

Dec. 5, 1950

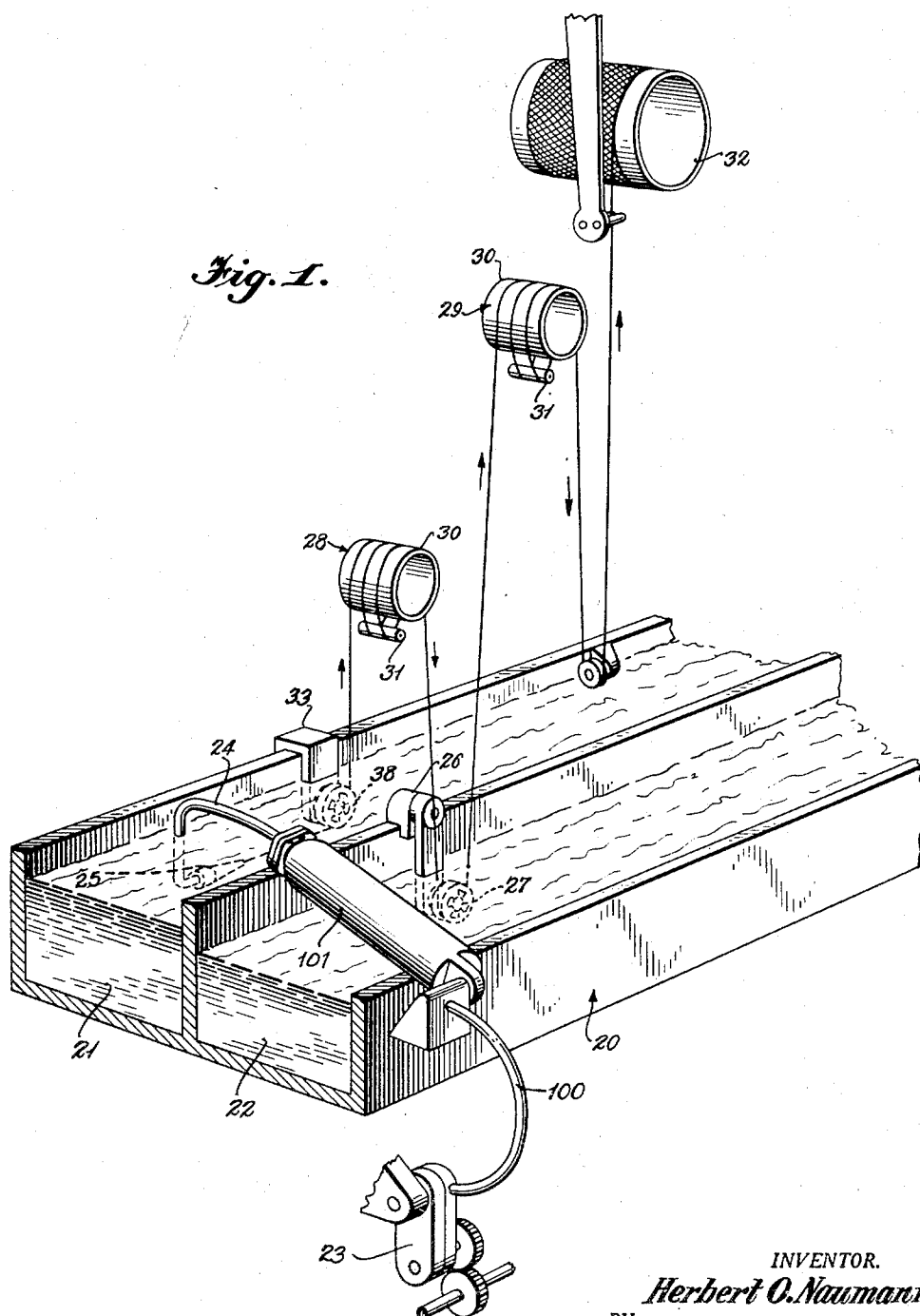
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2,532,326

FLUID CIRCULATING THREAD GUIDE ROLLER

Filed Aug. 17, 1945

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

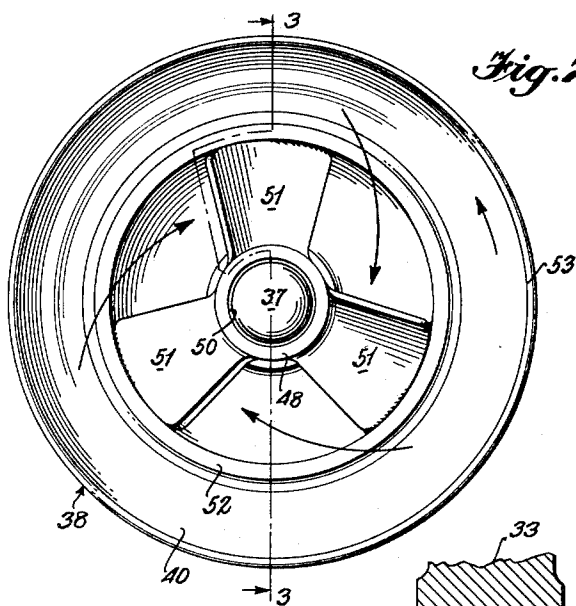


Fig. 2.

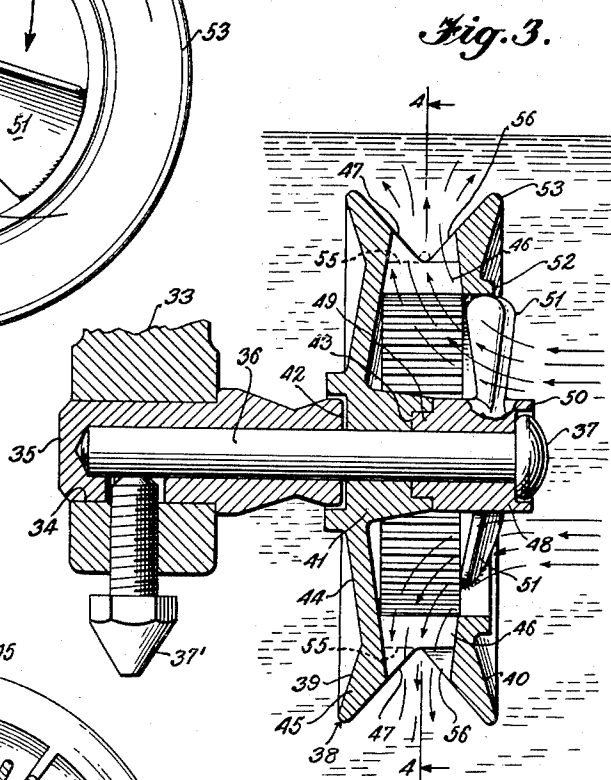


Fig. 3.

Fig. 4.

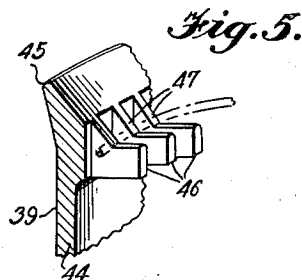
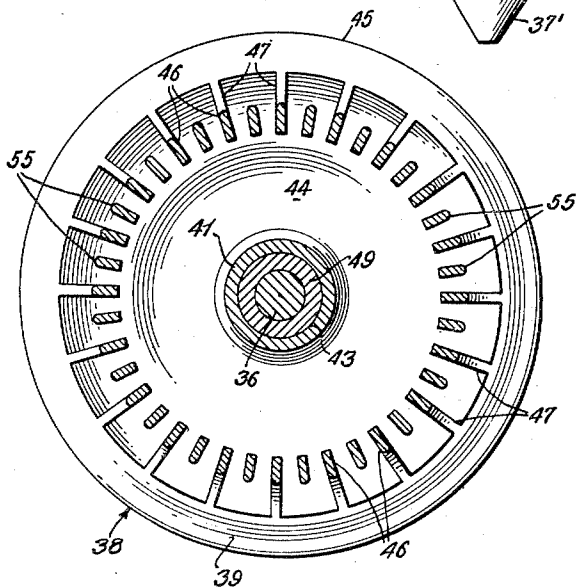


Fig. 5.

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Fig. 6.

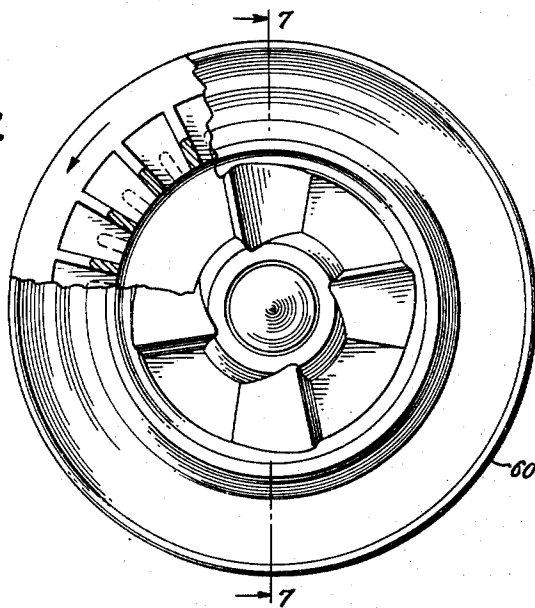


Fig. 7.

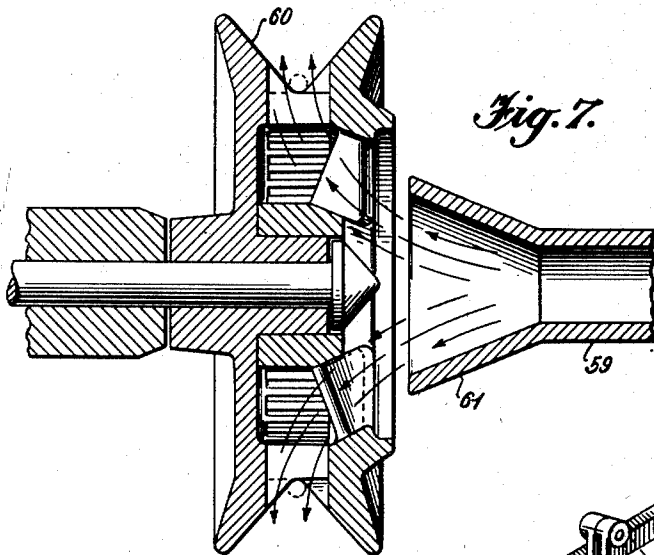


Fig. 8.

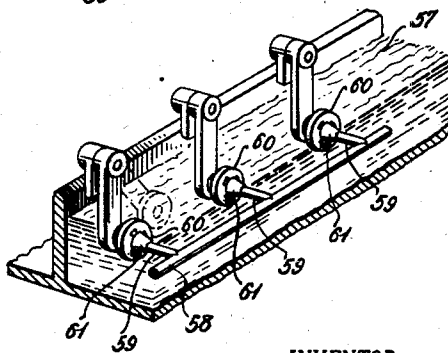
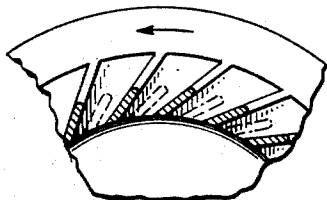


Fig. 9.



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4 Sheets-Sheet 4

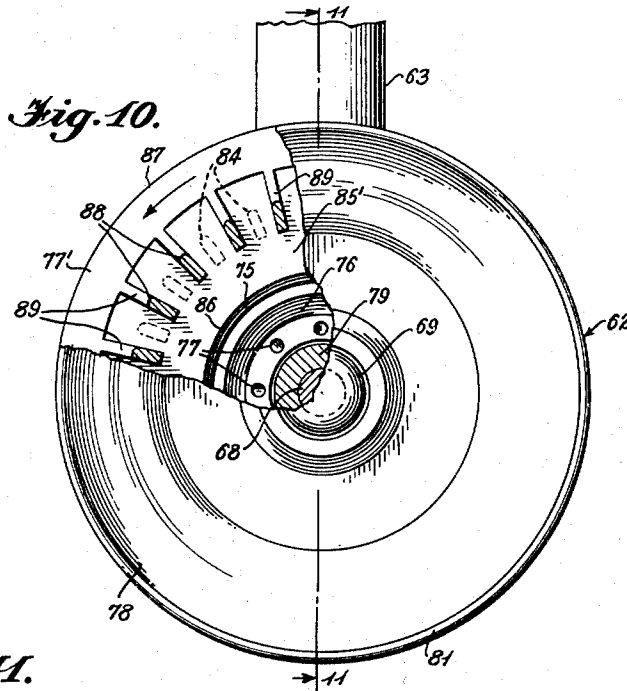


Fig. 11.

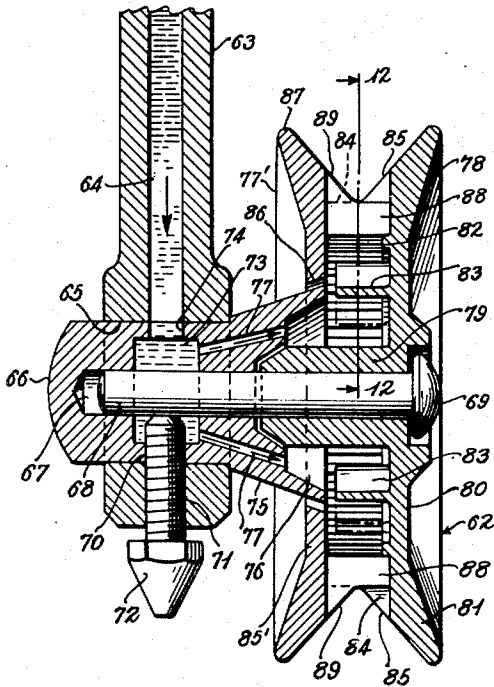
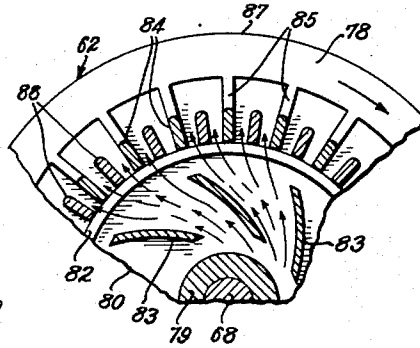


Fig. 12.



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FLUID CIRCULATING THREAD GUIDE
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Application August 17, 1945, Serial No. 611,005

3 Claims. (Cl. 68—175)

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This invention relates to improvements in methods and apparatus intended for the wet treatment of synthetic filaments and threads in general and more particularly to the spinning of high denier threads of regenerated cellulose.

In the ordinary practice of spinning high denier, high strength, regenerated cellulose threads from viscose, a viscose solution is squirted from spinnerets into an acid spin-bath to form a multi-filament thread, the filaments of which are then substantially completely regenerated under tension in a second bath of water held at a temperature of at least 60° C. The threads thus produced are subsequently washed and desulfurized and otherwise treated to produce cords suitable for use in heavy duty tire carcasses and the like.

In actual practice much difficulty has been experienced in spinning multi-filament yarn of high strength and high denier, due to the fact that the alkali content of the viscose solution rapidly neutralizes the acid content of the spin-bath in the immediate vicinity of the filaments as they issue from the spinnerets. Moreover, in the conventional type of spinning machine in which a trough containing a spin-bath is used and in which a plurality of threads are simultaneously being formed, it is difficult to maintain uniform concentration of the chemical constituents of the spin-bath at each spinning place. The result is that wide variations in the quality of the thread produced on a single spinning machine may be experienced.

The primary object of the present invention is to provide a method and apparatus for insuring uniformity of coagulation and regeneration of each filament of each thread produced at all spinning places on a spinning machine or a battery of such machines.

Another object is to provide means for circulating treating liquids, such as spin-baths, in such a manner that any liquid which has become neutralized or otherwise altered by contact with the freshly coagulated thread will be carried away and quickly replaced by liquid having the correct chemical composition for effecting regeneration of the cellulose content of the thread or otherwise altering its condition.

A further object is to provide means for insuring an adequate supply of spin bath of proper composition to each spinning place on a spinning machine.

The above and other objects may be attained by employing this invention, which embodies among its features a system involving the directing of freshly coagulated filaments to and around

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a guide roller that is adapted to withdraw spin-bath liquid from a part of the spin bath remote from the filaments and to direct such liquid into contact with the filaments as they pass around the guide roller.

Other features include the provision at or near each spinning place on a spinning machine of a hollow guide roller having a groove in its periphery into which the thread as it is formed is directed, said roller also having peripheral openings communicating with its interior through which treating liquid is forced outwardly and into contact with the freshly spun thread lying in the groove.

The invention also contemplates the provision of means for suitably supplying the treating liquid to each roller so that it may be directed into the interior thereof and discharged outwardly through the periphery for treating the thread lying in the groove.

Illustrative embodiments of the invention and their application to the production of synthetic thread are illustrated in the figures of the accompanying drawings, wherein;

Figure 1 is a fragmentary perspective view of a spinning machine illustrating the use of one embodiment of this invention;

Figure 2 is a front view on an enlarged scale showing in detail the guide roller used on the spinning machine of Figure 1;

Figure 3 is a vertical sectional view taken on the line 3—3 of Figure 2;

Figure 4 is a sectional view taken on the line 4—4 of Figure 3;

Figure 5 shows a fragmentary perspective view of one part of the roller shown in Figures 2 to 4;

Figure 6 is a view similar to Figure 2, disclosing a modified form of this invention;

Figure 7 is a vertical sectional view taken on the line 7—7 of Figure 6;

Figure 8 is a fragmentary perspective view showing the method of using a series of the rollers illustrated in Figures 6 and 7;

Figure 9 is a fragmentary sectional view illustrating a modified form of liquid directing vane;

Figure 10 is a front elevation of a further modification;

Figure 11 shows a vertical sectional view taken on the line 11—11 of Figure 10; and

Figure 12 depicts a fragmentary sectional view taken on the line 12—12 of Figure 11.

Referring to the drawings in detail, a spinning machine is designated generally by 20 and includes a spinning trough 21 extending the entire length of the machine and containing a

liquid spin-bath of an acid character which serves as a common coagulant and regenerating medium for each spinning place. Supported adjacent the spinning trough 21 is a trough 22 adapted to contain a water bath preferably held at a temperature of from 60 to 90° C. Like the spin-bath contained in the trough 21, the water bath extends for the entire length of the machine and serves each spinning place. Mounted at spaced intervals along the front of the machine adjacent the water containing trough 22 are spinning pumps 23 each of which has attached thereto a flexible tubing 100 leading to a candle filter 101 which in turn leads to a goose neck 24 and spinneret 25 through which latter the viscose solution is extruded by the spinning pumps into the spin-bath contained in trough 21, it being understood that the viscose solution is supplied to the pumps 23 in the customary manner from a suitable source, not shown.

Mounted on a bracket 26 adjacent each spinning place and lying wholly beneath the level of the liquid in the trough 22 is a grooved guide roller 27, the construction and use of which will be more fully explained, and rotatably mounted on the machine above the troughs 21 and 22 is a godet arrangement designated generally by 28, it being understood that there is one such godet arrangement for each spinning place. Mounted on the machine above the horizontal level and to one side of each godet arrangement 28 is a similar godet arrangement designated generally by 29. Each of these godet arrangements comprises a driven godet wheel 30 below which is rotatably mounted an idler roller 31 and the godet arrangement 29 is adapted to be operated at a higher peripheral speed than the godet arrangement 28 so as to impart stretch to the thread before it is delivered to the collecting device of each spinning place which in the present instance is illustrated as spool 32. It is to be understood, however, that any other type of conventional collecting device such as a centrifugal pot may be used in place of the bobbin 32.

Thus far the disclosure has been confined to apparatus of the type commonly employed in the manufacture of high strength high denier yarn from viscose spinning solution. As has been stated before, however, it has been found that considerable improvement can be attained in the production of yarn of such character and to this end it has been found desirable to increase to some extent the length of travel of the thread in the coagulating and regenerating bath. For this purpose, according to the present invention there is introduced into the spin-bath trough 21 a bracket 33 (Figure 3), the lower end of which is pierced as at 34 to receive a bushing 35 in which a shaft 36 having a head 37 is secured by a set screw 37' which extends through the bracket 33 and bushing 35 perpendicular to the axis of the shaft 36 as clearly shown in Figure 3.

Rotatably mounted on the shaft between one end of the bushing 35 and shaft head 37 is a thread guide roller designated generally by 38. This guide roller is composed of two separate parts 39 and 40, the part 39 including a hub portion 41 having at its outer end a socket 42 for receiving the end of the bushing 35 and at its opposite end a socket 43 for a purpose to be more fully hereinafter described. Formed integral with the hub 41 is an annular wall 44 which terminates at its periphery in an outwardly inclined flange 45. Projecting inwardly, i. e., in the direction of the socket 43 in the hub

41, at spaced intervals at the periphery of the web 44, are lugs 46 forming liquid directing vanes, the outer edges 47 of which are inclined to coincide with the inclination of the inner face of the flange 45 (see Figures 4 and 10).

The part 40 of the guide roller 38 comprises a hub 48 which is provided at the end facing the hub 41 with a boss 49 of a diameter to fit snugly within the socket 43 of the hub 41 and serve accurately to locate the parts upon assembly. Formed in the end of the hub 48 opposite the boss 49 is a socket 50 of a diameter to receive the head 37 of shaft 36, it being understood that both of the aforesaid hubs are bored to permit free rotation of the roller 38 about the shaft 36. Projecting radially from and at spaced intervals around the periphery of the hub 48 are impeller blades 51 which support at their outer ends a rim or felly 52 carrying about its periphery an outwardly inclined flange 53 which in all respects corresponds to the flange 45 of part 39 except that it inclines outwardly in the opposite direction so that when the parts are assembled a V-shaped groove is produced in the periphery of the thread guide roller 38. Projecting inwardly, i. e., in the direction of the boss 49 on the hub 48, at spaced intervals adjacent the periphery of the rim 52 are lugs 55 forming liquid directing vanes, the outer edges of which are inclined as at 56 to coincide with the inclination of the inner face of the flange 53. The lugs 46 and the lugs 55 are so spaced that when the parts 39 and 40 are assembled they fit alternately between one another and form slots in the periphery of the roller 38 for the discharge of liquid which is forced into the roller by the impeller blades 51. It is obvious that by varying the thickness of the lugs or vanes 46 and 55 the dimensions of the slots may be varied to suit different liquid discharge rates.

In the modified form of the invention illustrated in Figure 8 the spin bath solution is introduced into a spin bath trough 57, of which only a fragment is shown, and which corresponds to trough 21, through a longitudinally extending submerged feed pipe 58 which is provided at each spinning place with a branch pipe 59 axially aligned with a guide roller 60 corresponding in every respect to the rollers 38. The primary difference between the construction of the modification disclosed in Figure 8 and that disclosed in Figure 3 is that the brackets supporting the guide rollers 60 are so mounted on the trough 57 (in the case of Figure 8), as to be readily elevated so as to raise the guide rollers 60 clear of the pipes 59 to facilitate threading-up. In this modified form of the invention the properly prepared spin bath solution is pumped through feed pipe 58 and is directed through branch pipes 59 directly to the roller 60 so as to assure a fresh supply of spin bath solution to the thread as it traverses the rollers. In order to insure proper discharge of the spin-bath solution at each roller, each branch pipe 59 is provided with a flared end or inverted funnel 61 which is so designed as to compensate for the volume normally occupied by the roller hub and the shaft upon which the roller is mounted.

In the operation of the device thus far disclosed, spinning solution (e. g. viscose) is fed to the spinning pumps 23 (Figure 1) in the usual manner and is forced by them through flexible tubing 100, filter 101, the goose necks 24 and outwardly through spinnerets 25 into the

spin-bath contained in trough 21. Upon contact with the spin-bath the spinning solution coagulates and forms a plurality of filaments which are then led away from the spinnerets 25 and around the guide rollers 38, thence upwardly to the first godet arrangement 28 around which the thread thus formed is looped several times. Leaving its respective godet arrangement 28 each thread is then conducted around the guide roller 27 which is situated wholly beneath the level of the hot water in trough 22 and from said guide roller the thread is directed to godet arrangement 29 which is operated at a greater peripheral speed than the godet arrangement 28 so as to impart stretch to the filaments as they pass through the hot water bath and during the regeneration of the cellulose content of the thread. As shown, the thread is looped several times about the godet arrangement 29 and upon leaving this godet arrangement it is directed to a suitable collecting device such as spool 32. Due to the pumping of the spin-bath from the interior of the rollers 38 outwardly through the peripheries thereof, it will be seen that as spin-bath in the immediate locality of the thread becomes spent or neutralized it is rapidly driven away and fresh uncontaminated and full strength spin-bath solution is supplied. This not only assures rapid and complete coagulation of the filaments but also improves the quality of regeneration of the cellulose content of the thread. It also prevents localizing of a weakened spin-bath about the spinnerets inasmuch as the spin-bath is kept in constant circulation. In the modification of the invention disclosed in Figures 7 and 8, the operation is essentially the same as that described above with the added advantage that fresh spin-bath solution is supplied to each roller 60 and is, by the action of the elements of the roller, discharged and circulated through the balance of the spin-bath in trough 57. The rollers 60 are so mounted that they may be elevated to clear the flared discharge ends 61 or the branch pipes 59 thus avoiding interference by these pipes when the device is being threaded-up.

In the modification illustrated in Figures 10 to 12, inclusive, the roller, designated generally by 62, like those previously described, is designed to be submerged below the surface of a thread-treating bath, but differs from the others in that its source of liquid supply is wholly independent of the liquid bath and hence it may be used exteriorly of the bath, e. g. suspended thereabove. In this type of construction the roller 62 is suspended at the lower end of a bracket 63 which is provided with a longitudinal passage 64 through which treating fluid is conducted. Formed near the lower end of the bracket and extending transversely thereof is a bore 65 into which a bushing 66 is fitted. This bushing is formed with an axial opening 67 for the reception of a shaft 68 the outer end of which terminates in a head 69, and formed in the bushing 66 is a radial opening 70 aligning with a threaded opening 71 formed in the bracket 63 for the reception of a set screw 72, the inner end of which bears against the shaft 68 as illustrated.

Formed within the interior of the bushing is an annular chamber concentric with the bore 67 and opening through the side wall of the bushing in alignment with the passage 64 in the bracket 63 is a passage 74 through which com-

munication between the passage 64 and chamber 73 is established. Carried at one end of the bushing is a conical part 75 provided at its outer end with a chamber 76 and formed in the bushing concentric with its axis are passages 77 through which communication between the chambers 73 and 76 is established.

The roller 62, like the roller 38, is made in two parts 77' and 78, respectively. The part 78 comprises a hub 79 which is bored to receive the shaft 68 about which the roller freely rotates. Carried at one end of the hub 79 is a web or wall 80 which is provided at its periphery with an outwardly inclined flange 81 and formed on the inner face of the web or wall 80 at its junction with the flange 81 is an annular rib 82 which forms a support for the part 77' as will be more fully hereinafter explained. Carried on the inner face of the web 80 between the rib 82 and the hub 79 are impeller blades 83 of such size and contour as to cause liquid introduced into the interior of the roller 62 to be discharged radially. Formed at the periphery of the web 80 and projecting in the direction of the hub 79 is an annular series of spaced lugs 84 and the outer edges of which are inclined as at 85 to coincide with the inclination of the inner face of the flange 81 (see Figure 10).

The part 77' includes a web or wall 85' having a central opening 86 of a size adapted loosely to receive the outer end of the conical part 75 of bushing 66. Formed at the periphery of the wall 85 is an outwardly inclined flange 87 corresponding in size and contour to the flange 81 carried by the web 80, but being oppositely disposed thereto. Formed at the junction of the web 85 and flange 87 is an annular series of lugs 88, the inner edges of which are adapted to contact frictionally with the outer face of the annular rib 82 when the parts are assembled. The outer edges of the lugs 88 are inclined as at 89 to coincide with the inclined inner face of the flange 87 so that when the parts are assembled a V-shaped groove will be formed in the periphery of the roller 62. It is to be understood that the lugs 84 and 88 alternate with one another so as to form vanes separated by radial passages through which liquid entering the interior of the roller 62 through passages 64, 74, chamber 73, passages 77, chamber 76 and opening 86 is discharged in contact with a thread or strand traversing the roller.

A treating roller such as that just described may be provided for each spinning place as previously set forth and a roller of the type of roller 62 with a bracket of the type of bracket 63 possesses the advantage over the rollers and brackets previously disclosed in that fresh uncontaminated treating liquid may be supplied directly to the thread and the device threaded up without interference by liquid supply pipes. The principles of function and operation of all of the rollers however is the same in that the spin-bath is kept in constant circulation about the thread as coagulation and regeneration takes place and localization of neutralized spin bath is prevented. Moreover, any spin-bath that may become neutralized is rapidly displaced by a fresh supply of spin-bath from a remote source and the proper concentration of spin-bath constituents in the immediate vicinity of the thread is thus assured.

In Figure 9 there is disclosed a modified form of lug or vane construction in which the vanes are inclined to the radius of the roller. Such an arrangement is applicable to any of the rollers

above described, should it be found desirable to change the direction of discharge of the liquid from or to the roller in something other than a radial direction.

The rollers herein used and described as part of the thread treating system may be regarded as constituting suitably modified centrifugal or rotary pumps adapted for carrying the thread externally upon themselves. The impeller portions of the pumps serve to force liquid through the thread-carrying portions and onto and through the thread. A noteworthy feature is that the pump is propelled by the material that is to be treated, e. g., the filament, thread, or yarn. Obviously, of course, the impelling portions could also be driven by extraneous drive means, such as belts, gears, motors and the like if desired.

The term "spin-bath" has of course been used in describing the application of the apparatus to the manufacture of viscose thread. It is obvious, however, that the devices shown are equally applicable for use with any thread treatment liquids and even ordinary water where the success of the process depends on maintaining the solutions or liquids in a predetermined condition of strength or composition and where stagnation of the circulation thereof is to be avoided.

While in the foregoing certain embodiments of this invention have been disclosed, it is to be understood that minor changes in the details of construction, combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention as claimed.

Furthermore, although the apparatus and method have been described by way of illustrative example as applied to the spinning of high strength high denier viscose yarn, the same apparatus and method are applicable to the production of synthetic thread from cuprammonium cellulose solutions, protein materials (ossein, casein and the like), cellulose esters, cellulose ethers, and others, by the wet spinning method.

What is claimed is:

1. A guide roller for the liquid treatment of multi-filament high denier high strength synthetic thread comprising an interiorly hollow pulley-like body formed of two mutually facing members each having lug-like portions extending laterally from one side at a distance below the edge, the lug-like portions of one member interfitting in alternate relation between those of the other member to provide a plurality of closely spaced radial slit-like passages leading to the internally hollow portion of the roller, the walls of the members above said lugs serving to provide flanges defining a thread receiving groove, the tops of the lugs constituting the floor of said groove, impeller blades integrally incorporated with one of said members below the lugs thereon, openings in said roller coaxial with the axis of rotation of the roller for admitting liquid from a portion of a bath remote from said groove to said impeller blades when said roller is submerged, said blades being adapted to force said liquid under pressure through said slit-like passages and into contact with and through thread reposing on the floor of said groove.

2. A guide roller for the liquid treatment of multi-filament high denier high strength syn-

thetic thread comprising an interiorly hollow pulley-like body formed of two mutually facing members each having lug-like portions extending laterally from one side at a distance below the edge, the lug-like portions of one member interfitting in alternate relation between those of the other member to provide a plurality of closely spaced radial slit-like passages extending parallel to the axis of said roller and inclined to the radius of the roller and leading to the internally hollow portion of the roller, the walls of the members above said lugs being oppositely chamfered and serving to provide flanges defining a V-shaped thread receiving groove, the tops of the lugs constituting the floor of said groove, impeller blades integrally incorporated with one of said members below the lugs thereon, openings in said members coaxial with the axis of rotation of the roller for admitting liquid from a portion of a bath remote from said groove to said impeller blades when said roller is submerged, said blades being adapted to force said liquid under pressure through said slit-like passages and into contact with and through thread reposing on the bottom of said groove.

3. A guide roller for the liquid treatment of multi-filament high denier high strength synthetic thread comprising an interiorly hollow pulley-like body formed of two mutually facing members each having lug-like portions extending laterally from one side at a distance below the edge, the lug-like portions of one member interfitting in alternate relation between those of the other member to provide a plurality of closely spaced radial slit-like passages extending parallel to the axis of said roller and leading to the internally hollow portion of the roller, the walls of the members above said lugs being oppositely chamfered and serving to provide flanges defining a V-shaped thread-receiving groove, the tops of the lugs constituting the floor of said groove, impeller blades integrally incorporated with one of said members below the lugs thereon, openings in the other of said members coaxial with the axis of rotation of the roller for admitting liquid to said impeller blades, said blades being adapted to force said liquid under pressure through said slit-like passages and into contact with and through thread reposing on the bottom of said groove.

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