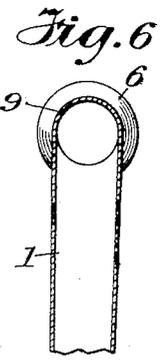
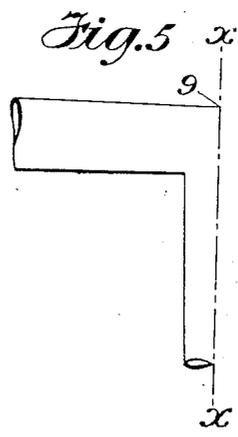
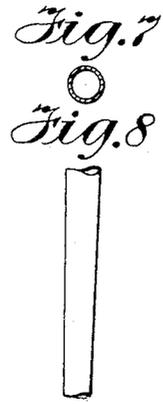
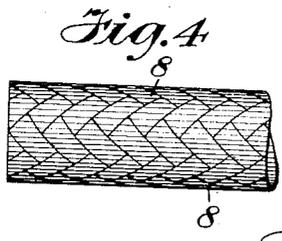
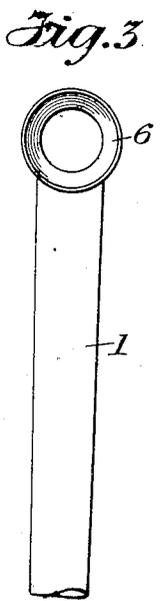
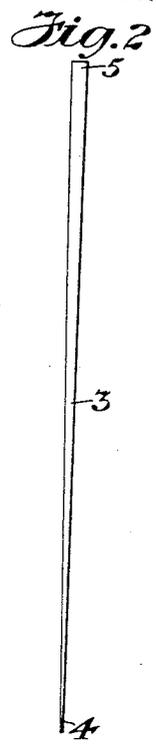
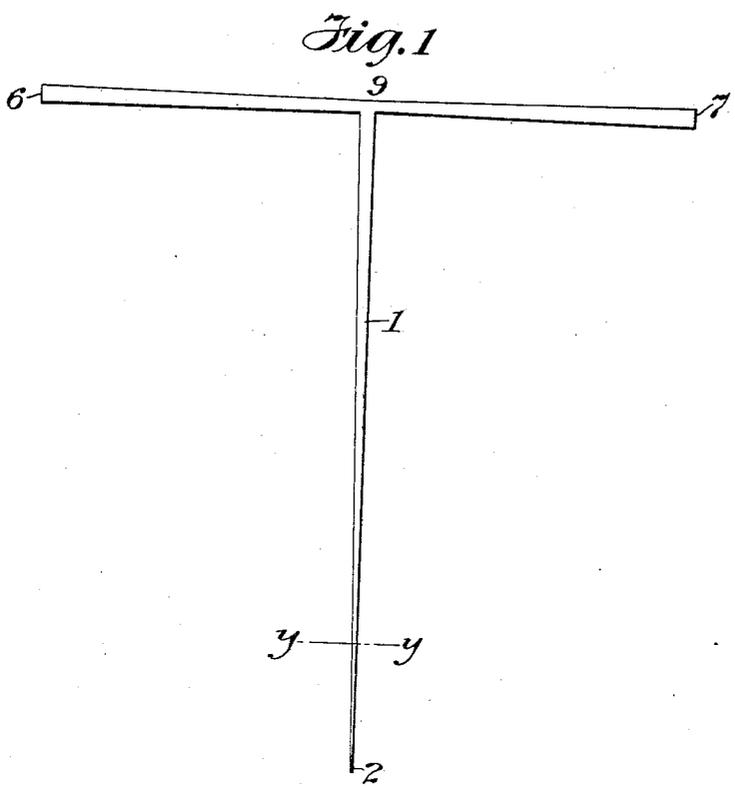


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APPLICATION FILED AUG. 12, 1916.

1,305,104.

Patented May 27, 1919.  
5 SHEETS—SHEET 1.



*Peter Cooper Hewitt* INVENTOR  
BY *Charles A. [Signature]* ATTORNEY

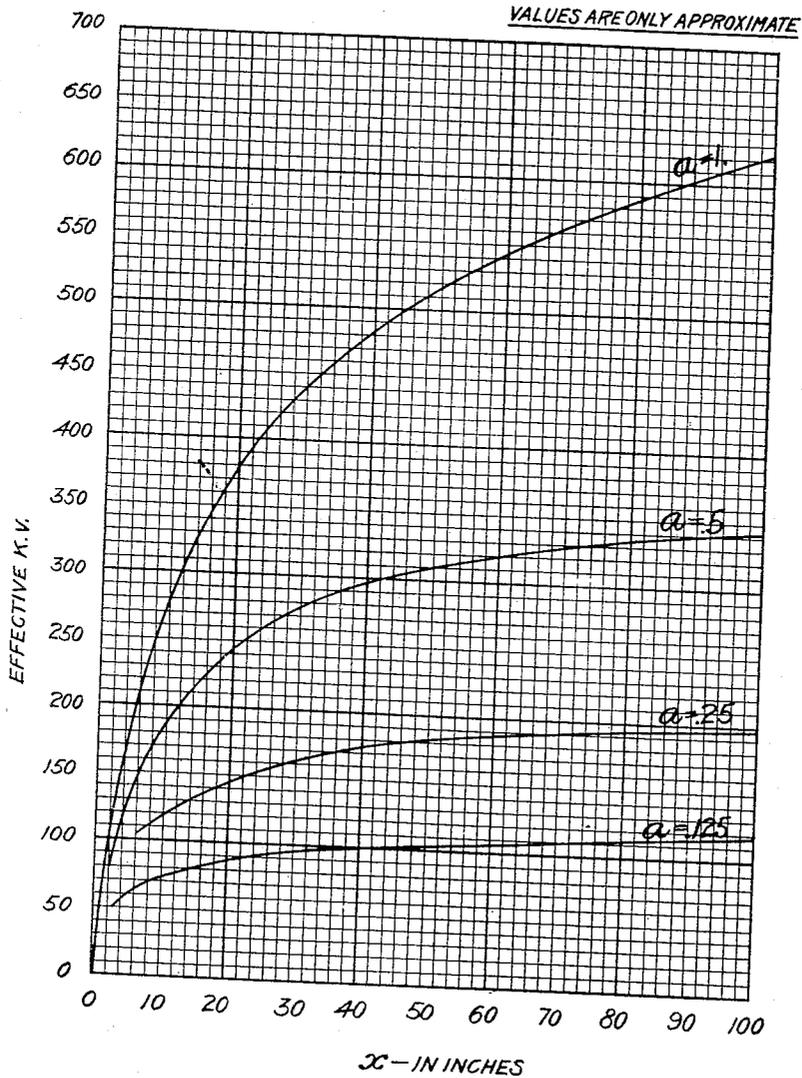
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*Fig. 9*  
VOLTAGE AT WHICH CORONA WILL FORM AROUND  
PARALLEL WIRES

$a$  = RADIUS - IN INCHES  
 $x$  = MIN. DISTANCE BETWEEN WIRES - IN INCHES  
 $R_{max}$  = 68.4 EFFECTIVE KV. PER INCH



INVENTOR  
*Percy Cooper Hewitt*  
BY  
*Charles A. Perry*  
ATTORNEY

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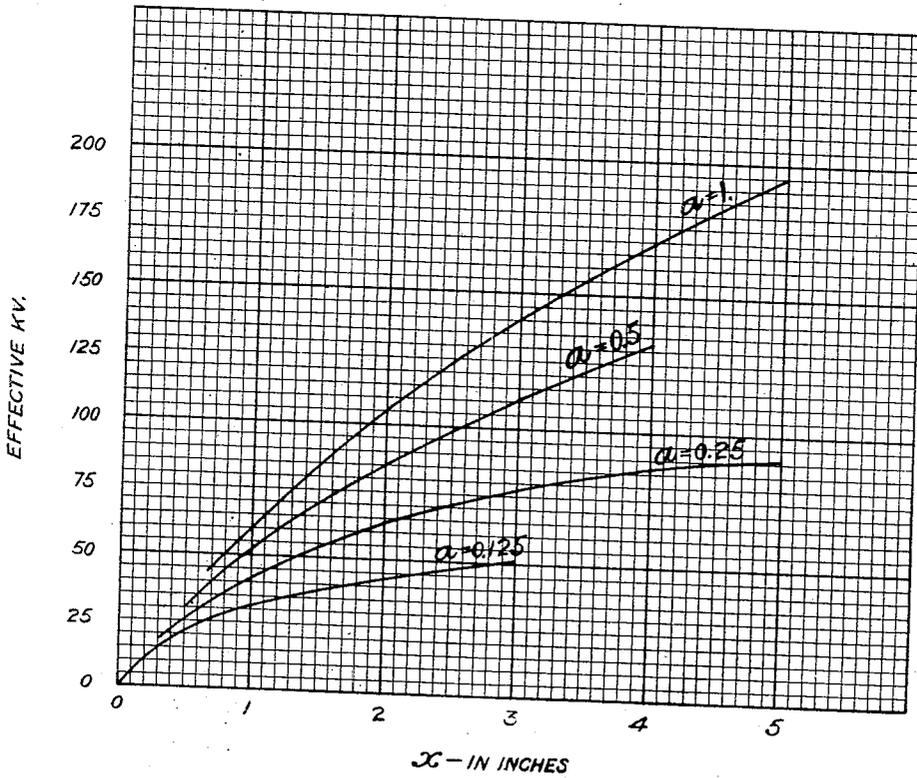
*Fig. 10*

VOLTAGE AT WHICH CORONA WILL FORM AROUND  
PARALLEL WIRES

" $a$ " = radius of wire  
" $x$ " = dist. between surfaces of wires

The following formula was used  $R_{max} = (\frac{V}{x})f'$  where  
 $R_{max}$  is taken as 68.4 eff. KV per inch

NOTE; for  $x < 6a$  the curves also give the break down voltage.



*Peter Edgar Hewitt* INVENTOR  
BY *Charles A. King* ATTORNEY

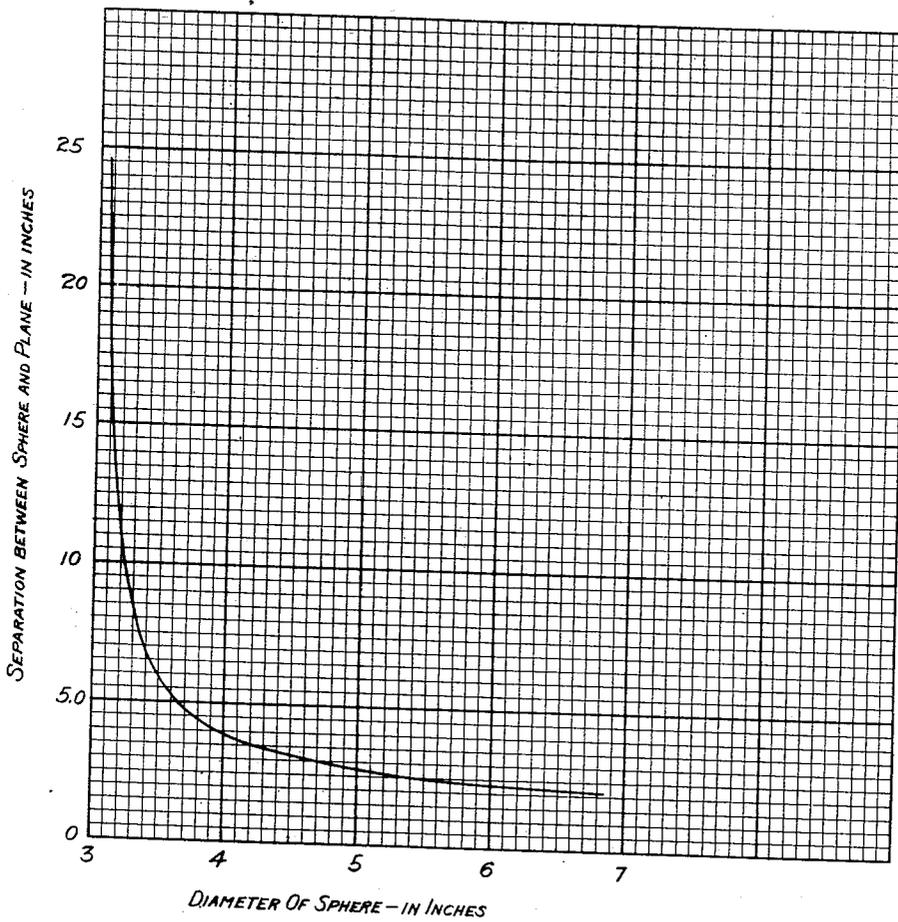
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5 SHEETS—SHEET 4.

*Fig. 11*

*SPHERE AND PLANE  
SEPARATION NECESSARY TO PREVENT FORMATION  
OF CORONA AROUND SPHERE WHEN:  
SPHERE IS AT POTENTIAL OF 100,000 VOLTS  
PLANE IS AT POTENTIAL OF GROUND.*



*Peter Cooper Hewitt* INVENTOR  
BY  
*Charles A. King* ATTORNEY

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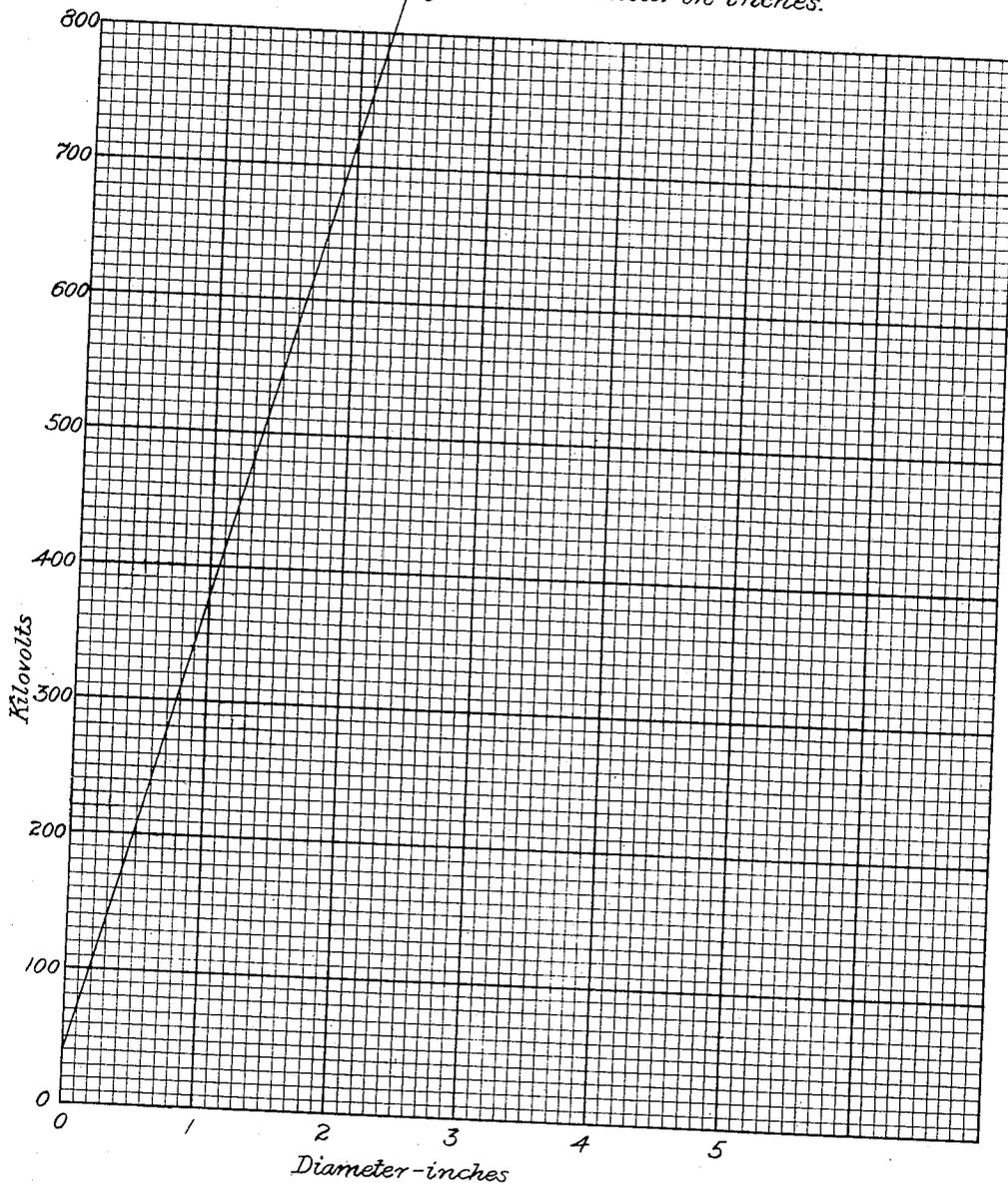
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5 SHEETS-SHEET 5.

*Fig. 12*

*Relation is expressed by the formula  $V=340d+40$   
where  $V$ =Volts in kilovolts at which aerial is to be maintained.  
 $d$ = Diameter of aerial conductor in inches.*



*Peter C. Hewitt* INVENTOR  
BY *Charles A. [Signature]* ATTORNEY

# UNITED STATES PATENT OFFICE.

PETER COOPER HEWITT, OF RINGWOOD MANOR, NEW JERSEY.

ANTENNA FOR WIRELESS DISTRIBUTION SYSTEMS.

1,305,104.

Specification of Letters Patent.

Patented May 27, 1919.

Application filed August 12, 1916. Serial No. 114,527.

*To all whom it may concern:*

Be it known that I, PETER COOPER HEWITT, a citizen of the United States, and resident of Ringwood Manor, county of Passaic, State of New Jersey, have invented certain new and useful Improvements in Antennæ for Wireless Distribution Systems, of which the following is a specification.

This invention has for its object increasing the radiating power of an aerial by means of increasing the voltage to which the aerial may be raised without loss due to corona effect. The invention consists in constructing the diameter of the aerial along its length and its various parts in direct relation to the voltage which the aerial at any point is required to sustain. It is known that the dielectric strength of air to resist corona effect for small isolated conductors is about 70,000 to 80,000 volts and, in order to increase the dielectric strength of air surrounding a conductor, it is necessary to increase the diameter of the conductor. On increasing the diameter of a conductor subjected to the strain of a definite voltage, the dielectric value of the air improves until a certain diameter is attained, after which increase in diameter has but little practical value. Such ratio is expressed approximately by the formula

$$\text{Volts} = 340,000 \times \text{diameter in inches} + 40,000.$$

This formula is derived from data compiled from actual tests by the Westinghouse Electric & Manufacturing Company of Pittsburgh, Pennsylvania, in connection with high tension transmission work.

My invention is embodied in an aerial having an increasing diameter from the conductors used at the ground end, to a diameter of 6 inches, or thereabout, at the terminal end. The end should be insulated by means of an insulator in practically the same manner and of substantially the same construction as high voltage transmission lines are now insulated. With such an arrangement the terminal voltage to which the aerial may be operated without corona effect or leakage loss may be, or may even exceed, 600,000 volts, while with the ordinary wire and insulator, the corona loss incident thereto may be attained below 100,000 volts, thereby rendering operation impractical at such high voltage. The energy that may be

radiated from an aerial increases in some direct ratio as the operating voltage of the aerial is increased. Therefore, an aerial as herein described, will be capable of greater radiation than one of ordinary wire, since the voltage to which it may be raised without corona is many times greater. When current leaks away into air from a conductor raised to a high voltage, it produces a luminous effect around the surface of the conductor: this is herein called "corona effect," and the loss incident thereto is called "corona loss."

My aerial may be constructed of flat wire, woven basket fashion, so as to be 6 inches in diameter at the end, or it may be made bird-cage fashion of wires held close together, or be made of sheet metal, or otherwise fashioned. For convenience, the aerial may at parts of its length, be larger in diameter than as herein described as necessary, but should not be smaller, except that it has electro-static effect imposed on it as would be the case in internal convolutions of a spiral.

My invention is illustrated in the accompanying drawings in which Figures 1, 2, 3, 4, 5, 6, 7 and 8 show various forms of construction of my antenna; Figs. 9, 10 and 11 show curves plotted from data compiled by the Westinghouse Electric & Manufacturing Company in connection with high tension transmission work, and

Fig. 12 shows a curve deduced from the curve of Figs. 9, 10 and 11.

Referring to Fig. 1, 1 is a T shaped aerial, the ground end 2 being connected to the exciting circuits of any suitable type.

In Fig. 2, 3 is a vertical straight antenna tapered from its base, 4, to its tip, 5, in such a manner that the diameter at any point is proportional to the voltage between said point and the ground end 4.

In Fig. 3 is shown an enlarged view of the antenna of Fig. 1 looking at the tip 6. It will be noted that the antenna 1 is hollow and as shown in Fig. 1 gradually increases in diameter from the point 2 to the ends 6 and 7.

In Fig. 4 I have shown a construction suitable for my antenna wherein flat pieces 8, 8, are woyen basket fashion.

Fig. 5 is an elevation of the joint 9 in Fig. 1 and Fig. 6 is a section of Fig. 5 show-

ing the taper from the point 9 to the end 6 and the hollow construction of the vertical part 1.

Fig. 7 is a section through Y—Y, of Fig. 1, and Fig. 8 shows an enlarged elevation of the antenna of Fig. 1 below the line Y—Y.

In Fig. 9 I show a set of curves which illustrate the effect of the diameter of two parallel wires on the voltage at which corona will form at four different distances between the wires. The curves of Fig. 10 are similar to those of Fig. 9 but are plotted on a different scale and show the effect of the diameter of the conductors for small separation. The curve of Fig. 11 illustrates the effect of the diameter of a sphere charged to one hundred thousand volts on the separation between it and a plate necessary to prevent the formation of corona. The curve of Fig. 12 shows approximately the relation between the diameter of a conductor separated a considerable distance from the ground and the potential at which the conductor can be maintained above that of the ground without corona loss. For instance, if it is desired to maintain a certain point in an antenna at seven hundred and twenty thousand volts (720,000) it will be necessary to make the diameter of the antenna conductor at that point two inches.

I claim as my invention:

1. A tapering antenna having a diameter at its tip greater than a diameter at the ground and of such a size at all points that a corona will not form under the conditions of operation.

2. A non-leaking, high voltage, antenna

having its diameter at any point proportional to the voltage between said point and the ground.

3. A non-leaking, high voltage, antenna so constructed that its diameter at any point and the voltage at any point shall be as represented in Fig. 12.

4. A non-leaking, high voltage, antenna for a wireless transmission system consisting of a conductor greater than 3.5 inches in diameter at its tip and tapered so that the diameter at any point is nowhere less than proportional to the voltage between said point and the ground.

5. A non-leaking, high voltage, tapering conductor grounded at one end and greater than 3.5 inches in diameter at the other end.

6. A non-leaking, high voltage, antenna for wireless electric circuits consisting of a conductor presenting an external surface gradually increasing toward one end, the ratio of the increment corresponding approximately to that of the normal movement of tendency toward corona losses.

7. In a wireless telephone or telegraph system, a non-leaking, high voltage, antenna having a diameter at each point such that throughout its effective length the tendency to form corona is equalized.

Signed at New York, in the county of New York and State of New York, this 27th day of July, A. D. 1916.

PETER COOPER HEWITT.

Witnesses:

WALTER E. F. BRADLEY,  
JOHN F. NELSON.