Further Points on the Static Problem

Graphic Explanation of Various Phenomena

By "M.I.R.E."

IN continuance of a discussion relative to methods available for the reduction of static interference with radio reception, there are several considerations worthy of mention in view of the fact that they are simply explained and especially because there are points easily understood by the average user of certain types of receiving apparatus which are capable of developing the particular symptoms about to be described.

As the readers of the last two issues of this column will understand, the most effective method of reducing static, or in other words increasing the signal to static ratio in favour of signal, is to use an aerial capable of receiving only in the direction of the incoming signals and to be non-receptive in the direction of the static, static being aether waves just as the signals are, of course, if the static and the signals are both arriving from the same point of the compass, this method of sorting the one from the other fails entirely.

It has been demonstrated that an L type aerial of special design will assist materially under certain circumstances, and in view of the fact that an aerial with a very small electrical height will be quite effective in driving a multi-valve set, this is the most popular method where distant signals are aimed at, and the one it is advised should be attempted seriously.

THE LOOP PICK-UP.

THE simplest directional pick-up is the loop As is well known, the loop consists of a frame-work or "former" on which is wound a coil of wire. This wire may be wound in the form of a spider-web in such a manner that each successive turn has a different diameter, that is, one turn inside the other, or it may be wound with the wires lying side by side and each turn having the same diameter. All designs of loops are made, so that the whole frame-work can be rotated, and the coil of wire caused to point in such a direction as to bring in the loudest signals. When rotating the loop it will be found that there are two places 180 degrees apart where the signals rise to a maximum, and under certain circumstances, of these two positions, one will be found to give somewhat better results than the other. Theoretically the two positions should give equal results, and the reason why they invariably do not is due to well-known effects, which will be dealt with later.

Without indulging in involved technicalities as to why a loop "points" towards the direction of the incoming signals, it may be stated that this action is based on the fact that a loop is responsive to the magnetic effect of the incoming ether waves, in contradistinction to the action of an orthodox aerial, which is responsive to the "eltctro-static" component of the waves, and is responsive at almost any angle. However, the net result is as previously described, and the loop indicates two possible directions, diametrically opposite one another, from which the signals may be arriving. For navigational purposes it is necessary to find which is which, unless the bearings are so well-known that obviously one of them is the correct one. In order to find out which is which, or decide the "sense" of the signals, auxiliary apparatus is used and two readings taken, but this is of no interest from the point of view of static reduction.

INTERESTING FACTS.

IT is of interest in attempting a simple understanding of these phenomena, to lay the facts out graphically. If two circles of the same diameter are drawn in such a way that they are touching one another on their circumferences, it will be seen that a figure 8 has been drawn. Now, if the point where the circles touch is taken as the centre, and two lines are drawn at right-angles, one cutting the two circles in two, the points of the compass, north, south, east, and west, may be marked on the straight lines, such that they form a standard graphical representation of a compass. The circles now represent signal strength with respect to direction, and if, in the case of the graph just described, the loop is pointing north and south, and responding to signals coming from a northerly or southerly direction, it will be noticed that nothing is received from an easterly or westerly direction. If it is desired to receive signals from either of the latter directions, then, of course, the loop is pointed accordingly, and a rearrangement of the figure takes the form of two similar circles drawn with their edges touching at the same spot as before, but their centres are now along the easterly and westerly lines. The lines of zero reception are now north and south. It follows, therefore, that rotation of the receiving loop requires a similar movement of the circles round the graphical points of the compass in order to describe what is happening.

A loop is said to have "Figure of Right" reception, because of this just-described performance.

Now, it has been shown in previous discussions in this column that a T aerial receives equalling well all round the compass. If a diagram of such a performance is drawn, a circle will have to be described, having its centre where the two lines and the edges of the "figure of 8" circles, all had a common point of contact. Obviously this circle denotes equal signal strength at a central point from a portable station moving in a circle round that point. A T aerial is therefore said to have "Circle" reception.

"OVAL" RECEPTION.

AN L aerial, by the same reasoning, will have "oval" reception, but more of the oval will be towards the direction in which the down-leads come down. It is unnecessary to point out that unless the L aerial is of the type described in last week's issue, that is, exceptionally long with respect to height, the oval will not be very narrow nor will it be definitely located more in one direction than the one immediately opposite, as it would have to be to represent definite directivity. Furthermore, if the aerial is moored in one position the oval diagram will always be a fixed representation so far as a graphical picture is concerned.

An interesting effect is now available for description. A loop also acts as a miniature aerial because it is sticking up in the air a good distance in some cases. The receiver, batteries, and leads, etc., act as a counterpoise or earth connection (in many cases no doubt an earth connection is in use). This little aerial system picks up a surprising signal strength, and it represents "circle" reception. In adding it to the graph a small circle is drawn over the "figure of 8." It will be at once seen that there are two bulges which represent a leakage of signals (or static, which is what is most undesired) into the system from the two directions which received nothing before. Also, if the graph is solved mathematically it will be seen that part of the little circle adds to the big circle, but the other subtracts, and the net result of this is to enlarge one of the circles forming the figure of 8, and to diminish the size of the other. Thus it is seen that it is this effect which causes the loop to show a somewhat greater signal strength in one of the two positions at which it is receptive.

COMBINING THE SIGNALS.

ADVANTAGE is taken of this effect to further improve the fight against static by reducing the size of one of the circles, and this is done by deliberately combining the signals obtained from a loop and an aerial. It is necessary to "phase" the effects from the aerial in order to adjust the signal strength to be the same as that obtained from the loop in order that the size of the "circle" due to the signals from the aerial will have a radius equal to the diameter of one of the circles of the figure of 8 it is combined with. This is done by inserting a nameable resistance of several hundred ohms (this will vary according to wave-length) in series with the aerial. The effects of aerial and loop are combined by feeding a common secondary attached to the receiver from the primaries, one being in the loop circuit and one in the aerial circuit. Actually the diagram of reception obtained by combining circle with figure of 8 reception is a figure exactly the same as a heart. Such a combination is called "heart-shape" reception. The core of the heart is the centre and the heart revolves with the loop, and the pick-up of the combination is that of the loop and aerial added together. By drawing a diagram of a heart on a compass, as was done previously, it will be seen that signals (or static) can only come in from one direction, and this single direction is regulable by simply rotating the loop. Of course, owing to the series resistance in the aerial circuit (and this resistance, by the way, must be non-inductive) the aerial will not give its normal impetus to the receiver, but will deliver the same signal strength as the loop when "phased" correctly, and this means that the total pick-up of the system will be twice that obtainable from the loop.

RESULT OF RE-RADIATION.

SIGHT should not be lost of the fact mentioned in a previous article that re-radiation of signals from metallic or other objects in the vicinity of the receiver will cause loss of definition of direction, and that the shorter the wavelength being received, the more indefinite will become the direction. On standard broadcast wavelengths, however, the effect is quite marked, and very considerable relief may be obtained from both static and induction. This effect of re-radiation is most noticeable if a loop set is in operation near to an aerial, and even if the aerial is out of commission by being disconnected from a receiver or even earthed through a resistance to damp it, it will invariably be found that the maximum signals will be available when the loop is pointing to the aerial, and this direction may be at right angles to the true direction of the transmitter.

A very simple method of getting a crude but effective "heart shape" is to join the aerial lead on to the loop either directly, through a series fixed condenser, or by just laying the wire over the loop or receiver. There should be no earth connection from the receiver. Under these circumstances the loop will be energised by the aerial, and will give wonderful signal strength. There will still be two positions on the loop where signals will come in, but one will not be as definite as the other. Under circumstances of bad static, reception will often be found possible under these circumstances, whereas with the aerial direct there will be nothing but clatter and on the loop alone. The strength will be too small for comfortable reception.

BATTERY ELIMINATORS

SUCCESSFUL DEVELOPMENTS.

One of the chief technical developments which has been made in the construction of wireless receivers in the last year has been the steady improvement in equipment to enable the set to be worked from the electric supply mains. For some years an eliminator for the high-tension battery has been on the market, but early types of high-tension battery eliminators lacked the flexibility of a high-tension battery, and as they were also rather expensive they were very little used. Many improvements in detail have now made a battery eliminator a far more satisfactory source of high-tension supply for a large receiver than a high-tension battery, and the chief fault with the early models—a tendency for some of the hum or ripple of the electric supply service to make its way into the receiver when a heavy current was drawn from the eliminator—has now been entirely overcome. Prices of completed eliminators are still high—higher, in fact, than they should be in proportion to the cost of other wireless equipment, but so wide a range of moderately-priced eliminator parts is available that a person can assemble one of these units at home at a reasonable outlay.

"A" BATTERY ELIMINATED.

From a technical point of view the progress made in the elimination of the low-tension, or A, battery has been more interesting than the development of the high-tension eliminator. Comparatively little difficulty is experienced in rectifying and smoothing out into a direct current the alternating current having the necessary characteristic for high-tension supply, because the intensity of the current necessary is very small. The opposite, however, applies to a current for filament lighting. Because the necessary pressure is low it is difficult to produce an efficient rectifier for converting the current for filament supply from an alternating to a direct current, and because the necessary current intensity is comparatively high an efficient rectifier would need to be bulky and expensive. These difficulties have been so grat that except in one or two special cases the attempt to rectify and smooth an alternating current for filament supply has been abandoned, and attention has been concentrated on the application of an alternating current supply direct to the valve without introducing into the receiver the hum of the alternating current supply. Many different kinds of valves have been produced in the last year which will work effectively from alternating current. These valves differ materially from ordinary valves, because the filament proper is surrounded closely by a sheath of very light metal which is not in electrical connection with the filament. The grid and the plate of the valve are placed outside this metal sheath. The filament, which is heated from a small transformer working from the electric supply mains, plays the part of a radiator, which heats the sheath surrounding it to a very dull red heat. This sheath is treated with the energising material used in dull emitter valve filaments, and when heated in this manner it takes the place of an ordinary filament. By the use of this arrangement the alternating current supply is used to do the necessary heating work in the valve without being actually connected into the receiving circuit proper, and it cannot interfere with the ordinary working of the set.

LOUDSPEAKER CORDS

SOURCES OF TROUBLE.

The loudspeaker cord is such an insignificant part of the wireless set that few ever give it any consideration. Yet it is sometimes the cause of much crackling, which many imagine to be static. Speaker cords are made of very fine copper wire, twisted with a piece of cotton thread. The whole assembly is covered by a woven cotton or silk braid.

Sometimes one of these minute wires will become broken, and any movement of the cords will cause a scratching sound in the speaker or 'phones. Such a noise will be located when the 'phones are shaken.

During damp and rainy weather, or around the sea shores, the fibre covering the conductors may become moist and leaky and cause noises in the speaker. This trouble is harder to find, for if we check the parts of the set with the speaker connected, as the noise will still be prevalent, it it likely to be assumed that it is caused by static.

As a protection against such trouble, a speaker cord with rubber insulation should be used.

Grasping a 'phone cord and not the 'phone tip when withdrawing it from a plug will often cause scoring of the delicate wire, with consequent breakage and noises in the set. By connecting a small lamp in series with the 'phones or loudspeaker, and a small dry cell, flickering of the light will occur when the cords are moved around in the case of a broken wire.

If you are troubled with hand capacity effects in the 'phone or loudspeaker cords, a small fixed condenser connected between A positive and a separate earth will either eliminate or minimise the trouble.