

[54] TRAVELING PNEUMATIC CLEANER WITH ELECTROSTATIC CHARGE REDUCING MEANS AND METHOD

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[56]

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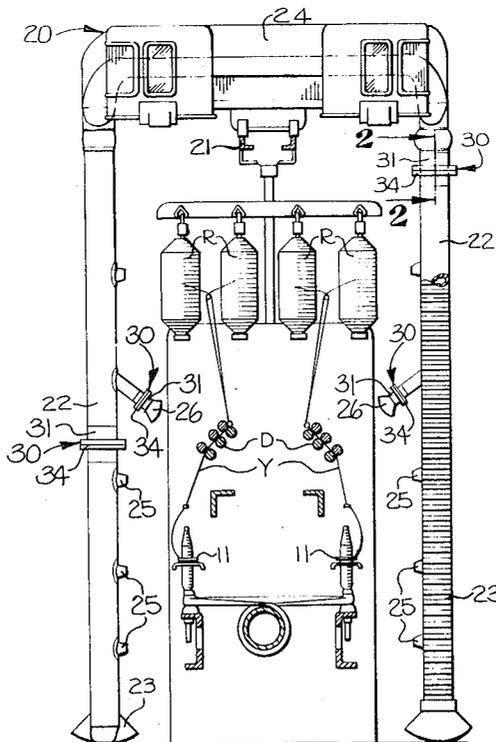
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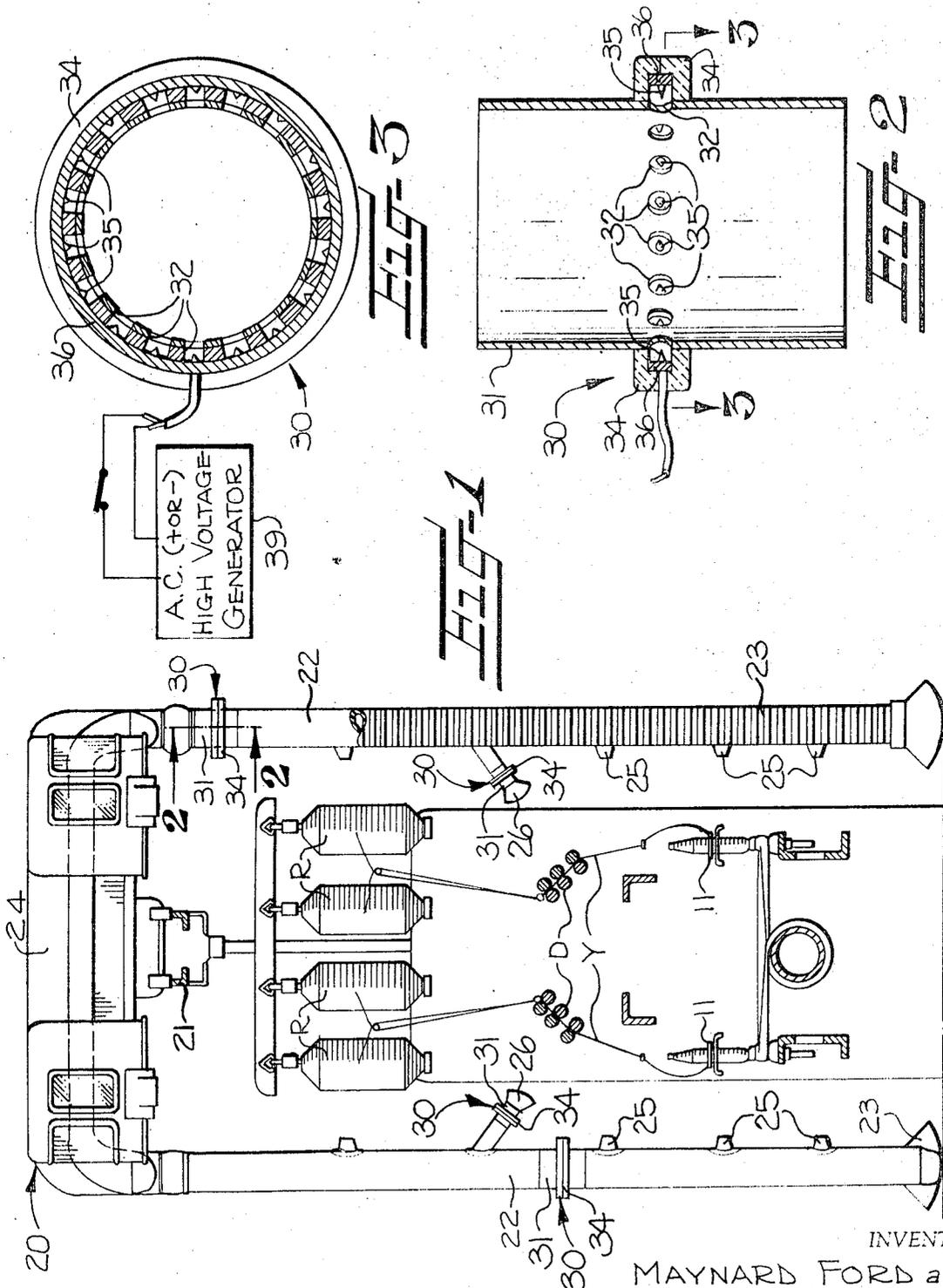
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ABSTRACT

The formation of textile materials into strands by a textile strand forming machine such as a spinning frame is facilitated by reduction of electrostatic charges produced in forming the strand, through the combination of a device, preferably a traveling pneumatic cleaner, which sequentially directs an air stream toward strands being formed and an electrical charging device for electrically charging the air stream.

11 Claims, 3 Drawing Figures





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## TRAVELING PNEUMATIC CLEANER WITH ELECTROSTATIC CHARGE REDUCING MEANS AND METHOD

The processing of fibrous textile materials to form strands thereof, such as the spinning of yarns on a spinning frame or the like, gives rise to static electricity. In such textile processes the work being done on the fibrous textile materials, in drafting and twisting, generates electrostatic charges which may reach relatively high magnitudes.

It has been recognized that such electrostatic charges interfere with the process of strand formation where the magnitude of the charges exceeds a threshold level. In particular, the relative ease with which fibrous textile materials are spun into yarns on a spinning frame, for example a ring spinning frame, and the consistency of the yarns produced, depend in part upon the levels of electrostatic force acting on the fibrous textile materials. As used herein, "spinnability" refers to the ease with which desired production of textile strands such as yarn is reached and maintained. A yarn or material is said to be more "spinnable" when the production thereof does not give rise to excessive difficulty. The higher the levels of electrostatic charge generated, the less spinnable the materials become.

In the past, efforts at controlling the levels of electrostatic charge permitted to be present on strands being formed have been particularly directed to control over the relative humidity of air in the textile mill room in which strand forming operations proceed. It has been the view that a low relative humidity encourages build up of electrostatic charges on strands being formed, while a high relative humidity facilitates bleeding off of electrostatic charges through the higher yarn conductivity from absorption of moisture from air ambient to the strand forming operation and thus aids in maintaining the accumulated charges below the spinnability impairing threshold level.

Such prior efforts toward control over accumulation of electrostatic charges, in an effort to facilitate strand forming operations, have been less than successful in that significant variations in the spinnability of a yarn may still be found to be related to variations in electrostatic charges on the strands being formed. While high relative humidity conditions may be of some aid with hydrophilic materials such as cotton, the increasing use of hydrophobic materials such as polyester has again brought electrostatic charge accumulation problems forward while adding difficulties of lap-up of materials about rolls or turbines used as processing instrumentalities. The use of special cots and aprons with such hydrophobic materials has not so reduced the fiber repulsion effect of electrostatic charges generated during drafting as to overcome these difficulties.

In view of such continuing difficulty, it is an object of the present invention to facilitate the formation of textile materials into strands by overcoming the resistance of textile materials to orderly formation into strands which otherwise results from electrostatic charges accumulating on the strands being formed. In accordance with the present invention, electrostatic charges otherwise produced in forming the strands are reduced through the direction of an electrically charged air stream toward the strands being formed.

A further object of the present invention is to repeatedly and periodically bathe the strand forming stations spaced along a textile strand forming machine such as a spinning frame with a flowing stream of electrically charged air. By such application of electrically charged air to a textile strand forming machine such as a spinning frame, the accumulation of electrostatic charges on elements of the machine and on strands being formed thereby is reduced, so as to facilitate formation of yarns by the textile machine. In accordance with this invention, the repeated and periodic direction of an electrically charged flowing stream of air toward the machine is preferably accomplished through the provision of a traveling pneumatic cleaner means and electrical charging means mounted thereon for electrically charging an air stream delivered by the traveling pneumatic cleaner means.

Some of the objects and advantages of the invention having been stated, others will appear as the description proceeds,

when taken in connection with the accompanying drawings, in which

FIG. 1 is an elevation view, in partial section, showing the combination of a traveling pneumatic cleaner means with electrical charging means in accordance with the present invention and mounted for movement along a textile strand forming machine;

FIG. 2 is an enlarged elevation view, in section, of a portion of the combination of FIG. 1, taken generally as indicated by the line 2—2 in that Figure; and

FIG. 3 is a plan view, in partial section, through the apparatus illustrated in FIG. 2, taken generally along the line 3—3 in that Figure.

Referring now more particularly to the drawing, the apparatus of the present invention is there disclosed in operating relation to a textile yarn forming machine, namely a ring spinning frame 10. While only a single spinning frame 10 is illustrated, it is to be understood that the frame 10 may be one of a substantial number of yarn forming machines arranged in rows in a spinning room, in patterns which are substantially conventional, or may be another form of yarn forming machine. A traveling pneumatic cleaner means 20 is supported from a track 21 extending above the textile machine 10 for traversing the same along a predetermined path of travel. The specific apparatus chose for illustration of the drawings is substantially identical to the fourth embodiment of the traveling pneumatic cleaner disclosed in U.S. Pat. No. 3,304,571 issued on Feb. 21, 1967 and owned in common with the present invention, but it must be understood that a wide variety of other traveling pneumatic cleaners are contemplated as useful in the combination of this invention and that the invention is accordingly not to be limited solely to the specific apparatus shown. Other traveling pneumatic cleaners are disclosed, for example, in U.S. Pat. Nos. 3,011,925; 3,016,559 and 3,055,038.

The traveling cleaner means 20 is supported for movement along a track 21 extending above the spinning frame 10 and includes stream directing blowing and sucking air conduits or sleeves 22, 23 depending on either side of the spinning frame 10 from a main fan housing 24, for removing lint and the like from the spinning frame and the floor by currents of air. As is disclosed more fully in the aforementioned patent directed to the cleaner structure itself, drive means and a fan are provided for inducing air in the spinning room to flow through the cleaner means for pneumatic cleaning. While the traveling pneumatic cleaner means 20 may be arranged to traverse a plurality of textile machines such as a spinning frame 10, the present invention contemplates also that the traveling pneumatic cleaner means 20 or the manner in which the cleaner is supported and arranged for traversing a textile machine may be changed in varying ways, including limiting the path of travel of the cleaner to traversal of the single machine only.

In any instance, the traveling pneumatic cleaner means 20, in accordance with the present invention, travels a flowing stream of air along a textile strand forming machine such as a spinning frame 10 and sequentially directs the air stream toward individual strand forming stations in a series spaced therealong and toward the strands being formed at the stations. In this connection, conventional ring spinning frames in wide use in the textile industry of the world at the present time include a creel portion wherein a plurality of bobbins of roving R are suspended, drafting systems D to which the roving is supplied, and spindles on which bobbins of spun yarn Y are wound. In order to provide for spinning of the yarn Y in the conventional manner, the frame 10 is provided with spinning rings 11 encircling each of a plurality of spindles driven in rotation from the center shaft or tape drum of the frame. On each of the spinning rings 11 is mounted a traveler, through which the yarn Y is threaded for spinning and packaging as the traveler moves rapidly around the spinning ring 11 in a well-known manner.

The attenuation of roving in the drawing systems D and spinning of the yarn Y between the drafting systems D and the

spinning rings 11 give rise to electrostatic charges, generated by the operations of the elements of the frame 10 on the roving R of fibrous textile material being spun into the yarn Y. Typically, electrostatic charges are generated at each of the series of strand forming stations spaced along the frame 10, as defined by the spinning rings 11 and associated spindles.

In accordance with the present invention, advantage is taken of the traversal of the spinning frame 10 by the traveling pneumatic cleaner means 20 for reducing accumulation of electrostatic charges produced in forming the yarns Y at the strand forming stations along the frame 10. In particular, movement of the traveling pneumatic cleaner means 20 relative to the frame 10 travels a flowing stream of air along the textile strand forming machine while sequentially directing the air stream toward the individual strand forming stations and toward strands being formed at the stations. This broad function of the traveling pneumatic cleaner means 20 is as set forth in aforementioned U.S. Pat. No. 3,304,571.

In accordance with the present invention, the air stream delivered by the traveling pneumatic cleaner means 20 is electrically charged, such as by delivery of the air through an electrical charging means generally indicated at 30 which ionizes at least a portion of the air flowing in the stream through a trailing blowing sleeve 22 and emitted from the traveling pneumatic cleaner means 20. In particular, the electrical charging means 30 comprises a conduit section 31 (FIGS. 2 and 3) preferably defined by a metallic tube and having a plurality of openings 32 therethrough. The openings 32 preferably are circular in character and are arranged around the circumference of the conduit section 31 in a generally circular pattern. Surrounding the openings 32 is a mounting ring 34 bearing therewithin a plurality of pointed electrode members 35. By means of the mounting ring 34 and a spacing ring 36 for the electrode members 35, the electrode members 35 are electrically insulated from the conduit section 31.

By means of a two conductor cable 38, the conduit section 31 and the electrode members 35 are electrically connected with a high voltage generator 39. Preferably, for reasons pointed out hereinafter, the high voltage generator 39 generates a relatively high voltage alternating current, but supplies such current at a relatively low amperage. In application of the present invention, suitable transformer means may be incorporated in the high voltage generator 39 and power therefor may be drawn from the electrical power source from which current is obtained for the traveling pneumatic cleaner means 20.

In the presence of a high voltage differential between the conduit section 31 and the electrode members 35, air passing through the conduit section 31 becomes ionized and therefore carries an electrical charge. In particular, it is recognized that the constituents of air are effected by passage through or adjacent electrical fields wherein high gradients of potential exist, in that electrons are shifted to result in the air becoming electrically charged or ionized. It is to be understood that, inasmuch as ionization proceeds by shifting electrons from the constituents of air, ionized air has a tendency to return to an electrically neutral condition by taking up or giving off electrons which have been so shifted. This transfer of electrons is used to advantage, in the present invention, for accommodating the electrons which give rise to the electrostatic charges otherwise accumulating on yarns Y being formed.

In accordance with the present invention, ionized or electrically charged air is delivered by the traveling pneumatic cleaner 10 to those portions of the spinning frame where the yarns Y are being formed. With such ionized or electrically charged air bathing the elements of the frame 10 and the yarns Y being formed therealong, the ionized air gives up or takes on electrons in such a manner as to reduce electrostatic charges otherwise found on the frame 10 and the yarn Y. With such reduction or neutralization of the electrostatic charges, spinnability of the textile materials being formed into the yarns Y is promoted and a more consistent yarn is produced.

In FIG. 1, certain alternative arrangements for an electrical charging means are illustrated in connection with a leading blowing sleeve 22, which will be noted as incorporating electrical charging means 30 mounted at a location nearer to air discharge nozzles 25 through which air is emitted from the sleeve 22. A drafting system air discharge nozzle 26 is particularly illustrated as having an electrical charging means 30 mounted immediately adjacent thereto. While not specifically illustrated herein, the present invention contemplates that such cooperation of electrical charging means with blowing air means may be independent of the incorporation of cleaning functions and electrostatic reducing apparatus as herein disclosed may operate independently of but on a common track with traveling pneumatic cleaner means.

In practicing the method of the present invention, it is desirable that the ionized air delivered by the traveling pneumatic cleaner 10 be able to accommodate electrostatic charges of either positive or negative polarity. This is preferred due to the observed fact that the polarity of electrostatic charges on a spinning frame 10 varies from time to time and may quickly reverse from one polarity to the other. Accordingly, it is desirable to accommodate any such reversal of polarity as may occur. The use of an alternating current high voltage generator is of particular assistance in achieving this end, in that ions of both negative and positive polarity are generated thereby. As an alternative to the use of an alternating current high voltage generator, it is recognized that direct current voltage generators may be employed with the structure illustrated in the drawing, to produce ions of a single polarity. While such production of single polarity ions is effective to neutralize electrostatic charges of one polarity when encountered, it will be understood that production only of a single polarity of ions may, under some circumstances, limit the range of usefulness of such a combination.

Where a direct current high voltage generator is employed, it is anticipated that means may be provided for sensing the polarity of electrostatic charges found on a traversed spinning frame 10, with cooperating control means switching the polarity of ions produced in accordance with the sensed electrostatic charges. Further, it is contemplated that appropriate control means may respond to variations in the magnitude of electrostatic charges sensed to be present on a spinning frame 10 by varying the relative quantities of ions produced.

While the present invention has been illustrated with particular reference to one form of electrical charging means for air being delivered by the traveling pneumatic cleaner means 20 (as illustrated in FIGS. 2 and 3), the present invention contemplates that electrically charged or ionized air may be produced through the use of other means. In particular, it is recognized that the relative persistency of ionized air around the spinning frame 10 may depend in part upon the relative concentration of ions in the volume of air ambient to the spinning frame 10, the relative volume of ions present in air delivered from the traveling pneumatic cleaner means 20, and the velocities of the air. Variations in these factors will be noted, in application of the present invention, as having relation to improvement in the spinnability of yarns Y on a traversed spinning frame 10 and achievement of optimal conditions in any given environment may depend upon experimental adjustment of these relative factors. In line with such adjustment, the present invention contemplates that electrically charged or ionized air may be produced by other ionizing apparatus in addition to that shown in FIGS. 2 and 3.

In the drawings and specification, there has been set forth a preferred embodiment of the invention, and although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation.

What is claimed is

1. A method of facilitating formation of textile materials into strands at a series of strand forming stations spaced along a textile strand forming machine such as a spinning frame comprising the steps of traveling a flowing stream of air along the textile strand forming machine while sequentially directing

the air stream toward the individual strand forming stations in the series and toward strands being formed at the stations, and while reducing electrostatic charges otherwise accumulated in forming the strands at the stations by electrically charging the air stream, so that resistance of the textile material to orderly formation into strands which otherwise results from electrostatic charges present at the strand forming stations is overcome.

2. A method according to claim 1 wherein the traveling of a flowing stream of air along the textile strand forming machine comprises moving a traveling pneumatic cleaner along a track extending in predetermined spaced relation to the textile strand forming machine.

3. A method according to claim 1 wherein the traveling of a flowing stream of air along the textile strand forming machine comprises inducing air in a room enclosing the textile strand forming machine to flow through a stream directing conduit and emitting the flowing stream with particular direction, volume and velocity from an orifice movable along the textile strand forming machine.

4. A method according to claim 1 wherein the step of reducing electrostatic charges by electrically charging the air stream comprises ionizing the constituents of the air just prior to direction thereof toward the strand forming stations.

5. A method according to claim 1 wherein the step of reducing electrostatic charges comprises repeatedly and periodically bathing the strand forming stations with ionized constituents of the air stream.

6. Apparatus for facilitating formation of textile materials into strands at a series of strand forming stations spaced along a textile strand forming machine such as a spinning frame and comprising, in combination, air blowing means for traveling a flowing stream of air along a textile strand forming machine

and sequentially directing the air stream toward the individual strand forming stations in the series and towards strands being formed at the stations, and electrical charging means mounted on said air blowing means for reducing electrostatic charges otherwise accumulated in forming the strands at the stations by electrically charging said air stream so that resistance of the textile material to orderly formation into strands which otherwise results from electrostatic charges present at the strand forming stations is overcome.

7. Apparatus according to claim 6 wherein said air blowing means comprises traveling pneumatic cleaner means supported for movement over said textile strand forming machine.

8. Apparatus according to claim 6 further comprising track means extending in predetermined spaced relation to said textile strand forming machine for supporting said air blowing means for travel along a predetermined path.

9. Apparatus according to claim 6 wherein said air blowing means comprises fan means for inducing a flow through said means of air within a mill room enclosing the textile strand forming machine and conduit means communicating with said fan means for directing the induced flow into said air stream.

10. Apparatus according to claim 6 wherein said electrical charging means comprises air ionizing means for ionizing constituents of said air stream as the same pass through said air blowing means.

11. Apparatus according to claim 6 wherein said electrical charging means comprises conduit means for passing said air stream through an electrical field having a high voltage gradient just prior to direction thereof toward the strand forming stations.

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