July 28, 1942. P. M. STRANG 2,291,005

APPARATUS FOR REDUCING STATIC IN TEXTILE MACHINES

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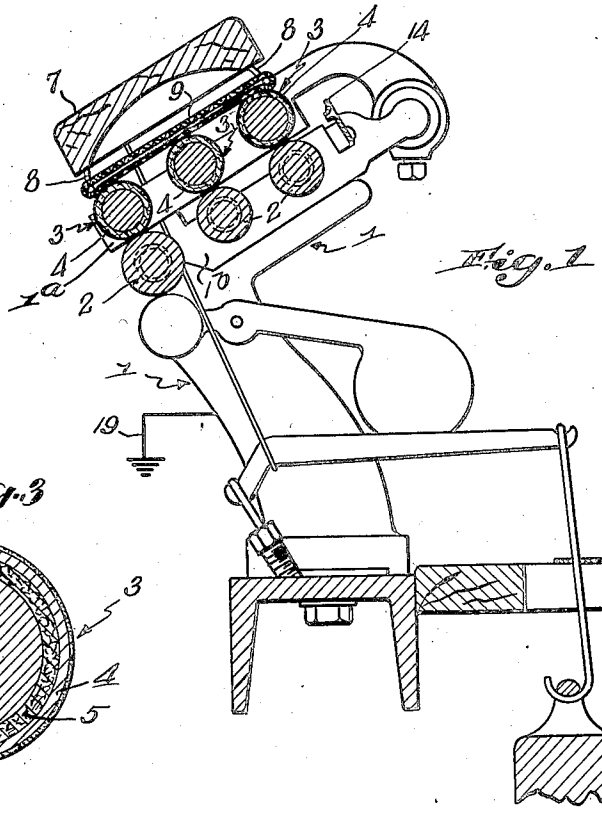


Fig. 1

Fig. 3

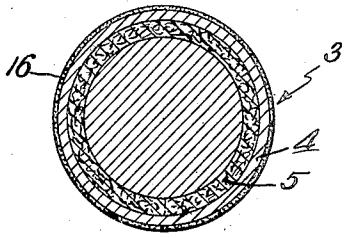
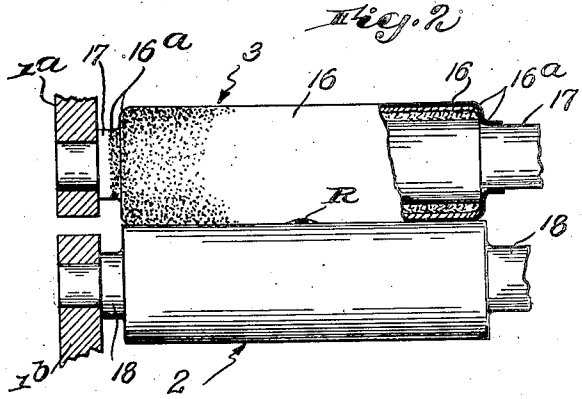


Fig. 2



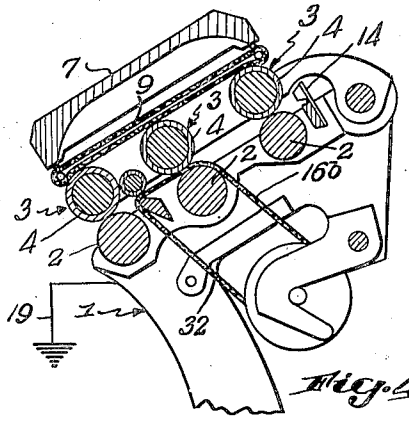
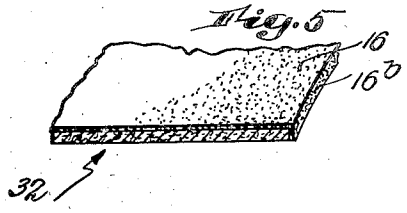


Fig. 4

Fig. 5



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APPARATUS FOR REDUCING STATIC IN TEXTILE MACHINES

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21 Claims. (Cl. 19—143)

This invention relates to textile machinery and is particularly applicable to fiber drafting machinery. In drafting frames of the usual type in which the fibers in the form of roving are passed between pairs of drafting rolls, one set of the rolls, usually the lower set, are constructed of metal and the other set, usually the upper set, are covered with some yieldable material such as leather. I have determined that in the operation of many of these machines charges of static electricity are built up on the surfaces of such yieldable rolls and that as a consequence the fibers emerging from the machine often are so highly charged with static electricity that the quality of the yarn is lowered.

An object of the invention is to avoid the accumulation of static charges on the yieldable rolls or analogous fiber-contacting elements such as leather aprons in textile machines. By the application of the present invention to fiber drafting machines, elimination or a marked decrease in the amount of static electrical charges on the yieldable rolls can be secured, and in addition to improving the quality of the yarn, there is secured a reduction in the tendency of small bits of fiber to stick to the rolls of the machine, thus rendering it much easier to keep the machine clean. A further object is to avoid the difficulty of the fibers clinging to and winding up on a roll of the machine. This difficulty has previously been particularly acute in roving and drawing frames handling material having little or no twist, and in cold atmosphere as when work is begun on a cold day at the beginning of a week, and has often seriously reduced the productive output of such machines.

Other objects of invention and features of advantage and utility will be apparent from this specification and its drawing, wherein the invention is explained by way of example.

In the drawing:

Fig. 1 is a vertical sectional view somewhat diagrammatic in character showing a textile drafting machine;

Fig. 2 is a fragmentary view in front elevation, partly broken away, showing part of the drafting rolls of the machine embodying the present invention;

Fig. 3 is a cross-sectional view of the upper roll;

Fig. 4 is a view similar to Fig. 1, but showing the application of the invention to another form of drafting machine; and

Fig. 5 is a perspective view of a fragment of the apron of the machine of Fig. 4.

The principles of this invention may be employed generally in textile machinery, such for example as drawing, roving and spinning machines and machines such as cards and press rolls on cotton gins where textile material passes between moving rolls, aprons or the like so that static electricity tends to collect on the fibrous material.

For the purposes of illustration the present invention shows the application of the invention to a typical drafting machine for cotton or rayon roving, although the principle of the invention is also applicable to machines which handle wool or silk. As shown in Fig. 1, such a machine may be provided with a metal frame, indicated generally at 1, holding lower metal rolls 2 and yieldable upper rolls 3 having leather coverings 4, with usually, in practice, a cushion 5 of woolen cloth or the like disposed beneath the leather. In some cases cork composition is used in place of leather as the covering of the deformable rolls. Successive pairs of rolls are rotated at different speeds so that the material passing through the bites of successive pairs of rolls is thus drawn out. A clearer board 7 is arranged above the rolls 3 and is provided with bail elements 8 supporting a looped clearer cloth 9, the lower run of which frictionally engages the surfaces of the leather-covered rolls 3. A guide 14 is customarily provided for the roving at the entry end of the set of rolls.

During the rotation of usual leather-covered drafting rolls, tests with an electroscope indicate the presence of very substantial electrical charges on the surfaces of leather-covered rolls and this effect may be observed even in the absence of fiber between the rolls. It is probable that the electrical charge is built up on the surface of leather-covered rolls partly as a result of the continued deformation of the roll at the nip line, partly by the rubbing of the roll by the clearer cloth or clearer roll, and when fibrous material is drawn through the set of rolls also partly by the frictional effect of the fibers on each other as they are drawn apart by the rolls, and by the slippage of the fibers against the roll. Leather and cork-composition being non-conductors, this static charge tends to build up to such proportions that in many cases the fibers emerging from the machine are adversely affected. For convenience the increment of static charge which appears to be produced in the roving as the result of an accumulation of static charge on a roll or rolls or other moving elements may be referred to as the "induced static charge." This charge

on the roving causes adjoining fibers to have a mutually repelling effect, thus tending to cause them to flare apart and resist control in the drawing and spinning operations and rendering the spinning less effective in producing a strong, firmly twisted yarn. It can be shown that by eliminating or materially reducing the static charge on the yieldable roll, while of course avoiding the accumulation of a static charge on the metal roll, the amount of static charge in the drawn roving or fibrous material can be very much reduced.

According to the present invention the portion of the surface of the yieldable roll that contacts with the fibrous material is covered with a very thin covering of conducting material and the static charge which would otherwise accumulate on the surface of the roll is conducted through this conducting material and led to a ground. The thickness and character of the coating of conducting material are such as not to interfere with the deformability of the roll. Various metallic or metal-like coatings may be used, the principal requirements of such coatings being that they shall adhere to the yieldable roll, themselves be capable of deformation along with the roll so as not to render the roll rigid, and constitute an electrically continuous conductor.

I have discovered that the metallic coating can be made to conform to the yieldable surface of the leather roll by forming the coating of finely-divided metallic particles. It is probable that the fine division of these metallic particles promotes their adhesion to the leather surface and at the same time permits movement of the particles with respect to each other as the roll deforms, but without preventing the metallic coating from conducting electricity.

A preferred way of producing an especially effective metallic coating is to paint the surface of the yieldable roll with an aqueous colloidal solution of silver, which when it dries leaves a silver coating of the order of .001 inch or less in thickness. It is probable that the best adhesion of the colloidal silver to leather-covered rolls has occurred when the polarity of the surface of the leather has been opposite to that of the colloidal silver solution so that electro-static attraction aided in causing adhesion of the silver and leather.

Referring to Fig. 2 wherein portions of the upper and lower front rolls of the machine are shown with the roving R therebetween, the upper roll 3 has its leather surface covered with a thin coating 16 of finely-divided metallic particles, preferably silver as described above. This coating extends not only over the outer peripheral surface of the roll, but is carried down as indicated at 16a at either or both the end faces of the roll to make electrical contact with the metal shaft 17 of the roll. The metal shaft 17 of the upper roll 3 is mounted in suitable bearings in the upper roll-carrying elements 1a of the machine, and the metal shaft 18 of the lower roll 2 is similarly mounted in the lower roll-carrying elements 1b, both the upper and lower roll-carrying elements 1a and 1b being connected to and electrically a part of the general metal framework 1 of the machine. The metal framework of the machine is preferably connected to the ground itself as diagrammatically indicated at 19 in Fig. 1, but in some instances an adequate grounding effect may be secured without a special connection between the frame and the actual ground. The surfaces of both rolls are thus effectively connected to a common grounding medium, the static charges which tend to be formed on these surfaces being directed to such common grounding medium, thereby preventing the building up of a static potential on either roll and thereby preventing the rolls from imparting an "induced static charge" to the fibers.

Preferably all of the lower rolls are of steel and all of the upper rolls have the above-described thin metallic coating which grounds their surfaces.

If in any case the electrical conductivity of the bearings in which the roll shafts are mounted is low enough to interfere to any important extent with the sufficiently rapid grounding of the roll surfaces, it is within the scope of the invention to employ any suitable means such for example as brushes or slip rings to transmit the static charges from the roll shafts past the bearings to the frame or other ground. However, it has been found as a practical matter that the usual bearings in which these rolls are mounted are sufficiently conductive to be used to conduct the static charges from the roll shafts to the framework of the machine.

While the surface of the top roll has been described as electrically connected to the framework of the machine through the roll shaft, it will be apparent that unless the roving R or other fibrous material is too thick, there will be actual contact between the metallic coating of the top roll and the steel bottom roll, near the lateral edges of these rolls where the fibrous material does not run between them. That is, usually the rolls will be held together with sufficient pressure so that an effective electrical contact is made between their surfaces wherever the fibrous material is absent. In this manner, it is possible for static charges on the upper roll to be discharged through the lower roll without having to pass along the shaft, and through the bearings of the upper roll, so that in some cases it may not be necessary to employ the portion of the coating 16a which has been described as electrically connecting the outer peripheral surface of the top roll with the shaft of this roll.

In the apparatus of Fig. 4 wherein parts similar to those of Figs. 1, 2 and 3 are indicated by the same reference character, there is additionally provided an apron 32 of leather or the like running partly around the middle lower metal roll, contacting the middle upper leather metal-coated roll, and running forwardly nearly to the nip between the front rolls. On its surface which contacts with the roving, this apron is provided with a thin coating 16 of finely-divided metallic particles, preferably silver, as described above. This coating is carried down as indicated at 16b across either or both edges of the apron, so as to make contact with the middle metallic roll 2 on which the belt runs. Thus there is provided a path through which static charges can run from the surface of the apron to the metal roll and thence through the roll bearings to the metallic frame of the machine and the ground. The upper leather-covered rolls of this form of machine are preferably also provided with metallic coatings as described above in connection with Figs. 1, 2 and 3.

In the practice of this invention generally (and as above exemplified with respect to specific details and applications) it is to be noted that the metal to be used is first prepared in the form of colloidal particles. Particles of such small dimensions,—approaching those of molecules,—are

generically characterized by their capability of effecting intimate contact with solid surfaces. With such small particles gravitational forces alone may be sufficient to account for their individual strong attraction thereto. In any event, such strong attraction is in fact found to exist. And it may be easily realized in practice by first dispersing the colloidal metal particles, as above described, in a uniform dispersing liquid which is of low viscosity and completely volatile,—such as water. It is thought that such dispersing liquid dispels any adsorbed gases and the like from the deformable surface to which it is applied, such as leather or the like, and hence makes possible and actually effects intimate contact between the colloidal particles and the deformable surface, per se, so that the strong attraction and resultant tenacious adhesion as above described is set up spontaneously. Obviously, high viscosity of this liquid dispersing agent would oppose such intimate contact between the particles, while low volatility or non-volatility of the dispersing liquid would tend to cause the liquid to remain upon and hence coat over the deposited colloidal metal particles. Being non-conductors of electricity, such non-volatile coatings would thus offset the effectiveness of the metal particles as electrical conductors which is herein desired to be provided and preserved.

By applying a dispersion of colloidal metal particles, in a volatile liquid dispersing vehicle of low viscosity, and then causing the liquid to vaporize, the colloidal particles are individually deposited directly upon the surface of the leather, in intimate contact, and, under the attractive influences above described, adhere firmly thereto. Such individual particles do not, therefore, interfere with the individual direct adhesion of adjacent particles. Moreover, the metal coated deformable surface thus produced may be deformed without affecting such adhesion, and flexing of such surface (as when the roll above described revolves through the bite, under pressure and in contact with the roving and the other roll or rolls) has substantially no effect in displacing the colloidal particles therefrom.

At the same time, by depositing a sufficient concentration of such individually attached colloidal particles of metal upon the surface of the deformable leather roll, these particles will contact with each other laterally and thus form or constitute a continuously electrically conductive surface or layer upon or along which any induced static charges formed are rapidly dissipated and conducted therefrom and thence through the electrically conductive path to the ground, as above described. This electrically continuous and conductive surface, being made up of individual, firmly and separately attached colloidal particles, may be readily, rapidly and constantly deformed, substantially without affecting the adhesion of the individual particles and without dispersing or impairing the continuous, electrically conductive and discharging characteristics of the surface or layer as a whole. When ultimately worn off, the continuity of the layer or coating may be restored by again treating it with a fresh colloidal dispersion of metal particles.

It may be practiced, within the invention to apply a thin and preferably flexible surface of adhesive to the flexible or deformable surface of the roll and then to apply a layer of colloidal metal particles thereto. In this way, the intervening adhesive is relied upon for retention of the colloidal particles instead of intimate contact alone. It may also be practiced to impart opposite electrical charges to the dispersed colloidal particles of metal and to the surface of the leather, so that upon contact the opposite electrostatic forces will draw the particles and surface together into intimate contact and direct adhesion.

In applying the invention to specific installations of equipment and for the handling of different kinds of materials, the surrounding conditions must be considered, including the atmosphere of the room especially in the immediate vicinity of the rolls. This will have a determining effect upon the metal or metals which may be advantageously used from which to form the electrically continuous conductive surface of the rolls. Thus, for example, if the atmosphere or the condition of the fibrous material is such as to present a sufficient amount of moisture, chemically reactive metals such as aluminum will be readily oxidized or hydrated, and although such action may be extremely superficial and of microscopic thickness, nevertheless the aluminum oxide formed is an effective resistor of the electric current and hence opposes the collation of electrical charges from the surface of the textile and transmission of this to the conducting path to the ground. Consequently, while inert atmospheric and other suitable attendant conditions will permit of any electrically conductive metal being used to form the electrically continuous surface, when chemically reactive conditions are encountered these must be offset, or provided for by using a metal which is sufficiently resistant to them to be compatible with the preservation of the effective reception and conductivity of the static charge from the textile and to the ground.

I claim:

1. A textile machine having therein elements between which textile material passes, one at least of said elements being a moving element with a deformable surface, and a thin coating of electrically-conducting finely divided material on said deformable surface, and deformable therewith, said coating of electrically-conducting material contacting with a conducting path through which static electricity can discharge from said coating.

2. A textile machine having therein rolls between which textile material passes, one at least of said rolls having a deformable surface, and a thin coating of electrically-conducting finely divided material on said deformable surface, and deformable therewith, said coating of electrically-conducting material contacting with a conducting path through which static electricity can discharge from said coating.

3. A textile machine having therein elements between which textile material passes, one at least of said elements being a moving element with a leather surface, and a thin coating of electrically-conducting finely divided material on said leather surface, and deformable therewith, said coating of electrically-conducting material contacting with a conducting path through which static electricity can discharge from said coating.

4. A textile machine having therein elements between which textile material passes, one at least of said elements being a moving element with a cork-composition surface, and a thin coating of electrically-conducting finely divided material on said cork-composition surface, and deformable therewith, said coating of electrically-conducting material contacting with a conducting

path through which static electricity can discharge from said coating.

5. A fiber-drafting machine having therein fiber-drafting elements between which textile material passes, one at least of said elements having a deformable surface, and a thin coating of electrically-conducting finely divided material on said deformable surface, and deformable therewith, said coating of electrically-conducting material contacting with a conducting path through which static electricity can discharge from said coating.

6. A textile machine having therein a frame, rolls between which textile material passes, one of said rolls having a deformable surface, and a thin coating of electrically-conducting finely divided material on said deformable surface, and deformable therewith, the other of said rolls being a metal roll, and said metal roll and said thin coating being electrically connected to the frame.

7. A textile machine having therein rolls between which textile material passes, one of said rolls having a deformable surface, and a thin coating of electrically-conducting finely divided material on said deformable surface, and deformable therewith, the other of said rolls being a metal roll, and said metal roll and said thin coating being electrically connected.

8. A textile machine having therein elements between which textile material passes, one at least of said elements being a moving element with a deformable surface, and a thin coating of finely-divided metal on said deformable surface, and deformable therewith, said coating of finely-divided metal contacting with a conducting path through which static electricity can discharge from said coating.

9. A textile machine having therein elements between which textile material passes, one at least of said elements being a moving element with a deformable surface, and a thin coating of colloidal particles of metal on said deformable surface, and deformable therewith, said coating of colloidal particles of metal contacting with a conducting path through which static electricity can discharge from said coating.

10. A textile machine having therein elements between which textile material passes, one at least of said elements being a moving element with a deformable surface, and a thin coating of colloidal particles of relatively non-reactive metal on said deformable surface, and deformable therewith, said coating of colloidal particles of metal contacting with a conducting path through which static electricity can discharge from said coating.

11. A textile machine having therein elements between which textile material passes, one at least of said elements being a moving element with a deformable surface, and a thin coating of colloidal particles of silver on said deformable surface, and deformable therewith, said coating of colloidal particles of silver contacting with a conducting path through which static electricity can discharge from said coating.

12. A textile machine having therein a frame, drafting rolls between which textile material passes, said rolls having shafts mounted in the frame, one of the said rolls having a deformable peripheral surface and a thin coating of electrically-conducting finely divided material on said deformable surface, and deformable therewith, and an electrical connection between said coating on the peripheral surface and the shaft.

13. In combination with a machine for treating fibrous textile material, wherein the material passes between opposite cooperating moving parts one of which has a deformable surface, and the other of which is metallic, a thin coating of electrically-conducting finely divided material on said deformable surface, and deformable therewith, and electrical connections from the metallic part and from the said thin coating to a common grounding medium, whereby static electricity may be removed from said parts and the building up of an induced static charge on said material may be impeded.

14. A roll for fiber-drafting machines and the like having therein a metal shaft portion, a deformable covering and a thin outer coating of electrically conducting finely divided material capable of deformation with said deformable covering, and the roll including an electrical connection between the said thin outer coating and the said shaft portion.

15. A roll for fiber-drafting machines and the like having therein a metal shaft portion, a deformable leather covering and a thin outer coating of electrically-conducting finely divided material capable of deformation with said deformable covering, and the roll including an electrical connection between the said thin outer coating and the said shaft portion.

16. A roll for fiber-drafting machines and the like having therein a metal shaft portion, a deformable cork-composition covering and a thin outer coating of electrically-conducting finely divided material capable of deformation with said deformable covering, and the roll including an electrical connection between the said thin outer coating and the said shaft portion.

17. A roll for fiber-drafting machines and the like having therein a metal shaft portion, a deformable covering and a thin outer coating of finely-divided metal capable of deformation with said deformable covering, and the roll including an electrical connection between the said thin outer coating and the said shaft portion.

18. A roll for fiber-drafting machines and the like having therein a metal shaft portion, a deformable leather covering and a thin outer coating of finely-divided metal capable of deformation with said deformable covering, and the roll including an electrical connection between the said thin outer coating and the said shaft portion.

19. A roll for fiber-drafting machines and the like having therein a metal shaft portion, a deformable cork-composition covering and a thin outer coating of finely-divided metal capable of deformation with said deformable covering, and the roll including an electrical connection between the said thin outer coating and the said shaft portion.

20. A roll for fiber-drafting machines and the like having therein a metal shaft, a deformable covering, a thin outer coating of electrically-continuous-conducting finely divided material capable of deformation with said deformable covering, and an electrical connection between said coating and said shaft.

21. A roll for fiber-drafting machines and the like having therein a metal shaft, a deformable covering, and a thin outer coating of electrically-conducting finely divided material capable of deformation with said deformable covering, the said coating continuing on an end of the roll to connect electrically with the shaft.

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