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Theory and Construction of Frame Antennae

Ideal for Summer Conditions

OWING to the character of the atmosphere during summer, reception is more or less uncertain. There is always a great deal of static which is picked up by the aerial and passed into the set much to the annoyance of all who listen-in. Static, as has been explained before, is the result of charges of electricity present in the air in greater or in smaller quantities according to the degree of ionization of the air.

The longer the aerial the more static is picked up, and it is apparent that if reception during the summer is to be enjoyed, the aerial must be reduced in length.

DUE in no small measure to the prevalence of static, conditions for radio reception are adverse during the summer months. This to a very large extent can be overcome by the use of a loop antenna. The accompanying article tells how a loop works, how it differs from an aerial, and how to build one.

If we imagine this reduction to go on until the aerial is so small that both static and signal strength have been reduced considerably, we get the first function of the loop antenna. In any aerial system the portion which connects the greatest degree of signal strength is the vertical part. Suppose we have a loop of wire arranged as shown in Figure 1, the vertical portion A-B will pick up a small amount of energy from the transmitting station. The horizontal position A-C and B-D will likewise pick up energy, but not to the same extent. If the antenna takes a square form as indicated in the diagram, there will be presented to the oncoming waves two receptive surfaces, A-B and C-D. Oncoming waves will then strike first one edge of the loop and then pass across to the other side. As a wave strikes the nearest side of the loop, a voltage is generated. The wave then travels across to the other side and causes an equal voltage on that side. The two voltages oppose each other in phase. Both voltages tend to force a current up, or both tend to force it down on both sides of the loop. If the currents reach the points E and F at the same time they will cancel out one another and the loop will be ineffective. The only reason the loop delivers any signal is because the two voltages generated on the opposite sides are not generated at the same time. The voltage on the side of the loop towards the transmitting station will rise to its maximum before the one on the side distant from the station. There is, then, a difference of phase between both sides when they are in the position indicated in the diagram. Because of this difference in the voltage produced a certain amount of signal strength is available. Obviously, therefore, the voltage, even in the maximum position, will be extremely small.

Were it possible to build a loop with its sides so far apart that they would be separated by one half the length of the wave we would have ideal conditions, because the rise of the wave to positive voltage would then act on one side of the loop while the increase of the wave in negative voltage acted on the other side. This, however, is not practicable, and some compromise is necessary.

The higher the loop the greater will be the length of the vertical side. The greater the length of wire exposed to the radio wave the greater will be the voltage gnerated. Therefore, the higher the loop, or the longer its vertical sides, the greater will be the signal strength received. The signal energy received by the loop increases with the increase in the number of turns or the increase in the inductance of the loop. The signal energy increases with the decrease of the resistance of the loop. The resistance of a loop increases rapidly as its natural frequency is approached.

The natural frequency is the resonance produced by the inductance of the loop and its distributing capacity. For best results the frequency of a signal must be equal to at least one-third the natural frequency of the loop. For frequencies closer to the natural frequencies the results will be unsatisfactory. Therefore, for high frequency (or short waves) the operation of a small loop would be better than a large one.

The capacity in between parts of the loops cause it to act as an ordinary antenna as well as a loop for it is generally understood that an ordinary aerial and earth system obtaining its energy by virtue of its being a species of huge condenser. For this reason, the actual strength of signals received by the loop is always greater than a calculated signal. The aerial effect is one reason why the signal from the loop can never be reduced to zero, no matter how the loop is turned with reference to the direction of the incoming signal.

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