W. H. CHAPMAN.

MEANS FOR NEUTRALIZING STATIC ELECTRICITY.

APPLICATION FILED MAR. 13, 1908.

940,431. Patented Nov. 16, 1909.

Fig. 1.

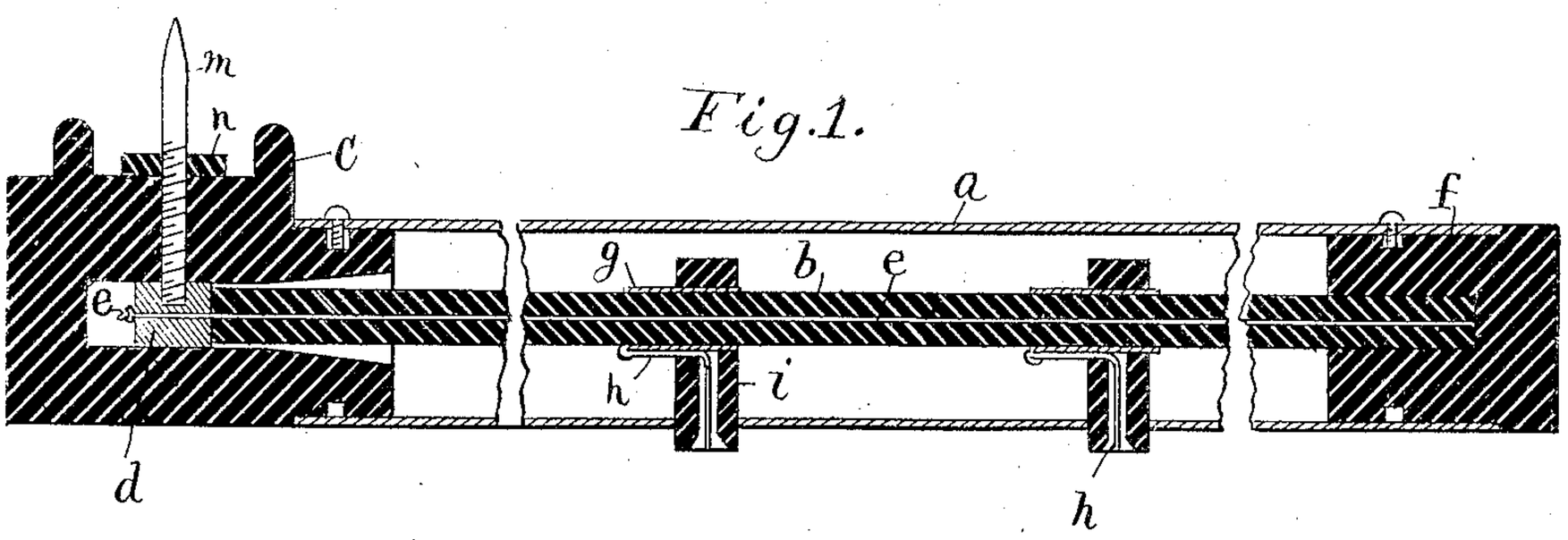


Fig. 2.

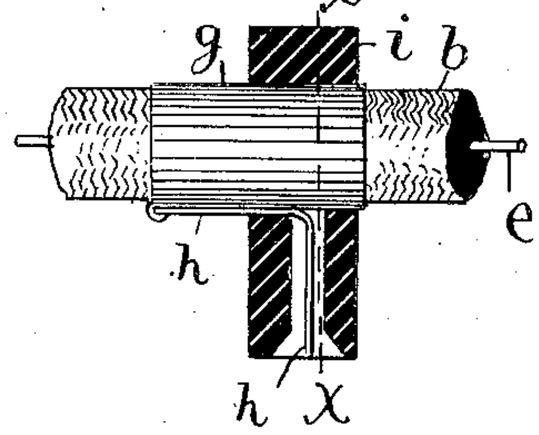


Fig. 3.

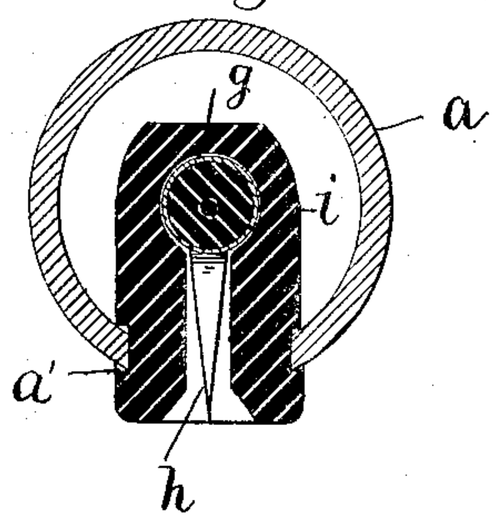
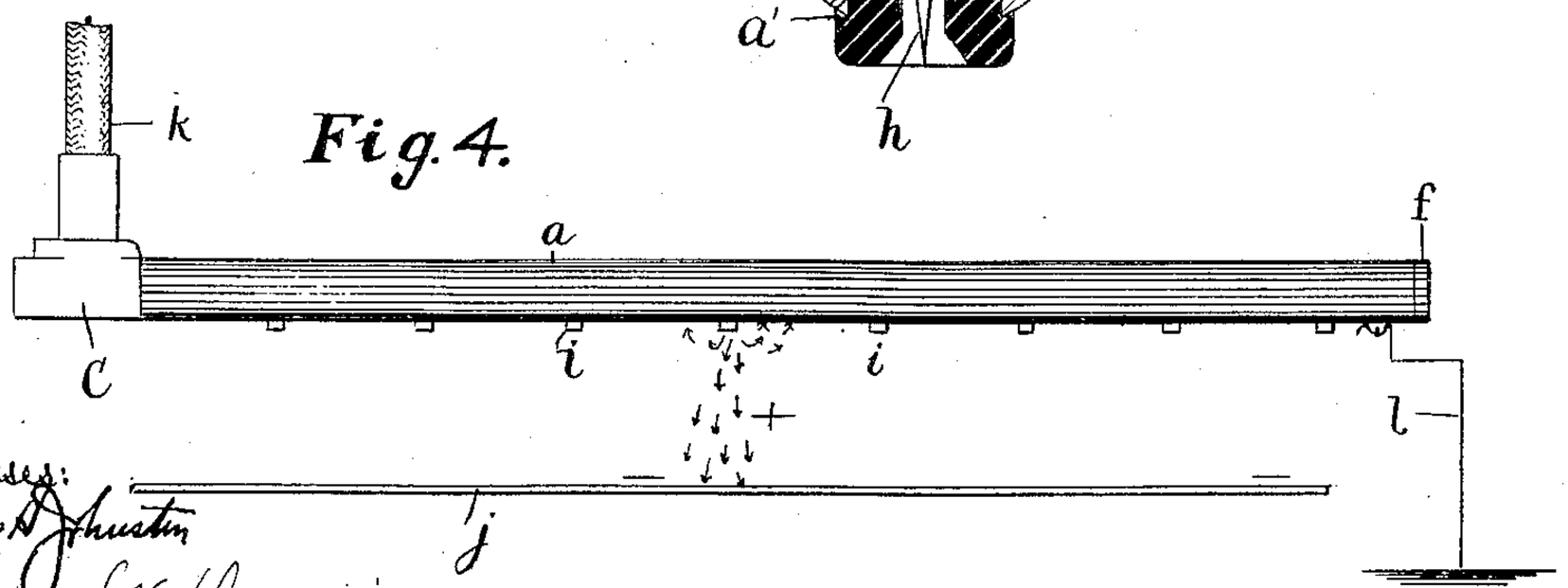


Fig. 4.



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UNITED STATES PATENT OFFICE.

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MEANS FOR NEUTRALIZING STATIC ELECTRICITY.

940,431. Specification of Letters Patent. Patented Nov. 16, 1909.

Application filed March 13, 1908. Serial No. 420,781.

To all whom it may concern:

Be it known that I, WILLIAM H. CHAPMAN, a citizen of the United States of America, and a resident of Portland, county of Cumberland, State of Maine, have invented certain new and useful Improvements in Means for Neutralizing Static Electricity, of which the following is a specification.

My invention relates to the neutralization of static electricity in paper, yarn roving and other material such as is developed during the process of manufacture or manipulation. In this act as shown in my Letters Patent No. 824,339 dated June 26, 1906 and in subsequent application I have made use of an insulated discharging conductor provided with fine points or surfaces adapted to discharge high voltage alternating electricity through the air and into contact with the material to be neutralized whereby the electricity contained in the charged material selected from the alternating charge enough of the opposite kind to neutralize itself.

In practice I have found difficulty in getting a form of discharging conductor which would not emit sparks and shocks when in contact with persons or materials capable of receiving the high voltage charge.

The objects of my present invention are, 1st to produce a discharging conductor whose discharge points are rendered as active as possible in the ionization of the air, and 2nd to produce such a conductor in which the discharge points are fed with a current whose quantity is only commensurate with what is actually utilized for ionizing the air, and thus render disruptive discharges impossible and so avoid the danger of setting fires or giving shocks. I accomplish these objects by placing near the discharge points a strip of metal connected to the earth, and by inserting a condenser of small capacity between the source of supply of alternating current and each discharge point, and preferably making the metal strip in the form of a tube which incloses and protects the condensers. The conditions necessary for the attainment of these two objects are in harmony with each other, as will be seen by the following considerations:—

It is a well known fact that the discharge of electricity into the air from a point is greatly facilitated by placing near the point a conductor that is connected to the earth, and when in proximity to such an earth connection, a point will discharge electricity at a much lower voltage than it will when a wide space separates it from any ground conductor. The reason for this is that the ions produced at the point find a much steeper potential gradient to propel them when the grounded conductor is near, and consequently, their velocity is greatly increased and the discharge current due to their carrying power increased, and this constitutes the best condition for the quick neutralization of any charged body within the range of influence of the ions. But the current of ionization in air from single point is at greatest but a very small current, in fact of such a small amount that it will not set fire to inflammable substances and will give no shock that a person can feel; consequently it is perfectly feasible to feed such a point with all the current it can transmit and utilize, and yet have some throttling device that shall limit the current within the danger point as to fire and shock, in case of accidental contact of materials or persons with the exposed point. In my present invention I accomplish this limitation by a small condenser placed in series with each individual point, and by making the electrodes of this condenser large or small in surface, I can secure a limitation at any desired value of current. As a matter of practice I find that a metal sleeve 1″ long surrounding an insulated cable $\frac{1}{2}$″ outside diameter, whose conducting wire is equal to No. 14 B. & S. gage, and wall of rubber $\frac{6}{32}$″ thick constitutes a condenser of ample capacity for neutralizing paper running 800 feet per minute. However, in applying this principle of limiting the quantity it is necessary to consider the fact that the charge on the material is continuously of one polarity, and that consequently a condenser so located will soon acquire a continuous charge of one polarity on that electrode which is connected to the discharge

points, and the polarity of the charge thus acquired being the same as that of the material, the process of taking away the charge of the paper would soon be clogged unless an alternative course is provided for the escape of these accumulative charges on the condenser electrode; accordingly, I provide this alternative course by placing in the vicinity of the discharge points a conducting strip connected to the earth, and this strip is preferably in the form of a tube inclosing and protecting the condensers. Thus the two objects of my invention harmonize with each other in their method of attainment.

I illustrate my invention in the accompanying drawing in which is shown a discharging conductor constructed in accordance with my invention.

In the drawing, Figure 1 is a vertical longitudinal section through the center of my discharging conductor, Fig. 2 is an enlarged side elevation of a section of the insulated cable with supporting block in section. Fig. 3 is a cross section on the line *x x* of Fig. 2 and Fig. 4 is an elevation of the entire conductor illustrating its action.

The main conductor which is insulated or not connected with a closed circuit is connected with a source of high voltage alternating electricity. As here shown my main conductor is a heavily insulated cable *b* extending longitudinally through a metal tube *a* which incases and protects it. The connection with the source of supply is made through a head *c* composed of insulating material having a longitudinal opening in its inner end into which the cable enters. A metal block *d* fits in this opening and through this metal block passes a small wire conductor *e* which is soldered or otherwise secured on the outer end of the block. The block is held in place by a spindle *m* which enters a screw threaded hole in the side or the block. An insulating nut *n* holds the spindle in place. The head is connected by means of a socket of ordinary construction with the supply cable *k*. The tube *a* is secured to the head *c* by screws fitting into an annular slot *o* and at the opposite end of the tube an insulated plug *f* is secured in the same manner and the plug has a central opening in which the end of the cable enters.

A series of independent discharging points are arranged along the cable at a distance apart according to the work to be done. They are placed sometimes as near as 1½ inches from centers. Each discharging point is formed of a pointed metal body electrically connected with a suitable metal plate on the outside of the cable thus forming a small condenser which thus becomes charged by induction with a charge which is proportional to the surface of the condenser but is always of full voltage. As here shown I form the plate of the condenser as a sleeve of thin metal *g* to which is soldered or otherwise secured an L-shaped metal strip *h* pointed at its lower end from which the discharge takes place.

The cable and discharging points are supported by supporting blocks *i* of insulating material each of which contains an opening through which the metal cylinder *g* and the cable pass and extending downward at right angles from the opening is another opening terminating at the lower end for protecting and containing the discharging point *h*. These supporting blocks *i* are secured to the tube *a* at frequent intervals and as I prefer to make the device the blocks are provided with recesses on each side and these recesses engage the edges of a longitudinal slot formed in the tube. Thus the blocks *i* may be slipped along in the slot and located at any desired point and the cable will be securely held in place. By this construction any length of conductor may be made by cutting off the tube *a* the right length and the discharging points may be as numerous as is necessary. The tube *a* is grounded by means of a wire *l*.

In Fig. 4, I represent a sheet of paper *j* passing beneath the conductor and charged with negative electricity. The alternating charge in the wire *e* acts through the rubber of the insulated cable on the sleeve *g* inducing a charge of alternating electricity which passes off through the air through each of the discharging points. So long as there is negative in the paper the positive pinions represented by small arrows pass to the paper and neutralize the negative and the negative ions pass to the tube attracted by the earth connection but when the paper becomes neutralized both positive and negative ions pass to the tube and then to the earth. Thus there is a constant attraction to the tube of the ions thrown off by the discharging points and a free discharge is maintained which is more active and effective and will act on the charged material through a longer distance than if the discharge came direct from the main cable. The reason for this is that the condenser inserted between the main conductor and the discharge point makes it possible to place the ground conductor in closer proximity to the points. If the points were connected directly to the main cable the discharge is liable to take the form of a spark discharge or an arc from some one point thus dissipating all the energy at that one point, whereas when connected to the little condenser each point is so limited in its quantity that the discharge always takes the form of a glow or brush discharge and is productive of ions

no matter how narrow the air space between the point and ground conductor. It is well known that the brush or glow discharge is increased by the proximity of a grounded conductor, and the little condensers make it practicable to bring the grounded conductor so much nearer to the points that it is more productive of ions than it could be by direct connection with the cable. The surface of the condenser plate being small no shock or disruptive discharge will take place from the discharging point and none can come from any other point of the apparatus. By increasing the insulation on the main conductor the voltage may be increased and the discharge given off from the discharging points become effective through a greater distance, that is, the process can be forced without danger, as the dangerous points are thoroughly insulated.

I claim:—

1. The herein described process of neutralizing static electricity in yarn, paper and other material which consists of locating in the vicinity of the material to be neutralized a discharging conductor having one or more fine discharging points adapted to discharge electricity into the air, producing an alternating charge of high voltage electricity in said conductor by electrostatic induction, and conducting to earth the discharge not passing to said material.

2. The herein described means for neutralizing static electricity which consists of an insulated main conductor connected with a source of high voltage alternating electricity, a discharging conductor having one or more fine points adapted to effect a discharge through the air, a condenser inserted between said conductors and a grounded conductor located adjacent to the points of said discharging conductor.

3. The herein described means for neutralizing static electricity which consist of a main conductor covered with insulating material and connected with a source of high voltage alternating electricity, a discharging conductor having a fine discharging point adapted to effect a discharge through the air, a condenser plate adjacent to said main conductor and connected to said discharging conductor, and a grounded conductor located adjacent to said discharging point.

4. The herein described means for neutralizing static electricity which consist of an insulated cable connected with a source of high voltage alternating electricity, a metal sleeve on the outside of said cable, a discharging conductor with a fine discharging point connected with said sleeve and a grounded conductor located adjacent to said discharging point.

5. The herein described means for neutralizing static electricity which consist of an insulated cable connected with a source of high voltage alternating electricity, a metal sleeve on the outside of said cable, a discharging conductor having a fine discharging point connected with said sleeve, a casing of insulating material in which the body of said discharging conductor is contained and a grounded conductor located adjacent to said discharging point.

6. The herein described means for neutralizing static electricity which consist of an insulated cable connected with a source of high voltage alternating electricity, a metal plate outside of said cable, a discharging conductor having a fine discharging point connected with said plate, a casing of insulating material in which the body of said discharging conductor is located and a grounded metal tube containing said parts having an opening for the exposure of said discharging point.

7. The herein described means for neutralizing static electricity which consist of an insulated cable connected with a source of high voltage alternating electricity, a series of metal plates on the outside of said cable, a discharging conductor having a fine discharging point connected with each of said plates, a block of insulating material forming a casing for containing each of said discharging conductors, each block having an opening for the passage of said cable and an opening at right angles therto for containing the discharging conductor and a grounded metal tube in which each of said blocks is secured and having an opening for exposing each of said discharging points.

8. The herein described means for neutralizing static electricity which consist of an insulated cable connected with a source of high voltage alternating electricity, a series of metal sleeves outside of said cable, an L-shaped discharging conductor connected to each of said sleeves, each having a discharging point projecting outward laterally from said cable, a series of blocks of insulating material each having an opening for the passage of said sleeve and cable and an opening at right angles thereto for containing said discharging conductor and having recesses in its opposite sides and a grounded metal tube for containing said parts and having a longitudinal slot the edges of which fit in said recesses to support said blocks.

9. The herein described means for neutralizing static electricity which consists of an insulated cable connected with a source of high voltage alternating electricity, two concentric conducting sheaths, the outer one connected to the earth and having an opening through its wall, and the inner one insulated from the earth and having a dis-

charge point projecting outward through said opening.

10. The herein described means for neutralizing static electricity which consists of an insulated cable connected with a source of high voltage alternating electricity, two concentric conducting sheaths, the outer one connected to the earth and having an opening through its wall, the inner one insulated from the earth, having a discharge point projecting outward through said opening and a casing of insulating material surrounding said point.

In witness whereof I have hereunto set my hand this 24th day of Feb'y, 1908.

WILLIAM H. CHAPMAN.

Witnesses:
S. W. BATES,
ELEANOR W. DENNIS.