March 30, 1954 R. H. STEVENS 2,673,931

HIGH-FREQUENCY ANTENNA SYSTEM

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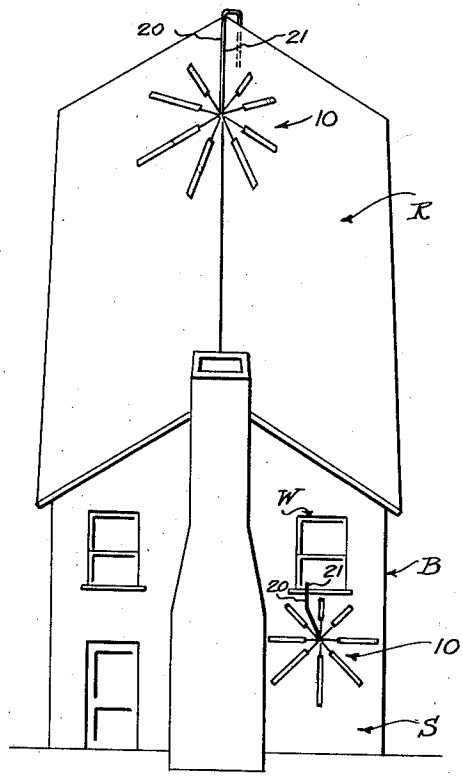

Fig. 1.

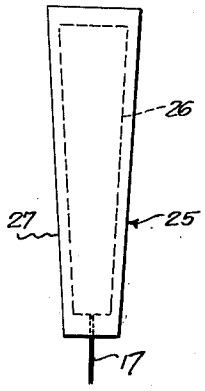

Fig. 5.

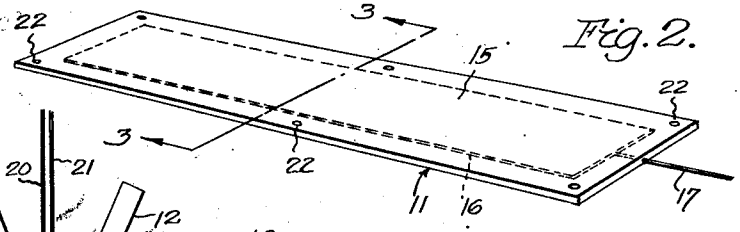

Fig. 2.

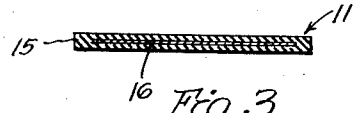

Fig. 3.

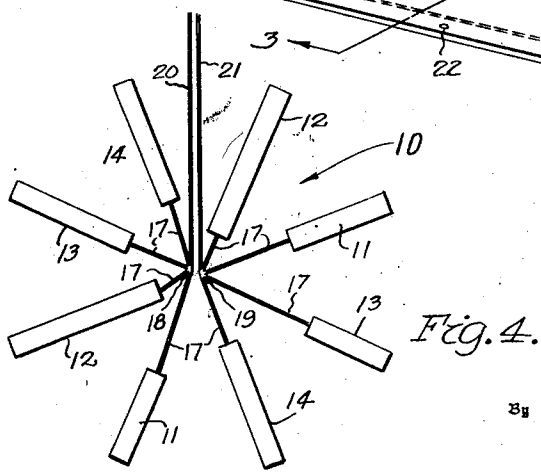

Fig. 4.

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HIGH-FREQUENCY ANTENNA SYSTEM

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3 Claims. (Cl. 250—33.53)

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This invention relates to high frequency electro-magnetic radiation systems and, in particular, to high frequency antenna arrangements.

One object of this invention is to provide a high frequency dipole antenna system for television, frequency modulation radio, and the like which is relatively inconspicuous when placed upon the roof, walls or other portion of a building, thereby eliminating the present unsightly and fragile antennas in ordinary use.

Another object is to provide a high frequency dipole antenna system of the foregoing character, wherein the antenna includes one or more pairs of antenna units which are preferably matched approximately for resonance with the high frequency radiation expected to be received, the individual units consisting of conductors of sheet or ribbon form sealed within a plate-like insulating member in such a manner as to be protected from moisture, these plate-like units being easily attached to a roof or wall and oriented in the directions giving the best reception from the transmitting stations from which they are expected to receive radiation.

Another object is to provide a high frequency dipole antenna system of the foregoing character, wherein the antenna system includes a plurality of pairs of such units of different characteristics and dimension corresponding to the characteristics of the number of different stations from which it is expected to receive radiation, these relatively flat units being capable of being secured to the roof or wall in a radiating array according to the disposition found to produce the best signal reception for each particular station.

Another object is to provide a high frequency dipole antenna system of the foregoing character, wherein the thin plate-like antenna units may be given different colors to make them conform to the color of the roof or wall to which they are secured, thereby rendering them inconspicuous.

In the drawings:

Figure 1 is a perspective view of the roof and side wall of a building, showing two antenna systems secured thereto, according to one form of the invention;

Figure 2 is a perspective view of one of the antenna units used in the antenna systems shown in Figure 1;

Figure 3 is a vertical cross-section taken along the line 3—3 in Figure 2;

Figure 4 is an enlarged top plan view of one of the antenna systems shown in Figure 1; and

Figure 5 is a top plan view of a modification of the antenna unit shown in Figures 1 to 4 inclusive.

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Antenna systems for the reception of high frequency electro-magnetic radiation, such as television or frequency modulation radio, have hitherto consisted of structures formed of metallic rods or tubes projecting from poles or other uprights located on and rising from the roofs of buildings. In such antenna systems, it is necessary to have pairs of conductors of the proper dimensions and characteristics corresponding to the frequency of radiation emitted from each transmitting station, and these must be very nearly in resonance with the incoming radiation in order to properly receive such radiation. Consequently, it has hitherto been necessary to provide as many pairs of these antenna conductors as there are transmitting stations from which it is expected to receive radiation. Such antenna systems, however, have hitherto been very unsightly and very conspicuous. They have also been easily damaged by high winds and consequently have been considered by many users to be a necessary evil for which there was no alternative.

The present invention provides an antenna system which eliminates these unsightly prior antenna systems with their multiple projecting poles and rods and their numerous guy wires. Instead, the present invention provides an antenna system consisting of an array of paired plate-like antenna units, each consisting of a sheet or plate of insulating material, such as molded plastic material, containing a conductor of sheet or ribbon form whose characteristics are made to match the characteristics of the radiation to be received, there being a pair of units of different dimensions for each station from which reception is expected, corresponding to the different frequency of each such station. As the radiation frequency increases, the length of the receiving antenna unit consequently decreases.

These sheet or ribbon conductors are preferably sealed in the insulating plate so as to be waterproof and weatherproof, a lead wire being connected to the conductor and emerging from the insulating plate for connection to the lead-in conductors. The various antenna units are preferably secured flat against the roof or side wall of the building in which the radiation receiver is to be used, and the various units are moved to and fro until the maximum signal strength is received from each station, whereupon they are then permanently secured to the roof or wall. The units are preferably made up in colors conforming to the color of the surface on which they are to be placed, so that they will be least con-

spicuous when they are mounted on the roof or wall. The different pairs of units are connected to a pair of lead-in conductors so that one unit of each pair is connected to one conductor and its mate connected to the other conductor.

Referring to the drawings in detail, Figure 1 shows a pair of antenna systems 10 mounted on a building B, one antenna system being mounted on the roof R of the building and the other on the side wall S near a window W. Each antenna system or array 10 (Figure 4) consists of approximately matched pairs or antenna units 11—11, 12—12, 13—13, and 14—14. The antenna units 11 to 14 inclusive are of similar construction and differ only in their dimensions, hence the description of the unit 11 will suffice for the others.

The antenna unit 11 consists of a plate 15 of either opaque or transparent insulating material, such as synthetic plastic material, preferably of elongated shape, and having a sheet or ribbon 16 of electrically-conducting material sealed within it (Figure 3) in such a manner as to be completely enclosed and therefore water-tight and weather-tight. The sheet or ribbon forming the antenna conductor 16 may, for example, consist of copper or aluminum foil, and a connecting conductor or wire 17, extends from the antenna conductor 16 to a common junction 18 or 19 on one only of a pair of lead-in or terminal conductors 20 or 21. Apertures 22 may be provided for the insertion of fasteners, such as nails or screws, by which the antenna unit 11, 12, 13 or 14 may be secured to the roof R or wall S of the building B.

The dimensions of the antenna conductors 16 of each pair of units 11—11, 12—12, 13—13, or 14—14 are preferably so chosen as to be in resonance with the frequency of the signals of the particular station which is to be received. Accordingly, it will be understood that since the neighboring television or frequency modulation stations are obviously of different frequencies in order to prevent their signals from conflicting with one another, each receiving antenna system 10 must possess as many pairs of units 11, 12, 13 or 14 of different dimensions as there are different stations, the radiation from which it is expected to receive. The radiation emitted from a television transmitting station is ordinarily frequency modulation radiation, hence similar characteristics follow for the antenna units of each.

In selecting the wall or roof surface upon which it is desired to mount the antenna system or array 10, it is desirable to avoid metallic surfaces, such as those of copper, sheet iron or the like, because of the capacity effect which would thus be set up between the antenna conductor 16 and such metallic roofing or siding. It is also preferable to select a sloping roof or wall in order to provide adequate drainage and consequently to avoid capacitance arising from a layer of such moisture on the roof. The effect of moisture may be eliminated, at some loss in efficiency, by mounting the antenna system 10 inside the building, such as next to the inner side of the roof in the attic of the building.

The antenna units 11—11, 12—12, 13—13 and 14—14 are at first laid out and fastened temporarily to the roof or wall and their positions changed until the maximum signal strength and quality of reception is obtained for each pair of antenna units. When the most satisfactory reception has been obtained for each station, the pairs of antenna units are then permanently fastened to the roof or wall. It is, of course, necessary to connect each of the lead wires 17 to the common electrical midpoint or center 18 or 19 (Figure 4) from which the coaxial cable 20 or 21 runs. The antenna units 11 to 14 inclusive may be painted or otherwise colored in order to cause them to blend in most suitably with the wall or roof. Since the frequencies ordinarily employed in television and frequency modulation work are very high, the lengths of the antenna units 11 to 14 inclusive are relatively short.

The modified antenna unit, generally designated 25, shown in Figure 5 is similar in priciple to the antenna unit 11 of Figure 2, except that the antenna conductor 26 is in the form of a sheet or ribbon of conducting material, such as metallic foil, of trapezoidal shape embedded in a plate 27 of insulating material, such as synthetic plastic material. It has been found that this trapezoidal shape is very suitable for television work and gives efficient reception. It will be understood, however, that the antenna unit may be made in other different shapes, such as circular or oval shapes, if desired. It may also be made in the shape of a shingle, clapboard or other part of a building.

What I claim is:

1. A receiving antenna system for high frequency television radiation comprising a pair of terminal conductors adapted to be connected to the television receiving set, a plurality of pairs of antenna units arranged in a group in a location exposed to such radiation; each antenna unit consisting of a plate of electrical insulating material, an elongated sheet of electrically-conducting material embedded in said plate and enclosed substantially in its entirety on all sides by said plate, and a connecting conductor leading from said sheet through said plate to the exterior of said plate; the antenna units of each said pair being dimensioned to possess substantially the same electrical resonance characteristics corresponding to one radiation frequency to be received but differing from the electrical resonance characteristics of any other pair of antenna units in said group, whereby each said pair of antenna units is adapted to receive a specific frequency of radiation which is different from the specific frequency adapted to be received by any other pair of said antenna units, one connecting conductor of one antenna unit of each said pair being electrically connected to one of said terminal conductors and the other connecting conductor of the other antenna unit of each said pair being electrically connected to the other terminal conductor.

2. A receiving antenna system for high frequency television radiation comprising a pair of terminal conductors adapted to be connected to the television receiving set, a plurality of pairs of antenna units arranged in a group in a location exposed to such radiation; each antenna unit consisting of a plate of electrical insulating material, an elongated sheet of electrically-conducting material embedded in said plate and enclosed substantially in its entirety on all sides by said plate, and a connecting conductor leading from said sheet through said plate to the exterior of said plate; the antenna units of each said pair being dimensioned to possess substantially the same electrical resonance characteristics corresponding to one radiation frequency to be received but differing from the electrical res-

onance characteristics of any other pair of antenna units in said group, whereby each said pair of antenna units is adapted to receive a specific frequency of radiation which is different from the specific frequency adapted to be received by any other pair of said antenna units, one connecting conductor of one antenna unit of each of said pair being electrically connected to one of said terminal conductors and the other connecting conductor of the other antenna unit of each said pair being electrically connected to the other terminal conductor, all the connecting conductors of the antenna units connected to each terminal conductor being connected thereto at a common junction on its respective terminal conductor.

3. A receiving antenna system for high frequency television radiation comprising a pair of terminal conductors adapted to be connected to the television receiving set, a plurality of pairs of antenna units arranged in a group in a location exposed to such radiation; each antenna unit consisting of a plate of electrical insulating material, an elongated sheet of electrically-conducting material embedded in said plate and enclosed substantially in its entirety on all sides by said plate, and a connecting conductor leading from said sheet through said plate to the exterior of said plate; the antenna units of each said pair being dimensioned to possess substantially the same electrical resonance characteristics corresponding to one radiation frequency to be received but differing from the electrical reso-

nance characteristics of any other pair of antenna units in said group, whereby each said pair of antenna units is adapted to receive a specific frequency of radiation which is different from the specific frequency adapted to be received by any other pair of said antenna units, one connecting conductor of one antenna unit of each said pair being electrically connected to one of said terminal conductors and the other connecting conductor of the other antenna unit of each said pair being electrically connected to the other terminal conductor, all the connecting conductors of the antenna units connected to each terminal conductor being connected thereto at a common junction on its respective terminal conductor, the antenna units connected to each junction being disposed approximately radially of their respective junction.

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