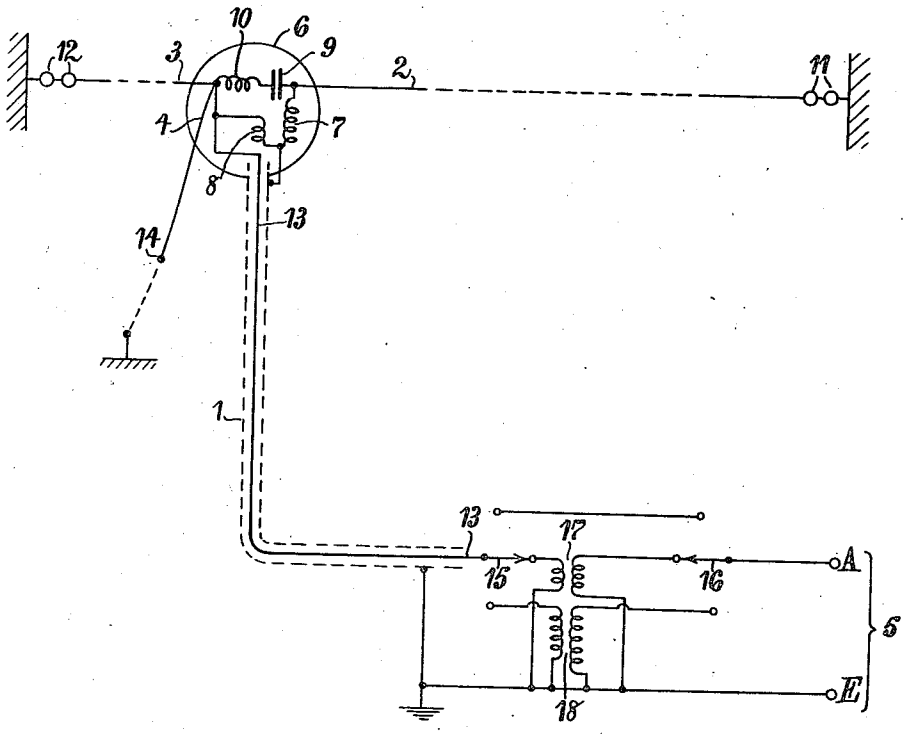
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WIRELESS-AERIAL SYSTEM

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WIRELESS AERIAL SYSTEM

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The present invention relates to wireless aerial systems and has particular but not exclusive reference to receiving aerial systems capable of operating over a wide band of wavelengths.

In the case of broadcast receivers, it is usual to employ a single aerial which is tuned by inductance and capacitive elements contained within a receiver, the wavelengths employed for broadcast purposes being such that no critical dimensions are necessary for the aerial itself. With the increase in the number of transmitting systems covering an extremely wide range of frequencies from very short waves such as are used in television systems, to the long waves employed by some broadcast transmitters, it has become desirable from the point of view of efficiency to provide aerial systems which are designed to operate over selected wavelength ranges.

The object of the present invention is to provide an aerial system which is capable of efficient operation over an extremely wide range of wavelengths.

According to the present invention, a wireless aerial system comprises a first aerial designed for operation over a band of relatively long wavelengths, and coupled by a transformer to a feeder, and a second aerial designed to operate at a relatively short wavelength and connected directly to said feeder. The first aerial may also be capable of operating at relatively short wavelengths, and for this purpose is given a length which is an integral number of quarter wavelengths at the frequencies of the relatively short wavelengths at which it is intended to operate. For the purpose of operation at such relatively short wavelengths, the first aerial is connected to the feeder through a filter network which effectively short circuits the coupling transformer. A further aerial designed for operation at wavelengths of the order used in television systems may be connected directly to the feeder.

The first and second aerials are preferably arranged in a substantially straight line, the adjacent ends of these aerials being attached to a suitable insulator with which is associated the transformer and filter and to which there is connected one end of the feeder, the other end of the feeder being associated with one or more wireless receiving circuits. The filter may be a high pass filter, or it may for example be an acceptor circuit tuned to a desired frequency.

More than one aerial may be connected directly to the feeder so that the efficient reception over several short wave bands may be obtained.

In order that the invention may be more clearly understood and readily carried into effect, a wireless aerial system designed in accordance therewith will now be described by way of example with reference to the accompanying drawing.

Referring to the drawing, a feeder 1 serves to couple an aerial system including aerials 2, 3 and 4 to receiving apparatus 5 and is of the low-loss concentric type having a low characteristic impedance for example of about 80 ohms. The upper end of the feeder is attached to a hollow water-proof insulator 6 which is arranged to house transformer and filter elements 7, 8, 9 and 10, and may be of the type shown in the specification of British Patent No. 444,494. The aerial 2 is a 60 foot length of wire and the aerial 3 a 39 foot length of wire. The adjacent ends of the aerials 2 and 3 are attached to the insulator 6 and the remote ends are supported by insulators 11, 12, which are suitably suspended from two elevated points such as for example, a mast or a chimney. The two aerials thus form parts of a single suspension between the two elevated points.

In the case of a broadcast aerial couple to a receiver through a screened down lead, it is necessary to employ a transformer for coupling the aerial 2 which has a relatively high reactive impedance to the low impedance feeder. A transformer 7, 8 is therefore employed to couple the aerial 2 to the low impedance feeder 1. One end of the primary winding 7 of the transformer is connected to the aerial and one end of the secondary winding 8 is connected to the centre conductor 13 of the feeder 1. The other ends of both windings 7 and 8 are connected to the sheath of the feeder.

It is known in practice that an aerial which is a small odd number of quarter-wavelengths long has an impedance of between 40 and 100 ohms between its end and earth. It is thus suitable for direct connection to the 80 ohm feeder. The 60 ft. aerial 2 which is a three-quarter wavelength aerial at about 30 metres is therefore connected effectively directly to the low impedance feeder 1 at this wavelength through a filter 9, 10 having a low impedance at this wavelength and a high impedance at broadcast wavelengths. The filter may be of the high-pass type having a cut-off at a frequency somewhat below 10 megacycles per second (30 metres) or it may be a series resonant circuit tuned to a frequency of about 10 megacycles per second. In the case of the series resonant circuit shown comprising the condenser 9 in series with the inductance 10 the

capacity of the condenser is preferably not greater than 0.0001 microfarad in order that the efficiency for the shorter waves of the broadcast waveband shall not be unduly impaired. By suitable choice of the value of the condenser 9, it can be arranged that the aerial has substantially greater efficiency over the broadcast wavebands than would be obtained if a plain unscreened down-lead were employed. In an example it has been found that the use of a condenser of 0.0001 microfarad gives an improvement of efficiency of about 10 decibels over the greater part of medium and long waves as compared with an open aerial. As mentioned previously, the filter is preferably enclosed in the insulator together with the transformer 7, 8.

The 39 foot aerial 3 operates as a quarter wavelength aerial at about 48 metres and as a three-quarter wavelength aerial at 17 metres. At other frequencies neither of the aerials 2 or 3 are well matched to the feeder but together they give a reasonably uniform input to the feeder at wavelengths between about 16 and 50 metres.

In order that the aerial system may operate satisfactorily at still shorter wavelengths, for example for the reception of television signals on a carrier of frequency 45 megacycles per second, the third aerial 4 is connected directly to the feeder. This aerial comprises a quarter wavelength conductor attached to the insulator 6, and is allowed to hang vertically. The lower end is connected to an insulator 14 which is suitably anchored. For a frequency of 45 megacycles per second the aerial conductor 4 should have a length of about 5 feet. This aerial may be converted into a half wave dipole fed at its centre by connecting a conductor not shown in the drawing, to the sheath of the feeder 1, this conductor having the same length as the conductor which extends vertically downwards and being supported so that it extends vertically upwards from the feeder.

Signals at wavelengths of the order of 7 metres are received almost exclusively by the direct ground ray which is generally vertically polarised. A vertical aerial as described above is therefore the most effective. Signals received on somewhat longer wavelengths are often received from very great distances and they have then been subjected to reflection, bending and scattering in the ionosphere. The angle of polarisation is therefore very variable and it is more advantageous to consider the physical layout of the system than to take account of the direction of polarisation of the signals to be received although of course if necessary this can be done.

If space is limited, the 60 ft. aerial 2 may be replaced by a 20 ft. aerial which will operate as a quarter wavelength aerial at 30 metres, but this reduces the effective pick-up on broadcast wavelengths. The connections remain exactly as shown in the drawing.

At the receiver end of the feeder the central conductor 13 is connected to the movable contact of one of two ganged switches 15 and 16, and the sheath 1 is earthed. A conducting lead is taken from the moving contact of switch 16 to the aerial terminal A of the receiver. For reception of wavelengths below approximately 30 metres, the moving contacts are placed in the uppermost position, and the central conductor 13 is then connected directly to the aerial terminal A. When the moving contacts are in the mid-position a step-up transformer 17 suitable for reception in the range of wavelengths between 30 to 200 metres couples the feeder to the terminal A. In the lower-most position of the moving contacts a second transformer 18 couples the feeder to the terminal A for reception in the range of wavelengths between 200 and 2,000 metres.

The two switches 15 and 16, together with the transformers 17 and 18 may be housed separately or may be built in the receiver itself. Alternatively the receiver can be built so as to offer suitable input conditions in order that it will operate without the matching transformers 17 and 18. This would be done for example, by providing suitable tappings on the input coils.

The concentric type of feeder as described and shown serves to minimise the pickup of local interference on all the wave bands on which signals are to be received.

By suitably modifying the lengths of the two horizontal aerials 2 and 3, they may be arranged to aid reception at the frequency of the television carrier. For example, the horizontal aerials may give increased reception at the higher television sideband frequencies, thereby effectively flattening the response curve of the system at the television carrier frequency. In the particular arrangement described the 60 foot aerial 2 is effectively three wavelengths and the 39 foot aerial is effectively two wavelengths of the television signals. In this case each presents an impedance of about 2000 ohms to the line and, due to the degree of mis-match, television signals from these aerials are very inefficiently fed to the receiving circuits.

In the above description the shortest wave signals to be received have been called television signals. It will be understood of course that the aerial can be used for the reception of signals other than television signals, and again the lengths of the various aerial elements can be modified according to the frequencies or bands of frequencies which it is desired to receive. More than three aerials may be included in the system depending upon the number of separate wavelengths at which the system is desired to operate.

The aerial can also be used for simultaneous reception of two or more signals of different wavelengths, filter circuits being provided to separate out the different frequencies for transmission to the desired circuits. While use of the aerial has been described in connection with reception, the system may also be used for transmission purposes.

It will be realised that a balanced system can be used comprising a two wire balanced feeder. It will then be necessary to use a balanced aerial system, that is to say, a further set of conductors will be provided, corresponding conductors forming at the short wavelengths, the two halves of a half wavelength dipole.

I claim:

1. A wireless aerial system designed for operation over a band of relatively long wavelengths and also at a relatively short wavelength comprising in combination an aerial, a transformer for coupling said aerial to a feeder for the purpose of long wave operation and means for coupling said aerial directly to said feeder for operation at a wavelength at which said aerial is substantially an odd number of quarter wavelengths long, said means comprising a series tuned circuit resonant at the resonant frequency of said aerial, said aerial being connected to said feeder through the series tuned circuit, said transformer

being effectively short-circuited by the series tuned circuit.

2. A wireless aerial system comprising a transmission line including an inner conductor and an outer conductor, a first aerial for operating over a band of relatively long wavelengths such as the broadcast range, said first aerial having a length which is equal to an integral number of quarter wavelengths at the frequency of a first relatively short wavelength desired to be received through said aerial system, a transformer for coupling said first aerial to said transmission line, a second aerial directly connected to the inner conductor of said transmission line for operation at a second relatively short wavelength, and means including a filter network which effectively short-circuits said transformer at said first named short wavelength for directly connecting said first aerial to said inner conductor.

3. A wireless aerial system according to claim 2 wherein there is provided a hollow insulator, said transformer and said filter being housed within said hollow insulator and the adjacent ends of said first and second aerials are supported by said hollow insulator.

4. A wireless aerial system according to claim 1 wherein there are provided two additional aerials designed for operation at wavelengths different from that of said long wave aerial and means directly connecting said two additional aerials to said feeder.

5. A wireless aerial system according to claim 1 where there is provided a first additional aerial designed for operation at a wavelength which is short compared with the operating wavelength of said long wave aerial and a second additional aerial designed for operation at a wavelength of the order used in television systems and means directly connecting said first and second additional aerials to said feeder.

6. An aerial system comprising a first aerial adapted for operation over a band of relatively long wavelengths, a feeder line, means comprising a transformer for coupling said first aerial to the feeder line, a second aerial adapted for operation at a relatively short wavelength, said second aerial being directly connected to the feeder line and means for adapting the first aerial for operation at relatively short-wavelengths comprising a filter network connected directly between the first aerial and the feeder line, and arranged so as to effectively short-circuit said transformer.

7. An aerial system comprising a pair of antenna wires of different lengths, means comprising an insulation element for connecting one end of one of said wires to one end of the other of said wires, the remote ends being adapted to be insulatingly suspended from two spaced elevated points so that said two wires form a single suspension between the two points, a low loss concentric type feed line, a transformer for coupling the longer of said antenna wires to one end of said feed line, said transformer being effective throughout a range of relatively low frequencies, a filter device adapted to pass a range of frequencies which is relatively high as compared to the range of frequencies for which said transformer is effective of the high-pass type connected directly between said longer antenna wire and the inner conductor of the feed line, said inner conductor being also directly connected to said other antenna wire.

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