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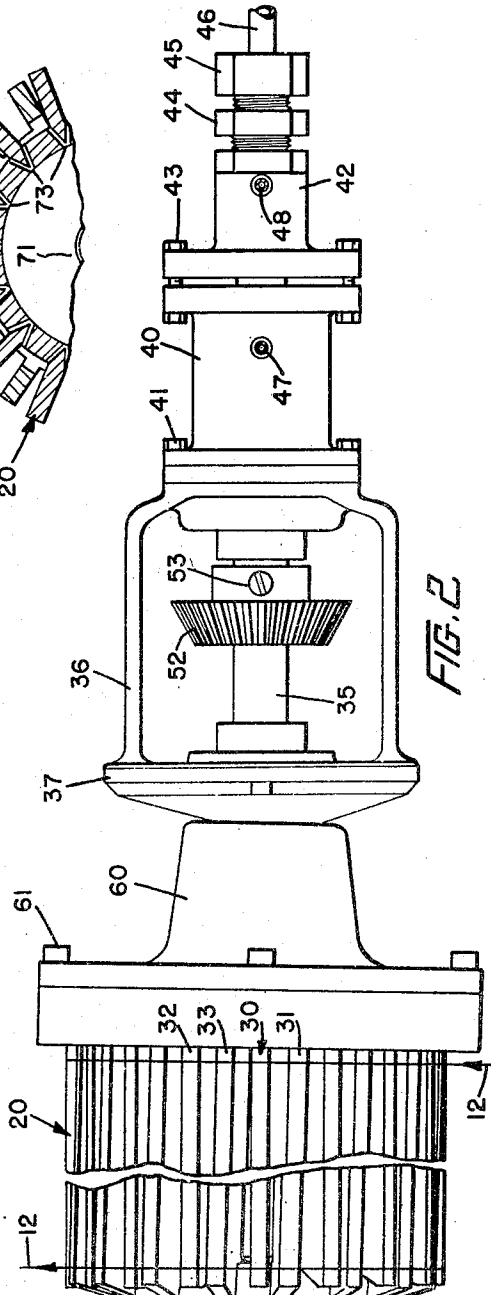
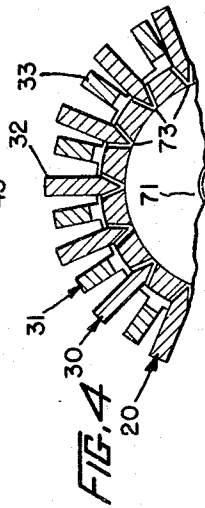
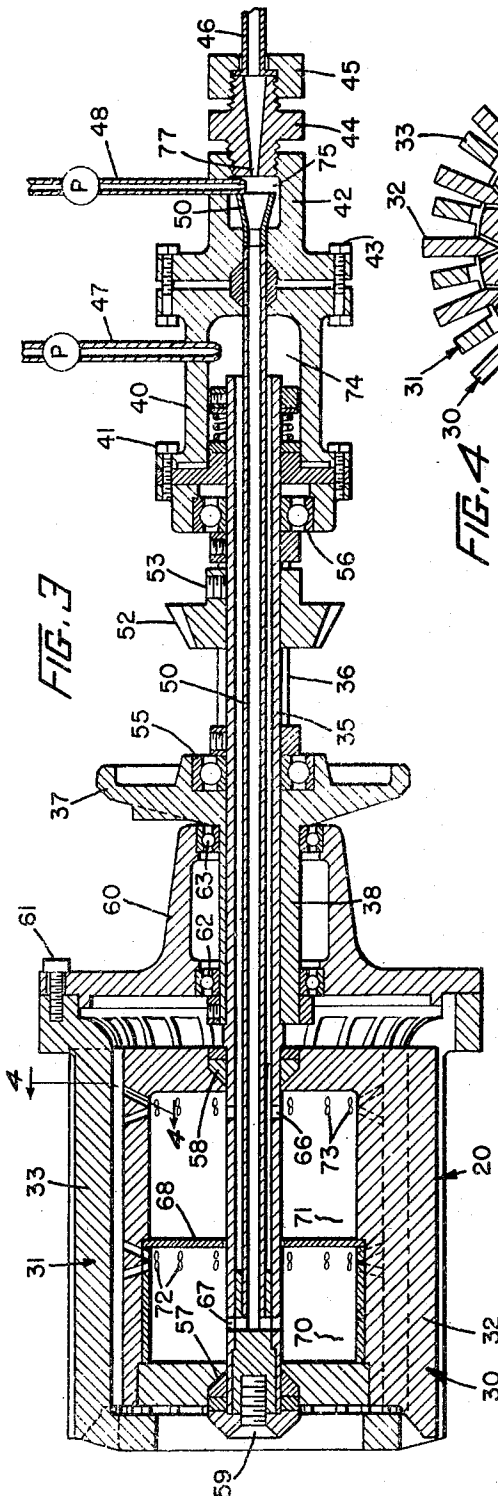
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THREAD-ADVANCING REEL

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## THREAD-ADVANCING REEL

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3 Claims. (Cl. 68—205)

This invention relates to apparatus for the processing of thread while it is being advanced in the form of a general helix. More particularly, the invention relates to apparatus for processing thread at elevated temperatures when one or more thread treatments are performed.

In the manufacture of artificial filamentary material such as viscose thread by continuous processing generally, the thread is continuously stored and advanced in the form of a helix in a plurality of rotations and subjected to a plurality of processing treatments. The thread is stored in helical form by various kinds of apparatuses, for instance, such as on two spaced rollers rotating about axes that are canted to each other, on unitary devices based on the principle disclosed in the Knebusch Patent No. 2,210,914, or modifications of such devices. Processing liquids are generally conducted and externally applied to the thread-advancing devices or stations by tubes extending from conveniently located supply conduits, the application of the processing liquids being, generally, at room temperatures.

It has been discovered that spinning speeds of viscose rayon yarn can be increased when processing of thread is performed at higher or elevated temperatures. Also, more complete and rapid regeneration of the viscose thread and greater economy and treatment effectiveness result from such processing. Externally applied treating liquids unless heated along their paths are usually applied at substantially room temperatures at the time of application. Such treating liquids sometimes are heated to higher than required temperatures to offset heat losses occurring in the conduction, or some external heating means must be provided; however, these efforts do not insure a constant applied higher temperature. By means of this invention treating liquids are conducted to the thread alongside a flowing heating fluid that is capable of use for treating and maintaining the thread and the advancing apparatus at desirable elevated temperatures. Advantageously, the method comprises one where the thread helix is heated from within its interior and the treating liquids are also conducted through the heated reel interior. The reel heating medium, which can be steam, is advantageously converted to condensate within the reel and later utilized at a treating liquid itself, or with a simultaneously added second liquid treating medium such as a lubricant oil, both being passed through the interior of the reel to the helix on the reel surface. Another treating liquid can also be applied to a separate section of a travelling thread helix, a thread regenerating acid solution, the temperature of which also is maintained at the same high level as the heating fluid. The conduction of both treating media and of a heating fluid through the interior of the reel to the thread helix has the advantage of minimizing heat losses, maintenance of a desired reel surface temperature during the processing and drying the thread helix.

This invention utilizes an apparatus including reels based on the Knebusch principle. The reel is mounted for rotation on a hollow shaft through which are conducted treating liquids, as well as a reel heating and thread

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drying fluid. Within the hollow shaft there is positioned a concentric tube through which flows one of the thread processing fluids; while through the annular space formed by the centrally positioned tube and the reel shaft the second thread treating and processing medium as steam is conducted. To the steam there can also be added a measured amount of a third treating medium, such as an oil. The tubular shaft and the concentric tube terminate within the reel within separated sections, each being provided with outlets at positions where it is desired to process the thread helix. The reel itself is provided with a chamber that is subdivided, each subdivision encompassing the outlets of the tubular shaft and of the concentric tube within the shaft.

These subdivisions or internal chambers within the reel are provided with passages to the exterior of the reel and therethrough to the thread helix on the reel. To more advantageously and effectively distribute the processing liquids over the thread helix the passages to the reel surfaces are arranged so as to conduct the processing liquids along the outer side surfaces of the reel bars to the thread helix. The liquids, thus, are distributed more efficiently in that they are caused to flow along surfaces of the bar members rather than be flung directly onto the internal surface of the thread helix. A still further advantage of such a processing liquid feed to the helix is the minimizing of salt formation on the bar members by the continuous wetting of them by the flowing processing liquids.

The method and apparatus for processing thread will be more specifically described in the following specification and in the accompanying drawing, where:

Figure 1 diagrammatically represents a rayon spinning apparatus;

Figure 2 represents, in plan, the thread processing reel of the spinning apparatus;

Figure 3 represents the processing reel of Figure 1 in section; and

Figure 4 represents that part of the reel of Figure 3 taken along lines 4—4.

As shown in the drawing a viscose thread 12 is extruded through forming spinneret 10 positioned in an acid coagulating bath 11. The thread is drawn through an opening 13 of trough 14 by the withdrawing reel 15, thence the thread 12 is passed over a guide 16 positioned in an opening 17 of a trough 18 to the thread processing reel 20. After processing on the reel 20 the thread is led over guides 21, 22, 23, to a collecting means 24 (generally shown). The thread-advancing reel 20, advantageously, lends itself to the performance of several processing steps which condition the yarn substantially completely.

Referring particularly to Figure 2 of the drawing the reel 20 is shown in its supporting structure. The reel 20 is based on the principle disclosed in the Knebusch Patent No. 2,210,914, and also on a principle disclosed in the Bergmann Patent No. 2,294,866. The store of thread forming the helix on the reel is subjected to a plurality of treatments while it is continuously advanced over the reel periphery. Generally, the reel comprises two reel members 30 and 31, each of which is formed of a plurality of longitudinally extending bar members 32 and 33, that rotate about axes that are offset and askew relative to each other. The reel members 30 and 31 are mounted on a shaft 35 for rotation therewith.

There is positioned about the shaft 35 a reel supporting yoke 36 having a conically shaped portion or flange 37 at one end of which there extends an eccentric sleeve 38 (see Figure 3). The axis of the eccentric sleeve 38 is offset and askew to the axis of the reel shaft 35. To the other end of the yoke 36 there is attached a housing 40 by means of bolts 41. To the housing 40 there is at-

tached a further housing 42 by means of bolts 43. Into the housing 42 there is threaded a nipple 44 having a sealing cap 45 positioned about a heating fluid supply conduit 46.

In housings 40 and 42 there are positioned additional treating fluid conduits 47 and 48. The conduits 47, 48 and 46 are adapted to provide required amounts of processing fluids and a heating fluid to the hollow reel shaft 35 which, also, has positioned concentrically within it a hollow tube or conduit 50, both being open to the interior of the reel itself. Within the yoke 36 there is mounted about the shaft 35 a driving gear 52 being secured thereto by means of a set-screw 53. Thus the reel 20 of Figure 2 is adapted to be driven through the gear 52 to advance a helical store of thread over its bar members 32 and 33. During the advance of the thread helix treating liquids are supplied through the interior of the shaft 35 to the reel interior, which is subdivided, then through peripheral passages in the reel to the thread.

The reel shaft 35 as shown in Figure 3 extends through the yoke section 36, rotating therein on spaced bearings 55, 56. The reel shaft 35 supports the concentrically mounted reel member 30 secured to the shaft by seals 57, 58 kept under compression by bolt 59 carried in the unsupported end of the reel shaft 35. Reel member 31, or the eccentric reel member, is secured to a flanged hub 60 by bolts 61. The flanged hub 60 is mounted for rotation on spaced bearings 62, and 63 positioned about the eccentric sleeve 38.

In that portion of the shaft 35 that extends within the reel there are provided exhaust outlets or passages 66 which open into chamber 71 formed within the reel member 30. The reel member 30, as shown, has a periphery of a plurality of spaced longitudinally extending bar members 32, and a compartmented interior. The reel interior is subdivided by a partition 68 into two sections 70, 71. The forward section 70 communicates with the reel exterior through wall passages 72, and it is supplied with a treating fluid by the passages 67 through the concentrically positioned conduit 50 within the reel shaft 35.

The housing 40 and 42 are positioned about the ends of the reel shaft 35 and about the inner fluid conduit 50. Housing 40 contains a chamber 74 into which extends the conduit 47. The shaft 35 also terminates within the housing chamber 74. A treating fluid from conduit 47 empties into the chamber 74, and being under pressure, flows into and through the annular space within the shaft 35, through the outlets or passages 66 into the chambered section 71, thence by centrifugal force due to reel rotation through the passages 73 to the exterior of the reel, and to the thread being advanced over the reel. The inner tube 50 empties into section 70, and the condensate section 70 empties through passages 72 to the reel surface. The other end of the inner conduit 50 terminates within a chamber 75 of the housing 42. Treating fluid conduit 48 also extends into the chamber 75. Further, there is admitted into chamber 75 a heating fluid through the end conduit 46. The heating fluid entering chamber 75 is measured by the nozzle 77. A lubricant oil emulsion is fed through the conduit 48 simultaneously with the flow of the heating fluid through chamber 75. The oil emulsion is absorbed by the flowing steam to form a mixture, and the mixture flows through the concentric conduit 50 in the shaft 35, to the forward part of the reel, then from the conduit into the chamber section 70. From chamber section 70 the heating fluid and oil emulsion mixture flow through the passages 72 to the thread being advanced over the reel. The thread helix, while on the reel advantageously, thus is subjected to more than one treatment.

By way of a specific example to complete the regeneration of the viscose thread on the reel a measured amount of a dilute acid solution is admitted through the conduit 47, and through the annular passage of the shaft 35

into the section 71, and therefrom through the passages 73, to the thread. The dilute acid in the thread is then washed out by a following subsequent condensate treatment including an oil emulsion on a further portion of the reel to which end the acid laden thread is advanced, then the thread is substantially dried as it travels over the last several inches of the hot reel. The reel 20 is generally positioned of from about 5° to 10° to the horizontal so that a treating liquid will tend to flow toward the back end of the reel and against the advancing helix. The dilute acid treatment is applied to several initial turns of the helix; and the wash and oil application is made further along the reel and for over a greater section of the helix.

Saturated steam that is admitted through the supply 46 to the chamber 70 is appreciably further condensed by the addition of an oil emulsion. The mixture of steam and oil emulsion flowing to the reel interior through the tube 50, the passages 67, into the forward reel section 70, becomes a condensate-oil emulsion mixture which is forced to the reel exterior. The condensate-oil emulsion mixture forms an effective wash and a conditioning treatment of a thread containing previously applied acid. The thread is thus prepared for subsequent drying on the forward end of reel, or, if desired, for further conditioning treatment on subsequent reels of a series of reels.

#### Example

A thread formed of 150 denier, 40 filament viscose rayon was produced in the following manner: A viscose solution containing about 6.5% sodium hydroxide and about 8% cellulose is prepared in a conventional manner. The viscose being ripened to a salt index of approximately 4.5 (sodium chloride) is extruded through a spinneret into an acid coagulating bath having a temperature of about approximately 45° C. and containing, approximately, by weight, 12% sulfuric acid, 22% sodium sulphate, 2% zinc sulphate, and 0.1% of a cation-active agent.

Formed yarn or thread is drawn from the bath at a rate of about 90 meters per minute by reel 15 then it is led upwardly to reel 20 on which the thread is stored and advanced while still containing an entrained acid bath liquid. As shown in the drawing, the reel 20 is provided with peripheral openings 72 and 73 of about 1/8" in diameter between each pair of bars 32, the openings being located at the foot of such bars 32 so that a treating liquid flowing from the openings will tend to flow along their side surfaces and also along the sides of the interleaved bars 33 to the thread on the reel. To the thread helix and approximately at the initial point of contact with the reel there is conducted through the reel shaft 35 a 2% solution of sulphuric acid. The diluted acid admitted at about 20 cc. per minute through the tube 47 which terminates in the end chamber 40, from whence the dilute acid solution flows through the annular passage in the reel shaft 35 to and through openings 66 into the reel chamber 71. From the chamber 71 the solution flows through the reel peripheral openings 73 to the thread helix. The dilute acid solution is maintained at an elevated temperature of between about 90 to 100° C., being kept at that level by flowing parallel with saturated steam flowing through the tube 50. The steam-oil mixture flows into reel chamber 70 and therefrom as a condensate mixture through peripheral openings 72 to the thread helix on the reel. Excess dilute acid from reel 20 is collected in a trough 19 having an outlet directed on the withdrawing reel 15. The dilute acid dilutes the bath acid on reel 15 and tends to prevent the formation of salt crystals.

The reel is maintained at an elevated temperature by the circulation of the steam flowing through the core of the reel shaft, the steam is condensed within the reel, and the condensate and oil mixture is applied as a wash and lubricant to the thread helix on the reel. The dilute

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acid solution in the thread is thus washed out, the thread is substantially dried on the forward portion of the reel, then it is collected, as an undesulphured yarn. Steam is admitted to the reel interior in an amount to yield from about 25 to 30 cc. per minute of condensate. The finishing oil that is added to the flowing steam at the point of injection of the steam into the reel is added to the steam at the rate of about 2.5 cc. per minute. The thread upon leaving the reel is substantially regenerated, washed; and lubricated and dried, it is then led to a collecting means, or led to other reels for further subsequent treatments.

Due to the direction of the flow of the dilute acid solution, or steam condensate, or steam condensate and oil mixture, through the peripheral passages 72 and 73 formation of salt crystals on the bars is minimized for the side surfaces of the bars where the crystals tend to form are washed by the solutions flowing along their sides to the thread.

I claim:

1. A thread-advancing reel for processing thread comprising, two reel members each having a periphery of longitudinally extending bar members, said reel members being arranged in an interdigitating relation about axes that are eccentric to each other so that upon rotation thread is advanced in the form of a helix over the reel periphery, an enclosed chamber in one of said reel members, means for supplying a treating fluid to said chamber, exhaust passages for said treating fluid from said chamber having outlet openings along the sides of the bar members, said outlet openings directing the flow of the treating fluid from the chamber along the sides of the bar members to thread on the reel.

2. A thread-advancing reel for processing thread comprising, two reel members each having a periphery of longitudinally extending bar members, said reel members being arranged in an interdigitating relation about axes that are eccentric to each other, so that upon rotation thread is advanced in the form of a helix, one of said reel members having an enclosed chamber, said chamber being divided into two sections and each section being

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adapted to receive a treating fluid, means for supplying treating fluids to said sections, treating fluid exhaust openings in each of said sections of the chamber, the outlet openings of said exhaust passages being along the sides of the bar members, said exhaust passages directing treating fluids from each of the said chamber sections along the sides of the bar members to the thread on the reel.

3. A thread-advancing reel for processing thread comprising, a hollow shaft, a concentric tube within said shaft, two reel members mounted on said shaft each having a periphery of longitudinally extending bar members, said reel members being arranged in an interdigitating relation about axes that are eccentric to each other, so that upon rotation thread is advanced in the form of a helix, one of said reel members having an enclosed chamber, said chamber being divided into two sections and each section being adapted to receive a treating fluid, said shaft having openings into one of said sections and said tube within said shaft having openings into said second section, means for supplying treating fluids to said hollow shaft and said concentric tube, treating fluid exhaust openings in each of said sections of the chamber, the outlet openings of said exhaust passages being along the sides of the bar members, said exhaust passages directing treating fluids from each of the said chamber sections along the sides of the bar members to the thread on the reel.

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