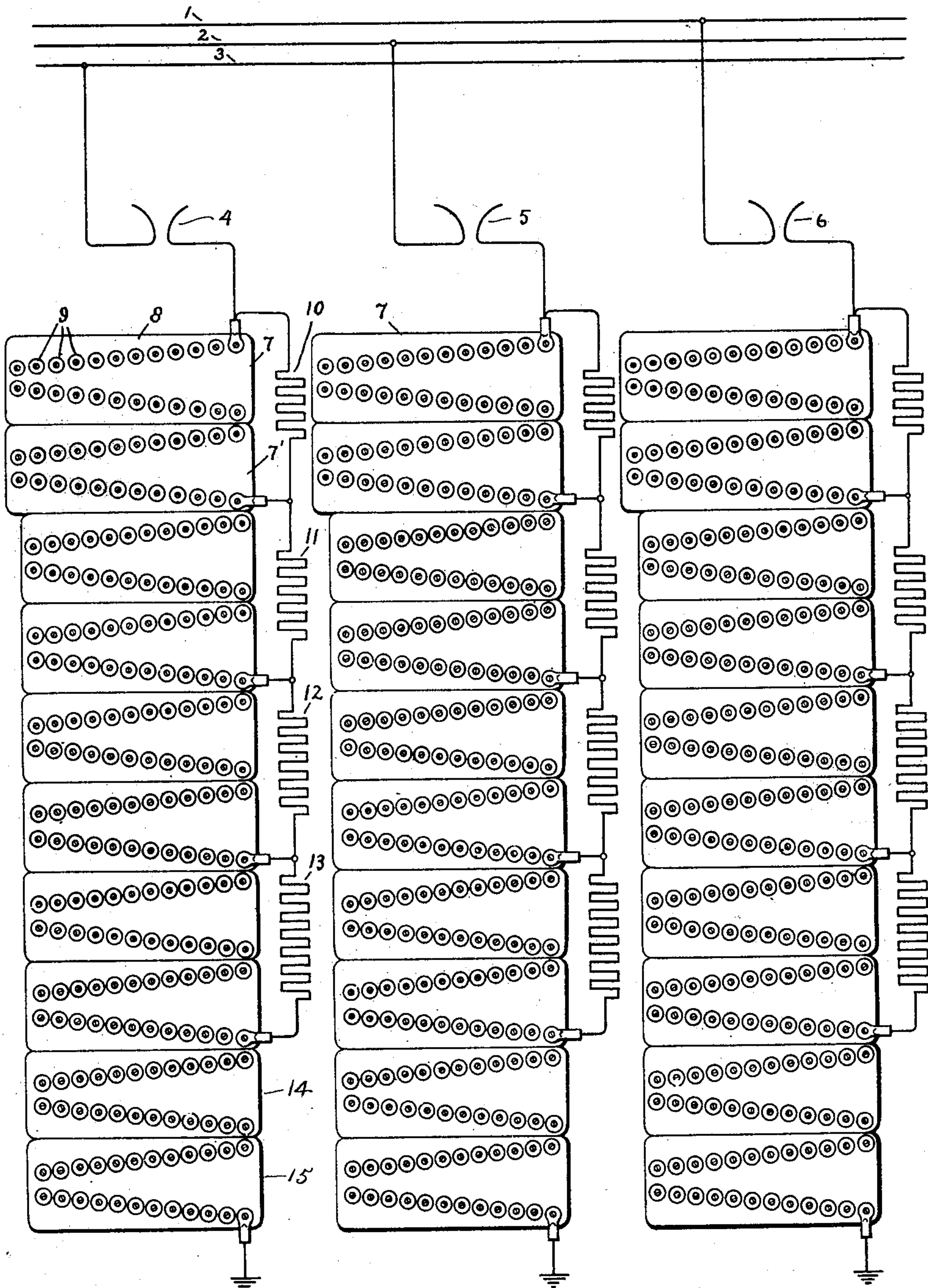


No. 887,525.

PATENTED MAY 12, 1908.

D. B. RUSHMORE.
LIGHTNING ARRESTER.
APPLICATION FILED JAN. 5, 1907.



WITNESSES:

Lester H. Fulmer.
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UNITED STATES PATENT OFFICE.

DAVID B. RUSHMORE, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

LIGHTNING-ARRESTER.

No. 887,525.

Specification of Letters Patent.

Patented May 12, 1908.

Application filed January 5, 1907. Serial No. 350,910.

To all whom it may concern:

Be it known that I, DAVID B. RUSHMORE, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Lightning-Arresters, of which the following is a specification.

My present invention relates to an improvement in so-called multi-gap lightning arresters.

It has been common practice to protect the line conductors of a high voltage electrical distribution system with a plurality of spark gaps connected directly between conductors and ground. In such an arrangement the spark gaps should preferably be great in number and so arranged that the conductors forming the electrodes of each spark gap have proper electrostatic capacity for breaking down the gaps of the series successively. Various advantages are obtained by connecting a resistance in parallel with some of the spark gaps of the series. These facts are well understood by persons skilled in the art.

According to my present invention, the resistances used in parallel with the spark gaps are graduated in value so that while one group of spark gaps is in parallel with a relatively high resistance, other groups of an equal number of spark gaps are in parallel with a much lower resistance.

My invention also embodies certain other departures from prior practice as will be more clearly understood by reference to the following description and to the drawings accompanying this specification.

For purposes of illustration I have shown my invention as applied to a high potential alternating current system of distribution, but various features of my invention are clearly applicable to other types of distribution systems and their application thereto will be readily understood by persons skilled in the art.

In the drawings, the line conductors 1, 2 and 3 are connected through horn gaps 4, 5 and 6, represented diagrammatically, with three series or trains of spark gaps connected directly to ground. Each of these trains may consist of a plurality of groups, say five, and each group may include two units 7, 7'. Each unit comprises a porcelain base 8 on which metal cylinders 9 are mounted and properly spaced apart to form spark gaps of

equal length. For a transmission system of say 50,000 volts, I may utilize ten of these units arranged in five groups between each line conductor and ground. As shown in the drawings, I may build the two units nearest the line with spark gaps of greater length than the spark gaps of other units of the train or series; they may be 25 per cent. larger. In parallel with the first group (of two units) in each series or train I place a relatively low resistance 10, preferably non-inductive in character and permanent in value. In parallel with the second group of the series or train I place a resistance 11 similar to resistance 10, but of higher value. Likewise, successive pairs of units are in parallel with the resistances 12 and 13. I prefer to leave some of the gaps, say one group of two units 14 and 15 unshunted. The other legs of the protective device are similarly provided with resistances.

The progressive variations in the values of the resistances give the protective device, as a whole, great selective capacity for the various disturbances commonly met with on high voltage distribution circuits. These disturbances may be of a great variety and quite different in voltage, frequency and quantity. They may arise from direct strokes of lightning or from the inductive effect of distant strokes; or from resonance or other peculiar conditions of the line itself; or even from oscillations or disturbances set up by short circuits, arcs, and switch-board manipulations. I find that some disturbances, particularly those of low frequency, will traverse all the resistances 10, 11, 12 and 13 and pass to ground through the remaining spark gap units 14 and 15, while disturbances of a higher frequency will avoid one or more of the resistances. In extreme cases the high potential charge will pass directly through all the spark gaps of the series.

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

1. The combination of a line conductor, a plurality of spark gaps arranged in groups and connecting said conductor to ground, and graduated resistances shunting some of said groups.

2. The combination of a line conductor, a series of spark gaps connected directly to ground and arranged in a plurality of groups, and a series of resistances each in shunt with

one of said groups, the resistance nearest the line conductor being smaller than those more distant.

3. A lightning arrester comprising a plurality of spark gaps connected directly in series and forming a plurality of groups, and a plurality of resistances arranged in series, each in parallel with one of said groups, said resistances being arranged in the order of their magnitude.

4. The combination of a line conductor, a plurality of spark gaps connected therewith and arranged in groups, graduated resistances in shunt with said groups, and a single path to ground for said resistances, said path including spark gaps.

5. The combination of a line conductor, a group of spark gaps connected therewith, a relatively low resistance in parallel with said spark gaps, a second group in series with said first group and having a total sparking distance somewhat less than that of said first

group, a resistance in shunt with said second group and having a magnitude somewhat larger than that of said first named resistances, and means for connecting said groups to ground through spark gaps.

6. The combination with a line conductor, of a group of spark gaps connected therewith, and a second group in series with said first group and having gaps somewhat smaller than those in said first group.

7. The combination of a line conductor, a plurality of spark gaps arranged in groups and connecting said conductor directly to ground, and resistances shunting some of said groups, said resistances being arranged in the order of their magnitude.

In witness whereof, I have hereunto set my hand this 4th day of January, 1907.

DAVID B. RUSHMORE.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.