No. 23. HOW TO MAKE A LOOSE COUPLER.

POPULAR WIRELESS Weekly

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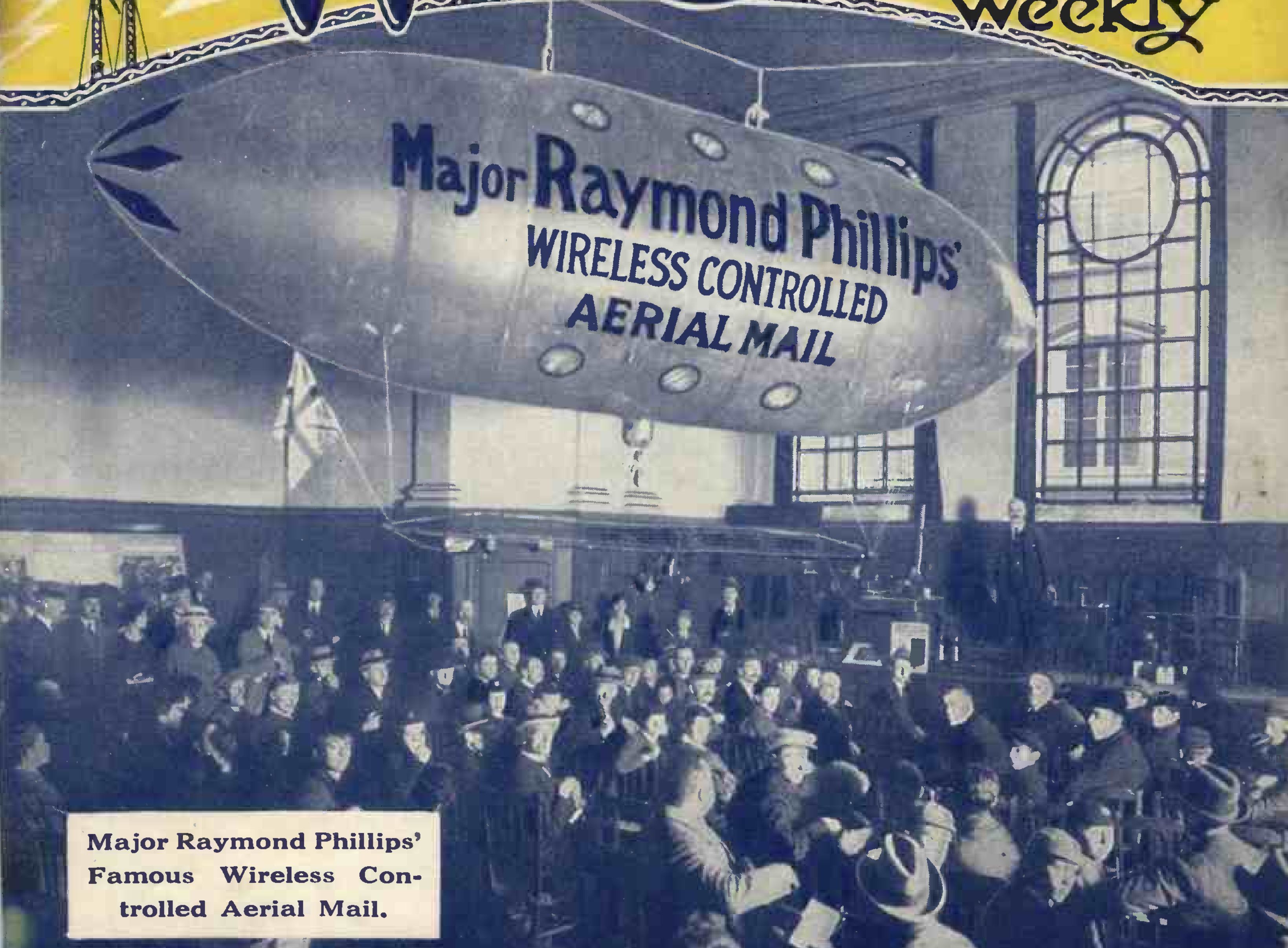


Major Raymond Phillips' Famous Wireless Controlled Aerial Mail.

FEATURES IN THIS ISSUE:

THE BIGGEST STATION IN AMERICA.

NEXT WEEK.

Making a Home Broadcast Receiver.

Useful Analogies for the Beginner.

The Story of the De Forest Valve.

Popular Wireless

TOPICAL NEWS AND NOTES.

COMMENCING SHORTLY.

How to Make a D.F. Station.

The Eliminator.
An Invention of Interest to All.

Special New Section for the Beginner.
This section will enable the veriest novice to acquire a good knowledge of wireless in record time.

The Coming Demand.

THE Post Office is preparing for a great demand for wireless broadcasting licences. Orders have been given for printing 2,500,000 forms, and it is expected that they will be ready for issue very shortly.

At present any wireless enthusiast, so long as he is able to satisfy the authorities that he has some knowledge of wireless, can obtain an experimental licence, and already about 16,000 of these have been issued. This enables him to conduct experiments and, of course, listen in, but not to send messages.

* * *

£4,000,000 Capital.

A RECENT extraordinary meeting of Marconi's Wireless Telegraph Company authorised the raising of £1,000,000 additional capital for the development of broadcasting and other wireless business. This will bring the total capital up to £4,000,000. The directors were also empowered to borrow money to the amount of the capital of the company.

Senator Marconi said that, in addition to the construction of telegraph stations in many parts of the world, they had the advent of broadcasting. This was an entirely new business which they had every reason to believe would assume very big dimensions, and would add very considerably to the earnings of the company.

Not only was broadcasting proceeding at home, but likewise it was going ahead in most other important capitals of the world.

* * *

Secret Wireless.

THE "Chicago Tribune" (Paris edition) says Senator Marconi is perfecting a new invention in wireless telephony in the form of a machine for strictly private conversations.

"I am working on a device for sending messages directly between two points," he told the "Tribune" representative in Paris.

"The new apparatus eliminates all chance of outside parties listening in, and enables messages to be sent and delivered with absolute privacy.

"We are already able to send 100 miles. This winter I hope to perfect a device for a Trans-continental service."

Explaining the principle of the invention, he said:

"With an instrument built on the theory of a searchlight reflector, I am concentrating electric waves into beams that can be sent in a straight line in any direction. Up to the present we have had only a circular radiation of waves from a sending point, all stations within range receiving the vibrations.

"Now I expect to see wireless outfits with which London will talk to Paris or America in strict privacy."

* * *

Iddy Umpty.

A FINE way of teaching the youngsters Morse! Buy them the game called "Iddy Umpty." It is just like Snap, only the letters of the alphabet and its Morse equivalent are used; and, instead of shouting "Snap," you have to say the letter in Morse and its name. It really is the greatest fun. These can be bought from any stationer's.

* * *

The Marconiphone.

"IRIS, the golden-winged Goddess of the Rainbow, with the Swiftness of the Wind, penetrates everywhere, leaving the messages of Heaven."

The Iris flower, which is incorporated in the picture painted for the Marconi Company by the famous artist, Mr. Lewis Baumer, has been adopted as the symbol of the Marconiphone; for by means of this most wonderful instrument the actual tones of music and of speech can be conveyed more swiftly than the wind—nay, swiftly even as light—and over vast distances of space to the expectant ears of the world.

Joy and pleasure, entertainment and solace can now be given to tens of thousands simultaneously, whatever their situation or condition—to the humble cottage and to the palace, to the sufferer on his sick-bed and to the lonely traveller far from the amenities of civilisation.

Truly, "Iris, swift-footed messenger of the gods," has become a reality. By the marvels of science, her spirit has been embodied and her visible presence is manifested to all by the Marconiphone.

* * *

Radio and Nelson.

WIRELESS was called to the aid of Nelson's flagship on the 117th anniversary of Trafalgar.

Admiral Sir Doveton Sturdee wirelessed from Marconi House an appeal for the preservation of the Victory.

* * *

Wireless and Schools.

THE London Elementary Education Sub-committee recommend the inclusion of wireless telegraphy in the curriculum of an approved number of elementary schools, not exceeding 25. So far permission has been given to 13.

* * *

A Radio Dance.

THE Radio Society of Highgate is giving a radio dance at the Gate House, Highgate, N.6, on Saturday, November 25th, 7.30 till 11.30 p.m. Single tickets (inclusive), 7s. 6d., and double tickets (inclusive), 12s. 6d., may be obtained from Mr. J. F. Stanley, 49, Cholmerley Park, Highgate, N.6, and Mr. D. H. Eade, "Gatra," 13a, Sedgemere Avenue, East Finchley, N.2.

Mr. P. A. Hodges' set, at 16, Grove Hill Road, Handsworth, Birmingham.

NOTES AND NEWS.

(Continued from previous page.)

A Royal Patron.

AT the ordinary general meeting of the Wireless Society of London, held on Wednesday, October 25th, the announcement was made that H.R.H. the Prince of Wales had graciously consented to become the Patron of the Wireless Society of London and its affiliated societies, and that he noted it was intended to change the title to that of the Radio Society of Great Britain in the near future. The President had acknowledged this communication on behalf of the societies, expressing the extreme gratification that will be felt by all connected with the Society at this mark of His Royal Highness's interest in the work of Radio-telegraphy.

* * *

An Appeal.

THE following announcement was also made regarding work which the Society is undertaking in connection with St. Dunstan's. His Royal Highness has expressed the desire to associate himself with this work as his first action on becoming Patron of the Society.

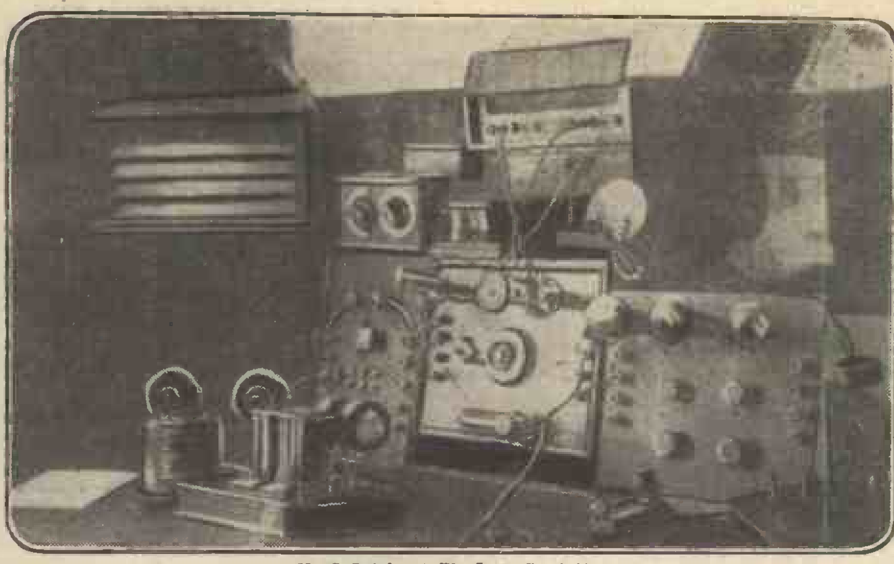
The Council of the Wireless Society of London have had under consideration a request from Captain Ian Fraser, the chairman of St. Dunstan's, that they should bring to the notice of wireless amateurs a direction in which they can contribute very materially to the instruction and entertainment of blind people who are, or will be, interested in radio-telegraphy and telephony. Captain Fraser was himself blinded in the war, and has, both before and since he lost his sight, made a hobby of the study of radio and allied sciences. He states from his own practical experience that it is possible for a totally blind person with no more knowledge of the subject than the average ordinary amateur to look after his instruments, accumulators, batteries, etc., and manipulate them with great accuracy, and without any sighted assistance. He further claims that with a little more knowledge of the subject the connecting up of instruments, experimenting with various circuits, and even the building-up of simple apparatus is not outside a blind man's reach. In his appeal to the council, Captain Fraser points out that in spite of the above there are initial difficulties such as the fitting-up of an aerial, leading-in tube, etc., which the most skilful blind man cannot undertake, and that in the case of absolute beginners unusual difficulties present themselves in connection with the choice of suitable apparatus to purchase, learning how to use it, etc.

* * *

You Can Help.

SINCE a blind man is deprived of many forms of enjoyment which are available for those who can see, Captain Fraser asked the council if it would consider these points on behalf of its members, and take steps to place them before the councils or committees of all associated or affiliated societies, with the following objects: (1) To obtain an indication as to whether or no the societies would be willing to make a special point of arranging for one or more of their members to make a particular friend of any blinded soldier or other blind person who might qualify for membership of the society, and undertake to give him the personal assistance which is obviously required in the directions outlined above; and (2) if it is indicated that the affiliated societies are willing to help in this way, it is suggested that a notice should be printed in the St. Dunstan's Magazine, and in the Braille Press, and that all other suitable steps be taken to let blind people know that if they apply to either the Wireless Society of London or to Captain Fraser, they will be put in touch with their local society, the members of which—if the blind person qualifies in all other respects for membership—will be willing to welcome him and give him special assistance.

* * *

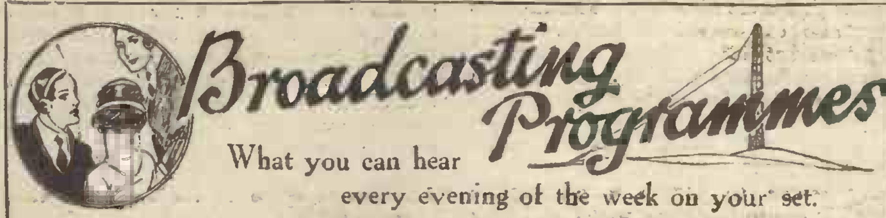


Mr. J. Dale's set, The Leys, Cambridge.

Radio for a Hospital.

HAVE you sent a subscription to the Royal National Hospital for Consumption for the purchase of a radio set for the patients? The address of the appeal secretary is 18, Buckingham Street, Strand, and remember "every little helps."

ARIEL.



TELEPHONY AND MUSIC TRANSMISSIONS.

Station.	Call sign.	Wave-length in metres.	Remarks.
Croydon	G E D	900	Throughout day to aeroplanes.
Marconi House, London	2 L O	360	Not regular.
Writtle, Essex	2 M T	400	Tuesdays, 8 p.m. (Concert.)
Paris	F L	2,600	7.20 a.m., 11.15 a.m., 5.10 p.m. Also occasional telephony at 10.10 a.m.
Königswusterhausen	L P	2,800	Between 6 and 7 a.m., between 11 and 12.30, and between 4 and 5.30 p.m.
The Hague	P C G G	1.085	Sundays, 3 to 5 p.m. (Concert.)
Haren	O P V H	900	Practically every 20 minutes past each hour from 11.20 to 4.20, giving messages to aeroplanes on the Brussels-Paris, Brussels-London, and Brussels-Amsterdam lines.
Brussels Meteorological Institute	O P O	1,500	Slow C.W. and Morse. Easy reading for amateurs.
Messrs. Burnham* (Blackheath)	2 F Q	440	About 9 o'clock in the evening.
Newcastle*	5 B A	440	Between 6 and 7.30 p.m.

NOTE.—The Bar Lightship, Liverpool, sends telephony at 7 a.m., 9 a.m., 11 a.m., 12 noon, 1 p.m., and every two hours until 9 p.m. Calls "Dock Office." Liverpool answers "Bar Ship."

In addition to the regular transmissions carried on between the British amateur stations, much telephonic conversation may be heard from St. Inglevert (A M), Le Bourget (Z M), and Brussels (B A V). These stations are quite powerful, but they call for a little extra care in tuning. Wave-length, 900 metres.

All times given are G.M.T.

An asterisk denotes transmissions made purely for experimental purposes.

The Editor will be pleased to hear from amateurs and commercial experimenters with regard to transmissions made at regular hours.

RADIO CENTRAL

AMERICA'S GREATEST WIRELESS STATION.

By

OUR NEW YORK CORRESPONDENT.

The "lead-in" supports at Radio Central, America's biggest wireless station.

FOR nearly fifty years Great Britain has been the centre of the world's cable systems, a position to which she attained by virtue of her imperative need for swift communications with which to carry on the foreign trade on which her existence depends.

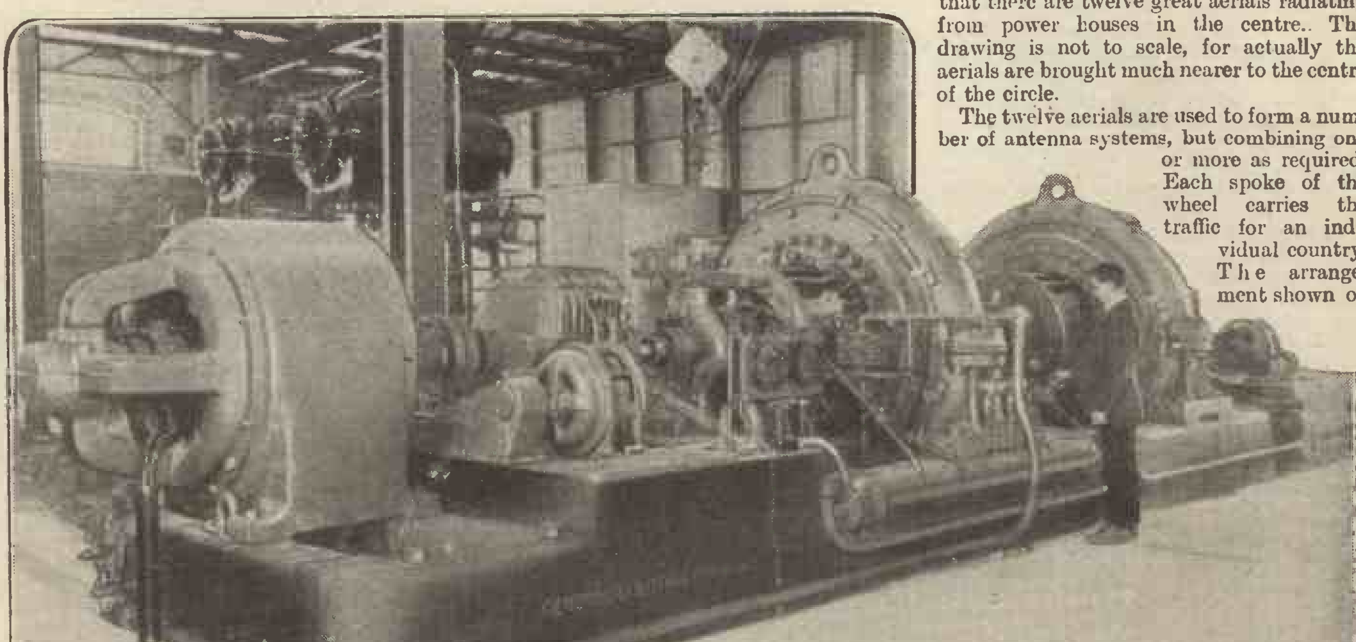
In the last few years a new method of communication has come into being, that of wireless telegraphy. For many reasons, each of them fairly obvious, it should have happened that the focal point of the world's wireless systems should have been, if not in England, at all events at some point in the British Empire.

Until a very few years ago England occupied a leading place in the development of wireless telegraphy, and, indeed, was carrying on business here in the United States. But since then the British interests in American wireless have been relinquished to Americans. And since then, though it was not a consequence of this fact, America has secured an overwhelming lead in the development of wireless communications. The seal on this accomplishment was set by the opening of the great Radio Central station at Rocky Point, Long Island, 70 miles from New York City, which it is the purpose of this article to describe. It has made New York City the focal point of world wireless communication.

For many years it had been the dream of wireless engineers to erect a huge transmitting station at some central point which should be able to command a world-wide field. Radio Central represents the realisation of their dream. In itself it is one of three units which comprise a complete station for sending and receiving messages, but that aspect I will deal with later, first describing the equipment of the sending station, the newest and most wonderful part of the whole.

The diagram showing the ground plan of the station gives a better notion of the idea underlying the conception of the station than any verbal description. It will be seen that there are twelve great aerials radiating from power houses in the centre. The drawing is not to scale, for actually the aerials are brought much nearer to the centre of the circle.

The twelve aerials are used to form a number of antenna systems, but combining one or more as required. Each spoke of the wheel carries the traffic for an individual country. The arrangement shown on



One of the huge Alexanderson alternators at Radio Central. Each alternater has an output of 200 k w.

RADIO CENTRAL.

(*Continued from previous page.*)

the diagram is not permanent, but can be changed at will. And as I described recently any two units can be combined through the synchronisation of two of the alternators, giving, of course, double the energy. In summer this renders the service completely free from stoppage through static interference, for the signals sent out with the combined energy of two 200 watt alternators behind them, can crash through any static yet encountered.

Each of the spokes of the wheel is a mile and a half long, consisting of steel towers, shown in another illustration, 410 feet high. The cross arms bearing the antenna wires are 150 feet across. Each tower contains about 150 tons of structural steel. The towers are sunk in

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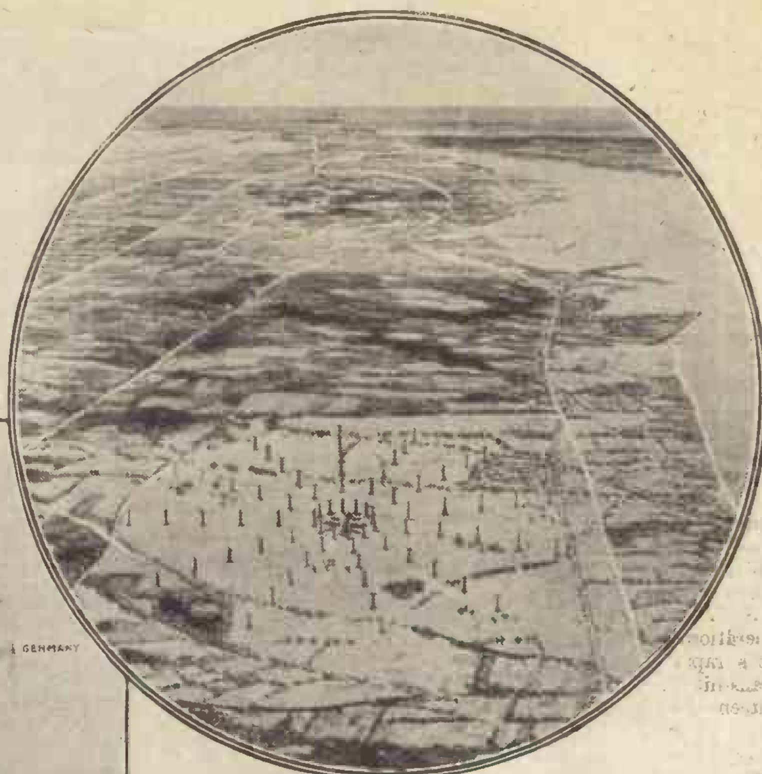
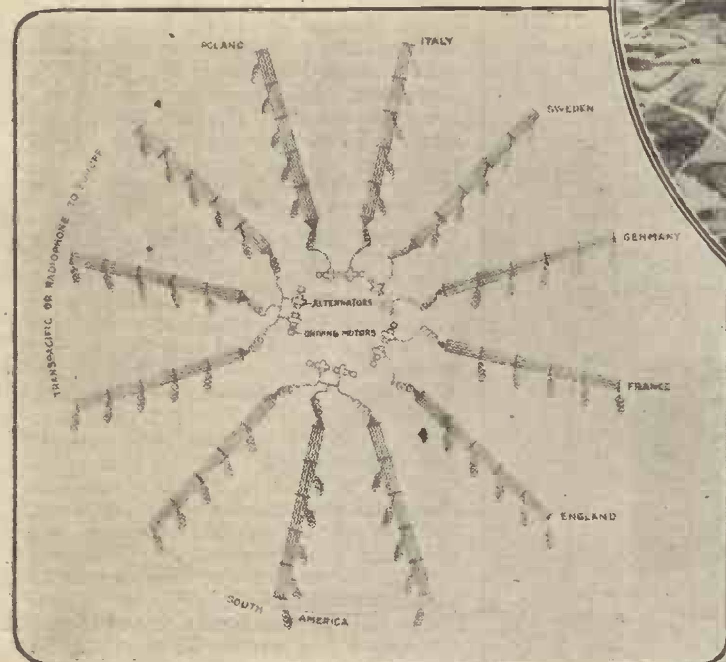
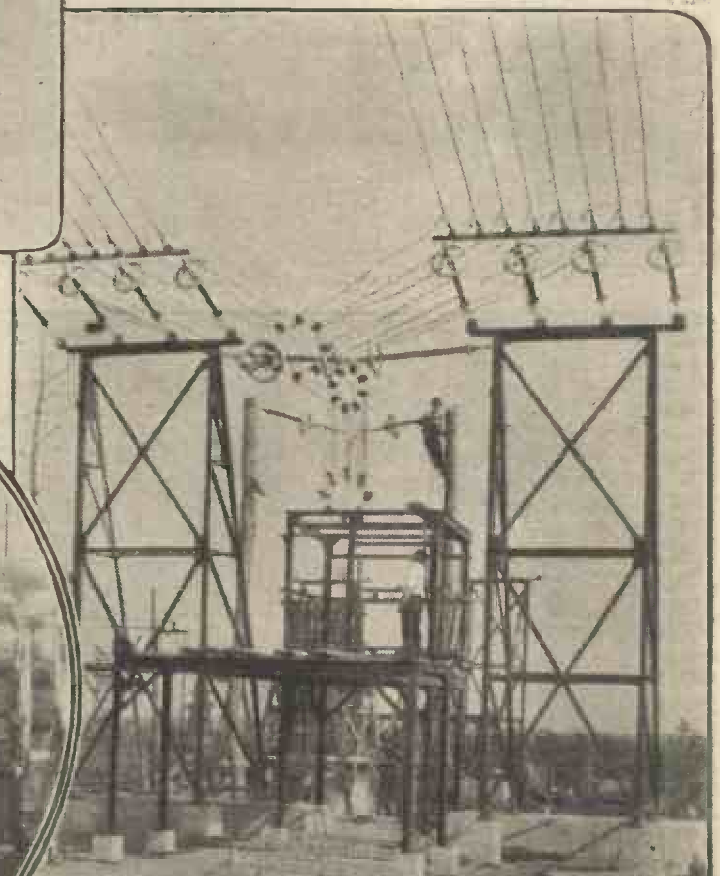


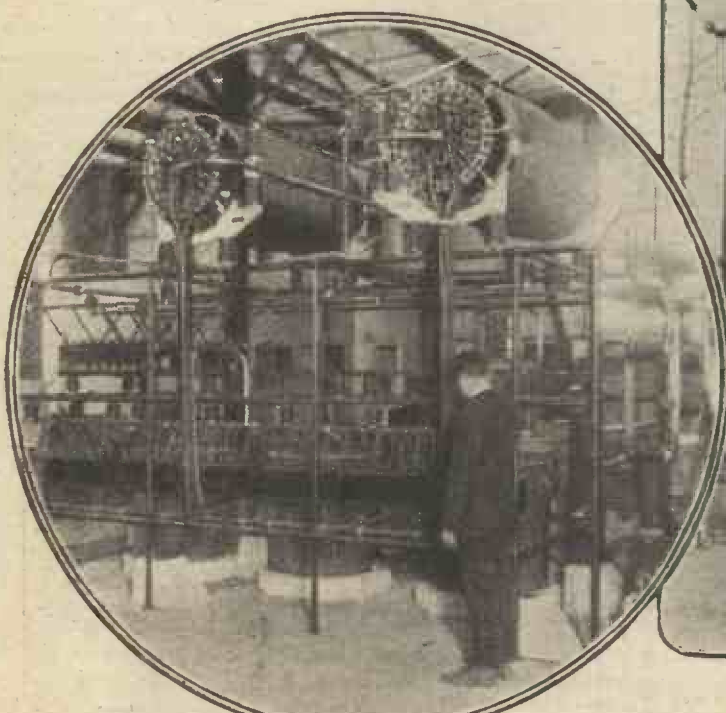
A bird's-eye view of Radio Central when all the towers have been erected.



Plan of the aerial system for Radio Central



This photo shows the "lead in" at Radio Central The system is rather more complex than an amateurs' "lead in!"



Interior of the station building showing high-frequency inductance and condenser packs

RADIO CENTRAL.

(Continued from previous page.)

8,200 tons of concrete, forming a bed under each tower nine feet thick.

The whole station is thus three miles in diameter, being the combined length of two aerials. It occupies the astonishing area of no less than ten square miles.

Each antenna consists of sixteen silicon bronze cables, three-eighths of an inch in thickness. There are 25 miles of this cable in each antenna. The ground system for each antenna unit consists of about 225 miles of copper wire buried under the entire length of the antenna. It is arranged in starfish and gridiron fashion.

The power of the enormous station is obtained from a public generating station, which supplies current of 23,000 volts. This is used to drive the motors which are coupled to the 200 kilowatt Alexanderson high frequency transmitting generators, which supply the exciting energy for the antennæ.

So far only two of the antenna units are in operation, but the remainder are being built at a rapid rate. To care for the existing transmitting apparatus there is a staff of fifteen engineers. There are no operators in the station, as will be explained presently.

At present the station works to England on a wave-length of about 23,000 metres, but with its multiple tuning, of course several different wave-lengths can be used.

In the beginning of this article it was stated that Radio Central was only one of three units making up a complete station. The other two are the receiving station, and the operating or controlling centre.

This three-cornered idea was first conceived some time ago and is now standard for all great stations where conditions are suitable. The most recent example is the great new station at St. Assise, near Paris. In the controlling or operating centre is done the actual work of sending and receiving messages. Here are the operators with their automatic high-speed transmitting instruments, which send and receive at 100 words a minute. In the case of Radio Central, the operating centre is in Broad Street, New York City, a few doors from the Stock Exchange and Wall Street, and next to the central offices of the great cable companies. From it the signals are carried over land wires out to Rocky Point, and there they are transferred automatically to the antennæ and sent out into the ether.

There remains the third unit, the receiving station. This is situated at Riverhead, a few miles from Rocky Point. This is an enormous multiplex receiving station, with an antenna system nine miles in length, giving it a natural wave-length approximating to the wave-length of the signals received. Here the signals are intercepted, transferred to land-lines, and again automatically reproduced on slips of paper.

Radio Central is world-wide in its range. Its signals are heard in practically every country of the world, almost instantaneously. It is owned by the Radio Corporation of America, and was built mainly by the General Electric Company. The erection of the first two antennæ with power houses, alternators, switchboards, etc., occupied a little over a year.

Up to the present it is the supreme expression of the wireless art.

HIGH OR LOW FREQUENCY.

By J. KAINE FISH.

THERE are many amateurs who are now building their own wireless sets, or who are thinking of buying the finished article, to whom the question of "What type of amplification shall I employ?" presents itself: "Should I use high or low frequency circuits?" Among the wireless enthusiasts who have given up the crystal and are using valves, I don't think I am far wrong when I say 75 per cent. of them employ two valves. It is principally the "Two Valves" for whom these words are written.

Of the two valves one, of course, must be the detector or rectifier, and it is the remaining one to which the all-important question of "high or low frequency?" applies. The answer to the question depends primarily on the stations one wishes to receive and their distance from the receiving set.

It is a sheer waste of good "juice," to say nothing of the extra initial expense, for a Londoner to use a two-valve circuit with high-frequency amplification for the sole purpose of "listening-in" to the Marconi concerts (2LO). After many experiments I have come to the conclusion that this circuit is only about 10 per cent. more efficient than a single-valve circuit, and is not worth the extra cost of filament current.

The H.F. two-valve circuit has its uses, however; for those residing from 20 to 100 miles from Marconi House it will be found excellent, and Londoners will, with care in building their sets and endeavouring to get the most from them, get fairly good reception of Paris telephony and the Hague concerts.

If two valves are decided upon, let the second be in a low-frequency circuit if the object of the set is to receive the broadcasting concerts, and within 20 miles of the transmitting station. With three valves the same applies, but one has more scope for diversity of circuits, for here can be used both high and low frequency with their respective advantages.

There are, of course, disadvantages with both methods of amplification. When listening to a high-power station such as 2 LO, which is fairly near in the "wireless sense" to all Londoners, and a high-frequency circuit is used, the volume of sound is little more, if any, than that obtained from a single-valve set.

With low-frequency magnification one has to remember that the audio-frequency or sound-frequency is being magnified, and this means that not only are the incoming signals, music, speech, and atmospherics magnified, but all the parasitic noises of the instrument itself, although these are negligible in a well-made two-valve set.

Both high and low-frequency circuits amplify and magnify, for both words mean practically the same thing. From Nuttall's Dictionary it is seen that "amplify" means to enlarge, and "magnify" to make greater; but to distinguish between the two methods, high-frequency is generally spoken of as amplification, and low-frequency as magnification.

Those amateurs using their sets for experimental purposes will, of course, use both types of circuits and will, like all "wireless bugs," find out for themselves. For those who have a knowledge of Morse my advice is H.F. every time.

With high-frequency a greater range is possible than with a single-valve set, but the volume of sound is practically the same.

With low-frequency the volume of sound is increased on an average to five times, but its range is little greater than a single valve.

A Motor Car Radio Set, with Frame Aerial.

HOW TO MAKE A LOOSE COUPLER.

By G. V. DOWDING, A.C.G.I.

IT is proposed to detail the construction of a loose coupled two-circuit crystal set with a useful wave-length range of approximately 300–2,700 metres. The employment of a closed circuit inductively coupled to the open circuit represents a distinct advance on the simple single-circuit receiver, inasmuch that it will allow finer tuning, greater selectivity, or the cutting out of unwanted stations and the elimination, to a considerable extent, of such parasitic noises as atmospherics. The completed set will be easily adaptable for use with valves, and the connections necessary are contained in the concluding remarks.

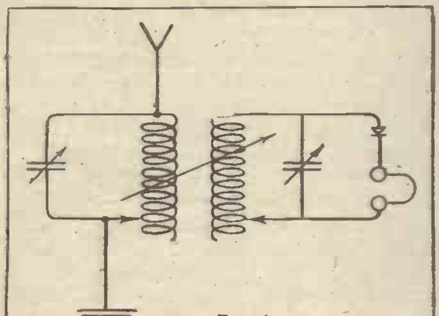


Fig. 1.

If the following instructions are carefully followed and the work not hurried the result will fully justify the strictest attention being paid to the smallest details.

Materials Required.

Before commencing the actual construction it will be as well to study the theoretical diagram shown in Fig. 1, and the dimensional diagram in section (Fig. 2), in order to gain some idea upon what lines it is intended to work.

Two feet of 12 in. x ½ in. and one foot of 6 in. x ¾ in. teak should be obtained. The wood should be well seasoned, but as an extra precaution it will be as well to place it in a moderately warm oven for an hour or two to drive out any possible residue moisture. Subsequently the re-entry of this should be prevented by means of a coating of shellac or a hard varnish.

For the base a piece 16 in. x 10 in. of the ½ in. material should be cut out and bevelled slightly to improve its appearance. Two 10 in. x ½ in. strips should be screwed along the two smaller sides in order to raise the base, so that the underneath wiring and projecting bolts can be accommodated. It will be necessary to use screws of fairly fine thread, and holes of slightly smaller diameter should be drilled to the full depth that the screws will take; otherwise, owing to the hardness of this particular wood, difficulty would be experienced in driving them right home. A few turns with a large drill should be made to countersink the heads of the screws to the surface of the wood.

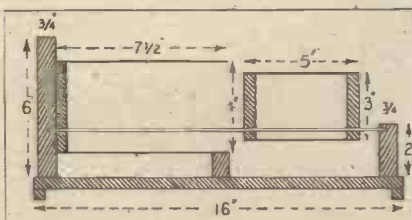


Fig 2

Then the large and small supports and the centre supporting block should be cut from the ¾ in. teak to the dimensions shown in Figs. 3, 4, and 5. It is most important that these should be carefully squared and the measurements checked. Two holes, centred exactly as shown in the diagrams, should be drilled with a $\frac{3}{16}$ in. metal drill to a depth of ⅜ in. in the two supports.

For the two inductance former tubes, which should be exactly 7½ in. x 4 in. diameter and 5 in. x 3 in., one large and two small circular end pieces will be required. Before these can be constructed it will be necessary to purchase the tubes so that the exact sizes can be ascertained. The above figures refer to the outside diameters; the sizes are standard, and no difficulty should be experienced in obtaining them. Waxed cardboard formers are retailed by most dealers in wireless sundries, and these will answer the purpose quite as well as the higher-priced ebonite tubes.

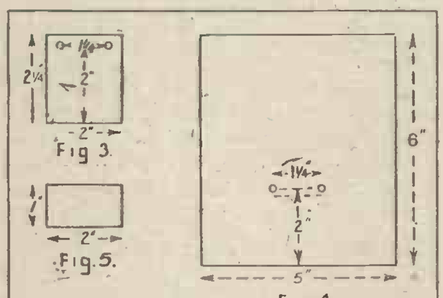


Fig 3. Fig. 5. Fig. 4.

Having obtained the tubes, the exact inside diameters should be measured, if possible, with inside callipers, in order that their end pieces may be cut. It will not be found a difficult task to cut the necessary one large and two small circles from the ½ in. material. The circles should be clearly drawn on the surface of the wood and carefully cut round with a fret or key-hole saw. If neither of these are available a small tenon saw can be used to cut round, first in the form of squares and then hexagons. The remaining corners can be trimmed off with a sharp chisel and the circles finally completed with coarse sand-paper, to make close, snug fits with their respective tubes.

The drilling of the 1·18 in. holes in the end pieces to take the slide rods is a little operation that calls for extreme care, as upon this will depend the smooth and evening running of the smaller coil. Figs. 6 and 7 show the positions of the holes. In order to ensure balance a circle with a 1·18 in. radius from the exact centre should be drawn. The centres of the holes, 1¼ in. apart, should both be on this line. That applies to both the large and small end pieces. It will be as well to mark these points on both sides of the wood and drill half-way through from the one side and complete the drilling from the other. To obtain exactly similar positions pins should be fixed to the centre and a thread with a small weight suspended from each side. If 1·18 in. radius circles have been drawn on both sides it will be a simple matter to mark the centres of the holes so that they will be exactly in line.

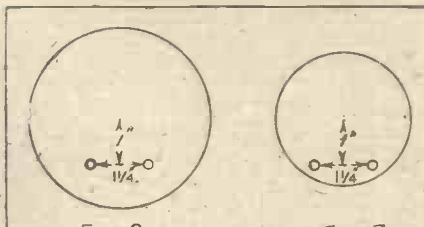


Fig. 6. Fig 7.

Tapping.

Next comes the winding and tapping of the secondary or smaller coil. Three ounces of 30 S.W.G. double silk-covered wire will be required. The turns should be closely wound in order to get on the required 270. Tappings are to be taken at every 45 turns so that there will be 6 contact studs. The taps should be taken evenly along the top of the coil, and small holes drilled to take the leads through. The commencement of the winding should be ⅛ in. from the switch end of the coil and the direction should be clockwise. (This latter will apply to the primary coil as well.) The end of the wire can be fixed to the former by drilling this latter with a thick needle, passing the wire through and securing it by means of a carefully tied simple knot in the wire itself.

When the point for tapping is reached it should not be necessary to cut the lead and heat a soldering iron; these should be prepared beforehand. Six leads cut from the 30 gauge wire, about 9 in. long, and a yard of double flex as used for electric-light wiring, should have their ends "tinned" in readiness. The tinned ends of the flex should be cut so that one is 2½ in. longer than the other. At the points of tapping a small hole should be drilled in the former and the lead pushed through.

Having completed the winding, the end of the wire should be soldered to the shorter end of the flex as shown in Fig. 8; it should be pushed through a hole from the inside of the former, and if this hole is so drilled that it proves a tight fit for the wire, so much the better, as the wire can be pulled through and a drop of seccotine will complete the fixing. A ⅛ in. hole should be drilled in one

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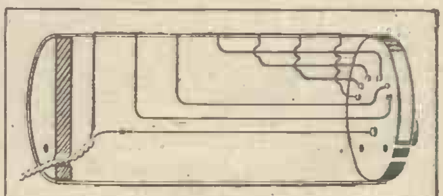


Fig. 8.

HOW TO MAKE A LOOSE COUPLER.

(*Continued from previous page.*)

of the small end pieces between the slide rod holes in order that the flex can pass through.

Plenty of room will be found on the other end piece to accommodate a 6-point switch on the lines described in a recent issue.

Soldering.

The next operation will be to cut the tapping leads so that just sufficient length is allowed to permit of soldering them to the contact studs. Needless to say, this length should be as small as possible. Tin both the backs of the studs and the ends of the leads before commencing to make the final connections, and do not forget to do the same for the end of the flex that will be soldered to the centre of the switch. Having completed the soldering, push both end pieces into their respective positions, but leave the final screwing until the slide rods

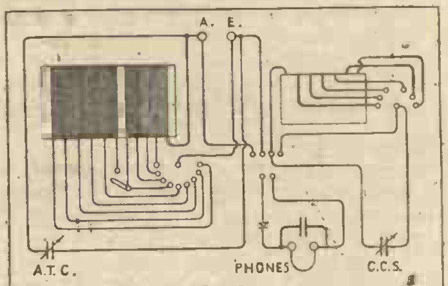


Fig. 9.

have been pushed through. This will ensure that the holes are exactly in line.

The winding of the primary, which will require 4 oz. of 24 S.W.G., S.S.C., can now be undertaken. In this case there will be two sections broken by a "dead-end" switch. Seven tappings will be taken, three from the first section and four from the second. A 9-point switch fixed to the base will be required, but the wiring of this must be left to the very last.

The "Dead End Switch."

Commence winding $\frac{3}{4}$ in. from the one end and leave 7 in. or 8 in. of wire in order to form the lead to the aerial terminal. A tap should be taken at each 20 turns until 80 turns have been wound, and at that point the wire should be cut, leaving at least 10 in. free to provide the lead to the "dead-end" switch. The wire can be made fast by passing it through back and through two small holes pierced in the former. The winding should be continued after leaving another 10 in. for the second "dead-end" switch connection with a space of about $\frac{1}{16}$ in. between the two sections. Tappings should be at every 32 turns until the remaining 160 turns have been wound on, when the wire should be made fast as in the first section, with at least 12 in. allowed for the lead.

If the wire has been closely and evenly wound there should be a space of $\frac{3}{4}$ in. to spare at the end of the former, and a $\frac{1}{8}$-in. hole should be drilled close to the wire in line with the tappings. This will take the flex from the secondary through to the base.

Two $\frac{3}{16}$-in. brass rods exactly $14\frac{3}{4}$ in. long should now be obtained. It need hardly be said that these must be absolutely straight. The rods should be threaded through the smaller coil and then through the end piece of the large coil, which should be forced into its position. The rods should be inserted in the holes of the supports, and a brief survey taken of the whole structure. It will be necessary to carefully align it $\frac{1}{4}$ in. from the back of the base in order that the screw holes can be placed. The best plan is to drill the base and mark the supports through with a bradawl. It will not be necessary to up-end the whole concern to do that. The positions of the supports can be carefully marked round with a pencil, and the coils laid aside. Then the positions for the holes in the base for the tappings and leads should be marked out. It is better to run the tappings straight down from the coil to separate holes than to "bunch" them, more especially if the introduction of valves is a possibility.

Fixing the Coils.

The coils should be mounted with light screwing first of all, as it is doubtful whether it will be found that the secondary coil will slide easily; but the holes where it appears to jamb can be slightly rimed out with the end of a file. After this has been satisfactorily accomplished the position can be marked for the centre supporting block and the screws taken out and the coils again laid aside. Then the centre block can be screwed into position and the holes drilled for wiring and tapping leads. There will be 12 of these in line underneath the primary coil, including the one of $\frac{1}{8}$ in. diameter to take the flex from the secondary.

The coils can then be remounted, attention being paid to that aforementioned flex. This must be passed through the primary coil and the $\frac{1}{8}$-in. hole in the base. This will apply to all the other leads and their respective holes. A small screw should be driven from inside the primary former into the centre supporting block and further small screws through the formers into the end pieces, care being taken that none of these touch the windings. The large end piece should be screwed to the large support.

Wiring Up.

At this point some amateurs may wish to diverge and arrange the lay-out according to their particular requirements, the only further details necessary for the bare loose coupler being a 9-point switch and a 2-way switch for the "dead end."

A ·0005 mfd. variable condenser will be required for the primary coil and a ·001 mfd. for the secondary, both being placed in parallel. A change-over switch to carry the detector and telephone receivers from one circuit to the other to facilitate tuning is almost essential with this type of set. A double throw-over knife switch, or even two 2-way switches, can be used. These latter coupled together are shown in the diagrams.

A full wiring diagram is given in Fig. 9. The fixed condenser should be underneath the base. Its value should be ·001 mfd.

A perikon crystal detector, zincite pressing against copper pyrites, will be eminently suitable. The "dead-end" switch is a simple 2-way switch operating at "short" up to 1,000 metres.

If it is desired to employ the complete set for valves all that is necessary is to disconnect the crystal and take the "A" and "E" "A.T.I," or "grid" and "filament" of the valve circuit directly to the centre points of the change-over switch.

BOOK REVIEW.

Wireless: Popular and Concise. By Lt.-Col. C. E. Chetwode Crawley, R.M.A., M.I.E.E., Deputy Inspector of Wireless Telegraphy G.P.O. (Hutchinson, 1s. 6d. net.)

Reviewed by William Le Queux, M.I.R.E.

The other day I opened a little book called "Wireless: Popular and Concise." I sighed and exclaimed, "Oh, yet another!" I sank into my armchair and began to read. I had read it half through before I glanced at its author's name. Then I was surprised, for it is a strange fact that every work from the pen of a Government official is dull and uninteresting. But I found that the book in question had been written by "a very old hand," as they say in political circles. Everybody in wireless knows Captain Loring and Colonel Crawley, but—well, I for one did not know that the latter could write such an excellent book.

The "Four Sevens."

First, the reader is taken swiftly through the history of wireless signalling from James Clerk Maxwell's paper before the Royal Society in 1864, when he proved the existence of the waves we now use to-day, to the "Four Sevens" Patent No. 7777 of 1900, of Marconi, the master-patent which provides for the tuning to a common wavelength of the four main wireless circuits, the spark circuit, the sending antenna, the receiving antenna, and the detector circuit.

In concise form Marconi's early troubles and experiments with the coherer are described, and I myself know those troubles, for in those early days I also experimented with the coherer. The discoveries of Fleming, Poulsen, Dr. R. Goldschmidt, and Alexanderson are described in a manner that all can understand, and finally the introduction of the valve, "the revolution in radio," is fully explained, together with that of the continuous-wave system.

It is the sound but simple style in which the book is written which makes it such a valuable contribution to our wireless literature. Energy, wave-motion, screening, and lines of propagation are dealt with in a manner so simple that everybody of ordinary intelligence can understand.

He shows us by simple diagrams how wireless messages are sent, and why they can be received. Since the long-ago day when I stood in the British Consulate in Leghorn, and witnessed the signing of the first Marconi contract, a document destined to revolutionise the world's signalling and save the lives of countless thousands at sea.

Get a Copy.

Colonel Crawley puts to us very plainly the great difficulties under which his department are working in connection with amateur experiments. I have heard many wireless men trounce the Post Office and all its ways. But after reading Colonel Crawley's excellent little book I think they will view the whole situation through quite a different pair of spectacles.

I am an "early enthusiast," like Colonel Crawley, and I congratulate him upon his book, for to all outside the official circle it will be found most helpful, and both to the amateur and the intending listener it will be found of greatest interest. Every wireless society should have a copy in its library.

HOW TO MAKE A LONG-WAVE RECEIVER.

By Y. W. P. EVANS.

PART 4.

THE panel is perhaps the most difficult part to construct, and great care must be taken in observing the various dimensions. I would advise that the reader should first of all make himself thoroughly acquainted with the following instructions, and endeavour to visualise the complete receiver, thereby obtaining a clear idea of what is required.

First, I will explain the lay-out of the panel, as shown in diagram. This is a sheet of ¼-in. ebonite (matt finish), 13 in. by 8 in., and the sketch reproduced here is intended to show the position of the various parts, both above and below the panel, and that is why the reader should exercise his imagination somewhat. The fittings on top of the panel are: One 4-pole change-over switch, two inductance switches, one filament resistance knob, one valve holder or four valve legs, ten 2 B.A. terminals.

Various Parts.

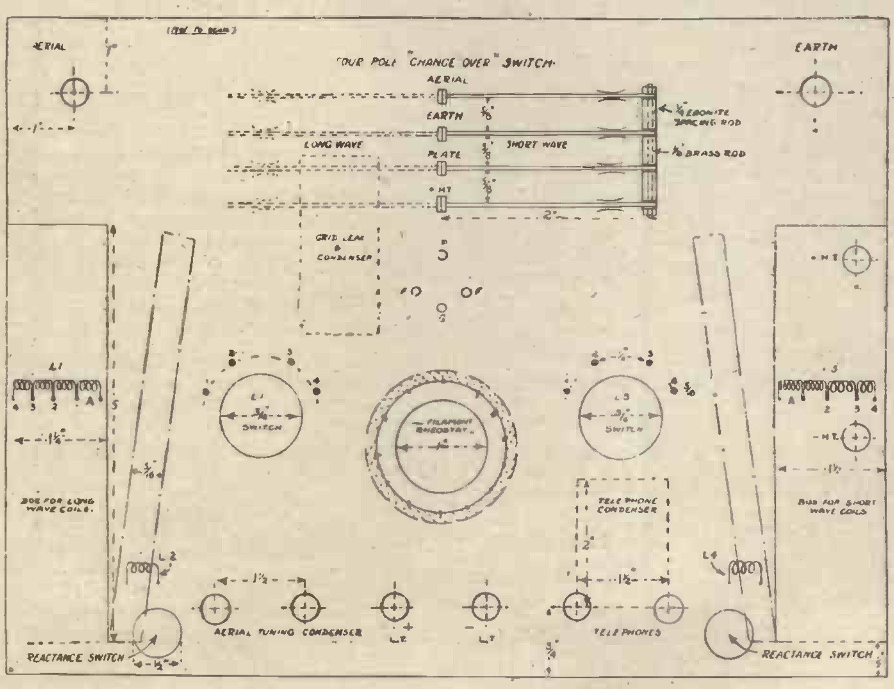
The large switch is at the top of the panel, and is shown in position on the short-wave side. The two inductance switches are marked L1 and L3. The filament resistance knob is in the centre below the valve holder, and the terminals are dispersed two on the top, two at the right-hand side, and six at the bottom of the panel. There are also eight studs shown, four around each switch knob, and marked from 1 to 4 to correspond with the tappings on the coils indicated at each side of the panel. The remainder of the drawing, shown in dotted lines, constitutes the instruments which will be on the under side of the panel or in the receiver box.

These are described clearly on the drawing, but it will be advisable to explain them more generously. The boxes on either side represent the receptacles for the tuning coils, and should be made of ply-wood, 5 in. square and 1½ in. deep. These will rest in the bottom of the receiver box or cabinet, and will be 1 in. clear of the under side of the panel, when the latter is placed in position. The second box, shown at an angle ($\frac{5}{16}$ in. deep), contains the reactance coil, and is hinged on the other box at the lower end of the drawing, and controlled throughout its swing of 90 degrees by the reactance switch, the fitting of which will be described in a further article on connecting up.

The Change-over Switch.

The telephone condenser, grid leak and condenser, explained in previous articles, are shown in their positions, the former underneath the telephone terminals, and the latter below the 4-pole change-over switch (c.o.s.), extending to the valve holder. Should it be decided to have this latter instrument on top of the panel, it will be found most convenient if placed lengthways over L1 switch, between the position of the long-wave box and the valve holder. The filament resistance is generally about 2 in. maximum diameter, and the coil of resistance wire is represented directly underneath the knob.

The construction of the 4-pole c.o.s. will be dealt with first. This is made up of two ordinary 2-pole c.o.s.'s, which are usually sold on a porcelain base at 4s. 6d. The reader can either buy two or make them on similar lines to the trade article. If they are bought, make careful notes as to how the copper strips are secured to the base and also the method of securing the terminal posts, and then dismantle both switches and fit them to the top of the panel in exactly the same manner, except that the distance apart of the copper switch blades should be ⅝ in., and the extremities of the blades should be joined together with ¼-in. spacing rods (ebonite), having an ⅛ in. brass rod through the centre, and secured at either end with a brass nut. (See diagram.)



Terminals.

Commencing at the top end of the panel, the first blade should be ½ in. from the edge, the others spaced ⅝ in. from this one, thus giving a full width of 2 in. to the switch itself. The four centre terminals are connected to aerial, earth, plate, and positive H.T. respectively (wiring diagram will be given later). Keeping to the centre line of the panel, mark off 3¼ in. from the top, and use this point as the centre of the holder. Two inches lower than this will be the centre of the filament resistance, and 2 in. below this last point forms the centre for the bottom line of terminals, which should be ¾ in. from the bottom of the panel. That completes the measurements on the central line.

Now mark off two points 3¼ in. from the bottom of the panel and 2½ in. on either side of the central line, these forming the centres for the inductance switches. Two more points 1 in. from each edge at the top-left and right-hand corners form a centre for the aerial and earth terminals, and two more 3 in. from the top and bottom of the panel, at a distance of ½ in. from the right-hand side, form the centres for the H.T. terminals.

Shop-window Advice.

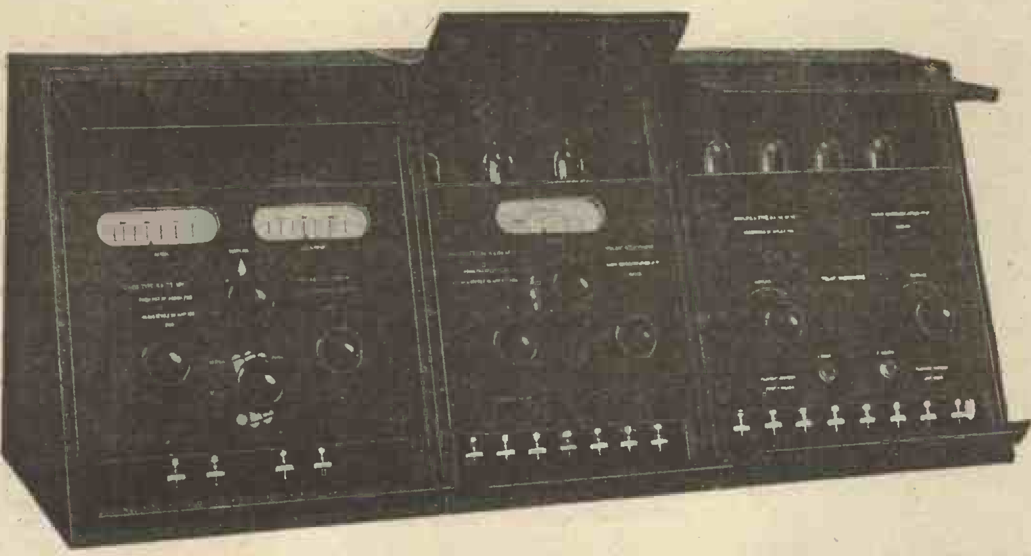
The various circles inscribed are as follows: Switch knobs for L1 and L3, ¾ in. diameter, the studs being displaced evenly on a half-circle 1½ in. diameter. Filament knob, 1 in. diameter, resistance wire 2½ in. diameter. The reactance switch knobs are ½ in. in diameter, but their position cannot be determined until you are ready to fit the cabinet part of the receiver. This will be described later. On the under side of the panel the condenser should be placed as shown, a good method of fixing being by means of shellac. Give the condensers a nice thick coat of shellac and allow it to become "tacky," and then press firmly against the panel and leave for about an hour, when it should then be stuck fast.

If you decide to have the grid leak and condenser on top, proceed accordingly. All terminals, switch-ends, studs, etc., should protrude on the under side of the panel about ¼ in., so that the wires can be soldered thereto.

The filament rheostat can be bought for 3s. 9d., and this is much more preferable to the novice than attempting to construct one. Should you care to try the experiment, there are plenty on show in shop windows, from which you can make notes. The writer has constructed several parts in this way. By noting the various instruments in a shop window, and basing the same on rough calculations, quite good results are obtained.

(To be concluded next week).

"POLAR"



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WIRELESS WITHOUT AERIALS.

By **SEXTON O'CONNOR.**

MARCONI, in 1896, was the first to use an upright aerial in combination with a Hertz spark-generator, an inventive step which marks the birth of wireless as a commercial proposition.

Whilst previously the distance over which Hertzian waves could be transmitted and received was limited to a mile or two at most, Marconi's aerial gave an effective range which gradually increased from tens to hundreds, and then thousands of miles. Nowadays it is a commonplace affair to girdle the earth with radio messages. This extreme range has, however, only been achieved by utilising energy of very large wave-length, which, in turn, has necessitated the erection of costly and elaborate aerial systems.

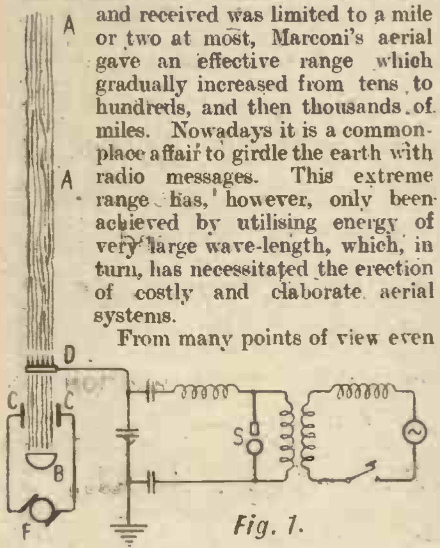


Fig. 1.

From many points of view even the simplest form of extended aerial may be said to constitute an unnecessary and clumsy obstacle to that universal use of the wireless medium which should theoretically be possible. The really essential factor of wireless communication, the ether, is all-pervading, and provides a permanent and ready-made connecting link between transmitter and receiver, wherever these may be located.

A Fascinating Prospect.

Incidentally, it is certain that many who now stand aloof from the cult of amateur wireless do so because they hesitate to undertake the trouble or expense involved in erecting unsightly masts and wires.

Unfortunately, however, a terminal erection of some kind or other appears to be inevitable, particularly for transmission, but there is no doubt that if the present awkward arrangement could either be eliminated altogether, or else replaced by some simpler and more "manageable" device, a tremendous field of development would at once be opened up.

There is a decided fascination in the idea of a new system of wireless by means of which it would be possible to make telephonic connection at any time, with anybody, and in any place, and it is conceivable that this prospect is not so utterly impossible of fulfilment as may at first sight appear. The problem will practically be solved when the right substitute for the aerial has been discovered.

Whilst the final solution still remains with the future, there is evidence that the subject is even now being seriously tackled upon entirely new and revolutionary lines.

Although ordinary air is normally a perfect insulator, it is well known that by means of ionisation it can be made to some extent a conductor of electricity.

For example, in the early forms of "soft" valve, there was usually an appreciable amount of air or other gas left within the globe. Instead of this forming an obstacle to the electron flow between the filament and plate, the ionised particles of the residual gas actually gave rise to an increase in the value of the current passing through the valve. In other words, they enhanced the conductivity of the plate-filament path.

Ionisation.

Again, the upper limit of the atmosphere is bordered by a layer of rarefied air in an ionised condition—generally termed the Heaviside layer—which undoubtedly acts to some extent as an electric conductor. In fact, it is due to the reflecting action of this ionised layer (analogous to that exhibited by metallic conductors when struck by ether waves) that it is possible to get wireless signals around the curvature of the earth, instead of losing them in interstellar space, as would happen if they kept strictly to the theoretical straight path of propagation.

Now, one of the known methods of ionising air is to pass through it a concentrated ray of light that is rich in ultra-violet rays. Such rays are much shorter than normal light-waves, which in themselves are almost infinitesimally small. (Actually, the ultra-violet rays have a wave-length which is commensurable with the size of the air molecules themselves, and therefore with the orbits of the associated electrons.) The result is that in their passage through the air these extremely short light-vibrations displace or set free a proportion of electrons from the molecules, thereby rendering the gaseous path containing the free electrons a conductor of electricity.

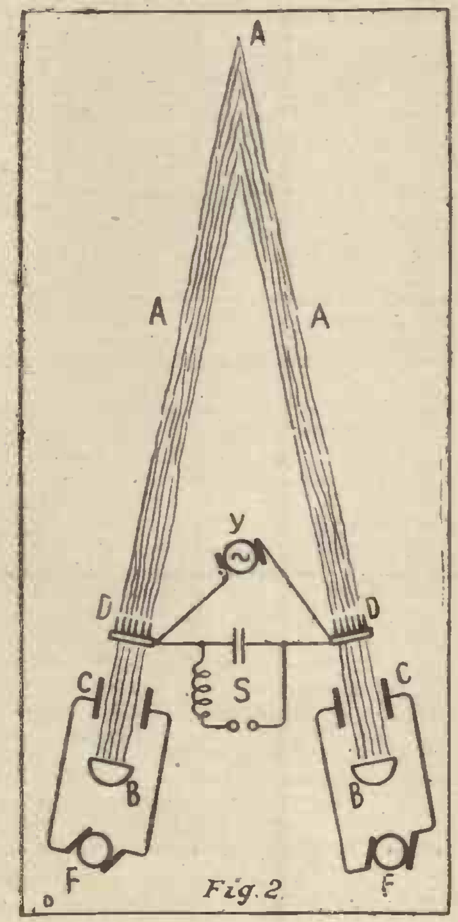


Fig. 2.

A "Beam" Aerial.

It may be pointed out that the modern definition of an ordinary metallic conductor of electricity simply states that it is a body wherein the electrons are so loosely bound to the atoms that they caused to pass from one atom to the next by application of an

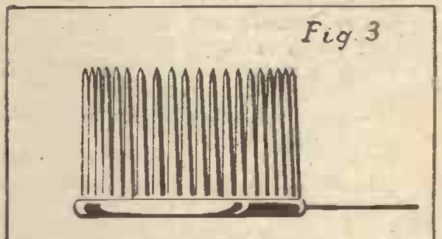


Fig. 3

SPIKED COUPLING-RING FOR CONNECTING SPARK SET TO THE BEAM AERIAL.

electro-motive force, the result of such a continuous "electron drift" being what we term an electric current.

Recently investigations have been made as to the feasibility of utilising a concentrated beam of ultra-violet rays as a means of creating a vertical column of ionised air which will be able to take the place of the usual metallic receiving and transmitting aerials. The original suggestion was due to Mr. J. Hettinger, who first put it forward during the War.

The underlying principle is clearly seen from the diagram given in Fig. 1. A searchlight beam of ultra-violet rays A is produced by means of a suitable electric arc or mercury vapour lamp B, the light being concentrated and focused by means of quartz lenses.

Transmission.

The upper end of the resulting column of ionised air remains insulated, as in the case of the ordinary wire aerial. The lower end is "tapped" or connected to one lead of any high-frequency generator—for example, a spark set S—by means of a metallic ring or coupling-piece fitted with upwardly pointing prongs D, shown separately in Fig. 3.

The prongs facilitate the discharge current from the metallic ring into the column of ionised air. The other lead from the generator is earthed, as shown, so that the beam aerial forms one plate of a condenser, the place of the other plate being taken by the earth in the usual way.

In order to cut off the conducting path of ionised air between the metal ring or connecting grid and the lamp source, a transverse electric field is interposed, as

(Continued on next page).

NOTES ON THE LONDON ETHER.

By 2 A N.

I SUPPOSE no law, or code of laws, seems fair to every individual—hence rules and regulations have to be passed for the greatest good of the greatest number, and the exceptional person sometimes feels ill-treated. Some of the early Post Office regulations did seem just a little onerous, and, like many others, we felt inclined to clamour for more freedom. Thanks to the well-directed efforts of the Wireless Society of London, many concessions have already been granted, and the friendly and helpful attitude of the Post Office officials to the genuine experimenter is a point for national congratulation. We feel that one additional regulation respecting transmitting licences is urgently wanted, and that its adoption would result in reduction of interference and secure more satisfactory reception for all workers.

We will deal first with the trouble and then with the remedy.

Wireless is becoming too easy and too attractive to suit the view of the early pioneer who was brought up on coherers and magnetic detectors.

It is the mysterious and almost miraculous character of radio science which gives it its uncanny and nearly morbid attraction, for all of us have a touch of the mystic in our mental "make-up."

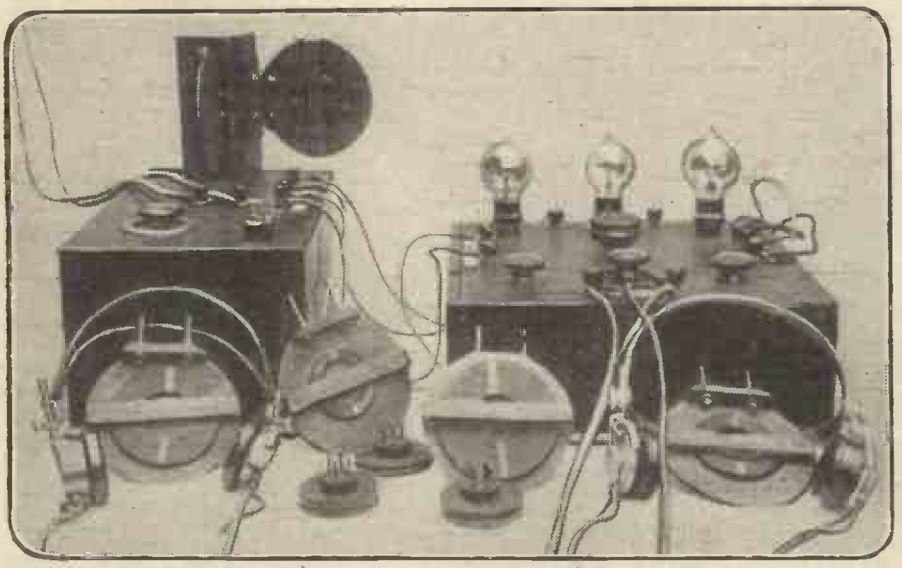
A "Radio Freshman."

It takes all kinds of men to make our every-day laborious old world, and I think that radio science can claim to have representatives of all grades within its ranks, from the bluff, jovial and genial 2 ? ? to the lean, attenuated and super-intellectual but well-beloved old 2 ? ?. Some are admittedly there for crude commercial reasons—and why shouldn't they be?—while others are there for pure love of the science itself.

Naturally this big collection of representative types includes many who have rushed into radio without serving their technical apprenticeship, and whilst the more experienced old birds are always ready to extend a helping hand to recent converts to our art, it is a little disconcerting to hear a "radio Freshman" shouting to all and sundry, "Hello, hello, hello, is anybody about? I want to know what my wave-length is and whether my speech is quite O.K. Changing over."

This is dangerously near the forbidden signal "Hello C Q," which is the official call for all stations and is absolutely "verboten" to the amateur experimenter.

Anyone who listens to the nightly clamour in the London ether cannot fail to be aware that experimenters who are nominally working on a wave-length of 440 metres are actually to be found on wave-lengths of anything between 380 metres and 500 metres.



Home-constructed set belonging to Mr. H. B. Wilks, 92, Mayford Road, Balham, S.W. 12.

Cruel.

While two bodies cannot, of course, occupy the same space at the same moment, it might be theoretically possible for all the London amateurs to comply strictly with the regulations and work dead on the official 440 metres, but it would result in hopeless confusion, so that a little reasonable latitude would doubtless be permitted by the authorities. At present wide range on either side of the official point, occupied by the amateurs, is altogether inexcusable, and can only be explained on the assumption that many transmitting stations are not provided with wavemeters, or that their owners fail to make use of them.

We would suggest that in future one of the qualifications required for applicants for transmission licences should be the possession of an accurate wavemeter and the ability to use it intelligently.

London amateurs were busy on a recent Sunday night. 2 A J was working at 2 A A, using relatively big power and transmitting very clear speech, which we received with great intensity on the loud speaker operated by two valves only. He gave us clear and lucid directions for constructing model gliders by the aid of paper and seccotine, and told us the length of flight we might anticipate from the finished model under certain conditions. We only regret that the lack of paper, scissors, seccotine, and time prevented us from carrying his directions into effect forthwith.

2 A J was not quite so successful with his music. The modulation produced by the gramophone was nothing like so intense or clear as that obtained by his speech.

The cruellest criticism we have ever heard of amateur musical transmission was intercepted in the ether on the same occasion. One gentleman, who shall be nameless, addressing another gentleman, who shall be equally anonymous, said that his transmission on the occasion referred to was nothing like so good as his normal transmission, but expressed the hope that his friends *might* be able to recognise the tune.

WIRELESS WITHOUT AERIALS.

(*Continued from previous page.*)

shown at C C. This is created between the two plates of a condenser connected to the terminals of a direct-current generator or a high-frequency alternator F.

Possibilities.

It is well known that certain metals, such as rubidium and alloys of sodium and potassium, emit streams of electrons when a ray of ultra-violet light impinges on their surface. In order to take advantage of this additional ionising factor, the surfaces of the pronged ring facing upwards are coated with a covering of such metals.

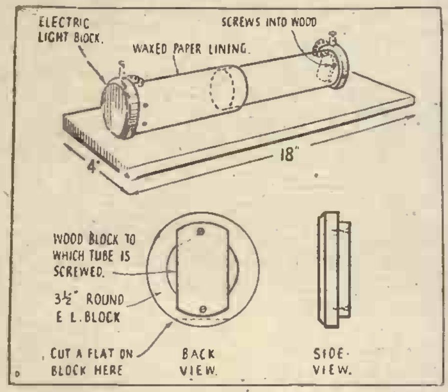
To increase the conductivity still further a constant direct or alternating electric field may advantageously be applied to the beam aerials, upon which the signal currents are superposed.

For this purpose the two terminals of a direct-current generator, or alternator Y, are linked by means of the spiked-ring coupling-piece to two beam aerials arranged to intersect at a given height above the ground. Two such intersecting beams may also act so as to give a directional effect to the transmitted signals, as indicated in Fig. 2.

It is conceivable that such ionised beams might be caused to penetrate the so-called Heaviside layer. Ordinary telegraphic or telephonic messages could then be transmitted by utilising the conductivity of this upper region of the atmosphere as the connecting circuit between two beam-aerials located at a distance from each other and acting as two tapping points for the entry and exit of the signalling currents.

A CHEAP VARIABLE CONDENSER.

VARIABLE condensers of the moving and fixed vane type are rather expensive articles to buy and very difficult for the amateur to make, but a very effective variable condenser, if made in the following manner, will do all that is required for a few pence and a little patience. The following instructions are for the construction of a cheap condenser, and by little additions, according to the amateur's fancy, it may be made quite a smart-looking instrument.



Construction of Plates.

In the first place you will require two tubes about 2 ins. in diameter. One should be 2 ins., and the other slightly smaller, so that it will pass inside easily. They should be 8 or 9 ins. long, but it is quite a simple matter to make the whole thing.

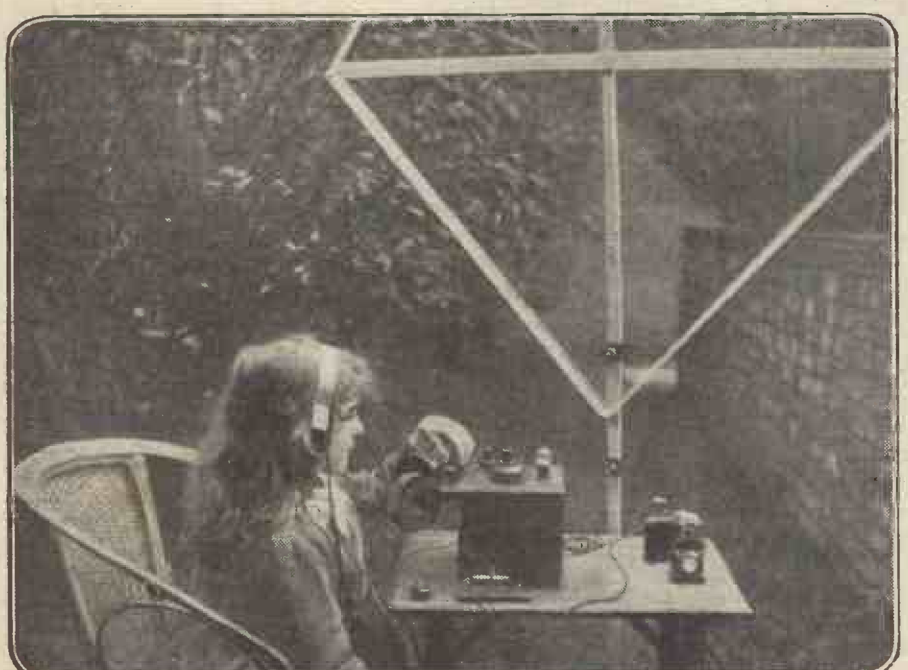
Procure two pieces of zinc, say 9 ins. by 6, and form them into tubes by rolling them round a broom handle, iron pipe, or anything cylindrical that is smaller than the actual size required. You will find that the zinc will spring open, and it is best to warm it first. This will make it easier to handle, and it will not be so springy. Solder the seam, and allow the edges of the first tube to overlap, say a sixteenth of an inch. The other tube that will have to slide inside will, of course, overlap a little more, about $\frac{3}{8}$ in.

The Dielectric.

Next thoroughly "paraffin wax" a piece of foolscap paper of sufficient size to neatly cover the smaller tube. Warm the tube, and wrap the paper round it whilst warm. This will stick the paper to the zinc. Do not have a lot of overlap of paper. When it is cold, try it for a sliding fit inside the larger tube, and by a little opening or closing of the larger tube it will be possible to get a very decent fit.

A neater way will be to line the large tube with paper in a similar manner, and leave the smaller tube quite plain, opening or closing the joint till a nice sliding fit is obtained.

So much for the metal part. You will now want a piece of wood for a baseboard 4 or 5 ins. wide and 18 ins. long, also two 3½-in. electric light blocks. Cut a flat on each, as in the drawing, and fasten a piece of wood on each, so that they fit inside the tubes. Mount the whole as shown in the drawing, and a very useful condenser will result. Soldering the joints will make a much stiffer job of the tubes, and the sliding tube will retain its nicety of fit.



Frame Aerial Set erected by Mr. C. H. Land, 1276 Leeds Road, Bradford.

HINTS ON SCREW CUTTING

MOST amateurs find a time when a thread to take a screw is absolutely essential, and how to get over the difficulty is a bit of a worry.

One hears of "taps" and "dies," so the first thing is to understand the meaning of these terms. The tap is a tool that cuts threads in a hole to take the screw; and the die is the tool that will cut a thread outside the metal—such as a piece of wire that will fit the thread in the tapped hole.

As an instance, we will suppose that a piece of metal is desired to have a hole with a thread in the hole to take a screw. First, the hole has to be drilled smaller than the desired thread, so assuming that we are to put $\frac{1}{8}$-in. thread in, then we will have to drill the hole $\frac{3}{32}$ in.

Method of Tapping.

There are two taps required for each size of thread: one is a taper, and has very little thread at the starting end. This tap gradually cuts the thread, and the next tap, with the full thread, completes the work.

Now for the screw portion. In this case we will assume that the thread has to be on the end of a long piece of wire. This thread will be cut with the die.

It must now be explained that unless you have a costly set there will be no separate dies for each thread, and for such small work this is unnecessary. The easier form will be to buy a screw plate. This will have several sizes of threads in it, but it is advisable to see that you get a good make, and that the thread has "clearance" holes.

These will look as though there are three holes close together: the centre hole has the thread, and the others are to allow the cut metal to clear away from the thread proper.

Sizes of Dies.

If funds will allow, it is as well to buy a set that has the little dies in a sort of frame that will be pressed on to the metal when cutting the thread by means of a thumbscrew at the very end. This pattern also allows of making a thread that is slightly tight or loose as desired.

As a guide, the following sizes will be found most useful to start with, and may be added to at times and when a better knowledge of threads has been obtained: $\frac{1}{16}$ in., $\frac{3}{32}$ in., $\frac{1}{8}$ in., $\frac{5}{32}$ in., and $\frac{3}{16}$ in.

Ask for standard Whitworth size, as this will allow you to cut threads that will take screws that may be in your stock or can be purchased. The taps are made square on the top to take a tap-wrench, but the amateur will find it is very easy to make just a little piece of flat metal about 3 in. long and $\frac{1}{2}$ in. wide with a hole in the centre, or a piece of round metal flattened in the centre and then drilled and the hole made square.

Never try to cut these small threads quickly; put very little pressure on, and take time over it or it will be found that brass will easily break off in the die, and if you happen to have a screw-plate it will give a lot of trouble to remove it.

CONTROLLING MODELS BY WIRELESS.

By MAJOR RAYMOND PHILLIPS, I.O.M., Late Member of the Inter-Allied Commission of Control.

PART 7 (NEW SERIES).

WHEN assembling the selector described in my previous articles, it will be advisable to loosely fit a brass washer $\frac{1}{16}$ in. thick to each of the drum spindles. Such a precaution will obviate any possibility of the brackets, or supports, coming in contact with the ratchet (fitted at one end of the drum) and drum flange, thus reducing friction.

Final Adjustments.

Care should also be exercised when mounting the drum, and particular notice taken that the latter revolves freely when set in motion by magnetic impulses.

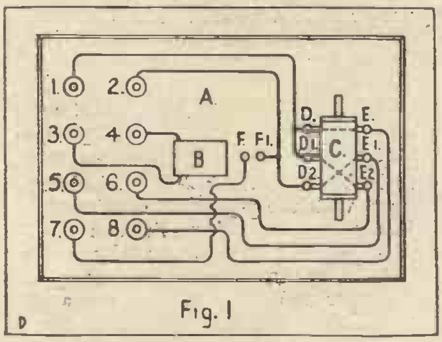


Fig. 1

The contact springs should be so adjusted that any unnecessary friction is eliminated.

On referring to Fig. 1 (No. 21 of POPULAR WIRELESS) it will be observed that the balance-spring H can be adjusted until the desired tension is attained. The adjusting screw G should be so arranged that the distance of the armature D from the cores of the electro-magnet B does not exceed $\frac{1}{8}$ in.

The eight terminals can be attached to the baseboard, and connected up as shown in Fig. 1 (this article).

To simplify matters the diagram is arranged as a skeleton plan, and shows a baseboard A, electro-magnet B (armature not shown), drum C with contacts D, D1, D2, and E, E1, and E2. Contacts F and F1 are for connecting with a de-cohering device to be described in due course.

Connecting Up.

It will be observed that the eight terminals are numbered 1 to 8 respectively, and connected up as shown. No. 18 gauge double-cotton-covered copper wire may be used for connecting the terminals to the electro-magnet B, and various contacts.

The wire should be laid in slots or grooves cut in the baseboard A, and can thus be neatly hidden. The slots, or grooves, should not be cut on the surface of the baseboard upon which the electro-magnet and other component parts are mounted, otherwise the general appearance of the selector will not be enhanced.

After assembling the selector it will be advisable to test all circuits.

On connecting terminals Nos. 3 and 4 with the terminals of a 4-volt accumulator (the latter comprises two cells made up as a complete unit), electric current should traverse the windings of the electro-magnet B, energising the latter, which should then strongly attract its armature.

Testing the Selector.

Immediately electric current is cut off from the windings of the electro-magnet B, its armature should be automatically released, and the pawl (attached to the armature support) engaging with the ratchet attached to the drum C should cause the latter to revolve a step forward.

Contacts F and F1 (Fig. 1) can next be tested. This can be effected with the aid of an ordinary electric bell, one terminal of the latter being connected with terminal No. 7 on baseboard A. The other bell terminal can be connected with one terminal of a 4-volt accumulator; the other terminal of the latter being connected with terminal No. 2.

On further connecting terminals Nos. 3 and 4 with the terminals of the accumulator in question, contacts F and F1 should immediately close, and thus admit electric current to the electric bell (used for testing purposes), thereby functioning same.

The contacts F and F1 (Fig. 1) are marked J and J1 in Fig. 1, No. 21, of POPULAR WIRELESS.

It will be noted that for testing purposes I recommend using a 4-volt accumulator.

Control Motor.

My reason for adopting such a course is that as electric current for the whole apparatus (including the model electric train to be wirelessly controlled) will be provided from such a "source of energy," it is obvious that the tests applied will be the same as those to which the apparatus will be subjected when in actual use.

Contacts D and E can be tested by connecting one terminal of an ordinary electric bell with terminal No. 8 (Fig. 1), and the other bell terminal with one terminal of a 4-volt accumulator, the other terminal of the latter being connected with terminal No. 1.

When the drum C is revolved to the correct position, contacts D and E should close a circuit, and so cause the electric bell in question to function. Contacts D1, D2, E1, and E2 can be tested by connecting terminals Nos. 1 and 2 (Fig. 1) with the terminals of a 4-volt accumulator, and (if available) the terminals of a model (permanent magnet type) electric motor should be connected with terminals Nos. 5 and 6.

On revolving the drum C to the correct position, the armature of the electric motor should revolve in either direction as desired. If the motor in question is not available, the terminals of an ordinary electric bell should be connected with terminals Nos. 5 and 6. It will then only be possible to test the circuits in the ordinary way.

The selector in question has been designed in such a manner that either a "series" or "shunt" wound model electric motor can be controlled, in addition to the permanent magnet type (as described in my last article), but it will be understood that (except by introducing complications) the latter type of model motor is the simplest form to control, as it will be observed in subsequent articles (when I shall furnish a wiring diagram of the complete receiving apparatus) that the conductor, and outer rails of a model electric railway, will be simply connected to terminals Nos. 5 and 6 (Fig. 1).

Series-Wound Motor.

As many wireless enthusiasts have on various occasions asked me to describe a scheme for controlling a series-wound model electric motor, a skeleton plan, Fig. 2, (this article), shows a method of connecting such a motor to the selector already described, and comprises a battery A, series-wound model electric motor B, drum C, with contacts D, D1, D2, and E, E1, E2.

In operation it will be observed that electric current from the battery A would traverse the field magnet winding B1, thence to terminal No. 1, and contacts D1, E2, and terminal No. 6 through the windings of armature with commutator B2 to terminal No. 5, thence to contacts E1, D2, and finally to battery A, thus causing the armature with commutator B2 to revolve in the usual manner.

Reversing the Current.

It will be noted that electric current can be caused to flow in a reverse direction in the windings of armature B2, by revolving the drum C until contact D1 is connected with E1, and contact D2 connected with contact E2.

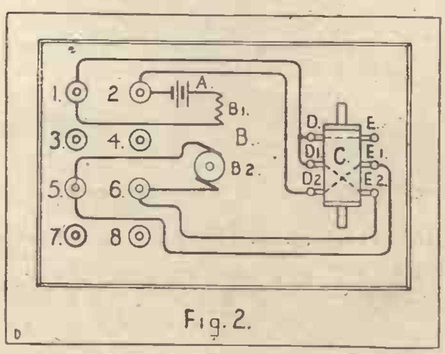


Fig. 2.

The polarity of the current traversing the field magnet winding B1 would, however, remain unaltered, so that the armature with commutator B2 would revolve in a reverse direction to that previously described.

In my next and subsequent articles I hope to furnish constructional details, also diagrams of a coherer, de-cohering device, and baseboard. Upon the latter will be mounted the relay (already described in previous articles), selector, coherer, de-cohering device, etc.

A DESK MOUNTED RECEIVING PANEL.

By GEORGE SUTTON, A.M.I.E.E.

IT will very often much enhance the ease of working, and nearly always add considerably to the appearance of an ebonite valve panel, if it is mounted "desk fashion." This style of mounting is much easier than placing the panel horizontally or vertically so that it forms either the lid or the side of a box, and it is proposed to give detailed instructions as to how it is done in the following article.

If the amateur has a good "jack" plane all the rest is easy, but if not, the good offices of a joiner may be invoked, and the four pieces of hard wood cut to dimensions and shape. It is essential that the edges of the end pieces, at least, be planed up absolutely square.

The panel shown mounted in the photograph is 13 ins. long and 9 ins. wide. A board of half-inch mahogany was cut into, to provide one piece for the base 15 ins. by 8 ins., and the top 15 ins. by $3\frac{1}{2}$ ins., both rectangular.

The two ends were cut so that the base, back, top, and front measured respectively 7 ins., $6\frac{1}{2}$ ins., $3\frac{1}{4}$ ins., and $9\frac{1}{4}$ ins.

Squaring the Edges.

A "shooting board," a plane and a small wooden bracket should be placed into position in order to true the one side with the other. The shooting board is made up of a baseboard; deal will do, but hardwood is better, 2 ft. long, $5\frac{1}{2}$ ins. wide, and $\frac{1}{2}$ in. thick.

Upon this is placed another board 2 ft. long, 3 ins. wide, and $\frac{1}{2}$ in. thick. If two of the long edges of these boards are made to coincide the other two edges will make the "rebate," or shelf, along which the plane slides when "trueing" up the work, which is pressed against the block. The block is 4 ins. long, 2 ins. wide, and $1\frac{1}{2}$ ins. thick, and is screwed upon the top long piece, so that its edges make an exact right angle with the long edge of the top board.

A little consideration will show that if a shaving is cut off a piece of board by moving the plane along the rebate, while one edge of the board is held firmly against the top block, the edge which is cut must be square with regard to the edge pressed against the block, and also to the surface of the board.

Planing.

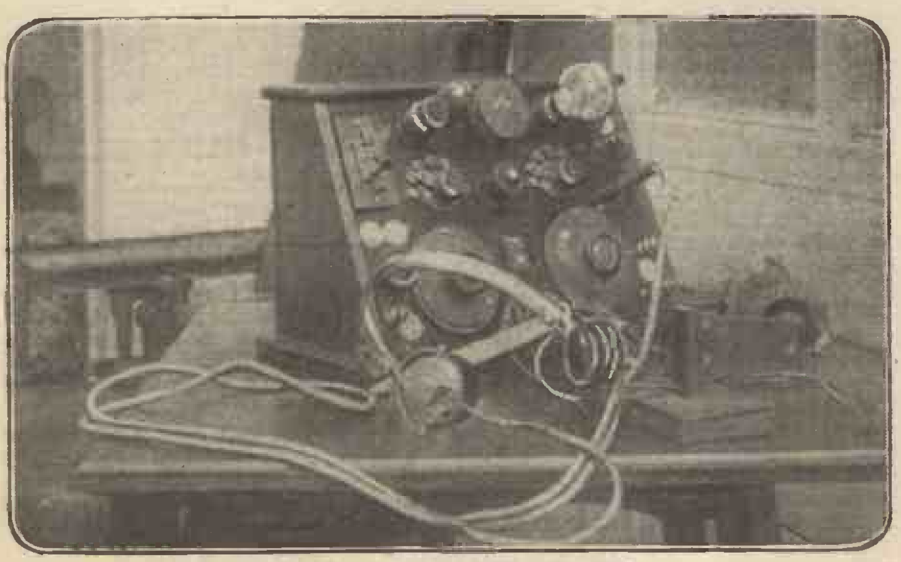
If we consider the end boards of our desk mounting, the top and bottom of which must be square with the back, it will be seen that if the backs of these boards are pressed against the block, and the tops and the bottoms are planed on the shooting boards, they will be square back to front, and also sideways.

The plane must be very sharp and very finely set, or else you will only succeed in splitting off the corners of the boards which you are attempting to true up. In any case you had better plane from front to back for two reasons; one that the front at the bottom will have a short grain, and the angle, which is less than a right angle, not being very robust, is certain to chip off. The other reason is that if any little chips do come off the corners, they will be behind the desk and less unsightly.

As there is no great strain exerted on the corners of the boxwood when it is completed, three brass wood-screws in each end of the base, screwed up into the sides, and two in each end of the top, screwed down into the sides will make it strong enough, though the screws will only be driven into the end grain of the wood. The screws on the top should be neatly "counter-sunk" for appearance sake. These screws had better be driven home when the panel is in position so as to avoid ugly gaps between the wood and the ebonite, or perhaps preventing the ebonite panel from going into its place at all.

French Polishing.

Under the top should be a thin "fillet" of wood, screwed up inside for the top of the ebonite panel to rest against. At the bottom, if the woodwork is carefully carried out, this should not be necessary. A screw in each corner to hold the ebonite panel in position will be required.



The finished desk panel as made by the author.

Just a word on finishing. No hard wood looks its best unless it is french polished, but, like soldering, this is a job which most amateurs "fight shy" of, though it is comparatively easy to acquire the knack. The whole art of french polishing consists in knowing when to leave off rubbing.

By this we mean that up to a certain point, at any one time, you make progress. After passing that point you rub the polish off rather than rub it on.

That "Glossy" Surface.

Buy a small quantity of polish at a good oil shop. A little raw linseed oil and some methylated spirit will also be needed. Take a piece of cotton-wool and fold it so that when squeezed very tightly it is rather larger than a walnut. Place this inside a piece of white linen rag and pull the edges of the rag back round it, so that the front of the pad of cotton-wool, with its skin of linen rag, is smooth and plain, and you have as a handle the bunched-up rag at the back.

Now make the cotton-wool damp (not wet) with the polish by opening the back of the rag and pouring a little on the cotton-wool inside. Hold the pad by the handle formed by the loose ends of the rag and rub all over the woodwork with a helical motion as though you were trying to trace out the rings in a piece of chain armour or a chain purse.

If the pad drags, moisten the face of the linen rag with just a little dab of linseed oil and go on again. Do not use too much oil, or it will "sweat" out of your work later on. You will soon get a glossy surface, but as soon as the surface refuses to become more glossy as you rub, put the work aside and try again on the morrow.

Professional "Finish."

The spirit in which the gums are dissolved to make the polish contains water, and when the wood gets waterlogged, as it is almost certain to do in patches if you keep on applying the polish, it must be allowed to dry out again before continuing the process.

Professional polishers always use "fillers" to stop up the pores of the wood and prevent the polish sinking in, and sooner to get the gloss all on the surface, but this is largely a matter of time.

The writer is of opinion that no fillers can produce such a translucent polish as filling up the grain with the polish itself, by steady application. If the grain rises owing to the wet polish, so that the surface gets a little roughened, wait till next day and then rub along the grain with a piece of fine glass-paper. A very slight suspicion of fine pumice powder worked in with the polish prevents the surface getting stringy.

The finishing strokes are straight along the grain. Glide on to and off of your work, or you will mark and mar it. If you prepare the surface of the wood with glass-paper, never rub across the grain, or the scratches will show badly. Considerations of space forbid enlarging now on this matter, but it is well worth the amateur's while to study it.

WIRELESS CLUB REPORTS.

The Editor will be pleased to publish concise reports of meetings of Wireless clubs and associations, reserving the right to curtail the reports if necessary. Hon. secretaries are reminded that reports should be sent in as soon after a meeting as possible. Reports sent in cannot appear in this paper in less than ten days after receipt of same. An asterisk denotes affiliation with the Wireless Society of London.

Ilkley and District Wireless Society.*

On Monday, October 2nd, the fifth general meeting of the above society was held at the headquarters, the "Regent Cafe," Ilkley, the president, Dr. J. B. Whitfield, occupying the chair.

The minutes of the last meeting being read, the chairman called upon the secretary to read the report of the committee appointed to design and draw up the estimates for the society's receiving set.

The report was adopted, and the committee instructed to acquire and assemble the necessary apparatus, which will consist of a single valve receiver and tuner built on the unit system so as to facilitate future extensions and re-arrangement of circuits for demonstration purposes.

The rules of the society were then officially formulated, and it was resolved that a technical library be instituted for the use of members, Mr. C. D. Marshall being elected hon. librarian.

The hon. sec., Mr. E. Stanley Dobson, was then called upon to give his lecture on "Capacity and Condensers."

A vote of thanks was accorded to the lecturer, and before the meeting closed, the announcement was made that the society's affiliation with the Wireless Society of London had become an accomplished fact.

Hon. sec., Mr. E. Stanley Dobson, "Lorne House," Richmond Place, Ilkley.

The Leicestershire Radio and Scientific Society.

The above society held their bi-monthly meeting on the 25th ult., at headquarters.

The president, Mr. Cyril T. Atkinson, being the lecturer, Mr. H. E. Dyson, vice-president, took the chair.

Mr. Atkinson opened up with the elementary principles of wavemeter design, passing by easy stages to the consideration of one or two sound commercial instruments as follows:—

First, the well-known Marconi crystal type; second, a somewhat more elaborate Telefunken instrument; and thirdly, the popular Townsend pattern. Each of these types received a very detailed analysis, special reference being given to the latter owing to its suitability for home construction, which was next touched upon, detailed instruction being given of a similar instrument having a sample range of from 140 to 240 metres. The lecture was concluded with an explanation of a method of calibration suitable for wavemeters of a comparatively short maximum wave-length, viz., the Lecher wire. A discussion followed, Mr. Atkinson making suitable replies to the sundry questioners. The meeting then concluded by a very hearty vote of thanks from the assembly for the interesting and useful lecture, this being proposed by the chairman, and seconded by Messrs. J. W. Pallett and D. Morton.

All communications regarding the society should be addressed to the hon. sec., J. R. Crawley, 269, Mere Road, Leicester.

Ramsgate, Broadstairs and District Wireless Society.*

The inaugural meeting of the above society was held at the headquarters of the society, 22, Princes Street, Ramsgate, on September 28th.

The society was honoured by the presence of two of its vice-presidents, Sir Edward Rigg, C.B., C.V.O., D.S.O., and Sir Cecil Hertslet, K.B.E., J.P., who both expressed their great pleasure at being present at the first meeting of the society, and that they were keenly interested in its future welfare. Mr. C. E. Hume, engineer and manager of the Ramsgate and District Electric Supply Co., Ltd., has been appointed treasurer of the society, and the London Joint City and Midland Bank, Ramsgate, the bankers of the society.

A number of new members were enrolled at the termination of the meeting. A class of instruction in the reading of the Morse code will take up the first half-hour of the weekly meetings, as many members express their desire to be fully conversant with same. Any locally interested parties in the district are invited to apply for membership forms and full particulars from either of the joint hon. secs.

Joint hon. secs., Mr. F. Harrison, "Rochester Cottage," St. Lawrence (Ramsgate); Mr. F. C. Marshall, 6, Ramsgate Road, Broadstairs (Broadstairs and District).

The Eastern Enfield Wireless and Experimental Society.

The inaugural meeting of the above society was held on September 28th at the "Falcon Inn," South Street, Ponders End, when a very satisfactory attendance was recorded.

The chairman announced that Mr. Balfour had very kindly offered the use of the room for meetings and, moreover, was presenting the society with a complete three-valve receiving set with loud speaker and aerial for the use of the members at the meeting room. A hearty vote of thanks was accorded Mr. Balfour, and arrangements were made for the application for the licence immediately.

The subscription decided upon is 10s. 6d. per year; the objects of the society being to assist everybody in the district who is in any way interested in wireless, either from an experimental or "broadcasting" point of view. Meetings are held every Thursday at 8 p.m. at the "Falcon Inn," and the secretary will be very pleased to give prospective members any information if they will write him or attend the meetings. The society has had an enthusiastic commencement and has prospects of being very well equipped, and it is hoped that everybody in the district interested in the now popular hobby will recognise the advantages of the society.

Hon. sec., Arthur I. Dabbs, 315, High Road, Ponders End, N.

The East London Radio Society.*

A highly successful meeting was held at the lecture hall, Woodstock Road, E. 14, on Tuesday, September 19th, with Mr. A. J. Alexander in the chair.

Informal discussion preceded the actual opening of the meeting, and many interesting points were discussed. These short open discussions are proving of great value to the society, and most new members' difficulties are satisfactorily disposed of by the more experienced and competent experimenters. The society's set was then set in operation, and members listened with great interest to 2 M T's fine transmission. This over, the chairman called upon Mr. J. Keens to deliver the second lecture of the present series. The lecturer chose "The Application of the Thermionic Valve to Receiving Circuits" as his subject, and his remarks were very closely followed for over an hour. Those who knew little of the subject were agreeably surprised to find what was to them a difficult matter ably brought within their comprehension. Those who knew a great deal of the subject were equally surprised to listen to the matter being so simply explained. All of which indicates Mr. J. Keens' exceptional ability, and we count ourselves fortunate in the possession of such a member.

The meeting closed at 10.20 p.m. with votes of thanks to the chairman and lecturer.

On Friday, September 22nd, the week's second meeting was held at the above lecture hall. A very pleasant evening was spent with buzzer practice, various discussions, and listening in.

The meeting closed at ten o'clock.

The secretary will be pleased to hear from any East London amateur desirous of joining the society.

A club, to be known as the Kendal Amateur Radio Club, is being formed in this district. As the membership will be limited, will all persons interested please communicate as early as possible with the secretary (*pro. tem.*), H. W. Walker, 24, Highgate, Kendal ?

RADIOTORIAL

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

RADIOTORIAL.

The recent political debacle has left amateurs wondering whether broadcasting will be delayed in consequence. It certainly may be so. There is bound to be some delay in the legislation connected with broadcasting until the new Government is fairly on its feet.

Many readers have written to me with regard to experimental licences. They ask whether it would be best to acquire a condensed knowledge of wireless and then apply for an experimental licence, or whether they should begin by applying for a broadcasting licence. My advice is, apply for an experimental licence. It should not be very hard to convince the Postal Authorities that you really have a bona-fide reason for applying for an experimental licence. If you merely intend to be a listener-in with no other thought except for the reception of music, etc., etc., then a broadcasting licence should meet your needs excellently.

But there are many thousands of new amateurs who have recently acquired a strong taste for wireless experiments, and who wish to do rather more than just listen in to music, etc.

In applying for an experimental licence it should be clearly indicated that the applicant is desirous of studying wireless with a view to something more than becoming an efficient knob-twister. Outline for yourself an experimental programme which you feel confident you could undertake, and then write to the P.M.G. explaining lucidly, but concisely, the nature of your intended experiments.

If you really are a novice, apply first of all for an experimental licence for a crystal set. Do not attempt to take out a licence for a valve set until you are fully conversant with the perils of re-radiation caused by valves. A good many new amateurs are trying to jump into a field which they have never explored before. This is not right. It is only fair to bona-fide experimenters who have proved their worth by years of patient work, that they should be entitled to privileges. With knowledge, and a realisation of the responsibilities of an experimental licence, will come a proficiency which will entitle you to those privileges. They should not be hard to obtain, providing you apply for an experimental licence with bona-fide intentions and with all due conscientiousness.

THE EDITOR.

Questions Answered

Owing to the enormous number of queries received daily from readers of POPULAR WIRELESS, I have decided to reply individually by post. A weekly selection of questions will, however, be printed on this page, together with the answers, for the benefit of readers of POPULAR WIRELESS in general. Questions should be clearly and explicitly written, and should be numbered and written on one side of the paper only.

All questions to be addressed to: POPULAR WIRELESS, Queries Dept., Room 131, The Fleetway House, Farringdon Street, London, E.C.4.

Readers are requested to send necessary postage for reply.

S. C. H. (Colchester).—Is there any duty on wireless apparatus entering into the United States of America?

Yes, 40 per cent. of invoice value.

* * *

W. L. (Colchester).—It would seem to me that a unit for the current-carrying capabilities of a wire would be more logical than a unit that represents the reverse, such as the Ohm.

As a matter of fact, for certain purposes, especially in land-line telegraphy, the Ohm is reversed and styled a Mho, which is the unit of conductivity. We prefer the Ohm and not its reciprocal the Mho, in order that Ohm's Law can be adhered to. What could be clearer than the simple fact that the current flowing in a circuit is directly proportional to the pressure and inversely proportional to the resistance?

* * *

"CURIOUS" (Walsall).—What does T.S.F. signify? I often see it in connection with wireless stations—Bordeaux T.S.F., etc.

They are the initials of Telegraphie Sans Fils, which is French for Wireless Telegraphy

A. J. H. (Bexhill-on-Sea).—Having applied to the P.M.G. for a transmitting licence in order to allow me to test apparatus, I am informed that I may employ an "artificial aerial" with no earth connection. Does that mean that I may use a frame or loop aerial?

Correctly defined, an "artificial" or dumb aerial is a non-radiating closed oscillatory circuit, and therefore must consist only of an inductance and condenser. A two-circuit receiver could be said to be an artificial aerial if the open circuit was entirely removed, including, of course, the earth and aerial.

* * *

V. B. (Carlisle).—Should I be able to hear Paris on a single-valve set?

You should certainly hear Eiffel Tower's spark signals if your tuner will reach 2,600 metres and you have a fairly good outdoor aerial, but although quite possible the telephony will be by no means a certainty.

* * *

E. R. B. (Stockport).—Is the "Diplex" and "Duplex" working the same thing?

No. The former refers to the simultaneous reception *or* transmission of two messages, while the latter refers to the simultaneous reception *and* transmission of two messages by one station.

* * *

P. L. (Wantage).—I find I cannot put up an outdoor aerial as there is not much space. Can I use a frame aerial? If so, as I am thinking of employing valves, how do I fix my resistance? How far shall I be able to receive telephony?

As you do not give the full details of your set we are afraid we cannot give a very definite answer to your question. A frame aerial is of course useless with a crystal set. If you are using one valve your telephony range will be about 5 miles. Two valves would give about 10–12 miles, and three would enable you to hear concerts up to 50–100 miles. If you decide on a frame aerial—and it seems the only thing if you cannot erect an outdoor one—you may find it necessary to add to your valves so as to be able to receive those stations you require. Of course, you need no earth with this type of aerial. For construction of same see the article in No. 2 of POPULAR WIRELESS. Your reactance can be used in either of two ways. You can construct a frame reactance to be hinged near your aerial, and use direct coupling to the aerial; or else you can put a small coil in series with the aerial, and, using an ordinary reactance, couple it to the coil in the aerial circuit.

* * *

T. D. C. (South Africa).—I am thinking of putting up a receiving station, but do not know if it would be of much use. I want to have a crystal and one valve set. Could I hear anything with these?

Yes; a crystal or one valve set should be quite sufficient to give you several of the coast stations round about. Cape Town, Durban Radio, Durban (Jacobs), Port Elizabeth all transmit spark telegraphy, and you should be able to hear one or more of these working during the day. No; a crystal is really quite an efficient method of reception, especially for telegraphy. Its range for telephony, of course, is small, but if well handled, and with a good aerial, it should give very good results for telegraphy over quite long distances. There is no reason to despise the crystal at all, though many amateurs are inclined to look down upon it. It is very easy and simple to adjust.

* * *

"IMPATIENT" (Ulster).—Would you kindly inform me and numerous other readers living in Ulster if it is possible to get wireless receiving licences here? Also, would a crystal set be of any use here for hearing Morse code or speech broadcasted in England or Scotland?

The P.M.G. has not yet given permission for receiving licences in Ireland.

We are afraid that a crystal would not be of any use for the purpose you mention. You would probably be able to receive telegraphy from English and Scottish stations, but for telephony you would need at least three valves for good reception. This is, of course, on the assumption that Manchester, Glasgow, and several other north-western towns are shortly to commence broadcasting.

(Continued on page 514)

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 512.)

G. S. T. (Luton).—I have a diagram, which was given to me by a friend, of a one-valve set. It has a coil on it, apparently coupled to the aerial, marked T. What is this coil, and what does T stand for?

The diagram you have is probably from an American paper or else copied from one of their diagrams. The coil you speak of is the reactance coil. The Americans call it a "tickler," hence the initial T.

* * *

"INTERESTED" (Aberdeen).—I am afraid this question is only indirectly connected with wireless, but I was discussing atmospherics with a friend and the subject turned upon the "Northern Lights." I should be pleased if you could enlighten me on the subject of their origin.

This is a subject which is really outside the scope of P.W., but briefly, the Aurora may be put down as electric discharges in the atmosphere. How these charges are formed is a subject open to much discussion, but it has been assumed that the earth induces currents into a belt of conductive atmosphere, and this causes a flow of electricity north and south. This is said to be the cause of the numerous thunderstorms of the tropics and of the Aurora at the Poles. These discharges occur in rarefied air, and take the same form as discharges in a partially vacuated tube. This causes the variation of colour—they are produced by gases which have become luminous owing to the discharge.

* * *

T. L. N. (York).—Why is it that naval vessels have aerials of the cone or "sausage" type, consisting of several wires, while merchant ships have only two or three stretched horizontally between the masts?

The reason is that naval vessels work mainly upon comparatively long wave-lengths. Merchant ships, however, use 600 metres as their usual wave-length. When several wires are used, as in the case of the battleships, the capacity of the aerial is greatly increased, and hence its wave-length is raised. This is desirable as less loss of energy in extra inductances and capacities occurs when working in high wave-lengths.

* * *

"ANNOYED" (Clapham). I have two accumulators—2 volt. 40 amps.—and after using for some time the filament of my valve suddenly went dim and I could no longer use it. This often happens during concerts. I hear them well for about 20 minutes, and then the valve goes dim and I hear no more.

Your trouble probably is that your cells are run low and are beginning to sulphate. To cure them, give them a long overcharge at about ½ amp. rate. Then rinse and refill with fresh acid solution of 1.2 specific gravity and charge until they gas again. This should remedy the fault.

* * *

F. R. D. (Oldham).—If a wireless set is re-sold, does the licence go with it in the same way as a motor licence?

No. Wireless licences are non-transferable.

Supposing I have two houses, two aerials, and only one wireless set. Would it be necessary to have two licences to cover each address, and, if so, how about a motor-car fitted with a set and touring the country?

Two licences would be required. In the latter instance it would be possible to obtain a licence covering the use of a portable set within a certain fixed radius of a given address; outside that area it would be necessary to have a further licensed address.

* * *

"PIPPED" (Dover).—I find that signals on my crystal set increase very considerably when I touch certain parts with my hand. Can you explain this curious effect, and tell me how I can make the result permanent?

If you are touching the set on the earth side of the detector, it indicates that the earth connection is capable of improvement, but if it is on the aerial side it is a capacity effect bringing the circuit more in tune with the signals in question. In the latter case it may be that you have no variable condenser, and therefore cannot obtain the necessary fine tuning in any other manner.

* * *

"STUDENT" (Glasgow).—What is the difference between impedance and resistance?

None at all, as the impedance offered by a circuit to a flow of current is obviously resistance, but impedance covers the resistance due to ohmic resistance, self-induction, etc. The resistance that you evidently refer to is ohmic or apparent resistance, which is one of the impedance factors of a circuit.

* * *

Why is it that high-frequency currents can be choked back by a highly inductive coil, because, although you state it is due to the impedance of such a coil, I cannot see that it should do so, as the high-frequency current is not necessarily oscillating, but may consist purely of unidirectional impulses in all respects similar to low frequency, except in point of tim e.

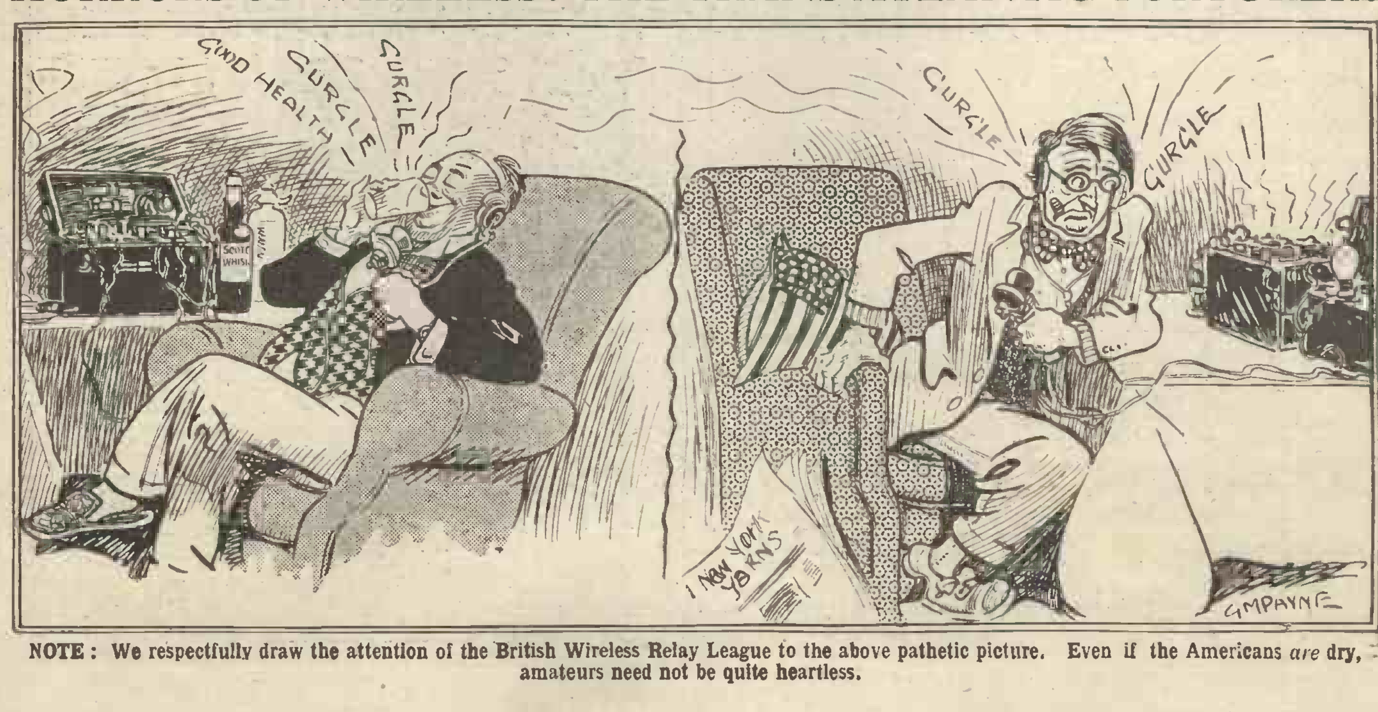
It is because of that latter that the H.F. impulses are choked back owing to the fact that their vastly greater frequency produces a greater back or opposing E.M.F. in a coil by self-induction.

* * *

D. F. (Woking).—Can you tell me what Wood's Metal, as used for mounting crystals is composed of?

Two parts lead, one part tin, four parts bismuth, and one part cadmium.

HORRORS OF WIRELESS: THE TRANS-ATLANTIC TORTURERS



NOTE: We respectfully draw the attention of the British Wireless Relay League to the above pathetic picture. Even if the Americans *are* dry, amateurs need not be quite heartless.

RADIOTORIAL QUESTIONS & ANSWERS.

(Continued from page 514.)

A. A. (London, N).—I have read with much interest the various remarks concerning the use of rubber-covered aerials, and the idea occurred to me that the most perfect aerial would be a glass tube filled with mercury of suitable length, and suspended at a suitable height. Is that correct ?

The idea being, we presume, to maintain a surface of the lowest possible resistance—and that is one of the efficiency factors of an aerial—therefore your theory is more or less correct, but an enamelled copper wire would answer the purpose quite as well.

* * *

"WONDERING" (South Shields).—When I sent my accumulator to be charged I was told that the electrician passed some remark that sounded like "panning," after briefly examining the plates. Can you tell me what that is likely to mean, and whether it is anything to do with the condition of the battery ?

Doubtless the remark was "fanning," which means that the negative plates are curling over at the ends, due most probably to faulty construction, such as the separators being too thick. However, it is not at all harmful unless excessive. You must not confuse it with "buckling," which is very much the reverse.

* * *

A. T. M. (Manchester).—I have several old sparking plugs. Do you think I could put them to any use on my receiving set ?

Providing the insulation of the sparking plugs is still good—not cracked—they can be used as lead-in insulators. The two nuts which fix the porcelain into the cap of one of the plugs must be unscrewed and the porcelain removed. Then the centre electrode should be unscrewed and taken out. The short piece of china now is clear for the lead-in wire of your aerial. By tapping the centre electrode, and fixing another terminal screw on the bottom end of it, the aerial lead-in wire could be screwed on and off at will, and also the wire leading from the set to the insulator. Make sure, of course, that the inside of the plug is perfectly clean before using, and that the wires make good contact, if the latter method is used.

* * *

"HAZY" (Potters Bar).—I am using a crystal set with a carborundum detector, and whenever I listen in there always seems to be a great deal of interference and jamming. I am using a loose coupler and two variable condensers. Can I do anything to prevent these annoying occurrences ?

As you are using a loose coupler and two variable condensers you should be able to tune out most of the interference that you experience. However, if it is impossible, and the signals you require are hopelessly jammed, resort may be had to what is termed "balanced crystals." For this you need two potentiometers—one for each of two carborundum crystals—which are so arranged that one conducts one way while the other is inverted and conducts in the opposite direction. The crystals are, of course, in parallel with each other, but in series with the 'phones. Since the crystals rectify in opposite directions, they nullify each other. They must both be adjusted (separately—one disconnected while the other is used) to their sensitive points. Then, when they are both switched in, there will be practically no signals heard. The crystals used should be as nearly equal in sensitivity as possible. Now, when one of the potentiometers is moved so that the potential across one crystal is reduced, signals will be heard. These signals are due to the difference in rectification between the two crystals. The reduction in signal strength compared with that when one crystal alone is used is fairly small, so that good signals should be obtained using balanced crystals. Of course, for ordinary reception one crystal only is used, the other being switched off altogether. Then, when jamming or bad atmospherics occur, the second crystal—which should be all ready with its sensitive point found—is switched in, and the potentiometer reduced until signals are heard almost as strong as they were with one crystal.

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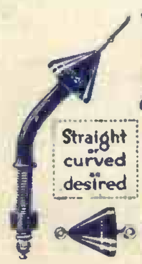

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Y/Y