June 18, 1940. C. W. HANSELL 2,205,358

ANTENNA

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Fig. 1

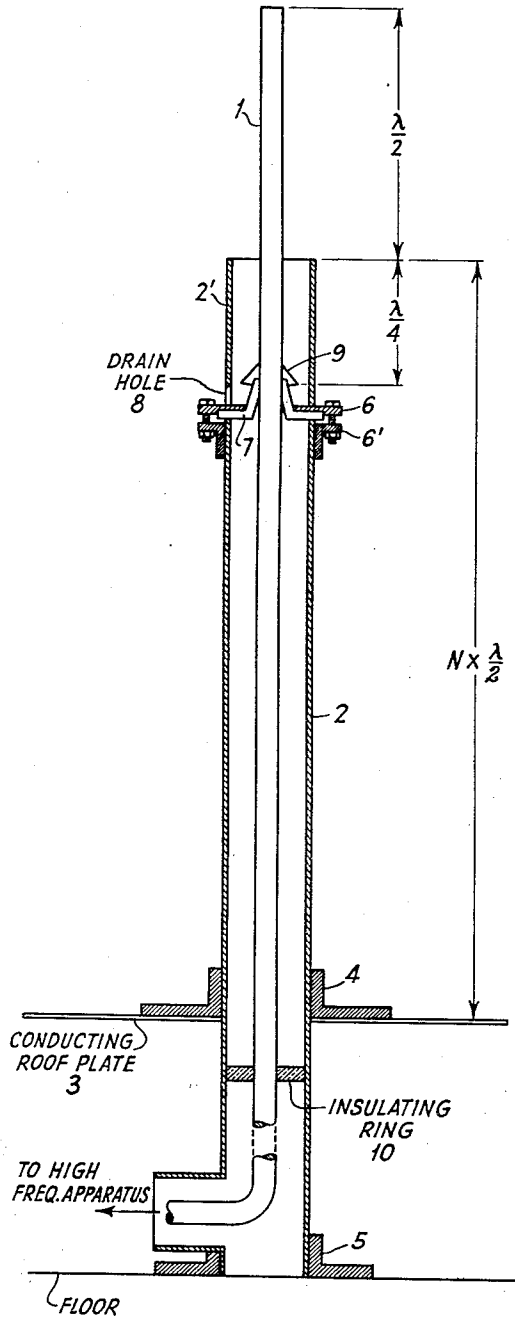
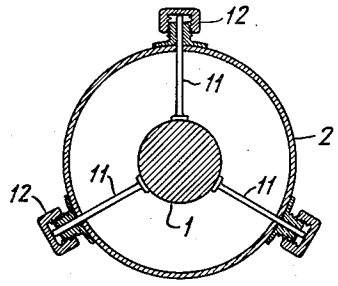


Fig. 2



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ANTENNA

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10 Claims. (Cl. 250—33)

This invention relates to antennas, and particularly to a vertical antenna structure adapted for use on buildings.

Heretofore, the arrangement of and support for vertical antennas have not been suitable for use on the tops of high buildings without great elaborateness of structure. Among other things, it was found that the insulation for the radiating antenna element and its associated conductors gave trouble because of leakage in all but the most favorable weather and because of dielectric losses and liability to failures in the insulation.

The present invention is an improvement over previous types of vertical antennas and provides a highly simplified antenna structure possessing excellent electrical features. One feature of the invention lies in placing that portion of the antenna insulation which is exposed to weather at a low potential point in the antenna system.

The following is a detailed description of the invention in conjunction with a drawing wherein Fig. 1 shows a preferred form of vertical antenna structure in accordance with the invention, and Fig. 2 is a detail or cross-section of an antenna system showing a stand-off insulator which may be used between concentric conductors to restrain the inner conductor from undesired movement with respect to the outer conductor.

Referring to Fig. 1 of the drawing, there is shown an antenna 1 having an effective portion which is one-half wavelength long at the operating frequency, and which is supported by a pipe 2, preferably copper, brass or bronze, of sufficient diameter and thickness to safely absorb the most violent stresses to which it may be subjected by the highest wind pressures. Pipe 2 extends through and above a conducting roof plate 3 of the building, atop which the antenna is to be mounted, for a distance effectively an integral number of half wavelengths based on the frequency utilized. The pipe 2 is secured to the roof plate 3 by means of a suitably massive flanged collar 4, and the lower end of the pipe may be secured against movement by means of a similar flanged collar 5 attached to the floor below the roof. If desired, that portion of pipe 2 which extends below roof plate 3 may, if near a massive wall, be secured to the wall by means of suitable V connections or braces.

The upper part of copper pipe 2 is divided to provide a sectional portion 2' for a distance equal to or a little over a quarter of a wavelength, as measured from the upper end. Sections 2 and 2' are provided at the adjacent ends with flange plates 6 and 6', as shown so that an insulator 7 may be clamped securely therebetween for making the structure weather tight. One or more drain holes 8 are cut in the upper section 2' near the flange 6 to enable rain water entering the open top of section 2' to drain from above the insulator 7.

Antenna element 1 is a suitable copper or copper plated rod or pipe which extends through the insulator 7 a distance equal to effectively one-half wavelength above the open top of the section 2' of the outer pipe 2.

Attached to that portion of antenna element 1 which extends within section 2' is a rain shield 9, the lower edge of whose skirt is effectively close to three-quarters of a wavelength from the uppermost end of antenna element 1. Shield 9 shelters a portion of the upper end of the insulator 7 from rain water which may otherwise run down the radiating element and wet the whole insulator.

Insulator 7 is located effectively near or at a low voltage point on the concentric conductor line or connection to the antenna element 1 in order to protect the insulator from electrical stress. Other insulators, such as 10, may be supplied below the roof line for spacing the inner rod from pipe 2 and these should preferably also be at minimum potential points. Of course, stand-off insulators may be used which are fastened to the wall of the pipe 2 and extend inwardly so as to restrain the inner rod from flexural movement. The latter arrangement is shown, by way of example only, in Fig. 2 which discloses three insulating rods 11, 11 arranged between the outer conductor 2 and the inner conductor 1. The rods 11, 11 are each fastened to the outer conductor by a suitable adjustable screw device 12.

When the antenna system is in use for transmitting electromagnetic waves it is desired that, so far as possible, radiation take place only due to currents in the upper half wavelength portion of the radiating element 1. To accomplish this the total effective length of the outer pipe 2 and 2' above the roof plate should be an integral number of half wave lengths. This most nearly detunes the outer pipe and prevents building up large currents on its outside surface. Effective lengths of an odd number of quarter waves would cause maximum current on the outer surface of the outer pipe and usually should be avoided. Of course, the foregoing principles also apply when the antenna is used for receiving purposes.

It will be understood that the invention is not

limited to the precise details of construction shown since various modifications may be made without departing from the spirit and scope of the invention. For example, it is possible to apply a reactance of any suitable form, at a proper point, between the inner and outer conductors of the concentric conductor line connected to the antenna, for the purpose of matching the effective impedance of the antenna to the surge or characteristic impedance of the line. The principles of impedance matching are shown in United States Patent No. 1,909,610, issued May 16, 1933, and United States Patent No. 1,623,996, issued April 12, 1927 to Philip S. Carter. Also, in many cases, the concentric conductor line below the roof may be extended a relatively long distance to the transmitter or receiver.

The term "multiple of a half wave" mentioned in the specification and appended claims, it is to be distinctly understood, includes any multiple including unity.

What is claimed is:

1. A vertical antenna structure comprising a vertical radiating element extending from above an electrically conducting roof top of a building to a point below the roof top, an electrically conducting pipe similarly located and surrounding said element for all but the upper half wavelength portion of said radiating element, means for fastening said pipe to said roof top and to said building below said roof top, and an insulator located above said roof top and placed between said element and pipe for preventing water from running into said pipe below said insulator, said insulator being located at a low voltage point on said radiating element, said insulator also functioning to maintain said radiating element in spaced relation to said pipe.

2. A system in accordance with claim 1, characterized in this that said insulator is located at a point approximately one-quarter of a wavelength below the upper end of said pipe and three-quarters of a wavelength from the upper end of said radiating element.

3. A vertical antenna structure comprising a vertical radiating element extending from above the roof top of a building to a point below the roof top, an electrically conducting pipe similarly located and surrounding said element for all but the upper half wavelength portion of said radiating element, means for fastening said pipe to said roof top and to said building below said roof top, and an insulator located above said roof top and placed between said element and pipe for preventing water from running into said pipe below said insulator, said insulator being located at a low voltage point on said radiating element, and a rain shield adjacent to said element and surrounding the upper part of said insulator, said insulator also functioning to maintain said radiating element in spaced relation to said pipe.

4. A vertical antenna structure comprising a vertical antenna element extending from above the roof top of a building to a point below the roof top, an electrically conducting pipe similarly located and surrounding said element for all but the upper half wavelength portion of said antenna element, means for fastening said pipe to said roof top and to said building below said roof top, and an insulator located above said roof top and placed between said antenna element and pipe for preventing water from running into said pipe below said insulator, said insulator being located at a low voltage point on said antenna element, said pipe being divided into at least two sections, and means for clamping said insulator between said two sections, said insulator also functioning to maintain said radiating element in spaced relation to said pipe.

5. An antenna system comprising inner and outer straight, rigid, spaced, concentric conductors mounted at right angles to a conducting surface, said inner conductor extending substantially one half the length of the communication wave outside the adjacent end of the outer conductor, an insulator between the two conductors located substantially three-quarters of the length of the communication wave from the extended end of the inner conductor, said inner conductor extending to a distance a multiple of one-half the length of the communication wave from said conducting surface, said insulator also functioning to maintain said radiating element in spaced relation to said pipe.

6. An antenna system according to claim 5, characterized in this that the length of the outer conductor from said adjacent end to said conducting surface is made substantially an integral number of half waves for the waves to be radiated or received.

7. In combination, a building having an electrically conducting roof, an antenna so mounted that its lowest radiating portion is a multiple of half the length of the operating wave above said roof, and a non-radiating feeder coupling said antenna to high frequency translating apparatus.

8. In combination, a building having an electrically conducting surface above ground, an antenna so mounted that its lowest radiating portion is a multiple of half the length of the operating wave above said surface, and a concentric line non-radiating feeder coupling said antenna to high frequency translating apparatus.

9. In combination, a building having an electrically conducting roof, a vertical antenna having an effective radiating portion one-half wavelength long, the lowest radiating portion being mounted an integral multiple of half the length of the operating wave above said roof, and a non-radiating feeder coupling the lower end of said vertical antenna to high frequency translating apparatus.

10. In combination, a building having an electrically conducting surface on top thereof, an antenna system arranged to radiate waves substantially uniformly in a horizontal plane, the lowest radiating portion thereof being mounted above said building at a distance an integral multiple of half the length of the operating wave from said surface, and a non-radiating feeder system connecting said antenna system to transmitting apparatus.

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