

No. 777,598.

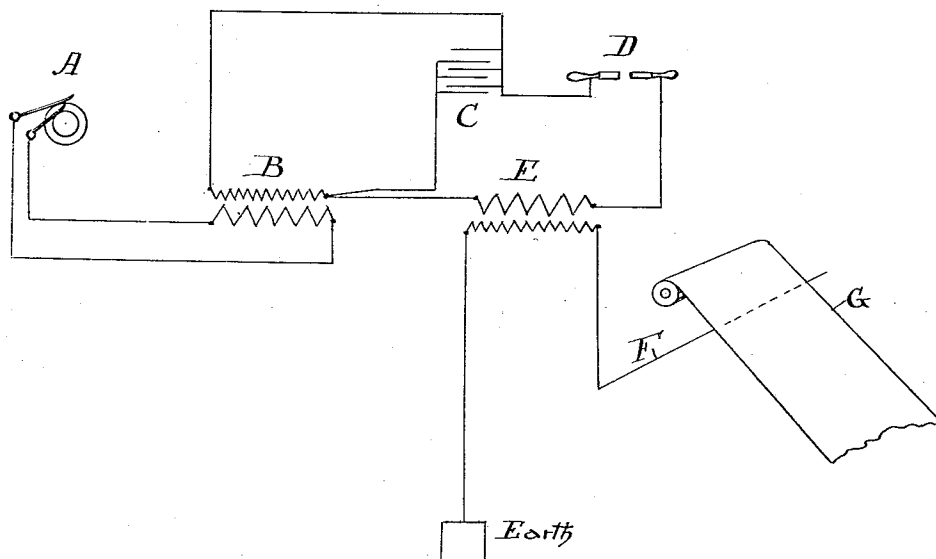
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W. H. CHAPMAN.

METHOD OF REMOVING STATIC ELECTRICITY FROM PAPER, YARN, &c.

APPLICATION FILED JAN. 25, 1904.

NO MODEL.



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UNITED STATES PATENT OFFICE.

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METHOD OF REMOVING STATIC ELECTRICITY FROM PAPER, YARN, &c.

SPECIFICATION forming part of Letters Patent No. 777,598, dated December 13, 1904.

Application filed January 25, 1904. Serial No. 190,451. (No model.)

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, Cumberland county, State of Maine, have invented certain new and useful Improvements in Methods of Removing Static Electricity from Paper, Yarn, &c., of which the following is a specification.

My invention relates to a method of removing static electricity from paper, yarn, and other like articles which during their manufacture or manipulation become charged with such electricity.

Static electricity generated by friction and by the separation of surfaces is often the source of great annoyance and delay in the operation of various kinds of machinery—as, for instance, in the calenders of paper-machines, in printing-presses, and in the machinery for working different kinds of fabrics—and it becomes of great importance to neutralize these static charges in order that the machinery may be worked in an efficient manner and at a desirable rate of speed. In the handling of paper the sheets of paper stick to each other and to other surfaces, causing breakage and delay, and to prevent these difficulties a variety of devices have been tried in the past with unsatisfactory results. Steam-jets have been used to some extent to conduct away the static charge, and metallic conductors studded with numerous sharp points presented to the charged surfaces and connected by wire to the earth have also been used; but these methods while partially successful and somewhat useful do not remove the whole charge and enough remains to cause a great deal of trouble. The method of my present invention, however, completely takes away all of the static charge, leaving the paper or fabric perfectly neutral.

It is a well-known principle of static electricity that a charged body of small surface, like a wire or a body with projecting points, discharges its electricity into the surrounding air more readily than one of a large surface and smooth, and charges are thus delivered to other bodies in the vicinity of it by a slow

kind of conduction, sometimes called “convection.” Now if the charged body of small surface or having projecting points is all the while of one polarity and another body be placed in a fixed position near it the second body will slowly acquire a charge of the same polarity as the first one, even though it previously had a charge of opposite sign. If, however, the second body instead of being retained in one position of proximity to the charged body be moved past it, coming gradually to the position of proximity and then receding from it, a previously-existing charge of opposite polarity in the second body will become entirely neutralized and the body will pass away in a neutral condition, provided the point termed the “position of proximity” be properly chosen with reference to the speed of the movement and the potential of the charge existing on the first-named charged body. On the other hand, when an alternating charge is used for the purpose the charges become self-selective and tend to a condition of neutrality for the second body, which becomes the stable condition for that body, as will be apparent by the following considerations, whether the body be at rest or in motion: Let us assume the second body to be positively charged and placed in a fixed position near a fine wire having an alternating charge. Then the tendency of the negative impulses of the alternating charge to pass over to the second body becomes much greater than the tendency of the positive impulses to pass over until the body is reduced to neutrality, when a balance is arrived at between the two; but whatever polarity the second body may have it creates for itself a tendency to neutralize in the presence of the alternating charge, which becomes enormously in evidence by reason of the well-known fact that the tendency to discharge through air from one body to another is proportional to the square of the difference of voltage between the two bodies, so that whatever be the polarity of the charge in the second body it becomes enormously easier for

the opposing charge to come to it across the intervening air than it does for the like charge to come across, and the condition of neutrality thereby becomes the only stable condition, and it comes to that condition just as rapidly as the extreme differences of potential can cause the leakage of the necessary quantity across the intervening air-space.

In the case of an electrified body whose charge we wish to dissipate if a wire be placed near it and maintained at no charge by being connected with the earth the charge will be gradually dissipated from the body by leakage through the air; but under ordinary atmospheric conditions as to moisture this leakage is so slow as to make it inadequate to obviate the difficulty which is the object of this application to overcome, and I therefore take advantage of the fact that the tendency of leakage in the case of electric charges is proportional to the square of the potential of the charges, thus hastening the process in an enormous ratio. The electric charges on such articles as paper or yarn are sometimes of very high potential; but they are always of very small quantity, so small, in fact, that a single alternation of even a small transformer may provide quantity enough to neutralize several square feet of surface of the material, and this fact makes it practicable to move the surface of the material at a rapid rate past the wire having the alternating charge and still secure perfect neutralization. A convenient and effective alternating potential to use is one that will give about three-fourths of an inch spark length in air, and by practical experience I find that a wire charged with this potential has a useful range of influence extending several inches or even a foot each side of the wire, so that even if we consider the range to be only six inches the velocity of the material for perfect neutralization may be anywhere from the very lowest possible up to a speed at which any given point on the surface of the material travels one foot during the time of one cycle or two alternations of the charge on the wire. With a current of sixty cycles per second, therefore, this would be a speed of one foot in one-sixtieth part of a second or sixty feet per second. As a matter of fact I have used alternating charges of forty cycles per second together with a velocity of material of six hundred feet per minute with perfect results, which is far within the limits of speed above indicated.

The invention consists, broadly, of placing a conductor in close proximity to the charged surface and charging the conductor with an alternating potential.

In practice I subject the conductor to an alternating current of high voltage and of standard frequency used in commercial electric lighting. In a paper-calender, for in-

stance, this may be done by placing a wire across the face of the rolls at the point where the paper comes off from them or at other points where the paper may come in close proximity to the wire. The wire is kept charged at a high voltage from a transformer-coil delivering an alternating voltage high enough to discharge through the distance which separates the wire from the paper, which may be, for instance, one inch. The paper is thus subjected to a rapidly-alternating charge which effectually removes all the fixed charge, leaving the surface of the paper perfectly neutral as it passes on. In a printing-press the wire is stretched across the face of the cylinder at a convenient distance, usually about one inch. It is not necessary in carrying out this process that the opposite impulses of the alternating charge should be equal, as I may use, for instance, an ordinary induction-coil, in which the impulses are well known to be unequal in voltage.

I illustrate my invention by means of the accompanying drawing, in which is shown a diagram of the necessary apparatus for applying my process in its preferable form to a web of paper.

In the drawing, A represents the alternator, and B the main transformer; C, the condenser; D, the air-gap, and E the secondary transformer of the well-known Tesla coil, by which an alternating charge of high voltage and high frequency is given to a wire F, which is stretched across in close proximity and parallel with the face of the web of paper C.

The wire F is so placed with relation to the paper that the charge will pass across from the wire to the paper. As the paper moves along its surface passes through the rapidly-alternating field thus formed, and as a result the static electricity of the paper is completely neutralized. It is evident that the same process may be readily applied to yarn, roving, and other articles which become charged with static electricity and that any suitable apparatus other than that here shown may be used.

Other means than the wire here shown may be used to receive the alternating charge; but I have found that the process works best when a body with a limited amount of surface, like a wire, is used.

I claim—

1. The herein-described method of neutralizing a charge of static electricity in a body by passing it through a field of alternating static electricity.

2. The herein-described method of neutralizing a charge of static electricity in a body by placing it in close proximity to another body subjected to an alternating charge of high voltage.

3. The herein-described method of neutralizing a charge of static electricity in a body by passing it in close proximity to another

body having a relatively small surface and subjected to an alternating charge of high voltage.

4. The herein-described method of neutral-
5 izing a charge of static electricity in a body by placing it in close proximity to another body subjected to an alternating charge of high voltage and high frequency.

5. The herein-described method of neutral-

izing a charge of static electricity in a body 10 by passing it in close proximity to a wire subjected to an alternating charge of high voltage.

Signed at Portland, Maine, this 7th day of January, 1904.

WILLIAM H. CHAPMAN.

Witnesses:

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