March 11, 1958 E. S. OLSON 2,826,057

APPARATUS FOR CONTINUOUSLY WASHING RUNNING LENGTHS OF TEXTILE MATERIALS

Filed April 16, 1953 3 Sheets-Sheet 1

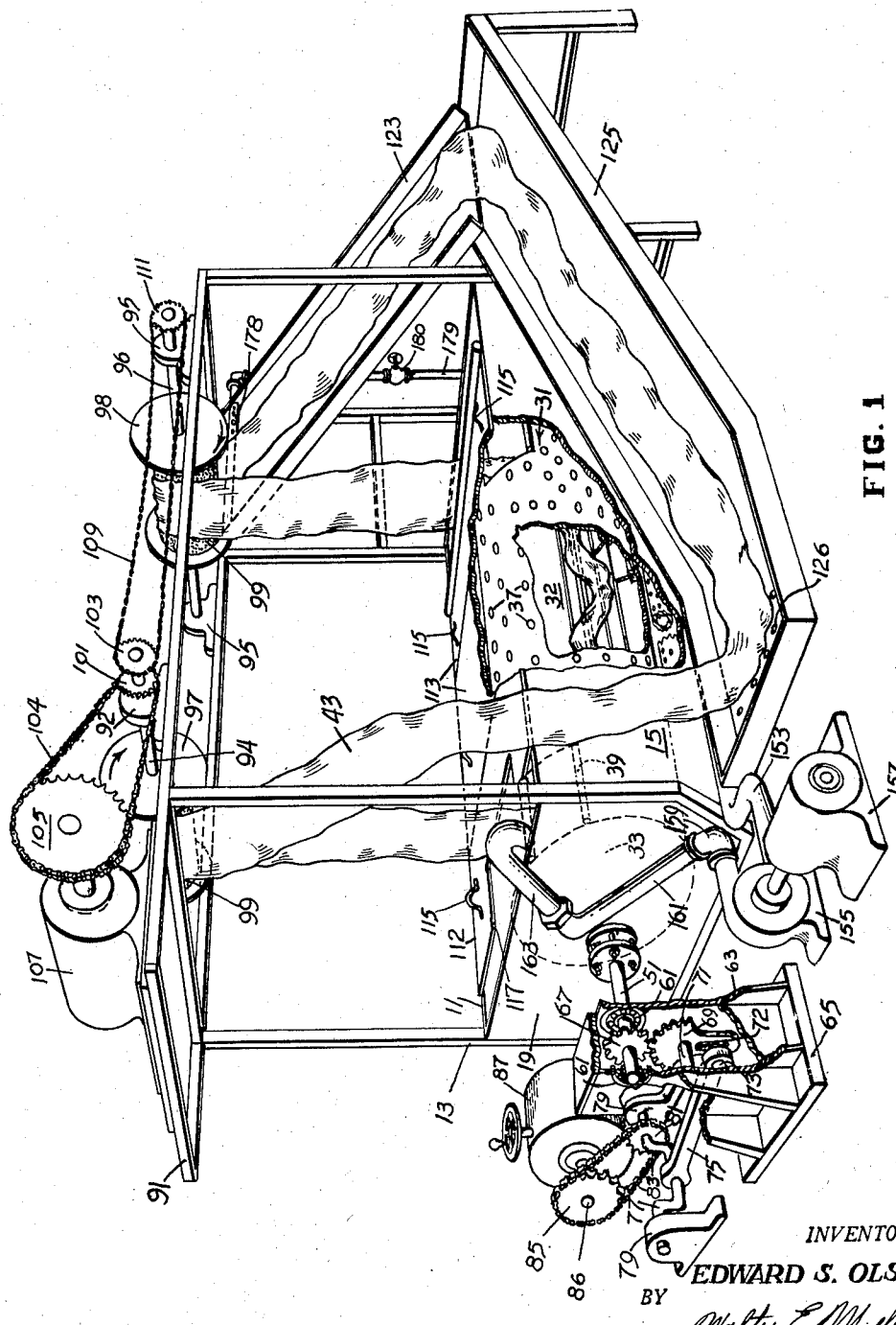


FIG. 1

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Filed April 16, 1953 3 Sheets-Sheet 2

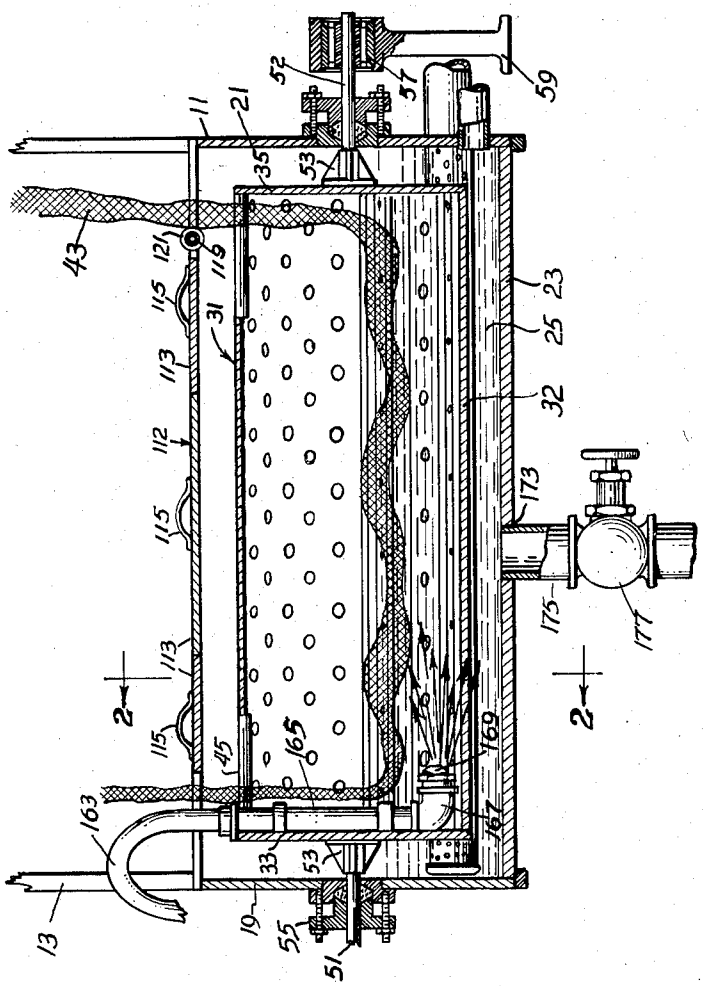


FIG. 3

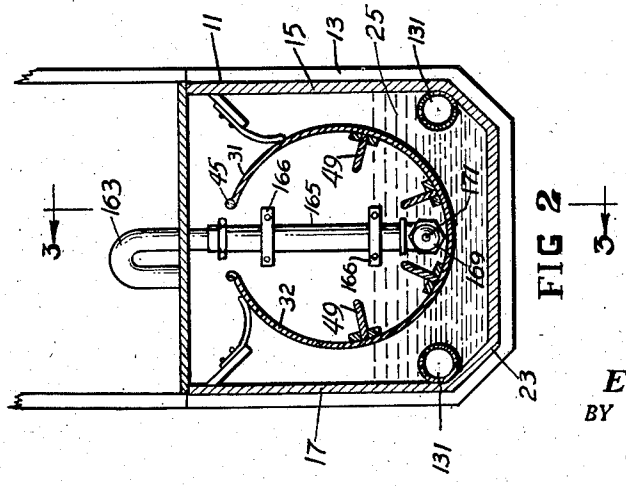


FIG 2

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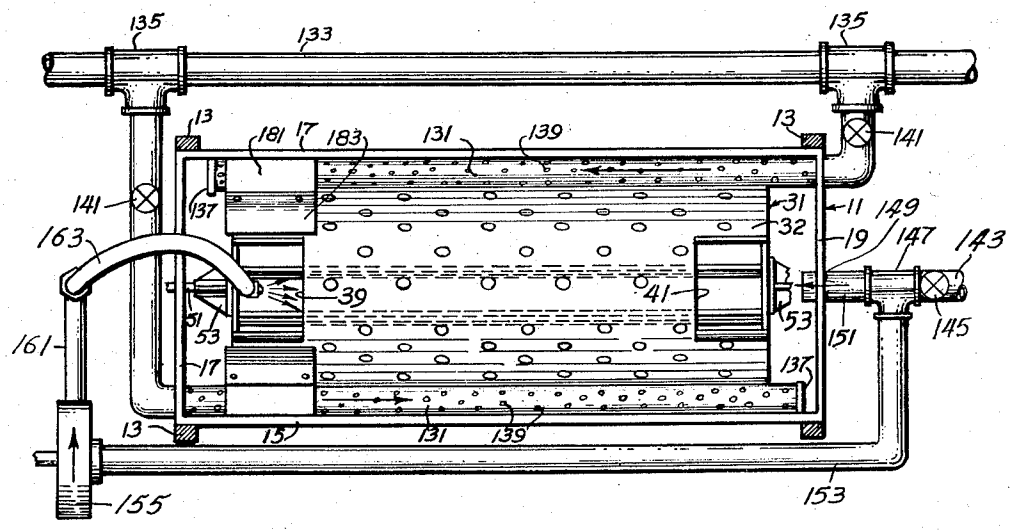


FIG. 4

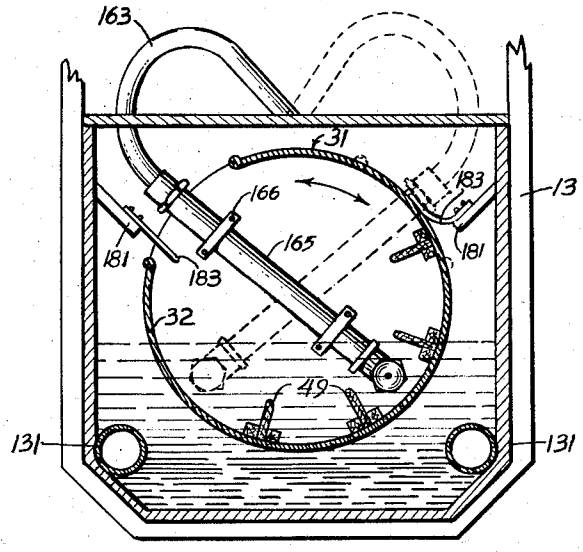


FIG. 5

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United States Patent Office 2,826,057 Patented Mar. 11, 1958

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APPARATUS FOR CONTINUOUSLY WASHING RUNNING LENGTHS OF TEXTILE MATERIALS

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Application April 16, 1953, Serial No. 349,160

11 Claims. (Cl. 68—148)

This invention relates to an apparatus for treating textiles and is more particularly directed to a textile washer or boil-off machine wherein a relatively long length of textile material is progressively passed through the machine or series of machines and in the course of such passage is subjected to vigorous agitation.

Heretofore, textile washers have, in general, consisted of two types: a batch wash wheel in which a fairly short length of textile material is subjected to agitation within a closed cylinder rotated or oscillated about its axis which may be either vertically or horizontally disposed and a continuous washer in which a relatively long length of textile material is passed either in open width or rope form through a bath for one or more cycles, the bath being unagitated except for such agitation as is inherently caused by the passage of the material therethrough.

While is has long been known that agitation is a desirable adjunct in textile washing operations, no one to my knowledge had been successful prior to my invention in combining the feature of agitative action with the feature of continuous operation.

The primary object of this invention is, therefore, the provision of an agitator type washer which is adapted for continuous operation.

A further object of this invention is to provide a washer or boil-off machine which progressively subjects a continuous or substantially continuous length of textile material to vigorous mechanical agitation.

Other and further objects and advantages of my invention will be apparent from the detailed description when read in connection with the accompanying drawing, in which:

Figure 1 is a perspective view of the improved washer with certain parts broken away to reveal important features of the invention;

Figure 2 is a transverse cross-sectional view through the tank and agitator cylinder taken along line 2—2 of Figure 3;

Figure 3 is a longitudinal cross-sectional view along line 3—3 in Figure 2, but with the driving mechanism omitted for purposes of clarity;

Figure 4 is a top plan view of the apparatus looking down at the top of Figures 2 and 3, omitting the driving mechanism and cover and showing the piping system schematically to better illustrate the fluid flow pattern; and

Figure 5 is a cross-sectional view similar to Figure 2 but showing the cylinder at the preferred extreme positions of oscillation.

In general, my invention consists of a tank or fluid receptacle in which a perforated hollow cylindrical agitator is horizontally mounted for rotation about its axis, being adapted to be partially submerged in the fluid contained by the tank. The agitator is shown constructed with openings adjacent each end to permit the continuous passage of textile material therethrough and is coupled to an oscillatory drive which rocks it to and fro through a

maximum arc of less than 180° between a position where one edge of the opening coincides with a horizontal plane through the agitator on one side of the axis and a position where the other edge coincides with such plane on the other side of the axis, which is to say, the openings never face downwardly. Suitable means for delivering cloth to and from the cylinder are provided as are means for supplying the tank with fluid, recirculating the fluid within the tank and heating the fluid supplied to the tank.

Turning now to a detailed description of my invention, the numeral **11** designates a tank or fluid receptacle of generally rectangular shape having at each end thereof a U-shaped frame member **13** formed of channel steel which supports the side walls **15** and **17**, the end walls **19** and **21** and a bottom wall **23**, all being preferably made from stainless steel sheet material. While the side walls **15** and **17** and bottom wall **23** may be separate, I prefer that they be constructed of a single sheet of material, bent to conform to the configuraion of the U-shaped frame **13**. The joints of the tank **11** are, of course, suitably sealed so as to retain a washer fluid or boil-off medium **25**. For the purposes of description, it is assumed that the rear of the washer is disposed in the direction of travel of the material therethrough and, therefore, end walls **19** and **21** shall be referred to as ingress and egress end walls, respectively.

Side walls **15** and **17** and end walls **19** and **21** may be further supported or braced intermediate the members **13** by other suitably shaped channel members, if desired.

Horizontally supported in the tank **11** by means hereinafter to be described is a hollow cylindrical agitator **31**, having a shell **32** and ingress and egress end walls numbered **33** and **35**, respectively. The shell **32** of the agitator **31** is perforated as at **37** and the end walls **33** and **35** may be perforated or solid as desired. Shell **32** is also partially cut away adjacent each end thereof to provide an ingress opening **39** and an egress opening **41**, both of which face generally upwardly and through which a length of textile material designated **43** may be admitted into agitator **31** and withdrawn therefrom. The openings **39** and **41** may be separate, as shown, in which case they are in axial alignment or they may comprise a single opening which extends the full length of the agitator **31**.

Preferably, the agitator **31** has a longitudinal dimension somewhat greater than its diameter. To facilitate the passage of the material **43** through the openings **39** and **41**, it is desirable to roll the edges of the openings to provide a bead-like lip or rim **45** so as to guard against the material **43** becoming snagged upon the rough edges of the openings. The inside of agitator should be as smooth as possible, particularly adjacent the perforations **37**, to prevent snagging there.

Secured to the interior of the agitator shell **32** and spaced about the lower half circle thereof are a number of radially directed vanes or baffles **49** formed of stainless steel or other suitable material, the sides of which are perpendicular to a plane normal to the agitator shell at the point of intersection of the vane with the shell in order that movement of the agitator will transmit a maximum shock wave to the fluid therein.

The agitator **31** is supported at its ends thereof by shafts **51** and **52**, the former being attached to ingress end wall **33** and the latter to egress end wall **35** by means of brackets or mounting flanges **53**. Each of the shafts **51** and **52** extend through one of the end walls **19** and **21** of the tank **11**, being sealed therein by means of a packing gland **55**. As shown in Figure 3, the free end of the shaft **52** at the egress end of the agitator **31** is journaled in a bearing **57** supported by a vertical standard **59** and, as shown in Figure 1, the free end of the ingress end shaft **51** is journaled in a pair of spaced bear-

ings 61 mounted in the walls 63 of a housing designated 65.

Fixed on the ingress end shaft intermediate the spaced bearings 61 is a pinion 67 which meshes with a segment gear 69 rockably carried by a shaft 71 journaled in the walls 63 of housing 65. Secured to segment gear 69 below shaft 71 for vertical adjustment within a slot 72 formed in gear 69 is a pin 73 to which is connected one end of a pitman 75, the other end being connected to a crank shaft 77. The ends of crank shaft 77 are rotatably supported in pillow blocks 79. A small sprocket 81 is fitted on the crank shaft 77, being driven through a sprocket chain 83 by a large sprocket 85 fixed to the shaft 86 of a variable speed motor and transmission unit 87.

The legs of U-shaped frame members 13 extend vertically above the tank 11 to support an open horizontal framework 91 formed of angle iron. Mounted on frame work 91 above the ingress end of tank 11 is one pair of pillow blocks 92, only one of which is shown in Figure 1, in which is journaled a first shaft 94, a second pair of pillow blocks 95 being mounted on framework 91 above the egress end of tank 11 for supporting a second shaft 96. Carried by shafts 94 and 96 in general alignment with the ingress and egress openings 39 and 41 are reels 97 and 98 which are provided with roughened peripherial surfaces indicated at 99. Fitted on the shaft 94 is a spaced pair of sprockets 101 and 103, sprocket 101 being connected by means of a sprocket chain 104 to a larger sprocket 105 driven by a variable speed motor 107, sprocket 103 being connected by a chain 109 to a sprocket 111 carried by the shaft 96.

Preferably, I provide the tank 11 with a cover designated 112 consisting of a number of sections 113 furnished with handles 115. One of the sections 113 which is intended to fit over the ingress end of the tank 11 is cut away as at 117 to provide an opening somewhat larger than the opening 39 in the agitator 31 through which the material 43 may pass when the cover is in place. I prefer to leave the egress end of the tank open and in lieu of a cover section in this area there is mounted transversely across the top of the tank 11 a rod 119 rotatably encircled by a tube 121, as shown in Figure 3. Since the material 43 must pass under the tube 121 and rod 119 in departing from the agitator 31 and tank 11, it does not leave the agitator until it has traversed substantially the full length thereof.

Disposed transversely of the axis of the tank 11 adjacent the exterior of the egress end thereof is an inclined chute 123 having its upper end at about the level of the open framework 91 into which the material 43 is directed as it leaves the egress reel 97. A scray 125 situated along one side of tank 11 receives the material 43 as it falls from the chute 123, the scray being provided with holes 126 at the lower end thereof to permit the discharge of fluid therefrom.

The operation of the portions of this invention thus far described is as follows:

Assuming that only a single piece of textile material 43 of a length of a hundred yards or so is to be treated in my washer, a leader is threaded over the ingress reel 97, down through the opening 117 in the cover section 113, into the ingress opening 39 in the agitator 31, then along the length of the agitator 31, under and past the rod 119 and tube 121, out through the egress opening 41, up over the egress reel 98, and down the chute 123 and scray 125. The trailing edge of the leader is thereafter stitched in any conventional manner to the leading edge of the material. Tank 11 is then filled with any desired treating medium by means hereinafter to be more fully described and reel motor 107 and variable speed motor transmission unit 87 are simultaneously actuated. As crank shaft 77 rotates, segment gear 69 is rocked about its shaft 71 through pitman 75, this rocking motion being transmitted to shaft 51 through pinion 67, thus

oscillating agitator 31 about its axis. Material 43 is fed down into agitator 31 by ingress reel 97 and passes along substantially the entire length of agitator 31. In the course of this passage, the material is vigorously agitated to and fro by virtue of the action of baffles 49 on the fluid 25. After completing its passage through agitator 31, the cloth is drawn upwardly over egress reel 98 which delivers it to chute 123 and thence to scray 125 where it is collected.

In those cases where it is necessary to pass the material through the washer a number of times, the operation may be facilitated by stitching the leading edge of the leader to the trailing edge of the material so that an endless length is formed which may then be repeatedly run through the washer, the temperature of the fluid being controlled by means to be hereinafter described.

Where it is desired to process a number of lengths of textile material starting at a temperature and ending at a different temperature I advantageously make use of a number of washers as herein described arranged in series, the temperature of the fluid in successive washers being maintained at different levels. In this case, the leading edge of the first piece of material is stitched to a leader which has been threaded through all of the machines and the trailing edge of the first piece is stitched to the leading edge of the next succeeding piece, the trailing edge of the next succeeding piece to the leading edge of the next succeeding piece and so on. Using this arrangement, the lengths of material are not allowed to collect in a scray alongside of each washer as shown in Figure 1 but are fed from the egress reel of one washer directly to the ingress reel of the next washer although in particular situations it may be desirable to utilize a scray intermediate each pair of washers. Thus, the lengths of material are successively passed from washer to washer and the operation is for all practical purposes a continuous one.

The piping system which is associated with my washer is best shown in Figures 2 through 4. Disposed within tank 11 along the lower edge of each of side walls 15 and 17 and extending substantially the full length thereof parallel to the agitator axis is a steam pipe 131 which is connected at one end to a steam header line 133 through a pipe T 135, the terminal end of each of the pipes 131 inside of tank 11 being plugged by a cap 137. The portion of the pipes 131 which is inside tank 11 is perforated as at 139 to permit the entry of steam into the interior of tank 11. Valves 141 are provided in steam pipes 131 adjacent their connection to steam header 133 so as to enable the flow of steam to the tank 11 to be regulated.

A water supply line 143 having a valve 145 and terminates in a pipe T 147, one branch of which is in communication with a port 149 in the lower central portion of end wall 21 at the egress end of tank 11 through a nipple 151, the other branch being connected to one end of a by-pass line 153. The other end of by-pass line 153 is connected to the intake side of a pump 155 driven by motor 157.

The discharge side of pump 155 is connected through a pipe elbow 159, a short length of pipe 161, and flexible conduit or hose 163 to a section of pipe 165 disposed vertically inside of agitator 31 and secured to the interior face of end wall 33 at the ingress end of agitator 31 by means of clamps or brackets 166. At the lower end of pipe 165 is a pipe elbow 167 in which is threaded a nozzle 169. The opening 171 in nozzle 169 faces in the direction of the egress end of agitator 31 so that the stream of water which issues from nozzle opening 171 is directed toward the egress end as indicated by the arrows in Figure 3. The length of pipe section 165 is desirably such that the nozzle opening will at all times be submerged in the fluid 25 when tank 11 is filled to its normal operating level. Pipe section 165, however, should not be so long that the nozzle 169 is closely adjacent the

shell 32 of agitator 31 as this tends to create undesirable currents in the body of fluid 25 within tank 11.

As shown in Figure 3, the bottom wall 23 of tank 11 has a discharge opening 173 therein which is in communication with a discharge pipe 175, the latter having interposed therein a quick discharge valve 177 by which the fluid 25 can be conventiently dumped from tank 11. Since the conduit 163 connecting the vertical section of pipe 165 to the pipe 161 is flexible, pipe section 165 and nozzle 169 carried thereby are permitted to rock with agitator 31 through its complete arc of oscillation.

The piping system of this invention functions in the following manner: Assuming that the tank 11 is empty, the valve 145 is opened, permitting fluid to flow therefrom into the tank 11 through the nipple 151 and port 149. As soon as the level of the fluid 25 in the tank 11 reaches the desired height, the valve 145 is closed and assuming that a length of material 43 has been properly threaded into the tank in the manner heretofore described and that the washing operation is ready to commence, the pump motor 157 is actuated. Fluid 23 is withdrawn from the tank 11 through port 149 and by-pass line 153 into the pump 155 from whence it is fed under pressure to the nozzle 169 and discharged into the interior of agitator 31.

Extending across the top of chute 123 is a small pipe 178 perforated along its length which is connected to a vertical pipe 179 connected in turn to the water supply line 143 by means not shown, a shut-off valve 180 being interposed in pipe 179. During the operation of the washer, valve 180 is normally opened, allowing water to flow down chute 123 which assists material 43 in its passage down the chute into scray 125.

When it is necessary to raise the temperature of fluid 25, steam valves 141 are opened the necessary amount, permitting steam to flow from steam header 133 into the interior of tank 11, thus heating the fluid 25 contained by tank 11.

An essential feature of this invention is that the oscillating mechanism must be so designed that the agitator 31 is not rocked to a position at which the openings 39 and 41 are below a horizontal plane through the agitator axis. In other words, the arc of oscillation imparted to the agitator 31 should be less than 90 degrees on either side of a position at which openings 39 and 41 are directly vertical. I have found that this condition must be met in order to permit the textile material to be continuously fed into the oscillating agitator; otherwise, the cloth tends to escape from the agitator and it is not possible to maintain any degree of control over the feeding of the cloth into the agitator with the result that the material does not enter the agitator but tends to be deposited between the agitator and the side walls of the tank. While the above-mentioned range represents the maximum limits of oscillation of the agitator which can be satisfactorily employed, I prefer to use a total arc of oscillation of 140°, that is, 70° on either side of vertical, for the reason that at this arc the amount of mechanical energy transmitted by the agitator to the fluid and textile material is approaching the maximum practical value while the tendency for the material to fall outside of the agitator is minimized. In any case, it is recommended that the level of the fluid within the tank be maintained slightly lower than the lowest point reached by the openings in the agitator at any given arc of oscillation.

I have also found that better control over feeding of the material can be exercised if means are provided within the tank 11 for guiding the cloth into the openings of the agitator 31. To this end, as can be seen in Figures 4 and 5, I attach to the ingress end portion of each of the side walls 15 and 17 adjacent the top thereof a rigid plate 181 which extends downwardly into the tank at an angle of about 45 degrees but terminates short of the shell 32 of agitator 31. To the ends of each of the plates 181 is affixed a flexible wiper member 183 which is of sufficient length to contact the outer surface of the agitator shell. As the wipers 183 are flexible, they do not impede the oscillation of agitator 31 but merely wipe against the outer surface of the agitator 31 and brush or wipe into the openings any folds of cloth which may have fallen on either side thereof. Where separate ingress and egress openings are provided in the agitator 31, the width of the wiper members 183, i. e., the dimension parallel to the agitator axis, need only slightly exceed the length of the ingress opening. In the case, however, that a combined ingress and egress opening is provided in the agitator which opening extends the full length thereof, the wiper members 183 should be wide enough to effectively wipe the entire ingress area of the agitator.

The nozzle 169 associated with the ingress end of my washer fulfills a dual function in this invention. In the first place as water under pressure is discharged therefrom, agitation is imparted to the material thereby in addition to the normal agitation caused by the oscillation of agitator 31. In the second place, the jet of water issuing from the nozzles 169 tends to urge the cloth in the direction of the egress end of the washer and thus prevents the material from accumulating or building up at the ingress end. This latter function is especially advantageous where the particular material being treated undergoes shrinking within the washer and must needs be handled under a minimum of tension, as in the case of crepe and other similar constructions of fabric.

More specifically, by way of example, the machine of my invention may be advantageously used in obtaining a creping action on the so-called inert fibers of synthetic materials such as acetate, nylon, acrylic fiber, etc. The machine is peculiarly adapted to provide the necessary agitation of the fabric and the required temperature control to properly release the stored energy resulting from the crepe twist contained in the yarn from which the fabric is woven.

In the event but a single machine is used in the creping operation, the temperature may be readily adjusted prior to each pass of the fabric through the machine so as to subject the fabric during each pass to such predetermined temperature as will produce the desired result. On the other hand, if it is desired to operate a number of machines in tandem, each machine may be preset to operate at its respective predetermined temperature.

In order that my invention may be fully understood and appreciated, certain terms which I have used in the foregoing description should be defined. By "textile material" is meant any sheet or web formed by weaving, knitting, bonding or otherwise from any natural or synthetic fibrous material whether staple or continuous filament. The term "continuous" has been used to indicate that one or more lengths of textile material is passed successively through the washer as opposed to batch treatment in which an entire length of textile material is placed within a closed system and subjected to treatment all at once. By the use of the term "fluid," it is intended to embrace any liquid medium with which cloth or fabric may be treated irrespective of whether or not such medium contains an additive such as soap, surface active agents, swelling agents, dyes, dye assistants and the like.

It will thus be seen that I have provided an improved washer for textile material having a mechanical agitator through which a length of such material is adapted to be passed, thus assuring a maximum rate of production coupled with maximum washing efficiency and penetration by the washing medium of the fabric, but eliminating tangling or fouling of the material with the agitator.

Those skilled in the art will undoubtedly appreciate that my invention is susceptible of modification both in design and details of construction. For this reason I do not wish to be limited to the particular embodiment illustrated and described but only by the scope of the claims hereunto appended.

Having thus described my invention, that which is claimed is:

1. A continuous washer for textile materials comprising a tank for containing washing fluid, a perforated cylinder of substantially greater length than its diameter horizontally disposed in said tank and mounted for limited oscillating movement about its longitudinal axis, said cylinder having an opening in the normally top side adjacent each end thereof, a plurality of inwardly directed baffles extending longitudinally of said cylinder, means for supplying fluid to said tank, means for delivering said material in a vertical direction downwardly into said cylinder through one of said openings and for withdrawing said material in a vertical direction through the other of said openings, means for oscillating said cylinder, means assisting movement of said materials longitudinally of said cylinder, and means for heating the fluid within the tank during the passage of material therethrough.

2. The washer of claim 1 wherein said cylinder has a length at least twice its diameter and said tank is provided with guide means adjacent the material inlet opening in said cylinder to prevent feeding said material into the space between said cylinder and the side walls of the tank.

3. The washer according to claim 2 wherein said material guide means comprises a pair of downwardly inclined plates extending inwardly and respectively from the opposite side walls of said tank toward the material inlet opening in said cylinder and having a flexible terminating flap portion making wiping contact with the cylinder.

4. The washer according to claim 1 wherein the means for assisting movement of material longitudinally of the cylinder comprises a nozzle disposed at the inlet end of said cylinder to establish an agitating fluid discharge in the desired direction of material movement, and a pump for delivering fluid from said tank to said nozzle.

5. A continuous washer for textile material comprising a fixed open tank, a horizontally disposed perforated cylinder of substantially greater length than width mounted in said tank for rotation about its longitudinal axis, said cylinder having a longitudinally extending opening at each end along the normally top portion thereof whereby said material can be admitted into one end of said tank into said cylinder and withdrawn from the other end thereof, a plurality of radially directed narrow vanes secured to the interior wall of said cylinder and extending substantially the full length thereof, means for oscillating said cylinder through an arc of less than about 90° on either side of the vertical, the total arc of each oscillation being less than about 180°, means for supplying fluid to said tank, including means positioned within said cylinder adjacent the ingress end thereof for directing a jet of said fluid in the direction of the egress end of said cylinder, means for heating said fluid, and means for delivering said material into the ingress end of said cylinder and withdrawing the same from the egress end thereof at predetermined rates of speed.

6. A continuous washer for textile material comprising an open tank having end walls, side walls and a bottom wall, a closed end, perforated, hollow cylinder horizontally disposed within said tank, said cylinder being of a length substantially greater than its diameter, a plurality of spaced radially directed baffles secured to the inner periphery of said cylinder, said baffles having a radial dimension substantially less than the radius of said cylinder and extending the full axial length of said cylinder, a trunnion secured to the cylinder at each end thereof, projecting axially from said cylinder through the end walls of said tank and rotatably supported exteriorly of said tank, said cylinder having a pair of aligned openings therein adjacent each end thereof which extend at least a portion of its length whereby said material may be admitted into one end of said cylinder and withdrawn from the other end thereof, means for rocking said cylinder from side to side whereby said openings do not move below a horizontal plane extending through the cylinder axis, means for supplying fluid to the interior of said tank, including a nozzle secured to the interior wall of said cylinder at the ingress end thereof and facing the egress end and a flexible conduit connected to said nozzle whereby said nozzle may rock with said cylinder, means for elevating the temperature of the fluid supplied to said tank, a framework superstructure for said tank, a pair of reels rotatably supported on said superstructure, one at each end of said tank, over which said material is adapted to travel to and from the cylinder, and means for driving said reels at predetermined rates of speed.

7. A continuous washer for textile materials comprising a tank adapted to contain a washing fluid, an elongated, perforated cylinder mounted for oscillating movement within said tank, said cylinder having axially spaced apart, textile material ingress and egress points provided in the normally top portion thereof, to provide an internal flow-path, along at least a portion of its length, for a running length of textile material, a plurality of inwardly directed baffles within said cylinder, means for oscillating said cylinder, and means for assisting movement of said running length of material during its passage through said cylinder.

8. A continuous washer for textile materials, according to claim 7, wherein said last named means comprises a fluid nozzle mounted on and at one end of said cylinder for oscillation therewith, and a fluid conduit connected to said nozzle.

9. A continuous washer for textile materials, according to claim 8, wherein there is provided a fluid discharge port for said tank, said discharge port being axially spaced from said nozzle, and wherein said fluid conduit is operatively connected with said discharge port to form a closed liquid flow loop, and means for circulating fluid in said closed loop.

10. A continuous washer for textile materials, according to claim 7, wherein said tank is provided with guide means adjacent the material ingress point on said cylinder to prevent feeding of said material into the space between said cylinder and the side walls of said tank.

11. A washer, according to claim 7, wherein said material guide means comprises a pair of downwardly inclined plates extending inwardly and respectively from the opposite side walls of said tank toward said material ingress point on said cylinder and having a flexible terminating flap portion making wiping contact with said cylinder.

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