June 11, 1935. W. A. TRAVER 2,004,229

APPARATUS FOR PROCESSING TEXTILES AND LIKE MATERIALS

Filed April 11, 1933 3 Sheets-Sheet 1

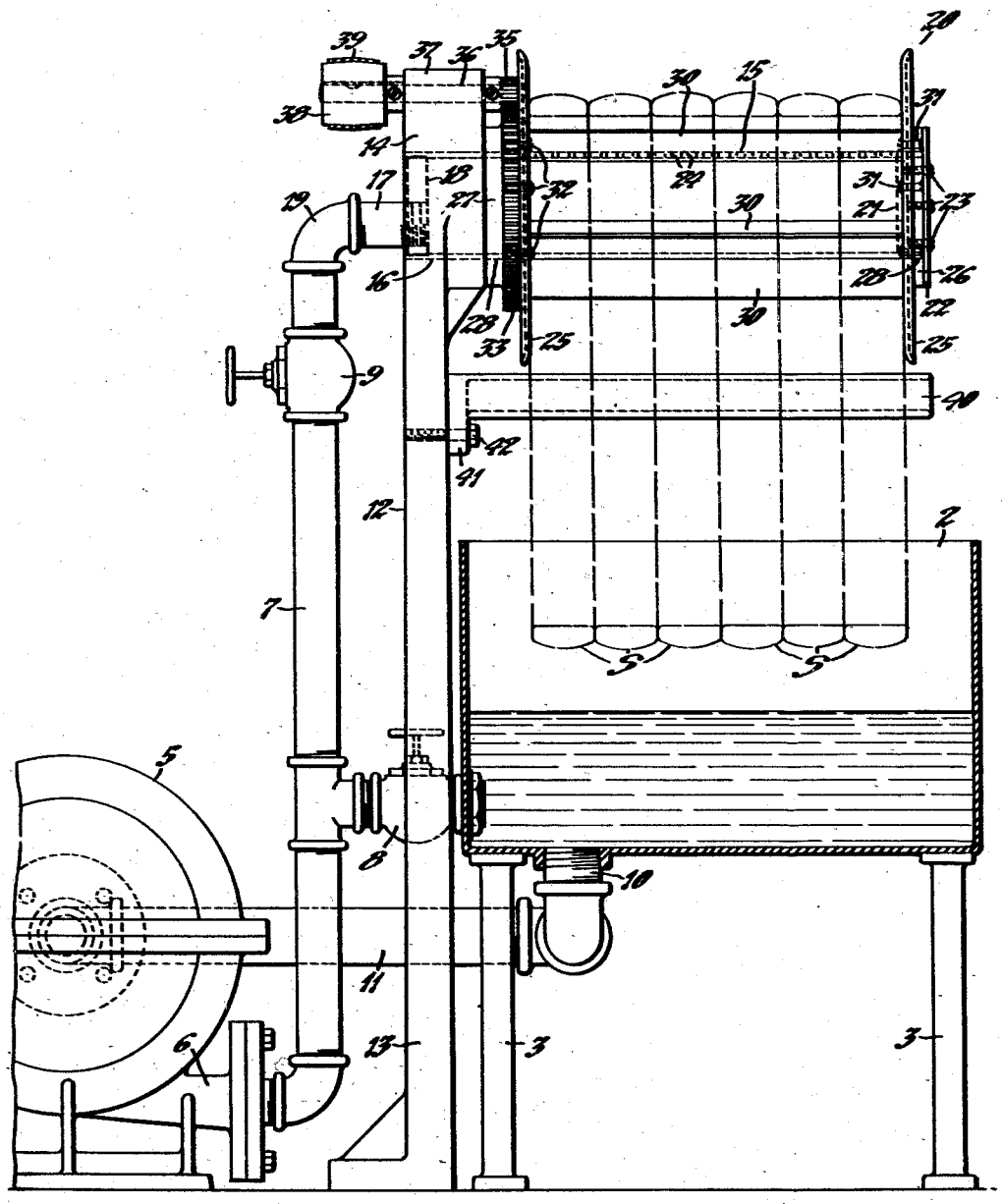

Fig. 1.

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Filed April 11, 1933 3 Sheets-Sheet 2

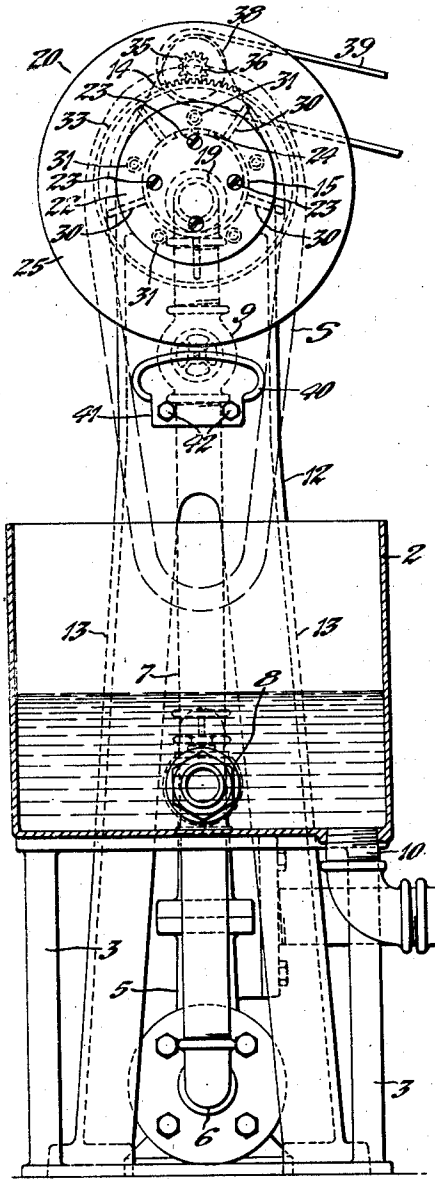

Fig. 2.

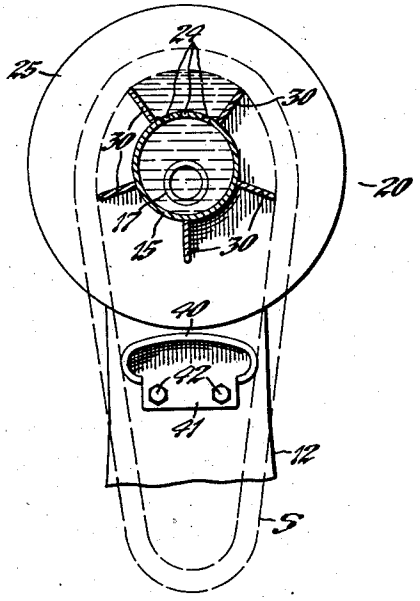

Fig. 3.

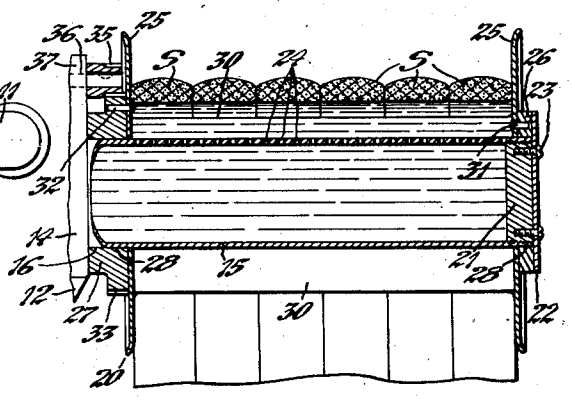

Fig. 4.

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APPARATUS FOR PROCESSING TEXTILES AND LIKE MATERIALS

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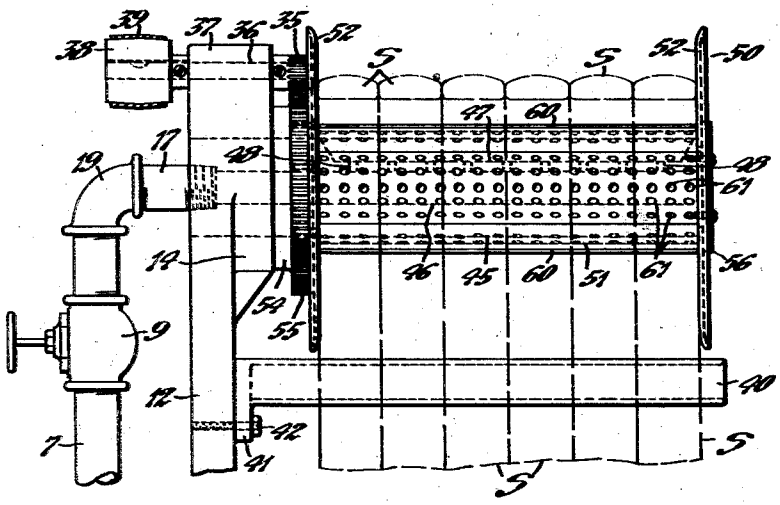

Fig. 5.

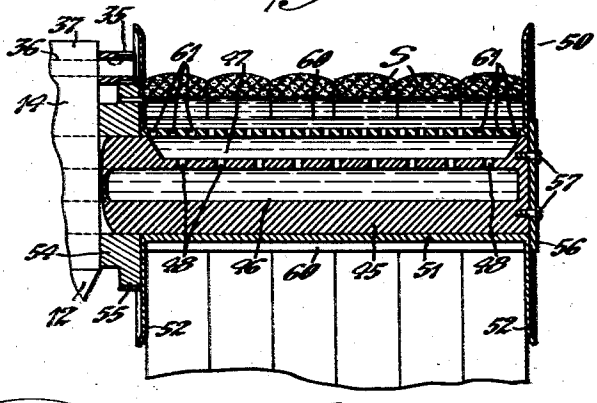

Fig. 6.

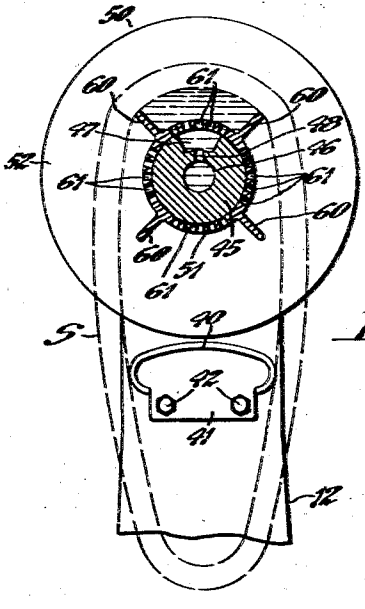

Fig. 7.

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Patented June 11, 1935 2,004,229

UNITED STATES PATENT OFFICE

2,004,229

APPARATUS FOR PROCESSING TEXTILES AND LIKE MATERIALS

William A. Traver, Providence, R. I., assignor to Franklin Process Company, Providence, R. I., a corporation of Rhode Island

Application April 11, 1933, Serial No. 665,546

11 Claims. (Cl. 8—19)

This invention relates to machines or apparatus for dyeing, washing and otherwise treating textile and like materials with fluids. The invention consists particularly in an improved machine or apparatus for dyeing and similarly treating silk, rayon and other natural and synthetic yarns in the form of hanks or skeins. The apparatus is also adapted for processing materials in other forms, however; for example, lengths of woven or knitted fabrics.

In the following specification and claims the term "yarn" is employed in its generic sense to indicate all kinds of textile or like materials, and the term "skein" is intended to apply to any character of yarn-mass wherein the strands are laid, looped or coiled in juxtaposition.

One object of the invention is to provide an apparatus of the type indicated wherein the yarn or other material may be subjected to a bath of fluid in such manner as to thoroughly and completely permeate the fibers thereof to secure an even, level dyeing of the same.

Another object of the invention is to provide an apparatus of the type indicated wherein fluid may be applied to the material as it is suspended or festooned in loops to permeate its fibers and penetrate through the mass to surround its portions exposed to the atmosphere.

Another object of the invention is to provide an apparatus of the type indicated wherein the yarn is sustained on a body of the fluid which is forced through the material to flow downwardly along the sides of its suspended portions and drain from the bottom thereof.

Another object of the invention is to provide an apparatus of the type indicated wherein the fluid is applied to the material in such manner as to prevent the spurting of a jet or spray thereagainst liable to disarrange the strands in the skeins and injure the delicate fibers of the yarn.

Another object of the invention is to provide an apparatus of the type indicated wherein the skeins or other masses of material may be constantly or periodically shifted in position to bring different portions of the yarn into direct contact with the pressure-circulated fluid without subjecting the material to the harsh action of a spray or jet.

Further objects of the invention are set forth in the following specification which describes two preferred forms of construction of the apparatus, by way of example, as illustrated by the accompanying drawings. In the drawings:

Fig. 1 is a side elevation of the improved dyeing apparatus shown with the tank or vat for the dye-liquor in section and illustrating the fluid-circulating means connected therewith;

Fig. 2 is an end view of the apparatus, also showing the dye-vat or fluid tank in section;

Fig. 3 is a detailed view of the skein-suspending and shifting means, illustrating the reel or support for the skeins in cross section;

Fig. 4 is a vertical sectional view of the reel taken on its longitudinal axis;

Fig. 5 is a view of a modified form of reel or skein-support;

Fig. 6 is a longitudinal, sectional view of the same taken on its axis; and

Fig. 7 is a cross sectional view of the skein-support or reel illustrated in Figs. 5 and 6.

Whereas in modern practice it is the preferred method to dye and similarly process cotton, wool and worsted yarns in package form, such materials as silk, rayon and synthetic yarns usually require different treatment with the fibers less compactly massed. That is to say, it is the preferred practice to dye silk, rayon and other delicate materials with the strands in more or less loose arrangement, for example, looped in hanks or skeins; the material being wound into cop or package form after the dyeing operation.

Various types of machines and apparatus have been devised for treating yarn in skein form, for example, by immersing the material in fluid contained in vats or dye-kiers or by applying the dye-liquor to the yarn in a jet or spray. In most machines of this type the skeins must be manipulated or shifted manually at intervals of the dyeing process and this adds to the cost of the process and also renders it difficult to produce even, level dyeing with uniformity of color and shade in different batches.

In other types of automatically-operated apparatus where the material is subjected to the direct force of the fluid projected or spurted thereagainst the delicate fibers of the yarn are liable to be injured and the strands of the skein forced out of place, tangled and matted so as to interfere with subsequent winding processes. It is a particular object of the present invention to provide means for thoroughly immersing the skeined material with the dye-liquor or other fluid to effect a complete and even penetration thereof without injury to the delicate fibers and without causing disarrangement, matting or entanglement of the strands of the skein. To accomplish this result the present invention contemplates the employment of a compartmented reel or support around which the material is looped or festooned, combined with means for discharging fluid under

pressure severally into the different compartments of the reel without spurting it against the material. More specifically, the compartmented barrel of the reel is constituted by radial blades or vanes upon which the loops of the skeins are suspended without direct contact of any substantial portion of the yarn therewith and the dye-liquor or other fluid is discharged into a compartment under pressure to contact with that portion of the yarn suspended between two of the blades whereby the yarn is actually supported by a body of the fluid itself. The construction and arrangement of the apparatus is such that the reel or ribbed support may be rotated, either continuously or intermittently, to bring different portions of the material into direct contact with the circulating fluid which, penetrating through the mass in the skein, flows downwardly along the sides thereof to be drained into a tank or other receptacle wherefrom it is again circulated through another portion of the mass of material on the reel.

As illustrative of this improved means for and method of treating textile and like materials with fluids, two preferred forms of construction of the apparatus are shown in the present drawings. Referring to Fig. 1 of the drawings, the apparatus comprises essentially a tank for the dye-liquor or other fluid; an improved form of compartmented reel or support around which the skeins of yarn are looped to suspend them above the tank; and a pump or other pressure means for continuously circulating the fluid from the tank through the reel.

The tank 2 may be of any suitable size and shape and, as herein shown, it is supported from the floor by means of legs or standards 3. As illustrated in the present drawings the tank is of a size to adapt it for use with a single reel unit; but in other cases it may be extended in length to serve for any number of units arranged in parallel spaced relationship above its open top. Located at one side of the tank 2 is a power-operated pressure pump 5 which may be of the centrifugal or other suitable type. Connected with the outlet 6 of the pump 5 is a standpipe 7 which is employed for supplying fluid to the tank 2 and to the skein-supporting means or reel located thereabove. For this purpose the standpipe 7 is connected to the side of the tank 2 through a hand-operated valve 8, while a similar valve 9 at the top of the pipe controls the flow to the reel. It will be understood that during the circulation of the fluid through the reel the lower valve 8 is closed and the upper valve 9 is open. An outlet 10 in the bottom of the tank 2 is connected by an exhaust pipe 11 leading to the intake of the pump 5. The dye-liquor may be supplied by connecting the pump with a suitable source, but these and such other connections as are necessary are not herein shown and described since they form no part of the present invention.

The reel or support for the yarn skeins, which forms one essential and novel feature of the invention, may be supported on a suitable frame which, in the present embodiment of the invention, is constructed in the form of a bracket or standard 12 having ribbed legs 13 with their feet bolted to the floor. Surmounting the legs of the standard or bracket 12 is a head 14 which serves as a support or mounting for a hollow cylinder or pipe 15 forming the bearing for the skein-reel 20 to be later described. The head 14 has a lateral bore 16 in which the end of the pipe or cylinder 15 is fixedly secured. Screwed into the end of the pipe or cylinder 15 is a closure plug 18 having a threaded opening for receiving the end of a pipe or nipple 17 which is connected to the standpipe 7 by means of an elbow 19.

The opposite end of the cylinder 15 is closed by a plug 21 screwed into its interior, see Fig. 4 of the drawings. Secured against the outer side of the plug 21 is a circular flange or disk 22 fastened in place by screws 23 or other suitable means. The disk 22 cooperates with the side of the head 14 on the frame or bracket 12 to hold the reel 20 in position on the cylinder 15 while adapting it to rotate thereon. The upper side of the cylinder or pipe 15 is formed with a plurality of relatively small perforations or holes 24 for egress of the dye-liquor or other fluid therethrough. As shown in Fig. 3, there are three rows of closely spaced holes or perforations 24 extending longitudinally of the cylinder with the holes of the different rows staggered in relation to each other.

The reel 20 which constitutes the rotatable support for the yarn skeins may be constructed in different forms. As a preferred embodiment of this element of the invention the reel 20 comprises end heads or flanges 25 having hubs 26 and 27 provided with axial bores 28 closely fitted to the cylinder 15. The end heads or flanges 25 are connected by longitudinally-extending radial blades or division vanes 30, shown most clearly in Fig. 3 of the drawings. The hub 26 for the outer head 25 consists simply in a ring or annulus adapted to surround the cylinder 15 abutting the inner face of the end disk 22. The flange 25 may be secured to the side of the annulus or hub 26 by means of rivets 31 shown in Fig. 4. The opposite flange 25 is riveted at 32 to the side of the hub or annulus 27 whose lateral face abuts the side of the head 14. The hub or annulus 27 is formed with a spur-gear 33 by means of which the reel 20 may be rotated on the tubular bearing or cylinder 15. Preferably, the flanges 25 are flared outwardly at their marginal rims to facilitate the placing of the skeins on the reel.

There may be any suitable number of blades or vanes 30 extending between the end flanges 25 of the reel, Fig. 3 illustrating five of these division members spaced equidistantly around the circumference of the cylinder 15. The ends of the blades 30 may be welded or otherwise suitably secured to the inner faces of the end flanges 25 to form a unitary structure therewith. The outer edges of the blades or vanes 30 are preferably rounded to present a smooth surface to the strands of yarn in the skeins S suspended on the reel, while their inner edges are shaped substantially to the contour of the axial openings in the disks 25 so as to fit closely against the outer periphery of the pipe or cylinder 15 while being free to rotate therearound.

The reel 20 may be rotated either continuously or intermittently on the tubular bearing or cylinder 15 through the means of a pinion 35 meshing with the teeth of the gear 33 on the hub 27. The pinion 35 is secured fast to a shaft 36 journaled in a bearing 37 at the top of the head 14. The opposite end of the shaft 36 may carry a sprocket-wheel, pulley or other means for imparting rotation to the pinion 35. As herein shown, a pulley 38 is secured fast on the shaft 36 to adapt it to be driven by a belt 39 connected with an electric motor or other suitable source of power, not herein shown.

Extending longitudinally of the reel 20 beneath the edges of its heads 25 is a splash-plate or guard 40 supported from the standard or bracket 12.

As illustrated most clearly in Figs. 1 and 2, the guard 40 is preferably constructed in the form of a convex plate having a foot 41 bolted to the side of the bracket 12 at 42. The guard 40 is of a width to adapt it to extend between the sides of the skeins S as they are draped or suspended around the reel 20 and its lateral edges are curved or rounded downwardly to provide smooth surfaces where the yarn is liable to contact therewith. The guard or splash-plate 40 is provided to catch the drip from the reel 20 to prevent the fluid from forcibly striking against the material in the lower loops of the skeins, in which case it would be liable to damage the fibers. The small amount of fluid dripping from the reel is caught by the splash-plate or guard 40 and diverted onto the yarn at the inner sides of the skeins S to flow down to the bottom thereof where it drains off into the tank 2.

Figs. 5 to 7 of the drawings illustrate another form of construction of the skein-supporting reel and its mounting. In this embodiment of the invention the central bearing 45 for the reel is substantially solid in cross section with a relatively small bore 46 extending axially from one end thereof with its opposite end closed. The open end of the bore 46 is connected with the end of the nipple or pipe 17 which is screwed into the head 14 and coupled to the standpipe 7 by means of the elbow 19. The bearing member 45 is fixedly secured within the head 14 and extending along its upper side is a trough-like slot 47 having sloping sides. The slot 47 communicates with the axial bore 46 of the bearing member 45 through a plurality of apertures or holes 48 spaced along its bottom.

The reel 50 employed with the form of bearing above described is constructed with a tubular or cylindrical barrel 51 having circular heads or flanges 52 at its ends. The heads or flanges 52 of the reel may be formed integral with the barrel 51 or welded or otherwise suitably secured thereto. The bore of the barrel 51 of the reel 50 is fitted closely to the cylindrical bearing member 45 while permitting the reel to turn freely thereon. Secured to the inner head 52 of the reel 50 is a hub or annulus 54 formed with a spur-gear 55 adapted to mesh with the pinion 35 on the drive-shaft 36. The reel 50 is held in place on its bearing 45 by means of a circular plate or disk 56 fastened to the end of the bearing by screws 57 with its rim overlapping the inner rim of the outer flange 52 on the reel. As shown in Fig. 7 of the drawings, in this latter form of construction there are four radial vanes or division blades 60 spaced equidistantly around the circumference of the barrel 51 of the reel 50 and suitably joined at their ends to the heads 52. The blades 60 may be welded or otherwise secured in place on the barrel 51 and similarly fastened at their ends to the heads 52. Between each pair of blades or vanes 60 the barrel 51 is perforated with rows of holes 61, preferably arranged in staggered relationship with respect to each other and also to the holes 48 in the bearing 45.

The method of operation of the first described form of construction of the apparatus is as next explained: A number of skeins of yarn S, indicated by dash lines in Figs. 1 and 3 and by full lines in Fig. 4, are draped or suspended across the edges of the radial blades or vanes 30 of the reel 20 between its heads 25. As herein shown the reel is of suitable length to accommodate six closely grouped skeins, but it may be constructed of different dimensions to hold a greater or less number of the skeins as desired. In looping the skeins around the reel their sides are spread apart to straddle the sides of the splash-plate or guard 40 whereby the coiled lengths of yarn are suspended to hang in close relation thereto with the lower looped ends of the skeins within the open top of the tank 2.

The tank 2 is supplied with dye-liquor or other fluid at a level somewhat below the bottom of the skeins, the filling of the tank being accomplished by operating the pump 5 with the valve 8 open and the valve 9 closed. After a sufficient quantity of fluid has been pumped into the tank 2 the valve 8 is closed and the valve 9 opened, whereupon the continued operation of the pump 5 will force the fluid up through the standpipe 7 and into the inner chamber of the enlarged pipe or cylinder 15. Under the pressure of the pump the fluid will be expelled through the perforations 24 in the top of the cylinder 15 to cause it to fill the space between the uppermost pair of division blades or vanes 30 when the reel is turned to a position with these blades at either side of the rows of apertures 24 in the cylinder as illustrated in Fig. 3 of the drawings.

The pocket or compartment formed by the two uppermost blades 30 and the sides of the end heads or flanges 25 of the reel 20 is filled with fluid under pressure tending to lift the mass of yarn resting across the edges of the blades so that the material is sustained on a cushion of the fluid. The provision of this compartment or trough full of fluid prevents the pressure in the chamber of the cylinder 15 from causing the fluid to be spurted against the yarn in the form of jets. Consequently, the force of the fluid is applied over the whole surface of the yarn exposed thereto between the two uppermost blades on which the skeins rest and thus there is no harsh action on the delicate material in the skeins. As the circulation of the pump is continued the fluid discharged into the compartment on the top of the reel is caused to penetrate through the mass of yarn to flow down along the sides of the skeins to effect a thorough and complete permeation thereof. A certain amount of the fluid surrounds the surface of the whole mass of yarn in the skeins to prevent any deleterious action that might be caused by oxidization through direct contact with the atmosphere during the dyeing process.

As the fluid is applied to the yarn in the manner as above explained any excess thereof escaping through the reel or from the center of the skeins is caught by the splash-plate or guard 40 and diverted outwardly against the sides of the loops of the skeins. From the bottom of the skeins the fluid drains back into the tank 2 to be again circulated through the reel in the manner as before explained.

During the operation of the circulating system in the manner indicated the pulley 38 may be revolved slowly to rotate the gear 35 and thereby drive the gear 23 to rotate the reel 20. The turning of the reel may be effected either continuously or with an intermittent action to periodically carry succeeding pairs of the vanes or blades 30 on the reel into uppermost position whereby to open the compartments therebetween to the flow of fluid through the apertures 24 in the cylinder 15. In this way every portion of the yarn in the skeins may be submitted to direct contact with the pressure-circulated fluid emitted from the cylinder 15 through the perforations 24.

With the modified form of construction of the

apparatus as illustrated in Figs. 5, 6 and 7 the method of operation is as next explained. The skeins of yarn S are placed on the reel 50 in the same manner as previously stated with the sides of the skeins depending therefrom across the edges of the splash-plate 40, the reel being first turned to a position as shown in Fig. 7 with two of the blades 60 at the top standing at angles of forty-five degrees to the perpendicular. In this position the series of apertures 61 between the two uppermost blades are in register with the top of the trough or pocket 47 in the bearing member 45. The yarn in the skeins S resting across the upper edges of the uppermost blades forms therewith a closed pocket or compartment extending between the end heads or flanges 52.

As the dye-liquor or other fluid is circulated from the pump 5 through the bore 46 in the bearing member 45 it is discharged through the openings 48 in the top thereof and into the trough or pocket 47. From the pocket 47 the fluid flows through the perforations 61 to fill the space beneath the mass of yarn bounded by the end flanges 52 and the two uppermost blades 60. The flow of the fluid is thus controlled to prevent it from being forcibly projected or spurted against the material in the skeins in such a manner as to disturb the strands and injure the delicate fibers of the yarn.

The pressure of the fluid in the pocket or compartment between the blades 60 tends to lift the skeins to relieve their contact with the edges of the blades. In this way the weight of the wetted mass of material is cushioned on a body of the fluid, thereby tending to prevent any deleterious effect from the contact of the blades with the yarn in the skeins. Under the pressure from the pump the fluid is caused to penetrate through the yarn to permeate the fibers thereof and to spread over the surface of the mass both at the top and where it flows down along the sides of the skein.

As with the first described arrangement of the apparatus the fluid is circulated continuously from the tank through the reel, and the reel may be rotated continuously at a slow rate or intermittently with a step by step motion. After the dyeing operation is completed the material may be washed by a similar treatment with water, either in the same or another apparatus of similar arrangement; after which the skeins may be readily removed from the reel for further processing when necessary.

With either form of construction of the apparatus the material may be subjected to the dyeing or other process without chance of its delicate fibers being injured by harsh action of the fluid thereagainst, as is the case with other previously used machines wherein the material is supported directly on a holder having perforations through which the fluid is forcibly discharged. With the present arrangement the dye-liquor or other fluid is pumped continuously through the yarn as it rests on a substantial body of the fluid maintained under pressure in the trough or compartment between the division blades of the reel. As the reel is rotated, either continuously or intermittently, one compartment after another is filled with the fluid which is maintained under a controlled pressure to prevent it from being spurted against the surface of the yarn. Moreover, the smooth, rotary movement of the reel has only a gentle action in shifting different portions of the yarn into direct contact with the fluid in the compartments formed by the blades of the reel. This gentle shifting motion is not liable to disarrange or rupture the fibers of the material as is the case where the skeins are forcibly lifted and shifted in position by a rod or element rotated about the perforated cylinder on which the yarn rests. That is to say, in the present apparatus the yarn is not lifted from its support so that the spurting of the fluid thereagainst is avoided. Moreover, the arrangement of the splash-plate or guard beneath the reel prevents any escaping fluid from dropping against the material in the lower loops of the skeins and thereby protects it from injury at this point.

As a further advantage of the present invention, the protection of the material from the direct impact of jets of fluid and the gentle shifting action of the skeins avoids disarrangement or disturbance of the strands coiled therein. Stated another way, there is no tendency for the strands to be blown or forced out of position to cause them to be tangled or matted together, or to intermingle the strands of one skein with those of another. The skeins of yarn are thus preserved in their original condition and the flowing of the fluid down the sides thereof has a tendency to straighten the coils so that when the skeins are removed from the reel the material will be in proper shape for rewinding into cops or packages.

It will therefore be observed that the present invention provides a novel and improved method of processing yarn in skein form or for treating other materials with fluids. For example, lengths of woven fabrics or knitted goods may be looped around one or a series of the compartmented reels or supports to be processed in the same manner as the skeined yarn.

While the improved apparatus is herein described and illustrated as embodied in two preferred forms of construction, variations may be made in the structure and arrangement of the parts of the device without departing from the spirit and scope of the invention. Therefore, without limiting myself in this respect, I claim:

1. In an apparatus for treating textiles and other materials with fluids, a rotatable reel for supporting the material, said reel having a barrel provided with a series of circumferentially disposed compartments open on the periphery of the barrel, and means for admitting fluid under pressure successively into the compartments one at a time as the reel is rotated.

2. In an apparatus for treating textiles and other materials with fluids, a support for the material comprising a pair of end flanges connected by a plurality of radial blades forming a series of circumferentially disposed compartments open at the top, and means for admitting fluid under pressure selectively and individually into each of the several compartments.

3. In an apparatus of the type indicated, the combination of a conduit for fluid, a reel rotatable with respect to said conduit and having a barrel divided into a series of circumferentially disposed compartments open at the periphery of the barrel, and means for effecting communication between the conduit and a single compartment of the reel as the latter is turned into predetermined position.

4. In an apparatus of the type indicated, the combination of a conduit adapted for connection with a source of fluid and provided with openings on its side, and a reel rotatable about the conduit, said reel having a barrel provided with circumferentially disposed compartments open on the periphery of the barrel and adapted to be suc-

cessively turned into position to register one at a time with the openings in the side of the conduit to receive the fluid therethrough.

5. In an apparatus of the type indicated, the combination of a bearing member having a conduit therein for receiving fluid under pressure and perforations in a portion of the wall of the conduit, and a reel rotatably supported on said bearing member and provided with end flanges and radial blades extending therebetween, said blades arranged with their edges in contact with the periphery of the bearing member to form separate compartments open at their outer ends, each of said compartments communicating with the conduit in the support through the perforations as said compartment is turned into predetermined position on the support.

6. In an apparatus of the type indicated, the combination of a hollow bearing member having a series of perforations extending longitudinally of its upper side, and a reel rotatable on the bearing member, said reel having end flanges with radial division blades extending therebetween with their edges in contact with the periphery of the bearing member to form a plurality of compartments disposed around the circumference of the bearing member and open at their outer ends, said blades being adapted to support skeins of yarn suspended around the reel and said reel being adapted to be turned into position to successively bring its several compartments into register with the perforations in the bearing member to admit fluid therethrough to permeate the yarn in the skeins suspended on the reel.

7. In an apparatus of the type indicated, the combination of a fixed tubular bearing member having a series of perforations extending longitudinally of its upper side, means connecting the interior of said bearing member with a source of fluid, and a reel rotatable on the bearing member, said reel having spaced end flanges with radial division blades disposed therearound with their edges in contact with the periphery of the tubular bearing member to form a series of substantially fluid-tight compartments open at the top and each adapted to be turned into position to register with the openings in the side of the bearing member to supply it with fluid.

8. In an apparatus of the type indicated, the combination of a conduit adapted for connection with a source of fluid, said conduit having a longitudinally-extending pocket in its side communicating with its interior, and a reel rotatable with respect to said conduit and provided with a series of circumferentially-disposed compartments open at their outer ends and substantially fluid-tight at their inner ends, said compartments being adapted to register individually with the pocket in the conduit to receive a supply of fluid therefrom.

9. In an apparatus of the type indicated, the combination of a tank for containing a supply of fluid, a reel rotatably supported above said tank and formed with a series of circumferentially disposed compartments open at their outer ends and substantially fluid-tight at their inner ends, a conduit for the fluid extending axially of the reel, means for circulating the fluid from the tank into the conduit, and means for discharging the fluid from the conduit into one of the compartments of the reel as the latter is rotated into predetermined position with respect to the conduit.

10. In an apparatus of the type indicated, the combination of a tank, an exhaust pipe leading from said tank, a pump connected with said exhaust pipe, a conduit leading from the pump, a reel rotatably mounted above the tank, said reel formed with a series of compartments circumferentially disposed about its axis of rotation, said compartments open at their outer ends, and means communicating between the conduit and the bottom of a single compartment of the reel as said compartment is carried into predetermined position by turning the reel.

11. In an apparatus of the type indicated, the combination of a rotatable reel having a series of circumferentially disposed compartments open at their outer ends and substantially fluid-tight at their inner ends, the sides of said compartments providing a support surrounding which the material to be treated may be arranged, a conduit leading to the center of the reel and adapted to be connected with a source of fluid, and means of communication between the conduit and one of the compartments of the reel adapted to be opened as the reel is turned to bring each compartment into predetermined position.

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