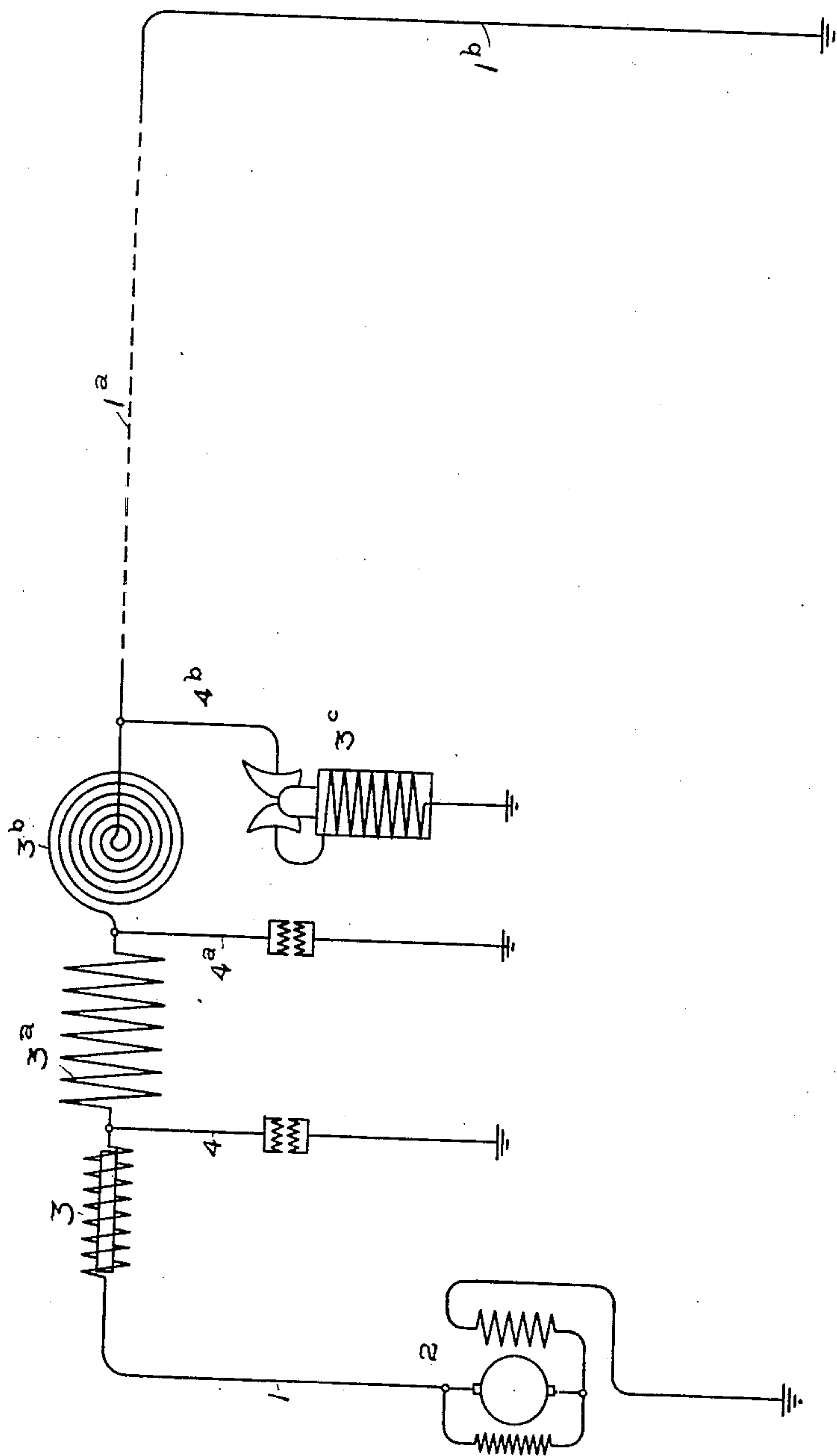


No. 822,610.

PATENTED JUNE 5, 1906.

T. J. JOHNSTON.
LIGHTNING ARRESTER.
APPLICATION FILED JULY 11, 1901.



Witnesses.

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UNITED STATES PATENT OFFICE.

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LIGHTNING-ARRESTER.

No. 822,610.

Specification of Letters Patent.

Patented June 5, 1906.

Application filed July 11, 1901. Serial No. 67,915.

To all whom it may concern:

Be it known that I, THOMAS J. JOHNSTON, a citizen of the United States, residing at Brooklyn, in the county of Kings and 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 lightning-arresters, the object being to render more perfect the protection against lightning or other static discharge.

It frequently happens that apparatus in circuits protected by lightning-arresters is damaged notwithstanding such present forms of protection, the arresters not fully guarding the apparatus against all kinds of discharges. Even when the protectors are of improved pattern this damage may result from what are colloquially designated as "sneak" discharges, which are probably discharges of such rate of vibration or such wave length as not to be earthed by the protective device. A consideration of the causes at work in a lightning discharge will indicate the reason for this result. The lightning-stroke may develop oscillations of different wave lengths in the circuit struck or inductively affected, and obviously the character of the wave may be such that it will not leap the air-gap in the discharge device, or a wave may be of such a length as to develop at the connection of the earth branch to the line a node or point of zero potential, in which case the absence of electromotive force would prevent the discharge being earthed, resulting in probable damage to the apparatus to be protected; which might be for that wave at a point of high potential. Thus a lightning-arrester in order to be thoroughly effective should guard against the establishment of such a nodal point at the earth joint and should, moreover, prevent transmission through the protected apparatus of currents of low frequency, such as might traverse an air-core helix without material opposition. I accomplish these results by establishing a plurality of grounds or earth branches and interposing in the protected circuit at the machine side of the several grounds devices of different obstructive value, the result being that if waves of a given frequency are established in the line which might find a nodal point at one of the connections it will not find such a point at others, and the discharge

will therefore pass to earth. This result may be practically effected by interposing obstructive devices at different points in the line and varying the value of their impedance, as by a relative difference of length or number of turns or character of coil. For example, I may employ a helix having an air-core as one obstructive device, a spiral as another, a helix with a soft-iron core as a third, a helix with a polarized core as another, and I may further multiply the number by varying the number of turns of these types of coil. Earth branches containing spark-gaps may be connected between these coils.

My invention therefore consists in coupling in a line for protection against lightning discharge a plurality of obstructive devices adapted to guard against waves of different rates and connecting earth branches at points between the several devices. The several features of novelty will be more particularly hereinafter described and will be definitely indicated in the claims appended to this specification.

In the accompanying drawing, (which diagrammatically illustrates the invention,) 1^a represent a circuit of any length, and 2 a device to be protected—as, for example, an electric generator in said circuit.

3, 3^a, 3^b, and 3^c represent a group of protective devices, of which 3^c is an ordinary type of lightning-arrester having a magnetic blow-out for extinguishing any arc formed by the line-current, and 3, 3^a, and 3^b represent coils, between which are connected earth branches 4 4^a, in which may be interposed ordinary spark-gap lightning-arresters. These would ordinarily be provided with arc-rupturing devices of any approved type, as is now so well understood that I have not deemed it necessary to illustrate them. The equally well-known non-inductive resistance may be provided, as described in the patent to Thomson, No. 493,314. This it seems unnecessary to depict. The coils 3, 3^a, and 3^b are so selected as to have different choking effects for a lightning discharge.

3^a represents an air-core helix, 3^b a spiral, and 3 a helix containing a magnetic or iron core, which may or may not be polarized. Coils of the same character may also be duplicated and made of different impedance by varying the number of turns or length. Of the three types shown the air-core helix

offers the least opposition, the spiral a greater opposition, and the coil with the iron core a maximum opposition; but the opposition of the coil with the iron core is relatively small
 5 to currents of low frequency as compared with its opposition to currents of high frequency.

With a combination of this kind the apparatus is much more effectively guarded
 10 against damage than with the ordinary arrangement where a single obstructive device is provided, since the different coils will choke off currents of different rates of vibration, thereby preventing the escape through the
 15 generator of sneak discharges, and if by chance a discharge of such a rate as would establish a nodal point at, say, the joint for the branch 4^a should be produced in the line the currents would be earthed through the
 20 branch 4 or 4^b, since the coils being designedly of different values a node would not be likely to form at all these points.

Having thus described my invention, what I claim as new, and desire to protect by Letters Patent of the United States, is—
 25

1. A lightning-arrester comprising a plurality of obstructive devices of differing impedance connected in circuit with the protected device for guarding against waves of different frequencies, and earth branches connect-
 30 ed at points between the devices.

2. A lightning-arrester comprising a group of coils, spiral and helical in shape of differing impedance, in series with the line, and earth branches on the line side of said coils. 35

3. A lightning-arrester comprising a plurality of coils having air-cores and iron cores of differing impedance, and earth branches on the line side of the several coils.

4. In a lightning-arrester, the combination 40 of an air-core coil and an iron-core coil having different impedance arranged in series in the line, each with a spark-gap in an earth connection on its line side.

5. In a lightning-arrester, the combination 45 of a spiral, an air-core helix and a helix with a core of magnetic material arranged in series in the line and differing in impedance, with spark-gaps in an earth connection on the line side of each coil. 50

6. A lightning-arrester comprising a plurality of earth branches and a plurality of obstructive coils of differing impedance connected in series with the protected device and between the protected sides of said branches. 55

In witness whereof I have hereunto set my hand this 5th day of July, 1901.

THOMAS J. JOHNSTON.

Witnesses:

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 DANIEL J. McNAMARA, Jr