APPARATUS FOR APPLYING LIQUIDS TO UNSPUN TEXTILE FIBERS

Filed July 28, 1951 5 Sheets-Sheet 1

Fig. 1.

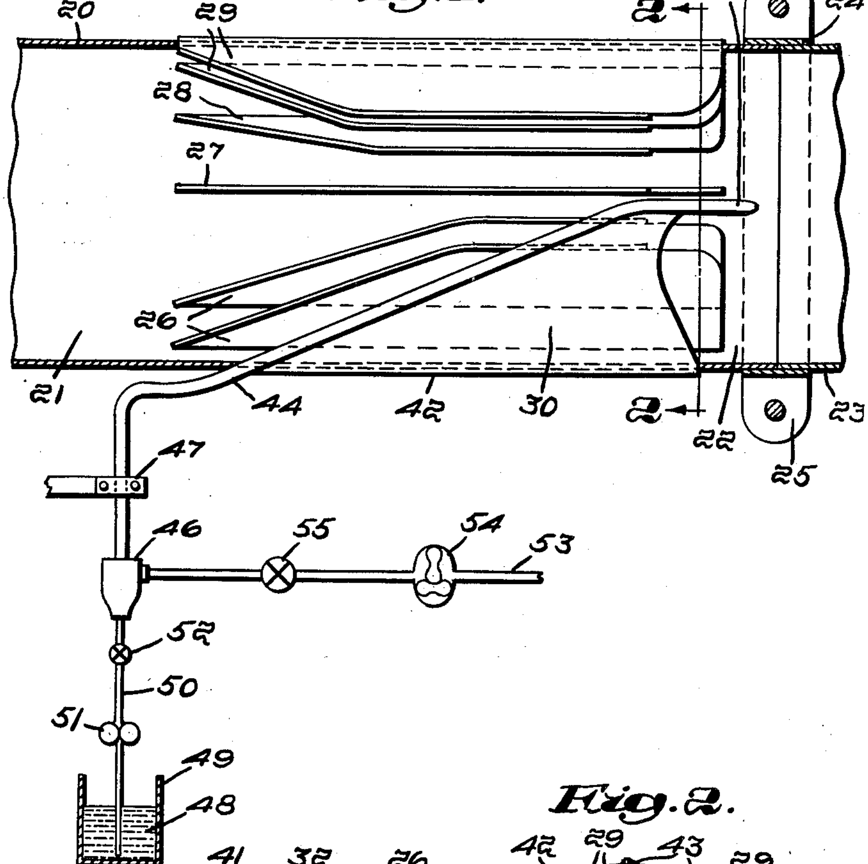


Fig. 2.

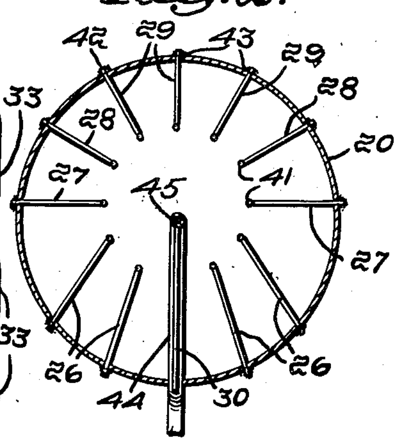
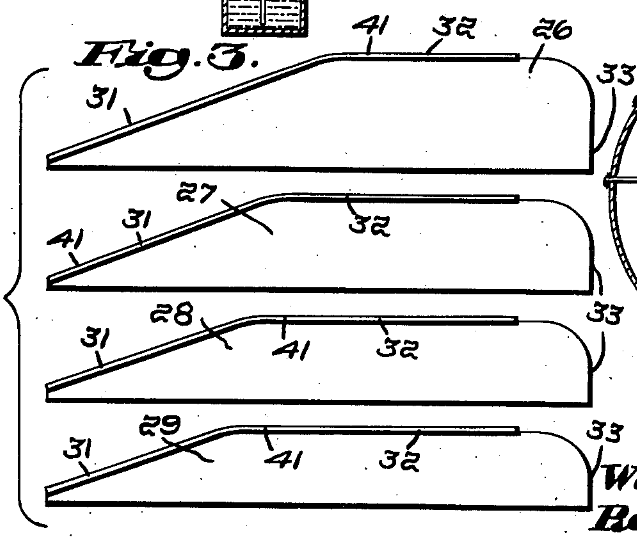


Fig. 3.



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APPARATUS FOR APPLYING LIQUIDS TO UNSPUN TEXTILE FIBERS

Filed July 28, 1951 5 Sheets-Sheet 2

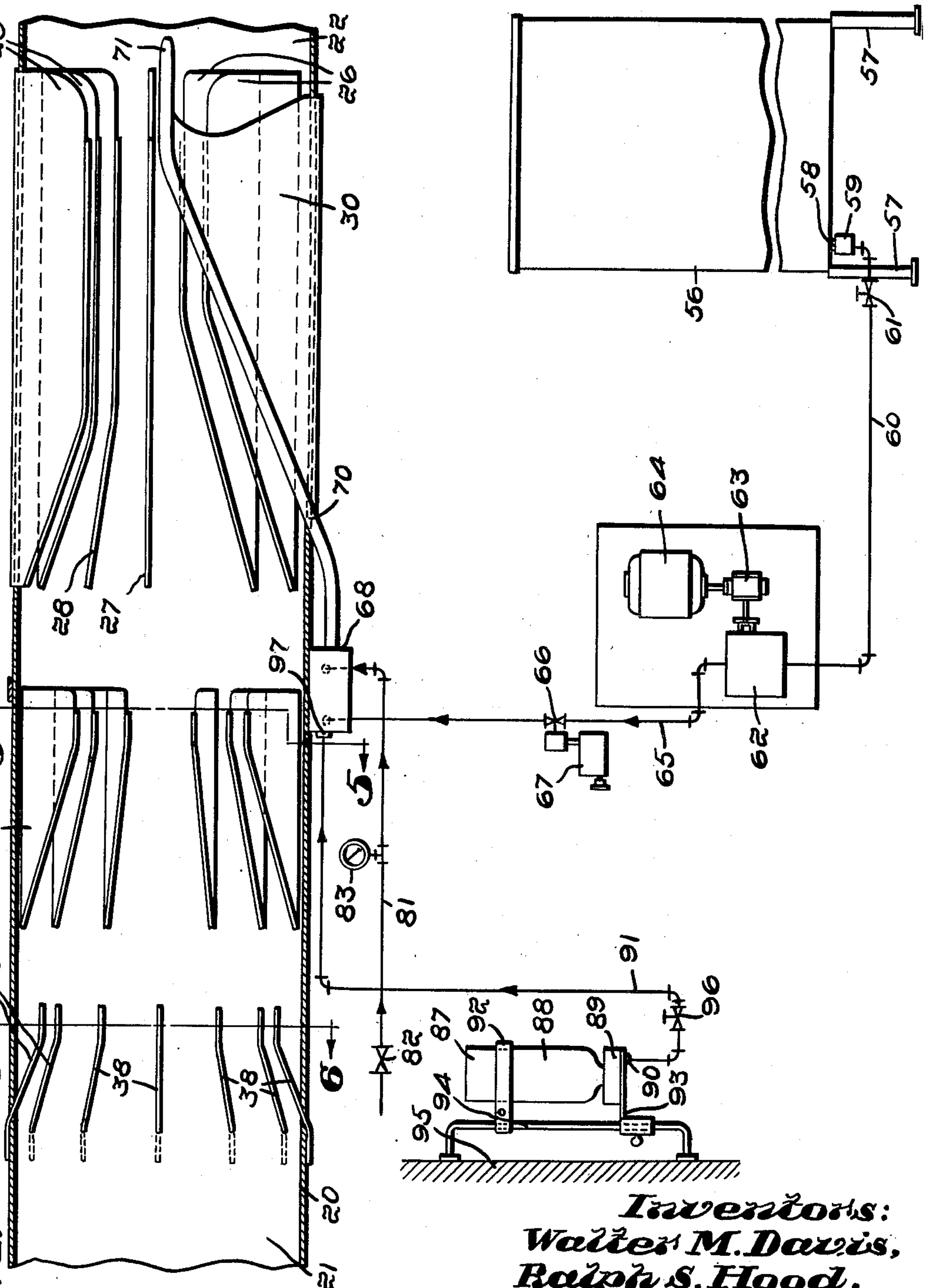

Fig. 4.

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APPARATUS FOR APPLYING LIQUIDS TO UNSPUN TEXTILE FIBERS

Filed July 28, 1951 5 Sheets-Sheet 3

Fig. 5.

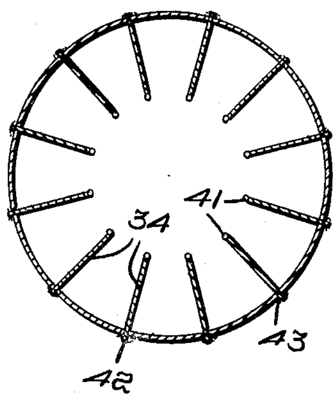

Fig. 6.

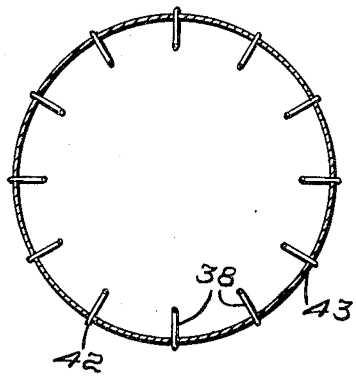

Fig. 7.

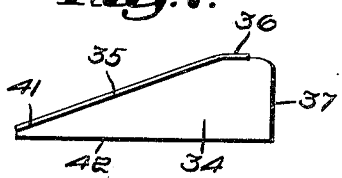

Fig. 8.

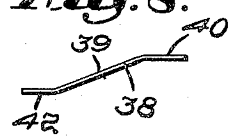

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Fig. 9.

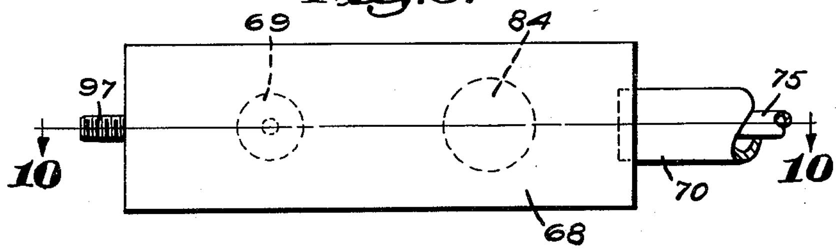


Fig. 10.

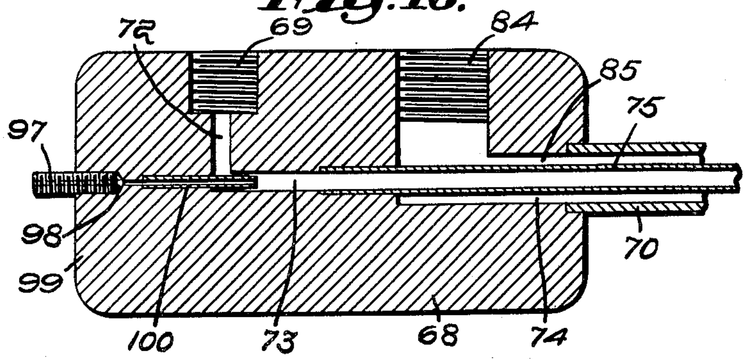


Fig. 11.

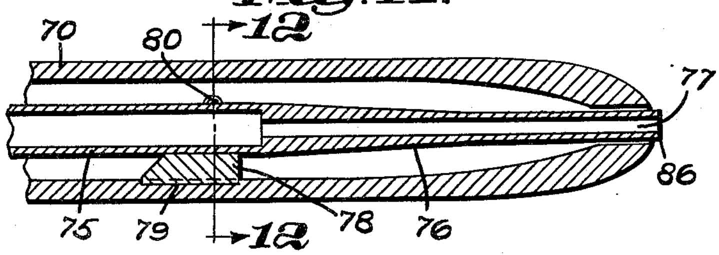
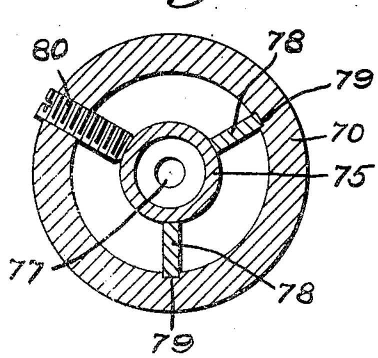


Fig. 12



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APPARATUS FOR APPLYING LIQUIDS TO UNSPUN TEXTILE FIBERS

Filed July 28, 1951 5 Sheets-Sheet 5

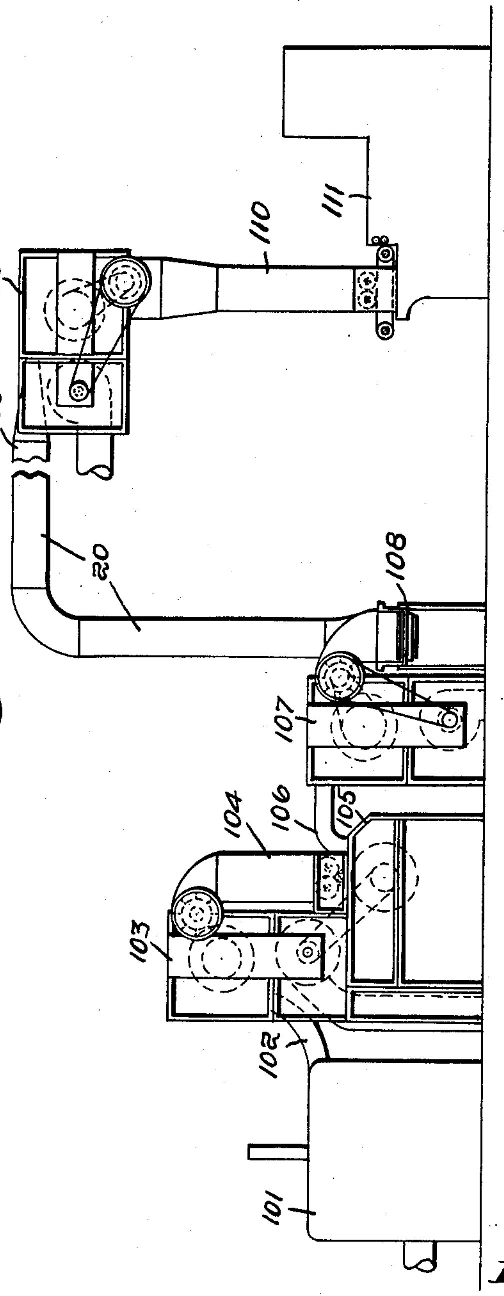

Fig. 13.

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United States Patent Office

2,805,640

Patented Sept. 10, 1957

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2,805,640

APPARATUS FOR APPLYING LIQUIDS TO UNSPUN TEXTILE FIBERS

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Application July 23, 1951, Serial No. 239,054

10 Claims. (Cl. 118—62)

The present invention relates to an improved method of applying liquids, and particularly liquids containing an adhesive substance, to unspun textile fibers at some stage of their processing prior to their formation into a lap. The present invention also relates to an improved apparatus for applying liquids, and particularly liquids containing an adhesive substance, to unspun textile fibers which at some stage of their processing are conveyed in a gaseous stream.

Various methods have been proposed heretofore for treating unspun cotton fibers to increase their moisture content. In one of the prior methods, it has been proposed to continually progress the cotton fibers through a predetermined path and to continually agitate and repeatedly drop the fibers through a moving column of gas containing sufficient water vapor or moisture so that a certain amount of water vapor will be transferred from the gas to the fibers. An essential feature of this method is the manipulation of the fibers in such a manner that the fibers strike the walls of the conduit through which the fibers are conveyed. The apparatus used to carry out such method includes a rotatable horizontally positioned drum, the inner walls of which are provided with vanes which are fastened to the walls of the drum and extend the entire length of the drum. Such vanes serve the purpose of conveying the fibers from the bottom of the drum to the top of the drum, as the drum rotates, so that the fibers will fall through the column of moisture-containing gas moving through the drum. The above described method and apparatus are satisfactory in those instances where relatively small amounts of moisture are introduced into the fibers, but are not suitable where relatively large amounts of moisture or liquid are present in the moving gas stream or where the moisture or liquid contains an adhesive substance. In such instances the fibers become sufficiently wet or sticky to adhere to the walls of the drum with the result that the walls of the drum must be cleaned out at frequent intervals. Moreover, the fibers which stick to the walls of the drum are usually not suitable for further processing. Further, the apparatus used in carrying out the above method is relatively costly and must be furnished as an additional piece of equipment since such apparatus is not employed in normal textile mill operations.

In another prior method, it has been proposed to treat salvaged cotton with slightly moistened ozone. In this method the cotton is conveyed in a moving air stream through a pipe which is provided with a fan. The cotton fibers on their passage through the pipe are broken up by the blades of the rotating fan and the slightly moistened ozone is blown into the moving air stream before the fibers reach the fan. This method is satisfactory in those instances where the amount of water introduced into the air stream is not sufficient to wet the fibers. However, when relatively large amounts of moisture or liquids, that is, amounts sufficient to penetrate into the fibers, are introduced into the moving air stream, the distribution of liquid on the fibers is not sufficiently uniform with

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the result that some fibers become sufficiently wet to adhere to the walls of the pipe or the fan blades and must be removed at frequent intervals to prevent operating difficulties. These disadvantages are also encountered when a liquid containing an adhesive substance is introduced into the moving air stream.

Various methods and apparatus other than described above have been proposed heretofore for applying liquids to loose fibers while they are being processed in various types of apparatus such as beaters, pickers, etc., or while the fibers are being conveyed mechanically, that is, by conveyor belts, wheels, rolls, etc., but none of these methods or devices have been commercially satisfactory for obtaining uniform distribution of the treating liquid through the fibers. In such cases some of the fibers become too saturated with the liquid and aggregate with other fibers to form an undesirably large number of "neps," that is, lumps of fibers, which appear as such in the finished yarn. This is considered to be objectionable in the commercial manufacture of spun textile yarns.

It has also been proposed in the co-pending application of Ralph S. Hood, Serial No. 146,666, filed February 28, 1950, now U. S. Patent No. 2,568,499, granted September 18, 1951, to treat unspun textile fibers by spraying the fibers with a liquid as the fibers are being conveyed through a conduit while suspended in an air stream. In accordance with the method disclosed in said application, the textile fibers are brought into contact with a gas stream which is moving at a velocity sufficient to pick up and convey the fibers and to maintain the fibers in a suspended state. The gas stream containing the fibers suspended therein is next directed through a passageway provided with at least one narrow potrion which converges to form an opening of substantially smaller, cross-sectional area than the normal cross-sectional area of the passageway. A jet of air is continuously discharged into the moving gas stream in the same direction that the gas stream is moving and at such point in the line of travel of the gas stream and at sufficient velocity to accelerate the fibers in their passage through the narrow portion of the passageway. As the fibers emerge from the narrow portion of the passageway and move into the downstream end of the passageway the fibers decelerate. At some point between the time the fibers are accelerated by the jet of air and the time they decelerate because of the loss in velocity of the gas stream emerging from the narrow portion of the passageway, the fibers are subjected to a spray consisting of fine droplets or a mist of the liquid which it is desired to apply to the fibers.

The apparatus described in said application of Ralph S. Hood comprises a conduit or pipe through which textile fibers are conveyed, means for supplying fibers to one end of the conduit, means for generating a gas stream in the conduit for conveying fibers through the conduit, means for discharging a jet of air into the conduit and longitudinally thereof, and means for spraying liquid onto the fibers as they pass through the conduit. The conduit is also provided with at least one narrow portion which converges in the direction of flow of the fibers and which may be a converging duct or nozzle inserted within the conduit. The air jet means referred to above is located near the large end of the converging duct or nozzle while the spraying means is located in the immediate vicinity of the converging duct or nozzle, that is, either just in front of or within the nozzle or just beyond the narrowest portion of the nozzle.

The method and apparatus described in said application of Ralph S. Hood enable the intimate mixing of the fibers and the treating liquid and make it possible to secure substantially uniform distribution of the liquid through the fibers without appreciably overwetting the fibers. Moreover, it is possible to open the fibers so that they will be more amenable to further processing. However, the method and apparatus of the present invention provide an improvement over the method and apparatus of said Hood application in that it is possible in accordance with the present invention to continuously treat unspun textile fibers with liquids for longer periods of time without shutting down the process or cleaning the apparatus than is possible with the method and apparatus of the co-pending Hood application, particularly when the treating liquid contains an adhesive substance.

The present invention has for one object, therefore, the provision of an improved method for continuously applying liquids, particularly liquids containing an adhesive substance, to unspun textile fibers at some stage of their processing prior to the formation of a lap while the fibers are being conveyed in an air stream through a passageway so that a substantially uniform distribution of the liquid through the fibers will be obtained without the necessity of discontinuing the operation at frequent intervals because of the accumulation of fibers on the walls of the passageway through which the fibers are conveyed.

It is a further object of this invention to provide an improved apparatus for continuously applying liquids, particularly liquids which contain an adhesive substance, to unspun textile fibers, which apparatus enables the liquid to be distributed through the fibers in a substantially uniform manner, and is capable of being operated for relatively long periods of time without cleaning.

Still further objects and advantages of this invention will appear in the following description when considered in connection with the accompanying drawings and the appended claims.

The method of this invention are carried out, in general, by first bringing unspun textile fibers, preferably fibers which have been at least partially opened, into contact with a gas stream which is moving at a velocity sufficient to pick up and convey the fibers and to maintain the fibers in a suspended state. The gas stream containing the fibers suspended therein is next directed through a passageway which is provided with a series of relatively thin inclined surfaces which deflect a major proportion of the fibers toward the central portion of the passageway and simultaneously streamline the flow of the gas stream, that is, cause the gas stream to flow parallel to the walls of the passageway without any substantial turbulence. Thereafter the fibers are subjected to a spray consisting of fine droplets or a mist of the liquid which it is desired to apply to the fibers, preferably a liquid which contains an adhesive substance since the present invention is particularly directed to the use of such a liquid. This is accomplished while a substantial proportion of the fibers are in the central longitudinal portion of the passageway and while the gas stream is still relatively free of turbulence. The spray of liquid is directed in the same direction that the fibers are moving and is generated substantially in the central portion of the passageway through which the fibers are conveyed by the gas stream. By carrying out the above process, it is possible to obtain a substantially uniform distribution of the liquid through the fibers without appreciably overwetting the fibers. Moreover, it is possible to operate the process continuously for relatively long periods of time without the necessity of cleaning the walls and surfaces of the passageway through which the fibers are conveyed.

The term "adhesive substance" as used in the description and the appended claims is intended to include substances which are tacky or sticky in an anhydrous or liquid-free state, or substance which are sticky or tacky when they contain small amounts, for example, 3 to 10% by weight of water or an organic liquid. As examples of materials which fall in the latter category are colloidal silica, starches, silicates, casein and the like.

The apparatus of the present invention comprises, in general, a conduit or pipe through which the fibers are conveyed and which is provided internally with one or more sets of fins which are spaced from each other and are attached to the wall of the conduit in such a manner that they are parallel to the direction of flow of the fibers in the conduit, the fins being adapted to deflect fibers in the conduit toward the central longitudinal portion of the conduit and to streamline the flow of a gas stream in the conduit, means for supplying fibers to one end of the conduit, means for generating a gas stream in the conduit for conveying fibers through the conduit, and means for spraying liquid onto the fibers as they pass through the conduit. The fins inside the conduit have a smooth leading edge which slopes away from the wall of the conduit in the direction that the fibers travel through the conduit, that is, toward the downstream end of the conduit. The spraying means is positioned substantially near the longitudinal axis of the conduit, and preferably, close to the trailing edge of the fins located nearest to the downstream end of the conduit.

Specific embodiments of such apparatus are illustrated in the accompanying drawings which form a part of this application. In the drawings:

Figure 1 is a central vertical longitudinal section of a conduit provided with fins in accordance with the present invention, and also is a semi-diagrammatic side elevation of means for spraying fibers in said conduit with a liquid spray;

Figure 2 is a cross-section of the conduit illustrated in Figure 1 taken along the line **2—2** of Figure 1 and showing the radial arrangement of fins in the conduit;

Figure 3 is a side elevation of the various types and sizes of fins illustrated in Figures 1 and 2;

Figure 4 is a semi-diagrammatic side elevation of a preferred apparatus employed in spraying liquids on unspun textile fibers in accordance with the present invention, and also is a central vertical longitudinal section of a conduit provided with a set of rods and several sets of fins;

Figure 5 is a cross-section of the conduit illustrated in Figure 4 taken along the line **5—5** of Figure 4 and showing the radial arrangement of a second set of fins in the conduit;

Figure 6 is a cross-section of the conduit illustrated in Figure 4 taken along the line **6—6** of Figure 4 and showing the radial arrangement of rods in the conduit;

Figure 7 is a side elevation of the fins illustrated in Figure 5;

Figure 8 is a side elevation of the rods illustrated in Figure 6;

Figure 9 is an enlarged side elevation of the terminal box illustrated in Figure 4, through which liquids and gas pass prior to spraying the liquid into the conduit;

Figure 10 is a plan section of the terminal box illustrated in Figure 9 taken along the line **10—10** of Figure 9;

Figure 11 is a central vertical longitudinal section of the spraying end of the spray nozzle illustrated in Figures 1 and 4;

Figure 12 is a cross-section of the spraying nozzle illustrated in Figure 11 taken along the line **12—12** of Figure 11; and

Figure 13 is a semi-diagrammatic side elevation of a number of devices, including a conventional fiber feed table and a conventional fiber condenser, employed in a mill which processes textile fibers according to the cotton system.

In the drawings the numeral **20** designates a cylindrical conduit. The feed or upstream portion **21** of the conduit extends as a single conduit to a conventional fiber feed table shown in Figure 13, such as is also illustrated in Figure 1 of the co-pending application of Ralph S.

Hood previously referred to, or is connected to a series of similar conduits the last of which terminates over such a conventional fiber feed table. The discharge or downstream portion **22** of the conduit terminates in a conventional fiber condenser shown in Figure 13 which feeds the condensed fibers into a conventional picker shown in Figure 13, both of which are also illustrated in Figure 1 of the co-pending application of Ralph S. Hood previously referred to and on pages 199 and 204, respectively, of the "American Cotton Handbook" (1949) published by Textile Book Publishers, Inc., New York, N. Y., or the downstream portion **22** of the conduit is joined to a similar conduit **23**, as illustrated in Figure 1, by means of an elastic gasket **24**, which overlaps the edges of each conduit, and an annular hoop clamp **25** which encompasses the gasket, which conduit **23** terminates in a conventional fiber condenser in the manner described. The conventional fiber condenser referred to above, and which is illustrated in Figure 1 of the co-pending Hood application previously referred to, is equipped with a fan which generates a gas stream in conduit **20**, which gas stream has sufficient velocity to pick up fibers from a conventional fiber feed table over which the upstream end of the conduit is positioned, and to convey the fibers through the conduit in a suspended state.

In Figure 13 of the drawings, the numeral **101** refers to a vertical opener for opening cototn fibers. This opener communicates through pipe **102** with a fiber condenser **103** which is provided with a fan for sucking the fibers from the vertical opener through pipe **102** into the condenser. Adjacent to condenser **103** is a feed chamber **104** which communicates with a cleaning and opening section **105**. The latter communicates through pipe **106** with a second condenser **107** which is provided with a fan for sucking fibers from the cleaning section **105** through pipe **106** into the condenser. The fibers in condenser **107** are discharged mechanically on a feed table **108**. Positioned immediately above the feed table and the fibers thereon is the conduit **20**, hereinbefore referred to, which at this point is arranged vertically and is provided with an opening, the open end of the conduit being in a horizontal plane substantially parallel to the surface of the feed table **108**. The apparatus described in this paragraph is conventional and forms no part of the present invention, except to provide a setting in relation to which the present invention may be more readily understood.

The conduit **20** is provided with a horizontally positioned section, shown partially broken away in Figure 13, which conduit is joined to conduit **23** as shown in Figure 1. The portion of conduit **23** shown in Figure 13 terminates at a conventional fiber condenser **109** which is provided with a suction fan. The fan sucks air from conduits **20** and **23** thus inducing a flow of air into the upstream end of conduit **20** (positioned above feed table **108**) at sufficient velocity to pick up the fibers from feed table **108** and convey them through conduits **20** and **23**. The condenser **109** communicates with a conventional feed chamber **110** from which the fibers are fed at a predetermined rate into a conventional picker **111** in which the fibers are further cleaned and opened and eventually formed into a lap.

The walls of the conduit may be made from any rigid material such as glass, sheet metal, cast metal, wood, moulded plastic, or the like provided such material does not generate static electricity by the rubbing action of the particular fibers processed therein. The inner surface of the wall of the conduit should be smooth and substantially free of protuberances or sharp projections on which the fibers passing through the conduit will be caught and held, or which will cause turbulence of the gas flow through the conduit. However, it is not necessary for the inner surface of the wall of the conduit to be polished.

The conduit is provided with a set of fins **26**, **27**, **28** and **29** which are mounted in the wall of the conduit so as to extend parallel to the longitudinal axis of the conduit. These fins are located in the same longitudinal portion of the conduit. As is illustrated in Figure 2 and Figure 3, the fins are of different height, fins **26** being taller than fins **27** which are in turn taller than fins **28**. Fins **29** are the shortest. Fins **27**, **28** and **29** extend radially inwardly from the wall of the conduit toward a line which is slightly above and parallel to the longitudinal axis of the conduit a distance which varies approximately from one third to one half the radius of the conduit, and are positioned in the upper half of the conduit. Fins **26** extend generally inwardly from the wall of the conduit toward the central portion of the conduit a distance approximately equal to two thirds the radius of the conduit and are so arranged that the tops of the fins are spaced apart a distance approximately equal to the spacing between the tops of fins **27**, **28** and **29**, with the exception that the tops of the two lowest fins in the conduit are spaced apart a distance approximately twice such distance to provide room for fin **30** which extends from the lowest portion of the wall of the conduit to a point just below the center of the conduit.

As is illustrated in Figures 1, 3, and 4, the fins **26**, **27**, **28** and **29**, which are generally trapezoidal in elevation, have a sloping forward edge **31**, a top edge **32** which is substantially parallel to the longitudinal axis of the conduit and a substantially vertical trailing edge **33**. The forward edge of the fins slopes away from the inner wall of the conduit toward the central portion of the conduit and toward the downstream or discharge portion **22** of the conduit, that is, in the direction that the fibers move through the conduit. The slope of the forward edge of the fins may be varied to some extent, but preferably should not exceed about 45°. Since one function of the fins is to provide thin or narrow sloping surface against which the fibers moving through the conduit will impinge and move upwardly, sidewardly or downwardly toward the central longitudinal portion of the conduit, depending on where the fin is positioned in the conduit, the forward edge of the fin should slope sufficiently to direct the fibers away from the walls of the conduit toward the central longitudinal portion of the conduit without materially slowing down the fibers or holding back the fibers in their passage through the conduit.

The top edge **32** of the fins, that is, the edge of the fins farthest from the wall of the conduit is normally parallel to the longitudinal axis of the conduit in order to maintain the fibers in the central portion of the conduit. However, it is possible to use fins which do not have such an edge, especially when the fibers are sprayed with a liquid immediately after they pass by the highest point on the fins. In such case, however, the trailing edge **33** of the fins should be substantially perpendicular to the wall of the conduit or undercut toward the upstream portion of the conduit, otherwise the treated fibers are apt to stick to and accumulate on the trailing edge of the fins.

The purpose of the fins **26**, **27**, **28**, **29**, and **30**, illustrated in Figures 1, 2, 3 and 4, is to streamline the flow of the gas stream moving through the conduit so that the gas stream will be substantially free of turbulence at the point where the fibers suspended therein are sprayed with a liquid. Thus, the liquid will not strike the inner walls of the conduit and cause the fibers to stick to the inner walls of the conduit. For this purpose the fins should be relatively thin, and preferably less than $\frac{1}{16}$ inch in thickness. Moreover, there should be a sufficient number of fins in the conduit to streamline the flow of the gas stream moving through the conduit, and the fins should be so arranged with respect to each other that they will accomplish this purpose. Usually from 8 to 20 fins will suffice, depending on the size of the conduit.

Another purpose of the fins, which has previously been referred to, is to deflect or direct the fibers moving through the conduit toward the central longitudinal portion of the conduit so that the fibers will be bunched together when they are sprayed with liquid and thus enable the spray of liquid to be directed in the central portion of the conduit without striking the wells of the conduit. This bunching of the fibers in the central portion of the conduit also enables the fibers to be treated uniformly with the sprayed liquid. Consequently, the fins should be sufficiently close together to direct the greatest possible number of fibers toward the central portion of the conduit. However, since it is necessary to process some fibers in the form of tufts or clumps, for example, tufts of cotton fibers, it is necessary to space the fins far enough apart to prevent the wedging of tufts or clumps of fibers between the fins otherwise the flow of the gas stream will become turbulent.

Although only one set of fins need be used as illustrated in Figures 1 and 2, it is preferred to use at least two sets of fins as illustrated in Figure 4. In Figure 4 the set of fins **26**, **27**, **28** and **29** closest to the discharge or downstream portion **22** of the conduit correspond to the fins illustrated in Figures 1, 2 and 3. The conduit in Figure 4 is also provided with a second set of fins **34** which are located closer to the feed or upstream portion **21** of the conduit than fins **26**, **27**, **28** and **29**. Fins **34** are attached to the walls of the conduit so that they extend radially inward from the inner walls of the conduit toward the longitudinal axis of the conduit a distance approximately equal to from ⅓ to ⅝ the radius of the conduit. Fins **34** which are located in the same longitudinal portion of the conduit, are spaced substantially equidistant from each other, and are offset radially, with respect to fins **26**, **27**, **28** and **29**.

Fins **34**, which are also generally trapezoidal in form, are provided with a sloping forward edge **35**, a top edge **36** and a vertical trailing edge **37**. The forward edge **35** of fins **34** slopes away from the inner wall of the conduit toward the central portion of the conduit and toward the downstream portion **22** of the conduit, that is, in the direction that the fibers move through the conduit. The slope of the forward edge of fins **34** may be varied to some extent but should not exceed 35°, and preferably should not exceed 30°. The forward edges of fins **34** should have sufficient slope, however, to direct the fibers moving through the conduit away from the inner wall of the conduit toward the central portion of the conduit without materially slowing down the fibers or holding back the fibers in their passage through the conduit. The top edge **36** of fins **34**, that is, the edge of the fins farthest from the wall of the conduit, is normally parallel to the longitudinal axis of the conduit so that the fibers passing along the edge of the fins will be maintained in the central portion of the conduit. However, the fins **34** need not be provided with such an edge or with a vertical trailing edge **37** if a high degree of efficiency is not essential.

The advantages in using a second set of fins **34**, as illustrated in Figure 4, over the use of a single set of fins **26**, **27**, **28** and **29**, as illustrated in Figure 1, is that it is possible to obtain a more streamlined flow of the gas stream. It is also possible to direct a large proportion of the fibers toward the central portion of the conduit, especially when the fins **34** are offset radially with respect to fins **26**, **27**, **28** and **29**. The number of fins **34** may be varied considerably. Preferably, from about 10 to 20 fins are used, depending on the size of the conduit. By increasing the number of fins it is possible to obtain improved streamlining of the gas stream and to direct a greater portion of the fibers toward the central longitudinal portion of the conduit. However, fins **34** should not be spaced so close together that fibers will wedge or lodge between the fins and cause turbulent gas flow and possible jamming in the conduit.

It is also possible to obtain a greater concentration of the fibers in the central portion of the conduit by providing in the conduit, as illustrated in Figure 4, a set of bumper rods **38** which are attached to the wall of the conduit and extend radially inward from the inner wall of the conduit toward the longitudinal axis of the conduit a distance approximately equal to from ⅛ and ¼ the radius of the conduit. The bumper rods **38** are spaced substantially equidistant from each other, although such spacing is not essential, and are provided with a sloping forward edge **39** and a top edge **40** which is substantially parallel to the longitudinal axis of the conduit. The forward edge of the rods **38** slopes away from the inner wall of the conduit toward the central portion of the conduit and toward the downstream portion of the conduit, that is, in the direction which the fibers move through the conduit. The slope of the forward edge of the rods may be varied to some extent, but should not exceed 35°, and preferably should not exceed 30°. The number of rods used may be varied considerably, depending on the size of the conduit. By spacing the rods close together it is possible to deflect a large number of the fibers passing through the conduit toward the central longitudinal portion of the conduit and away from the walls of the conduit, and this makes for more uniform application of liquid to the fibers. However, the rods should not be spaced too close together otherwise the fibers will become lodged or wedged between the rods and the fibers will not flow efficiently through the conduit.

The edges of the fins and rods which are exposed to the fibers passing through the conduit should be smooth and free of projections, burrs or the like so that the fibers striking the edges of the fins or rods will not catch on such edges but will be deflected from or slide over the edges of such fins or rods in their passage through the conduit. To insure such smooth edges, it is preferred to fabricate the fins so that the forward and top edges thereof have a bead or rod-like edge **41** thereon, or the fins may be made out of thin sheet material such as sheet metal and have a thin cylindrical or oval-shaped metal rod **41** welded or soldered to the edge of the fin. The rods **38** are illustrated as being circular in cross-section. However, they may also be oval or elliptical in cross-section.

The fins or rods may be joined to the walls of the conduit in various ways. One suitable method of accomplishing this is by cutting slits in the wall of the conduit through which the bottom edge **42** of the fin or rod can be inserted from the inside of the conduit so that a portion of the fin or rod protrudes from the outer wall of the conduit. This protruding portion is firmly joined to the outer wall of the conduit by a weld or solder joint **43**.

The fins or rods may be constructed from any suitable rigid material such as metal, wood, plastic or the like provided that the materials used do not generate static electricity due to the rubbing of the fibers on the fins or rods.

Turning now to a consideration of the means used for applying liquids to the fibers in the conduit, illustrated in Figure 1, numeral **44** represents a pipe or tube which is welded or soldered or otherwise secured to fin **30**. This pipe thus is firmly supported inside the conduit without the use of members which would interfere with the passage of fibers through the conduit or without creating turbulence of gas flow. One end of pipe **44** terminates in spray nozzle **45** which is substantially coincident with the longitudinal axis of the conduit and terminates slightly downstream from the trailing edge of fins **26**, **27**, **28**, **29** and **30**, and the other end terminates in reducing T **46**. Pipe **44** is firmly held in position below conduit **20** by a suitable support (not shown) to which the pipe is attached by clamp **47**. Liquid **48**, suitable for application to textile fibers, is stored in container **49** and is supplied to the spray nozzle **45** through pipe **50** which extends from a point near the bottom of the container, passes through the inside of reducing T **46** and inside pipe **44** and terminates slightly beyond nozzle **45**. Pipe **50** is provided with a suitable pump such as a gear pump **51** for pumping the liquid through the pipe, and a valve **52** for cutting off the liquid supply. Compressed air for spraying the liquid from spray nozzle **45** is supplied by means of pipe **53** which terminates inside of reducing **T 46**, and pipe **44** which conveys the compressed air from inside of **T 46** to the nozzle **45**. Pipe **53** is provided with a centrifugal blower **54** which generates the compressed air, and valve **55** which enables the supply of compressed air to be shut off as desired. The liquid and compressed air supply means described immediately above are illustrated in greater detail in Figure 2 of the copending application of Ralph S. Hood previously referred to. The spray nozzle **45** is of the same design and construction as the nozzle illustrated in Figures 4, 11 and 12, which nozzle will be described in detail hereinafter.

A preferred means for supplying a liquid spray to fibers in the conduit is illustrated in Figure 4. Liquid suitable for application to textile fibers is stored in container **56** which is supported on supporting members **57**, and is provided with a pipe and screen adapter **58** which is connected by means of a rubber or elastic hose **59** to tubing **60**. Tubing **60** is provided with a valve **61** and terminates in the feed inlet of metering pump **62**. This pump is driven through a speed reducer **63** by means of electric motor **64**. The discharge end of the metering pump is connected to tubing **65** which is provided with a solenoid valve **66** actuated by time delay relay **67** which is in turn actuated by suitable electrical switches on the fiber feed table (not shown). When no fiber is supplied to the feed table the time delay relay is actuated automatically by suitable electrical switches and the solenoid valve closes cutting off the liquid supply from the metering pump. The discharge portion of tubing **65** is connected to the terminal box **68** by means of a flared tubing fitting screwed to a nipple which is screwed into the internally threaded terminal box opening **69**. The terminal box is provided with a pipe **70** which terminates in a spray nozzle **71**.

As is illustrated in Figures 10 and 11, the internally threaded opening **69** in the terminal box communicates with a smaller cylindrical bore **72** which extends from the base of the opening to the center of the terminal box where it communicates with a similar cylindrical bore **73** which runs at right angles thereto. Bore **73** opens into a larger bore **74** and is reamed sufficiently to accommodate tube **75** so that the inner walls of bore **73** and tube **75** provide a substantially continuous surface. The tube **75** extends from inside the terminal box **68** through pipe **70** and terminates slightly beyond the tip of nozzle **71**, and is provided with a tapered portion **76** and a small bore opening **77** in the end thereof which forms part of spray nozzle **71**. Tube **75** is supported inside of pipe **70** by means of removable spacers **78** which seat in recesses **79** in the inner wall of pipe **70**, and by means of set screw **80**. The spacers and the set screw extend radially inward from the inner wall of pipe **70**.

The liquid in container **56** thus is pumped from such container through tubing **60** and **65** by means of metering pump **62** and thence through bores **72** and **73** in terminal box **68** and finally through tube **75**.

Compressed air for spraying the liquid from spray nozzle **71** is supplied through pipe **81** from a suitable storage tank or blower (not shown). Pipe **81** is provided with a valve **82** and gage **83**. This pipe is screwed into the internally threaded opening **84** in the terminal box, which opening extends to the center of the terminal box and communicates with a cylindrical bore **85** of smaller diameter and at right angles thereto. Bore **85** is reamed to accommodate pipe **70** so that the inner walls of bore **85** and pipe **70** form a substantially continuous surface. Pipe **70** terminates in nozzle **71**, the outer surface of which tapers gradually in streamlined fashion to form a knife-edged opening or a restricted orifice **86** in combination with tube **75**. Thus the compressed air is supplied to spray nozzle **71** through pipe **81**, thence through bore **85** and the passageway formed by the inner wall of pipe **70** and the outer wall of tube **75** and finally through orifice **86**.

By using the spraying means and spray nozzle described above it is possible to produce a fine spray of liquid which can be confined substantially to the central portion of the conduit. The conical pattern of the spray and the size of the droplets formed can be readily regulated by the pressure of the compressed air, the rate of feed of liquid and the size of the bore **77** and orifice **86**. By using a streamlined spray nozzle such as nozzle **71** it is possible to spray liquids for long periods of time without plugging the nozzle, particularly when liquids which contain adhesive substances are being sprayed. Due to the central location of the nozzle in the conduit and the fact that the fibers in the conduit are directed toward the central portion of the conduit by the fins, the fibers tend to wipe the outer surfaces of the nozzle thus inhibiting the formation of deposits on the nozzle which would otherwise eventually tend to clog the nozzle.

The embodiment of the invention, illustrated in Figure 4, includes means for preventing the build up of adhesive substances on nozzle **71** when a liquid containing an adhesive substance is being used for application to fibers. This means comprises a container **87** in which a suitable non-adhesive liquid is stored. The container **87** is inverted over a shallow pan **89** which is provided with an outlet nipple **90** to which is connected tubing **91**. Container **87** and pan **89** are held in position by a circular clamp **92** and adjustable support **93**, respectively, which are in turn slideably mounted on rod **94**. Rod **94** is fastened to a rigid support **95** in suitable manner. Tubing **91**, which is provided with a valve **96**, is connected to one end of nipple **97** on terminal box **68** by means of a flared tubing fitting. As is illustrated in Figures 10 and 11, the other end of nipple **97** is screwed into an internally threaded opening **98** which terminates in a small bore **99**. Bore **99** communicates with bore **73** and is reamed sufficiently near its junction with bore **73** to accommodate a short pipe **100** which extends for a short distance past bore **72**.

Although the container **87** and other parts of the apparatus described in the paragraph immediately above are illustrated as being below conduit **20**, for convenience of illustration, they are actually positioned above conduit **20**, with the excepton of the terminal box **68**, in order to permit the liquid in container **87** to flow to terminal box **68** by gravity. However, the liquid may be pumped from container **87** if desired. This apparatus may be operated in various ways. Thus, a small amount of liquid may be allowed to flow continuously from container **87** into pan **89**, through tubing **91** and thence into the opening **98**, the bore **99** and pipe **100** of the terminal box where the liquid mixes with the liquid which is desired to be applied to the fibers in bore **73**. When it is necessary for any reason to cut off the supply of liquid which it is desired to apply to the fibers, for example, when no fibers are being processed in the conduit **20**, the liquid from container **87** is allowed to flow continuously as is described above and is sprayed out of nozzle **71** continuously thus preventing the clogging of pipe **70** or orifice **86** with the adhesive substance in the liquid which normally is applied to the fibers. Instead of allowing the liquid from container **87** to flow into terminal box **68** and thence to nozzle **71** continuously, the liquid from container **87** may only be allowed to flow into the terminal box at such times when the supply of liquid which is normally supplied to the fibers is cut off, thus preventing the hardening of any adhesive substance in bore **73** and tube **70**.

The operation of the liquid-applying apparatus is as follows:

Textile fibers such as synthetic staple fibers, animal fibers, ramie fibers, opened or partially opened cotton fibers, or the like are conveyed through conduit **20**, as illustrated in Figures 1 and 13, in a moving gas or air stream, which is generated by a blower or some suitable device, such as the fan in condenser **109** in Figure 13, at such a rate that the fibers remain in a suspended state. The fibers in conduit **20** are conveyed from the upstream portion **21** of the conduit toward the downstream portion **22** of the conduit. In their passage through the condit **20**, illustrated in Figure 1, a substantial portion of the fibers strike the forward edges **31** of fins **26**, **27**, **28** and **29**, and the pipe **44** and are deflected toward the longitudinal axis of the conduit. Thus, a substantial portion of the fibers are directed toward the longitudinal axis of the conduit. The fibers in this section of the conduit are substantially prevented from falling toward the lower wall of the conduit by the movement of the gas stream in the conduit and by the top edges of fins **26**, and pipe **44**. At the same time the gas stream in conduit **20** is largely channeled between the fins and the flow of the gas stream is considerably streamlined, that is, a substantial amount of the air turbulence in the gas stream is eliminated so that the gas stream tends to flow parallel to the walls of the conduit.

As the fibers in the gas stream flow past the vertical edge **33** of the fins, illustrated in Figure 1, they are sprayed with a fine mist or fine droplets of the liquid **48** from container **49**, which mist or fine droplets of liquid is generated by nozzle **45** and is directed along the longitudinal axis of the conduit in the same direction that the fibers are moving. The spray of liquid is generated by pumping liquid **48** from container **49** by means of pump **51** through pipe **50** which extends through reducing **T** and pipe **44** terminating slightly beyond nozzle **45**, and by simultaneously pumping air through pipe **53** by means of blower **54** into reducing **T 46** from whence the air flows through the passageway formed by the inner wall of pipe **44** and the outerwall of pipe **50**, which is inside pipe **44**, and finally through the nozzle **45**. The air leaving the orifice **45** atomizes the liquid pumped from pipe **50** which is inside of pipe **44**. The rate of flow of liquid is adjusted so that the desired amount of liquid is supplied to the fibers while the rate of air flow is adjusted so that the liquid is atomized sufficiently to penetrate the fibers uniformly. Although the fibers are preferably sprayed with the liquid immediately after they pass the vertical edge **33** of fins **26**, **27**, **28** and **29**, they may also be sprayed satisfactorily at any distance within about one foot from the vertical edge **33** of the fins toward the downstream portion of the conduit. After the fibers have been sprayed in the above manner, they are separated in any suitable manner from the gas stream in which they are suspended. This is suitably accomplished, for example, by employing a conventional fiber condenser **109** as shown in Figure 13 at the end of the conduit.

By using the apparatus illustrated in Figure 1, 2 and 3, it is possible to apply liquids to textile fibers in a uniform manner. Moreover, it is also possible to operate such apparatus for relatively long periods of time without cleaning out the conduit since there is no appreciable tendency for the treated fibers to stick to the inner walls of the conduit. The reason for this is that the fibers are largely confined to the central longitudinal portion of the conduit during the spraying of the fibers and the fibers are sufficiently dry before they contact the inner walls of the conduit so that they do not stick to the inner walls of the conduit to any appreciable extent.

It is possible, however, to obtain a more uniform application of liquid to the fibers, greater efficiency of operation and even greater continuity of operation when liquids containing adhesive substances are used, by the use of the apparatus illustrated in Figures 4 through 12. Accordingly, such apparatus is preferred. The operation of the liquid-applying device illustrated in Figures 4 through 12 is somewhat similar to the operation of the device illustrated in Figures 1 to 3, as described above, with certain exceptions. Thus, before the fibers being conveyed through conduit **20** by a gas stream reach fins

26, **27**, **28** and **29** they first are deflected toward the longitudinal axis of conduit **20** by bumper rods **38** and fins **34**. Since a greater number of sloping surfaces are thus presented to the fibers a greater proportion of the fibers are directed toward the central longitudinal axis of the conduit than is possible with one set of fins. Moreover, the fins **34** which are offset radially with respect to fins **26**, **27**, **28** and **29** provide a more streamlined flow of the gas through the conduit than is possible with one set of fins. Consequently, there is less turbulence in the gas stream and less tendency for fibers and spray droplets to contact the inner walls of the conduit than is the case when one set of fins is employed.

The fibers are sprayed in much the same manner as was described in the operation of the apparatus illustrated in Figures 1 to 3. However, the spraying means illustrated in Figures 4 and 9 to 12 are provided with the additional means, hereinbefore referred to, for supplying liquid from container **87** to prevent clogging of the nozzle during those periods of time when the supply of liquid from container **56**, which is the liquid desired to be applied to the fibers, is cut off.

By using the apparatus illustrated in the drawings and described above, it is possible to apply liquids which contain adhesive substances to textile fibers in a uniform manner for extended periods of time without causing the fibers to stick to the inner walls of the conduit. Moreover, there is no appreciable tendency to overwet the fibers or to wet the inner walls of the conduit. Further, since the flow of the gas stream is streamlined there is little tendency for the fibers to contact the inner walls of the conduit until they have dried to the stage where they no longer adhere to the inner walls of the conduit. Consequently, fibers can be processed continuously for relatively long periods of time before the apparatus requires cleaning. By using the liquid supply means illustrated in Figures 4 and 9 through 12, it is also possible to operate the fiber-treating apparatus for long periods of time without clogging the nozzle with adhesive substances when liquids containing such adhesive substances are applied to the fibers.

Various changes and modifications may be made in the apparatus illustrated in the drawings. Thus, the size and shape of the conduit may be varied to some extent. The diameter of the conduit may vary between about 8 and 20 inches. The conduit may vary between an ellipse and a circle in cross-section. For best results, however, a cylindrical conduit having a diameter between about 12 and 18 inches is preferred.

The number of sets in the fins may be varied considerably. Generally one set of fins gives satisfactory results. However, best results from the standpoint of uniform application of liquid to fibers and continuity of operation without cleaning the walls of the conduit are obtained when at least two sets of fins are used as illustrated in Figure 4. Moreover, although practically any number of sets of fins may be used, as long as the drop in velocity of the gas stream is not excessive, no advantage is apparent in using more than three sets of fins.

The arrangement of the individual fins in each set of fins need not be such that the fins extend radially inward toward the longitudinal axis of the conduit. However, in order to obtain the most uniform distribution of the treating liquid on the fibers and to obtain a highly streamlined gas flow through the conduit, it is preferred that the individual fins in each set of fins be arranged so that they extend inward from the inner walls of the conduit substantially toward the central longitudinal portion of the conduit.

Various types of spray nozzles and liquid supply means may be used to apply the treating liquid to the fibers in the conduit. However, it is essential that the treating liquid be sprayed on the fibers, and that the spray be generated in the central longitudinal portion of the conduit and in the direction that the fibers are moving through the conduit. When fibers have to be processed continuously, for long periods of time, and the treating liquid contains and adhesive substance, however, it is preferred to use the liquid supply means and a spray nozzle such as is illustrated in Figures 4 and 9 through 12.

It is not essential that the conduit be in a horizontal position since it is possible to have the conduit inclined at any angle from the horizontal. Thus, the conduit may be horizontal or inclined at any angle varying between 0 and 90° from the horizontal providing the gas stream is moving through the conduit at a sufficient velocity to convey the fibers through the conduit in a suspended state. However, best results are obtained in most instances when the conduit is substantially horizontal, and, accordingly, such position of the conduit is preferred.

A wide variety of liquids may be supplied to unspun textile fibers by the liquid-applying apparatus of the present invention. Thus, it is possible to apply water solutions or dispersions of casein, starch, water-soluble salts of styrene-maleic anhydride copolymers, polyvinyl chloride or other thermoplastic resins or colloidal solutions of silica or the like. Other suitable liquids which may be applied include textile lubricating or conditioning oils, either alone or in admixture with water in the form of emulsions; liquid hygroscopic agents or water solutions of hydroscopic agents; water solutions of inorganic salts; dispersions of inorganic oxide gels such as silica gel; solutions of dyes and tinting agents and the like. The methods and apparatus of the present invention are particularly useful, however, for the application to unspun textile fibers of a liquid which contains an adhesive substance as hereinbefore described.

The amount of liquid which is applied to unspun textile fibers, in accordance with the methods and apparatus of the present invention may be varied considerably depending primarily on the particular fibers which are being processed. Thus, in the case of wool or other animal fibers, the amount of liquid applied may be such that the total amount of liquid in the processed fibers, including the natural liquid in the untreated fibers, is as high as 40% by weight, based on the bone dry fibers. In the case of natural cellulose fibers or regenerated cellulose staple fibers, the amount of liquid applied to the fibers together with the water or liquid originally present in the fibers normally should not exceed about 12% by weight, based on the bone dry weight of the fibers. Synthetic staple fibers derived from cellulose esters or polymers normally will not tolerate more water or liquid than the natural cellulose fibers and, in some instances, will require less water or liquid.

The methods and apparatus of the present invention are particularly suitable for the application of aqueous solutions of colloidal silica to unspun fibers which are normally processed in machinery employed in the cotton system for the purpose of increasing the inter-fiber friction of such fibers. As examples of such fibers may be mentioned cotton fibers, linen fibers, ramie fibers, jute fibers and synthetic staple fibers, including viscose and cuprammonium staple fibers. Aqueous solutions of colloidal silica containing from about 1 to 35% by weight of colloidal silica are readily applied in the form of a mist or fine droplets to such fibers, the solution being supplied in an amount sufficient to deposit from about 0.05 to 3% by weight of colloidal silica, based on the weight of the bone dry fibers.

A further understanding of the methods of the present invention will be obtained from the following specific example, which is intended to illustrate the invention but not to limit the scope thereof.

Example

Small tufts of cotton fibers, less than one inch in diameter, were conveyed through a 15 inch conduit **20**, provided with rods and fins, as illustrated in Figure 4, at the rate of 700 pounds per hour while suspended in an air stream moving at a velocity of 1600 feet per minute. As the fibers moved through the section of the conduit where the rods and fins were located about 70% of the fibers or more were deflected toward the central longitudinal portion of the conduit and at the same time the flow of the air stream was streamlined so that no substantial turbulence along the inner walls of the conduit was noted. As the fibers continuously moved past the last set of fins they were sprayed with an atomized stable aqueous solution of colloidal silica using the liquid applying apparatus illustrated in Figures 4 and 9 through 12. This silica solution, which contained 15% by weight of silica, and about 1% of a water-soluble dye, was supplied through spray nozzle **71** at the rate of 14 pounds per hour. The fibers were then separated from the air stream in which they were suspended by means of a conventional fiber condenser. On analysis of the fibers, it was found that about 0.3% by weight of silica, based on the bone dry weight of the fibers, was applied to the fibers. The tufts of fibers had a dry feel and were uniformly tinted with the dye from the silica solution, which indicated that the liquid was applied uniformly throughout the fibers. The walls of the conduit were found to be free of moisture or fibers after operating for 24 hours, and the spray nozzle was substantially free of silica deposits.

Various modifications and changes in the method and apparatus of the present invention, in addition to those referred to herein, may be made as will be apparent to those skilled in the art to which this invention appertains without departing from the spirit and intent of this invention. It is to be understood therefore that the present invention is not to be limited except by the scope of the appended claims.

What is claimed is:

1. An apparatus for applying liquids to unspun textile fibers comprising a tubular conduit having smooth inner walls and an upstream portion and a downstream portion through which conduit textile fibers are conveyed by a gas stream from the upstream to the downstream portion, said conduit being provided with at least one set of fins comprising a plurality of fins which project inwardly from the inner walls of the conduit in the same longitudinal portion of the conduit and extend parallel to the longitudinal axis of the conduit, said fins being adapted to deflect textile fibers moving through said conduit toward the central longitudinal portion of the conduit and to streamline the flow of a gas stream in said conduit; a spray nozzle mounted in the central longitudinal portion of said conduit and terminating downstream of said fins, said nozzle being adapted to project a spray of textile treating liquid toward the downstream portion of said conduit; and means for supplying a textile treating liquid to said spray nozzle.

2. An apparatus as in claim 1, but further characterized in that the said conduit is generally circular in cross-section.

3. An apparatus for applying liquids to unspun textile fibers comprising a tubular conduit having smooth inner walls through which conduit textile fibers are conveyed by a gas stream, said conduit having an upstream portion and a downstream portion and being provided with at least one set of fins, said set of fins comprising a plurality of fins which project from the inners walls of said conduit in the same longitudinal portion of the conduit and extend parallel to the longitudinal axis of the conduit, and which are adapted to deflect textile fibers moving through said conduit toward the central longitudinal portion of the conduit and to streamline the flow of a gas stream in said conduit; a spray nozzle mounted in the central longitudinal portion of said conduit and terminating downstream of said fins, said nozzle being adapted to project a spray of textile treating liquid toward the downstream portion of said conduit; means for supplying textile fibers to the upstream portion of the conduit; means for generating a gas stream in said conduit for

conveying the fibers from the upstream to the downstream portion of said conduit; and means for supplying a textile treating liquid to said spray nozzle.

4. An apparatus for applying liquids to unspun textile fibers comprising a tubular conduit having smooth inner walls through which textile fibers are conveyed by a gas stream, said conduit having an upstream portion and a downstream portion and being provided with at least one set of fins, said set of fins comprising a plurality of fins which are arranged parallel to the longitudinal axis of the conduit and in the same longitudinal portion of the conduit, said fins projecting from the inner wall of the conduit and extending generally toward the central portion of the conduit and being provided with a smooth forward edge and at least one other edge which is farther from the inner wall of said conduit than said forward edge, the forward edge of the fins sloping away from the inner wall of the conduit and in the direction that the fibers move through said conduit, a spray nozzle mounted in the central longitudinal portion of said conduit and terminating downstream of said fins; said nozzle being adapted to project a spray of textile treating liquid in the same direction that the fibers move through said conduit; means for supplying textile fibers to the upstream portion of said conduit; means for generating a gas stream in said conduit for conveying the fibers from the upstream to the downstream portion of said conduit; and means for supplying a textile treating liquid to said spray nozzle.

5. An apparatus, according to claim 4, but further characterized in that the apparatus comprises means for supplying a liquid which is free of adhesive substances to the spray nozzle when the supply of the textile treating liquid to the spray nozzle is cut off.

6. An apparatus for applying liquids to unspun textile fibers comprising a substantially horizontal cylindrical conduit through which textile fibers are conveyed by an air stream, said conduit having an upstream portion and a downstream portion and smooth inner walls and being provided with at least one set of fins comprising a plurality of trapezoidal-shaped fins which are fastened to the wall of the conduit in the same longitudinal portion of the conduit and extend parallel to the longitudinal axis of the conduit and generally inward from the inner wall of the conduit partway toward the central portion of the conduit, said fins being provided with a smooth sloping forward edge and a second edge which is farther from the inner wall of said conduit than said forward edge, the forward edge of said fins sloping away from the inner wall of the conduit toward the downstream portion of the conduit and at an angle not exceeding 45° from the inner wall of the conduit and the escond edge of said fins being substantially parallel to the longitudinal axis of said conduit, the number of fins in said conduit being sufficient to deflect a substantial proportion of the fibers moving through the conduit toward the central longitudinal portion of the conduit, but being insufficient to prevent the movement of fibers through said conduit; a spray nozzle mounted on one of the fins in said conduit substantially coincident with the longitudinal axis of said conduit and terminating downstream of said fins, said nozzle being adapted to project a spray of textile treating liquid in the same direction that the fibers move through said conduit; means for supplying textile fibers to the upstream portion of said conduit; means for generating an air stream in said conduit for conveying the fibers from the upstream to the downstream portion of the conduit; means for supplying an aqueous textile treating medium to said spray nozzle; and means for supplying compressed air to said spray nozzle to atomize said treating liquid.

7. An apparatus according to claim 6, but further characterized in that the sloping forward portion and the portion of the fins farthest from the inner wall of the conduit are provided with a smooth rod-like edge which is circular in cross-section.

8. An apparatus for applying liquids to unspun textile fibers comprising a substantially horizontal, cylindrical conduit through which textile fibers are conveyed by an air stream, said conduit having an upstream portion and a downstream portion and smooth inner walls and being provided with at least two sets of fins, each set comprising a plurality of fins, the fin-like members of each set being fastened to the wall of the conduit in the same longitudinal portion of the interior of the conduit and parallel to the longitudinal axis of the conduit and being adapted to deflect fibers moving through the conduit toward the central longitudinal portion of the conduit and to streamline the flow of an air stream in said conduit; the number of fins in said conduit being sufficient to deflect a substantial proportion of fibers in said conduit but insufficient to prevent the flow of fibers between said fins; a spray nozzle mounted substantially coincident with the longitudinal axis of the conduit on one of the fins located in the set of fins closest to the downstream portion of the conduit, said spray nozzle being adapted to project a spray of textile treating liquid toward the downstream portion of said conduit and beyond the last sets of fins closest to the downstream portion of said conduit; means for supplying textile fibers to the upstream portion of said conduit; means for generating an air stream in said conduit for conveying said textile fibers from the upstream to the donwstream portion of said conduit; means for supplying a textile treating liquid to said spray nozzle; and means for supplying compressed air to said spray nozzle to spray said liquid.

9. An apparatus according to claim 8, but further characterized in that the apparatus comprises means for supplying water to the spray nozzle to prevent clogging of the nozzle when the supply of the textile treating liquid is cut off.

10. An apparatus according to claim 8, but further characterized in that the conduit is provided with at least one set of rods, said set of rods comprising a plurality of smooth edged rods which are located in the same longitudinal portion of the conduit and are fastened to the wall of the conduit closer to the upstream portion of the conduit than any one of the sets of fins, said rods being adapted to deflect fibers in the conduit toward the central longitudinal portion of the conduit.

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