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**Bernholz et al.**

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[54] **APPARATUS FOR TREATING TEXTILE FIBERS IN STAPLE FIBER FORM**


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[52] **U.S. Cl.** .......... **68/19.1,** 8/156, 68/20, 68/22 R, 68/44, 68/205 R, 68/3 SS

[51] **Int. Cl.** .......... **B05c 3/136**

[58] **Field of Search** .......... 68/19.1, 20, 22 R, 68/44, 205 R; 8/156



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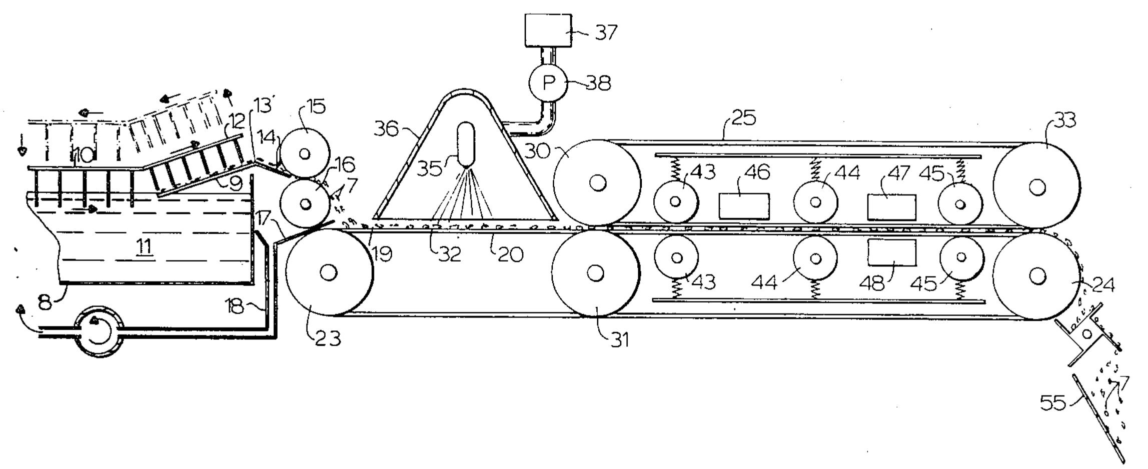
[57] **ABSTRACT**

A continuous lower apron is matched with a continuous upper apron, both of which are driven from an inlet end toward an outlet end, but the upper apron is shorter than the lower apron to provide an exposed portion at the inlet end of the upper apron. Staple fibers are fed to the inlet end of the lower apron and are there sprayed with a treating liquid directed toward the upper surface of the lower apron. The sprayed fibers then pass in between the two aprons, while a series of squeeze rolls located along them urge the aprons together and distribute the sprayed liquid upon the fibers and into them. The aprons perferably comprise imperforate rubber belts, the lower apron preferably being of harder rubber than the upper one, both belts having rough surfaces to discourage adherence of wet fibers to them. The lower apron may have a series of ridges extending diagonally and lengthwise across it; the valleys between ridges distribute treating liquid that misses the fibers and helps to treat the underpart of the fiber groups.


**12 Claims, 5 Drawing Figures**



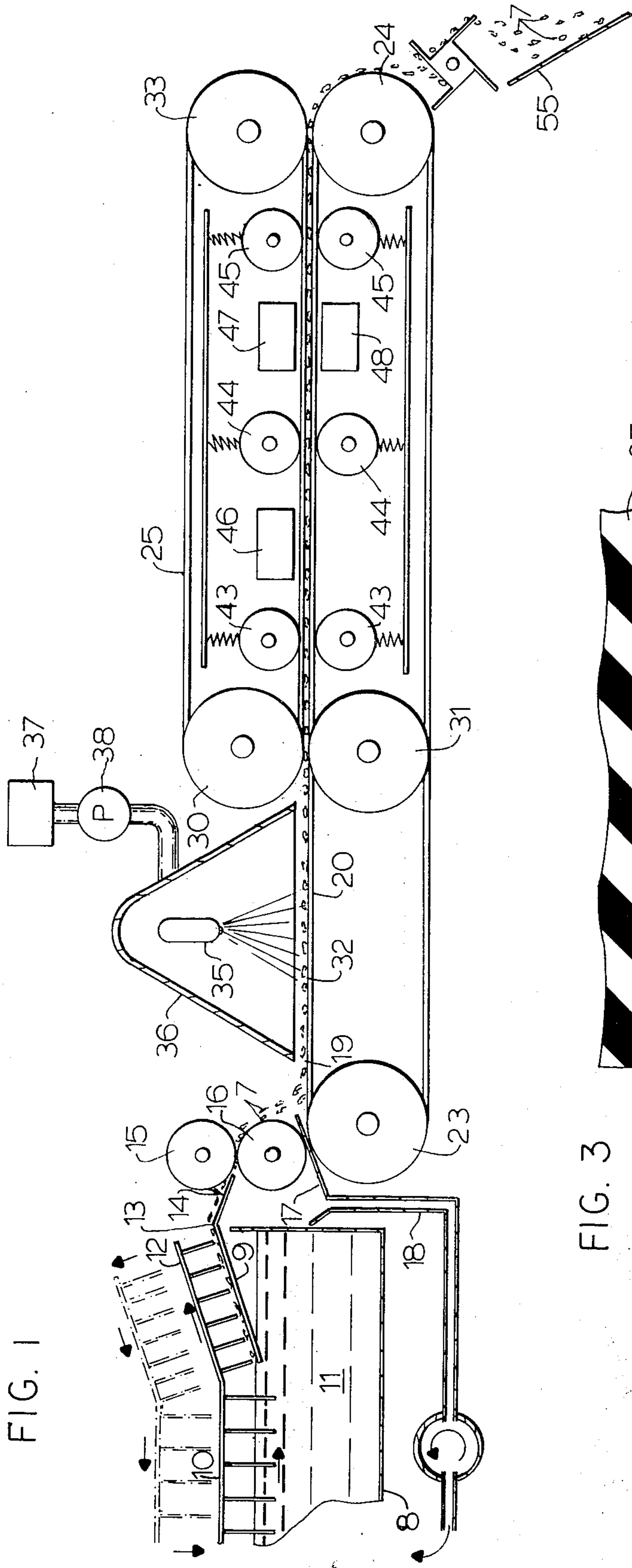

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FIG. 1

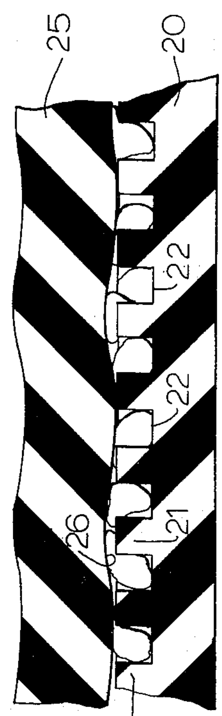
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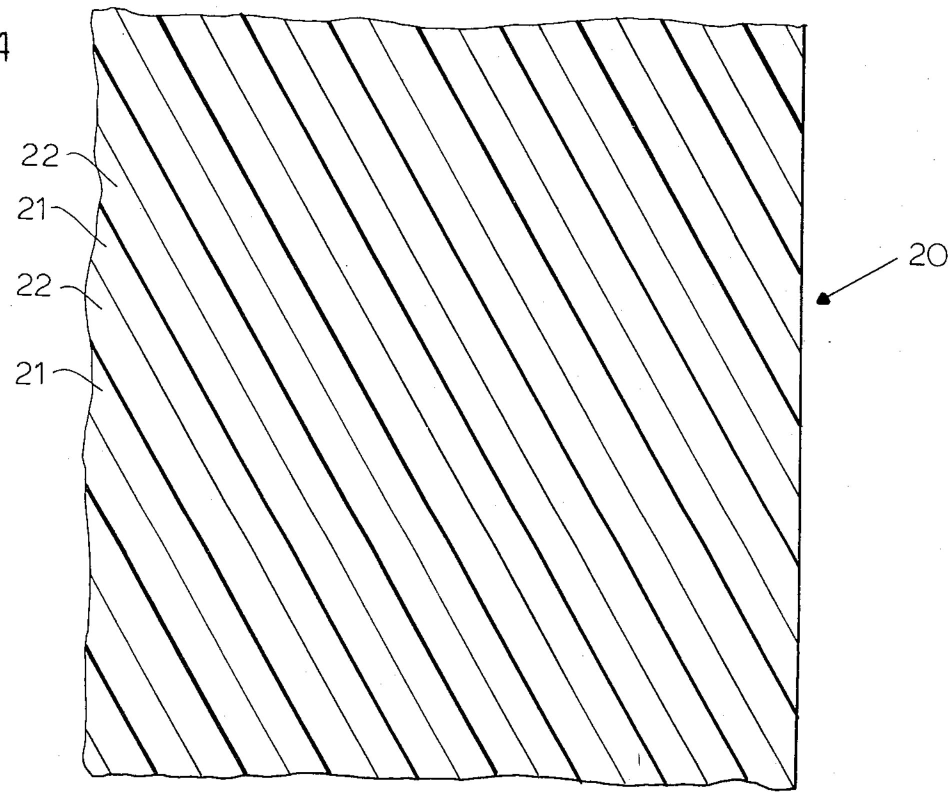
FIG. 3

FIG. 4



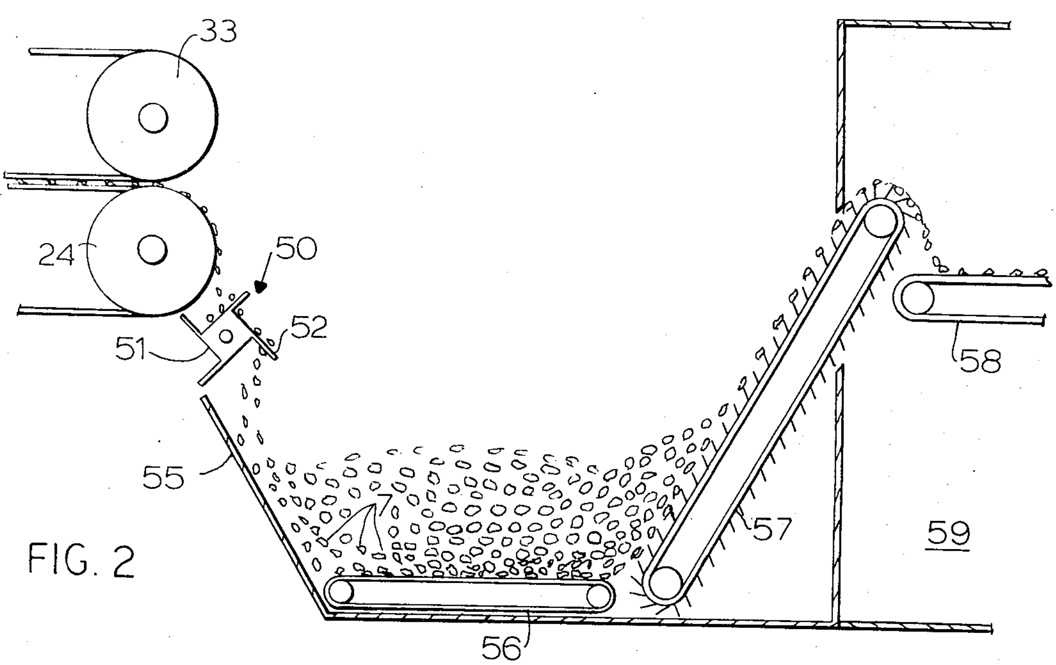




FIG. 2

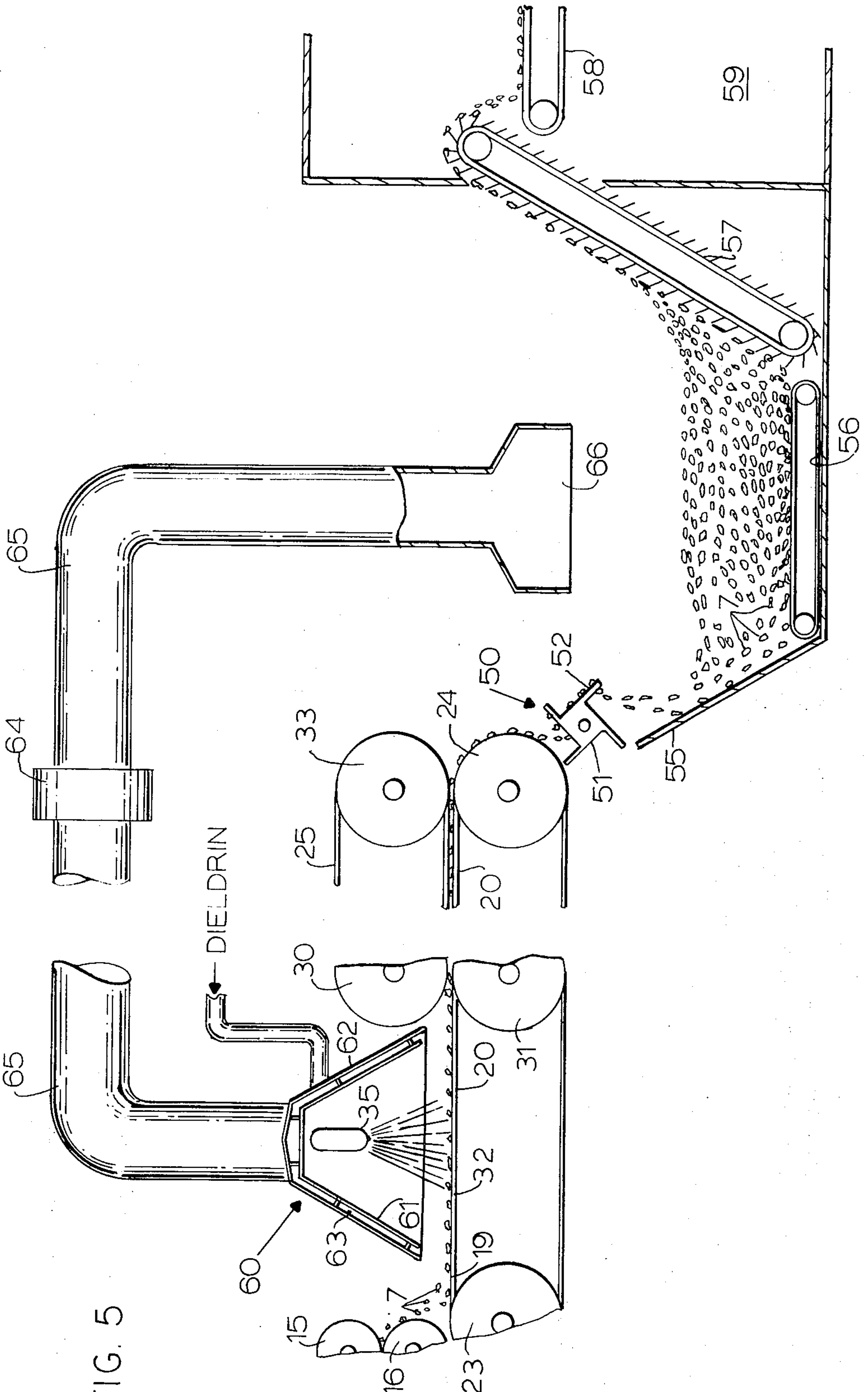

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FIG. 5

# APPARATUS FOR TREATING TEXTILE FIBERS IN STAPLE FIBER FORM

## BACKGROUND OF THE INVENTION

This invention relates to apparatus and process for treating textile fibers in staple fiber form with a liquid chemical in a continuous process.

The invention applies to such treatment as the mothproofing of scoured or raw stock wool dyed fibers, the dyeing of wool staple fibers and of other types of fibers, including cotton and man-made fibers. It applies to the application of water repellents, fire retardants, lubricants, antistatic agents, and other surface treatments of synthetic fibers, chiefly in staple fiber form.

Currently, the only satisfactory way of applying mothproofing agents, such as dieldrin, to wool is by total immersion in a dye liquor or similar treating bath. However, only about 50 to 75 percent of the dieldrin is taken up by the wool, and the remainder contaminates an effluent. Disposal of such an effluent contaminates the environment and may upset the ecological balance and has been said to have disastrous effects upon various, if not all, living aquatic organisms and fish, and the insects, birds, and mammals that feed upon them.

When mothproofing, surface finishing or dyeing such fibers, it is important to obtain intimate contact between the chemicals used and the fibers. For example, in dyeing of wool, this is often obtained by using such chemicals as acids and salts to exhaust the dye from the abundant water that is present onto the wool. The process may be applied to raw stock fiber or to yarn or in the form of piece goods. The fabric is often padded through a concentrated solution immediately before drying. In all these instances the fiber is submerged in the treating solutions. This consumes a large amount of water and chemicals and is rather expensive. For that reason it has been sought to spray the chemical onto the material, but it has been found that upon spraying, the intimate contact between the chemical and the fiber is lacking and the same degree of fastness is not obtained as is obtained by complete immersion.

Those versed in the art know that staple fibers, that is, those of short length from about 1 to about 6 inches, when processed together in an aqueous medium where they have free movement, tend to assemble together in clusters, tufts, or clumps of fibers. When these assemblies pass through heavy squeeze rolls on to an endless belt, it becomes almost impossible to spray them evenly because (*a*) only the tops of the assemblies are exposed to the spray; (*b*) much of the spray effect is lost because the liquid often falls on the intermittent spaces between the various assemblies, clumps, or tufts of fibers, and is therefore wasted. This waste happens in spite of devices, such as solenoid valves, which are designed to shut off individual spray heads when no fiber is passing beneath them.

It is well known that one good way of applying treatments to textile woven fabric is by padding. In padding, open-width, continuous fabric is conducted by complete immersion around a roller submerged in a shallow pan containing the chemical in solution or in emulsion form, and the chemical is squeezed out of the fabric as it passes in open width through heavy squeeze rollers. The amount of liquor held by the wool fabric may be 40 to 100 percent or more of the weight of the dry fabric before treatment. Thereafter, the fabric may be dried immediately, open width, and the water or other solvent evaporated away, leaving only the chemicals on the wool with the required fastness. On the other hand, we have found that if raw wool, either freshly scoured or raw stock dyed, is squeezed through heavy rollers to leave a like 40 to 100 percent or more of water, based on the dry weight of the wool, and then is sprayed with a concentrated solution of chemical before drying, the chemical does not always impart the respectable or required fastness referred to above.

For example, effective mothproofing of wool with dieldrin has been obtained by padding it onto the wool in conjunction with a small amount of resin, and it has been found that woolen pieces treated by this padding method are still mothproof after twenty or more hand washings or twenty or more dry cleanings carried out by standard (e.g. AATCC) methods. In contrast, when the wet raw wool has been sprayed after scouring, whether there has been raw stock dyeing or not, with a spray evenly applied and depositing the same amount of resin and dieldrin for the same amount of wool as used for padding fabric as above, the fastness was equivalent only to about five hand washings or five or less than ten shampooings.

Similar results have been found with other chemicals. For example, Tolgyesi et al, Chemical Technology, January 1971, reported only 0.15 percent of Tri (octyldecyl) methylammonium chloride, (the percentage being as of the weight of the fiber) is sufficient to mothproof wool when it is applied by total immersion, whereas for spraying, Tolgyesi reports 2 percent by weight must be applied.

Thus, complete immersion of the fiber in the dye or chemical solution or emulsion has heretofore been essential to the achievement of adequate fastness. But complete immersion requires large amounts of water and it takes time to achieve equilibrium between the solution or emulsion and the wool, this time depending partly on the weight ratio of the wool to the water in the solution or emulsion, for it takes longer to exhaust the dye onto the wool from a dilute solution or emulsion than from a concentrated one. Such immersion application, whether for dyeing or for mothproofing with dieldrin, is carried out in a batch application which, in itself, requires extra labor, dye machines, and supervision, compared to a simple "in process" spray-on treatment.

On the other hand, spraying can be carried out continuously, as an additive to the forward continuous movement of the fibers coming from wet processing through squeezing to drying, and requires such addition to be by only minimal amounts of water. The trouble has been that prior-art spraying resulted in uneven application and failed to give the complete immersion which is necessary to the development of maximum fastness.

One object of the invention is to provide a method and apparatus by which chemicals can be continuously sprayed upon fibers and by which one can obtain the high degree of fastness previously obtainable only from dipping, immersion, or padding.

Another object of the present invention is to overcome the shortcomings of prior spraying processes.

Another object of the invention is to impart to natural fibers such as wool, cotton, viscose, cellulose esters, and to man-made fiber, when in their raw stock or short staple fiber form, an immersion treatment equivalent in efficiency to that available to these fibers when in woven form and subject to treatment in batch dyeing machines, padders, washing machines, etc.

Another object of this invention is to provide an apparatus which can be fitted into many continuous production lines without changing the operation or moving already installed machinery out of line.

A further object of the invention is to provide a dieldrin treatment for wool that minimizes or even eliminates the presence of dieldrin in effluent waters from the raw wool dyehouse.

## SUMMARY OF THE INVENTION

In the present invention apparatus is provided for treating staple fibers in such a way that results comparable to bath and padding treatments are obtained by spraying. After the spray is applied in this invention, the fibers are squeezed between a pair of continuous belts or aprons, which act to distribute the sprayed liquid over all of the fibers and also force it into the fibers. Both aprons are continuous and are preferably imperforate, and the textile fibrous material absorbs substantially all the liquid that is sprayed, the spray being metered to correlate with the production rate of fibers moving forward on the apron. The upper apron is shorter than the lower one to allow the spraying to take place on an exposed inlet end of the lower apron. In removing the material from the belts or aprons at the outlet end, the fibers fall into a reservoir or hopper in front of the dryer. A standard whip and roll removes any clumps of fibers that tend to adhere to either apron.

The apron preferably comprises rubber belts, and preferably the lower belt is substantially harder than the upper one and is provided with a series of ridges. These ridges are preferably between ⅛ inch and ¼ inch high and are spaced apart at the same distance as the height. Preferably, both belts have rough surfaces to discourage adherence of wet fibers to them.

When the action is that of mothproofing wool or dyeing wool, it is preferred that the wool have a moisture content of between fifty and sixty percent, on the weight of the dry wool, before being sprayed; this amount may vary from forty to even one hundred percent on the weight of the dry wool. The amount of moisture content depends upon local conditions of squeeze-roll efficiency, type of fiber, water-evaporating efficiency, etc., of the dryer. This moisture content falls well within the range that wool can absorb, since wool can absorb water up to about 200 percent of its dry weight. The critical thing is that the amount of liquid sprayed on be about five percent, on the weight of the dry wool, and not much more than five percent, so that the efficiency and rate of production through the dryer is not impaired, even though some extra heat may be required.

Other objects and advantages of the invention will appear from the following description of a preferred embodiment.

## BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a view in side elevation somewhat schematic in form of a portion of an apparatus embodying the present invention and usable for a process of the invention.

FIG. 2 is a view similar to FIG. 1 of a succeeding portion of the same invention.

FIG. 3 is an enlarged fragmentary view in side elevation and in section of the two aprons compressing clumps of fibers between them.

FIG. 4 is a top plan view of a portion of the lower apron.

FIG. 5 is a view like FIGS. 1 and 2 of a modified form of the invention with parts broken to conserve space.

## DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

FIG. 1 shows a portion of a wool-treating operation adjacent the end of a scouring operation, where blended wool fibers 7 have gone through a rinse tank 8 with an inclined and perforated drip board 9 at its outlet end. The wool fibers 7 are moved forward by a series of reciprocating rakes, such as the last rake 10 which carries the blended wool fibers 7 forward through the rinse tank 8, moving forward, then rising above the rinsing liquid 11 in the tank 8 into the air above the scouring bath at the end of its forward stroke. It moves backward and then dips down again into the liquid 11 for its next forward stroke. The last rake 10 has a portion 12 equipped with shorter tines and inclined at about 35° to the horizontal, and this portion 12 moves the wool fibers up the perforated drip board 9 to a crest, peak, or dam 13 where the wool 7, lubricated with water slides down a slide 14 into the nip of a pair of squeeze rolls 15 and 16. The wool fibers 12 leaving the squeeze rolls 15 and 16 hold between 40 and 100 percent of water, based on the dry weight of the wool. A draining pan 17 collects the squeezed-out water, and via a conduit 18 and a pump 18*a* returns the water 11 to the entrance end of the rinse tank 8. The raw stock wool 7 is delivered to the apron 20 at a warm or preferably hot temperature and at a suitable pH as used for dyeing, induced preferably by a suitable acid present in the water rinsing bath 11 immediately preceding the heavy squeeze rollers 15 and 16. Other fibers may or may not require that the fibers be brought to a higher than ambient room temperature, by passage through a previous treating medium.

When dyeing or tinting wool or other fibers by the "spray-on" technique of this invention, the fibers may be dry before coming under the spray.

While, for mothproofing, a previous hot rinse, approximately 120°–200° F., through an acidic solution, may be used to impart the correct pre-spray condition to the wool, the temperature may be enhanced by means of steam at suitable junctures in the process. Suitable and known chemicals may be introduced enabling mothproofing or dyeing or both at room temperatures.

The staple fibers 12 are deposited by the squeeze rolls 15 and 16 on the inlet end 19 of a lower apron 20, which may be an imperforate rubber apron of relatively hard rubber. For example, it may have a durometer of about 90. Preferably, but not necessarily, the apron has a series of diagonal ridges 21 about ⅛ to ¼ inch high spaced about ¼ to ⅛ inch apart by valleys 22. The diagonals may be about 30° to the apron's side edge. At each end of the apron 20 is a training roller 23 or 24 to provide an upper reach and a return reach.

There is also an upper apron 25, also imperforate, preferably of rubber and preferably made from softer material than the lower apron to absorb the high and low indentations of the apron 20. It may have, for example, a durometer of about 70. The gentle softness of the rubber belts 20 and 25 avoids the friction necessary to cause felting of such fibers. Since wet fibers tend to stick to entirely smooth rubber belts. it preferably has a rough or grainy surface 26. It is preferably without ridges, but, alternatively it may have ridges and may be mated with the lower apron 20 so that the ridges 21 are opposite ridges 27 or mated so that ridges 21 lie opposite valleys 28. This upper apron has an inlet training roller 30 spaced away from the inlet training roller 23 of the lower apron 20 and preferably opposite another roller 31 beneath the lower apron 20 to provide a squeeze roll combination. This leaves an exposed upper surface portion 32 of the lower apron 20. Preferably, the two aprons 20 and 25 are horizontal in their opposite reaches, although they may be somewhat inclined, if desired. There is a training roller 33 at the outlet end of the upper apron 25. The purpose of the ⅛ inch of ¼ inch apart diagonals 21 and 22 is to distribute the sprayed-on material all across the apron 20 until the liquid reaches a clump of wool ready to absorb the liquid. In like manner the ⅛ or ¼ inch canal 22 carries away to the extremities of the belt the excess water squeezed out of the wool. This is an important part of the apparatus because many dryers are installed to take a maximum amount of wool or other fiber, and the extra amount of liquid (about 5–10 lbs. in the case of wool) might be sufficient to slow down the production of the dryer if extra steam or heat is not available to compensate for the extra water. All in all, the oblique or transverse hills and valleys of the canal system provide a good intermingling of the wet wool with the added chemical.

The canals 22 may traverse the apron 20 from left to right or right to left or may criss-cross in both directions. In like manner the canals 22 might proceed lengthwise around the apron. The best configuration is a combination of criss-cross and lengthwise ways, for this ensures maximum distribution of the spray that falls on the apron 20 without initially encountering any fiber. By means of the canal distribution system, far more of the spray reaches the fiber, and, what is even more important, is the fact that the bottom or underneath part of each separate assembly of fibers is exposed to the treatment, thus assuring even treatment. An added feature of the hills and valleys of the canal system is that the valley breaks the ever present tendency of wet fibers to adhere to flat surfaces, and this ensures that the clumps or assemblies of fibers will fall by gravity into the hopper or reservoir of the dryer. The valleys 22, with pressure from the softer top rubber apron 25, also offer a means whereby any excess water or treating liquid may run off at the sides of the lower apron 20. A typical use of such equipment is to immerse and squeeze wool in a dieldrin emulsion in a manner that reproduces the fastness of application in the dyebath and yet eliminates the presence of dieldrin in effluent waters from a wool processing plant. A spray device 35 is positioned above the exposed portion 32 of the lower apron. There may be, typically, four to six spray nozzles, and preferably there is a hood 36 located around the spray nozzles 35.

In one form of the invention, shown in FIG. 1, the treating liquid is delivered from a supply 37 to the spray nozzles 35 by means of a positively driven pump 38. In this instance, a simple glass or plastic hood 36 may be used to confine the spray within the hood 36. it has been found that even as close as two feet from the hood 36, the dieldrin content of the air is much lower than the approved safe amounts, typically only one-tenth dieldrin being present as what has been determined to be safe. Pressure alone is relied on in this form of the invention to deliver the liquid from the supply 37 to the spray heads 35 and to spray it upon the wool.

In another form of the invention, shown in FIG. 5, the mill is equipped with air pressure and uses it to deliver the mothproofing, dyestuff, or other chemical from the supply 37 to the nozzles 35. Then, since there is a tendency for an air current to build up in the hood and to result in airborne chemical leaving the hood, a different sort of hood 60 is used with an inner shell 61 and an outer shell 62, and the inner space 63 between the inner shell 61 and the outer shell 62 to a fan 64 via a pipe 65. This sets up an air current, drawing the air away from plant personnel. The pipe 65 continues on past the fan 64, and by downward draft its outlet end 66 drops the condensed spray onto the wool 7 in a reservoir or hopper 55 in front of the dryer.

Assuming the liquid to be sprayed is a mixture of dieldrin and resin, the amount is governed according to the feed of the fiber through it. The spray assembly 35 may deliver about 5–10 lbs. of emulsion per 100 lbs. of wool (dry weight), and the spray is delivered evenly across the belt from four to six spray heads fed, preferably by the airless system relying on an accurate gear pump.

On opposite sides of the two aprons 20 and 25 at their facing reaches is a series of squeeze rollers 43, 44, 45 adapted to squeeze the aprons 20 and 25 toward each other. The pressure is regulated to assure complete wetting penetration and even distribution of the sprayed chemical into the wool but it not overdone, in accordance with the normal practice of squeezing wool.

It may be desirable to apply additional treatment to the wool fibers as they go between the two aprons 20 and 25. For example, an ultrasonic generator 46 may be located adjacent one of the reaches and may be used to provide some agitation. Similarly, one or more heaters may be applied, such as microwave or infrared heaters 47 and 48. Microwave heaters have the advantage that they can operate on the water vapor being applied and tuned to the key frequency for water so that the aprons 20 and 25 are not directly heated, and the microwave energy passes through them without any trouble, while still getting the desired results on the liquid.

Beneath the outlet end of the apron 20 is a whip assembly 50 which comprises a polygonal rod 51 having a plurality of sheet-like members 52 of leather or plastic which are located where they strike the apron 20 as it rounds the lower end of the training roller 24 or approximately thereabout, to pull loose any particles or groups of wool fibers which have stuck to the lower apron. They then drop off into a hopper 55 before going to a drier and from there to the carding operation.

As FIG. 5 shows, the condensed exhaust from the spray hood 60 is delivered by the conduit 65 to the wool 12 in the hopper 55. In both FIG. 2 and FIG. 5 a wooden slotted endless belt 56 may be used to deliver the wool 7 to an endless spiked apron 57 that carries it upwardly and places it in a drying belt 58 of a dryer 59.

Applications

As an example of how the invention may be practised, we shall describe an apparatus for mothproofing wool. The mothproofing material may be the dieldrin emulsion described in the patent application of William F. Bernholz, Thomas C. Cox, and John P. Redston, Ser. No. 11,192, filed Feb. 13, 1970 for Insecticidal Composition and Method of Protecting Proteinaceous Materials Therewith. In this instance there is a combination of the dieldrin plus a resin, giving superior results and capable of being sprayed.

This mothproofing material may be applied to wool cloth or to wool fibers after they have been dried and carded and before or after spinning, but such an application of liquid means that there has to be another drying operation in addition to preceding drying steps. Therefore, for the sake of economy, the present invention prefers to have the spraying operation take place before carding and preferably immediately after the dyeing operation and before the drying operation that precedes carding. The spray may be used for dyeing, or there may be a combination mixture of dyeing and mothproofing, or there may be two spray systems, one for dyeing and one for moth-proofing. It is desirable to work with the wet wool as it comes from the dyeing operation with the extra squeeze rolls reducing it to the desired moisture content of about forty to sixty percent or even one hundred percent, but preferably fifty to sixty, on the weight of the dry wool.

When the invention is used with synthetic fibers, usually there is no necessity for these fibers to be scoured. It may be desirable to moisten them to a desired moisture content before sending them to this process, or in other instances it may be desirable simply to submit them dry. In either instance, the combination of the spray and the squeeze belts acts to distribute and impregnate the fibers with the chemical treatment.

The roller **33** need not be directly over the roller **24.** The belt **25** can be shortened and the roller **33** to the left of the roller **24.** In this case, the roller **33** and an auxiliary roller of approximately the same size would provide the necessary last squeezing action to the fiber before it falls over the roller **24** into the reservoir in front of the dryer.

Dyeing Procedures

One of the disadvantages of normal dyeing is the fact that the fiber or fabric has often to be processed in long liquor ratios using, say, ten to forty times as much water as weight of fiber yarn or fabric. This water has to be heated to the boil or higher under pressure and maintained at that temperature for an hour or more. To overcome, to some degree, this great disadvantage, yarns are being spun, knitted into fabric, printed or padded, rinsed, dryed, deknitted, wound into bobbins and then tufted, woven knitted, etc. This requires, of course, a battery of knitting and deknitting machines, continuous printers, etc.

By use of the double-belt contoured-canaled bottom apron **20**, raw stock fiber may now be simply sprayed with any dye system that operates at low liquor ratios and low time cycles. Such systems are:

Wool dyestuff dissolved in formic acids for wool dyeing, using the method of Harrap J.S.D.C. 75 (1959) 106.

Selected acid, disperse and direct (substantive) dyestuffs applied to acetate from about 75 percent methyl alcohol 25 percent water solution, originally used by British Celanese for coloring acetate lining fabric and successfully used for skein dyeing of acetate by one of us in the 1930's.

Wool treated with reactive dyes in presence of high percentages of urea, as exemplified by the method of D.M. Lewis and I. Seltzer J.S.D.C. 84 (1968) 501, which may now be operated by a 30 percent urea solution and steaming, then a second water spray to remove excess urea color, etc.

After spraying of the dyestuff and passage of the fibers through the double belt assembly, normally the fibers stand about five to ten minutes in the reservoir or hopper in front of the dryer before reaching the inclined spike apron **57** and entering the drying chamber **59.** Where raw wool or other fibers require a longer dwelling time for completion of the coloring process before drying or other subsequent processing, suitable waiting areas, trucks, or conveyors can be employed. Thereafter, the complete mixing of the fibers that takes place during the carding operation provides completely even color distribution. The spun yarn is then tufted, knitted, or woven as desired. Where resin is to be applied to fibers which must then be carded, the resin content should not exceed 0.25–0.50 percent; otherwise incipient cross linking may cause fiber breakage in the carding process.

The saving in labor, time, machinery, dyes, chemicals, steam, water, is readily apparent.

Another use for the double-belt process is in bonding of non-woven fabrics using acrylic and other suitable resins, such as polyamide-epoxy or acrylic resins with polyamide-epoxy resins, followed by drying and curing. Indeed, the same types of resin recommended in the above-mentioned patent application Ser. No. 11,192, filed Feb. 13, 1970, may be used for such bonding of man-made fibers as well as for dyeing glass fibers.

To those skilled in the art to which this invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

We claim:

**1.** Apparatus for treating textile fibers in staple fiber form with a liquid chemical, in a continuous process, including in combination:

a continuous lower imperforate apron having a training roller at each end of a continuous loop, with an upper reach having an inlet end and an outlet end and a return reach, and means for driving said apron to move in the direction from the inlet end to the outlet end across said upper reach,

a continuous upper imperforate apron above and adjacent to said lower apron and having a training roller at each end of a continuous loop, with a lower reach facing the upper reach of said lower apron and shorter than said upper reach, said lower reach having an inlet end spaced from the inlet end of said upper reach to provide an exposed portion of said upper reach, and an outlet end lying not beyond the outlet end of said lower apron,

means adjacent the inlet end of said lower apron for feeding staple fibers to the inlet end of said lower apron,

means above said exposed portion for spraying a treating liquid toward said exposed portion,

a series of squeeze rolls located along said reaches urging said upper apron and said lower apron toward each other so as to squeeze the spray-moistened fibers and distribute the sprayed liquid upon them and into them, and

drying means following said outlet end.

2. The apparatus of claim 1 wherein both said aprons comprise rubber belts, one being substantially harder than the other.

3. The apparatus of claim 2 wherein said belts have rough surfaces to discourage adherence of wet fibers to their surfaces.

4. The apparatus of claim 3 wherein the lower apron is the hard rubber belt and it has its upper surface provided with diagonally extending ridges.

5. The apparatus of claim 4 wherein said ridges are between about ⅛ and about ¼ inch high and are about the same distance apart.

6. Apparatus for treating staple fiber wool with a liquid chemical such as a dyeing or mothproofing liquid, in a continuous process, including in combination:

scouring means for the raw wool having terminal squeeze rollers,

conveyor means for the wet raw wool leading from said terminal squeeze rollers,

additional squeeze rollers at the end of said conveyor means for reducing the moisture content of said raw wool to about 50 to 60 percent,

a continuous lower imperforate rubber apron succeeding said additional squeeze rollers and having a training roller at each end of a continuous loop, with an upper reach having an inlet end and an outlet end and a return reach, and means for driving said apron to move in the direction from the inlet end to the outlet end across said upper reach,

a continuous upper imperforate rubber apron above and adjacent to said lower apron and having a training roller at each end of a continuous loop, with a lower reach facing the upper reach of said lower apron and shorter than said upper reach, said lower reach having an inlet end spaced from the inlet end of said upper reach to provide an exposed portion of said upper reach to which said additional squeeze rollers feed raw wool, and an outlet end approximately in line with the outlet end of said lower apron,

a group of spray nozzles above said exposed portion for spraying a treating liquid toward said exposed portion,

a hood over said spray nozzles and said exposed portion,

a series of squeeze rolls located along said reaches urging said upper apron and said lower apron toward each other so as to squeeze the spray-moistened fibers and distribute the sprayed liquid upon them and into them, and

drying means following said outlet end and leading to a carder.



7. The apparatus of claim 6 wherein the lower apron is substantially harder rubber than the upper one.

8. The apparatus of claim 7 wherein the lower harder rubber apron has its upper surface ridges by diagonally extending ridges.

9. The apparatus of claim 8 wherein said ridges are between ⅛ and ¼ inch high and are the same distance apart.

10. The apparatus of claim 6 wherein said aprons have rough surfaces to discourage adherence of wet fibers to their surfaces.

11. The apparatus of claim 6 having positive pump means for supplying the treating liquid to said spray nozzles.

12. The apparatus of claim 6 having pneumatic means for supplying said liquid to said nozzles entrained in air under pressure, said hood having an inner shell and an outer shell with a passage therebetween, fan means and a conduit for withdrawing air from said passage, and means for directing the air on the wool just prior to said drying means.

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