The Why of Wireless

Interesting Series Setting Out Scientific Facts Simply

(By "Electron.")

PART IX.—ATMOSPHERICS OR STATIC.

These disturbances are well known to most listeners even crystal users. They are due to little electric disturbances in the atmosphere like miniature lightning flashes. They may appear in many different forms; the familiar crash just like thunder, but without the rumbling after effects, then there is the rustling —something like crushing a newspaper and also the sound like hail on an iron roof. There are many modifications of these effects and so far have caused much trouble as they cannot be tuned out. The reason for this is that the static hits the aerial a sudden blow—just like someone striking a clock pendulum—and the current flows up an down the aerial at its natural frequency. Suppose two neighbouring aerials were tuned one to 420 metres and another to 600 metres, it would be found that the atmospherics would affect each equally without the slightest regard to their different wave-length. This, therefore, is the reason why even selective sets suffer from static. It seems that static is generally more troublesome as we approach the equator and becomes less as we approach the poles. Also trouble from atmospherics is in nearly every case local. That is, suppose two sets, one in Auckland and one in Dunedin, were listening to 2YA, it is probable that the first would find great trouble from static while the latter would report perfect reception. If the first now tunes in to 1YA, he will find that the static ceases. Yes, but that is because his set does not need to amplify so much with the near station, and the static is correspondingly reduced.

The reason for static being so local is similar to the effect of using a lighted candle out of doors when a full moon is shining at night. Within a foot or so, the light of the candle will overpower that of the moon, while at a distance of several yards the effect will be negligible.

Static can be reduced at times by means of a super heterodyne set with loop aerial. These sets, as will be explained shortly, have a pronounced directional effect and if the aerial is pointed in the direction of the station whose signals are required, then any other signals—broadcast music or static—coming from any other direction are neglected and ignored. The ordinary aerial, of course, picks up static no matter from what direction it comes.

LOOP AERIALS.

Reference was made in the last paragraph to the "loop aerial." This aerial, instead of rising to 30 feet or so, and then going horizontal to form one plate of a condenser, is wound into a coil or loop of fairly large diameter. If these wireless waves are made to pass through the coil, currents will be induced in it, as in the case of the seconlary of a transformer.

The position of the coil has a lot to do with the reception of the signals, however, because it is essential that the waves should pass through the coil. Two cases are shown in Fig. I with the coil in position "a," the waves from the transmitter X will obviously pass through it, and induce currents in, as shown in Fig. IIa. In the case of Ib, however, the wave will hit all the sides of the coil at the same time, and the effect will be as in Fig. IIb. No current will flow round the coil, and the station X will be "cut out."

It may be worth while for those whose sets permit of it to try to experiment with the position of the coils in their high frequency stages, if they find it impossible to cut out a broadcasting station to which they may be near. Those who are within a mile or so of 2YA find great difficulty in cutting it out, because the waves are so strong. They can even get full loudspeaker strength without an aerial or earth, because the coils act like loop aerials. The relative positions of the three coils, however, must not be altered, since that arrangement (Fig. III) has been specially designed to prevent the currents in one coil from interfering with those in the other two.

DIRECTION-FINDING.

The rotation which a loop aerial must be given so as to enable it to receive a given transmitter has been given several most important uses. It will be seen from Fig. Ia that by means of it we are able to find the direction from which the waves come. This method gives us no clue as to the distance of the transmitter, but a simple addition will give us that information also.

If we find the direction of the station at a certain place, then move the receiver through a given distance, and then find the new direction, we will be able to make a diagram similar to Fig. IV. Where the two directions cross obviously gives us the position of the transmitter. This method is largely used in navigation in places where fogs are frequent and where traffic is dense, for example, in the English Channel. It is clearly much superior to fog horns, etc., because it gives the captain of the ship (the ship in this case being the transmitting station) definite information as to his exact position, and he can then find all the rocks, etc., from his charts and his compass.

This method can also be used to trace and track down oscillators, whose persistance is inclined to fray the tempers of the neighbours and the P. and T. inspectors. By means of a portable set on a motor-car the house can be located with ease.

BEAM WIRELESS.

The previous article gave indications for finding the direction from which the waves come. The next thing to do is to so construct the transmitter that we can have control over the direction in which the waves travel. The reasons for requiring the waves to travel in a beam like the light from a motor-car headlight are several—(1) The elimination of interference in receiving sets in the neighbourhood listening to other stations. (2) Secrecy in war time. (3) Great reduction in the power used. Just imagine the size of the lamp required in a motor-car to give the same illumination in front if it were entirely unshielded and placed on the hood!

As was explained in the article on fading, if wireless waves strike a flat conducting surface they will be reflected like light from a mirror. If, then, we surround the aerial by a mirror like that of a motor-car headlight, we will reflect the waves in a beam. There are however, two main difficulties in the way—(1) The aerial must be small compared with the reflector. (2) The reflector must be large compared with the wave length. These seemed insuperable at the beginning of the investigation—about 20 years ago—but with modern progress in the production of short waves it has been found quite feasible, as the new Post Office beam stations in Australia, Canada, and India have proved.

In order to keep the aerial small with regard to the reflector it was made without a "top," that is, the aerial consists of a vertical wire rising straight up. The reflector consists of a flat sheet of metal (or a form of wire netting) surrounding the aerial, as shown in fig. V. When the waves hit the reflector they are projected in the form of a beam directed towards the receiver. When these waves hit the receivers reflector they in turn are reflected back on to the receivers aerial when, as will be seen from figure VI, they will be highly concentrated, and a loud signal will be heard.

Other methods of directing the waves in a particular direction have been tried, the only one worth mentioning now being the inverted L type. This aerial will both transmit and receive, with a preference in the direction opposite to that in which the flat top is pointing, but this preference is not noticeable unless the length of the top is at least ten times its height, so that with an aerial 20 feet high no appreciable effect would be obtained unless the top were 200 feet long. So that to all intents and purposes the L aerial of normal dimensions will receive equally well from all directions.

It has been stated earlier in this article that waves if they are strong enough will affect the most sensitive and selective of sets. The atmospheric being untuned will break through the best of sets, but we can if we take suffieient care cut out a near-by station fairly satisfactorily. If we go back to the condenser and coil and apply an oscillating pressure of the correct frequency an oscillating current will flow from one plate of the condenser through the coil to the other plate and back again. This current surging backwards and forwards through the coil produces an oscillating magnetic effect which can be used to induce similar currents in neighbouring coils as has been explained.

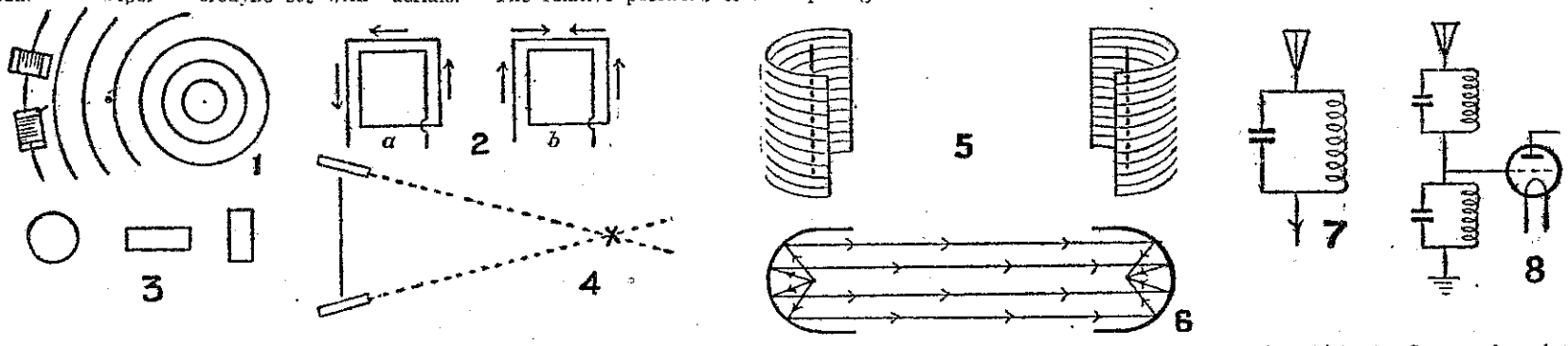
This effect will prevent any current from passing through the apparatus, as shown by the arrows of figure 7, because any electricity getting through the coil will be swept along by the surging current on to the condenser plate.

If a higher frequency is applied, then it will not be able to pass through the coil, due to its choking effect, and will pass through the condenser with ease. A lower frequency will flow through the coil and leave the condenser alone. But the correct frequency will find great difficulty in passing through, and will pile itself up on the plates, thus producing a high pressure, which in the receiving set is used to operate the grid or the crystal. We have then the peculiar state of affairs that an arrangement as shown will act more or less like an insulator to a particular frequency, and will prevent that frequency from flowing through.

Here, therefore, is the secret of the wave trap. If we fit an arrangement like this in the aerial of our set and tune it to the frequency of the station which we wish to cut out, then all other signals will pass through to our receiving set, but this one will be stopped (figure 8).

Since the wave trap is always most useful at frequencies close to those which we wish to receive, it follows that its tuning must be exceedingly sharp, and this means that resistance must be as small as possible. The wire should be very thick, ¼in. diameter is quite small for this purpose—nothing will be ridiculous, and all joints must be soldered. Because of the large wire the number of turns will be limited, and the condenser should therefore be large, and, of course, should be of good quality. If these points were considered more there would be less complaints of weakened signals or incomplete trapping.

One must take care also to see that the coils of the receiving set do not act as loop aerials, and thus nullify the effects of the wave trap. They, or perhaps better still the whole set, should be shielded by a coating of copper or tin foil, which should be earthed so as to keep the waves out. Also the wave trap should be as near the set as possible, and the earth wire kept short or else be shielded also.



The Children's Corner

By "ARIEL"

Dear Family,—Here we have our final inmate for the Zoo, and a truly extraordinary creature he is! As I told you last week, we are closing it down just for the summer months. Next winter I hope you will all break out into bright ideas! Several letter writers tell me they are looking forward to winning Zoo prizes when we open up again.

I think we have made a wonderful little collection, and I am very proud of my artists.

I will think of some new competitions for you soon—some nice easy ones that don't take very long to do, because most of your spare time must be spent in the out-of-doors now, as I remarked last week. How many of you have crystal sets? And have you ever wondered what it is that makes a crystal sensitive? It is the sulphur contained in the crystal that allows an electric current to pass through it. So you see, that is probably why your crystals are more sensitive in some spots where there is a large deposit of sulphur than in others where it is scarcer.

Are you beginning to think about Christmas holidays, and making lots of wonderful plans for them? What a lot of lovely, exciting things you will have to tell me when they are all over!

It's great to have a holiday to look forward to, and it's a wonderful thing to be able to do all the scrumptious things we've been wanting for such a long time, but don't you think that sometimes the most exciting part of all is the coming home again at the end? Aren't you eager to see if everything looks the same as when you left, and don't you race into the garden to have a peep at your favourite nooks and corners? Don't you love to smell the dear old familiar smells about the house? Of course you do, for after all, there is no place anywhere that is quite so interesting as home.—Your

ARIEL.

A LETTER OF THANKS

Dear Ariel,—I was very glad to know I had won the squealer prize, as I had been trying to draw a good enough inmate for your Zoo for some time. I am fond of drawing and so is my brother, and we hope to send some animals in next winter. We like the children's corner and always read it when the "Record" comes.—Will Hodgson, Picton.

Answer to Letter.

D. Ridler, Tinakori Road, Wellington.—The result of the Pokkit and Pykk painting competition was published in the "Radio Record" on September 2, but perhaps you were not watching very carefully. If you look back you will see that the prize was won by Mervyn Jillings.

THE NIGHT EXPRESS

Each night, as soon as bedtime comes,
We step aboard the train
That whisks us off to Sleepyland,
And brings us back again.
The Dustman waves his wand and—well,
Before you understand
What's happening, you're halfway there
To sleepy Sleepyland.

E. L. R.

SOME MORE OF BROTHER BILL'S LIMERICKS

There was once a young man of Calcutta,
Whose set would do nothing but splutter,
After trying for weeks,
He got nothing but shrieks
So he pitched the whole thing in the gutter.

* * *

Said the cat at the town undertaker's
When asked by the cat at the baker's,
Why he had sheared
Off his beautiful beard,
"I now grow for the crystal-set makers."

* * *

A girl, whatever possessed her,
Dispensed with a lightning arrester.
The lightning one night
Set the whole house alight,
You should have heard how her poor father blessed her!

THE DISHONEST DAIRYMAN

IF THIN MILK BRINGS ILLICIT TIN,
I THINK I'LL SKIM IT, MIX IT, TILL IT'S THIN.

OUR WIRELESS ZOO—No. 6: "THE SURPRISE"

This is our No. 6 Animal. He is the last of the season, for the Zoo is closing down till next winter. The prize goes to Mary Steele, 10 Test Street, Oamaru.

THE SURPRISE

This freak of nature, above you see,
Was cast up from the depths of the sea,
For "Ariel's" Zoo he'd make a fine prize,
This hideous animal called a "Surprise."

Mary Steele.

THE ADVENTURES OF HENRY

Henry was a good boy, particularly good at doing exactly as he was told, never waiting to be told a second time. Even his parents said he was a good boy, and they ought to know, for they have had him for twelve years. One day Henry was busy in the kitchen hammering nails into his new rabbit hutch. His mother had a bad headache, and at last she said, "I can't stand that noise any longer. Run away, there's a good boy." So Henry, like the good boy he was, ran away; but before running, he took half a loaf and some cheese, and a nice mince pie also. Then he started running, and ran till he was tired. Then he sat down and ate the mince pie, and started running again till he was tired. Then he sat down and ate most of the bread and all the cheese. He got up and ran again. Only a short distance this time, and then he finished the bread, and tried to run again, but couldn't. Then he began to cry. A big boy came along and asked what he was snivelling for, and did his mother know he was out? Henry told him that she did, and the big boy punched his head for being cheeky. Presently Henry met another boy, and asked his way home, and that boy told him to follow his nose, and ask a policeman. Henry could not see a policeman, so he followed his nose, which led him into an orchard. Now some bad boys had broken into that orchard the day before and stolen some apples, and the man that owned the orchard was behind a tree watching. Of course, he dashed out and grabbed Henry, saying, "Now I have got you!" And Henry said, "Yes, he had." The man said, "None of your cheek. What's your name and where do you live?" Henry told him, but the man did not believe him, and sent for a policeman, who put the name and address down in a book, and to make sure he walked home with Henry. By they time they got there all the boys in the neighbourhood were walking behind, but Henry did not feel a bit proud of heading the procession. Two days later Henry's father got a summons, and when the Magistrate heard the story of how Henry had run away, and also about the mince pie and bread and cheese, he said he had no doubt that Henry was in the orchard for an unlawful purpose, and fined him five shillings and seven shillings costs, which Henry's father had to pay. The magistrate also told Henry's father to advise him to be careful in future. Henry's father did not give him any advice, but on the way home he bought a cane, and next morning Henry ate his breakfast standing up, as there were no cushions on the kitchen chairs. And the schoolmaster made a lot of talk about hypocrites, which Henry could not understand, but as all the other boys looked at Henry and grinned, he thought it must be something to do with him.

One day Henry's mother was out of starch, so she gave him sixpence and sent him to buy some, telling him to "Look sharp." Henry understood about the starch, but not about looking sharp. On the way down the street he passed a scissor grinder, so he asked him if he could tell him how to look sharp. The scissor grinder was not a nice man, for with his finger and thumb he gave one of Henry's ears a sharp twist, saying, "That will make you look sharp, now hook it." Henry rubbed his ear, but as he had no looking glass he could not tell whether he was looking sharp of not. Besides he had been told to "Hook it." Seeing a man fishing in the canal he asked him politely, "Please sir, can you tell me how to hook it." Now the man had been fishing all day without even a bite, so he did not return Henry's politeness, but called him a saucy young monkey, and twisting his other ear told him to "hop it." Henry was on his way for the starch at full speed, when he cannoned against a gouty old gentleman, and kicked his foot. The old boy hopped for a dozen yards, telling all the world what he thought of boys. Henry did not stop to apologise, he was so pleased to learn how to hop it, that he continued on his way, only to find on reaching the shop that he had lost the sixpence. On reaching home his mother wished to know where he had been, and whether she had not told him to look sharp. Henry told her all, and then she sat down on the nearest chair and advised Henry to wait until his father came home. Henry thought it best to wait in bed, but he chose to stand up for breakfast again.

(To be Continued.)