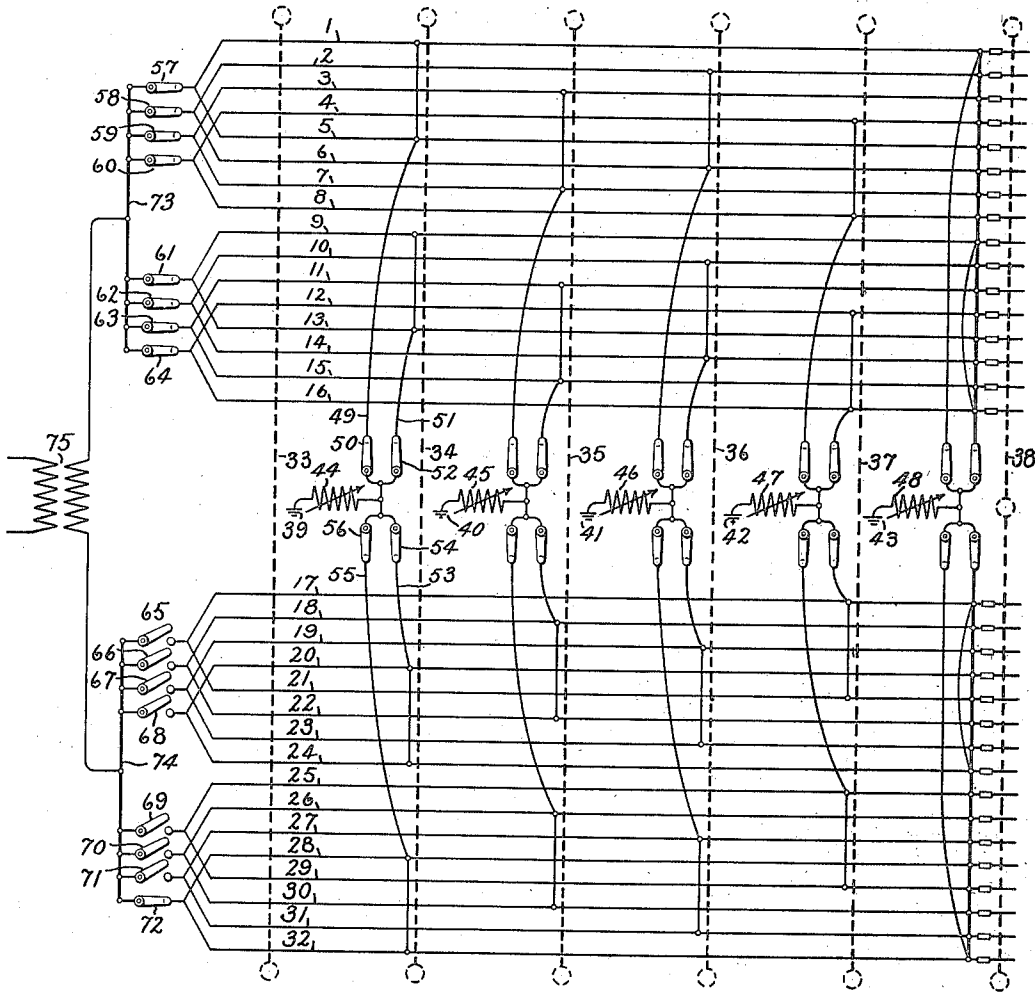


E. F. W. ALEXANDERSON.
 REMOVING SLEET FROM ANTENNE.
 APPLICATION FILED JAN. 14, 1919.

1,404,726.

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UNITED STATES PATENT OFFICE.

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REMOVING SLEET FROM ANTENNÆ.

1,404,726.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ERNST F. W. ALEXANDERSON, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Removing Sleet from Antennæ, of which the following is a specification.

My present invention relates to a radiating antenna system in which special means is provided for passing current through the aerial conductors for the purpose of heating them in order to thaw sleet therefrom and thus avoid any danger of their becoming overloaded and breaking. More particularly my invention relates to an organization which will enable the thawing of sleet from a radiating antenna which is provided with a plurality of grounding connections, such, for example, as one which is described in my prior applications, Serial No. 123,276, filed October 2, 1916, and Serial No. 191,110, filed September 13, 1917, which has issued as Patent No. 1,360,167, dated Nov. 23, 1920.

In the above-mentioned applications a radiating antenna system is described and claimed in which a plurality of ground connections uniformly distributed along the length of the antenna are provided, with tuning coils in each ground connection, in order to increase the radiation efficiency of the antenna. In the systems described in these applications all of the aerial conductors are indicated as being connected together at each grounding point. It has been customary in previous installations to arrange the antennæ conductors, which are usually of considerable size and length, so that heating current may be passed through a portion of the conductors at one time, and hence the current required for this purpose will be much less than if it was necessary to pass heating current through all the conductors at once.

When it is desired to provide a system for passing heating current through an antenna with multiple grounds in such a way that it is not necessary to heat the entire length of all of the conductors simultaneously, certain difficulties arise. If all of the conductors are connected together at each grounding point it becomes necessary to supply heating current through each ground connection, or to provide means for disconnecting the con-

ductors from one another at each grounding point. This obviously is inconvenient in the case of the antenna for a high power station which is made up of a large number of aerial conductors of great length.

The object of my invention is to provide a system which will overcome such disadvantages and which will possess the advantages of the multiple tuned antenna, and at the same time enable the operator to readily cause heating current to flow through a small portion of the antenna at one time.

In carrying my invention into effect I make use of the discovery that in order to obtain the advantages of the multiple tuning, it is not at all essential that all of the conductors should be connected together at each grounding point. I have found that the desired result may be obtained by connecting together at each grounding point only a portion of the conductors. If the conductors which are connected together are properly selected the ground connections will carry charging current not only from the conductors which are directly connected to ground, but also from the conductors adjacent to these conductors by reason of the large capacity between the conductors. If different conductors are connected to ground at the different points each ground connection will carry current from a greater length of conductor than would be the case if all of the conductors were connected to each ground. By proper selection of conductors which are directly connected to ground at the various points it is possible to arrange the system so that the charging currents carried by the different ground connections will be substantially equal and will also be substantially as great as it would be if all of the conductors were connected to each ground. By making use of this discovery it is possible to greatly simplify the switching system necessary to enable the operator to pass heating current through any portion of the antenna desired.

The novel features which I believe to be characteristic of my invention are pointed out with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following description taken in connection with the accompanying draw-

ing in which I have illustrated one manner in which my invention may be carried into effect.

In the drawing I have indicated a radiating antenna system made up of thirty-two horizontally extending conductors numbered 1 to 32, inclusive. These conductors are supported by the usual towers and cross-spans 33 to 38, inclusive, indicated by dotted lines in the drawing. The usual ground connection may be provided at the station end of the antenna adjacent the cross-span 33, and the energy introduced to the antenna through the ground connection in the usual manner, this ground connection and the source of energy not being shown in the drawing. Ground connections 39 to 43, inclusive, are provided at the other cross-spans 34 to 38, inclusive, and tuning coils 44 to 48, inclusive, are inserted in each of these ground connections. Instead of connecting all of the serial conductors together at each cross span intermediate the ends of the antenna, the conductors are connected together at the supporting points in pairs. For example, at supporting spans 34, conductors 1 and 5 are connected together and to ground by means of a lead 49 and disconnecting switch 50. Conductors 9 and 13 are similarly connected by means of the lead 51 and disconnecting switch 52. Conductors 20 and 24 are connected to ground through the lead 53 and disconnecting switch 54, and conductors 28 and 32 are connected to ground by means of the lead 55 and disconnecting switch 56. Similar arrangements are used at the other intermediate supporting points, while at the end support 38 all of the conductors are connected together and connected to ground through the ground leads indicated. It will be noted that with the connections shown the majority of conductors not directly connected to ground at each supporting point are immediately adjacent a conductor which is thus connected, and that the maximum separation between a conductor which is not connected to ground and one which is connected, is three times the distance between adjacent conductors. By reason of the capacity between adjacent conductors the ground connections will in all cases carry a substantial amount of charging current from conductors which are not directly connected to ground. It will also be noted that each pair of conductors is connected to only one intermediate ground. As a result each intermediate ground connection will carry charging current from a greater length of the conductors which are connected thereto than would be the case if all of the conductors were connected to each ground. By reason of these two factors it will be found that each ground connection will carry substantially the same current that it would carry if all of the conductors were connected

thereto. At the station end of the antenna the conductors are connected in pairs by means of switches 57 to 72, inclusive, to bus-bars 73 and 74. A source of heating current, which in the present case is indicated as a transformer 75, has its terminals connected to bus-bars 73 and 74.

When it is desired to pass heating current through the antenna the disconnecting switches in the individual ground leads at the intermediate supporting points are opened. The switches 57 to 72, inclusive, may then be manipulated by the operator so as to pass heating current through each pair of antenna conductors successively. It will be noted that in the drawing switches 57 to 64, inclusive, are indicated as being closed, switches 65 to 71, inclusive, are open, and switch 72 is closed. With this arrangement of the switches heating current may be passed through conductors 28 and 32 in parallel, and will return through conductors 1 to 16, inclusive, in parallel to the bus bar 73. When the thawing operation has been completed on conductors 28 and 32, switch 72 may be opened and switch 71 closed, allowing current to flow through conductors 27 and 31, etc.

It will be apparent that the switching arrangement thus provided will permit the operator to pass heating current through all the conductors successively, and that the maximum heating current required will be the current necessary for heating two conductors at once. It will also be apparent that in case a current source is available which will supply more current than that required for heating two conductors, four, or even more, conductors may be thawed out at one time by suitable manipulation of the switches. The disconnecting switches which are inserted in the individual ground connections will of course be located at some distance from the station. To avoid the necessity of opening these switches each time it is desired to remove the sleet from the antennae, these switches may be opened whenever the sleet begins to form and may be left open until the formation of sleet on the conductors has entirely ceased. Since sleet forms only in cold weather when transmission conditions are most favorable, the antenna may be operated as a single radiator during these periods when there is danger of sleet forming on the conductors, and hence the operation of the station does not need to be interrupted except for the brief period of time required for the actual removal of the sleet.

While I have indicated only one form of my invention, it will be apparent to those skilled in the art that my invention is by no means limited to the exact arrangement of conductors shown, but that many variations in the connections employed may be

used without departing from the scope of my invention as set forth in the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. A radiating antenna system comprising a plurality of horizontally extending conductors substantially parallel to one another, a plurality of ground connections distributed along the length of said conductors, each of said ground connections which are intermediate the ends of said conductors being made to a portion only of the horizontal conductors, the connections being made in such a way that substantially equal charging currents will be carried by all of the ground connections and the individual wires to which the ground connections are made being so chosen that by reason of the capacity between the wires directly connected to ground and those not directly connected thereto, each ground connection will carry a substantial amount of charging current from the wires not directly connected thereto.

2. The combination in a radiating antenna system of a plurality of elevated conductors, grounding connections located at a plurality of points intermediate the ends of said conductors for carrying charging currents to all of said conductors, a source of current for supplying heating current to said conductors for thawing sleet therefrom, and switching means arranged to supply heating current to said conductors in such a way that the heating current may be caused to flow through a portion only of said conductors at one time, and that by varying the arrangement of said switching means current may be caused to flow through all of said conductors successively.

3. The combination in a radiating antenna system of a plurality of elevated conductors, grounding connections located at a plurality of points intermediate the ends of said conductors for carrying charging currents to all of said conductors, a source of current for supplying heating current to said conductors for thawing sleet therefrom, all of said conductors being connected together at one end and being connected in pairs to switches at the opposite end in such a way that when all of said switches are closed all of said conductors will be connected together thereby, said switches being so arranged that any pair of conductors desired may be disconnected from the other conductors and connected to said source of heating current, and switching means in said ground connections for disconnecting the same so that the entire heating current supplied by the source may be caused to flow through the entire length of any desired pair of conductors.

4. The combination in a radiating an-

tenna system of a plurality of conductors forming an elevated network, which is supported at a plurality of points along the length of said conductors, a source of current for supplying heating current to said conductors for thawing sleet therefrom, selected pairs of non-adjacent conductors being connected together at each supporting point, a connection to ground from each pair of non-adjacent conductors which are thus connected together, each of said ground connections including a disconnecting switch, a portion only of the conductors being connected directly to ground at each intermediate supporting point, the conductors thus connected being so chosen that substantially equal charging currents will be carried by all of the ground connections and the individual conductors to which the ground connections are made being so chosen that by reason of the capacity between the conductors directly connected to ground and those not directly connected each ground connection will carry a substantial amount of charging current from the conductors not directly connected thereto, all of said conductors being connected together at one end and being connected in pairs to switches at the opposite end in such a way that when all of said switches are closed all of said conductors will be connected together thereby, said switches being so arranged that any desired pair of conductors may be disconnected from the other conductors and connected to said source of heating current, and that when the switches in the ground connections are opened the entire heating current supplied by the source may be caused to flow through the entire length of any desired pair of conductors.

5. The combination in a radiating antenna system of a plurality of conductors forming an elevated network, which is supported at a plurality of points along the length of said conductors, a source of current for supplying heating current to said conductors for thawing sleet therefrom, selected pairs of non-adjacent conductors being connected together at each supporting point, a connection to ground from each pair of non-adjacent conductors which are thus connected together, each of said ground connections including a disconnecting switch, a portion only of the conductors being connected directly to ground at each intermediate supporting point, the conductors thus connected being so chosen that substantially equal charging currents will be carried by all of the ground connections and the individual conductors to which the ground connections are made being so chosen that substantially the same amount of charging current will be carried by each ground connection as would be the case if

all of the conductors were connected to each ground connection, all of said conductors being connected together at one end and being connected in pairs to switches at the
5 opposite end in such a way that when all of said switches are closed all of said conductors will be connected together thereby, said switches being so arranged that any desired pair of conductors may be disconnected
10 from the other conductors and connected to said source of heating current, and that when the switches in the ground connections are opened the entire heating current supplied by the source may be caused to
15 flow through the entire length of any desired pair of conductors.

6. A radiating antenna system comprising

a plurality of elevated conductors, a plurality of ground connections distributed along the length of said conductors, each
20 of said ground connections which are intermediate the ends of said conductors being made to a portion only of the elevated conductors, the individual conductors to which
25 the ground connections are made being so chosen that substantially the same amount of charging current will be carried by each ground connection as would be the case if
30 all of the conductors were connected to each ground connection.

In witness whereof, I have hereunto set my hand this 13th day of January, 1919.

ERNST F. W. ALEXANDERSON.