late, and I will see Mr. Wray out myself."

Wray exclaimed delightedly when he saw the library. It was a pleasant untidy room, where books and cigarette ends lay comfortably mixed. A woman would have called it his "den," or a rather nicer woman his "study."

A cabinet with glass doors held his collection of cups and trophies, a shining cluster in silver and gold. The most prominent piece of furniture, however, was his transmitting set. The wall behind it was covered with printed cards from transmitting stations he had picked up, in the middle of which, royally mounted on a decorative card, was Wray's from New Zealand. The two men went over and examined it. Weston exhibited his favourite gadgets, but to his surprise Wray's nervousness had increased, and he was not at all responsive. At length, however, the visitor grew interested.

"What is that?" he asked, pointing to the foot of the panel.

"I don't see what you mean," Weston answered, innocently bending down to look. "Where?" Instantly he felt a cruel blow on the back of his head, and fell forward unconscious.

III

The next thing Weston saw appeared to be a row of small mummies laid alongside each other in a sarcophagus. "I'm delirious," he thought. "They're not really there." A moment later, as consciousness came back to him, he realised that his head was hurting excruciatingly; and that the mummies were laid, not in a coffin, but in a brown leather suit-case. He tried to put a hand to his aching forehead, and the futility of the movement fully brought him round.

He had been tied hand and foot to the armchair at the side of his wireless set. His soldering bit had been forced into his mouth and bound there with his handkerchief.

(*Continued at bottom of next page.*)

Why Phones "Burn Out"

ALTHOUGH one constantly hears of telephones being "burnt out," it is fairly safe to assume that many of these casualties are not really caused by actual "burning out" by electrical current flow, but are faults due to other reasons, such as a fall, atmospheric conditions, or sudden changes of temperature.

Heavy-gauge Wire

The wire windings of a pair of high-resistance phones are of sufficiently heavy gauge wire to pass considerably more current than the average receiving valve can dissipate; in fact, determined efforts to burn out a 2,000-ohm bobbin by passing a quarter to half an ampere of direct current through it failed to attain the desired end, yet the writer has had 60-ohm telephones, which were wound with wire from four to six times as thick, "burn out" with minute fractions of induced alternating current!

Poor Winding

Very often the fault is directly traceable to poor construction. The telephone bobbins are sometimes wound in a slipshod manner and the magnetism and mechanical movements set up by the fluctuating current sooner or later results in a wire being chamfered through.

Winding by hand is rarely resorted to now-a-days, but handling the thin wire with moist fingers may very easily set up rapid decay in the copper, with disastrous results later on.

Should the telephones be dropped, this may not only break the delicate windings but also impair the magnetism of the magnets—a trouble often present but rarely suspected.

Moisture

The wearing of telephones for prolonged periods is one of the causes of premature breakdown, especially if worn on cold nights, the moisture in the warm air caused by close proximity to the wearer's head condensing and settling on the windings or connections. Should it be desired to wear the phones for long periods care should be taken to see that they are properly ventilated by auxiliary pads, or small holes may be bored in the metal case, care being taken not to injure the bobbins in so doing.

Some manufacturers, however, impregnate the windings with damp-proof varnish and thus render this precaution unnecessary.

Prizing Good Phones

A pair of telephones will often work satisfactorily with a burnt out bobbin, provided it is "shorted" with a piece of thin wire. A good pair of telephones should be greatly prized, for it is rarely that manufacture can be exactly repeated so that any two pairs are alike. A. J. C.

A GOOD many of the American signals picked up are not very strong. Like the American drinks.

THE voice of one wireless amateur has been heard at ten thousand miles. And he is not even a fish hawker at that.

EDINBURGH Council have declined to allow the B.B.C. to broadcast their proceedings. Perhaps they are afraid of being rounded up by the Entertainment Tax people.

LEEDS has been giving a lecture on cycling and its advantages. One of them, of course, is that you can sometimes get a lift from passing motorists.

A NUMBER of bright young listeners want "two-steps" in the programme on Sunday. Evidently they are not satisfied with that old-fashioned Sunday hymn which says "One step enough for me."

Angus Weston—Solitaire

(*Continued from preceding page*)

In front of him Wray's suit-case lay open on another chair. He recognised by their monograms that the mummy-wrappings were napkins and linen from the dinner-table; and a glance beyond the case to its owner explained the mummies.

Wray was standing at the cabinet of trophies, lovingly examining the Amritsar Polo Cup, queen of the collection for many years. He swaddled her in linen and placed her, too, in the case. The cabinet was nearly empty. Then he felt Weston's eyes on him and looked up.

"Sorry to have to be so rough, old man," he said, "especially after you've given me such a dinner; but you'll appreciate my position. I had to take the table-linen, too, to prevent the metal from rattling. I shall have to burn it, though—those monograms are dangerous."

Weston tried vainly to reply.

"And now," Wray went on, as he filled the last corner of his case, "I must be leaving you. Thanks for sending Betts to bed. It saved me a lot of trouble." He snapped the case to, picked it up, and made for the door. Weston's eyes followed him.

At the door Wray turned round for a final remark.

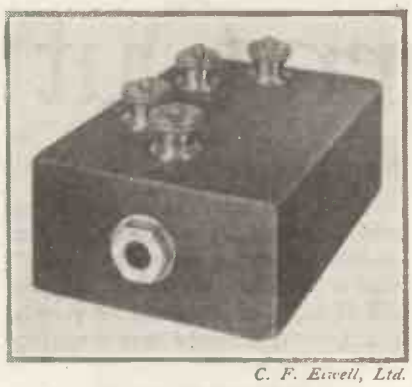
"I'll put your mind at rest for the night," he said. "I'm afraid you'll be uncomfortable enough in the body! . . . I'm not Mark Wray. I'm the owner of a humble receiving set, and I've picked up several of your conversations. They told me you'd never met, and as I'm a burglar as well as a wireless amateur, I at once thought of your collection of trophies. They're worth hundreds melted down." He patted the suit-case affectionately.

"Don't imagine you're going to find them again," he continued. "The police won't find me. I have somewhere to hide till this blows over, and then—well, what distinctive trait in me can you describe?"

Weston looked him over. He was perfectly ordinary, youngish, tallish, fairish, but nothing definitely. The man was right.

Then a thought struck Weston, and he looked up with a passionate question in his eyes.

"You're wondering what I've done with Mr. Wray," said the impostor. "Don't worry! I'm too skilled to practise violence. You shall have your dinner-party yet. I sent him a telegram on the boat, telling him you'd got flu and couldn't see him."



C. F. Elwell, Ltd.

Fig. 4.—Enclosed Jack.

How to Use PLUGS & JACKS in Your Set

PLUGS and jacks are probably the most convenient form of switching ever devised, and peculiarly suited for use in wireless circuits, but up to the present time amateurs do not seem to have fully appreciated their uses. This lack of attention is chiefly due to the fact that few circuit diagrams employing jacks have been published, and in a multi-valve circuit they are apt to appear a little complicated. This apparent complication, however, is in most cases due to duplicated leads, and in reality the circuits are little more difficult to follow than straightforward arrangements.

What is a Plug?

In construction the plug remains substantially the same for all purposes, but the jack varies according to the use to which it is to be put. Briefly, the plug consists of a metal rod made in two portions, each insulated from the other. The front portion is in the form of a knob, while the rear is a plain spigot. The ends of a flexible lead are individually connected to the two parts of the plug, and they are led through a tubular handle usually composed of ebonite or vulcanised fibre.

These constructional features may all be gathered from Fig. 1, where two plugs are shown. That on the right is an ordinary type for one pair of leads, while the other, which is shown in parts, is made to take two pairs of leads. Patented "Bull-dog" grips are fitted to ensure quick and positive connection to the ends of the wires.

The jack is a socket in which the plug is made to fit, and in so doing cause a number of electrical contacts to be made and broken. Fig. 2 shows the five types made for wireless uses.

Upon the shorter limb of a stiff metal frame of L formation is a brass bush, the hole in which is made to be a sliding fit for the plug barrel, so that a good electrical contact is made between them. The longer limb of the main frame carries a micanite block to which a spring strip is attached. This strip is kinked near its upper end, the position of the kink being such that when the plug is pushed right home firm contact is made in the groove cut just below the head of the plug. Thus the second contact is made,

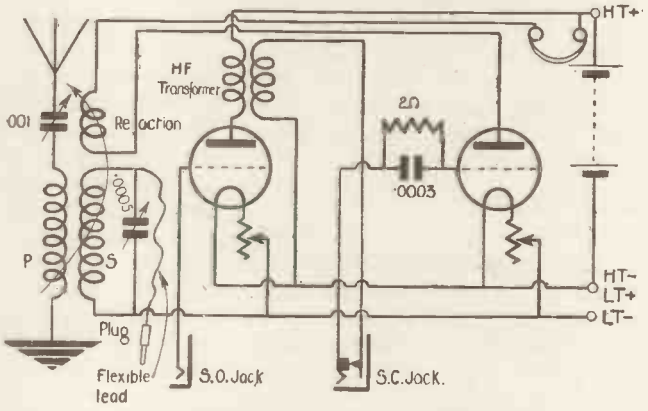


Fig. 6.—Use of an S.O. and an S.C. Jack.

and both portions of the plug have been connected to the two insulated sections of the jack.

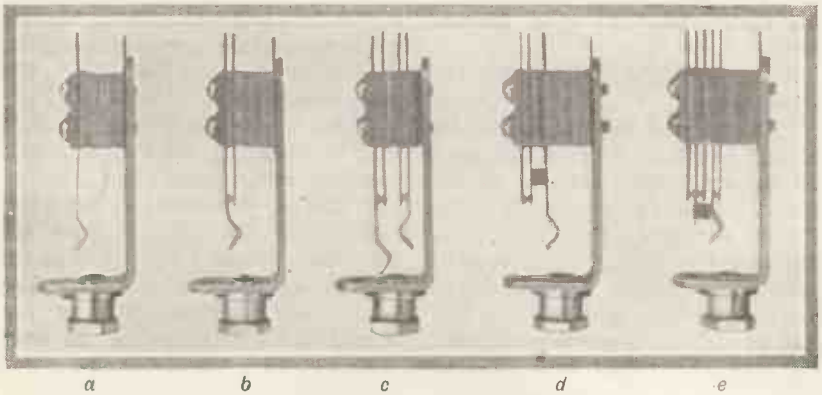
This is the total operation performed in the jack shown at A (Fig. 2), which is the simplest type made, and is known as an s.o. (single open) jack, for obvious reasons.

Platinum Contacts

The next type shown, B (Fig. 2), is known as an s.c. (single closed) jack. An additional contact is here fitted, situated on the plug side of the kinked strip. Small platinum contacts normally connect the two strips, but on the insertion of the plug the kinked strip is forced aside and the platinum points parted. Thus one circuit is opened while the other is closed.

An elaboration of this form of jack is shown at C (Fig. 2). Here the frame plays no part in contact

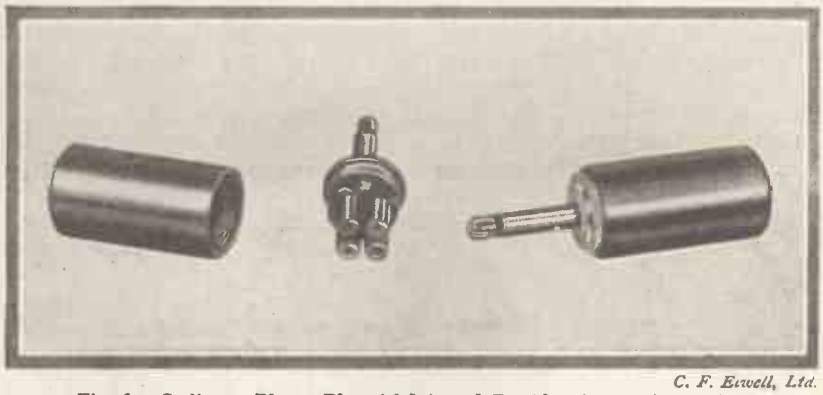
C. F. Elwell, Ltd



a b c d e

Fig. 2.—Five Types of Jacks used in Wireless Sets.

making, but, instead, an additional kinked strip is fitted which is sufficiently long to reach the rear half of the plug when the latter is inserted. Adjacent to the opposing faces of both kinked strips are further platinum fitted contacts, which, when the plug is not in position, are closed. Thus on the entry of the plug two circuits are completed and two are broken. The name applied to this type of jack is double closed (d.c.)



C. F. Elwell, Ltd.

Fig. 1.—Ordinary Phone Plug (right) and Double Phone Plug (left).

Filament-circuit Jacks

Another type of jack, known as the s.f. (single filament) pattern, is shown at D (Fig. 2). It is for insertion in the filament circuit of a valve, as well as for connecting the telephones. The large buffer between the kinked strip and the first contact is made of ebonite or fibre, and prevents electrical connection between the two strips, while at the same time allowing the movement of one to be transmitted to the other.

Finally, E (Fig. 2) shows the d.f. (double filament) jack, which is capable of controlling two filaments simultaneously. This jack has six contacts, and is also fitted with the insulating buffer. Fig. 3 clearly shows how this operates. It will be seen that the plug pushes the kinked strip to the left, which action causes two pairs of contacts to be broken while another pair closes. Contact is also made between the rear portion of the plug and the frame of the jack.

Jacks are secured to the panel of a wireless receiver by very simple means. A hole is drilled to take the outside diameter of the bush, and the latter is unscrewed from the main frame and pushed through the hole. Then the frame is screwed on from the rear of the panel. Final tightening is effected by means of a spanner or a pair of nut-pliers applied to the hexagonal head of the bush. A washer, which is supplied with the jack, is interposed between the head of the bush and the panel. The resulting appearance from the panel front is therefore extremely neat, only a plated hexagon being visible.

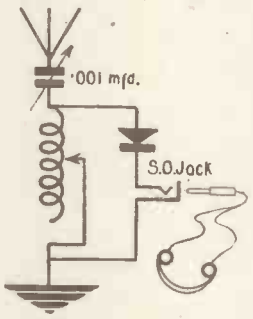


Fig. 5.—Phone Jack in Crystal Circuit.

Connections

The wire connections to the jack are made to the tinned soldering lugs shown in the photographs. These are not so congested as might appear from the illustrations, for they are conveniently staggered from side to side.

A special form of mounted jack which is very useful in purely experimental sets not laid out on a panel is shown in Fig. 4. Here the jack is horizontally disposed within a moulded ebonite box of rectangular shape. Countersunk holes are fitted which allow it to be screwed down to the bench.

It now remains to show how the different jacks are used in various circuits, and to what purposes they are most generally applied. The s.o. jack, besides being the simplest and cheapest, is also one of the most

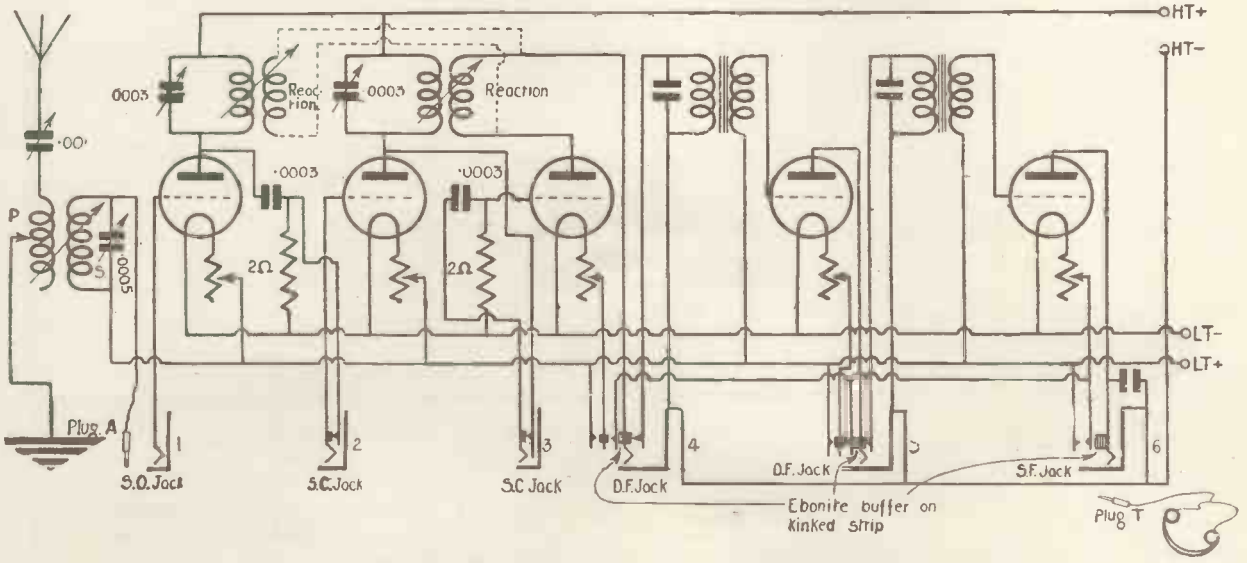


Fig. 8.—In this circuit nine different arrangements are possible with six jacks and two plugs.

useful and possesses the enormous advantage of having an almost negligible self-capacity. It is therefore frequently used in rectifier and H.F. circuits, but at the same time it will be found quite useful even in a simple crystal set for the connection of the telephones. Fig. 5 shows an example of this application.

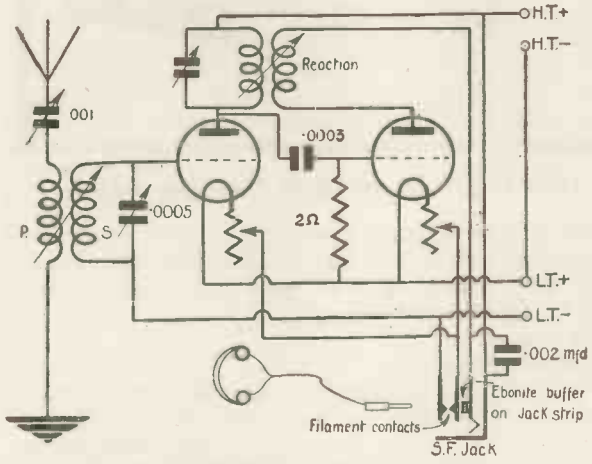


Fig. 7.—With an S.F. Jack the removal of the Phone Plugs cuts off the filament current.

Here the frame of the jack is connected to earth, and the other side to the crystal. The telephones are connected straight to the plug, and when the latter is inserted in the jack the circuit is complete, and the set ready for receiving signals.

For a two-valve circuit, where one H.F. and valve rectifier are used, it is most convenient to be able to use either one or two valves at will. Both are not required for work on near-by stations, but they may be needed to receive signals from stations at a considerable distance. Two jacks, an s.o. and s.c. respectively, and one plug may be used for this purpose, and Fig. 6 is the circuit diagram, showing how the plug and jacks are connected.

Frame Not Used

It will be noted that in neither case is the frame of the jack used, as the only contact to be made is between the tip of the plug and the kinked strip. The leading end of the plug is connected to the aerial secondary, as shown, while the rear portion is not required, and is therefore left unconnected.

Another two-valve H.F. and detector circuit is shown in Fig. 7. This has tuned-anode coupling and reaction to the anode coil is provided. The jack used in this instance is of the s.f. (single filament) type, and the circuit is so arranged that on the entry of the plug, which is connected to the telephones, the filaments light and the phones themselves are put in circuit. This feature automatically eliminates wastage of L.T. current through omitting to turn off the rheostats at the end of a reception.

It will be understood that this jack acts as a combined H. T. and L. T. switch.

The last illustration (Fig. 8) shows how useful and convenient jacks may be in a multi-valve circuit. In this instance there are five valves, and by means of two plugs and six jacks no less than nine different circuit arrangements are possible. These are as follow :—

(a)	By plug	A	in jack	3	and plug	T	in jack	4—Rectifier only.
(b)	,,	A	,,	3	,,	T	,,	5—Rectifier and 1 L.F.
(c)	,,	A	,,	3	,,	T	,,	6—Rectifier and 2 L.F.
(d)	,,	A	,,	2	,,	T	,,	4—1 H.F. and Rectifier.
(e)	,,	A	,,	1	,,	T	,,	4—2 H.F. and Rectifier.
(f)	,,	A	,,	2	,,	T	,,	5—1 H.F., Rect. and 1 L.F.
(g)	,,	A	,,	2	,,	T	,,	6—1 H.F., Rect. and 2 L.F.
(h)	,,	A	,,	1	,,	T	,,	5—2 H.F., Rect. and 1 L.F.
(i)	,,	A	,,	1	,,	T	,,	6—2 H.F., Rect. and 2 L.F.

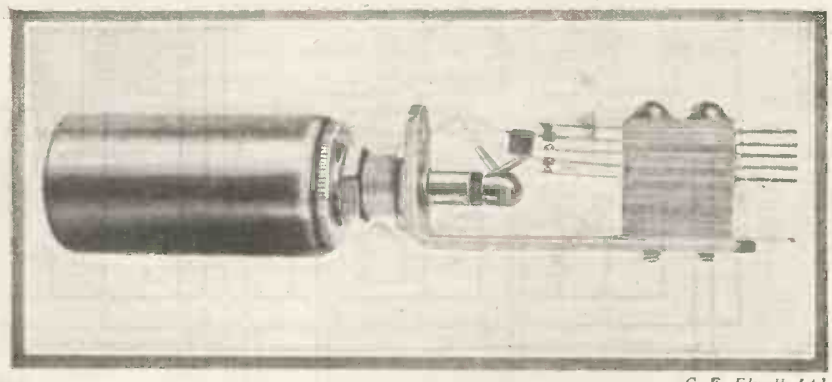
It will be seen that such a circuit will be extremely useful to anyone possessing a powerful set, all of the valves of which are only occasionally required. For instance, such a set should be capable of at least 500 miles range on the loud-speaker, with all its valves in action, but on nearer stations only the last three or perhaps four will be necessary, and therefore the aerial plug A may be connected straight to the second H.F. or the rectifier.

The last three jacks, Nos. 4, 5 and 6, are capable of controlling the filaments as well as connecting the telephones, and this will be found an added convenience. An important point in this circuit is that, as reaction is coupled to the H.F. valves, means must be provided to allow the reaction coil to be conveniently moved from the first to the second valves. The connections are clearly shown in the diagram, Fig. 8, by the dotted lines.

Other Uses

Many other uses of plugs and jacks will probably suggest themselves to the reader, and it is hoped that this article will revive interest in this form of switching. It is true that the appliances under discussion are not inexpensive, but their price is considerably below that of anti-capacity switches capable of performing the same circuit changes. Further, jacks have probably a lower self-capacity. In fact the self-capacity of the s.o. jack when used for H.F. circuits as shown is almost negligible. As far as the use of plugs for telephone connections is concerned they have the advantage of irreversibility.

R. B. H.



C. F. Elwell, Ltd.

Fig. 3.—Illustration of the Action of a D.F. Jack.

Wireless Femininities

NOT all things Victorian are hideous.

I make this remark not so much in justice to the memory of a much maligned era, as because I have always had a secret weakness for the charm and fine workmanship of those satinwood and rosewood inlaid boxes, lined daintily in all their many compartments with coloured paper, which our not so remote ancestresses used as tea-caddies, dressing-cases and work-boxes.

Most of us have one or two such boxes—handsome things in themselves, and with the sentimental value of having been given to grandmother as a wedding present or bestowed on great-great-aunt when she came of age. And they're rather white elephants, aren't they?

The Brilliant Solution

We can't use them, because we have ordinary tins for our tea and keep our manicure equipment in more modern receptacles. We daren't sell them, for the older members of the family remember those treasures from their earliest years and regard them tenderly as heirlooms. We can't have them as ornaments, because they're large (having been the fashion in the spacious Victorian days) and our houses are small.

But we *can* use them as wireless cabinets.

Don't you agree that this is a splendid idea? I saw it ingeniously carried out the other day with a long, narrow tea-caddy that had been dispossessed of its compartments and cut-glass equipment, and had had a set specially designed to fit its unusual shape.

Remember this idea next time you want a cabinet that costs nothing, is beautifully made, and looks handsome enough to adorn the sitting-room. The wireless enthusiast of the family will enjoy constructing a set to fit the special dimensions of one of these old-fashioned boxes.

Another Tip—A Small One this Time

By the way, what a tiresome thing a wireless set is to dust—yet neither its efficiency nor its appearance are improved by a layer that you could "write your name on," as old-fashioned housewives used to say.

A duster doesn't seem to get in between the little bits of mechanism and in and out of the intricacies of the headphones, at all satisfactorily, try as one will. I've found by experience that a small soft brush (the kind sold for cleaning typewriters is excellent) does the job much more easily and capably.

Jargon—Misunderstood

How extraordinary the jargon of any hobby always sounds to the uninitiated—among whom I must certainly count myself as regards wireless technicalities. I should win the booby prize with ease at any competition for defining wireless terms!

When the male fans (by the way, I learnt the other day for the first time that fan is short for "fanatic") forgather, we women listen to an unintelligible rain of "calibrated waves," "coupling coils," "grid-leak clips," and so on. It all sounds like double Dutch—only much more uninteresting.

Personally, Flewelling always seems to me to have a Welsh sound about it, and selenium might be one of those patent cures for rheumatism—but I expect I'm wrong again, and shall be howled down by the nearest man.

All the same, though men despise us for not understanding—and not wanting to understand—how things are made and function, we can turn the tables on them occasionally. Come to dressmaking—and clothes are as masculine as they are feminine—and which of the menfolk comprehends a word when we talk learnedly of gathers, overcasting and the like?

Even when their livelihood touches on the things of dress, they often remain in blissful ignorance. As witness a novelist friend of mine, who dressed all his heroines, summer and winter alike, in torchon and tulle, with all the satisfaction in the world, and was only rescued from his abysmal errors when he married a wife who undertook to garb the ladies (in words) more suitably for the future.

Art and Aerials

Have you noticed how aerials are now quite definitely an architectural item (if I may call them so) to be reckoned with as they hang slenderly against the skyline in country villages? In town, of course, they are mostly lost against the maze of bricks and mortar, but where houses are fewer they add a distinct grace to village roofs in many cases.

Some years ago I saw a really wonderful picture called "A Window in Wardour Street," which invested with poetry and romance a vista of London chimney pots framed in an attic window. Who'll be the first artist to immortalise the aerial in the same way—or has it even been done already?

While we're on the subject of aerials and poetry, it seems to me singularly appropriate that "aerial" and "Ariel" should have the same pronunciation, for surely there's something akin about these two airy, poetic and yet practical creations—the transmitter and receiver of our nightly concerts and Shakespeare's fairy boy.

The Talkative (?) Screen

The De Forest method of showing the portrait of a singer while he or she is performing has set me thinking if this simultaneous method couldn't be applied in another direction—that of the silent screen. Of course I haven't the faintest idea if or how it could be done (I leave that to the experts), but wouldn't it be splendid if wireless could supply the various speeches in a film, at the right moment, by the appropriate speaking voice (man's, woman's, or child's) instead of having them flashed as sub-titles?

A. M.

SOME minor alterations have been taking place in wavelengths recently, and although in all probability they have passed unnoticed by the majority of listeners, others with highly-selective apparatus have been quick to note the variations of a metre or two, such as the moving of Manchester from 375 to 374 and Bournemouth from 385 to 386 metres.

The revisions are not the outcome of mere caprice on the part of our engineers, and for any temporary inconvenience caused among listeners apology and explanation are offered.

The revisions are due to a desire to help in the disentangling of international broadcasting complications. If we would expect Continental countries to move to different wavelengths to suit the convenience of British stations, we must in turn concede something when the need is obvious.

The abolition of interference is mainly a matter of give and take, and the revisions accomplished and projected are an attempt to meet as far as possible the geographical situation and the peculiarities of jamming stations.

Improving the Service

We want to improve the service generally, and with the co-operation of listeners we can go a long way towards achieving that object if the difficulties of interference can be surmounted.

Any changes, therefore, which temporarily inconvenience local listeners should be regarded tolerantly, as the need of changes is urgent and the inconvenience is for a time only.

All-round improvement is the main line of our policy, and to that end we are continually introducing new apparatus at the various stations, after careful research and experiment, being convinced that the correction of fundamentals is a vital stage towards perfection, or to that happy state which is as near perfection as human endeavour and ingenuity can take us.

We have already sunk a sum of £100,000 in apparatus, and the resultant improvements are perceptible to the mass of listeners. The plans now in hand for introducing thermionic valves, or repeater stations, into the 10,000 miles of physical circuit which are an essential part of the broadcasting service will, when completed, effect further improvements in transmission, while the installation of new correction apparatus at the receiving end should enable listeners to obtain far better results than heretofore.

It is no rash prediction that within a year a full 100 per cent. of our population will be within crystal range of a broadcasting station. Already reports are in our possession from places as far removed from London as Alton of perfect reception of the new 2 L O on a crystal, while reception of the same station on one valve in Holland and Germany appears to be a fairly common experience.

The apparatus at the London station is at the moment up to date, and we are turning our attention to the provinces with the view of scrapping obsolescent plant as funds become available for its substitution by new apparatus ; for improvements in method are being brought about with such rapidity that equipment which a few months ago was the latest word in wireless achievement may now be described as almost antiquated, or at any rate possessed of shortcomings which cause the enterprising wireless engineer many anxious moments.

It is certain that in the immediate future an expenditure of several thousand pounds will be necessary on provincial stations to consolidate the gains that have been made in London.

Concurrently with the erection of one or two high-power stations it may be found desirable to provide special services on longish wavelengths ; and the cost of a high-power station is £50,000.

It is expected that Daventry, which will replace Chelmsford as the permanent high-power station, will be ready in August, and it will serve the London area with London programmes ; in other words, Daventry will cater for the area within a radius of about 100 miles ; but experts are already declaring that Daventry, ere even it begins work, cannot be regarded as the final goal.

Second London Station

London itself, for instance, will need a second station on its outskirts, and preferably a high-power station, particularly if the broadcasting of Parliament is to become a *fait accompli*.

It is further contended that certain main stations which have a present value of 1½ kilowatts should be increased to 10 kilowatts ; but we are, of course, faced with the limitation of 3 kilowatts imposed by the Postmaster-General.

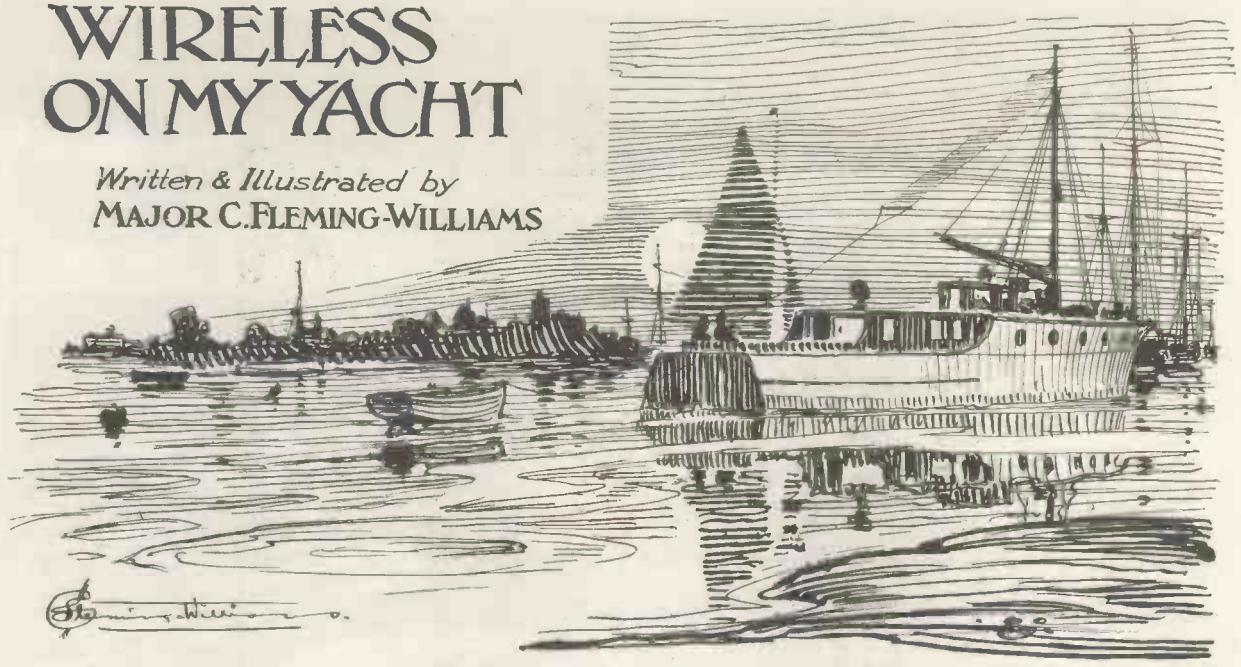
The data obtained at Chelmsford in connection with the contrasted programmes which are broadcast as a regular feature of the station's work have been found useful in laying the plans for the Daventry programmes ; but the elaboration of the schemes in hand will depend upon the added support of listeners as the preparations are far enough advanced to show that very heavy additional costs will be entailed.

Our revenue for the current year is estimated at £480,000, and between 50 per cent. and 60 per cent. of it will be swallowed up by programmes alone.

(*Continued on page 568*)

WIRELESS ON MY YACHT

Written & Illustrated by
MAJOR C. FLEMING-WILLIAMS



IT was a wild day in January, and the wind drove in under the car hood with vicious spurts as I turned into Oxford Street. Presently I drew up to the kerb to buy some cigarettes, and as I stepped out I ran into Maclean; or, rather, bending to the gale with head right down, he ran into me, broadside.

"Why the dev——" he commenced, and then, recognizing me, "Hello! Chucking your weight about as usual. My fault, though. Where are you off to?"

"Making a few purchases, and then I'm for the open road."

"Going for a nice little yachting week-end?" He was trying to be funny at my expense, knowing my weakness.

"Yes," I replied soberly. "Just off now."

He gazed at me in amazement.

"I'm driving down to my boat as soon as I've got this baccy," I continued. "And you are coming with me!"

"WHAT!" he shouted. I'm sorry to write it so big, but that is how he said it, opening his mouth so wide you could have put a square-law condenser inside it, and then have had a job to find the ebonite knob!

I continued quite calmly:

"You're coming down with me. You're clogged up with too much civilisation and riotous living, it hangs in festoons all about you. What's worse, you're getting fat."

"Do you seriously mean that you contemplate going down to your boat at this time of the year, and in this awful weather?"

"I do," I replied, pulling him inside the door of the tobacconist's, where we could talk without swallowing too much water. "We are moored in a very cosy place near Southampton Water. The family is installed aboard for a few weeks. I'll undertake that your bed is well aired, and we can even rise to a hot bath if you are not too dirty, and don't take too much water."

"If you'll promise to have the coffin of plain oiled oak, with oxidized fittings, I'll think about it and let you know in a few weeks. Good-bye."

But I had him firmly by the sleeve. He made a grimace of resignation.

"You've got a nasty bicep," he said. "I suppose you yachtsmen are so strong because only the soundest constitutions survive."

Then I started to talk in earnest. Finally I promised him that if he would come down one night on trial, I would give him a hundred of the best, if he did not stay for the rest of the week-end.

He listened attentively, and then very casually asked:

"Do you really think I am getting fatter, old chap?"

I knew he was mine then, roasted and spitted and done to a turn. You see he is a well-known cinema idol, and quarter of an inch more round the waist line might cost him hundreds, and decrease his post-bag by some dozens of letters a week. For all that he is one of the best fellows living, and not conceited in the least.

While he was collecting some clothes from his club, I sent the following wire to my wife on board:

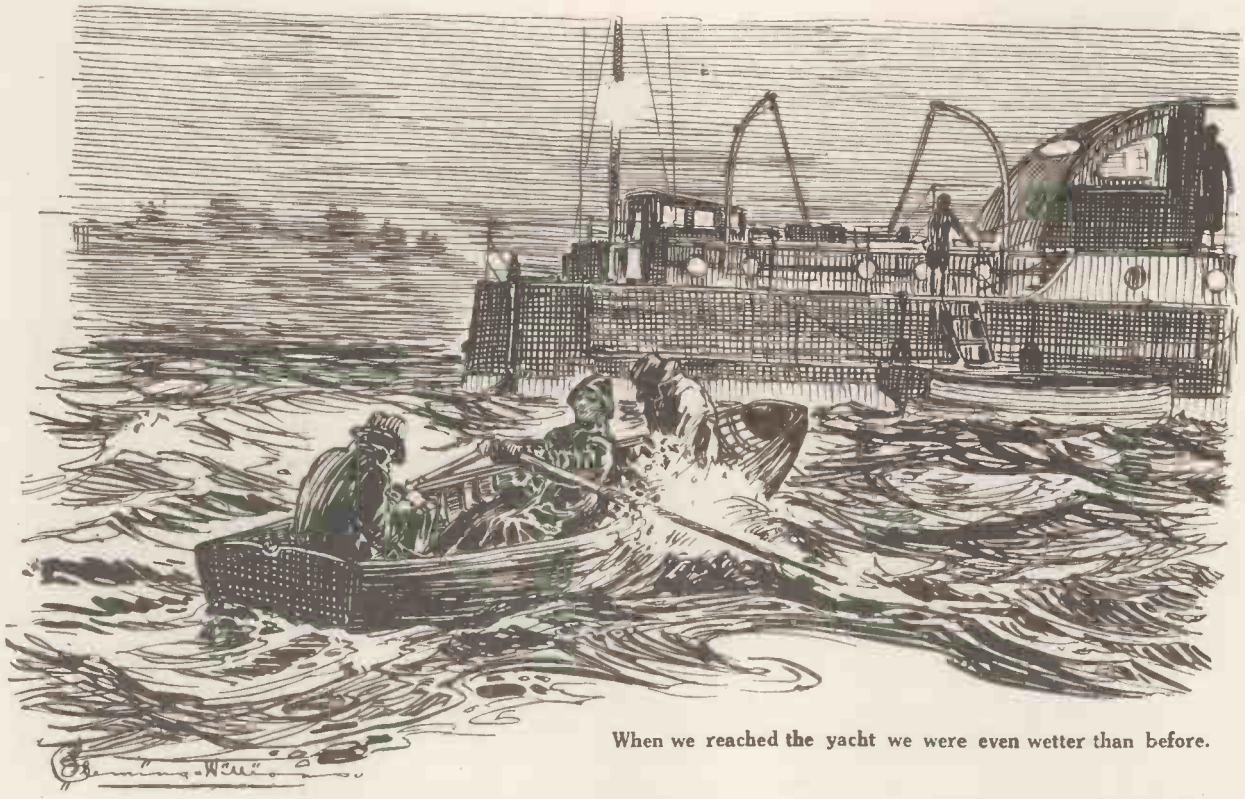
Bringing Mac, fatted calf for two, stoke her up, arrive seven.

The eighty-odd miles, drive down was about as bad as it could be. Going over the Punch Bowl one vicious gust hit my disc wheels so hard that I nearly found the ditch, and all the time it was more like flying a big seaplane than driving a car, she pitched and rolled so much.

Maclean was very cheerful, too cheerful. When we passed an hotel brilliantly lit, he remarked how inviting it looked, and grew silent. By the time we reached the Portsdown Hills, we were fairly damp and chilled to the bone. It was dark as the pit, visibility bad, and the roads fairly swimming, but through it all my trusty old engine roared merrily away, and we never dropped below a thirty average.

By the time we reached the garage where I keep my car, as the nearest point to the boat, poor old Mac was thoroughly wretched, his conversation was full of "atmospherics," and his temper more touchy than the tuner in a short-wave circuit!

It took a good deal of shouting to make the *Flamingo* hear us, when we got to the hard, but presently



When we reached the yacht we were even wetter than before.

we were in the blinding glare of a searchlight, which then flickered a welcome in morse.

A dinghy soon grated on the stones.

"Hello, Dad!" a voice called out from the darkness. "We got your wire. We've got a fug up you can cut with a knife, and mother's raided the store locker for a spread that will knock the stuffing out of the Ritz."

When we reached the yacht, after a stiff pull in a nasty little chop, we were even wetter than before. A "pram" dinghy is a good sea boat, but as wet in the nose as a baby with a bad cold.

As Mac climbed the slippery companion steps, I'm sure he would have given a small fortune to have been in Piccadilly Circus!

I must here explain that my boat is an 80-ft. motor yacht, with large deck-house, dining-room, saloon and three double-berth cabins, not to mention bath-room and usual offices; so that it is quite possible to get a degree of comfort aboard undreamed of by a landsman.

Once inside the deck-house, the gale, the cold, the discomfort were forgotten; vanished at the closing of a teak door. It is true the boat swayed a little to the gusts, the hail drummed on the coach roof, and the wind shrieked through the shrouds; but it all seemed a long way off—of another world. Here in the blaze of the electrics, in an atmosphere of cosy warmth, amid surroundings that to us, at least, are harmoniously artistic, was a spirit of comfort and homecoming that was worth all the misery of the drive down.

"Don't wait to change," urged my wife. "The meal is waiting. You must be starving."

I took Mac along to his cabin. With its dark mahogany and glistening white enamel, the rich blue coverlet and hangings, all suffused into a warm glow by the amber of the electric shade, it made about as cosy a picture as a tired heart could desire. Mac's spirits had been rising rapidly ever since we got inside the deck-house. When I showed him real sheets and a spring mattress, he overflowed.

"You fraud," he chuckled. "Here have I been picturing you living a simple life of spartan discomfort, and I find you wallowing in a downy nest, soft beyond all imagining."

When he sat down in our little ward room to a meal as delightful to look at as it was to eat, he was beyond words.

It is surprising what a clever woman can do with a well-stocked store locker and a tin opener, and my wife is no fool.

Then happened what I have been working up to all this time.

Mac laid down his fork and burst out:

"The only difference between this and the Savoy is that there is no music."

It was better than we had hoped for. I winked at my eldest son; he left the table quietly.

Suddenly the orchestra struck up, clear and true. I forget what they were playing, something not too heavy, and not too light; something dreamy, in absolute contrast to the gale raging outside. It was a miracle. No atmospherics, no morse, just as pure and loud as if they were playing in the saloon hard by.

It was a splendid climax. It put the tin hat on my friend.

"This is the most amazing experience of my life." (I have never seen him so moved.) "I was calling myself all kinds of an idiot on the way down; for two pins I would have jumped out of the car, and walked all the way home. Now this! Old man, I'm not going back to-morrow, nor am I going on Monday. I'm staying till I'm kicked out!"

He stayed for a fortnight, and with much reluctance we kicked him out when we all returned for a further period of strenuous work ashore.

After dinner we adjourned to the saloon, and, later, when the Savoy bands came on, we danced. There is not much room for it, you have to dodge several obstructions, including the big anthracite stove. But we danced to the strains of a band eighty miles away, on board a little yacht, during one of the worst gales of a bad winter, and we were as care-free and happy as children.

If the B.B.C. had asked us for a certificate of merit that night, every hat in Savoy Hill would have heterodyned badly, and even Eckersley would have blushed.

One other night comes to my memory as I write. It was last New Year's Eve. We had turned in, and the loud-speaker was still giving us the strains of the Orpheans, together with a lot of other noises.

That racket stopped and then we had some carols. When we were warned for the chime of Big Ben, I hopped out, went up into the deck-house, and as the sonorous tones came through, pressed the button of our electric horn to each stroke. It was a quiet night, and from all around I could hear hooters, fog-horns, sirens, car klaxons, and whistles. They were all rather distant, and blended into a continuous note.

After a few moments it all stopped. There was dead silence save for the lapping of the water outside. Then, with startling suddenness, church bells crashed out peals of joy. They were so loud it sounded as if we were up in the belfry. They woke my youngest boy, who will sleep through a thunderstorm. I have never heard the wireless so loud and yet free from blast.

Those bells were just the right touch, they thrilled every one of us. It indeed seemed that a new and vigorous year had been born, and it was one of real promise of joy and happiness to us all.

An amazing thing, wireless! I'll never get used to it.

It has made an enormous difference to yachtsmen.

No matter where we may be, at sea, or in a quiet backwater miles from everywhere, we get the time, the news, and the weather report, to say nothing of endless entertainment.

Nowadays there is no need for expensive chronometers. With wireless time signals coming through so many times a day, one could navigate the seven seas with a wrist watch.

The weather forecast is invaluable. We can stay where we are, snugly at anchor, and wait for that "depression" to blow itself out; or we can put to sea, assured that it is very unlikely that we shall be overtaken by a bad storm before we can reach port. It does not always work perfectly, but it is usually our own fault if we do not get fair warning of anything really dirty.

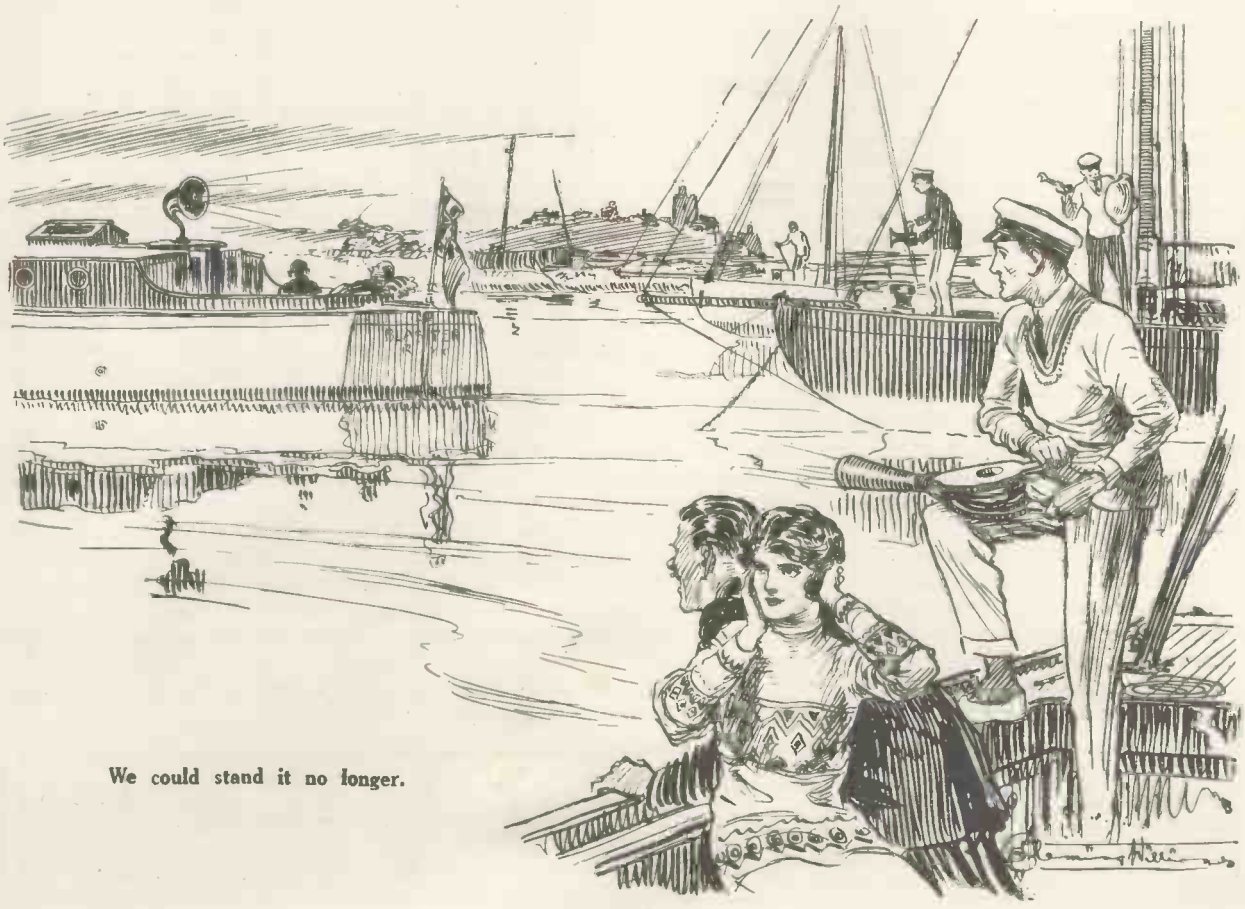
The weather report may bore you in your drawing-room in Mayfair, but, believe me, on the sea it is a godsend.

When the only paper obtainable may be a couple of days old and often got by much hard rowing and a stiff walk, the news bulletin, right from the horse's mouth, so to speak, is an asset beyond price.

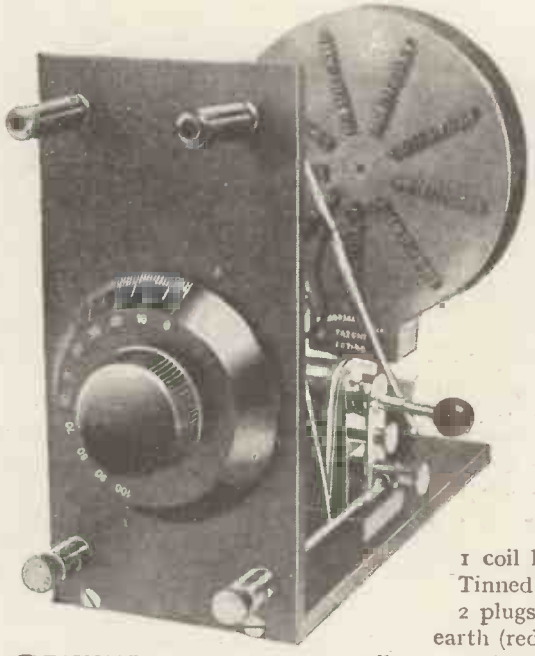
And the entertainment!

Can you imagine anything more delightful than to bring up in some quiet corner after a hard day's sailing, stow down, eat a good meal, and then smoke a blissful pipe; the

(Continued on page 540)



We could stand it no longer.



A CRYSTAL SET Out-of-the-Ordinary

A Design Introducing Novel Features and Components

CRYSTAL sets are generally built on the same lines, except for small alterations in the circuit or layout.

In the set here described, however, the design and components are altogether out of the ordinary.

Circuit

In the circuit diagram it will be noticed that the ·0002-microfarad fixed condenser in series with the aerial renders the aerial more or less aperiodic. Tuning is accomplished with a variable condenser in parallel with the plug-in coil. This latter condenser has a capacity of ·0005 microfarad and is totally enclosed in the dial.

Across the phones is placed one of the new Wates Bros. "K" type ·001-microfarad condensers.

Apparatus Required

For building the set the following components are required:

1 ebonite panel 12 in. by 3 in. by ¼ in. (St. Helens Cable and Rubber Co.).

1 variable condenser, ·0005 microfarad (Portable Utilities, Ltd.).

1 fixed condenser, ·0002 microfarad (The Electrical Research Laboratories, London).

1 fixed condenser, ·001 microfarad (Wates Bros.).

1 crystal detector, type "A" (Quality Products, Hyde).

1 coil holder, panel mounting.

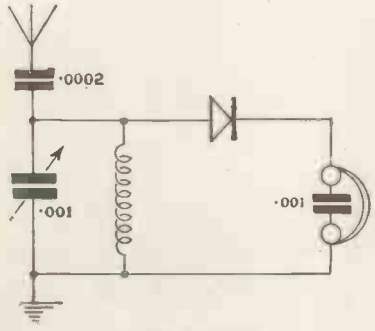
Tinned copper wire for connecting.

2 plugs and sockets for aerial and earth (red and black).

2 phone terminals.

The ebonite panel should be cut into two pieces, 6 in. by 3 in. each, and the edges squared. One piece serves as a baseboard, while the other forms the panel.

The panel is fastened to the baseboard by means of two 4 B.A. screws (countersunk). One end of the base board is drilled and tapped 4 B.A.



Circuit Diagram.

The crystal detector is mounted by drilling two holes in the baseboard corresponding to those on the detector base, and tapping 4 B.A., after which the detector is screwed down with ½-in. countersunk screws.

The coil holder is fixed to the baseboard by means of a countersunk screw.

To the variable condenser is attached a thin flexible covered lead. When fixing the condenser a small hole should be drilled to allow this lead to be taken to the other side of the panel.

Wiring

The wiring of the set is carried out with No. 16 S.W.G. square tinned copper wire, the connections being kept as short as possible so as to do away with any right-angled bends. Connections to the variable condenser are made from the centre spindle and from the flexible lead.

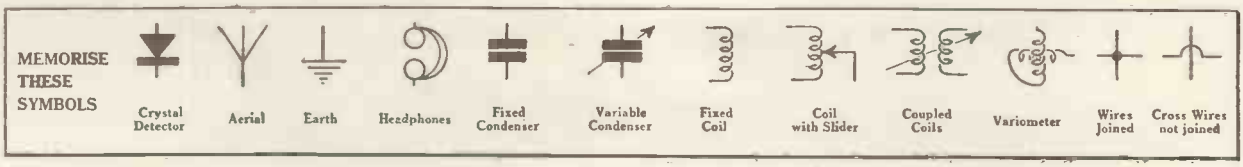
If this lead is longer than is required the covering should be pushed back and the lead cut to the right length. After the lead has been soldered the covering should be allowed to spring back into position, when it will cover the joint.

Operation and Results

In testing the set a Gambrell "A" coil was used. Fix the aerial and earth leads to the red and black plugs respectively, and push the plugs into the sockets at the top of the panel. Attach the phones to the phone terminals and tune in the local station.

Tuning should be quite sharp. By reversing the earth and aerial leads signals will come in at about half strength, and if the crystal is then adjusted to its most sensitive spot and the aerial and earth leads replaced the full strength of the signals will be attained.

Using the Gambrell coil as a frame aerial, London three quarters of a mile away could be heard quite distinctly!



The set was next tried using an "F" coil, when Chelmsford, 50 miles away, was heard at remarkable volume. During a two minutes' interval at Chelmsford the set was tuned down to a lower wavelength and Hilversum, Holland, transmitting a musical programme, was just audible!

In the latter tests the set was used in London five miles west of 2 L O. The receiver is ideal for the wireless enthusiast who wishes to have a reliable and sensitive crystal set as a stand-by for testing.

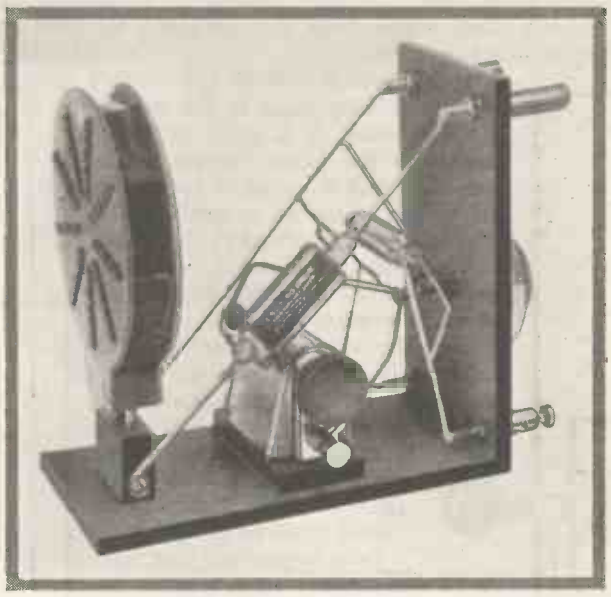
Cabinet

It will be noticed by the photographs that the set is not enclosed in any cabinet. In view of the components used a cabinet is not really necessary. Dust cannot get at the plates of the condenser as these are totally enclosed. The crystal detector is similarly protected.

Nevertheless, many constructors will prefer a cabinet of some sort, and to meet their needs details of a cabinet of original design are given on the next page.

The cabinet is made from ¼ in. mahogany, and all dimensions are given in the drawing. The case is fitted to the set by means of six 4 B. A. countersunk screws, three on each side. The ebonite baseboard should be tapped 4 B. A. to receive the screws.

A novel and neat cabinet could be made from celluloid, the edges of which may be joined with amyl acetate, obtainable from any chemist.



View of Completed Set.

CRYSTAL HINTS

FOR the benefit of those who have had little or no experience with crystal sets a few hints on the way to obtain the best results will not be out of place.

It is useless trying to get good results from a crystal that has been allowed to become coated with dust or grease. For this reason a crystal should never be handled with the fingers. If it is found necessary to remove the crystal from the detector all the handling should be done with a pair of tweezers.

View showing Disposition of Components.

The accumulation of dust on the surface of the crystal may be prevented by keeping some form of cover—such as an empty pill box—over the entire detector when the set is not in use. Better still, use a detector of the enclosed type.

Catwhiskers

Though small and insignificant, the catwhisker plays an important part in reception. With most crystals it will be found that best results are obtained when the catwhisker is making the lightest of contacts with the crystal.

The area of the catwhisker touching the crystal has also an important bearing on reception and should be as small as possible.

In actual practice best results have been obtained when the end of the catwhisker has been nipped off slantwise with a pair of scissors.

We have recently witnessed the placing on the market of several types of permanent detectors. Such detectors have several advantages over their older prototypes, chief of which are stability and protection from detrimental influences.

For those who require a crystal set that will give the minimum of trouble these detectors have many advantages to recommend them.

Distance

One hears much nowadays concerning long-distance reception on crystal sets. Such reception is, in many cases, freak reception, and owes its existence to abnormal or particularly satisfactory conditions.

Nevertheless, surprising results may be obtained from a simple crystal set, providing the aerial and earth systems are all that they should be and care is taken in operation.

The value of a good aerial and earth cannot be too highly stressed.

A CRYSTAL SET OUT OF THE ORDINARY (Continued)

Without them the most efficient set, be it crystal or valve, cannot give of its best, whilst if they are efficient a set that is not of the very best construction can be made to do wonders.

It is unusual to find insufficient attention being paid to the aerial, for the value of a good aerial is known to the merest novice. But one does find lamentable ignorance as to the value of a good earth. Yet one is as important as the other.

Where the set in use is a crystal set the earth lead should be kept as short as possible.

For the ordinary amateur the cold water tap provides about as good an earth as possible, but if something different must be used a metal plate about 18 in. square, to which is soldered the earth lead, should be buried in moist ground.

It is important that the earth surrounding such a plate be kept moist, as much of the falling-off in signal strength during the summer months is due to the "earth" being allowed to become dry.

A bucket of water poured on to the ground where the plate is buried will work wonders.

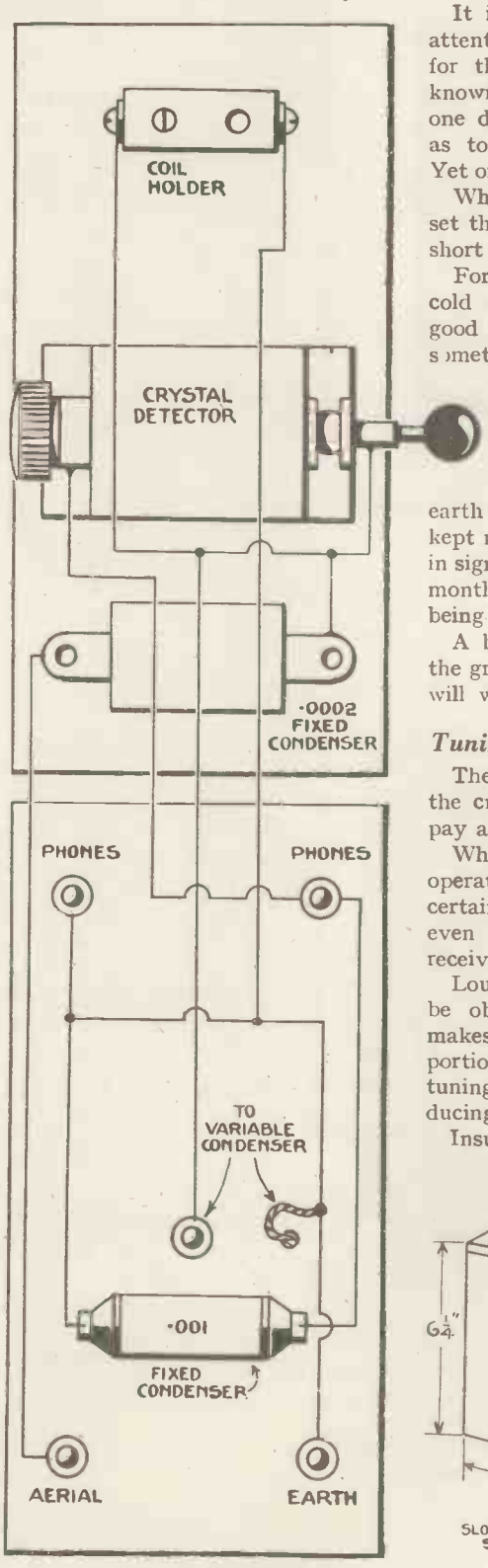
Tuning

There is one other point to which the crystal set user will do well to pay attention, and that is tuning.

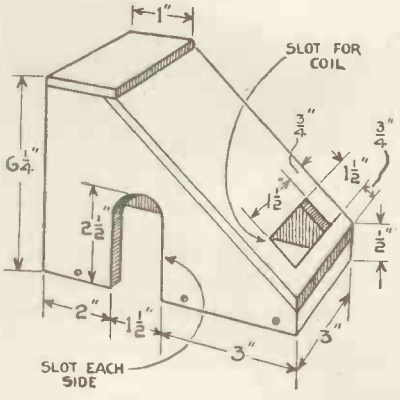
Whilst not exactly a difficult operation there is, nevertheless, a certain amount of skill in tuning even so simple a set as a crystal receiver.

Loud and clear reception can only be obtained when the catwhisker makes contact with a sensitive portion of the crystal and when the tuning condenser (if any) is introducing the correct capacity.

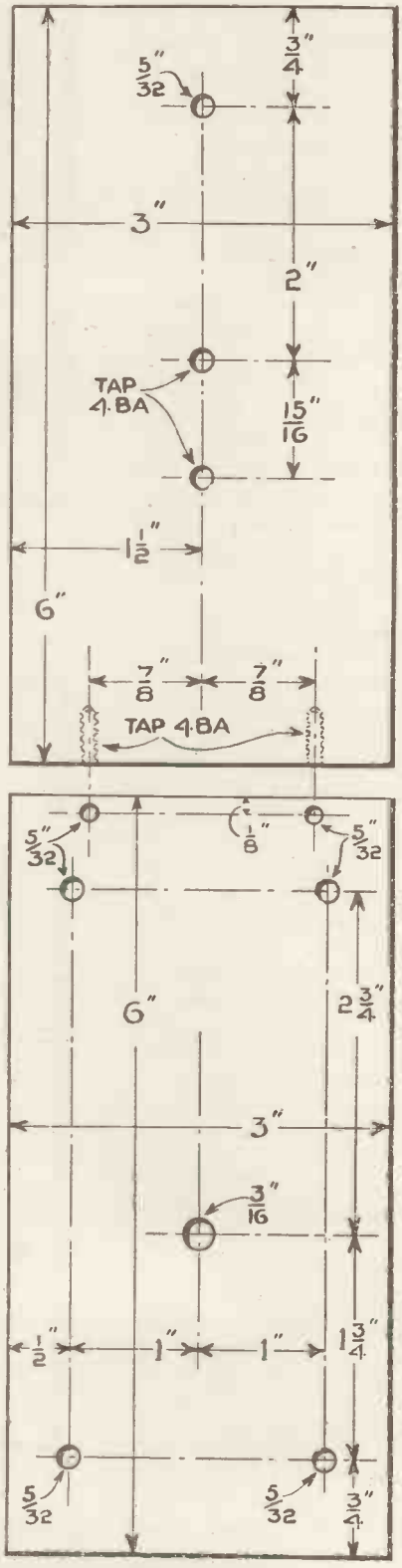
Insulation is another matter that calls for attention. Always use the best quality of ebonite for the panel of any set you construct.



Wiring Diagram of Crystal Set.



Details of Cabinet.



Lay-outs of Panel and Baseboard.

Wireless Eyes of Modern Aircraft

FOR years past aeroplanes and airships have been finding their way about the uncharted regions of the air by means of wireless. The majority of modern commercial aeroplanes are endowed with "wireless eyes" which enable them to find their way from city to city, and from country to country, in the vilest weather and during the blackest hours of the night.

Means of Navigating

The machines that operate daily between this country and the continent make constant use of wireless as a means of navigating from point to point, as well as of ascertaining their exact positions when necessary.

There are two rival "direction-finding" systems in vogue, and it is not easy to ascribe definite superiority to either owing to the several advantages and (minor) disadvantages that each possesses.

Perhaps it would be more correct to say that there are two methods in vogue—i.e. two different methods of applying the same system. The system used on our continental air services is known as the Bellini system. The different ways in which it can be applied will be explained by what follows.

The Bellini directional aerial consists of two vertical loops set at right angles to each other. The lower portion of each loop is brought into the receiving cabin and wound round a hollow cylindrical drum.

These windings are also at right angles to each other. Each loop is thus a closed circuit, part of which is outside the cabin, and part inside.

Energy Picked-up

As the reader is no doubt aware, the energy that will be picked up by either loop from passing waves will depend upon the direction in which the waves are travelling. If the waves are moving in line with the plane of one of the loops, that loop will pick up maximum energy from them, whilst the other loop will pick up no energy at all.

If the waves strike midway between the two loops, both loops will pick up equal quantities of energy—and so on.

The different amounts of energy absorbed by the two loops will, of course, be reflected in the different strengths of the "fields" produced around the windings on the drum inside the cabin, since each winding is in series with a loop.

Inside this drum is a small "exploring" coil, the two ends of which are led away to the receiving instrument. This coil is mounted on a vertical spindle, so that it can be rotated through 360 degrees.

Its purpose is to "explore" the resultant "field" produced by the drum windings. The amount of energy picked up by the exploring coil when set at a particular angle will depend upon the relative strengths of the fields produced around the drum windings, which will, in turn, depend upon the amount of energy picked up by each loop—which finally will depend, as previously stated, on the angle at which the waves approach the receiving station—that is, on the *direction* of the transmitting station.

It is a mystery to those who know little of wireless how an aeroplane or airship can find out its position by calling up a land station.

The systems used are simply explained in this article.

Thus the *loudness of the received signals* gives the clue to the direction of the transmitting station.

The drum windings and exploring coil are contained in a box, the lid of which is fitted with a graduated scale (from 0 to 360). The spindle of the exploring coil protrudes through the centre of this lid, the top of the spindle being fitted with an ebonite handle.

Beneath this handle there is a pointer which moves round the face of the graduated scale as the exploring coil is rotated. This pointer can be fixed so that when signals are at their loudest the reading indicated on the scale will represent the direction of the transmitting station.

The pointer may also be fixed so that the direction of the transmitting station is revealed when signals are at their weakest. (In practice, this latter way is usually found much more convenient than the former.)

Finding One's Position

The navigator of an aeroplane that is fitted with a direction-finding equipment of this kind can find his position by ascertaining the "bearings" of two land stations in the manner described above. While listening to signals from one station he rotates his exploring coil until signals are at their weakest, and then notes the direction of that station, as indicated by the position of the pointer. He then repeats the process with the other station.

When plotted on a map, the two bearings thus obtained will intersect at a point, and this point will represent the position of the aeroplane.

That is one application of the system. Instead of the aeroplane being fitted with the direction-finding apparatus, however, the same results may be obtained by erecting a number of direction-finding stations *on land* and fitting the aeroplane with an ordinary transmitter.

When this method is used, the navigator of the aeroplane calls up two land direction-finding stations and asks them to ascertain his position. The operators at the D.F. stations take bearings on the aeroplane's signals and communicate the results by wireless to the aeroplane. In this case, therefore, the aeroplane need only be fitted with an ordinary transmitter and receiver.

"Rough Work"

The "rough work" is done by the operators of the ground D.F. stations. Both systems are in use today, though the latter is perhaps more extensively employed than the former.

Until comparatively recent times all direction-finding systems were hampered by their inability to reveal the "sense" of a received wave.

Ordinarily, the pointer that is attached to the spindle on which the exploring coil is mounted (in the Bellini system) only indicates the "direction line" of the transmitting station whose signals are being received.

This line cuts through the D.F. station, and the transmitting station may be situated at any point along it. Two alternative bearings are thus obtained, 180 degrees apart. For instance, if we suppose the bearing of a particular transmitter is a line that runs from East to West through the D.F. station, this does not indicate whether the transmitter lies to the left or right of the D.F. station.

All that is known is that it lies *somewhere along this line*—to the left *or* right. This is what is meant by saying that an ordinary bearing, or direction line, does not reveal the "sense" of a received wave. All frame aerials, such as are used for broadcast reception, possess this characteristic.

Detecting the "Sense"

The direction-finding equipment at Croydon, the London air terminus, is free from this restriction, however. Special means are provided whereby the operator on duty can detect the "sense" of a received signal from a distant aeroplane, and thus ascertain on which side of the bearing line the aeroplane is.

A second pointer is fitted to the spindle of the exploring coil (at right angles to the pointer that indicates the bearing), and once the bearing has been found it is only a moment's work to detect the "sense."

"Stand-by"

When not occupied in communicating with machines the operator keeps his receiving switch in the "stand-by" position. The effect of this is to make his aerial more or less non-directional—that is, equally sensitive to signals coming from different directions. The receiving switch has three positions, marked "stand-by," "direction," and "sense."

As soon as signals are received from an aeroplane, the operator throws his switch into the "direction" position, thus bringing the directional quality of his aerial into play. Having taken the bearing of the machine, he throws his receiving switch into the "sense" position and determines the machine's *actual* direction.

M. E.

FATHER DEGAN says that kindness enables a man to be patient, sympathetic, self-forgetting and forgiving. In fact, it makes him the ideal P.M.G.

THREE DANGERS TO THE POPULARITY OF WIRELESS . . .

SOME two years ago, when broadcasting first began really to grip the public and the tremendous boom in the sale of sets and accessories got fairly under way, many cautious business men refused to have anything to do with it commercially, supposing that it was but another craze, destined, after a short career, to go the way of ping-pong, diabolo, etc.

Well, the boom has not collapsed, yet. Rather, there are signs that broadcasting has become permanently established as the cheapest and most convenient form of entertainment and instruction ever offered to man. Is it not our business, as true servants of its cause, to get it also recognised as the best form? Surely it is.

Now, it is submitted that there are three real dangers, not, of course, to the continuance of broadcasting—that is well assured—but to its complete and rapid recognition by the entire community as the boon it really is. These dangers are all "dangers from within," i.e. they are caused by members of the listening fraternity themselves.

Noise

First, there is the craze for noise. This is, it is to be feared, what is really at the back of the present popularity of the reflex set. The B.B.C. strain every nerve, Captain Eckersley and his worthy assistants spend their entire lives, to give us absolute purity in the quality of the transmission. Quite rightly, they have made it their aim to provide real music, real human voices, in the ether. But they have no sympathy with loudness, as such. Chelmsford, for instance, was not put up to enable Londoners to get loud-speaker results from one valve, but for the benefit of country crystal users. And the "unconverted" are not impressed by the feat of making a noise with inadequate gear. They think, "Oh, it's only the gramophone again, and not a very good gramophone at that!" By all means use a loud-speaker, if you can afford the apparatus to do it. But if you try to do it by overloading valves not really up to the work, either in power or number, you are doing a disservice to the cause of wireless.

Long-distance Reception

Secondly, there is the man who goes in for "long-distance reception." Almost any set can be "gingered up" to give some sort of results at really astounding ranges. But is it worth while? Merely for his own satisfaction, perhaps, the wireless enthusiast thinks it is. Then let him do it privately. If he calls in his, as yet uninterested, friends to listen to the "mush" and interference almost inevitably accompanying such reception—for which, incidentally, the transmission is not designed—they may, very likely, get the impression that that is the kind of thing one must expect to hear, and, especially if they are musical, it tends rather to "put them off" than to encourage them.

"Experts"

Thirdly, there is grave danger from the incompetent "expert." The writer recently saw a capital 4-valve set, owned by non-technical people, which was giving practically no results, although a man who "knew all about it (?)" had spent hours "putting it right."

Among other things, this "expert" had a special H.F. valve (a Cossor "red-top") in the last stage of the L.F. side, "because that was where the highest amplification was wanted!"

Now, if a man who doesn't know tries to put others right, the result is likely to be very disappointing to both parties, and not only his non-technical "clients" but all their friends are discouraged. A cheap reputation for cleverness may be very pleasant, but it is not for the real good of "the cause" to pretend you know, if you don't! H. W. S.

MOSTLY NONSENSE !

BETWEEN you and me, Hamlet's mental gymnastics can be solved by a sensible person, and they're nothing to do with psychologists. The cause of all the trouble ?—he had a wireless set that wouldn't. Mind you ! Shakespeare never got to hear about it, but he can't kid me.

The psycho people tell us his was a complex, but still, he probably started with a crystal, and when his step-father told him he'd just had America on a crystal and an indoor aerial, he said something about the stuff that dreams were made of. No wonder his Pa didn't hear him !

Wireless has caused trouble in more houses than his. Poor chap ! he got on to valves after, and there's no doubt about it, he got hold of a batch of ex-army French " R's ", 'cause he said something about " Sweet, not permanent, fragrant, not lasting."

You know, honestly I am sorry for poor old Hamlet, and yet Marconi gets all the praise. And why should he ? He's not the only one who started on a crystal. I did myself, and it was something like this :

" Just an old-fashioned crystal with
old-fashioned ways,
That won't work when I want it
most to,
The whisker won't whisker, the slider
won't slide,
And it's still quite the same if they
do !
How I've tried it each night, yet it's
never quite right,
Still there's something about it that's
fine,
Though its never worked yet, it will
some day, I'll bet,
Will that old-fashioned crystal of
mine ! "

" Under the spreading chestnut tree "

" He must have got excited "

He must have got excited about it, and that's how it all started. It is exciting you know ! Just watch me !

" Half a turn, half a turn, half a turn,
onward,
Past B.B.C. wave to noisy six
hundred :

" The whisker won't whisker."

Backwards for 6 LV, pile up that
low H.T.
Coil not capacity, bust it you've
blundered.
Filament just flashed out, work of
a clumsy lout,
H.T. up L.T. spout, ' New valve ! '
he thundered."

Soliloquised a lot, Hamlet did. It used to cheer him up, when he couldn't tune anybody else in. Probably, he used a microphone, invented " side tone," and talked to himself. He got wireless mania in the end. You can tell that, because he was morbid to start with, and when he'd tried the Danish Flewelling, his wiring was complex, and any fool knows that a morbid complex is a mania, now, don't they ?

Still, wireless has spread since his time,—the place is simply crawling with it now to a bigger extent than the row between the seats in the pictures is crawling with feet. Every daisy in the dell knows its secret, knows it well, sort of style, and what's the result ?

" Under the spreading chestnut tree,
The village expert stands :
The wire on his tuning coil.
Stands out like iron bands.
He drives a mighty crystal set,
He's burnt out all his valves,
But with a grin, he just tunes-in,
His conscience thus he salves."

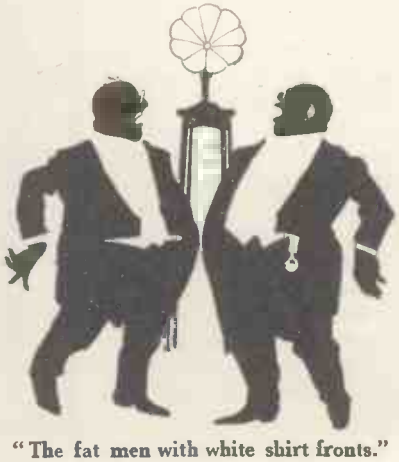
" Oh ! I ain't gonna bust no mo', no
mo,'
I ain't gonna bust no mo',
And what the deuce is the blighted
use,
So I ain't gonna bust no mo'. "

In a year or so all the fat men with white shirt fronts will be singing about, " Devonshire coil and slider." And really you'd be surprised, you know. Some of those wireless waves come rather a long way, like a Scotchman to an expensive funeral. America's nothing now, mark you, because !—

" Two H.F.'s give a fine range, what !
Like love, reach a long, long way ;
We never tune in Yankee tripe
But this is what we say :—
Yes, we'll get the Bahamas,
We'll get the Bahamas, to-day,
We'll get Wigan and Cardiff,
FL shouting hard, if
We don't get a breakdown ; and
say,
We've a soft D.E. detector,
In the latest feed-back rejector,
Oh, yes we'll get the Bahamas,
But p'raps it will not be to-day."

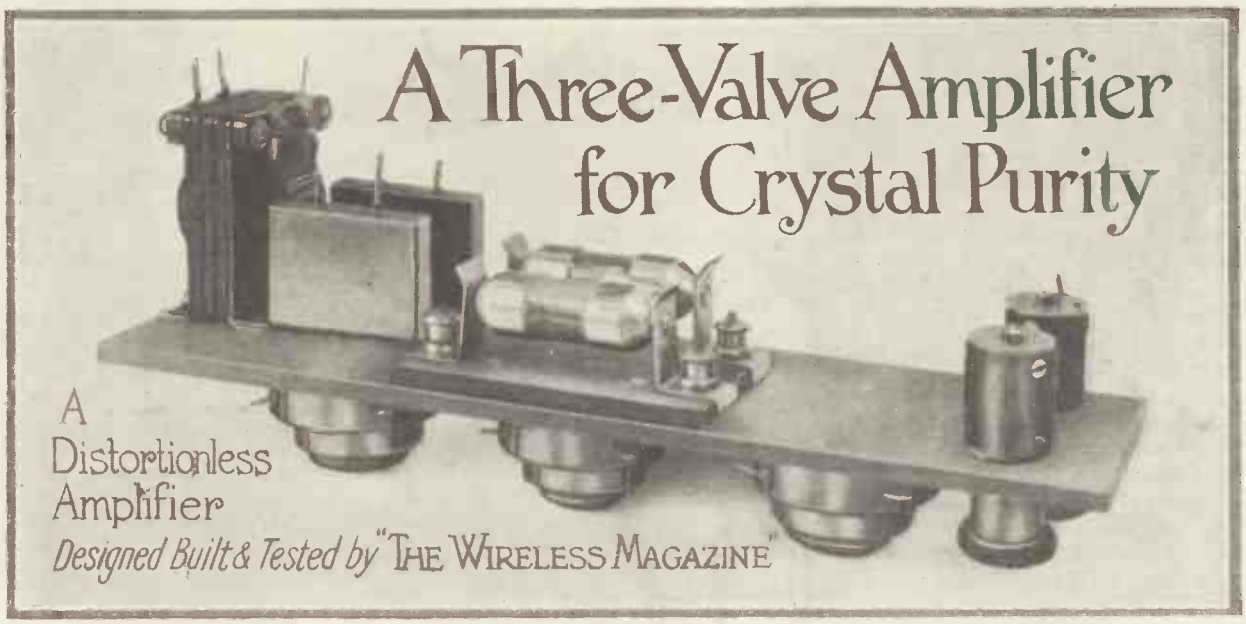
There's no use hurrying too much. Let them put up a station first.

(*Continued on page 565*)



" The fat men with white shirt fronts."

A Three-Valve Amplifier for Crystal Purity



A Distortionless Amplifier

Designed Built & Tested by "The Wireless Magazine"

IF we were asked what is the ideal circuit for the reception of a local station, giving absolutely pure distortionless reproduction by a loud-speaker, we should recommend a good crystal set, followed by a three-valve amplifier having one transformer and two resistance-capacity coupled stages of low-frequency amplification.

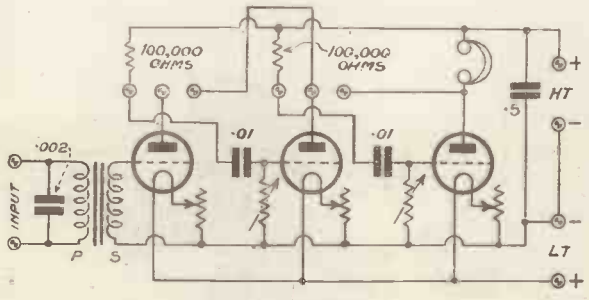
Simple and Efficient

A set of this type is not only extremely simple to operate but will fill a large room with that pure speech and music which is, unfortunately, only too rarely produced by a loud-speaker.

Of course, if it be so desired, the amplifier may be used in conjunction with an existing valve detector, in which case it should be particularly noted that H.T. – and L.T. – are connected together in the amplifier, thus necessitating a similar connection or no connection at all between H.T. and L.T. in the valve detector.

Provision has been made in this set for cutting out at will one or both of the resistance-capacity coupled stages (*see* diagram).

The "input" terminals of the amplifier here described are connected to the phone terminals of the crystal set. The signals that normally would pass through the phones now pass through the primary of the intervalve transformer, causing simultaneous impulses at a magnified voltage (due to the "step-up" effect of the transformer) to flow in the secondary.



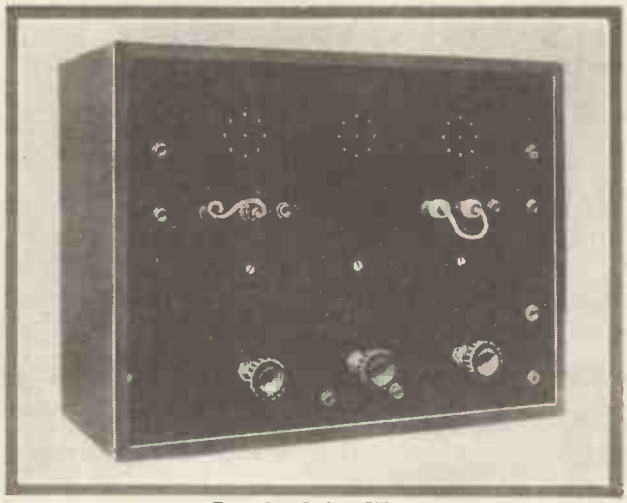
Circuit Diagram.

These magnified impulses are passed on to the grid of the first valve where they reappear in the plate circuit, further magnified by the amplifying properties of the valve. From the plate circuit of this valve the signals encounter two paths, one through the high resistance to H.T.+ and the other through the fixed condenser to the grid of the next valve.

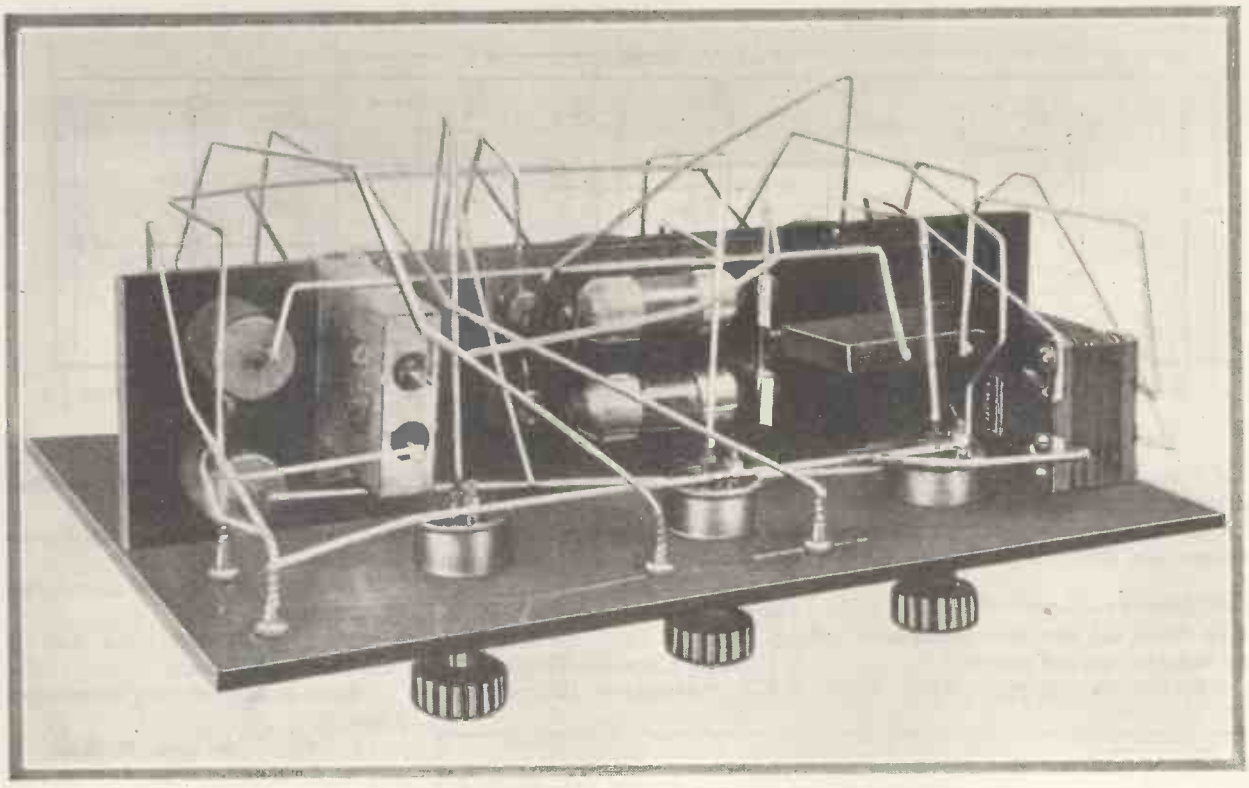
As the latter course gives them an easier passage they take it, and here they are amplified again by the second valve. Exactly the same process occurs in the final stage, where the signals are passed on to the third valve and still further amplified. In the plate circuit of this last valve is connected the loud-speaker.

It has probably been noticed that in place of the usual variable grid leaks in the grid circuits of the second and third valves, we have employed variable anode resistances having a lower resistance range than the grid leaks. The latter, we found, were not so satisfactory as the anode resistances.

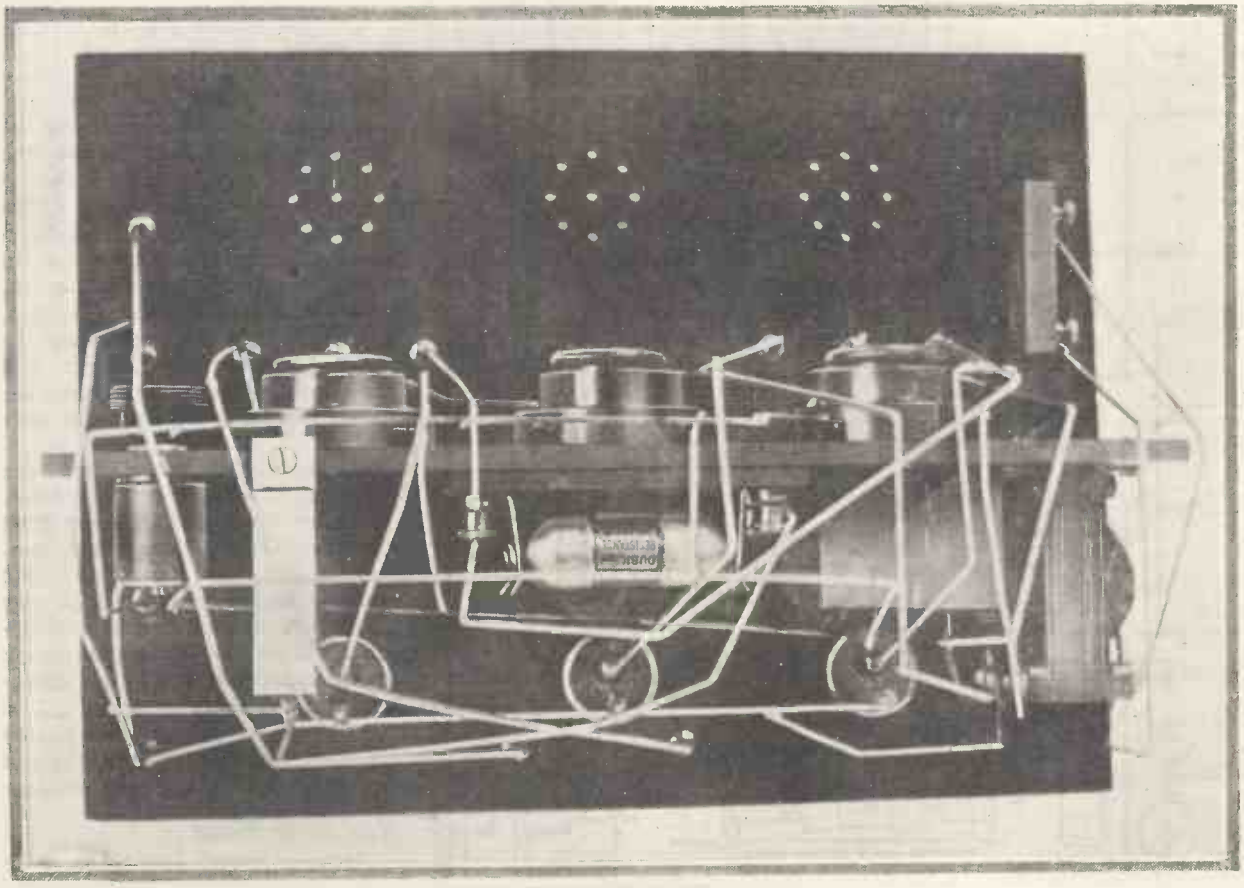
The cabinet is a very simple affair, consisting of an ordinary box having a removable back. The inside measurements are: length, 12 in.; breadth,



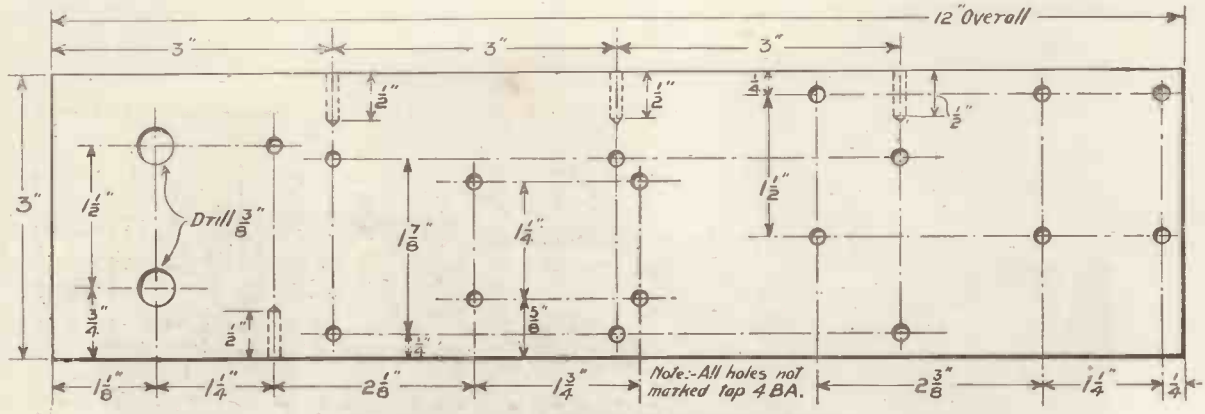
Completed Amplifier.



Underneath View of Valve and Resistance Platform.



View of Back of Three-valve Amplifier.



Half-scale Layout of Valve and Resistance Platform.

9 in.; depth, 5¾ in. The cabinet is made of oak throughout, ⅜ in. thick. For those who wish to construct it, a dimensioned sketch is given on p. 536.

Components Required

To build the amplifier the following components are required:

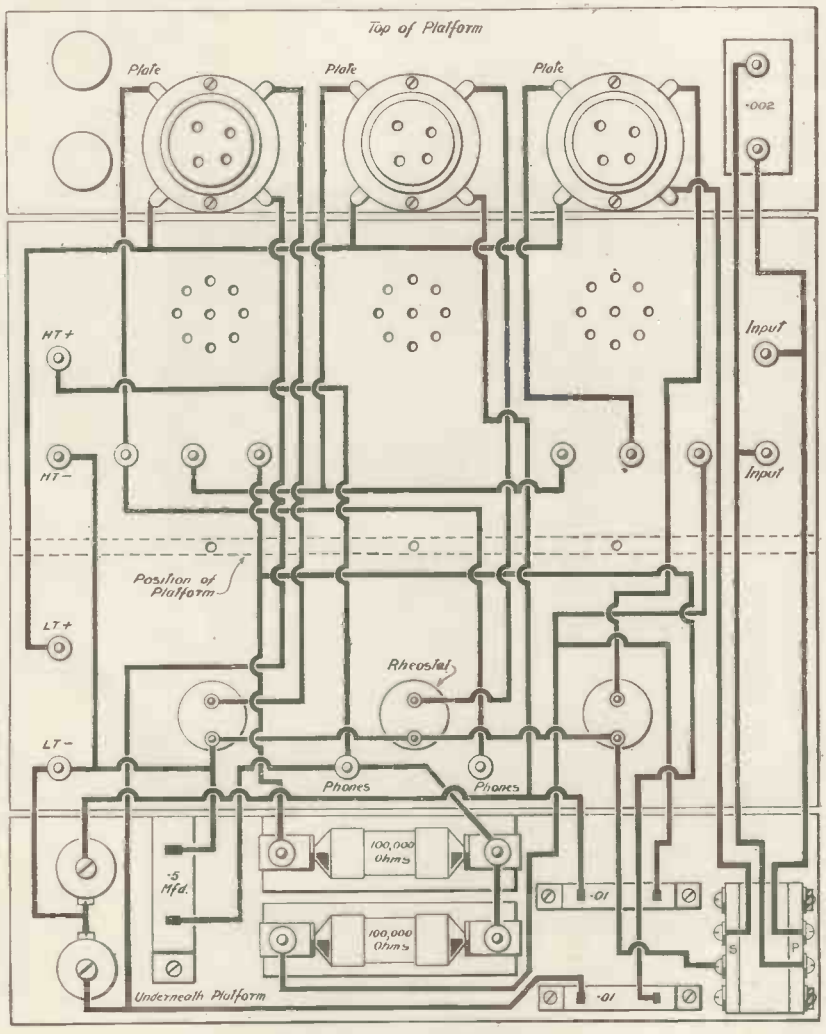
1 Radion ebonite panel, 12 in. by 9 in. by 3/16 in. thick (American Hard Rubber Co.).

1 ebonite platform, 9 in. long by 3 in. wide by ¼ in. thick (St. Helens Cable Co., Slough).

3 anti-phonic valve holders (Burndept).

3 filament rheostats (Wates).

1 L.F. transformer (Burndept).



Wiring Diagram of Amplifier.

2 fixed anode resistances, 100,000 ohms each (Dubilier).

2 variable anode resistances (Lissen).

2 fixed condensers, ·01 microfarad each (Lissen).

2 fixed condensers, ·002 and ·5 microfarad (Ediswan).

1 fixed condenser, ·002 microfarad (Lissen).

14 "Clix" sockets, 6 black, 2 yellow, 5 red and 1 blue (Autoveyors, Ltd.).

12 "Clix" plugs, 6 black, 2 white, 3 red and 1 blue (Autoveyors, Ltd.).

Quantity of heavy gauge wire for connecting up.

Constructing the Platform

A very convenient method of mounting the valves behind the main panel out of harm's way is shown in the photographs. This consists of an ebonite platform running the length of the panel, to which it is fixed by three 4 B.A. brass countersunk headed screws. Plenty of clearance space must be allowed between the platform and the top of the cabinet so that the valves can be easily placed in their sockets.

On the top of the platform are mounted the three valve holders, while on the under side are fixed the transformer, three fixed condensers and the four fixed and variable anode resistances. An idea of the compactness of the arrangement will be seen in the photograph of the platform with these instruments mounted thereon.

A layout of the platform showing the dimensions and the positions of holes to be drilled is shown above.

The Main Panel

The only instruments mounted on the main panel are the three filament rheostats and the ·002 micro-

farad input condenser. With the exception of this condenser all these instruments are mounted under the platform so that there is plenty of room left for the valves above.

When drilling the main panel, care should be taken that the valve inspection holes are drilled exactly above each valve holder on the platform. The "Clix" sockets, forming the two switching arrangements, are approximately on the same level as the tops of the valve holders so that the valves will not foul them. A panel-drilling layout is given below.

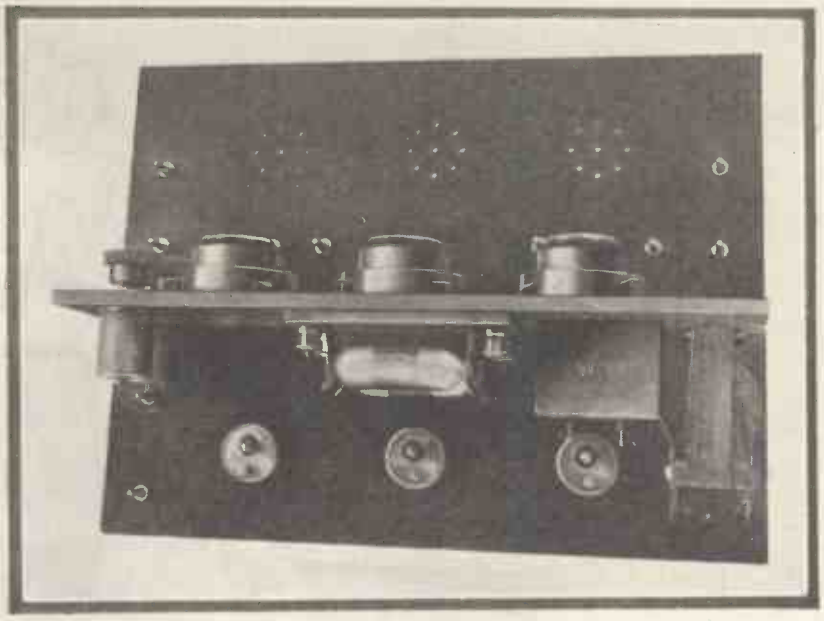
Wiring Up

Referring to the wiring diagram (opposite) it will be seen that the top side of the platform showing the valve holders is drawn above the main panel, while the under side of the platform is shown below. Bearing this in mind, the actual wiring of the amplifier should be a simple matter.

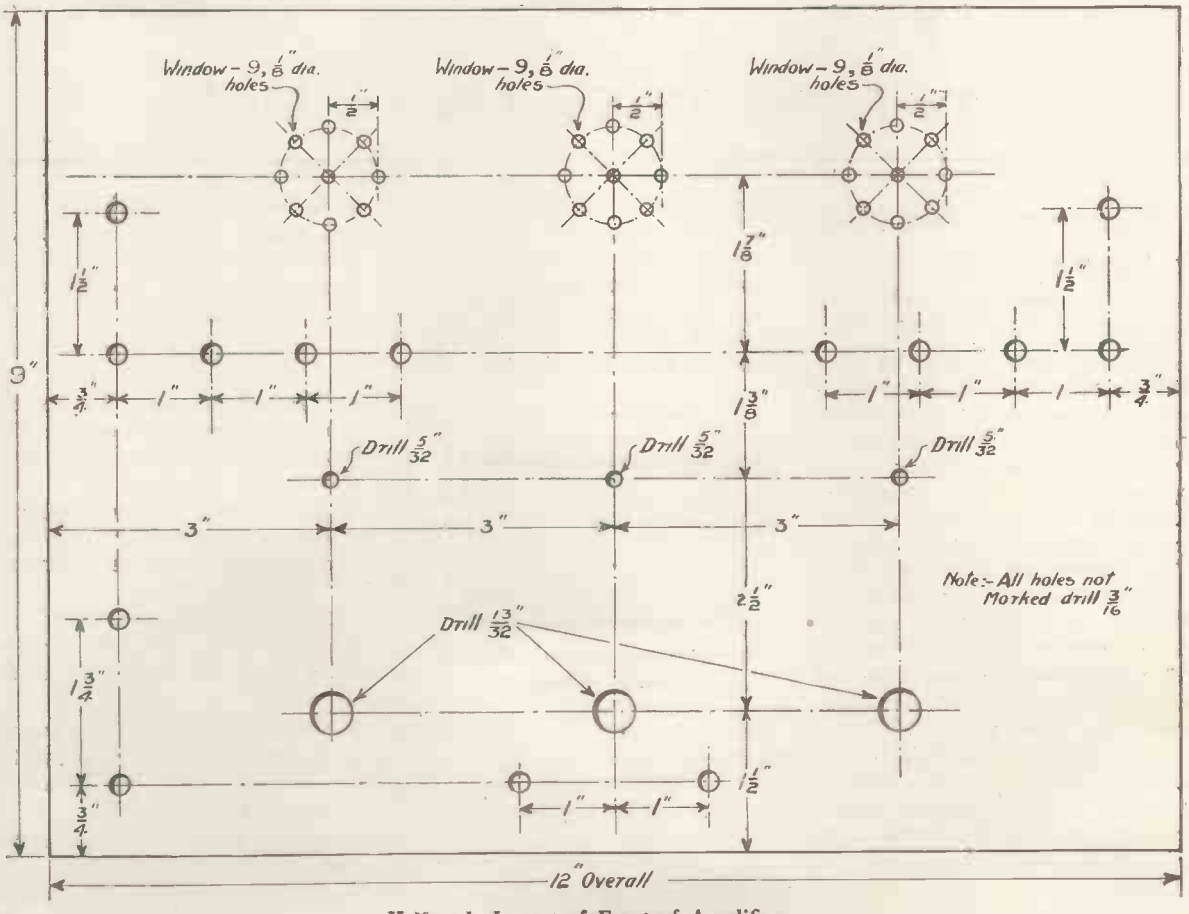
It is not necessary to bend the connecting wires so that every wire is either parallel or at right angles to the others. From the point of view of beauty this may be excellent, but it is doubtful whether there are any electrical benefits.

Make all the leads as short and as direct as it is possible. Keep all leads clear of the top of the valve holders, otherwise difficulty will be experienced in plugging the valves in their sockets.

(*Continued at bottom of next page*)



View of Components Before Wiring.



Half-scale Layout of Front of Amplifier.

The Respite: The Expert Stays up Late!

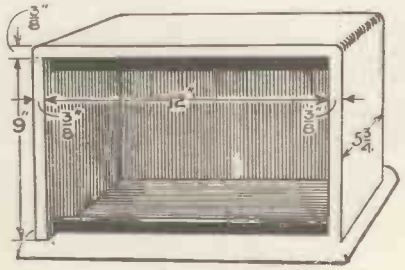
A Three-valve Amplifier for Crystal Purity

(*Continued from preceding page*)

All connections should be well soldered. A poor or faulty connection between a terminal and a wire is often the unsuspected cause of noisy reception. It should be possible to pick up a completed receiver by any one of its connections without breaking the joint.

The connections of the amplifier to the crystal set are made by bridging the terminals marked "input" over to the phone terminals on the crystal set. Connect up the H.T. and L.T. batteries and loud-speaker to the proper "Clix" sockets. This will necessitate the attachment of plugs on the ends of the battery and loud-speaker leads. Turn the filament rheostats until the valve filaments are at a suitable brilliancy.

The transformer-coupled stage of amplification is always in circuit, but by placing both the "Clix" plugs in the left-hand position (looking at the panel) all three valves are in use. By placing the left-hand plug in the right-hand position, still keeping the right-hand plug where it is, the second valve is cut out.



Details of Cabinet.

To cut out the third valve, place the right-hand plug in the right-hand position.

Any general-purpose valve of reliable make will be found satisfactory. We tested the amplifier, using three Cossor plain-top valves, and results were all that could be desired. Owing to the use of carbon filament rheostats the use of dull-emitter valves is possible.

A "SOUND-MIRROR" has been invented by a wireless expert. Every woman should be compelled by law to use one.

INASMUCH as sand is now being used in electric batteries, we may expect some grocers to announce themselves as wireless dealers.

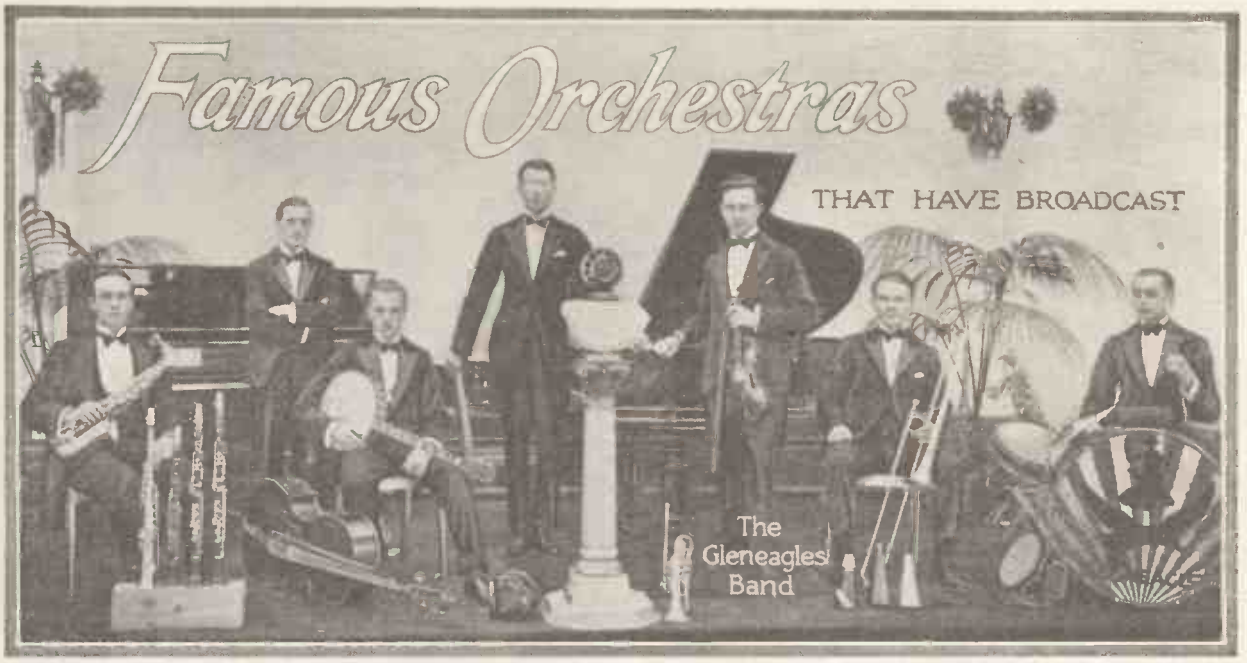
"EVEN the walls have ears," said a wise man once. He must have been using the walls of his steel house as an aerial.

WE read that when the aerial of 5 I T was lowered, it was found to be covered with soot. This must have been a bad thing 4 I T.

A REALLY good villain is said to be wanted for a wireless play. What about the author of the P.M.G.'s Bill?

Famous Orchestras

THAT HAVE BROADCAST



IT is not often that science and art work hand in hand, but wireless telephony has given us a strange anomaly, for just as the ether, that impalpable unknown medium, permeates all matter, so music, the inborn instinct of mankind to express its feelings in sound, exists throughout the world—between all nations, above all factions, ageless, tireless, from the primitive reed-pipe of the shepherd, the reiterating drum of the native witch doctor, to the complex orchestra of to-day. It is certainly due to wireless that the world at large has had more sounds crowded into its ears this last year alone than were dreamt of in their philosophy.

New Musical Policy

Literally and metaphorically, the flood-gates of the world's music have been opened by the B.B.C., pouring forth a stream which has threatened to overwhelm the public by its very volume. Like most enthusiasts bent on conversion, the direction of this wireless stream has not always been turned in the right direction, and has fallen on music-lover and music-listener alike, and mark you, there is a difference.

I do not believe there is a really unmusical person in all this living world of ours; it is a question of habit. The man who likes the permutations and combinations of Bach's Fugues is no better than he who rejoices in the simple melody of the peasant folk-song, an outpouring of the heart, whether in joy or sorrow.

But there is no doubt that the latter type is more numerous, for the human voice is common to all, while the instrument with its years of practice evolves eventually a more complex form of sound expression.

The mistake is in aiming to transform the mass of natural melodists into admirers of complicated tone-phrases, an aim praiseworthy enough, but unnecessary, in matters wireless, where the *vox populi* should be *vox Dei*.

London Wireless Orchestra

Realising the magnitude of their self-appointed task of educating a world, the B.B.C. have certainly chosen some of the best orchestral players, for their repertoire has to include anything from a fox-trot to a symphony (or vice versa, according to your musical taste), as well as lend support to all other forms of composition.

Commencing with a trio and gradually rising to an octet and then the full orchestra under Mr. Stanton Jefferies, one of the finest of all wireless conductors, 2 L O has become the standard orchestra of all

The Savoy Band.

Vladimoff's Balalaika Orchestra.

stations. It is now conducted by Mr. Dan Godfrey, and the personnel of the orchestra is interesting, for nearly all the players have been recruited from the greatest orchestras of the country, and most of them have been heard from time to time as soloists.

Members of the Orchestra

Mr. S. Kneale Kelley, the leader and sub-conductor, hails from the London Symphony and Royal Philharmonic Orchestras, as do Mr. E. B. Robinson ('cello leader) and Mr. Hinchcliffe (bassoon). Mr. Dickie (contra-bassoon) is one of the few exponents of this unique instrument, which in this orchestra takes the place of the string double bass.

Mr. Taylor (trombone) and Mr. Leggett (trumpet) are Kneller Hall players, the former being also a member of the Scottish Orchestra. Mr. Hook (the pianist) forms the third member, with Mr. Kneale Kelley and Mr. E. B. Robinson, in "The Wireless Trio," which we do not hear half enough. No restaurant band should be necessary as long as they can be requisitioned into active service.

The London Wireless Symphony Orchestra has been conducted by many conductors, including Sir Landon Ronald, both in hall and studio, Mr. Percy Pitt, of course, as Director of the B.B.C.'s music, also Aylmer Buesst, the clever conductor of the B.N.O.C., besides the great foreign conductors Pierre Monteux, Ernest Ansermet and Bruno Walter in the most recent International Symphony Concerts at Covent Garden, when the orchestra was still further augmented.

The Chaplin Trio.

The Hallé Orchestra

Of the great provincial orchestras, the Hallé occupies chief place in Central England, for it has held sway at Manchester since 1857, when first formed by Sir (then Mr.) Charles Hallé, and gave its first performance at the Arts Treasures Exhibition in that city.

From that time onward the orchestra became one of the great musical organisations of the country, its members being recruited from the finest virtuoso players, its conductors being Hans Richter, later followed by Mr. Hamilton Harty, who wields the baton at the present day.

Although known all over the world, but a very small proportion of English people had ever heard the great orchestra until wireless brought it literally within their doors.

Its special performance at Easter of Handel's "Messiah" was another triumph of broadcast orchestral and choral art.

The Great Orchestra of the South

To most music-lovers Bournemouth means but one thing—the habitat of the Municipal Orchestra. A very great debt is due to the director and conductor of this orchestra, Sir Dan Godfrey, for not only has he in face of much opposition always retained and justified the existence of the orchestra, but he has proved himself the pioneer again and again of British composers, whose works have afterwards gained fame, and which but for his giving them their initial performance might have remained unknown and unplayed.

Sir Dan Godfrey has been conductor since 1893, and

the performances broadcast weekly from the Winter Gardens are amongst the best musical events.

The Russian Orchestra

It is a far step to the folk-music of Russia, but Vladimir Vladimoff, with his balalaika orchestra, composed, too, of the ancient instruments of Russia, the balalaika, the domri and goosli, has revived the use and love of these quaint instruments, which broadcast wonderfully.

They have broadcast very frequently, and have appeared on every big concert platform in the world. It is the only orchestra of Russian music in which the modern instruments have not been introduced, and this helps to maintain the right accompaniment, when such songs as the Volga Boatmen's Chant or Arensky's Volga Lullaby are heard.

Old-world Music

Though on a simpler plan, the old-world orchestra is very clearly brought to life again by the performances of the Chaplin Trio. These three clever sisters at harpsichord, viola d'amore and viola da gamba have broadcast but recently when *The Beggar's Opera* was given a studio performance at 2 L O.

The Military Band

Many people consider that the " brass band " should be termed the " national instrument." The fact that every big regiment has its own special band speaks for itself, and these bands, by reason of their performances in the London parks, at the National Sunday League concerts and on the Vocalion records, have gradually made themselves a household word, outside of their regimental duties.

Over the ether, though by no means a perfect medium for works of Wagner or Chopin, and I have heard both bravely attacked, yet the rhythm and power when more suitable works are performed carry well to the hearts of their far-distant hearers. We have heard in this way the band of H.M. Royal Air Force,

The Virtuoso String Quartet.

under Flight-Lieut. J. Amers, the Grenadier Guards band, under Lieut. G. Miller, the Royal Artillery String band, conducted by Lieut. Stretton and the Coldstream Guards band, under Lieut. R. G. Evans, besides others, while at 2 L O a special Military Band has been formed by Mr. Dan Godfrey.

Provincial Orchestras

Nearly every great city has its orchestra. At Glasgow there is the Scottish Orchestra, which has been conducted by Sir Landon Ronald and Emil Mlynarski; the City of Birmingham Orchestra has had as conductor Paul Klenau, the Danish composer, the Liverpool Philharmonic Orchestra has been conducted by Felix Weingartner and Granville Bantock, the composer, while each broadcasting station may be said to have famous conductors in Mr. Joseph Lewis (Birmingham), Mr. Edward Clarke (Newcastle), Mr. Warwick Braithwaite (Cardiff), and Captain Featherstone, at Bournemouth.

The J. H. Squire Celeste Octet.

The Savoy Orpheans Band

Further novelty is lent to the Liverpool station by a Children's Orchestra, conducted by Harvey J. Dunkerley (Uncle Toby).

Miniature Orchestras

It is often found in practice that the small orchestra, or even quartet, broadcasts to much better advantage than a very large orchestra. This has led to the engagement of the famous quartet parties, and although by this means classical music has been superabundant, especially at 2 L O, the effect has been to give the public opportunities of hearing the finest executants of their type.

In this way we have had the London String Quartet, and the Virtuoso String Quartet, which includes all artists noted for their broadcasting work, namely Miss Marjorie Hayward, Mr. Edwin Virgo, Mr. Raymond Jeremy and Cedric Sharpe, while others have been the Spencer Dyke, the Snow, and the Kutcher String Quartet, the latter now playing under the name of The London Quartet, and a recent one, the Aeolian Players, also consisting of noted broadcast artists in Messrs. Gordon Bryan, Joseph Slater, and Mesdames Constance Izard and Rebecca Clarke.

The Lighter Side

Of the real miniature orchestras the palm must go to Mr. Frederic Casano's Octet, the finest performers of Wagner's music, and the J. H. Squire Octet, its performers being headed by the brilliant violinist, Mayer Gordon.

Of the dance bands, of course, the Savoy Havana and Orpheans bands lead, while close in popularity comes Mr. De Groot with his orchestra at the Piccadilly, the bands at the Trocadero, and in the provinces the Colin Biggin Band, and the Gleneagles Band at Glasgow and the Royal Bath Hotel Band, under David S. Liff, at Bournemouth.

Interest has been lent to many a programme, too, by the visits of the big provincial brass bands, such as the St. Hilda's Colliery Band, which are justly styled the world's champions, for they have won amongst cups and awards innumerable the challenge prize of ten thousand guineas from the National Musical Union, and the Crystal Palace trophy four years running.

Others are the Besses o' th' Barn Band, the Pendleton Brass Band and the big provincial police bands. Let the grumblers at the broadcasting concerts say what they may, they cannot justly complain of lack of variety in their concerted music.

STUDIUS.

Wireless on My Yacht

(Continued from page 525)

while sweet music harmonises with the colour of the sunset, and the peace of a well-earned rest ?

You don't need it very loud as a rule ; sound carries well on the water, with the hull of the boat as a sound-box. It should be just strong enough to be heard easily over the ripple of the water, the plop of a fish, or the cry of a gull ; a solo with accompaniment rather than an egotistical flow of sound.

Unless, of course, you desire to give a broadcast concert. Sometimes it is exceedingly pleasant to listen to someone else's loud-speaker, often it is quite the contrary. There are not many sets that will stand boosting up to full power without loss of tone ; and nothing is more annoying or does wireless more harm than a public exhibition in which the tonal quality is poor.

I remember one night on the Hamble river last summer a motor-boat had a set working three loud-speakers at once. It could be heard distinctly half a mile away, and the operator had an audience of several hundred people both ashore and afloat. In this instance the tone was perfect.

On the other hand, at a place that shall be nameless someone else tried the same thing. For hours we were tortured by a bull of Bashan that was as unmusical as it was loud. Speech sounded like badly oiled machinery and music like nothing on earth ! At last we could stand it no longer. Someone started working his fog-horn. Every other boat took it up ; if they had no horn or siren, a spanner on a washing-up bowl sufficed, until there was a babel like an air-raid warning.

If you have a good set and a good ear, by all means broadcast your blessings ; but be very, very careful, if only for the good name of wireless.

Some Crude "Apparatus"

WIRELESS signals have been received under some very crude, and at times absurd, conditions. You would, for instance, hardly deem it possible to receive your local station with no crystal in your crystal set. Yet this is being done almost daily. Instead of making contact with the crystal, the catwhisker simply rests on some part of the crystal cup.

Some very wonderful results have been obtained with temporary "aerials." Copper kettles suspended in the air, wire-fencing, bedstead mattresses, in fact, practically everything possible has at one time or another been utilised as an aerial with favourable results.

Perhaps the crudest and cheapest detector that was ever made was ultilised by one amateur in the early days of wireless. The crystal and catwhisker were a piece of coal and a needle respectively. And the wonder of it all was that the whole thing worked!

DEAR BOYS AND GIRLS,

Many readers continue to send me instructions for the making of novel and useful gadgets and sets, and for these I am very thankful. Such items are of interest to other readers and serve to keep alive that inter-exchange of ideas which is so beneficial to us all.

If you have anything that you think would interest others send it along to me, and if suitable you will be paid for the use of it. Remember I pay 10s. 6d. *for the most interesting contribution received during the month and* 5s. *for all items used.*

Address all letters to—

COUSIN CRYSTA,
THE WIRELESS MAGAZINE,
La Belle Sauvage,
London, E.C.4.

A Useful Nest of Drawers

QUITE a neat little nest of drawers for spare nuts, washers, terminals, etc., may be made with the aid of a few empty cigarette packets and a tube of gum.

The packets should be gummed together as shown in Fig. 1, after which the top, bottom and sides may have coloured paper pasted on them to hide the printing on the packets.

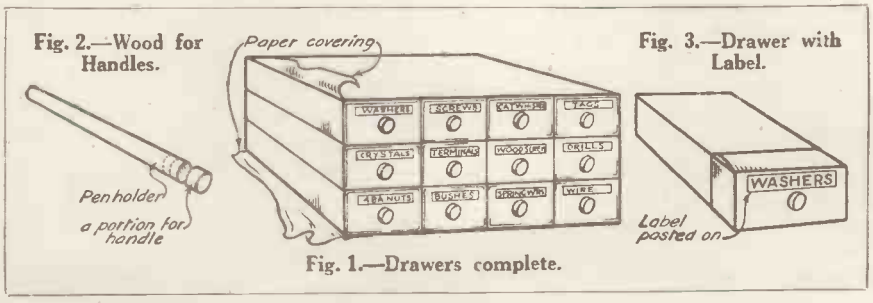
Handles for the drawers are made out of an old penholder or any other spare piece of round wood. This is cut in small pieces as shown in Fig. 2, the pieces afterwards being glued to the fronts of the packets.

The drawers will be enhanced in appearance if small labels bearing the names of the articles they contain are glued on them as shown in the drawings.—ARTHUR TILLETT, Tunnel Hill, Worcester.

This Month's Prizewinners

THE prize of 10s. 6d. for the best contribution received during the month has this month been awarded to Arthur Tillett, Tunnel Hill, Worcester, for the useful nest of drawers described on this page. To the writers of the other contributions printed a prize of 5s. has been awarded.

I am still ready to consider photographs of themselves taken in the open whilst listening-in.



What a Story!

THE mermaids underneath the sea,
Or so I understand,
Have palaces of ivory,
Which are so very grand.

They've coral doors so bright and pink,
With pearl electric bells,
And heaps of crystal sets—just think!
With headphones made of shells!

LESLIE M. OYLER.

Getting the Most out of a Crystal Set

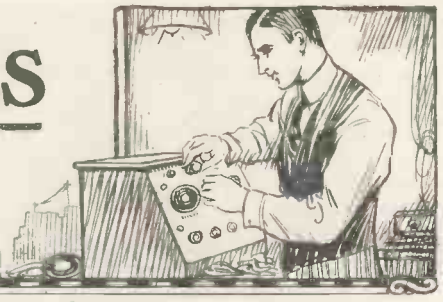
THE crystal set is so simple that one wonders how ever it "works" at all. That it does work we all know, but in many cases the work it does is not all that it might be.

With this type of set, as with any other type, it is absolutely necessary that one should have a good aerial and earth if results are to be worth while. The value of a good earth is not appreciated as it ought to be.

Extra care is taken in erecting the aerial to ensure that it is well insulated and as high as possible; but when it comes to the earth, well, a turn or two round the tap is considered enough. But it is not enough.

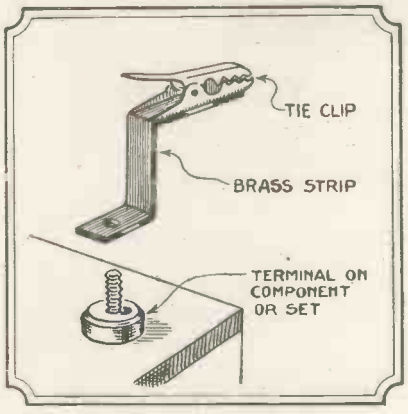
If at all possible the earth should consist of a metal plate about eighteen inches square to which is soldered the lead from the earth terminal on the set. Such a plate buried in moist ground will make an excellent earth, which in turn will increase the efficiency of the set. Keep the ground round the plate moist.

Gadgets, Hints and Tips



Quick Connections

FOR those who are constantly experimenting, and wish to have an easy connection to the accumulator



Device for Quick Connection.

or other apparatus, the sketch shows an easy and a quick method of making connections.

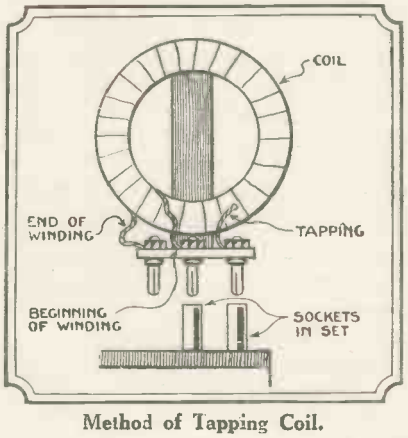
The tie clip is soldered on to a piece of strip brass drilled at one end to fit on the accumulator terminal.

To make a connection quickly, simply press on clip and insert lead.

G. Y.

Tapping Coils

To tap a basket coil it is usually



Method of Tapping Coil.

necessary to include a switch in the set, but the method of taking tappings without the use of a switch, which is described below, is quite satisfactory in the case of home-constructed coils.

Three valve legs are used for taking the leads from the coil (*see* diagram), and by placing either two of these at a time in the sockets on the panel, tapping is automatically carried out.

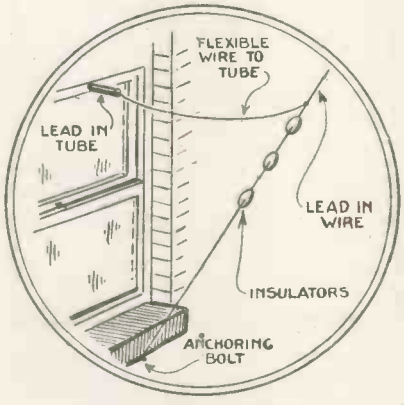
J. C.

Lead-in Wire

MOST amateurs find it more convenient to fix the lead-in tube through the window frame than through the sash.

This is all right until it comes to opening the window, for when this is done it frequently drags the aerial wire into contact with the wall.

This difficulty can be overcome



Method of Fixing Lead-in.

by fastening the down lead by insulators to the lower part of window frame, as shown in the diagram.

L. B. T.

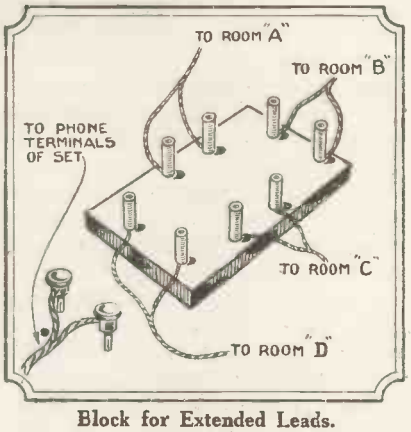
Extended Leads

A SIMPLE method of enabling listeners to change phones or loud-speaker from room to room without interfering with the receiving set is illustrated in the sketch.

The small portion of ebonite should be mounted on the wall in a convenient place, for example, the entrance hall. To change over from room to room it is only necessary to insert the plugs in the appropriate sockets.

Terminal blocks should, of course, be provided in each room for attachment of phones or loud-speaker.

If it is desired to use phones in

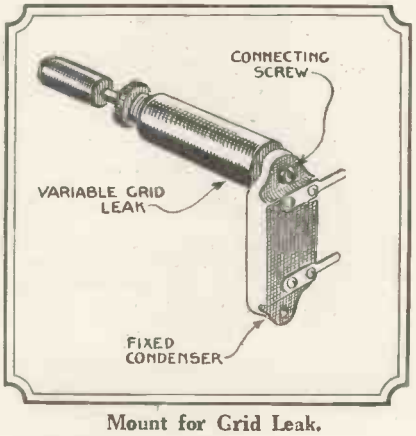


Block for Extended Leads.

several rooms at the same time it is advisable to wire the sockets in parallel.

Mounting Grid Leaks

MOST variable grid leaks of the carbon compression type have a screw or terminal at the end to make connections with. By taking the terminal top off or taking the screw out, and pushing it through the hole in the condenser normally used for mounting it to the panel, and then



Mount for Grid Leak.

tightening it up again, the condenser can be neatly fixed to the grid leak (*see* sketch).

D. W.

Measuring Wavelengths with a Ruler!

SINCE the problem of the use of very short wavelengths is being considered by many amateurs, it will perhaps be of general interest to describe a practical simple method of obtaining accurate measurements of waves from one to five metres in length

Wavelength

Without going deeply into theory, it might be stated that the wavelength of a transmitting station is twice the distance between the crests of the alternating current in the aerial wires. If, then, in the case of five-metre transmissions, we could tempt the current oscillating at the rate of 60,000,000 cycles per second to stand still on a wire whilst we measured it (always providing we could see it) we should find that each wavelength is 5 metres or 11 ft. 3 in., plus a small fraction of an inch.

Unfortunately we cannot see these waves; neither will they stand still, so that other methods of measurement must be resorted to.

Necessary Apparatus

Ordinary wavemeters are not very practicable for this purpose for various reasons, but the difficulties may be overcome in a very simple manner. The apparatus required for the method about to be described is a good "dual" condenser (·0002 microfarad), a coil of bare aerial wire, four insulators, a neon tube, and two pieces of ebonite rod or dry wood not less than 6 ft. long and about ½ in. in diameter.

The sketch shows the method in use. First of all a pair of wires 20 ft. long are tightly stretched, parallel to one another, and from 4 to 6 in. apart, the ends being attached to good quality insulators of porcelain. The dual condenser has its fixed plates shorted and is stood on an insulated table or base. The moving vane terminals are fitted with loops of wire, each loop being 3 in. in diameter and one of each of the stretched wires are led to these loops.

Next a pair of plain bare wire bridges is made from pieces of wire slightly longer than the distance between the stretched wires. These are bent at the tips so that when placed across the wires, the ends grip the wire and hold the bridge in position. The method of operation is to set the short-wave transmitter into oscillation and then to hang the neon tube, which has previously been fitted with very short rigid hooked leads, between the two wires near one end, each lead being attached to one of the wires.

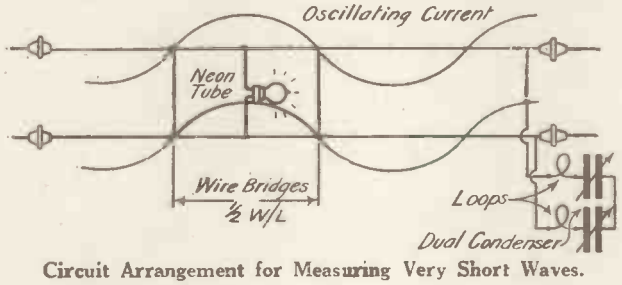
To many broadcast listeners 250 metres is a low wavelength, but to the experimenter a wavelength of 50 metres is not out of the ordinary.

Soon, transmissions on a wavelength of only a few metres will be commonplace.

When the transmitter is oscillating properly on or about the wavelength of 5 metres, adjust the dual condenser until the neon tube suspended on the wires lights.

Should the tube fail to glow it should be pushed slightly by means of the insulated rods until it functions as desired. When the tube is at the position in which it glows brightest, place one of the bridges beside it on the wires and then move it along until it fails to have any effect on the lighting of the tube.

Next place the other bridge on the other side of the tube and adjust it until the tube glows brightly. The distance between the bridges is now measured by means of a metric rule, and the resulting measurement is one half of the wavelength of the oscillations taking place in the wires.



Circuit Arrangement for Measuring Very Short Waves.

Transmitter Frequency

By the aid of the formula, frequency equals 300,000,000 ÷ wavelength, it is now also possible to determine the frequency of the transmitter.

It might also be mentioned that should wavelengths longer than 5 metres be used, the length of the wires should be so increased that they are about one and a half times as long as the wavelength which it is desired to measure. A. J. C.

New Berlin High-power Station

THE Reichs Posts and Telegraphs have under construction, in the immediate neighbourhood of Berlin, a 20-kilowatt broadcasting station which will transmit on a wavelength above 1,000 metres. It is hoped to start operations in September next.

Following the principle adopted by the B.B.C. at the Chelmsford and Daventry stations, the German authorities also hope to broadcast alternative programmes of concerts and lectures, of which reception is expected on simple crystal sets throughout the entire country.

The construction of the high-power transmitter will not in any way interfere with the new 10-kilowatt Witzleben station, now being built on the site of the last Radio Exhibition. The two stations will possess one common studio.

The alternative programmes will include special news bulletins for foreign consumption, as Germany is very anxious that her transmissions should be enjoyed by neighbouring countries.

The advent of the new service will coincide with the cancellation of the regulations governing restricted wavelengths. J. G. A.

The "AMPLIFICATION FACTOR" OF A VALVE

How Far Does Sound Volume Depend Upon It?

THERE appears at the present time to be a belief amongst those who are substituting the crystal-and-phones set for a more ambitious scheme with valves and loud-speaker that the volume of sound emanating from the horn of the loud-speaker is

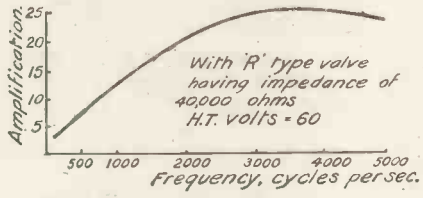


Fig. 1.—Valve Amplification Curve.

proportional to the "amplification factor" of the valves in the amplifier. This at first sight would appear quite a reasonable conclusion, and it is hoped that a few explanations on this point will prove of interest to the man with the valve amplifier, and may help him to get results which will surprise him in the quality of tone resulting from a suitable valve combination.

Action of Grid

The "grid" of a valve, being charged positively and negatively alternately by the applied alternating voltage, has an accelerating and retarding force respectively to the stream of electrons flowing from filament to anode. It will be clear that the extent of controlling action will be limited to a very large extent by the attractive or repellent force exerted by these positive or negative charges, and will be greatest when the "grid" is so constructed as to exert its influence on the greatest possible number of electrons flowing through it. This would take the form either of a very closely wound spiral of wire or of a close mesh gauze, and a valve thus constructed would in all probability have a high "amplification factor," but at the same time it will be obvious that electrons will find it much more difficult to get across to the plate, or in other words the "impedance" or A.C. resistance of the valve will now be increased.

These two terms briefly explained, we will consider how their values will affect the volume and purity of sound for loud-speaker operation.

Let us take the two most widely used forms of intervalve coupling—(1) the transformer, and (2) resistance-capacity. Another form, the "choke-capacity," may be taken, for the sake of argument, to be a form of 1 to 1 transformer, the capacity serving merely as a "block" to prevent the grid of the following valve being paralysed by application of a high D.C. potential.

This is, perhaps, the system most extensively used, and we will take the case of a standard transformer of reliable make, and of the most usual ratio of 4 to 1 step up. Cheap and "shoddy" transformers may be ruled out as no set can prove efficient unless all the components

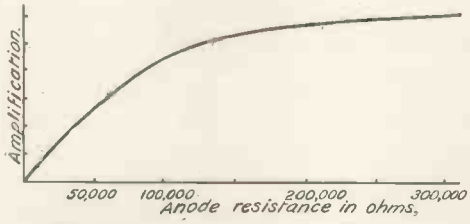


Fig. 3.—Amplification and Anode Resistance Curve.

are of reliable construction. It is, of course, essential for distortionless amplification that the whole range of audible sound frequencies found in speech and music be each magnified to the same extent, and without going deeply into technical explanations, it is necessary for the impedance of the transformer primary to be as nearly equal as possible to the impedance of the valve in whose anode circuit it is connected.

Now with most transformers having a 4 to 1 ratio, the primary winding is of relatively low impedance, and so a low impedance valve must precede it. If a "general purpose" valve which has usually rather a high impedance is used, the magnification is greater at the high frequencies than at the low, and a certain "tinniness" will result.

Figs. 1 and 2 show the magnification at different frequencies obtained with the same transformer but different valves.

In addition to tonal purity the volume of sound obtained is dependent on the amount to which the middle and lower frequencies are amplified, and thus it is important to obtain a curve such as that in Fig. 2.

Grid Bias

A further necessity for distortionless low-frequency amplification is absence of grid current. This must be prevented by a definite negative potential being applied to the grid of a valve, depending upon the amount of oscillating voltage applied. It is economical from the point of view of current taken from the H.T. battery to apply as large a grid bias as is possible while still working on the straight part of the "grid-volts plate-current" curve.

It will be noticed that hitherto the "amplification factor" has not been mentioned, impedance being stressed as the important point. As explained above, increased amplification factor will automatically put up the internal impedance of a valve, and vice versa, so that it should now be clear that with transformer coupling it is *not* the amplification factor of the valve in the primary circuit which must first be con-

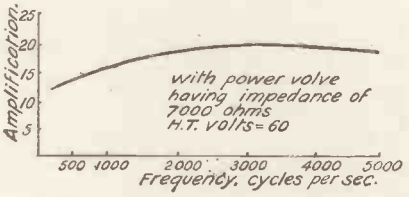


Fig. 2.—Another Amplification Curve.

sidered, but rather its impedance, which, for the best results, should be of a low value. A general purpose valve may sometimes be made to give better results by increasing the plate voltage and applying a larger

(Continued on page 546)

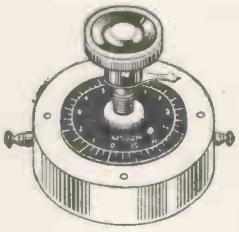
LISSENIUM

BUILD WITH ALL LISSEN PARTS— THERE IS ONE FOR EVERY VITAL PLACE

RECEIVERS WHICH ARE FITTED WITH LISSENSTAT CONTROL ARE EQUIPPED FOR THE FINEST DETECTION POSSIBLE. LISSENSTAT MAJOR (pats. pending) gives the most acute tuning possible **7/6**

LISSENSTAT MINOR (pats. pending) is replacing many thousands of inefficient rheostats. Provides LISSENSTAT control at a popular price **3/6**

Ask for LISSENAGON COILS— the coils which intensify Tuning



On short wave work where tuning is so critical the LISSEN MICA VARIABLE CONDENSER with its open scale and delightful tuning characteristics fills a great need.

Negligible minimum, maximum rated at .001. THIS LISSEN CONDENSER GIVES YOU EVERY CAPACITY YOU WILL EVER NEED—IT SUPERSEDES ALL OTHER CONDENSERS—AND IT IS TOTALLY UNLIKE THEM **17/6**

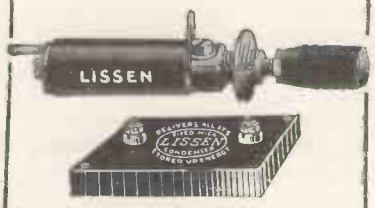
THE LISSEN T.1 TRANSFORMER WILL AMPLIFY A WHISPER TO A GREAT DEGREE OF LOUDNESS IN A BACKGROUND OF ABSOLUTE SILENCE. It is the Transformer which should be particularly used immediately behind the detector valve. The LISSEN T.1 TRANSFORMER is distortionless, for one reason, because the impedance of the transformer is obtained by means of the exceptional coil used and not by the use of a heavy iron core which always tends to distort.

THE LISSEN T.1 TRANSFORMER has a most expensive coil—IT WOULD AMPLIFY BY ITSELF WITHOUT ANY IRON CORE AT ALL **30/-**

Write for Text Book of Lissen Parts. FREE to Readers of "Wireless Magazine"

DON'T MIX YOUR PARTS.

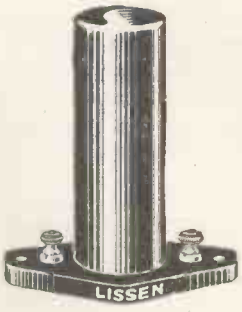
With all LISSEN Parts your receiver will give Results which would never be possible with Mixed Parts.



WITH THE LISSEN VARIABLE GRID LEAK YOUR RECEIVER WILL YIELD THE UTMOST SENSITIVITY WHICH CORRECT GRID POTENTIAL UNDER ALL CONDITIONS IMPLIES ... **2/6**

IT IS WORTH WHILE FITTING LISSEN FIXED CONDENSERS, TOO. MADE WITH SCRUPULOUS CARE — ACCURATE TO WITHIN 6% — THEY NEVER VARY — NEVER LEAK. THEY DELIVER ALL THEIR STORED-UP ENERGY

.0001—.0009	2/-
.001 —.002	2/6
.004 —.006	3/-



TO BUILD UP PURE SOUND AND YET RETAIN VOLUME THE LISSEN L.F. CHOKE IS RAPIDLY GAINING FAVOUR. This method of L.F. coupling gives the purity of resistance capacity coupling without the necessity for a large H.T. voltage and is also very suitable for power amplification **10/-**

LISSEN LIMITED

500-520 Woodger Rd., Goldhawk Road, Shepherd's Bush, London, W.12.

Telephones: Riverside 3380, 3381, 3382, 1072.

Telegrams: "LISSENIUM, London."

The "Amplification Factor" of a Valve (continued from page 544)

negative grid bias. The effect of the former is to lower the valve impedance, and louder and purer signals should result, but it is always advisable to avoid excessively high voltages by employing a "power" valve with a naturally low impedance wherever possible.

Given a type of transformer, however, having a high impedance primary winding, usually a low ratio of about 2 to 1 at most, it is of course possible to compensate for this loss in voltage step-up by using a valve having a higher amplification factor and impedance, and still obtain comparatively distortionless results.

Resistance-capacity Coupling

This is a form of coupling which is growing in popularity because of the ease with which pure distortionless reproduction can be obtained. The winding of a transformer primary or choke is replaced by a pure resistance, and this being aperiodic, that is, responsive to all frequencies alike, will reproduce the wave amplified by the valve in whose anode circuit it is connected, and pass this on in the form of an applied voltage to the following valve grid. Thus it will be seen that the resistance merely serves to pass on a voltage from valve to valve, and that the whole of the amplification must take place in the valve itself. In this case, as distinct from transformer coupling, it is the "amplification factor" which counts, as we are dealing wholly with a voltage change.

Amplification

The curve given in Fig. 3 shows how the amount of amplification increases with increased anode resistance, and therefore to get the best results from resistance-capacity coupling as large a value of resistance as possible should be used, depending upon the value of H.T. supply available. A greater resistance will of course require a higher voltage supply to compensate for the drop in volts across it.

We now come to the last valve in a low-frequency amplifier. This will be required to supply sufficient current to operate a loud-speaker, and must therefore be of the "power" type, whether transformers

(Continued at foot of next column)

(Continued from preceding column)

or resistance coupling has been used for the preceding valves. It would be of no use to employ a high amplification factor valve in this stage as its impedance would necessarily be high, and an excessively high H.T. voltage would have to be applied to the anode in order to raise the plate current to a sufficient value.

It is advisable to couple the loud-speaker, by means of either the telephone transformer or choke-and-condenser methods, to the valve, in order to prevent large D.C. currents flowing through the windings, which would tend to demagnetise the instrument.

Summary

To summarise the whole position, therefore, we find that where inter-valve transformers are in use a valve having a low impedance gives best results, while for resistance-coupling loudest signals are obtained with a high amplification factor valve; but in all cases the last valve must be a power valve of low impedance.

F. E. H.

ACCUMULATOR TROUBLES

THERE is no portion of the amateur's outfit that receives less attention than the filament accumulator. This accessory, although robust in appearance, is in reality as delicate as a bright-emitter valve and needs as much care in handling. Accumulators should, if possible, always be charged and discharged without moving them from place to place, for the lead paste which is filled into the grids of the plates by the manufacturer is easily shaken from position, thus giving rise to internal short-circuits and premature discharge.

Celluloid Containers

Accumulators built in celluloid containers have another source of weakness in such containers. They are easily buckled when carrying the cell and the seams burst and allow the electrolyte (sulphuric acid) to escape and damage any article with which it comes into contact. Therefore, if the accumulators must perforce be taken to a charging station to be charged, a good wooden carrying crate should be made up or obtained for the purpose. The strap, if of leather, is liable to premature demise, because if the charging station carries out its work properly the cells will gas and the acid spray speedily attacks the leather and rots it.

Impervious to Acid

The strap should therefore be of some material which is impervious to the attack of the acid or be detachable and removed after the cells have been deposited at the charging station, as the charging hand is not likely to study such matters.

Size of Crate

The constant removal of accumulator cells from the carrying crate is another speedy way of bursting the celluloid seams, especially if the cells are a tight fit in the crate. It is therefore better to have a crate which is slightly on the large side and provide suitable packing pieces to prevent movement of the cells when carrying.

Alternatively the accumulator crate could be provided with hinged sides so that it may be opened for ease of inspection. Brass hinges are liable to acid corrosion, but they are cheaper than celluloid containers.

A. J. C.

USEFUL SCRAP BOOK

QUITE a useful scrap book can be made by pasting the hints and tips to be found each month in this magazine into a suitable exercise book.

If a few pages at the beginning of the book are left free, and the contents entered up on them in alphabetical order, much time will be saved when you require information on different subjects.

In Use

For instance: If you wanted to know how to wind a coil you would look up letter "C" in your index pages, and find there something like this: "Coils: How to Wind Them, see page ——."

TRIODE.

"London and Chelmsford Calling"

Our Special Commissioner Visits the Studios at Savoy Hill

Aerial at the Chelmsford High-Power Station

THE red light blinked twice and went out. I gently pushed open the door of the new 2 L O studio. The London station director stepped forward to greet me.

Shall I be causing disillusion to thousands of nephews and nieces if I state that Uncle Rex is a young man and has *not* got "whiskers down to here?"

The red lights again issued their warning signal, an uncanny stillness settled on us all, and I slid noiselessly into the nearest chair.

In the Studio

Imagine a room of quite majestic proportions, tastefully draped with pale grey and powder blue hangings, with ceiling of the same tint; all noise precluded by the use of a thick carpet, and illuminated by shaded electric lamps which seemed to add a peculiar restfulness to the scene. At one end were seated the members of the military band, a matter of some forty musicians, in front of which, on a raised platform of—necessarily—hefty proportions, towered their conductor, Mr. Dan Godfrey, jun.

On my side of the room, close to a grand piano, stood "His Majesty the Microphone," a cage contraption on four legs, covered by a gauze similar to a meat-safe, to protect it from dust.

As all eyes rested on the clock, the stillness was intensified. The studio impressed me as would St. Paul's Cathedral or Westminster Abbey before the beginning of a service. It had the same atmosphere of dignity, of reverence and respect.

Mr. Rex Palmer gave one final glance at his wrist-watch, compared it again with the clock and walked towards the "mike." I fully expected his voice to ring out loud and clear as would that of an actor on the stage, but no, "This is the London Station calling." The tone in which the magic words were uttered were those used in ordinary conversation in a drawing-room, and amongst well-bred people at that.

His confidential talk to the microphone, by which many millions of listeners were advised of the nature of the evening's programme, made me feel that it was indiscreet on my part to overhear the announcements! Talking to the British Isles, forsooth! Why, a whisper alone would carry miles!

What goes on in the studio when broadcasting is taking place?

In this article our Special Commissioner gives his impressions of a visit to the studios at 2, Savoy Hill, W.C.2.

The London studios, it should be remembered, serve both 2 L O and 5 X X.

The conductor raised his baton and the United Kingdom listened to the strains of Wagner's "Huldigung's March." Although the echo in the studio was not equal to that which might have been raised in an ordinary concert hall, the sounds were by no means "dead"; the volume of this military band was of considerable magnitude and I would have thought it too great for broadcasting purposes.

In my immediate neighbourhood was a padded telephone box which the station director entered many times during the course of the evening. It fulfilled more than one purpose. If speech from another part of the building was desired with the announcer, a small white lamp blinked and winked, thus attracting his attention to the call. But the box possessed another more important advantage, that of allowing Mr. Palmer to hear, whilst in the studio, the performance as the outside listener would receive it.

Double Control

When two concerts were being broadcast, as was the case on the evening mentioned, it enabled him to listen to each in turn. This constituted a double control, that of the engineers on duty and of the station director or announcer in the room. It also linked him with the outside world.

The distance of the microphone is variable. In the case of the band it stood at about 30 feet from the nearest musician. Later, when a singer appeared on the scene, the distance was reduced to about twelve to fifteen feet.

(*Continued on page 550*)

Stories of Famous Operas

RIGOLETTO

First produced at Milan, 1851. One of the most popular of Verdi's operas. Written and instrumented in less than six weeks!

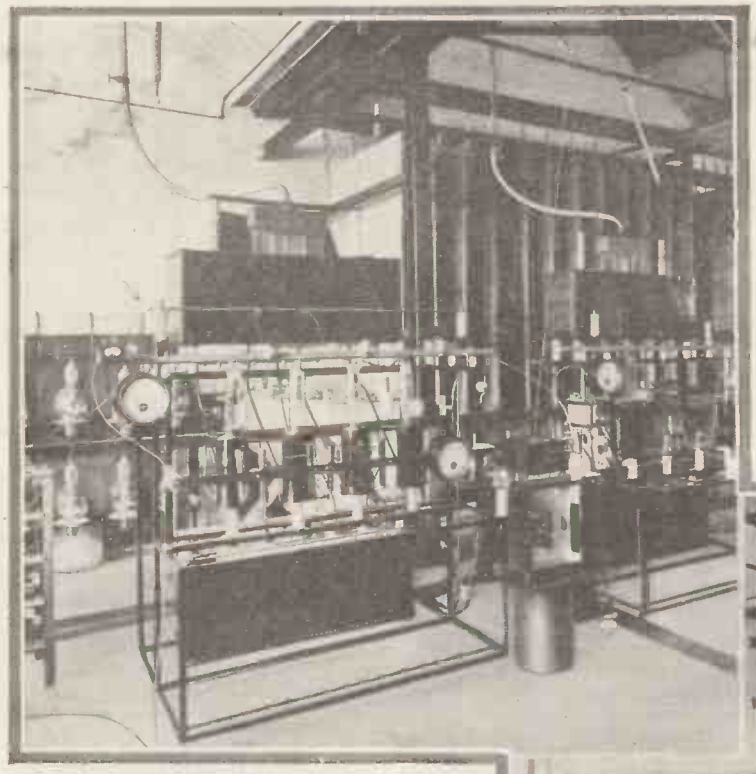
RIGOLETTO, Jester to the Duke of Mantua—a libertine whom Rigoletto abets—has a beautiful daughter, Gilda, whom he loves dearly. To preserve her from court contamination he secludes her in a remote quarter of Mantua, but the duke discovers her retreat and has her abducted. Rigoletto hires a desperado, Sparafucile, to assassinate his enemy; for, to add to his despair, Gilda has fallen in love with the faithless duke. Sparafucile owns a lonely inn, and uses his beautiful sister, Maddalina, as a decoy for the duke. Maddalina, however, is attracted by the handsome nobleman; and her brother, who has promised to deliver his victim's body to Rigoletto in a sack, consents to spare him and to kill instead the first person to enter the inn. Meanwhile the Jester, thinking to cure his daughter's infatuation, persuades Gilda to go to the inn and see her lover with her rival. Directly she enters she is stabbed. Rigoletto, arriving to claim his enemy's body, receives the sack, departs to open it, discovers his daughter and falls unconscious.

"London and Chelmsford Calling"

(Continued from page 548)

I watched the proceedings for about fifteen minutes and came to the conclusion that when my son grew up I would not make an announcer of him; it appeared to me to be a nerve-racking task. Although the public, at times, may see fit to complain of what may appear to be long intervals between turns, I can only say that for my visit to the studio I had not picked upon any special evening and that it struck me most forcibly that not a moment is wasted, that any few seconds which might elapse between the last notes of a band piece and the first words of the next spoken number were merely taken up by the necessary alteration in the position of the microphone.

THE CHELMSFORD TRANSMITTER



(*Above.*) **High-power valves get very hot and are therefore water-cooled. The circulating tanks and feed pipes can be seen above.**

In order to achieve variety, the items on the programmes must be cleverly dovetailed together, and as some of them—such as news bulletins, time signals and speeches which are S.B. to other stations—must be in any case fixtures, punctuality is an important factor and rules the situation. The "one-minute-please," which appears to have become a by-word, is just that short breathing space which allows the announcer to adhere to the schedule.

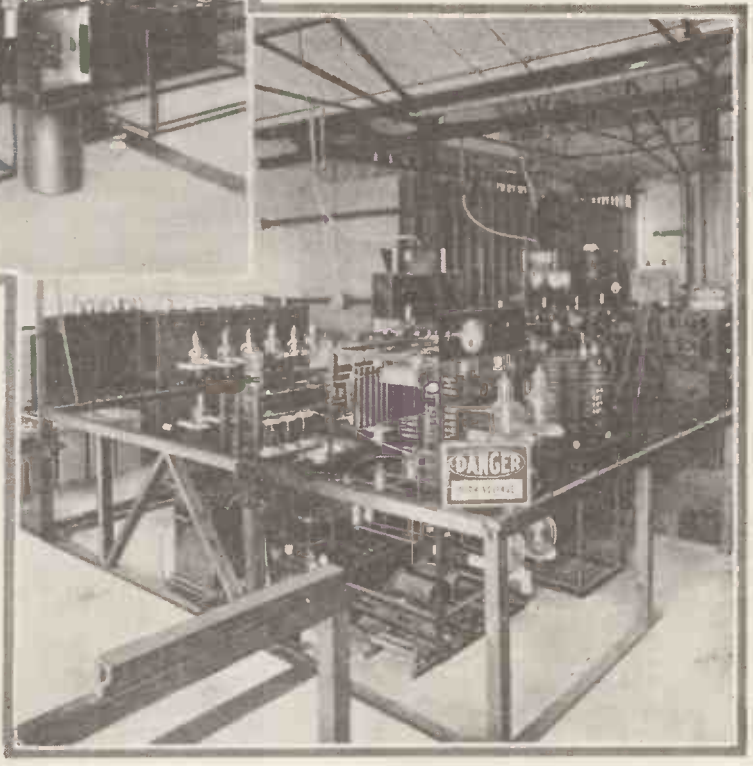
Whether 2 L O has adopted the practice permanently, I do not know, but on the occasion of my visit, for quite a number of turns, the microphone remained open and was not closed at the end of each item. So long as the red lamp is alight the studio is connected with the outside world and I, for one, during the entertainer's humorous remarks, barely dared to indulge in more than a subdued smile.

The microphone was so close to me that had I chuckled I might have disturbed Aberdeen. I could not contemplate the consequences of a sneeze through 5 X X. Why, some amateur "down under" might have reported receipt of the signal by cable with a note to the effect that atmospherics were troublesome that morning!

Up to Standard

Tenor songs interspersed with the band held my interest for some time. There was no effort on the part of the singer, the voice was not in any way, strained and the piano accompaniment was quite subdued. The announcer reappeared from the cabinet in true "Carl Hertz" style, indicating by a wave of the hand that a step or so nearer to the microphone would prove useful; a nod and a smile conveyed to the artist that the transmission was up to the standard quality.

(*Below.*) **Accidental contact of the body with certain parts of the apparatus means death. Danger cards are prominently displayed as warnings.**



The orchestra having settled down to the rendering of a long suite, I accepted the invitation to go to 5 X X. A few steps down the corridor, a short ride in the lift, and I had reached Chelmsford.

This may or may not be news to you but, as a matter of fact, all concerts broadcast by 5 X X are actually given in one or other of the studios at Savoy Hill.

It was before the land-line was fixed up that a

(Continued on page 552)

Look to your Valves

GENERAL PURPOSE VALVES:

Type R. ..... 11/- each

Filament voltage ..... 4 volts
Filament current..... 0.7 amp.
Max. plate voltage..... 100 volts

Type B 3. ..... 18/- each

Filament voltage ..... 1.8 volts
Filament current..... 0.35 amp.
Max. plate voltage ..... 80 volts

***Type B 5. ..... 21/- each**

Filament voltage..... 2.8–3 volts
Filament current..... 0.06 amp.
Max. plate voltage..... 80 volts

POWER AMPLIFYING VALVES:

Type B 4. ..... 30/- each

Filament voltage..... 5—6 volts
Filament current..... 0.25 amp.
Max. plate voltage ..... 120 volts

***Type B 6. ..... 30/- each**

Filament voltage ..... 3 volts
Filament current..... 0.12 amp.
Max. plate voltage..... 120 volts

***Type B 7. ..... 32/- each**

Filament voltage..... 6 volts
Filament current ..... 0.06 amp.
Max. plate voltage..... 120 volts

**For use with dry cells*

B T-H

They are chiefly responsible for the quality of reproduction. Badly exhausted valves, otherwise "soft" valves, are short-lived and give poor results. "Soft" valves cost less to make than "hard" valves, but they are expensive and unsatisfactory in use. B.T.H. Radio Valves are exhausted by a special B.T.H. process which produces an exceedingly high vacuum.

FIT B.T.H. VALVES & MAKE YOUR SET A GOOD SET

From all Electricians and Radio Dealers

B.T.H. RADIO VALVES

Made in Rugby, England

Note new reduced prices of all types

Advertisement of The British Thomson-Houston Co. Ltd.

2171

"London and Chelmsford Calling" (Continued from page 550)

concert by Madame Clara Butt was transmitted from Chelmsford proper.

The room I entered was smaller than the studio I had just left, but built and fitted in the same manner. It is the one from which the Children's Hour is broadcast, and with but little effort of imagination I could visualise Uncle Jeff at the piano or Uncle Caractacus, Aunt Sophie and the other relatives acknowledging the kiddies' letters and wishing them happy birthdays.

All Over Europe

It seemed incredible that the pianoforte solos, the songs and talks should be heard in most parts of Europe. The same stillness prevailed, the same respect for the "mike," the same subdued tones of the announcer's words, and yet, conveyed to Chelmsford, a distance of 40 miles or so, those sounds would reach the ears of foreign listeners who, although ignorant of English, could understand the international language of music. It seemed uncanny!

The station director cannot, like Boyle Roche's bird, "be in two places at the same time," and here, we had, of course, another announcer. But, hush, the red light has again issued its danger signal. John Henry stepped to the microphone. We have all heard him, and he has brought brightness and laughter to many homes. I, as a favoured one, have seen him in the flesh.

"The Frozen Mitt"

Personally, I do not possess the talent of singing comic songs or of giving humorous recitations for the amusement of my friends, but I greatly admire this gift in others. There is, however, something so chilly about the microphone, it is so unresponsive, that, in the language of the U.S.A., "it hands you the frozen mitt." To be funny in front of it must stamp you as a born humorist. Remember that to an unseen audience you are robbed of fifty per cent. of your personality. You cannot tell how your jokes are received, and all your attempts at "funniosities" are limited to the inflection of your voice and to the delivery of your words.

And John Henry was funny as he stood seriously and quietly there, explaining the making of a "superhet" wireless set. At the closing of his last sentence he appeared to take his leave of the "mike" as if he had been giving an oration over a comrade's grave. The callousness of the instrument! I quite expected it to retort: "We are not amused," and yet I had no difficulty in picturing the laughter which would accompany, in thousands of homes, the reception of the entertainer's words.

We were fast nearing the time-signal and the announcer was watching the clock with an anxious eye. The next turn ended as the hands pointed to 9.29. The red lights went out, the six dots came through, and we were allowed to speak. Automatically, 5 X X is connected with 2 L O, and the news bulletin is broadcast to the British Isles and to the lands across the sea from the larger room downstairs.

On this occasion, by 10 p.m., the studios had finished their work, and the music of the Savoy bands was relayed to the 2 L O "Clapham Junction," which connects Savoy Hill with all the main and relay stations.

RIPPLES

IT is rumoured that the Vegetarian Vigilance Society view with no little concern the way the thoughts of the community are being insidiously turned towards meat. Why, it argues, cannot wireless wavelengths be measured in terms of good old English yards instead of terms of m . . . . . (Yes! very subtle. But the first one who finds the missing word will *not* receive either a free Rolls-Royce or a tortoiseshell manicure set.)

* * *

"I'VE left it at home on the piano," is not a bit of use nowadays. If you *must* impress your acquaintances with your high social standing, better try: "*What* a nuisance! I've left it at home on the 45-valve set."

* * *

THE latest development is secret codes. And so if you happen to be passing an underground café and you hear through the ventilator a puzzled voice saying: "A word of six letters meaning a plant whose fruit has pips in it," you'll know a Scotland Yard wireless message has just been intercepted.

* * *

19TH CENTURY FATHER (to prospective son-in-law): "Can you afford to keep my daughter in the manner to which she has been accustomed?"

20th Century Father (to ditto): "Can you afford to give my daughter the valve sets to which she has been accustomed?"

* * *

I LEARN on the worst authority that the Police Authorities and the Professional Crooks Association now each have a special staff intercepting the other's wireless messages. When the "Flying Squad" wireless van oscillates Scotland Yard with: "Spotted a diamond in pawnbroker's window in Soho. Man with two legs, one head and a suspicious beard lounging in vicinity. What action?" the Uncrowned King of the Underworld immediately sends out on his secret set in the secret beer-cellar: "No. 6789. Curses. You are discovered. Shave. Then disguise yourself as a cop. But get that diamond or by thunder I'll . . ."

H. J. S.

That low filament consumption fetish!

TWELVE months' experience with Dull Emitter Valves working from Dry Batteries has proved to most wireless enthusiasts two things; first, that the low current consumption necessary for a Dry Battery means a whittling down of the filament to the point of fragility. Secondly, that if a multi-valve Set is used, large and expensive dry cells must be purchased to cope with the heavy current demands. It is not surprising, therefore, to find that prominent wireless engineers and experts attached to the various wireless magazines are wondering whether the price they are paying for the convenience of Dry Batteries is not out of all proportion to their advantages.

Obviously there are three distinct factors to be considered when choosing a Dull Emitter. They are (*a*) first cost, (*b*) upkeep cost, and (*c*) length of life.

No sensible man ever spent ninepence to save sixpence, yet that is exactly what you are doing if you choose your Dull Emitter on filament consumption alone. Current consumption, generally speaking, is influenced by the diameter of the wire used in the filament. The thinner the wire the less current it will consume. But obviously there is a very decided safety-limit, and a Valve that will give a tolerably long life in the hands of a careful laboratory worker would certainly not last long in the rough-and-tumble of everyday Broadcast reception.

The Cossor Wuncell Valve has been designed with a true realisation of the part it has to play in the hands of the average wireless enthusiast. In view of the immense popularity of the Cossor Bright Emitter we should not be doing our duty if the Wuncell carried the risk of fragility or lack of efficiency in the hands of the inexpert.

The Wuncell Valve is a long-life valve for two reasons—(*a*) because its filament glows only at 800 degrees (a dull red heat almost invisible in daylight), and (*b*) because its filament is essentially as robust and as stout as in any standard bright Valve.

Naturally this special filament is not an ordinary type of coated filament. It is manufactured under a process which is exclusive to the Wuncell.

That the Cossor policy of placing long life before current consumption is right is proved by the wave of popularity the Wuncell is enjoying. On every hand there is unmistakable evidence of public appreciation of its sterling qualities of greater sensitiveness, absolute reliability, and exceptional purity of tone coupled with an entire absence of microphonic noises. You'll end your search for an ideal Dull Emitter when you try the Wuncell.

Wuncell exclusive advantages featured:

IF you own a multi-valve Set using Bright Valves you will naturally decline to discard all your present valves in order to try out Dull Emitters. There's a better way than that with Wuncells. You can choose Wuncell W.R.1 or W.R.2 (see below) and use it at once alongside your other Valves. It has a special resistance within its base which enables it to function from a 4- or 6-volt accumulator. When all your bright Valves have been replaced by Wuncells you can short-circuit these resistances by means of the screws provided and alter your accumulator to give 2 volts with a greatly increased capacity. This advantage is found on no other Dull Emitter.

Technical Data:
Filament voltage, 1·2 to 1·8
Fil. consumption, ·3 amps.
Plate voltage, 20 to 80

Prices:

W.1 For Detector or L.F. Amplifier

W.2 (With red top) for long distance reception

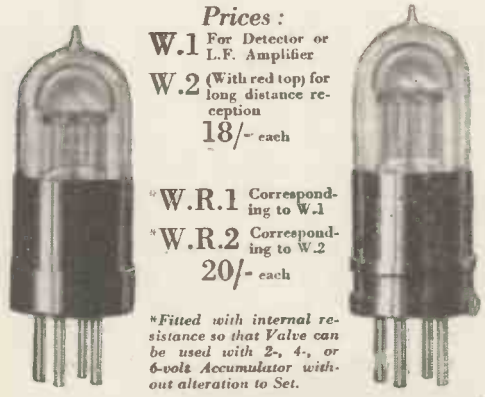
18/- each

***W.R.1** Corresponding to W.1

***W.R.2** Corresponding to W.2

20/- each

**Fitted with internal resistance so that Valve can be used with 2-, 4-, or 6-volt Accumulator without alteration to Set.*



Cossor Wuncell Valves

THE ONLY DULL-EMITTER VALVES SOLD IN SEALED BOXES

Advertisement of A. C. Cossor Ltd., Highbury Grove, N.5.

Gilbert Ad. 2619

Better the Phones with Fixed Polepieces Than the Very Cheap Adjustable Type.

Points to Watch in Adjustable Phones

IN this article I wish to deal with the adjustable phone and why the majority of designs do not allow of this critical clearance taking place. First of all let us consider a fixed polepiece over which a diaphragm is suspended.

Now, the best makers usually dispense with spacing washers and grind their polepieces to the exact distance below the level of the earpiece to allow for maximum strength of signals. The distance is worked out by experts when the gauges are being designed. This practice, however, costs money and means an extra phase in the manufacture of the better-class phones. These also have to be tested individually for actual signals as well as for continuity.

Price

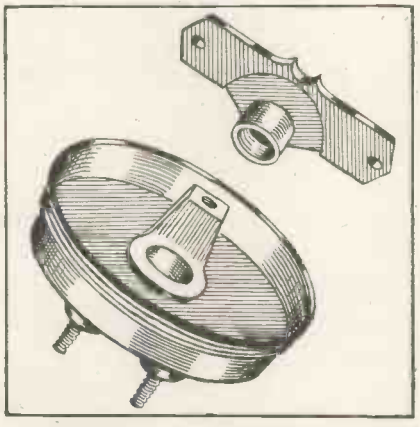
Unless, therefore, a reasonable price is asked for these phones they are not worth making from a commercial point of view.

Many manufacturers, mostly continental, have done away with this expensive but accurate system in order to produce a phone that will compete successfully with the better-class makers, and therefore get the business of those who could otherwise not afford to purchase phones or would have to use one pair instead of two or three.

Adjusting the Air Spacer

Perhaps it will be as well to explain how these manufacturers cut out these final adjustments and testing costs.

There are two methods: the most common being to roughly get the polepieces somewhere near the level of the earpiece, being careful to insert rings or washers of sufficient thickness so that the diaphragm will miss the polepieces. Signals will, in this case, be heard at a strength dependent upon the air space between the diaphragm and polepieces, but the chance that this air space will approach the minimum is extremely remote. The phones made in this way usually want a lot of experimenting with to get the best results out of them, as a very small difference in the thickness of the washer will make all the difference to signals. The other method is to have the whole interior assembled in the least time, ignoring the workmanship, and then to insert this interior into the earpiece, leaving the adjustment to the user by means of an external screw projecting at the back of this earpiece. According to the skill of the user, the signals will now approach the intensity of the former method. That is to say, the polepieces will be brought nearer to the diaphragm until signals are fairly loud, but unless by chance the polepieces should be parallel to the diaphragm the point will not be reached



Parallel Sleeve for Carrying Polepiece.

before the diaphragm is pulled down on to the polepieces. If the diaphragm were to drop on to *both* the polepieces at once all would be in order, and there would be proof that the polepieces were level and parallel, and, with the provision for adjustment by means of a screw, there is apparently no reason why the most sensitive point should not be reached to disprove this. Let us take the case of the more expensive type of adjustable phone, an example of which is shown in the diagram.

It will be noticed that the makers of this phone have a means of accurately confining this movement to where it is wanted. The movement in this case is at right-angles to the diaphragm, and to ensure that it shall be exactly 90 degrees there is provided a parallel sleeve of ample proportions which will allow no side play.

With this particular make a movement of $\frac{1}{4}$ in. on the periphery of the adjusting screw means that the polepieces will move about $\frac{1}{200}$th of an inch. This minute distance is sufficient to alter the signal strength by 50 per cent. It is remarkable what the least fraction of an inch will make in the signal strength.

Accurate Guide

By reason of the polepieces being kept perfectly parallel, and moving in a perfectly straight plane, it is possible to adjust these phones so that the "click" of the diaphragm may be heard 50 or 60 feet away, so accurately does this bearing surface guide the polepieces, although, luckily for our ears, special provision is made by the makers to reduce this sound without lessening the sensitivity of the phones. It is, therefore, better in one way to spend the same amount of money on a pair of fixed magnet phones in preference to very cheap adjustable makes, and then to experiment until you get better results. J. W. M.

"SPANISH GOLD" is to be broadcast from 2 L O. And we wish somebody would start broadcasting a bit of British gold.

THERE is something in favour of the new wireless alarm clock. After all, you can always have your valves out of order.

A KILMARNOCK reader has picked up Bournemouth on two valves. But then a Kilmarnock man would pick up anything that hadn't to be paid for.

ONE thing that is said about wireless is that it improves the quality of people's speech. Enterprising wireless dealers should bring this fact to the notice of parrot owners.

Absolutely for the Novice!

Working a Crystal Set

THIS chapter heading may seem ridiculous, inasmuch as many people would say there is nothing in working a crystal set correctly. Never mind. I will be ridiculous, if necessary, and set down what I can, even on so simple a subject, in the hope that it may turn out useful all the same.

The buyer of a crystal set will have had no trouble in getting it connected up and ready to listen with as soon as the "catwhisker" has been adjusted on the crystal and the inductance has been tuned. If he has not already bought his phones, here is a little advice about them.

Phones

Buy good ones of some well-known and reliable British make. Some small dealers in wireless goods have a way of sidling up to you and stealthily offering wonderful-looking pairs of phones at from twelve to fifteen shillings with the assurance that they beat any others on the market, but they bear no name, as they are of German origin.

Some of the best German made phones are good, but generally these cheap, unstamped foreign ones are not, and sometimes they are very bad indeed. I have tried in vain to get decent reception with a set and found in the end the only fault was that of inferior quality and corresponding insensitiveness of the phones. Excellent British phones can be had for a guinea or twenty-five shillings.

Resistance

You may buy high-resistance or low-resistance phones. High-resistance phones can be had wound for eight thousand ohms (four thousand a side), four thousand ohms or two thousand ohms. Except with very faint signals eight-thousand-ohm phones are too delicate.

A sudden heavy morse signal or strong "atmospheric" may burn the insulation off their internal wiring and spoil them in a moment. Four-thousand-ohm phones are reliable, and the most usual. Where a broadcasting station is less than ten miles away (or less than two miles away if a relay station) two-thousand-ohm phones may give slightly stronger reception with crystal sets, though these are not so sensitive for long range, nor can more than two pairs at a time be used on a crystal set without the help of note magnifiers.

Low-resistance phones are wound for one hundred and twenty ohms, an "ohm" being the unit of electrical resistance, standardised long before wireless telegraphy and telephony were thought of. Low-resistance phones can only be used on wireless sets of any sort by being attached to the secondary winding of a step-down telephone transformer, the primary winding of which is connected to the telephone terminals of the set.

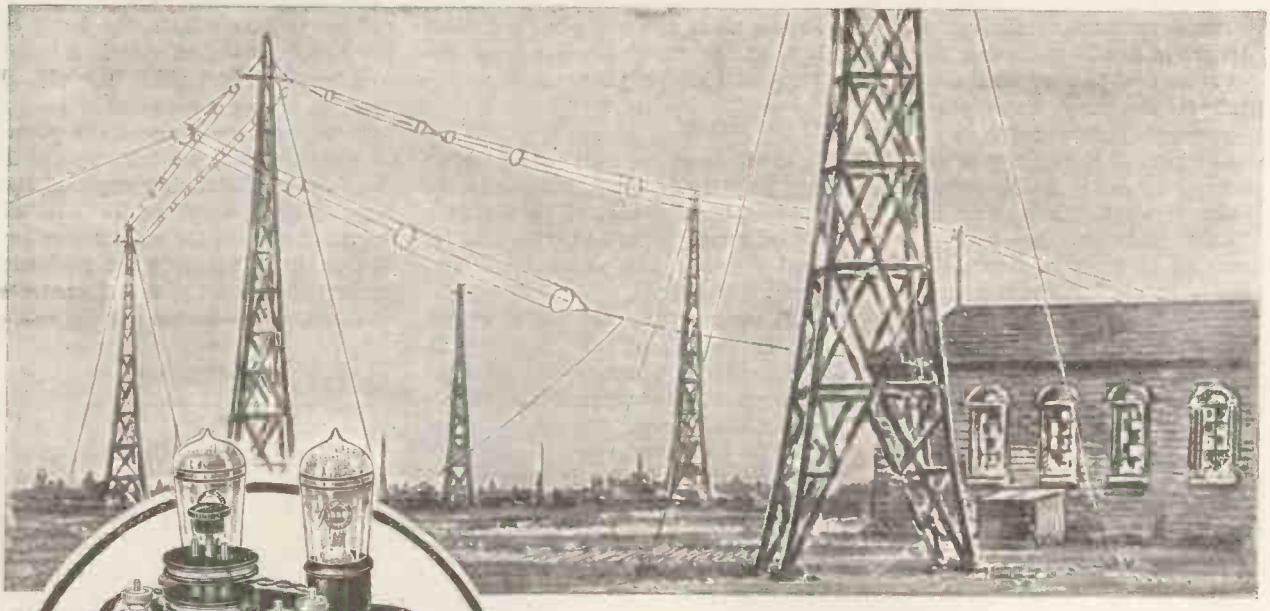
With valve sets, the use of a telephone transformer and low-resistance phones makes for quiet and clear reception and affords complete protection to the listener from all fear of getting a possibly painful, though not dangerous, electric shock through the head in the event of a rather unlikely type of breakdown occurring to the wiring inside the head-piece.

A crystal-set user generally sticks to four-thousand-ohm high-resistance phones. A plain crystal set could not give you an electric shock, anyhow.

Inductance and Tuning

It has been explained that an inductance is a coil of copper wire, the turns of which are fairly well insulated from one another. It is called "inductance" because the current from the aerial passing round each turn of wire induces a sympathetic voltage in the next wire turn.

We know the minute currents generated in an aerial and its lead-in wire are oscillatory currents—they surge backwards and forwards very rapidly, like the impulses of ordinary alternating electric current, only far more rapidly. Without attempting to go more deeply into what is really a complicated subject, we can appreciate that where a number of momentary electrical impulses going first in one direction and then in the other are induced in a number of wire turns placed close together, and where each induced impulse lags slightly after the original one, the mutual effect of these will depend partly upon the brief time intervals between the impulses (itself a measure of the wavelength of the wireless energy) and partly upon the number of turns and the size of wire used.



High-Power-Station Efficiency — in a Two Valve Set

The Radio Engineers of one of the largest Wireless Manufacturing Companies in the World have concentrated on a little 2-Valve Set for your entertainment. All the efficiency and instrument-finish associated with the High-Power and Maritime Equipment, for which Radio Communication Co., Ltd., are world-famous, are embodied in a 2-Valve Set that is not only the most efficient set of its class on the market to-day, but is also lower in price than most others.

The Polar-Twin Set can be operated by the merest novice. It comprises the latest developments in detail, yet presents no complications. It has a single dial for tuning, and when once set, can be switched on and off, giving consistently good reproduction without further adjustments. It is designed for yielding full enjoyment of "Broadcast," for music and entertainment without worries.

"Polar-Twin" is a two-valve Set, for use with Mullard Dull-Emitter Valves. It requires no accumulators; operates from Dry Batteries. It embodies H.F. and L.F. Amplification, with interchangeable rheostat and interchangeable A.T.I. and Reaction Coil Unit. One Unit covers all B.B.C. short-wave stations. Unit for Chelmsford is supplied separately at 7/6.

£6 - 15

(including Royalty, without accessories.)

The additional cost of accessories—2 Mullard D.06 (H.F. and L.F.) valves, 2 60-volt H.T. batteries, 3 Polar D.E. Batteries, one Chelmsford coil unit and 'phones—is £5 13s. 3d. or with Amplion Junior Loud Speaker in addition to 'phones, £8 3s. 3d. or as an alternative to 'phones, £7 3s. 3d.

Polar-Twin Receiving Set

Sold by all good-class Radio Dealers who will willingly demonstrate. We can supply, carriage paid, but your Dealer's name should be enclosed with your order.

16-page Booklet, fully descriptive, free from your Dealer, or from us. (Enclose 3d. stamps.)

What it will do

"Polar-Twin" will operate a loud speaker, with an outside aerial, at a distance of 60 miles; or with an indoor aerial at a distance of 15 to 20 miles. With an outdoor aerial of average efficiency it will receive all British Stations and many Continental ones on the Headphones. It will also receive American Stations, with a good aerial and careful tuning.

A Listener's Testimony

Extract from letter received from "F. T.," Seaton Carew :—

"My Polar-Twin Receiving Set, which I purchased from Messrs. Edgar Phillips, Ltd., West Hartlepool, gives me the greatest satisfaction. I have received the following stations on it : Newcastle, Manchester, Bournemouth, Glasgow, Aberdeen, London, Radio Paris (High Coil), Sundays, 12.45 to 1.45; Chelmsford (High Coil); Oslo, Norway (B.B.C. Coils), Week-days and many German Stations (B.B.C. Coils). I and my friends think it a most wonderful 2-valve Set, and I will have much pleasure in recommending it."

Radio Communication Co. Ltd.

34-35 Norfolk Street, Strand, W.C.2

E.W.B

Nor shall we be surprised to find there are mutual conditions of wavelength and inductance winding where the sum of the oscillations in the inductance may be made up of opposing components so that a good part of the energy is unable to escape to earth readily through the wire turns, but has to go by a bypath. This is the condition we aim at in order to trap and put to use a particular wavelength of wire-

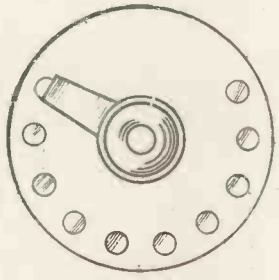


Fig. 1.—Ten-point Tapping Switch.

less energy; and the bypath provided for it is the set itself, or, more particularly, in a crystal set, the bypath is by way of the crystal, catwhisker and phones.

This brings us to the practical question of how to tune the inductance of our set, or, to put it briefly, how to tune the set. It can obviously be done by altering the number or diameter of the turns of wire.

Altering Effective Size

As most wireless sets are wanted to pick up wireless waves of various wavelengths, and to work with aerial and earth connections having a not previously (or at least accurately) known natural wavelength of their own, we shall want in our set some mechanical means of altering the effective size of the inductance coil Means for this will suggest themselves to the mechanically minded. Those generally in use are extremely simple.

The diameter of the inductance turns is not interfered with, but tuning is done either by altering the number of turns in circuit or by introducing or cutting out separate capacity. We will get an idea of what this capacity is later.

The simplest of all tunable inductances is made by winding a number of turns of enamelled copper wire upon a tube of insulating substance and fitting this inductance coil upon a baseboard, with a length of square brass rod running parallel to it. The rod carries a "slider," or metal spring contact, with an ebonite knob for handle, so that by pushing the handle along the slider bar the slider scrapes its metal portion over the turns of wire lying beneath it.

Wire Bared

The part of the wire pressed upon by the slider's contact must be rubbed bare of enamel by laying a slip of emery paper under the contact and running the slider back and forth a few times.

If we now connect the near end of the inductance coil winding to the aerial terminal of the set, and connect the earth terminal to the slider bar, leaving the opposite end of the coil unconnected, we shall be able to put in circuit more or less turns of wire according to the position at which we place the slider along the slider bar.

Dead-End Effect

In theory an inductance coil should not have a great number of turns over and above those necessary to tune up to the wavelength actually being received, for a certain amount of the energy generated in the wire turns is absorbed in those extra ones which lie on the dead side of the slider contact. This loss is called "dead-end effect." In a crystal set it is not of great importance. I have got excellent signals from a coil only one-tenth of which was being used for effective turning. With a valve set, however, dead-end loss is more serious.

Another usual way of tuning an inductance is to "tap" it and carry the tappings to a selector switch, or rather to two selector switches. "Tapping" the wire is simply another name for connecting on branch wires. If we take a three-inch diameter fibre tube, we may wind it as a tapped inductance in the following way: Wind on ten turns of cotton-covered wire, scrape the wire bare or burn off the cotton covering for a quarter of an inch, and solder on neatly a branch wire about a foot in length.

Continue the winding for another ten turns and take a second tapping, and so on till ninety turns in all are wound. A suitable gauge for the wire will be No. 20 s.w.g. After ninety turns are on the tube with a tapping for each ten, begin making a tapping for each single turn up to one hundred. The coil is then complete.

To put it into operation it needs two ten-point selector switches. (Fig. 1). These have a centrally pivoted handle and ten radial contacts, the shank of the handle being of metal, so that whichever contact point it is placed upon it makes an electrical bridge between that and the handle pivot. To the ten radial contacts of one of these selector switches connect the ten ten-turn tappings of the inductance coil, in their correct order. The one-turn tappings are similarly connected to the ten radial contacts of the second selector switch, while

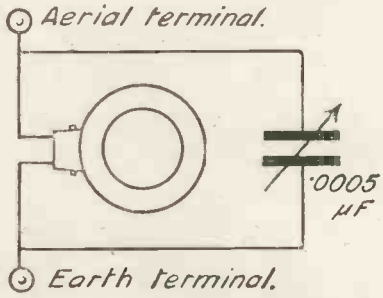


Fig. 2.—Method of Tuning Plug-in Coil.

the central contact of the "tens" selector switch must be connected to the aerial terminal and that of the "units" selector switch with the earth terminal of the set.

With this tuning arrangement, by moving the position of either or both selector switch handles, any number of turns of the inductance between one and one hundred may be thrown into circuit between aerial and earth wire.

Altering Capacity

Though there are other ways of tuning a set, the foregoing demonstrate the essential principle of it. Another way of tuning the set into resonance with wireless waves of the needed length is by altering its capacity, which is done by means of a variable condenser. Variable condensers can be used with either fixed or variable inductances. Some very efficient fixed value inductances (called honeycomb coils) are made interchangeable, so that one or other may be plugged in to a holder which will accommodate any of them equally well. With these "plug-in coils" fine tuning is always done by means of a condenser. (Fig. 2.)

COLIN BENNETT.

(To be continued.)

THE customs of some countries put a tax on wireless components. And the customs of some oscillation fiends put a tax on our temper.

NEW EDISWAN VALVES

WORTHY ADDITIONS TO A FAMOUS SERIES

Volume without distortion

To secure volume free from distortion you must use the right valves in the L.F. stage. This new series of Ediswan Power Valves is the result of much experimental work, resulting in the valves being perfect before being offered to the public.

P.V.5 D.E.	P.V.6 D.E.	P.V.8 D.E.
Fil. volts, 5	Fil. volts, 2.0	Fil. volts, 3
,, amps., 0.25	,, amps., 0.4	,, amps., 0.12
Plate volts, 50-150	Plate volts, 60-120	Plate volts, 60-120
Impedance, 8,500	Impedance, 12,500	Impedance, 12,000
Price 30/-	Price 22/6	Price 30/-

Valves for H.F. and L.F. Ediswan Dull Emitter Valves, types ARDE and AR.06, are now especially made for H.F. and L.F. work. They are distinguished by Red (H.F.) and Green (L.F.) lines. Prices, ARDE 18/-, AR.06 21/-.

TYPE ARDE
HF and LF

THE EDISON SWAN ELECTRIC CO., LTD.,
123–5, Queen Victoria Street, E.C.4.

TYPE AR·06
HF and LF

If your dealer does not yet stock **EDISWAN POWER VALVES** *or* **VALVES** *for* **HF** *and* **LF** *– write to us for full particulars and name of nearest agent*

WAVELETS

IN the long run, cheap wireless components do not pay. Judging from the long run we had last week, we are inclined to believe that the same remark applies to certain bookmakers.

EDINBURGH is to broadcast a mock trial in the early future. We can foresee crowds of Scots asking to be called to the Bar for this event.

THE *Daily Express* has been announcing the formation of a Wireless Association. So that listeners can express their feelings.

BROADCASTERS have recently had an Italian night. We hope the macaroni did not get mixed up with the Marconi.

ALL-STAR programmes are all right, but some people are only satisfied when they can have a three-star programme to accompany them.

SEVERAL amateurs have been picking up messages from the Rice Expedition on the Amazon. In their case, the proof of the pudding is in the hearing.

IT has been suggested that wireless licences should be placed on the same footing as dog licences. Is this because wireless sets have a habit of howling occasionally?

SEVERAL mistresses are providing their domestic servants with wireless sets. Possibly of the dry-cell variety, so that the policeman, when he calls, may feel thoroughly at home.

SOME people are asking that the B.B.C. programmes shall be of a more popular nature. But even then they won't be entirely popular.

SOME listeners are complaining that the programmes contain too much jazz music. But since when has jazz been music?

THERE are several kinds of howling, says an expert. One kind, we fancy, is not unknown in the House of Commons.

SHEFFIELD is said to be the worst pirate city. Surely that is only natural in a place that exists on "steel."

WIRELESS is a game of patience, says a correspondent. And as he writes from a town on the Southern Railway system, what he doesn't know about patience isn't worth knowing.

THERE are now 563 broadcast stations in U.S.A. Or, in other words, one for each strict teetotaller.

THE call sign of one of the American stations is W I T. Some day the Yanks hope it will be changed to W E T.

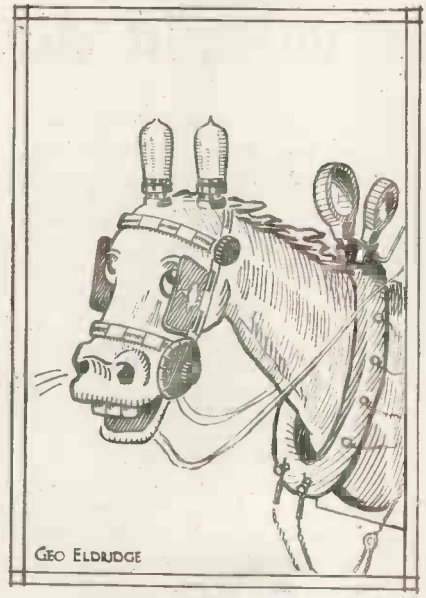
SOME German stations are giving their listeners the opportunity for daily shorthand practice over the wireless. It is not stated whether the German Government is supplying them with scraps of paper for the purpose.

"WOULD it be right," asks a correspondent, "to present a valve set to the local asylum for the benefit of the patients?" We are afraid that if it were right the asylum authorities would not admit it.

WHATEVER advantages the human ear has over the phone diaphragm, our young hopeful reminds us that phones don't have to be washed.

A WIRELESS set has been designed that registers earthquake shocks. The only difficulty with this, however, is that you cannot depend on picking up a programme every night.

AN "HORSECILLATOR"



AN old lady of 100 recently listened in. The young ones, of course, make their husbands do all the listening.

EVERY day, says an amateur, I hear America. We quite believe him, but it is hardly fair to condemn wireless as a whole because of that.

MR. G. K. CHESTERTON has been writing on the subject of making listeners jump. We are afraid that if they are all as portly as G.K.C., the jumping will not be conspicuous for its agility.

"TALES of a Wayside Inn" was one of the items recently broadcast. We hope they were tales of the days before the three-mile limit and the bona-fide traveller were abolished.

A WRITER says that crystals should not be handled with the fingers. Our experience, however, shows that this is much more convenient than picking them up with the teeth.

THE B.B.C. says it has given trials to more than ten thousand artistes. And some of them have been a trial to listeners, unfortunately.

WHEN Parliament is being broadcast, listeners who want to secure the best results should replace their variometer with a gas-meter.

A GAS-METER is one of the components used by Harry Tate in his stage transmitting apparatus. He will have to be on his guard against over-charging.

WIRELESS listeners have discovered that American time is five hours behind our own. So that when it's closing time in Chicago, it's "What's yours?" over here.

SHEFFIELD station was recently brought to a standstill owing to the depredations of the mice. Not the "rats," as was suggested by one listener who evidently had confused Sheffield with Aberdeen.

AMERICAN stations are broadcasting appeals on behalf of St. Paul's. The Yanks evidently mean it to be in a good state of repair when they decide to buy it for transportation to Pittsburg.

IT has already been pointed out that solder is not suitable for fixing crystals. We hasten to warn amateurs against the equally foolish practice of nailing them in position with tin tacks.

LEEDS has one wireless licence for every four houses. It looks as though Leeds leads.

FROM the 2 L O programme recently: "On the Road to Moscow, descriptive of a sleigh ride." Nowadays, of course, they spell it "slay."

THE decision to broadcast *Samson and Delilah* reminds us that in those days the ladies believed in shingling their husbands and not themselves.

Power-station Interference

Q.—Many amateurs in this district complain of interference caused by the local power station. The authorities are willing to assist in overcoming the difficulty, but do not know how. Will you please suggest remedies?—G. F. I. (Bradford).

A.—Of course, it is assumed that the power-station authorities keep the commutators clean and so adjust the brush-rockers as to reduce arcing to a minimum. A large capacity mica condenser may be placed across the output terminals of any D.C. generator and a large inductive choke in series with each main.

These precautions may prove to be sufficient. Each receiver may be fitted with loose-coupled aerial tuning and a counterpoise earth. Not more than one L.F. amplifying valve should be employed, and the transformer of this unit should be screened and earthed to the counterpoise.—L. A. C.

H.F. Valve Not Working

Q.—I have a 3-valve set, 1 H.F. detector and 1 L.F. I find that I can switch off the H.F. valve without any resultant loss in signal strength. In fact by readjusting I receive stronger signals. Can you explain?—S. E. P. (Bristol).

A.—Your trouble is doubtless due to your reaction coil being incorrectly connected. By reversing the connections to the reaction coil you should find a considerable improvement. When the reaction coil is brought up to the grid coil signal strength should increase up to the oscillation point.

If, in any receiver, this does not occur, then the connections to the reaction coil should be reversed.—L. A. C.

Transformer Connections

Q.—I have built the 4-valve set as described in the February issue of THE WIRELESS MAGAZINE. Marconiphone transformers could not be obtained, so R.I. were substituted. I experience considerable howling and distortion. Can you state the cause?—P. F. (Ealing).

A.—It appears that you have wired up the transformers using the connections specified for the "Ideal" transformers.

This is where you are at fault. The connections for R.I. transformers are: I P to + H.T., O P to plate, O S to grid and I S to — L.T. From this it will be seen that you must reverse your secondary connections. Neither howling nor distortion should then be apparent.—L. A. C.

Super Receivers and Outdoor Aerials

Q.—I have commenced building your 6-valve super-heterodyne receiver and would like to know whether it may be used with an outdoor aerial.—A. B. (Bath).

A.—You are not permitted to use a receiver which will cause interference to neighbouring listeners. Such will be the case if you attempt to use this set with an outdoor aerial. A frame aerial should be used as this is almost non-radiating.—L. A. C.

Cracklings in Valve Sets

Q.—I have a 2-valve set (detector and 1 L.F.) which, until a few weeks ago, worked splendidly. Now it has developed loud crackling noises which completely mar reception. I have examined all leads and can find no trace of any loose connections. Can you tell me the cause?—H. G. (Stepney).

LET US HELP YOU

IN operating or constructing a set you may possibly meet with some difficulty that you cannot solve yourself. It may be something to do with bad reception or you may be in difficulty over some connection.

Whatever it is don't worry yourself; let the Technical Staff of THE WIRELESS MAGAZINE *do all the worrying for you.*

Replies to queries of general interest are published each month on this page, but every querist is answered direct by post.

Please observe the following rules:

Ask one question at a time; write on one side of the paper only; attach to your query the coupon on page 583, and send it with a stamped addressed reply envelope to: The Editor, THE WIRELESS MAGAZINE, *La Belle Sauvage, London, E.C.4.*

A.—You trouble is doubtless due to a break in your L.F. transformer winding or a burn-out in your phones. If the trouble still persists when a different pair of phones is tried, you may be sure that your transformer is at fault.—L. A. C.

Cutting Out Interference

Q.—I often experience difficulty in separating different stations on my receiver. The set consists of 1 H.F. detector and 2 L.F.'s, with single-circuit tuning, and tuned-anode coupling. I do not wish to alter the set as it is in cabinet form. Can you suggest remedies?—E. K. (St. Albans).

A.—You may fit a wave-trap to your set. Such a unit may be built into a separate box and added externally to your receiver. A suitable wave-trap for the B.B.C. band of wavelengths may consist of a No. 50 coil with a ·0005-microfarad variable condenser in parallel.

The wave-trap should be connected across the aerial and earth terminals of the receiver.—L. A. C.

Poor Amplification

Q.—I have just added an L.F. amplifier to my 1-valve set, but there does not appear to be any increase in signal strength. I enclose a diagram of connections (not reproduced). The transformer is a brand new Eureka. Can you please assist?—M. R. (Ladywell).

A.—From the plan you submit it will be seen that your transformer connections are I P to + H.T., O P to plate, O S to grid and I S to — L.T. We have found a great improvement when using this make of transformer by reversing the secondary connections, that is, joining I S to grid and O S to negative L.T.—L. A. C.

Oscillation in Sets

Q.—Provided that my single-valve reaction set is not howling, may I be content that I am not oscillating and interfering with neighbouring receivers?—M. A. (Boscombe).

A.—It is not necessary for such a receiver to howl to denote that it is re-radiating. The receiver may cause a very slight hissing noise in the phones and can then be re-radiating interference to near-by sets.

The best plan when listening-in is to prevent even the slightest hiss or trace of distortion. You may then be almost sure you are not causing interference.—L. A. C.

For the WIRELESS BOOKSHELF

The "A.W." Handbooks

THE list of publications dealing with matters wireless includes books written solely for beginners and books that will appeal only to the advanced amateur.

In several cases are to be found books that will appeal to both the beginner and the advanced amateur, and it is in such a category that one would put the four "Amateur Wireless" handbooks published by Cassell's, of London (price 1s. 6d. each).

These four books are:—"Crystal Receiving Sets and How to Make Them," "Simple Valve Receiving Sets and How to Make Them," "Wireless Component Parts and How to Make Them," and "Wireless Telephony Simply Explained."

In the first three is given all the information required to construct any type of set from a simple crystal to a three-valve receiver, together with details enabling one to make one's own component parts. The last-named publication gives a simple and concise explanation of wireless telephony.

All the handbooks are profusely illustrated with photographs and drawings.

Wireless Valve Receivers and Circuits

It is safe to say that unless the amateur understands the principles of the circuit embodied in his receiver he can never hope to get the best results. In "Wireless Valve Receivers and Circuits in Principle and Practice," the authors, R. D. Bangay and N. Ashbridge, B.Sc., A.M.I.C.E., have sought to convey to the reader in as simple language as possible the "whys and the wherefores" of several of the more common circuits in use to-day.

The circuits treated upon include two- and three-valvers, and the latest supersonic receiver.

The book, which is published by Iliffe and Sons, Ltd., London (price 2s. 6d.) should prove very valuable to the amateur who wants to understand his set and get all there is to be got out of it.

Amusing Experiences

TO the senders of each of the following amusing experiences (asked for in the February issue of "The Wireless Magazine") we are awarding a Cossor Valve.

Patience

THINKING that I should be able to give a few hours' pleasure to an invalid old lady living in the upper part of my house, I extended the phone leads so that the loud-speaker could be taken into her room.

After an hour or so my wife chanced to go into the old lady's room, and the following conversation took place:

Old lady: "I do think your husband is a patient man."

Wife: "Why?"

Old Lady: "Why! To think that he is sitting downstairs all this time turning a handle just for my benefit!"—J. E. H. (Cricklewood).

* * *

And the Band Began to Play

IRRITABLE Amateur (father of three), after many hours of fruitless crystal scratching: "Sssh, shurrup! I hear a band."

Youngest of three: "So do we—Salvation Army's at the corner."

(Crystal set relegated to coal-box.)—W. G. A. V. (Bristol).

* * *

Overlap

IT is annoying when two stations come in at once, but this phenomenon has its humorous side. I am two miles from 2 Z Y, and this station comes in on top of everything else.

One night when Edinburgh was giving a talk on Sir John Moore and the Peninsular campaign, Manchester came in with a talk on the hygiene of milk. The result was ludicrous:

"The soldiers at this time were very badly fed . . ."

"So the nation cried out for milk, cheap milk . . ."

And yet again:

"The position of the enemy having been ascertained . . ."

"Milk inspectors were sent out to . . ."—R. M. S. K. (Manchester).

* * *

"Aberdeen's Calling"

A FRIEND of mine asked me to go along with him one evening to see a Hebrew gentleman to whom he had recently sold a two-valve set.

When we arrived this gentleman was listening-in and his little son was playing on the floor with his money-box.

Suddenly the father exclaimed in a loud voice: "For the love of Moses, stop rattling that money-box, Ikey—*Aberdeen's calling.*"—R. G. (Patricroft).

* * *

Heavenly

A BISHOP had been giving an address from 2 L O, and I was very surprised to hear him finish by saying:

"Well, brethren, we shall all meet in Heaven—I don't think."

Enquiry elicited the fact that before the microphone could be switched off he was asked a question and answered: "I don't think . . ."—D. T. P. N. (Plymouth).

Small Items— Big Troubles

VERY often it is the small items that cause the most trouble in wireless. A set that is working all right has, generally, what can only be termed a "feeling of liveliness" about it.

In many cases the trouble with a set is not due to the set at all, but to the phones, and before anything drastic is done these should always be examined. Probable sources of trouble in this direction are broken leads (sometimes very difficult to detect, especially if the breakage is concealed in the insulating covering), broken wires inside either of the ear-pieces, and damaged diaphragms.

Sometimes it may be found that with the phones in one position on the head signals are all that could be desired, whilst in another position they disappear altogether. Should this occur, the trouble may safely be laid down to a broken lead. Don't try to repair a broken lead. The probability is you will not succeed, and a new one can be bought very cheaply.

TERMINAL.

MOSTLY NONSENSE!

(*Continued from page 531*)

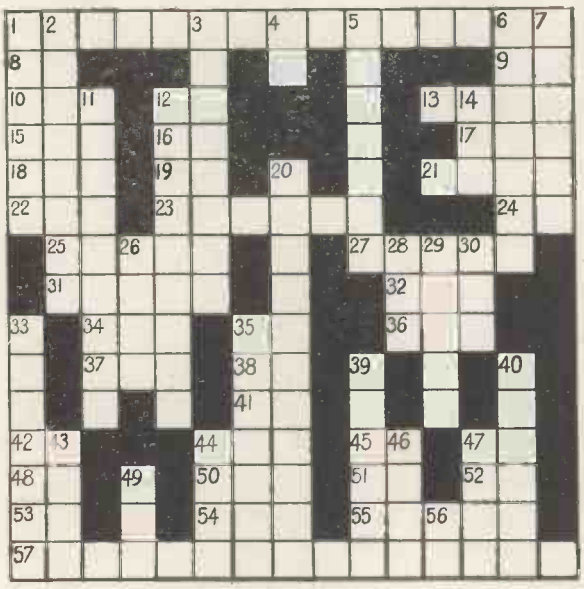
You hear some funny stuff sometimes. Little pigs and valve sets have big ears, without doubt! It's too bad sometimes, though. Have you ever felt like this?

"Oh, why did I buy that valve?
Why? oh, why? oh, why?
Why did I buy that valve? I could almost cry!
It's characteristic's not quite what it might,
It's useless for detecting; as an L.F. it's a sight.
Pa says that it's a Dutch,
And I think he's right.
Ma don't think much of such,
I can't sleep at night;
There's ninety volts now on the plate,
And still it will not oscillate:
Why did I buy that valve?
Why? oh, why? oh, why?"

Well, as the cobbler said as he threw it at his wife: "That's the last." Unfortunately I've got to close down, thank goodness. So, good night, everybody, good night.

FISHGLUE.

Our Cross-Word Puzzles



Mr. Freeman's Puzzle

THE puzzle given this month was compiled by Mr. H. A. Freeman, of the School House, Felsted, who was awarded a prize for the puzzle in the competition announced in our February issue.

We are also giving this month the solutions of the puzzles which appeared in our April and May issues. Next month's puzzle will be one compiled by Mr. G. Cater Turner, another successful competitor in the February contest.

Readers should note that no prizes are offered for correct solutions of the puzzle given herewith.

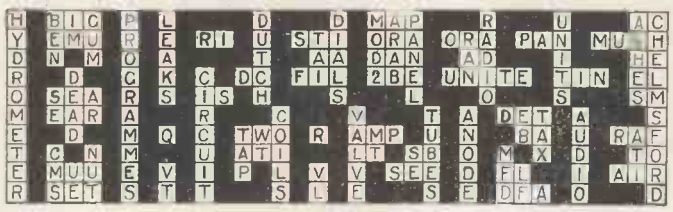
CLUES

Down

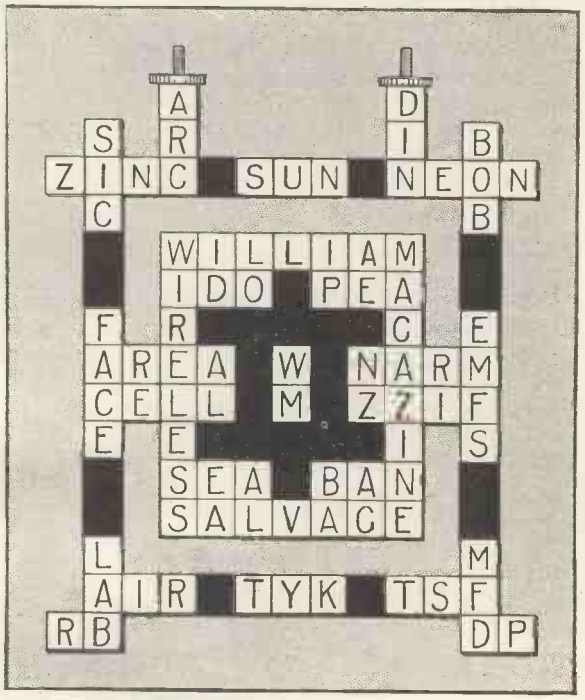
1.—Well-known grid leak. 2.—An electric company. 3.—Good steel for wireless-mast stays. 4.—A parallel system to 42 across. 5.—Well-known make of wireless battery. 6.—Well-known make of honeycomb coils. 7.—A good conductor of electrons. 11.—What the enthusiastic novice first tries to do. 12.—App's contact breakers (abbrev.). 14.—A coil. 20.—A selective type of coil. 26.—Descriptive of crystal set tuning. 28.—General-purpose valve. 29.—A valve (rectifier). 30.—International language. 33.—An early detector. 35.—A crystal. 39.—Anti-burglar protection for wireless set. 40.—Used in comparison of circuits. 43.—A good insulator. 44.—What filaments do with electrons. 46.—Elaborated the electrical atomic theory. 47.—Transmissions that cause great interference. 49.—Coupled to 14 down. 56.—Degree.

Across

1.—Wireless manufacturing company. 8.—Continually reversing direction. 9.—Depart. 10.—A letter of the alphabet. 12.—Steamship. 13.—Explains why ebonite should be protected from heat, damp, etc. 15.—Metallic oxide. 16.—Post and telegraph office (abbrev.). 17.—Often used as an earth. 18.—Period of time. 19.—Programme to suit all (abbrev.). 21.—Used in overland telegraphy. 22.—A railway company. 23.—Length of wire. 24.—Choke. 25.—In every B.B.C. programme. 27.—A train formerly used by amateurs. 31.—How a novice quickly becomes an authority on wireless matters. 32.—Part of a variable condenser. 34.—Prevents a fully-charged accumulator sulphating. 35.—When 38 across was written. 36.—Commotion. 37.—St. —— (a French town). 38.—Part of a world-famous book. 41.—Wireless manufacturer's initials. 42.—System of electrical units. 44.—Refreshing drink. 45.—Country catered for by B.B.C. 47.—A crystal (abbrev.). 48.—A good L.F. transformer. 50.—One reading of a tuning condenser (abbrev.). 51.—Perform. 52.—Used in conjunction with a valve. 53.—A London district. 54.—14 down reversed. 55.—One kind of resistance. 57.—Outcome of Hertz's experiments.



Solution of May Puzzle



Solution of April Puzzle

AT 2, SAVOY HILL, W.C.2

(*Continued from p. 522*)

Listeners cannot be indifferent to the financial aspect of broadcasting, for the provision of the best available talent is a matter that concerns them as much as it does us. We therefore ask that those who may be enjoying the programmes and have neglected to take out licences will repair their omission forthwith, so that it may be said of the listening public of Great Britain that it has a clean bill of health.

Broadcasting St. Paul's

Following the broadcasting of the service at York Minster on Military Sunday, May 3, the service in commemoration of Orlando Gibbons at Canterbury Cathedral on June 5, and the announcement that we expected soon to broadcast a service from Westminster Abbey, numerous letters were received asking whether and when a broadcast service might be expected from St. Paul's Cathedral.

The reply is this. When we approached the officials of St. Paul's a short time ago on the question of broadcasting, the suggestion was turned down summarily.

No effort, however, was spared to make the appeal for funds for the restoration of the Cathedral a success, and the wireless appeal was very fruitful in its results.

It is likely that those results would have been even more satisfactory if, in support of the appeal, we had been allowed to broadcast the bells of St. Paul's or one of the Cathedral services; but although the authorities were adamant, we have no resentment against them, and wish to emphasise that we are anxious, not on the score of broadcasting alone, but on the ground of national pride, to save a great national heritage.

Naturally we are ready at all times to comply with listeners' requests when their suggestions are of such patent value as in the case of broadcasting from St. Paul's; but not even the most pronounced opponents of the broadcasting of religion can find in the broadcasting of the bells and services at St. Martin-in-the-Fields, for example, any ground of objection, either in respect of the attendances or the religious atmosphere. We must leave it at that just for the present.

The Women's Hour

A good deal of trouble has been taken in the past to ascertain the kind of fare that is most desired by women listeners, and the proposal that weekly cooking lessons should be broadcast has been received sympathetically at headquarters.

When, however, a debate by broadcast was organised on the subject of the right kind of entertainment for women, opinion was divided between (1) an ultra-feminine type of hour and (2) a more amusing as well as a more intellectual type of programme on topics of general interest appealing particularly to women. Of the hundreds of letters received as a consequence of the debate some eighty per cent. were in favour of non-domestic subjects.

The majority of the writers said that they did not want talks on cookery, household management and child welfare, their cry being: "Keep us out of the kitchen and take us out of ourselves."

In order of preference they voted for talks on music, literature, travel, women's movements outside the home, fashions and humorous readings.

On the strength of this plebiscite, we have respected the wishes of the women, but as it is the special province of woman to change her mind as she listeth, so the headquarters staff will be ever ready to bow to her decision whenever that decision may be expressed in the mass.

Marking Your Panels

INSTEAD of marking out directly on to the panel of a home-constructed set it is a good plan to lay out the positions of the holes on a sheet of thin cardboard the exact size of the panel, afterwards pricking through the positions of the various holes on to the surface of the panel with some sharp-pointed instrument or a centre-punch.

By doing this all risk of spoiling the appearance of the panel surface with scriber lines or of forming leakage paths by leaving lead-pencil marks is obviated. R. N. W.

Catalogues and Pamphlets

When writing for these, mention "Wireless Mag.," please

COMPONENTS for making a super-heterodyne receiver, together with a simplified circuit, are described in an abridged list issued by R. A. Rothermel, 24-26, Maddox St., Regent St., W.1

A leaflet, describing "Beyond Reproach" loud-speakers, has recently been issued by A. J. Stevens, Wolverhampton.

A leaflet, describing accumulator charging boards for D.C. circuits, may be had from the Electric Depot, Ltd., Pritchett St., Aston, Birmingham.

The latest catalogue published by the M.A.P. Co., 246, Gt. Lister St., Birmingham, contains details of many novel wireless components.

"The Songster de Luxe" is the name of a loud-speaker described in a leaflet obtainable from Superlamp, Ltd., 92-94, Paul St., London, E.C.2.

The Eagle Manufacturing Co., Ltd., Eagle Works, Warwick, have just issued a new leaflet which describes in detail the famous Chakophone receivers.

A useful list of circuits, incorporating the famous Lissen parts, may be had on application to Lissen, Ltd., Woodger Rd., Goldhawk Rd., Shepherd's Bush, London, W.12.

"What Every Wireless User Should Know About the Crystal" is the title of an instructive booklet, free copies of which may be had from Harding, Holland and Fry, Ltd., 52, Queen Victoria St., London, E.C.4.

The catalogue and current price list of Leslie Dixon and Co., 9, Colonial Avenue, Minories, E.1., is now ready, and may be had on application.

A new folder issued by the General Radio Company, Radio House, 235, Regent Street, London, W.1, gives full details of the famous G.R.C. transformers and headphones.

In a pamphlet issued by Ferranti, Ltd., of Hollinwood, Lancashire (a copy of which will be sent free on request), are given details of the Ferranti low-frequency transformer, together with circuits for one-, two-, three- and four-valve receivers.

A new catalogue, which describes in full the latest A. J. S. components, has just been issued by Messrs. A. J. Stevens and Co. (1914) Ltd., Wolverhampton. Copies may be had free on request.

PRINCIPAL EUROPEAN AND AMERICAN BROADCASTING STATIONS

Wave-length	*Station*	*Call Sign*
233	New York (N.Y.)	WEBJ
265	Lockport (N.Y.)	WMAK
265	Brussels	—
265	Joenkoeping	SMZD
270	Malmoe (relay)	SASC
272	Staten Island (N.Y.)	WBBR
272	New York (N.Y.)	WFBH
273	Tarrytown (N.Y.)	WRW
275	Pittsburgh (Pa.)	KQV WJAS
278	Philadelphia (Pa.)	WCAU
280	Dresden (relay)	—
288	Cassel (relay)	—
290	Gothenberg	SASB
296	Hanover (relay)	—
300	Atlantic City (N.J.)	WPG
301	Sheffield (relay)	6FL
306	Providence (R.I.)	WJAR
306	Stoke-on-Trent (relay)	6ST
309	East Pittsburgh (Pa.)	KDKA
310	Bradford (relay)	2LS
315	Liverpool (relay)	6LV
316	Richmond (N.Y.)	WAHG
316	New York (N.Y.)	WGBS
319	Buffalo (N.Y.)	WGR
325	Barcelona	EAJ1
326	Nottingham (relay)	5NG
328	Edinburgh (relay)	2EH
330	Bremen (relay)	—
331	Dundee (relay)	2DE
335	Plymouth (relay)	5PY
335	Hull (relay)	6KH
340	Nuremberg (relay)	—
345	Le Petit Parisien	—
345	Bloemendaal	—
346	Leeds (relay)	2LS
350	Bilbao (Radio Vizcaya)	—
350	Seville	EAJ5
351	Cardiff	5WA
357	Toronto (Can.)	CHNC
357	Toronto (Ont.)	CFCA
361	New York (N.Y.)	WHN
365	London	2LO
370	Falun	SMZK
375	Manchester	2ZY
379	Schenectady (N.Y.)	WGY
379	Troy (N.Y.)	WHAZ
380	Oslau	—
385	Warsaw (Radiopol)	—
385	Bournemouth	6BM
392	Madrid	R1
394	Philadelphia (Pa.)	WFI
394	Philadelphia (Pa.)	WLIT
395	Hamburg	—
400	Havana (Cuba)	PWX
400	Newcastle	5NO
404	Graz (relay, Radio Hekaphon)	—
405	New York (N.Y.)	WJY
405	Newark (N.J.)	WOR
410	Montreal	CKAC
410	Munster	—
418	Breslau	—
420	Glasgow	5SC
425	Rome	1RO
427	Stockholm	SASA
434	Calgary (Alta.)	CFAC
434	Ottawa (Ont.)	CNRO
435	Belfast	2BE
441	Providence (R.I.)	WDWF
443	Stuttgart	—
450	Moscow (Trades Union Council)	—
454	Leipzig	—
454	New York (N.Y.)	WJZ
458	L'Ecole Sup.	PTT
461	Pittsburgh (Pa.)	WCAE
463	Königsberg	—
470	Frankfort-on-Main	—
475	Birmingham	5IT
481	Swansea (relay)	5SX
485	Münich	—
491	New York (N.Y.)	WEAF
495	Aberdeen	2BD
500	Berlin (Witzleben)	—
505	Berlin (Voxhaus)	—
508	Philadelphia (Pa.)	WIP WOO
515	Zurich (Höngg)	—
526	New York (N.Y.)	WNYC
530	Vienna (Radio Wien)	—
545	Sundsvall	SASD
570	Prague (Strasnice)	—
775	Copenhagen (Kjobenhavns Radiofoni)	—
850	Lausanne	HB2
1010	Moscow (Sokolniki)	—
1060	Hilversum	HDO
1100	Geneva	HB1
1190	Ryvang	—
1450	Moscow (Central)	—
1600	Chelmsford	5XX
1750	Radio-Paris	CFR
1800	Brünn	OKB
2200	Eiffel Tower	FL
2125	Amsterdam	PCFF
2400	Lyngby	OXE
2450	Königswusterhausen	LP
2500	Boden (relay)	SASE
2650	Eiffel Tower	FL

On this page is given a list of the principal European and American Broadcasting Stations arranged in order of wave-lengths.

Continental Notes

WHEN twirling my condensers the other night I picked up a fragment of "Salome." On re-reading this sentence it strikes me that I have suggested that my hobby is archæological excavations! I did not intend to convey this meaning, as I, of course, referred to Richard Strauss's well-known opera.

It was during the evening that I tuned-in the Frankfort-on-Main station. "Salome" is rarely given in London; in fact, I cannot remember when it was presented here, but it can be heard frequently at Continental opera houses.

Frankfort, as well as many of the German broadcasting stations, gives grand opera at least twice weekly and, personally, if I feel inclined for this kind of music at any time I always tune-in either Berlin, Frankfort, Munster, or Hamburg. In most instances I "strike lucky."

Referring to that opera reminds me of a young friend of mine who, on being asked at a general knowledge examination to state what he knew about "Salome," replied, in a few lines, that "so far as he could recall, she was a very wicked woman who danced before Harrods!"

Other Transmissions

The German stations are not the only ones to broadcast grand opera relayed from the local theatres. Such transmissions are now being made by Zurich, thrice weekly, and by the Strasnice station of Prague. I have not been able to tune-in the latter, but have no difficulty in securing good reception of the main Swiss station, although the energy is comparatively low.

Its power of radiation must be due to its geographical position as, from all reports, it seems to be well received over the greater part of Western Europe. The musical programmes are interesting and the transmission usually terminates with a news bulletin which sometimes includes quite "late items."

The New Bureau

Now that a new bureau has been established at Geneva to further the interests of broadcasting by regulating all questions of international interest, I should not be surprised to see a scheme put forward for the installation, in the neighbourhood of that city, of a high-power station, on a par with Daventry.

This could be easily arranged if the co-operation of all the different broadcasting concerns interested in the International Bureau is secured. Such a station, working at high power and on a special wavelength, could be of great utility for the dissemination of healthy propaganda, of general news bulletins, or the relaying of good concerts for European consumption.

The scheme may at first sight appear Utopian, but when you come to think of it, everything in the nature of broadcasting would have been deemed so a few years ago. The question of the language to be used is not a difficult one to solve and, in view of the fact that broadcast lessons in the English language are now being given from most of the Continental centres, it appears hardly likely that we shall be called upon to learn either Esperanto or Ido.

Russian Activity

Talking of high-power stations, I hear that the Russian authorities are also anxious to extend their—shall we say, aerial activities; they already possess the plans for the construction of a powerful transmitter in Moscow.

As it is they now run three broadcasting stations in that city which do not appear to be heard very frequently in this country. By a sheer fluke—because I have never repeated the performance since—I managed to "hold" one of their transmissions for a few minutes. Reception was great and, without difficulty, I was able to register the call. It ran as follows: "Hallo. Hallo. Eto goworyt Moskowskaja Centralnaja Radiotelefonia stantsia imeni kominterna."

A friend of mine informs me that this is the regular opening announcement of the Central Station, Moscow. It is a pity that the rest of the transmission was spoilt by atmospherics and other indefinite noises.

Hilversum

In my early notes, a couple of months ago, I referred to Hilversum, and am surprised that more attention is not paid to that station in this country. It is comparatively easy to pick it up at loud-speaker strength and at least twice weekly excellent programmes are broadcast.

On several occasions I have thoroughly enjoyed transmissions relayed from the "Amsterdamsche Concertgebouw," the well-known concert hall in Holland's principal city. For lovers of good music, Hilversum on those evenings provides a most interesting programme.

You need never doubt whether you have tuned-in the Dutch station or not, as the speaker announces every item in English and closes down with a very cheery: "Good night, ladies and gentlemen; good-night."

Have You Noticed

When we have been favoured with relays of high-class concerts from such buildings as the Albert Hall or the Royal Covent Garden Opera House, has it ever struck you how very silent the audience appears to be. The microphone, in its position near the platform or stage, does not pick up sounds from the back part of the house and, consequently, musical transmissions are received against a background of almost complete silence.

Yet, whenever you have been present you will have noticed that absolute peace never reigns supreme over a concert-hall audience, especially if the music happens to be of a high-brow character.

And this reminds me: The world-renowned pianist had expended considerable energy in the execution of an *ff* passage, and then, as usual, barely touched the keys with his fingers. In the midst of the hush which followed a shrill feminine voice clearly rang out: "No, my dear, we always fry ours in butter!"

Breakfast Broadcasting

If, as it is stated, the B.B.C. has the intention of adopting breakfast-time broadcasting they will only be introducing to this country a feature which has existed for some time on the Continent.

Personally, I should not feel inclined to listen to a musical programme whilst gulping down my matutinal coffee, but a late news

bulletin and weather forecast would be welcome.

Hamburg, for instance, gives out a time signal at 6.55 a.m., followed by weather report and news bulletin at 7.30 a.m. Berlin and the other German stations start the day at 10 a.m., with quotations of all foodstuffs, groceries, etc., of interest to the housewife. I do not think, however, that the adoption of such a programme would be necessary over here, as the "Continentals" are generally earlier risers than we are.

Most business men are in their offices and at work by 8.30 a.m., and a weather forecast before they leave home is very useful.

Barcelona

A station which, on two occasions, I have picked up is that of Barcelona and, for some reason or other, my reception of it was much better than that I usually get of Madrid. Barcelona appears to broadcast excellent programmes—or I was specially lucky on one of those evenings, as I heard a complete act of *Cavalleria Rusticana*. To all appearances it was relayed from a local opera house—no doubt the "Liceo." The Spanish stations all include many operatic items in their programmes, and to my mind may be numbered amongst the very best European transmissions. I have frequently sought for Seville, but up to the present without success.

"JAY COOTE."

ELECTRIC tram wires are said to interfere with wireless reception. Those politicians who believe in the abolition of tramcars will therefore be able to add this to their stock of arguments.

SOME one has advised us that earphones of the light-weight type are the best. We must ask our grocer to favour us with his expert opinion.

THE unfortunate thing about "soft" valves is that they are hard to detect until you get them home.

THE Air Ministry has been experimenting with bombs that can be dropped by wireless. The P.M.G. has been dropping a few bombs in wireless affairs as well.

"DRINK to me only with thine eyes," was one of the items in a recent Swansea programme. Is this a type of insidious propaganda designed to spread Scottish customs to Wales?

What the Reader Thinks

Let Us Know

To the Editor of "The Wireless Magazine."

SIR,—The B.B.C. has come in for such a torrent of unfair criticism of the amazingly good fare they provide us with that I hesitate to write criticising any of their methods.

There is, however, one small detail which could be improved easily and would be of great satisfaction to all users of valve sets. Why is not the transmitting station's name announced after each item? Two words would do it—"Manchester calling" or "from the Manchester station," inserted after every announcement. Several announcers make a regular practice of this, but only a very small number of them, and it is most annoying when one has tuned in a difficult station and cannot identify it.

A better way perhaps would be for each station to have a different tuning note.—*J. W. Byrom, Jnr.*, (*Altrincham*).

Shall We Oscillate?

SIR,—We are told that when trying to bring in stations other than the local station, we must not oscillate.

My set has a four-valve plain straightforward circuit, but I can only get one station without oscillating. I think it would be very interesting if readers would write and say conscientiously how many stations they can tune in without oscillating, and how they do it. I live six miles from the local station. —*J. Andrew* (*Manchester*).

Sunday Morning Service

SIR,—Why not broadcast the Sunday morning church service? It is a long wait until three o'clock, and thousands of people who must be at home would, no doubt, enjoy the service, which otherwise would be only heard by the people who can get to church, and not by our invalids, people in hospital, etc.

I know there are objections to this procedure, but we have them in all things, and I don't believe it would keep a person from church.—*A. Thompson* (*Wakefield*).

Spare the "Relay"

SIR,—There has lately been a considerable amount of dissatisfaction with the B.B.C., but I am afraid a good deal of it is due to selfishness.

A number of people would rather the B.B.C. did not build relay stations but employed better artistes. It is true it would be nicer to have better performers broadcast, but to have them at the expense of relay stations would be absurd.

To the writers of the letters printed this month we have awarded Mullard Valves. The writers of the letters printed next month will receive B.T.H. Valves.

Such a proposition would be all right for multi-valve set owners, but would not benefit thousands of crystal set owners who rely on the relay stations for any reception at all.—*Arthur Frymann* (*Nottingham*).

"Closing Down"

SIR,—Having regard to the consideration shown by some of the foreign broadcasting stations in announcing in English, after, of course, doing so in their own language, that they are about to close down, would it not be fairer to the foreign listener-in for the B.B.C. also to announce, say, in French, when about to close down?

While not meeting the needs of those abroad who could understand neither English nor French, it would certainly be of some help to those who could.

Failing this, why could there not be established some "International closing-down signal" which could not be mistaken? This would save much needless "holding on" on the part of those who are unaware when the foreign stations have ceased transmission.—*H. Phillips* (*Llanelly*).

Distortionless Valves

SIR,—I have read with interest Mr. H. M. Lowe's letter in the April issue of THE WIRELESS MAGAZINE concerning the fool-proof dull-emitter, and I quite agree with his statements. I have just heard of a new cheap valve, fil. volts 5-6, fil. amps. 1, which will go a long way to supply the wants of amateurs.

Surely if such new valves as this are forthcoming, we cannot be far away from such a valve as suggested by Mr. Lowe.—*J. McBeath* (*Sale*).

High- or Low-frequency?

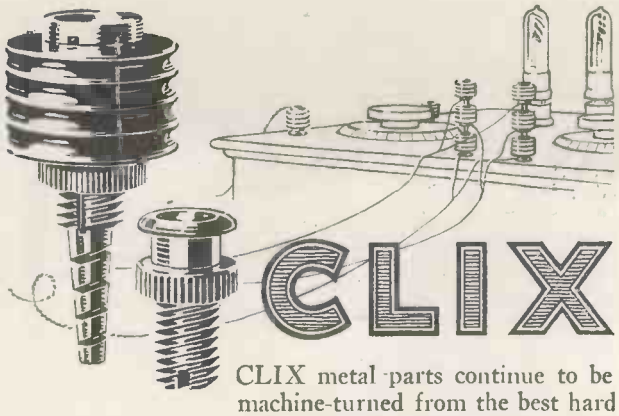
SIR,—A great deal of controversy is taking place regarding the respective merits of high- and low-frequency amplification, the point being very interesting. Personally I prefer a set containing a simple detector and a L.F. amplifier.

The detector gives all the distance desired by an ordinary amateur, and is infinitely easier to tune than one with high-frequency amplification added to it. My set has only one condenser and two coils to tune.

In this case high-frequency amplification is unnecessary and the extra valve is far better employed as a low-frequency amplifier. On one set with only detector and L.F. I get many foreign stations, whilst on another set comprising high-frequency amplifier and detector foreign stations are hard to get and unstable.

I hope some more competent person will take up the cause and champion low-frequency amplification.—*P. E. Russum* (*Rotherham*).

CHEAPER licences may come in the near future. And, no doubt, still cheaper criticism.



CLIX

CLIX metal parts continue to be machine-turned from the best hard brass rod, but a special nickel-bathing process is now employed to increase CLIX high standard of efficiency, workmanship and finish. The new skin of special nickel-silver alloy of high electrical conductivity ensures in CLIX a perfect fitting connection with a high frequency resistance of practically zero. This fact, in conjunction with the large area of contact surface provided with the minimum of capacitive metal in both plug and socket portions, gives CLIX its supremacy over every other form of plug, switch, or terminal.

Solder all connections!

Where you can't, use CLIX!

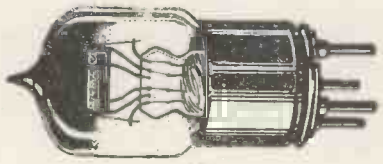
Retail Prices of the New CLIX

CLIX with Locknut, 3d.
CLIX Adapter with Locknut ... ... 2d.
CLIX Insulators (6 Colours) ... each 1d.
CLIX Bush (6 Colours) pair 1d.

AUTOVEYORS LTD., 84 VICTORIA ST., LONDON, S.W.1.

10/6

THE NEW PRICE



For the

C. & S. DULL EMITTER

2v. 0·2a (227)

which received New Zealand on a single valve. (Also made 0.06a (227L) now 13/6.)

Special dry batteries for the valves:—

227 ... 7/6 227L ... 5/-

The valve that gives you increased amplification, clear musical reception, has a long life, and low current consumption

CRAIK & SMITH (Desk B),

Allen St., Goswell Rd., London, E.C.1.

Phone: Clerkenwell 7346.

Every dial is graduated 0°—180°

Geared 80-1

Indispensable in DX work

NO ordinary standards of tuning efficiency can be applied to the Accuratune Micrometer Control. The perfected 80—1 gear allows infinitely fine tuning to be made with perfect ease, whilst a new principle takes up all lost motion and back lash. "Accuratone" will fit any standard condenser shaft, and you can change from ordinary dials to this Micrometer Control in an instant. Fit it now and log station after station you've never tuned in before.

17/6

Ask your Dealer. Write for Descriptive Folder.

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European Manager:

Gaston E. Marbaix,

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ACCURATUNE

MICROMETER CONTROLS

Broadcasting Below the Belt

IN previous years, with the coming of summer and the long light evenings, the activities of the amateurs on the short waves has considerably diminished; but it looks very much as though it will be quite otherwise in the present year of grace.

One of the items that is now claiming the amateur's attention is daylight long-distance work. The subject is a fascinating one and shows that the amateur is still leading on the short waves.

Ultra-short Waves for the British Transmitter

Of course one of the causes of this growing efficiency is the very short waves on which American amateurs are working. As we grow in knowledge we find that the shorter the waves the more efficient is the transmission.

Until recently it was held that the great reason why very short waves could not be used commercially was that they were only at their best efficiency during complete darkness between transmitter and receiver. The amateur, with his comparatively low power, has shown this to be a fallacy.

In this regard it is gratifying to record that British amateurs of proper standing have now been granted permission to work on wavelengths between 23 and 50 metres as well as on the other wavelengths allowed to them. This brings them into line with most of the other countries with which they work, or try to work.

An Efficient Short-wave Receiver

Last month I told you that my experiments in the direction of lower wave reception had progressed so favourably that I was able to get down to something like 30 metres with a Reinartz tuner. Since then I have been able to get a few metres lower; but I am beginning to think that some other form of receiver, with particular attention to the elimination of unwanted capacity, will be more successful.

In the meantime, my ordinary set for short-wave work being quite out of action for the more usual amateur wavelengths, because it was being tortured to induce it to go lower and lower, I had to do something to keep in touch with the merry crowd who nightly agitate the ether between 50 and 200 metres. I was just contemplating making up another Reinartz set when my attention was drawn to a short-wave tuner of commercial make. This consists of an aerial coil which is of the self-tuned sort (some people wrongly call them "aperiodic") loosely coupled to a secondary, with a loosely-coupled reaction coil.

The Arrangement

The arrangement, with a small variable condenser, was said to cover just the wavelength band I wanted. As the price was only 10s. and the article looked well-made I purchased one to save myself the trouble of winding low-loss coils for myself.

The arrangement of coils is known as the "Peranne" low-loss tuner, and I find it very efficient when used with a D E V valve and a variable condenser of ·0003 microfarad maximum capacity to tune the secondary.

Though both aerial coil and reaction are variably coupled with the secondary coil and the secondary is tuned with a condenser, there are, in effect, only two adjustments to be made when searching, because the aerial coupling needs very little change until the signal has been tuned in.

In this it is just as easy to use as the capacity-reaction Reinartz tuner and it seems rather more efficient for long-range work on C.W. though I do not find it quite so efficient on telephony. That may be that I have not yet got quite used to it. When working with these very high-frequency oscillations on telephony, reaction control is very important and many adjustments of filament heat and anode potential have to be made before reaction can be used smoothly.

A potentiometer to control the grid of the detector is a useful adjunct to the set when difficulty is experienced with the control of reaction.

More Double-wavelength Transmission

Last month I mentioned the interesting work that was being done by French Y N on two wavelengths. Since then the well-known French amateur 8 A B (M. Leon Deloy) has been working simultaneously on 55 and 90 metres using one aerial. For his first experiments 8 A B used two aerials, which is, I believe, the system in force at Y N; but later he connected his two transmitters to the same aerial and found the arrangement equally successful. On both occasions the signals were strongly heard in the United States.

Short-wave Telephony

Those who are in the habit of picking up K D K A's short-wave transmissions between eleven and eleven-thirty each evening have found that the coming of summer has made reception so difficult that it is almost impossible at that hour.

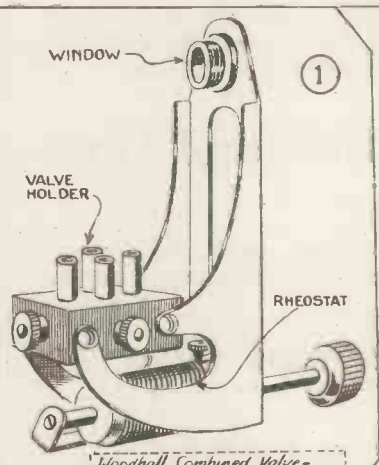
Earlier in the evening, however, they will be able to get hold of some most excellent amateur telephony, particularly on Sundays.

Usually British amateurs do not start working until after broadcast hours, but French, German and Dutch amateur stations can be picked up fairly easily directly darkness falls, and some of the best of them come in quite strongly even in full daylight. I find.

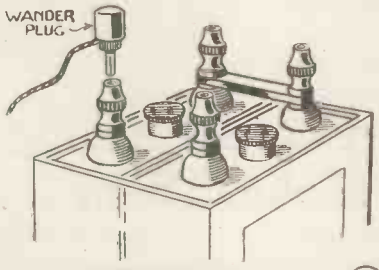
5 YM

NOVELTIES AND NEW APPARATUS OF THE MONTH

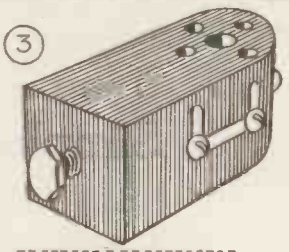
(For descriptions see opposite page)



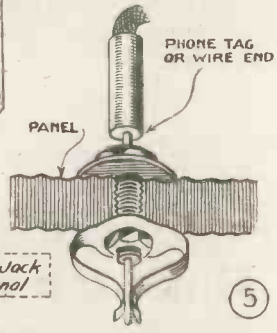
1 Woodhall Combined Valve-Holder, Rheostat and Window



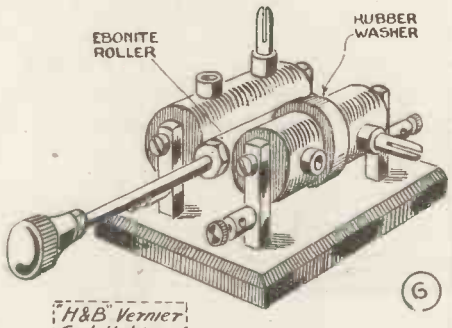
"Maxel" Accumulator (Details of Top) 2



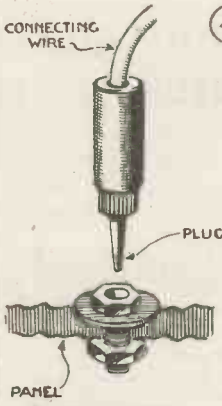
3 "Decko" Back-of-Panel Valve Holder



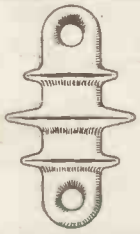
"S.W.C." Jack Terminal 5



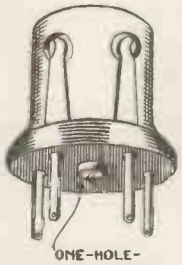
6 "H&B" Vernier Coil Holder



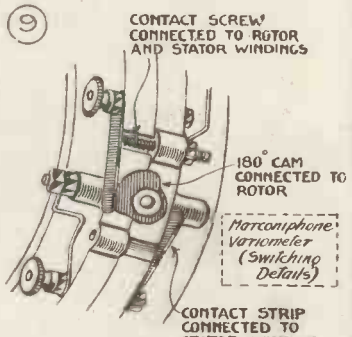
4 Lissen Plug-in Terminal



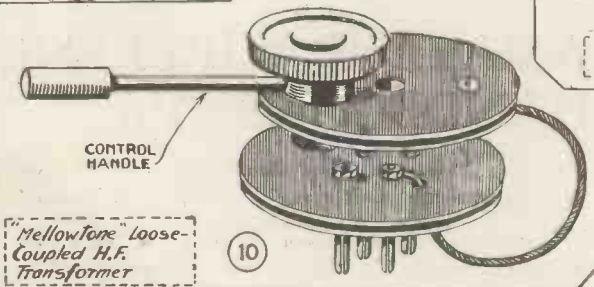
7 "Climax" Insulator



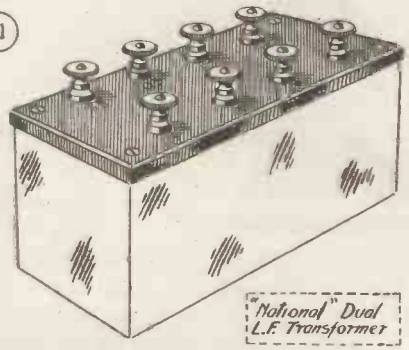
8 Lissen Valve Holder



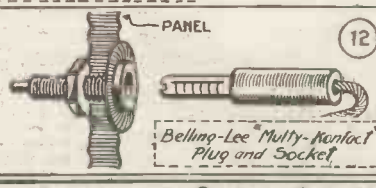
9 Marconiphone Variometer (Switching Details)



"Mellowtone" Loose-Coupled H.F. Transformer 10



11 "National" Dual L.F. Transformer



12 Belling-Lee "Multy-Kontact" Plug and Socket

13 Magnum Safety Plug

Novelties and New Apparatus of the Month Described

POINTS of special interest in the components illustrated on the opposite page are outlined below (in cases where the drawings are quite self-explanatory no description is given) :—

1.—To use the Woodhall combined valve holder, window and rheostat, it is only necessary to drill two holes in the panel, one for the window and the other for the rheostat spindle.

3.—In the Decko back-of-panel valve holder two contact screws are provided for both the grid and the plate sockets. In this way either grid bias or reaction can be easily applied.

6.—Adjustment of the moving portion of the H. and B. coil holder is made by means of an ebonite roller bearing on a rubber washer.

8.—Contact with the valve legs is made by metal springs in the new Lissen valve holder.

9.—By an ingenious switching arrangement the rotor and stator of the Marconiphone variometer can be placed in series or parallel for the reception of long and short wavelengths respectively.

10.—Fine control of amplification and selectivity can be carried out in any high-frequency circuit in which the Mellowtone loose-coupled transformer is used.

11.—For use in multi-valve low-frequency amplifiers the National Wireless and Electric Co. make two intervalve transformers in the same case.

13.—To protect valves from possible accidents through connecting the H.T. across the filaments, the Magnum wander plug has a fuse incorporated in it.

IT is suggested that we are to have more jazz in our programmes. This should make the highbrows raise their eyebrows in amazement.

CAMBRIDGE TOWN COUNCIL has decided to tax all aerials. It must think that the possession of a university carries with it the possession of the universe.

AERIAL INTERACTION

OUTSIDE aerials, when set up parallel with each other in adjacent gardens, are mutually affected by the magnetic field set up by the high-frequency currents flowing in each, when receiving signals. This magnetic "coupling" exists apart from any interference caused either by irradiation or re-radiation, and is comparable with the ordinary magnetic linkage between, say, the plate and grid coil of a back-coupled valve.

Just as in the latter case any alteration in the coupling affects the tuning of the aerial circuit, so any change in the magnetic coupling between neighbouring aerials may upset the operation of tuning-in.

For instance, when Robinson has succeeded after some difficulty in getting clear reception from URI, the sudden switching-on of the next-door valve set may prove quite sufficient to cause trouble. The neighbouring aerial is now a closed circuit carrying high-frequency currents of its own, and the consequent magnetic induction affects the inductive value, and consequently the tuning, of Robinson's aerial.

Which Valve Shall I Use?— *Valves on the market classified according to filament current and voltage*

For 2-volt Battery			For 3-volt Battery			For 4-volt Battery			For 6-volt Battery		
Filament Current	*Make and Type*	*Filament Voltage*	*Filament Current*	*Make and Type*	*Filament Voltage*	*Filament Current*	*Make and Type*	*Filament Voltage*	*Filament Current*	*Make and Type*	*Filament Voltage*
·25	Mullard Wecovalve	·8–1·1	·06	Ediswan A.R.06	3	·06	B.T.H. B.5	3–4	·06	Mullard D.F.A.3	5·5–6
·25	Met.-Vick. D.2	1·1	·06	Mullard D.06 H.F.	3	·2	Mullard D.F.A.2	3·5	·2	Mullard D.F.A.1	5·5
·29	Met.-Vick. S.P.18	1·7	·06	Mullard D.06 L.F.	3	·32	Marconi-Osram D.E.4	3·6	·25	Marconi-Osram D.E.5	5–6
·3	Ediswan A.R.D.E.	1·8–2	·06	Economic .06	3	·35	Mullard D.F.A.0	3·5	·25	Marconi-Osram D.E.5B.	5–6
·3	Cossor W.1	1·8–2	·06	B.T.H. B.5	3–4				·25	Ediswan P.V.5D.E.	5
·3	Cossor W.2	1·8–2	·06	Marconi-Osram D.E.3	2·4–3				·25	B.T.H. B.4	5–6
·3	Cossor W.R.1	1·8–2	·2	Marconi Osram D.E.Q.	3				·8	Marconi-Osram L.S.5	4·5
·3	Cossor W.R.2	1·8–2	·2	Marconi-Osram D.E.V.	3·						
·3	Mullard D.3 H.F.	1·8–2									
·3	Mullard D.3 L.F.	1·8–2									
·3	Mullard L.F. Ora B	1·4									
·35	B.T.H. B.3	2·									
·4	Mullard L.F. Ora C	1·8									
·4	Marconi-Osram D.E.R.	1·5–2									
·4	Marconi-Osram D.E.6	1·8									
·4	Marconi-Osram D.E.7	1·8–2									
						·6	Mullard Red Ring	3·2	·65	Marconi-Osram R.5	5
						·6	Mullard Green Ring	3·8	·75	Marconi-Osram Q.X.	5
						·63	B.T.H. R.	4			
						·65	Mullard D.G.	3·4–3·8	·75	Marconi-Osram V.24	5
						·65	Mullard Ora A & B	3·4–3·8			
						·65	Marconi-Osram R.4C.	3·8	1·5	Marconi-Osram F.E.1	4–5
						·65	Marconi-Osram L.S.3	4	1·5	Marconi-Osram F.E.2	4–5
						·67	Mullard R.A.	3·6–4	1·5	Marconi-Osram L.S.1	6
						·7	Marconi-Osram F.E.3	4	1·5	Marconi-Osram L.S.2	6
						·7	Marconi-Osram R.	4			
						·75	Ediswan A.R. & R.	4			
						·75	Cossor P.1 & P.2	4–4·5			

To use this table first determine what voltage battery you can most conveniently use and ascertain its maximum discharge rate. Divide the latter by the number of valves you intend to use, and you will have the greatest amount of current that you can afford for any one valve.

Under the appropriate battery-voltage heading you will find suitable valves arranged in order of filament consumption. Remember that when a number of valves of the same type are used the voltage of the battery may have to be a little higher than it would for only one valve of the same type.

The top half of this table comprises dull-emitters and the bottom half bright-emitters.

Jottings on the Month's Progress

"RADIO BROADCAST," a well-known American journal, some time ago published an article under the heading "The Truth About Trick Circuits" in which certain so-called "super" sets sold under various high-sounding names were analysed and subjected to somewhat scathing criticism. The upshot was what is probably the first wireless libel action on record. The journal defended its action on the grounds that it was merely telling the public the truth.

Although this defence is not invariably successful, it proved to be so in this case. The Court held that reasonable and expert criticism with the object of laying bare to the public the exact merit of a wiring circuit, labelled with a more or less incomprehensible name, was quite legitimate and in the circumstances fully justified. The action was dismissed with costs in favour of our American contemporary.

Another aspect of wireless "law" that awaits precise definition is the position of authors with regard to the copyright in broadcast plays, music, etc. In this connection it is interesting to note that the German courts have recently decided that a play must not be broadcast without the express permission of the author, otherwise an action for damages will lie.

Crystal Vibrators

The crystal "oscillator" is one having a negative-resistance characteristic, that is, it is capable of energising a tuned circuit and producing sustained electric oscillations. A piece of quartz, on the other hand, has been found capable of vibrating bodily or mechanically at radio-frequencies.

The vibration is, of course, of a molecular character, the crystalline setting being displaced and restored at an enormously high rate and with remarkable constancy. The "vibrating" crystal is intended to be used for regulating and standardising the carrier-wave emission from a transmitting station.

A somewhat analogous crystalline property known as piezo-electricity has recently been utilised as a selective coupling between two high-frequency valve amplifiers. In this case applied voltages are transferred as mechanical pressures, which alter the distance between two condenser plates and so affect the voltage applied to the grid of the next valve. A particular crystal is found to transmit vibrations of a definite frequency and to reject others, thus acting as an interference preventer.

A New Television Process

The latest attempt to solve the problem of transmitting moving-picture effects by wireless consists in converting the original light waves into equivalent wireless waves

(Continued on next page)

Jottings on the Month's Progress (*Continued from preceding page*)

by a process similar to that used in the super-heterodyne receiver.

In other words the extremely short light rays are combined or heterodyned with other waves of a slightly different frequency, the result being to produce vibrations of a wavelength that can be handled by standard wireless apparatus. The process is reversed at the receiving end.

Reproducing Colours

The system is capable of reproduction in natural colours, the method used being analogous to that employed in the three-colour process in printing. At the transmitting end three photo-electric cells are used, each responsive to one primary colour only. At the receiving end are three sources of light corresponding to the three primary colours. Each source is controlled by a separate shutter (under the action of the incoming waves). In this way the emerging rays are mixed and thrown on to a single screen.

Navigating Aeroplanes

An interesting account was recently given in Parliament by Sir Philip Sassoon of the growing use of cable leader-gear for navigating aeroplanes at night or during foggy weather. The new method is an ingenious adaptation of the principle of wireless direction-finding, and is worth a few words of explanation.

The essential feature is an electric cable carrying high-power low-frequency currents, which is laid on the ground so as to encircle the aerodrome. The cable currents set up corresponding magnetic fields which extend upwards for a thousand feet or more.

On the aeroplane is mounted a special frame aerial, the two windings of which are set at right angles. The action of the alternating magnetic fields upon the loop aerial induces corresponding currents, which, after being amplified by a thermionic valve, give a note in the phones corresponding to the A.C. frequency.

Once an aeroplane gets within range of the magnetic field, the navigator is able to determine the direction of the cable by the changes in signal strength as the loop aerial is rotated, and is thus able to navigate his machine safely to the centre of the landing ground. The receiving aerial may be built into the fusilage of the machine so that any change in the direction of flight automatically indicates to the pilot whether he is going away from or towards the ground cable.

The arrangement is not a wireless system in the strict sense of the term, as the emanation from the ground cable is an inductive and not a radiation effect. True radiation of ether waves does not normally occur with currents having a frequency lower than ten thousand per second, whereas those flowing through the ground cable are of the usual order of two hundred cycles per second.

Wireless Imports

In reply to a Parliamentary question, Mr. D. M. Samuel has stated that the value of wireless apparatus imported from foreign countries during January of this year was £100,038, or more than four times that of the corresponding month in 1924. Of this figure £13,117 represented the value of imported valves, as compared with £1,214 for January 1924.

ENQUIRER'S COUPON, available until end of month here mentioned.

"The Wireless Magazine" Buyers' Guide

The announcements below mentioned will be found in the February-June issues.

VOLUME

THE great cathedrals of the world were built by men who loved their labour. They sought to express the beauty and lofty grandeur that is associated with architecture, and they were successful. You can have beauty and grandeur in the volume of your loudspeaker reception. Just take out your last L.F. stage valve and insert a MULLARD D.F.A. MASTER VALVE. These valves have been specially designed for maximum power work with a low temperature long life filament for minimum current consumption.

MULLARD D.F.A.0 (.35 amp.) for 4-volt accumulators, 26s. each.

MULLARD D.F.A.1 (.2 amp.) for 6-volt accumulators, 30s. each.

MULLARD D.F.A.3 (.06 amp.) for dry cells or accumulators, 6 volts, 32s. each.

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Mullard

THE·MASTER·VALVE

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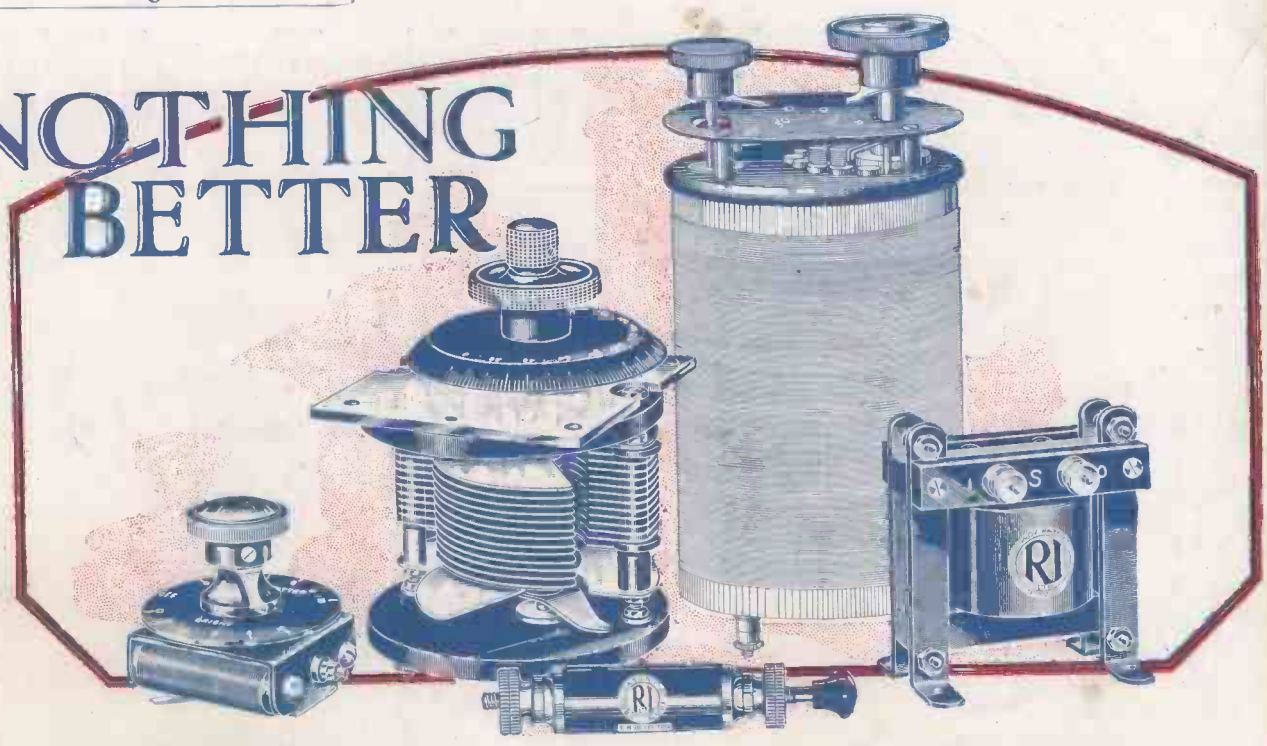

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Each one of the famous R.I. components stands on its own merits, each one possesses unique advantages, and each one is built in the confidence that the finest material and workmanship always beget the finest results.

The R.I. Transformer, famous for its unique sectionalised construction, giving the lowest possible self-capacity (only 18 micro-microfarads) and used by over 400,000 wireless enthusiasts. *Price* **25/-**

The R.I. Permanent Mineral Detector has marked a new era in wireless research. Absolute permanency, simplicity, reliability, together with maximum efficiency are a few of the reasons why the R.I. P.M. detector is steadily finding its way into the set of every crystal user in the country. *Price* (Complete with metal brackets and screws for mounting) **6/-**

The New R.I. Duostat, one-hole fixing, affords perfect radiation, and can be used with both bright and dull filament valves. *Price* **7/6**

The R.I. Corrected Variable Square Law Condenser is in a class by itself as regards quality of workmanship and accuracy in mounting. It has been specially designed to give a straight line curve in the wavelength adjustment of a receiving set, resulting in increased range, with the utmost precision in tuning. In 2 sizes. .0005 mfd. *Price* **24/-**
.00025 mfd. „ **22/6**

The R.I. Aerial Tuning Reactance (to be put on the market at an early date) is unique in that it covers a range of wavelength from 150—4,000 metres with aerial reaction suitable for giving maximum efficiency over the entire range of wavelength. "Far better than coils." *Price* **39/6**

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

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Printed and Published in England by CASSELL & COMPANY, LIMITED, Ludgate Hill, London, E.C.4. Sole Agent for South Africa, C.A.R. CENTRAL NEWS AGENCY, LIMITED. June, 1925