THE EDDYSTONE CROSSFEEDER AERIAL SYSTEM

FOR NOISE-FREE SHORT WAVE RECEPTION

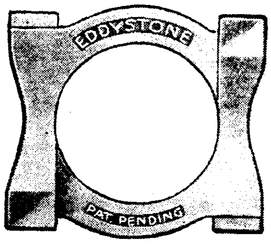
A short wave receiver, more than any other type of broadcast receiving apparatus, is frequently called upon to reproduce weak signals from a far off source. This necessitates that the receiver be operated in a sensitive condition with a maximum of amplification. Under such conditions, local man-made interference (caused by electric fans, refrigerators, flashing signs, small electric motors, and electric mains switch noises radiated from the house wiring), constitutes a source of considerable nuisance.

There are cases where even a strong short wave signal is spoiled by such interference, but there are many more instances where weak short wave signals, which even so should be clearly and audibly reproduced, are completely drowned and cut up by this man-made static. Now if the signal to noise ratio when receiving on the short waves can be considerably improved and man-made static practically eliminated as compared with the received signal, a tremendous improvement in reception is achieved. Following on lines of research in this direction, the Eddystone Crossfeeder Aerial System has been developed on the following principles.

The average owner of a short wave set seems content to use any type of aerial, and often the better the set in use, the lower the efficiency of the aerial system. Yet it should be the aim of every short wave listener to

Fig. A. **Showing Crossfeeder Aerial System in use at Eddystone Works.**

erect a really first class aerial, using efficient wire and high class insulation. It is easily realised that if an increase of signal voltage can be introduced from the aerial to the first valve, this increase times the amplification of the set will show up as a much increased output in the loud speaker. The first essential of the Eddystone Crossfeeder Aerial System is that it shall be absolutely efficient as far as materials and insulation is concerned. Next comes the elimination of man-made noise. Experience shows that even in the centre of a busy city, if an aerial is erected high up, unscreened, and the set is used quite close up to the aerial, there is a large reduction in the noise level. This proves that the lead-in wire is responsible for picking up the greatest



Eddystone Crossfeeder Block.
List Price, 8d.

portion of noise, all the more since interference radiated by certain electrical machines and ignition systems consists of vertically polarised rays which are picked up to a greater extent by the vertical lead-in wire than by the horizontal aerial. If a type of lead-in can be utilised that is a non-collector of energy, the problem is considerably solved.

The Eddystone Crossfeeder System of lead-in and doublet aerial is, therefore, employed, as shown in Figure 1. In this, the lead-in consists of two wires which are crossed over by means of the crossfeeder blocks at regular intervals. By this method, the signal voltage induced in one line is 180° out of phase with that in the other. The pick-up from each lead is impressed on the coil at the bottom of the system, where cancellation takes place. The lead-in thus becomes a conveyor only of the energy from the aerial proper and is itself not a collector. It is of definite importance that the lines should be crossed instead of running parallel in order that the amount of voltage induced in each lead shall be exactly equal, which would not be the case if one lead was nearer the source of noise than the other. Normally, it is sufficient to cross over the leads every 2 ft., but if the interference is very intense, this distance should be reduced to 1 ft. 3 ins.

The use of this crossfed lead-in enables a horizontal type of doublet aerial to be employed. The two sides of such an aerial form a complete collector system in themselves without earth connection and they can be erected high up out of the noise field since the length of the crossfeeder line is not important. On the other hand, the collecting system of the conventional single wire aerial with earth connection comprises the single wire as one side of the arrangement and the earth as the other. This ether dielectric condenser forms a great storehouse for man-made static through which the ordinary energy collecting lead-in is usually run. When it is also considered that the earth wire itself may be responsible for picking up or introducing noise, the advantage of the doublet aerial which requires no earth connection can be further appreciated.

With regard to directional properties, the doublet aerial receives energy best from directions at right angles to its own line of direction, being the opposite to the single wire type. When difficulties of erection are experienced in putting up a balanced doublet, an inverted L type of aerial can also be used with crossfeeder lead down, as shown in Figure 2, but this type of aerial is much more directional, its greatest pick-up being from the direction in which the lead-in end is pointing.

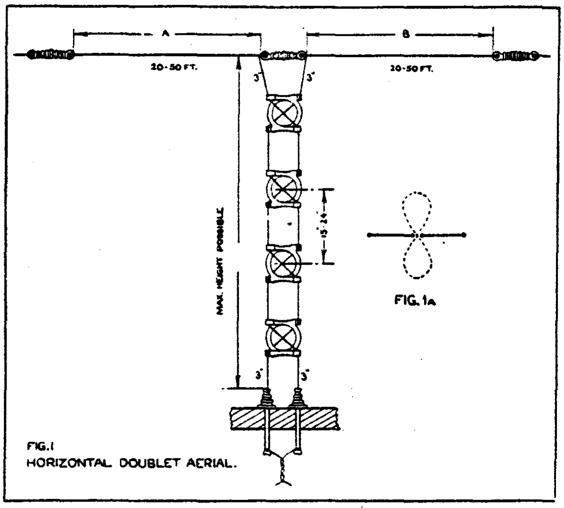


FIG. 1
HORIZONTAL DOUBLET AERIAL.

The doublet type of aerial is a form of Hertz aerial well-known to radio transmitters, and as such, the two top sections can be cut to a definite length to give maximum response on certain frequencies. An aerial cut to give maximum efficiency on a certain frequency band will still give as good results as an ordinary aerial on wavelengths outside this band so that it is worth consideration when erecting an aerial to cut the top section to a length which will be in resonance with the station wave which it is most desired to receive consistently. To cut the top lengths A and B, in Figure 1, correctly for any given wavelength, their combined length should be one half of the wavelength under consideration. The formula for working out the length necessary for any given frequency is :—

$$\text{Length in feet} = \frac{468{,}000}{\text{Frequency in Kc/s.}}$$

As an example, the Empire station GSC on 31.297 metres or 9,585 Kc/s per second would require :—

$$\frac{468{,}000}{9{,}585} = 48.8 \text{ feet, total length of top wire.}$$

This would mean the two top sections would be 24.4 feet each in length.

Figure 7 is a small graph showing the approximate length of top against wavelength. An aerial designed for a wavelength of 31.3 metres would also have a resonant peak at 15.65 metres, due to the harmonic condition. Similarly, an aerial cut for 80 metres would have harmonic resonances at 40 and 20 metres.

The length of feeder line from the receiver to the aerial is not of material consideration for general reception except that it must be over ½ wavelength in length.

GENERAL AERIAL INFORMATION.

Figure 1 shows the general lay-out for a horizontal doublet, which is recommended wherever possible, and Figure 2 for the inverted L type of aerial, which it may be necessary to use if the former type is not possible owing to space conditions. Figures 1A and 2A show the greatest field strength of the aerials and also illustrate their directional properties. It should be clearly understood that the Eddystone Crossfeeder Aerial System does not claim to cut out all noise and static. The point is, however, that if the aerial is efficiently erected with the top high and well above the general range of man-made static, a great improvement indeed of the signal to noise ratio is obtained and also some improvement in the elimination of true atmospherics. Figure A shows a doublet aerial with Crossfeeder lead-in erected at our factory, where the doublet top is taken well out of the range of electrical interference. Weak signals can be received on this with perfect readability

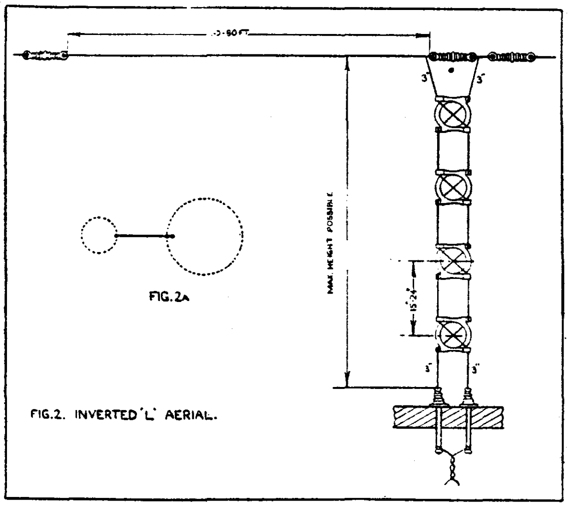


FIG. 2A

FIG. 2. INVERTED 'L' AERIAL.

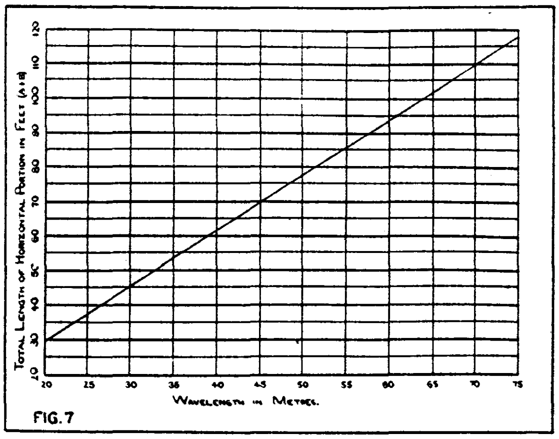


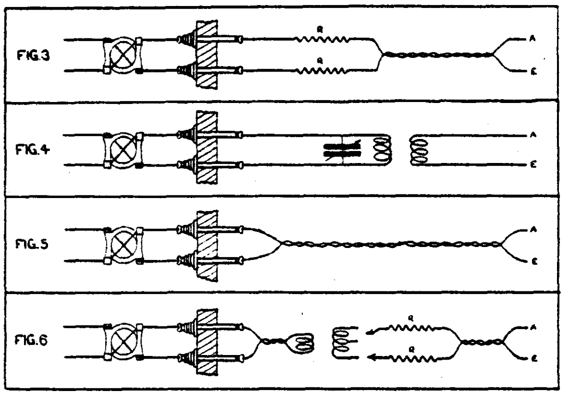
FIG. 7

which are absolutely lost on an ordinary aerial. Attention must also be paid to the receiver itself. If the coils and wiring of this are not screened, much of the advantage of the special aerial system will be lost. In erecting the aerial, it is advisable to thread the wires across the blocks all in the same way and great care should be taken to keep the blocks under constant tension in the wires, since if they fall out during erection, they will most surely be broken.

It is important that the aerial insulators, particularly the centre one in the doublet type of aerial be efficient. Eddystone Steatite insulators should be used.

COUPLING TO THE RECEIVER.

The coupling of the feeder leads to the receiver is a matter which calls for special attention. In the first place, the lead from the lead-in tube to the set should consist of twisted flex. Secondly, no side of the feeder system should be earthed. Figure 3 shows a coupling by means of two resistances, one in each feeder line, taken straight to the aerial and earth terminals of the set. In this case, no earth connection must be used on the receiver. In many cases, this is suitable for short wave reception but not for reception on broadcast wavebands. It is also impossible to use this method if the set is unstable without an earth. This system is very satisfactory when used with sets which already employ an aperiodic aerial coil coupled to the grid coil. In this case, however, the ends of the aperiodic coil are connected to A and E as shown and any



earth connection which already exists on this coil must be disconnected. The earth connection to the set in general, however, can still be retained. The value of the resistances can be between 200 and 1,000 ohms. In theory, a smaller resistance is more efficient on short wavelengths, but in practice, very little difference is found.

Figure 4 shows a transformer coupling. This can be effected by coupling a suitable coil to the grid coil of the receiver. This coil may either be aperiodic or tuned as shown in the diagram. Tuning is not generally necessary.

Figure 5 is a modified version of Figure 3, with the resistances omitted, and the remarks made in the case of Figure 3 still apply.

Figure 6 shows a transformer coupling which is connected to the aerial and earth terminals of the receiver. The resistances may either be used or omitted according to circumstances. This method of coupling is critical since the ratio of the transformer requires careful design for different wavelengths.

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