Feb. 16, 1971 A. GREIVE ET AL 3,563,019

METHOD OF AND APPARATUS FOR SPINNING AND TREATING THREAD

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FIG. 1

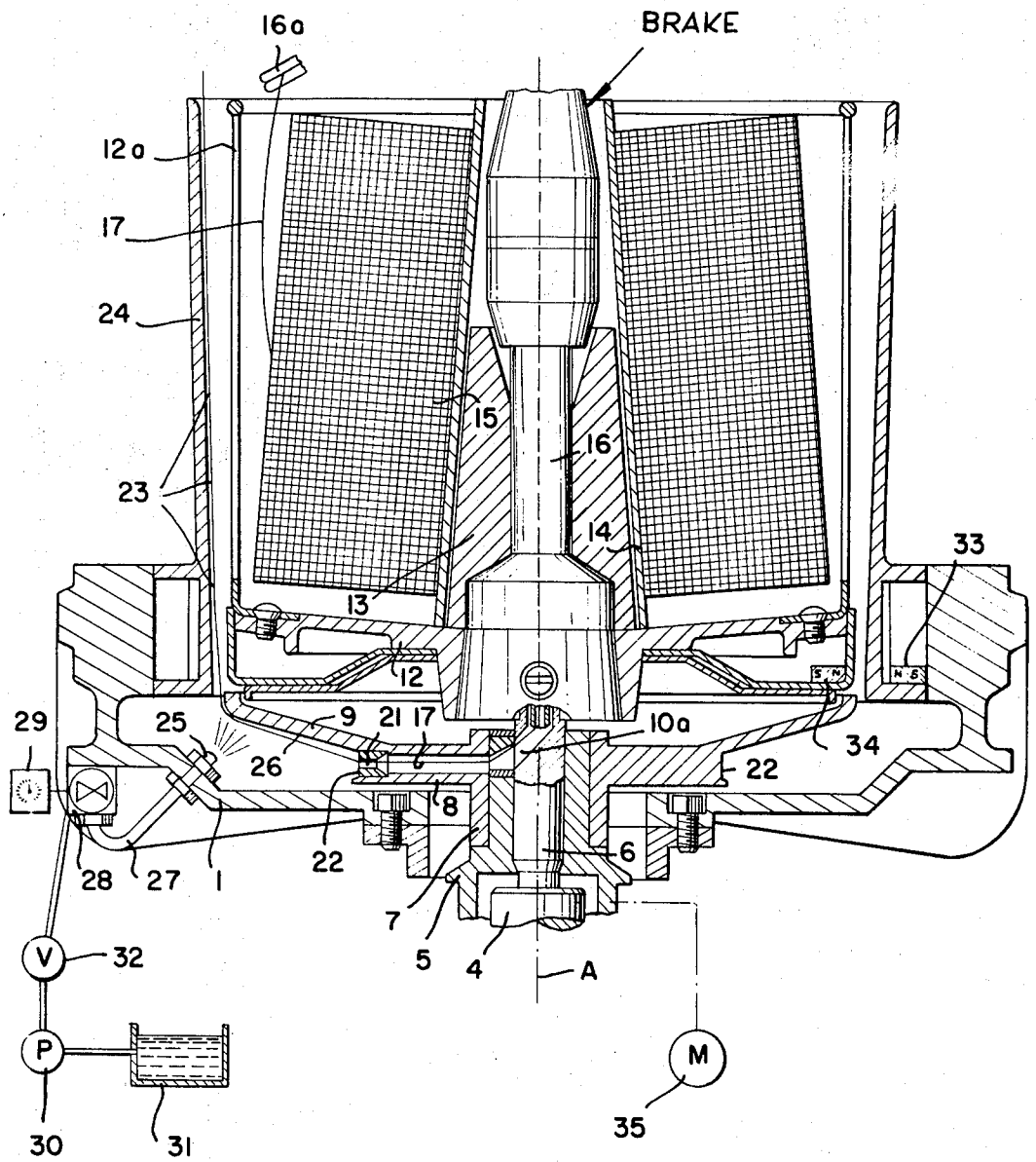

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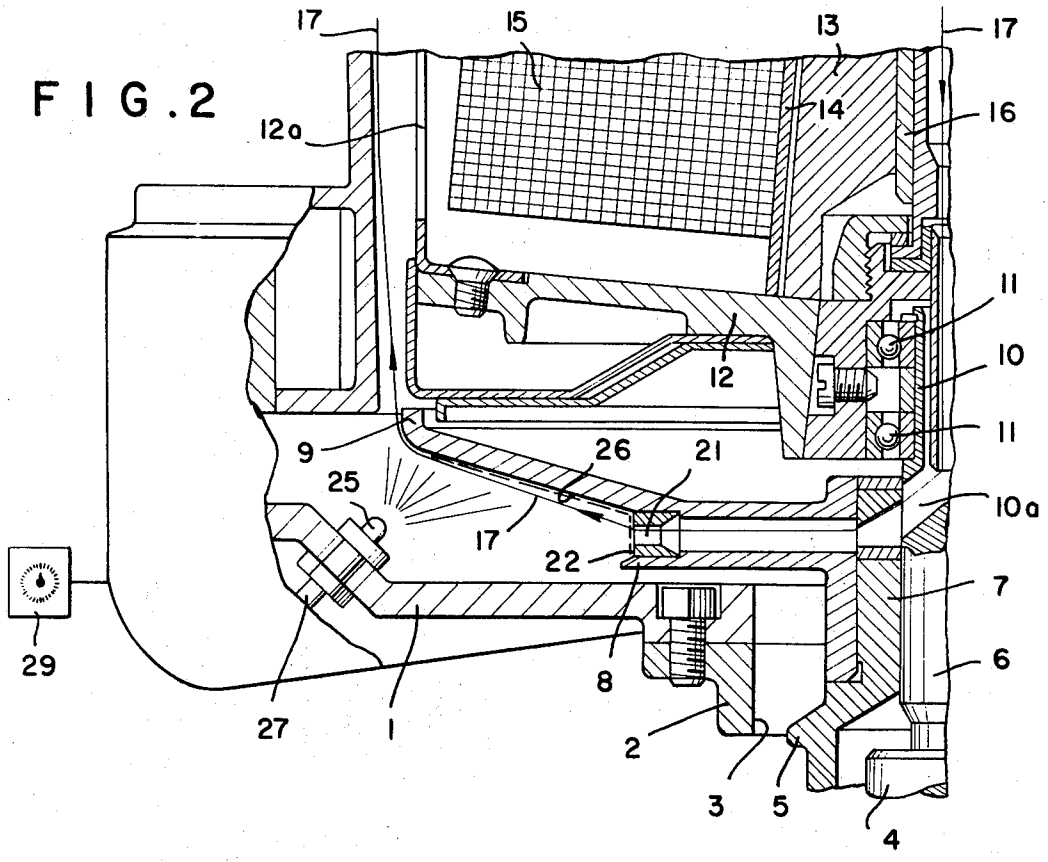
FIG. 2



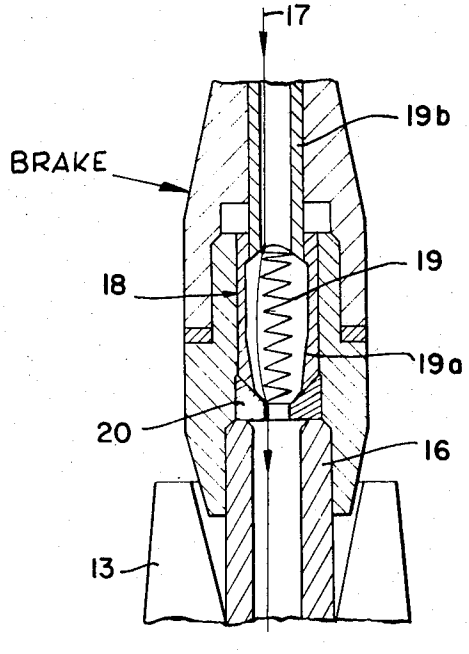


FIG. 3

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METHOD OF AND APPARATUS FOR SPINNING AND TREATING THREAD

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Int. Cl. D01k 7/86, 13/30
U.S. Cl. 57—35 12 Claims

ABSTRACT OF THE DISCLOSURE

A thread is drawn axially off a relatively nonrotatable spool and guided through the center of the spool which is equipped with a light friction brake for the thread. On leaving the spool the thread is fed through a lateral hole in a rotating hollow shaft and onto a rotating disk mounted on the shaft. A jet of treating liquid is pulsed against this disk to soak the thread moving radially outward thereon. Then the thread is drawn up between a sleeve surrounding the spool and the spool itself and wound on a bobbin or yarn package.

Our present invention relates to a method of and an apparatus for spinning and treating thread or yarn.

In commonly assigned application Ser. No. 705,360, filed Feb. 14, 1968, now Pat. No. 3,158,983, by Edmund Hamel, there is disclosed a process wherein thread is made to pass through a trough or bath of a treatment liquid prior to being wound on a spool or bobbin.

In most treatment systems wherein a liquid bath is used to treat the thread, however, the thread tends to dry out when wound from this spool or bobbin onto another spool or bobbin, on account of the centrifugal force generated as it is payed off the feed package and twisted at high speeds.

It has further been proposed to direct a jet of a liquid or vapor at the thread where it unwinds from the spool. Once again, the thread tends to dry because of the centrifugal force and cannot be effectively wetted on the side inwardly of the balloon it forms on unwinding.

Another suggestion has been to spray the liquid axially through a hollow spool directly at the twisting zone. This, however, can lead to a fouling of the device with the liquid. In all cases, even where vapor (e.g. steam) is directed from a nozzle against the yarn package, serious difficulties are encountered when a penetrating treatment is desired and the yarn moves at such high speeds as to dry the treatment liquid before penetration is complete.

It is therefore the principal object of the present invention to provide an improved method of and an apparatus for spinning and treating thread and yarn.

More specifically, an object of our invention is to provide a method and an apparatus which overcome the abovementioned drawbacks.

We attain these and other objects which will become apparent hereinafter by providing a method of and an apparatus for spinning and soaking thread wherein the thread is axially drawn off a relatively stationary or nonrotating spool or yarn package and is then threaded back through the center or hollow core of the spool. A light friction-braking device of small dimension is provided within the interior of the spool to insure proper twisting of the thread. The thread is then led through a lateral opening in a hollow shaft driving the spinning device onto a rotating disk mounted on and driven by the shaft, the disk serving to generate the usual balloon. The thread is drawn out over this disk, which has a

diameter in excess of the diameter of the largest spool to be accommodated, while a spray or jet of treating liquid is directed against the disk, preferably close to the point at which the thread leaves the latter, to thoroughly wet and treat the thread. Thence the thread is drawn upwardly between the spool and a sleeve limiting the spread of the balloon.

The spool and the sleeve are substantially nonrotatable while the disk whirls around at the speed necessary for the desired amount of twist. Of course, the spool could rotate if necessary, but we prefer to provide means, e.g. magnetic elements, to inhibit this rotation (see U.S. Pat. No. 2,718,363).

According to a further feature of our invention, the spray from the nozzle is pulsed against the disk at a rate of, for example, one pulse per revolution. In general, however, the interval between pulses of the liquid jet should be equal to a period of rotation or greater to prevent excessive accumulation of liquid on the disk. The upwardly widening frustoconical configuration of the downwardly turned treatment surface of the disk rotates at a speed which enables it to slough off excess liquid.

By this method the thread is completely wetted with the treating liquid. At the same time this wetting does not interfere with any other stage of the normal twisting or spinning operation. None of the extremely messy and irregularly effective prior-art methods are able to treat so effectively thread with such a nominal amount of treatment liquid. Furthermore, the pulsed operation of the jet which may be co-ordinated with the speed of the disk, and the control of the total flow of liquid in accordance with the rate at which the yarn is payed off, allows considerable economy of the treatment agent.

These and other objects, features and advantages will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is a vertical section through an apparatus according to our invention; and

FIGS. 2 and 3 are sectional views showing details of FIG. 1, drawn to an enlarged scale.

As shown in FIGS. 1–3, our apparatus has a nonrotatable disk-shaped base **1** bolted to a flange **2** forming an opening **3** through which the rotatable parts of the unit extend, this unit constituting part of a spinning machine having a number of assemblies of the character described below. Journaled in a bearing **4** is a shaft **6** which rotationally entrains a sleeve **7** having a lower portion or collar **5**. This collar **5** forms a whirling pulley adapted to be engaged by a belt from a motor **35** to drive shaft **6** along with two disks **8** and **9** connected rotatively entrained by it.

An upper end **10** of the shaft **6** is hollow and formed with a lateral opening **10***a*, while carrying via ball bearings **11** a spool assembly comprising an outer sleeve **12***a*, a bottom plate **12**, an inner sleeve **16**, and a mandrel **13**. A spool **15** of thread **17** with a core **14** fits over this spool assembly. Magnets **33** (one shown) mounted in the base **1** and magnets **34** (one shown) mounted on the plate **16** inhibit mutual rotation of the base **1** and the plate **16**. These magnets, shown diagrammatically, form a magnetic retaining clutch as described in U.S. Pat. No. 2,718,-363.

Sleeve **16** encloses a braking device **18** comprising a spring **19** pressing the thread **17** inside a sleeve **19***a* against a seat **20**. The tension can be adjusted by raising and lowering a tubular insert **19***b* above the spring **19**.

The disk **8** is formed with a radial passage **21** communicating with the opening **10***a* and has a cylindrical hub **22**. Beyond this, the disk **9** has a frustoconical surface **26** over which the thread **17** is intended to run. A housing **24** coaxially surrounds the sleeve **12***a*.

A conduit **27** passes through the base **1** and is provided with a nozzle **25** adapted to spray treating liquid against the surface **26**. The nozzle **25** is directed at an angle of $70° \pm 20°$ to the surface of the coating plate **9** which rotates at such speed that centrifugal force distributes the liquid uniformly over the surface. A solenoid-actuated valve **28** connected to an adjustable pulse generator **29** is supplied treating liquid from a reservoir **31** through a pump **30** and a restrictor valve **32**, which can be so coupled with motor **35** that the volume of treating liquid delivered at the plate **9** is proportional to the rate of advance of the yarn.

Our apparatus functions as follows:

A core **14** fully wound with string **17** is slipped over the frustoconical mandrel **13**. Then the string **17** is threaded through a rotatable eye **16***a*, down through the brake device **18**, through the opening **10***a*, out the channel **21**, over the disk surface **26**, and up next to the inner surface of housing **24** which confines the balloon **23** formed by the revolving thread.

The free end of the string **17** is attached to some conventional take-up device, such as a bobbin; then the drive **35** attached to the belt pulley **5** is started, as is the pump **30**.

As the disks **8** and **9** revolve the string winds around the hub **22** to a certain extent—up to 360°—and is then pulled off and over the rim of the downwardly convex underside **26** to form the balloon **23** inside the housing **24**. This twists the string **17** to an extent determined by the r.p.m. of the shaft **6** and the amount of braking in the device **18**. The pulse generator **29** is advantageously set to give one pulse per revolution of the disk **9** (or less) and the restrictor valve **32** is also set for an amount of fluid flow sufficient to thoroughly soak the thread **17** without building up an overflow which would leave through the opening **3**.

The improvement described and illustrated is believed to admit of many modifications within the ability of persons skilled in the art, all such modifications being considered within the spirit and scope of the invention except as limited by the appended claims.

We claim:

1. A method of spinning and treating thread, comprising the steps of:

paying thread off a spool generally along the axis thereof through a spool-supporting tubular upright core;

drawing said thread generally radially outwardly beneath said core;

guiding said thread below said spool along an outwardly rising surface rotating about said axis and thence upwardly in a balloon spinning about the axis; and

directing a jet of treatment fluid substantially at right angles onto said rotating surface for interaction with said thread.

2. A method as defined in claim **1** wherein said jet is intermittently trained upon said surface.

3. A method as defined in claim **2** wherein said jet is pulsed in step with the rotation of said surface.

4. A method of spinning and treating thread, comprising the steps of:

paying a thread off a spool generally along the axis thereof;

drawing said thread generally radially outwardly from said axis over a rotating surface;

intermittently directing a jet of treatment fluid onto said rotating surface for interaction with said thread; and

withdrawing said thread from said surface in substantially axial direction.

5. A method as defined in claim **4**, wherein said jet is pulsed at a frequency related to the period of rotation of said surface.

6. A spinning and treating apparatus for thread comprising:

a tubular upright spool support;

a disk adjoining the lower end of said support and centered on the axis thereof, said disk having a downwardly convex underside rising toward its rim;

drive means for rotating said disk about said axis;

guide means for drawing thread from a spool on said support downwardly through said support and out said lower end thereof onto the underside and across the rim of said disk;

a supply of treatment fluid for said thread; and

nozzle means connected to said supply and trained substantially perpendicularly upon said underside for directing a jet of said fluid onto said underside and into the path of said thread.

7. An apparatus as defined in claim **6** wherein said supply includes pulsing means for periodically interrupting said jet.

8. An apparatus as defined in claim **7** wherein said pulsing means is synchronized with said drive means for generating said jet in step with the rotation of said disk.

9. An apparatus as defined in claim **6** wherein said disk is provided with a hollow hub accessible from above through said support and provided with a lateral discharge orifice for said thread substantially at the level of said underside.

10. An apparatus as defined in claim **9** wherein said underside is substantially frustoconical around said hub.

11. An apparatus as defined in claim **10**, further comprising a stationary housing spacedly surrounding said disk and said support, said housing and said support being provided with retaining means for holding said support against rotation, said nozzle means being mounted on said housing near the rim of said disk.

12. An apparatus as defined in claim **6**, further comprising brake means in said support for tensioning said thread.

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