Aug. 16, 1949. C. B. KINGSBURY 2,478,926

YARN TENSIONING DEVICE

Filed Dec. 20, 1947

Fig. 1.

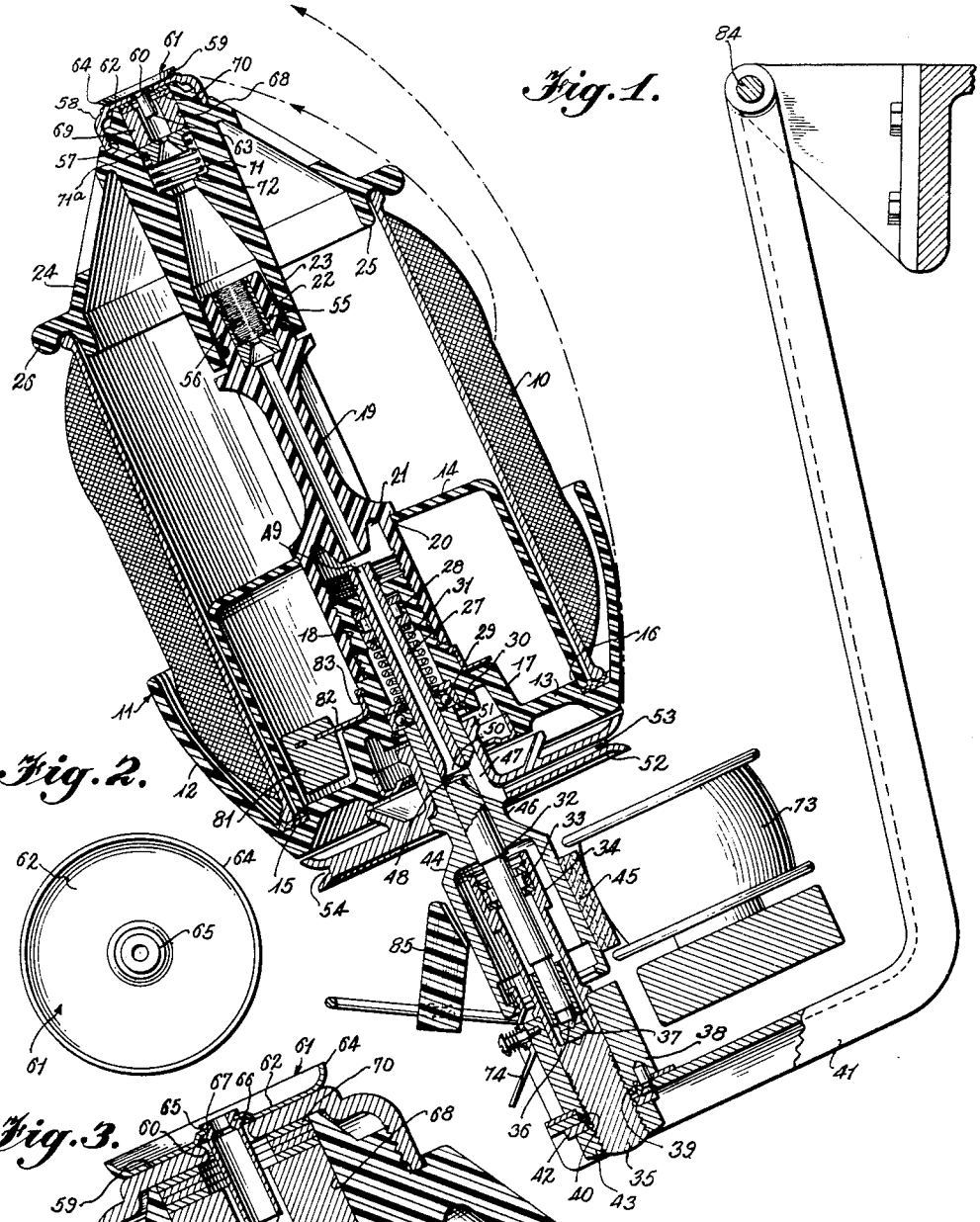
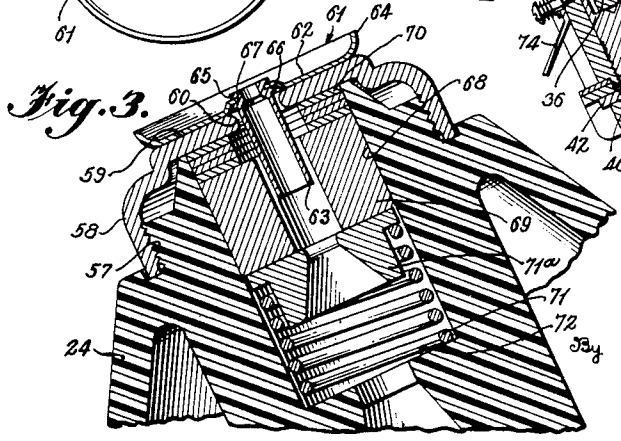


Fig. 2.

Fig. 3.



Inventor

Chadwick B. Kingsbury

Rudolph S. Bley

Attorney

Patented Aug. 16, 1949

2,478,926

UNITED STATES PATENT OFFICE

2,478,926

YARN TENSIONING DEVICE

Chadwick B. Kingsbury, Elizabethton, Tenn., assignor to North American Rayon Corporation, New York, N. Y., a corporation of Delaware

Application December 20, 1947, Serial No. 793,003

12 Claims. (Cl. 57—58)

1

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 remains substantially stationary. The yarn is withdrawn from the stationary package and passes downwardly through the hollow rotating spindle, emerges from a port in a storage wheel at the lower end thereof and then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 take-up device, usually through a guiding or gathering eye. The size of the balloon thus formed depends primarily upon the rotational speed of the spindle, the speed of thread take-up, and upon the denier of the yarn being twisted. For a given denier the spindle speed is adjusted to give the desired balloon size. Two types 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 the take-up 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 in addition it is desirable to be able to adjust such tension for threads of different denier. However, although double twisters 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.

2

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 port in the storage wheel. This supplementary tensioning depends on various factors inherent during a given twisting operation and its magnitude 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 correlation between the tensions imparted by these two tensioning means has heretofore been difficult to attain. It is therefore 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 by using a fixed magnet for urging a magnetically responsive tensioning disk member of light weight and having very little inertia against the cooperating surface of the nose of the twister cap in order to allow passage of yarn possessing slight variations in thread characteristics such as diameter and the like. Moreover, the delivered thread does not have a rough, jerky feel such as is often encountered when ordinary tensioning devices are used, but, on the contrary, it has a smooth, silky feel.

Among the objects of the present invention is therefore the provision of a tensioning arrangement employing a fixed magnet for effecting a pull on a light-weight tensioning disk member, the arrangement of said magnet being such as to permit the ready adjustment of the intensity of the pull exerted by the magnet on the disc member.

A further object is to provide a magnetic tensioning arrangement which may be readily applied to existing spindles and of such construction that adjustment of the magnetic force exerted on the tensioning disc can be effected in a positive manner by the mere interposition of replaceable non-magnetic spacers between the magnet and the magnetically responsive tensioning disc.

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 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 with and disengage from 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 a 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 constituted of radially extending fibers made of 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 at 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 disc is preferably riveted to the stem at 65 the bottom of the disc 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. To insure such rigidity 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. The nose 58 is made of non-magnetic material, preferably stainless steel.

One type of disc of the tensioning member

which was found particularly efficient in operation was stamped from sheets of hardened, rust-resistant, magnetically responsive, e. g. ferro-magnetic material of suitable composition, 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 drawings 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. Non-magnetic material, preferably stainless steel stock of light 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. The stems should be of non-magnetic material since otherwise their attraction by the magnet would prevent proper nutation of the disc tension member on the nose 58.

The magnetic arrangement used for causing the tensioning disc to exert its tensioning action on the yarn will now be described.

In accordance with the invention, a recess 68 is provided in the nose 58 in which a removable permanent magnet 69 reposes with a sliding fit. This magnet is referred to as a fixed magnet in that after the same has been placed in the optimum position desired for producing a given degree of pull on disc 62, it remains in that position in the nose of the spindle. A preferred material for constituting the magnet is the alloy well known in the art as "Alnico" of which a permanent magnet of great attractive power and small size can be made. The magnet 69 is of annular shape, the non-magnetic stem 63 carried by the ferro-magnetic disc tension member 62 extending downwardly loosely in the central bore of the magnet.

In order to be able to vary the amount of tension exerted by the disc tension member on the thread, the pull of the magnet 69 on the disc tension member 62 is adjusted by inserting one or more discs or shims 70 of non-magnetic material, e. g. brass, between the top of the magnet and the inside surface of the top of the nose 58. Fig. 3, for example, shows a plurality of such non-magnetic discs 70 in place for a given set of tensioning conditions. Obviously also a single disc of predetermined thickness may be used. A coil spring 71 bears against the bottom of the magnet 69 through agency of a shouldered guide washer 71-a and against an internal shoulder 72 in the member 23 and serves to press the magnet tightly against the inserted non-magnetic pull-adjusting discs or shims 70 and the latter in turn against the inside surface of the nose 58. Since the nose 58 as hereinbefore described is screwed into the member 23 constituting part of the cap 24, it is apparent that adjustment of the pull of the magnet can be easily effected by removing the nose 58 and adding or removing non-magnetic discs 70. It is obvious that the adjustment can be readily made by unskilled help by merely issuing discs 70 of predetermined thickness to be inserted singly or in multiple superposed relation on top of the magnet 70 within the nose 58.

In order to drive spindle 27, a series of idlers, one of which is illustrated at 73, is provided to guide belt 45 in a path adjacent belt pulley or whorl 44. In normal operation the whorl 44 engages belt 45 as a result of the pendulous pivoting of arm 41 about an upper pivot 84. A spring latch 74 is mounted upon nut 40 and engages with a flange interiorly of the whorl 44 when the spindle is placed in position within the bearing support 35 to prevent accidental displacement of the mechanism during operation.

The yarn supply 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 stationary during normal operation, a counterweight 81 is pivotally carried eccentrically of pedestal 17 by a tongue 82 extending from a flanged sleeve 83. The flange of sleeve 83 engages a disc secured to the upper surface of the pedestal. The yarn package is therefore able to turn or to be turned manually at low speed relatively to the parts of the spindle that rotate at high speed but will always be brought to rest by the counterweight during normal operation.

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 directed 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 52. The tensioning member 61 is removed during the threading up operation. Various portions of the internal structure of the spindle may be chamfered or flared to permit easy entry of the threading-up wire.

A loop of untwisted yarn from package 10 is connected to the projecting hooked 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 guide eye positioned above the package. The thread is then passed to a take-up device of appropriate construction. Thereupon tensioning member 61 is placed in position with its stem 63 extending into opening 60 of nose 58 adjacent the yarn, and the spindle as thus threaded up is then set in operation by allowing the whorl 44 to engage the belt 45.

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. This rotation of the spindle causes the rotation of wheel 52. The wheel therefore acts as a rotor to cause the thread to balloon outwardly in its passage to the centrally arranged thread guide. Since the mechanism assumes a position tilted from the vertical the counterbalance weight 81 moves downwardly where it tends to maintain the package in a relatively stationary position against rotation upon the otherwise rapidly rotating support. The take-up device and the formation of the balloon in the thread pulls the loops of yarn from the package 10 about flange 2[illegible] 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 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 corkscrews.

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. The tension disc member should therefore be of such a degree of hardness that it will break before it will deform.

The cylinder 55 which as set forth is arranged to engage the thread and restrict its passage through the spindle in the event of rupture of the thread beyond storage wheel 52, and the arrangement of the storage wheel in combination therewith, as well as the brake device of which the shoe 85 forms a part, are not claimed herein. Modifications of this invention will be readily recognized by those skilled in the art, and it is desired to cover all modifications coming within the scope of the appended claims.

I claim:

1. A device for tensioning thread comprising separate means defining complementary thread-contacting surfaces, magnetic means for urging said surfaces into contact, a thread aperture in one of said surface-defining means and a stem projecting from the other and fitting loosely into said aperture to guide the surfaces in movement toward and away from one another, whereby thread passed through the device is tensioned as it moves between the separate means in its passage to the thread aperture.

2. A device for tensioning thread comprising means defining a flat surface having a thread aperture therein, a disc-shape body having a stem projecting into said aperture and a marginal flange extending away from the flat surface of said means, and magnetic means urging said body and said surface into contact, said surface and body being susceptible of relative nutation during the passage of thread therebetween and through the aperture.

3. A device for tensioning thread comprising means defining a flat surface having a thread aperture therein, a disc-shape body of magnetic material, said body having a stem projecting into said aperture so that the body and said surface are susceptible of relative nutation during the passage of thread therebetween but are urged together by the action of the magnetic means.

4. Thread handling mechanism including two members having contiguous flat portions, one of said members being provided with a thread outlet aperture substantially centrally arranged with respect to the other member, 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°, and magnetic means urging said members toward one another to provide a braking action to the thread as it is passed therebetween.

5. A device for tensioning thread comprising means defining a flat surface having a thread aperture therein, an annular magnet beneath said flat surface and with its central aperture registering with the aperture in the means, a disc of magnetic material having a stem projecting through said aperture in said means, said magnet serving to urge said disc and said surface into contact but permitting nutation of said disc during passage of thread between said disc and said surface and through the aperture in said means.

6. A device for tensioning thread comprising means defining a flat surface having a thread aperture therein, an annular magnet beneath said flat surface and with its central aperture registering with the aperture in the means, a disc of magnetic material having a stem projecting through said aperture in said means, said magnet serving normally to maintain said disc and said surface in contact but permitting nutation of said disc during passage of thread between said disc and said surface and through the aperture in said means, and means for adjusting the effect of the magnet on the disc.

7. A device for tensioning thread comprising means defining a flat surface having a thread aperture therein, an annular magnet beneath said flat surface and with its central aperture registering with the aperture in the means, a disc of magnetic material having a stem projecting through said aperture in said means and into the aperture in said magnet, said magnet serving normally to maintain said disc and said surface in contact but permitting nutation of said disc during passage of thread between said disc and said surface and through the aperture in said means, and removable non-magnetic means spacing said magnet from said disc to vary the effect of the magnet on the disc.

8. 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 of light magnetic material having a hollow stem riveted thereto, depending from its lower surface for at least a half inch, and extending into said aperture, an annular magnet within said cap and coaxially mounted relative to said aperture, a spacer annulus of material of low permeability located between the magnet and the body to modify the effect of the magnet on the body, said spacer annulus being coaxially mounted relative to the magnet and the apertures of said cap, magnet and annulus being such as to permit free passage of thread therethrough when the stem is in position.

9. 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 projection extending from the other member and fitting loosely in the aperture in the first member to provide for the passage of thread beside the projection, a bodily rotating 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°, and magnetic means urging said members

toward one another to provide braking action to the thread as it is passed therebetween.

10. In a twister including a rotating spindle, a stationary yarn 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, an aperture in the upper surface of said cap registering with the bore in the spindle, a disc-shape body having a depending stem loosely extending into said aperture with sufficient clearance to permit the free passage of thread therethrough when the stem is in position, and magnetic means urging said body toward the top of said conical cap whereby the thread approaches the cap and the disc-shape body progressively from positions throughout an arc of 360° and passes between the body and cap and through the aperture beside the stem and effects relative nutation between the said cap and said body.

11. In a twister including a rotating spindle, a stationary yarn 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-shape body of magnetic material having an upstanding marginal flange and a hollow stem of non-magnetic material riveted to said body and depending therefrom through the aperture in the top of said cap, said stem and aperture affording clearance for the free passage of thread through the aperture when the stem is in position, an annular shelf in said cap, and an annular magnet resting on said shelf beneath the upper end of the cap and in position to act on said disc-shape body whereby the thread approaches the cap and the disc-shape body progressively from positions throughout an arc of 360° and passes between the body and cap and through the aperture beside the stem and effects relative nutation between the said cap and said body.

12. In a twister including a rotating spindle, a

stationary yarn 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-shape body of magnetic material having an upstanding marginal flange and a hollow stem of non-magnetic material riveted to said body and depending therefrom through the aperture in the top of said cap, said stem and aperture affording clearance for the free passage of thread through the aperture when the stem is in position, an annular shelf in said cap, an annular magnet resting on said shelf beneath the upper end of the cap and in position to act on said disc-shape body, and an annular shim separating said magnet from said body to vary the magnetic effect on the body and hence the drag imparted to the thread passing between said body and the upper surface of said cap whereby the thread approaches the cap and the disc-shape body progressively from positions throughout an arc of 360° and passes between the body and cap and through the aperture beside the stem and effects relative nutation between the said cap and said body.

CHADWICK B. KINGSBURY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,010,255	Bochman	Aug. 6, 1935
2,190,261	Feaster	Feb. 13, 1940
2,374,085	Gwaltney et al.	Apr. 17, 1945
2,397,153	Naumann	Mar. 26, 1946

FOREIGN PATENTS

Number	Country	Date
162,323	Great Britain	Apr. 26, 1921
545,462	Germany	Mar. 4, 1932
563,593	Germany	Nov. 7, 1932