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SHORT WAVE ANTENNA

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Fig. 1.

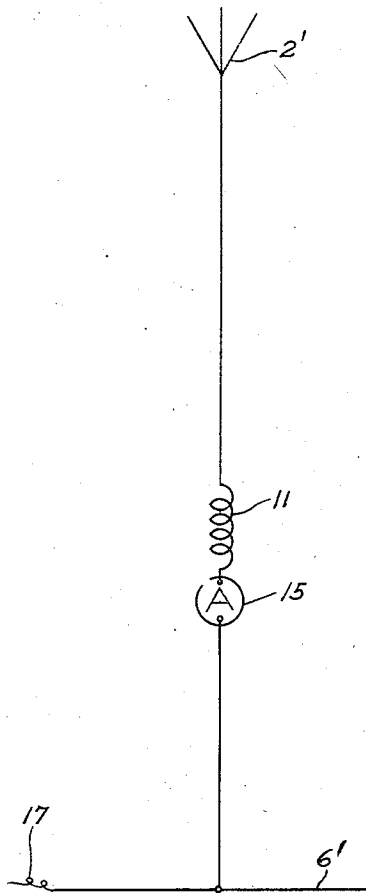
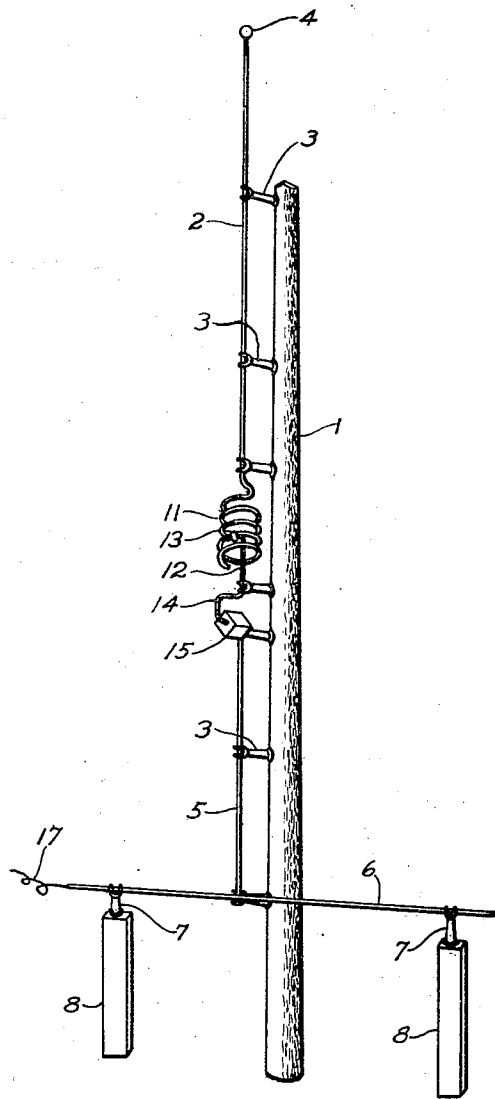


Fig. 2.



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SHORT-WAVE ANTENNA

Application filed January 24, 1925. Serial No. 4,497.

This invention relates to antennæ for electric signalling systems.

It is an object of this invention to produce an antenna particularly adapted to radio systems using short wave lengths.

It is a further object of this invention to provide an antenna which shall be mechanically rigid.

It is a further object of this invention to provide an antenna which may be loosely coupled to the oscillating circuit in the sending device without such loose coupling resulting in variations in the power radiated.

It is a further object of this invention to provide a lead-in-conductor which shall deliver an abundance of power to the antenna without introducing large losses at the point where the lead-in conductor goes through the wall of the building where the transmitter is located.

It is a further object of this invention to so locate a current measuring instrument in the antenna that it shall correctly indicate, at all wave lengths, the current present.

It is a further object of this invention to provide a tuning inductance at that part of the antenna where the current is greatest.

It is a further object of this invention to provide a means for supporting the antenna and counterpoise with sufficient rigidity to prevent movements which might result in variations in tuning.

Other objects of the invention, and details of construction will be apparent from the following description and the accompanying drawing, in which:

Figure 1 is a diagram of an arrangement of electrical conductors useful in the practice of my invention, and

Fig. 2 is a perspective view showing a preferred form of mechanical structure embodying my invention.

As shown on the drawing, the antenna is supported by a stout mast 1, preferably of wood, which will not be moved, to any perceptible amount by the wind or other ordinary causes. A vertical pipe 2, preferably of a fairly rigid conducting material such as hard drawn copper or brass, is supported from the mast 1 by long, heavy insulators 3,

of porcelain or the like. At the top of the pipe 2, a ball 4 is provided to avoid any sharp edges, at which brush effects might occur.

The lower part of the antenna includes a similar pipe 5, to which is joined a horizontal pipe 6 at approximately the middle thereof. The horizontal pipe is supported by insulators 7 which are mounted upon posts 8 so as to support the pipe 6 at a sufficient distance above the ground.

A coil 11, which is preferably of the same kind of pipe, is continuous with the lower end of the pipe 2. A short flexible lead 12 is arranged interiorly of the coil 11 and is attached by an adjustable clamp 13 to one of the turns of the coil 11. At the other end, the lead 12 is connected to a rigid conductor 14 which extends through the ammeter 15 to the pipe 5. The ammeter 15 presents minimum resistance and practically no inductance to the currents flowing in the antenna. For example, it may be of the thermo-couple type. Preferably, the ammeter is in a case, set at an angle whereby it may be more easily read from the ground.

A flexible conductor 17 is united to one end of the pipe 6 and serves as a lead-in conductor, which may, if desired, extend through the wall of the building housing the sending apparatus.

The antenna, therefore, consists as diagrammatically indicated in Fig. 1, of an elevated capacity 2', a counterpoise 6' and a vertical conductor between them, including an inductor 11 and an ammeter 15. The lead-in conductor 17, therefore, extends from one end of the counterpoise 6'.

In the operation of the device, the energy is impressed upon the antenna through the lead-in conductor 17. This conductor carries current which is small compared with the current measured by the ammeter 15. Also, because it is connected to the counterpoise where the potential changes are large and the current relatively small, the field surrounding this conductor is mainly electrostatic rather than electromagnetic. For this reason, the losses introduced by the interaction between this field and the walls of the building will be small.

The potential changes in the counterpoise, induced by the energy delivered over the wire 17, set up oscillations in the antenna, which cause current nodes and potential loops at the upper end 4 and near the counterpoise 6. Near the center of the antenna, there will be a current loop and a potential node. The inductance 11 is located near this current loop in order that it may have maximum effect in tuning the antenna.

The antenna is tuned approximately by so predetermining its size that it will have nearly the desired natural period of electrical vibration. The final adjustment to the exact period desired is accomplished in two steps. For the first of these steps, the counterpoise 6 is constructed longer than the desired wave length requires and is brought to approximately the correct length by cutting off successive portions. For the final adjustment, the flexible conductor 12 is connected to different points of the helix 11 by moving the clamp 13. It will be noted that this method of adjustment makes it possible to make very small changes in the inductance, because the clamp can be moved a small fraction of a turn. The tuning of the antenna can, therefore, be brought accurately to the desired wave length.

In antennæ constructed heretofore, undesirable changes in tuning have been caused by motion of the antenna, such as swaying in the wind. In order that the wave length of the radiated energy may be maintained constant, it has been customary to make the coupling between the antenna and the oscillating circuit loose, and to tune the oscillating circuit to a frequency differing sufficiently from the natural frequency of the antenna to insure stability of the operation of the system as a whole. This has had the disadvantage that when the tuning of the antenna changes, thus changing its relation to the tuning of the oscillating circuit, a marked diminution in the radiated energy occurred. The signals sent out by such antenna were consequently subject to much fading. With the antenna described herein, no unintentional changes in the tuning of the antenna occur and, consequently, the coupling may be made as loose as desired without danger of fading resulting.

The ammeter 15 serves to inform the operator when adjustments are such that the current in the antenna is a maximum. It is, however, desirable for many purposes to know, with a fair degree of accuracy, the magnitude of the antenna current. On this account, the ammeter is placed as near the electrical center of the system as possible. It can be placed elsewhere and a correction factor applied to its readings to determine the actual current in the antenna but, if the ammeter be more than a small distance from the electrical center, this correction factor

will change materially with different wave lengths and the operator cannot readily ascertain the magnitude of the antenna circuit. This difficulty is avoided by the location of the ammeter at the point described. The correction factor will then be so small that its changes, with differing wave lengths, can be ignored without serious error.

It will be obvious to those skilled in the art that many variations in details of construction can be made without departing from the spirit of this invention. Therefore, the fact that I have specifically described but one form of antenna is not to be construed as a limitation.

No claim is made in the present case to the combination of a radiating circuit, complete in itself and connected to the oscillating circuit by a link circuit which carries only the energy component of the current in the antenna, because this combination is claimed in my copending application, Serial No. 66,703, filed Oct. 5, 1923 and assigned to the Westinghouse Electric and Manufacturing Company.

I claim as my invention:

1. A radiating system comprising a vertical member, a counterpoise comprising a single straight rigid horizontal member extending on both sides of said vertical member, and means connected to said radiating system at said counterpoise for impressing high frequency energy thereon.

2. In combination, an antenna system comprising a rigid vertical portion and a rigid horizontal portion connected thereto, the characteristics of the system being such that a voltage loop occurs thereon in the vicinity of said horizontal portion when the said system is energized at its natural period, and means connected to said horizontal portion for supplying energy to said system.

3. In combination, a vertical rigid antenna, a horizontal rigid counterpoise connected to the lower end of said antenna, means for insulating said antenna and counterpoise from ground, and means connected only to said counterpoise for delivering energy thereto.

4. An antenna system having the form of an inverted T the elements of said system being constituted by rigid tubular conductors, the vertical portion of said system serially including a tuning inductor, and means for immovably and insulatingly supporting said system with respect to the earth's surface.

In testimony whereof, I have hereunto subscribed my name this 21st day of January 1925.

FRANK CONRAD.