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DEVICE FOR TENSIONING YARN

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Fig. 1.

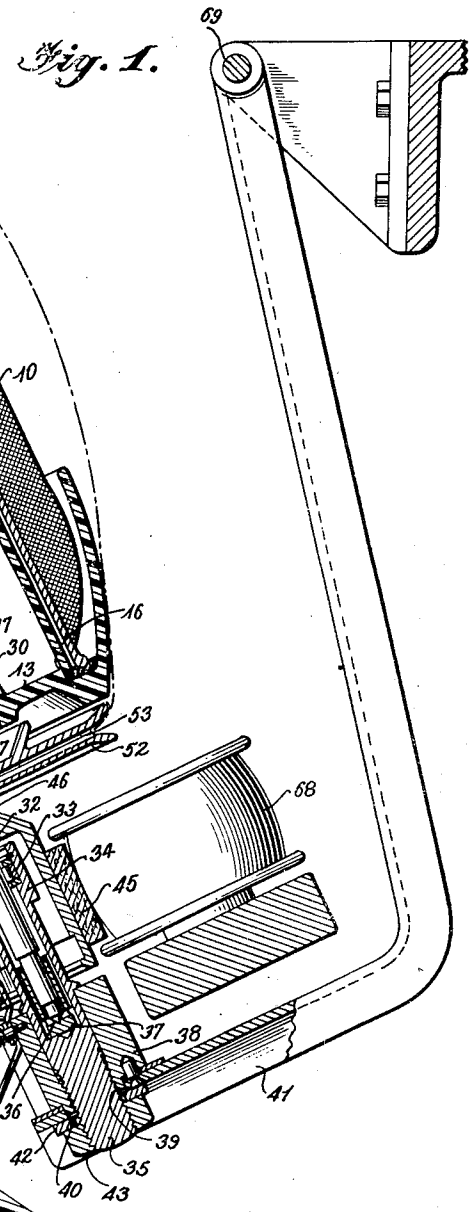


Fig. 2.

Fig. 3.

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DEVICE FOR TENSIONING YARN

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This invention relates to twisting machines and more particularly to twisting spindles of the kind adapted to impart two twists to the yarn, thread or the like, undergoing twisting, for each revolution of the spindle.

In double twist spindles of this kind the spindle per se revolves but the yarn package from which the yarn is drawn does not. The yarn is withdrawn from the stationary package and passes downwardly through the hollow rotating spindle, emerges from a port in a storage wheel at the lower end thereof and then passes outwardly around and in spaced relation to the yarn package where it forms a so-called "balloon" due to the high rotational speed of the spindle. The twisted thread then passes to a suitable takeup device, usually through a guiding or gathering eye. The size of the ballon thus formed depends primarily upon the rotational speed of the spindle, the speed of thread takeup and upon the denier of the yarn undergoing twist. For a given denier the spindle speed is adjusted to give the desired balloon size. Two type of "balloon" are used in the art, one being the "free balloon" and the other a balloon of restricted extent. The advantage of a "free balloon" resides in the uniform pull or tension exerted on the delivered thread, which in turn results in uniform density of takeup package. Obviously, therefore, the high centrifugal force exerted on the thread during ballooning, as a function of the denier of the thread and spindle speed, influences the pull exerted upon the yarn as it is drawn from the supply package. Thus, a balloon of large denier thread would tend to draw the yarn from the supply package at a much faster rate than a balloon of comparatively small denier thread.

It has been proposed to insert adjustable braking or tensioning means in the path traversed by the thread on its way from the supply package to the ballooning zone, so as to regulate the flow of thread caused by the pull of the balloon on the thread as it is drawn from the package and it is desirable to be able to adjust such tension for threads of different denier. However, although double twist spindle machines have been known for a number of years, their use has been restricted, largely due to lack of a reliable braking or tensioning means for controlling the tension applied to the yarn prior to its passage through the spindle before forming the so-called balloon-like spatial configuration assumed on its way to the take-up device. It is recognized that if uniform tension produced by a reliably functioning and easily adjusted device could be constantly exerted upon the yarn during the twisting operation on double twist spindles, a far superior yarn possessing round and uniform twist could be obtained. Additionally, yarn as thus twisted would be completely free of thread loops and corkscrews. Furthermore, a variety of supply packages could be utilized in such operations since the supply package is maintained stationary during the operation of a double twist spindle. Attempts have already been made to provide tensioning devices for use with double twist spindles, but while many of the devices were satisfactory to a certain degree, they did not entirely solve the problem. Thus, devices have been used embodying felt-like materials and sponge rubber coated with spun glass cloth as contactual thread braking and tensioning elements. The maintenance problems and general unreliability accruing from such constructions however have precluded their large-scale adoption.

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Moreover, in double twist spindles of the "free balloon" type, the storage wheel at the lower end of the spindle, from a port or opening of which the thread emerges, serves for imparting a certain amount of tension to the yarn supplementary to that imparted by tensioning means provided, for example, in the cap, in the path of travel of the yarn previous to its emergence from the pore in the storage wheel. This supplementary tension depends on various factors inherent during a given twisting operation and cannot readily be controlled; its magnitude however is of importance when taken in conjunction with tension applied to the yarn before it emerges from the port of the storage wheel, and it is this last named tension which must be readily and reliably controlled to insure smooth operation of the spindle. However, proper co-relation between the tensions imparted by these two tensioning means has heretofore been difficult to attain.

It is an object of the present invention to overcome the disadvantages heretofore encountered in the application of proper tension upon the yarn in a double twist spindle, the invention contemplating the use of a tensioning disc cooperating with a cap mounted upon the stationary supply package holder. In one embodiment, light-weight interchangeable tensioning discs having very little inertia are utilized, such discs, while coacting with the cap so as properly to tension the yarn being twisted, exerting no deleterious resistance to the passage of the thread thereunder in its passage through the spindle of the machine. The invention further contemplates the use of tensioning disc elements of various weights which can be interchanged and replaced, as required, to vary the tension applied to the thread, depending upon the spindle speed, denier and other characteristics of the thread.

Another object of the invention is to shape the edges of the discs and position the discs by means of stems carried thereby and engaging into the yarn opening in the nosepiece of the cap surmounting the spindle in such fashion that the

yarn drawn from the supply package approaches the cap throughout an arc of 360° and so that the shifting motion induced in the disc as the thread passes thereunder and around the stem reposing loosely within the opening in the cap, causes the disc to perform a nutational movement, in addition to which the yarn exerts a self-cleaning action upon the disc, stem and cap. Hence the thread, in unwinding over the end of the supply bobbin, continually wipes the nose of the cap and the tension disc and thus dirt particles, fly waste and the like cannot lodge between these tension producing members and thereby decrease the tension or cause material variation thereof. Moreover, the substitution of heavier or lighter stems on the discs serves as one means for varying the weight of the latter to suit the operating conditions involved, although, of course, the stems may be kept constant in weight and the weight of the disc portion per se increased to effect the same purpose.

It is also an object of the invention to co-relate the tension produced at the cap or entry end with the pull produced by the thread as it emerges from the port in the storage wheel or emerging end when a free balloon is employed during twisting, such corelation being effected by the use of interchangeable discs of predetermined weight.

Another, still further object, is to provide for the quick and facile release and removal of the parts of the tensioning arrangement so as to permit easy threading of the spindle, ready removal of broken thread, slubs, and the like, and substitution of a tensioning element possessing given tensioning characteristics by another possessing other predetermined characteristics.

Other objects and advantages of the invention will be manifest from the following detailed description when considered in connection with the accompanying drawings, wherein:

Fig. 1 is a vertical sectional view of a twisting spindle provided with the arrangement of the invention.

Fig. 2 is a top view of a tensioning member suitable for use with the spindle shown in Fig. 1.

Fig. 3 is a fragmentary vertical section on an enlarged scale of the top portion of the spindle.

Referring to the drawings in detail, the numeral 10 designates a package of untwisted yarn which is mounted in position upon a holder 11. Holder 11 comprises an upstanding bowl 12 having a base 13. The bowl encloses the lower portion of the yarn package but the wall thereof is spaced from the exterior of the package to permit the unwinding of the yarn therefrom. An inverted cup 14 is placed upon base 13 and engages within an annular groove 15 in the base. Cup 14 adjacent its lower edge abuts against shoulder 16, which forms one edge of the groove 15 whereby the cup is aligned in concentric position within bowl 13. Extending upwardly within inverted cup 14 is a raised hollow central pedestal 17 formed on base 13, and an externally threaded upstanding boss 18 is formed integral with the pedestal. A central guide tube 19 is screwed upon boss 18 and extends upwardly through an opening 20 in cup 14. Guide tube 19 is provided with an annular flange 21 which engages the edge of opening 20 of the cup 14 for causing the cup 14 to fit tightly within groove 15 when the guide tube is screwed in position upon the boss 18.

Guide tube 19 is tapered at its upper end as at 22 and is adapted to receive thereover an inner annular boss 23 of cap 24. Cap 24 is of conical formation and is provided with flanges 25 and 26,

respectively, providing a groove for engaging the upper edge of the yarn package holder. The construction is thus arranged properly to position and retain package 10 in aligned position with respect to bowl 12 and the opening provided within the pedestal projection 17 of base 13. As hereinafter pointed out, the package support portion of the spindle is normally maintained against rotation and the whole spindle normally reposes at an angle of about 25° to the vertical.

A hollow spindle 27 extends upwardly through tubular boss 18, pedestal 17 and terminates below the opening of guide tube 19. A roller bearing 28 is mounted within a recess in boss 18 and engages the interior wall thereof and the exterior of spindle 27 for maintaining the parts in position for relative rotation. A bearing 29 is arranged within pedestal 17, said bearing engaging the spindle 27 for maintaining the spindle in proper position with respect to base 13 at this point. Bearing 29 is maintained in position by spring ring 30 fitting in an appropriate groove and roller bearing 28 is maintained in proper elevation with respect to bearing 29 by means of coil spring 31.

Spindle 27 extends below base 13 and is there provided with a reduced portion 32 about which is encircled a bearing 33, the bearing being retained within an upstanding cup 34 of a non-rotatable bearing support 35. A pivot bearing 36 is provided at the lower end of the spindle, which bearing engages fixed bearing plate 37 carried in the bearing support.

Bearing support 35 is adjustably positioned by means of nut 38 having a reduced section 39 extending downwardly through opening 40 in a pivoted bracket arm 41. A washer 42 is placed over the lower end of the bearing support 35 and the support is held in position upon the bracket by means of lock nuts 43. A belt pulley or whorl 44 extends over a portion of spindle 27 and the upper portion of bearing support 35 and is integral with the spindle for rotation therewith. The whorl is adapted to engage and disengage a belt 45 in the manner hereinafter set forth. Reduced neck 46 of the whorl 44 is positioned upwardly within the opening in pedestal 17 of base 13 and it engages the inner race of bearing 29. Neck 46 is provided with three radial openings 47 which correspond to, and are in communication with, three openings 48 in the spindle. Openings 48 are in communication with the central opening 49 in spindle 27, the lower end of said central opening being flared outwardly as at 50 to aid in the threading-up of the device.

Hub 51 of the thread-storage wheel 52 is fixed to the periphery of neck 46 of the belt pulley or whorl and the storage wheel is provided with three radial openings 53 which communicate with openings 47. Storage wheel 52 is provided with an annular groove 54 which serves for the storage of yarn. Groove 54 communicates with openings 53.

Within reduced portion 22 of guide tube 19 is a recess 55 in which reposes a member provided with fur or plush-like material 56 constituting a yarn passage control means. Cap 24 is formed with a threaded central depression 57 into which nose 58 is screwed. Nose 58 has a flat surface 59 and a central opening 60. A thread tensioning member 61 reposes on nose 58 and is constituted as a disc 62 and stem 63, the latter fitting loosely within opening 60 of nose 58. Flat surface 59 of nose 58 is at least equal to, or slightly larger than, disc 62. Disc 62 is provided with an up-turned marginal edge 64 and the disk is riveted to the

stem at 65 the bottom of the disk being turned in at the center as at 66.

It is important that the surfaces of tensioning member 61 and of the nose 58 be maintained undistorted and free of pits as the application of tension to the yarn being twisted through the medium of the nose and the tensioning disc member is quite delicate. For this reason it is important, too, that stem 63 be accurately and securely maintained in position with respect to the disc 62. The stem 63 is therefore preferably constructed with an enlarged portion 65 terminating in a shoulder 66. Opening 67 in disc 62 is similarly curved and adapted to receive stem portion 65. As hereinafter pointed out, stems of different weight may be utilized to provide the desired weight for the tensioning member 61 and the stem is held in position with respect to the disc by being rolled over the upstanding edge defining the wall of opening 67.

The positions of the disk and stem are shown in the enlarged view given in Fig. 3. A hollow washer-like member 81 is provided within recess 80 of cap portion 24 the top of member 81 serving additionally to guide the stem 63 in floating fashion, and the bottom of member 81 being flared to facilitate entry of the threading-up tool. Member 81 is retained in position by sleeve 82 which bears against a shoulder on member 81, the structure being arranged to be assembled from the top.

A disc of the tensioning member which was found particularly efficient in operation was stamped from sheets of hardened metal approximately .015" in thickness. The diameters of the particular discs were 1.25" and the outer rims thereof were slightly curved as shown in the drawing. The hole designated as 67 in the drawing was stamped in each of the said discs to provide openings for the stems and the stems were rigidly and permanently secured in position in the manner shown. In order that the desired weight for a particular operation be had, stainless steel stock of predetermined weight was utilized in constructing the stems and the stems were formed of a diameter to permit free floating of the same within the openings 60 in nose 58. It was found that stems which extend about ½" below the face of the disc were particularly suitable.

In order to drive the spindle 27, a series of idlers, one of which is illustrated at 68 are mounted to guide belt 45 in a path adjacent belt pulley or whorl 44. In normal operation the whorl 44 engages belt 45 due to the pivotal and pendulous swinging of arm 41 about an upper pivot 69. In inoperative position whorl 44 is disengaged from belt 45 and is held in a disengaged position by means of a latch-out arrangement (not shown). 70 is a brake shoe operated by a bail 71 when it is desired to stop rotation of the spindle after it is disengaged from belt 45.

The package holder 11 is mounted in position upon the stationary bearing support 35 entirely through the medium of the rotating spindle 27. In order therefore for the package to be maintained during normal operation against rotation, advantage is taken of the angular disposition of the package holder during operation of the spindle and a counterweight 76 is frictionally carried eccentrically of pedestal 17 by a tongue 77 extending from a flanged sleeve 78 pivotally carried by the pedestal.

In threading up the twisting spindle, a tightly wound tension spring wire of about .10" diameter is preferably used. It is inserted through one of the openings 53 in the storage wheel 52 and is passed upwardly into the bore 49 of spindle 27. The wire is then forced upwardly through guide tube 19 and out through opening 60 in nose 58. The tensioning member 61 is removed during the thread-up operation.

A loop of untwisted yarn from package 10 is connected to the projecting end of the wire and the yarn is then drawn downwardly through the interior of the nose cap and guide tube and then through the spindle and out through the opening in wheel 52 where it is disconnected from the threading-up wire and passed upwardly to a centrally arranged guide positioned above the package. The thread is then passed to a takeup device of appropriate construction. At this time the tensioning member 61 is placed in position with its stem 63 extending into opening 60 of nose 58 adjacent the yarn. The spindle is then set in operation by engaging the whorl 44 with belt 45 as by releasing the latching device used for holding the spindle in inoperative position.

It is customary for the belt to be operated at a speed to cause the spindle to rotate at between 5000 and 10,000 R. P. M. The entire spindle unit carried by the pendulously pivoted arm 41 assumes a position tilted from the vertical and the counterweight 76 moves downwardly and tends to maintain the package support portion of the spindle in a relatively stationary position against rotation, although such support, including the yarn package, can turn or be turned manually relatively to the spindle, the latter meaning of course the whorl, storage wheel and the member 27. Due to the action of the take-up device (not shown) and the formation of the balloon, the yarn is drawn from the package 10 over flange 26 of cap 24 upwardly over nose 58 and between the flat surfaces of the nose and of the disc. Since the yarn is drawn off from convolutions of the package, the yarn approaches the nose 58 from an arc of 360° and is drawn between the nose and the disc and downwardly adjacent the stem 63 where succeeding portions of the yarn move bodily about the stem and urge the stem out of alignment. This activity in progressively passing the yarn between the flat surfaces in approaching the nose from progressive positions throughout a 360° arc, and the engagement of the stem 63 in like manner, effects a wiping of the nose and the surfaces between the disc and the flat surface 59 of the nose, as well as a cleaning of the wall defining the opening within the nose. Furthermore, nutation of the tensioning member results from this movement of the yarn. As the yarn passes between the tensioning member and grooved wheel 52 it is given one twist for each revolution of the spindle and as the yarn passes in the balloon between the wheel 52 and the centrally arranged guide it is given a similar twist for each rotation of the spindle. In this manner a two-for-one twist is imparted progressively as the yarn is passed from the package to the draw-off or collecting device.

It has been found that the use of a tensioning device of the character described not only maintains a proper balloon in the thread and a clean, uninterrupted operation, but the thread as twisted in such an operation has been found to be round, uniformly twisted and free of cockscrews. It has also been found that the tensioning member as thus described will operate for an indefinite period so long as it is not distorted or dented. It is therefore contemplated that the tensioning disc member will be subjected to a hardening treat-

ment after the stem is secured to the disc so that it will be of such a degree of hardness that it will break before it will deform.

The yarn passage control member 55 which serves to restrict passage of the yarn through the spindle when the yarn breaks within the balloon or between the balloon and the take-up device, as well as the latching-out mechanism mentioned above and the brake device 70, 71 shown in Fig. 1 are not claimed herein.

What is claimed is:

1. A device for tensioning thread comprising means defining a flat surface having a thread aperture therein, a disc-like body having a short stem projecting into said aperture and fitting loosely therein, a marginal flange extending away from the flat surface of said means, said body and said surface normally lying in contact but being susceptible of relative nutation during passage of thread therebetween and through the aperture beside said stem.

2. A device for tensioning thread comprising means defining a flat surface having a thread aperture therein, a disc-like body having a short stem at right angles thereto, said stem projecting into said aperture and fitting loosely therein, said body also having a marginal flange extending away from the flat surface of said means, the weight of said stem and body acting to urge said disc and said surface into contact, said surfaces being susceptible of relative nutation during the passage of thread therebetween and through the aperture beside said stem.

3. Thread handling mechanism including two members having contiguous flat portions, one of said members being provided with a thread outlet aperture located centrally thereof, a short stem extending from the other member and fitting loosely in the aperture in the first member to provide for the passage of thread beside the stem, and a thread supply from which the thread is passed linearly into engagement with the two members for passage therebetween and through said aperture, whereby the linearly moving thread contacts the members progressively from positions throughout an arc of 360°, one of said members being urged toward the other to provide a braking action to the thread as it is passed therebetween, the surfaces of said members being susceptible of relative nutation during the passage of the thread.

4. A device for tensioning thread comprising a frusto conical cap having a flat upper surface provided with a central thread aperture, a disc-like body having a short weighted stem attached thereto and depending from its lower surface, said stem extending into said aperture with sufficient clearance to permit free passage of the thread when the stem is in position, and to permit relative nutation between said flat upper surface and said disc-like body.

5. In a twister including a rotating spindle, a stationary thread support coaxially mounted thereover, said spindle having a central bore therein and a radial port at a point below the lower extremity of the support, the improvement that comprises; a frusto conical cap resting on said yarn support, the upper surface of said cap being flat and being provided with a central aperture in registry with the bore in the spindle, a disc-like body having an upstanding marginal flange and a depending short stem extending loosely through the aperture in the top of the cap, said stem and aperture affording clearance for the free passage of thread through the aperture when the stem is in position and the weight of the stem serving to urge said body toward said cap surface to cause them to function as a thread brake whereby the thread approaches the disc-like member progressively from positions throughout an arc of 360° and the thread is constantly subjected to tension, said cap surface and said disc-like body being susceptible of relative nutation during the passage of the thread therebetween and through the aperture beside the stem.

6. A device for tensioning thread comprising means defining a flat surface having a thread aperture therein, a flat disc-like body having a short stem at right angles thereto and rigidly attached thereto, said stem extending into said aperture and being substantially guided thereby but fitting therein with sufficient looseness to permit said disc-like body to nutate on said horizontal surface, said disc-like body also having a marginal flange extending away from the flat surface of said means, the weight of said stem and body acting to urge said disc and said surface into contact, said surface and said disc-like body being susceptible of relative nutation during the movement of said disc-like body engendered by passage of thread between said flat surface, said disc-like body and through said aperture and alongside said stem.

7. In a twister including a rotating spindle, a stationary thread support coaxially mounted thereover, said spindle having a central bore therein and a radial port at a point below the lower extremity of the support, the improvement that comprises; a frusto-conical cap resting on said thread support, the upper surface of said cap being flat and being provided with a central aperture in registry with the bore in the spindle, a flat disc-like body having an upstanding marginal flange and a rigidly attached depending short stem extending into the aperture in the top of the cap and fitting therein in substantially guided fashion but with sufficient looseness to permit said disc-like body to nutate on said flat surface of said cap, said stem and aperture affording clearance for the free passage of thread through the aperture when the stem is in position and the weight of the stem and the disc-like body serving to urge said body toward the surface of said cap to cause said surface and said body to function as a thread brake whereby the thread approaches the disc-like body progressively from positions throughout an arc of 360° and is constantly subjected to tension.

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