Nov. 27, 1951 C. B. KINGSBURY 2,576,124

DOUBLE TWIST SPINDLE

Filed Dec. 19, 1949

FIG. 1.

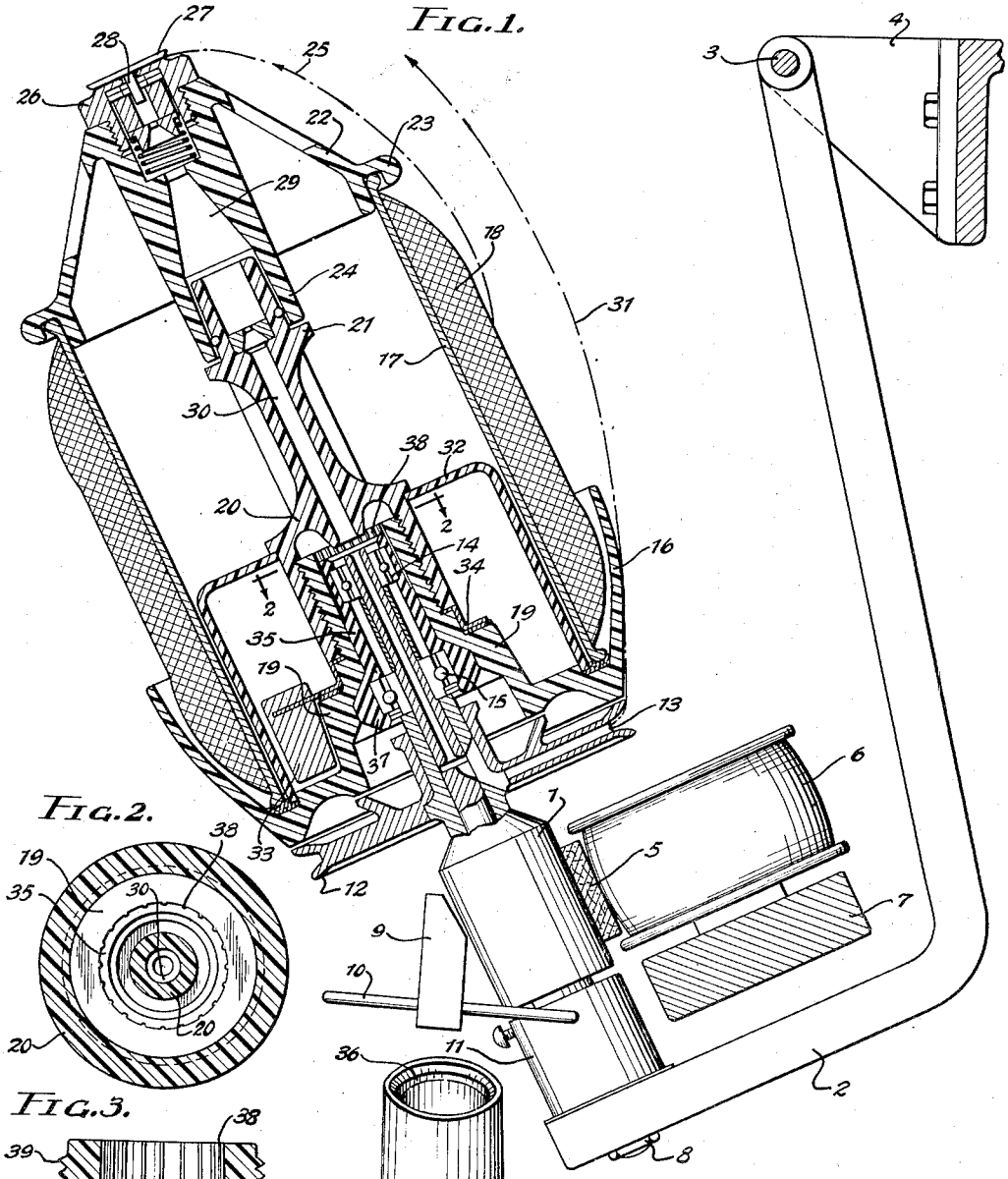
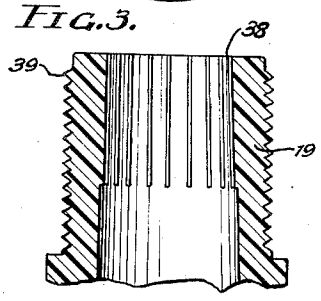


FIG. 2.

FIG. 3.



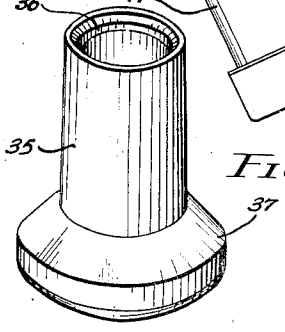


FIG. 4.

INVENTOR.
CHADWICK B. KINGSBURY.
BY Rudolph F. Bleg
ATTORNEY.

Patented Nov. 27, 1951

2,576,124

UNITED STATES PATENT OFFICE

2,576,124

DOUBLE TWIST SPINDLE

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

Application December 19, 1949, Serial No. 133,841

7 Claims. (Cl. 57—58)

1

This invention relates to improvements in twisting spindles and more particularly to double twist spindles of the type intended for imparting two twists to the yarn, thread, or the like, for each revolution of the spindle.

The purpose of the invention is to provide means for preventing the oscillatory movements or vibrations of one portion of the spindle from being transmitted in amplified form to another portion and causing improper functioning of the tensioning device of the spindle and damage to the yarn.

To this end the invention contemplates providing a twisting spindle assembly wherein a stationary structure which carries the yarn package is supported by bearings in non-rotating but permissibly gyratory relation on a rotating structure and wherein resilient means are interposed between said structures for preventing the transmission of oscillatory movements or vibrations from the rotating structure to the stationary structure.

Another object is to provide a twisting spindle structure wherein the vibration damping means interposed between the rotating and non-rotating structures is constituted as a sleeve or bushing made of resilient material such as rubber, synthetic plastic, or the like.

A further object is to provide a spindle structure that is adapted to embody such a vibration damping sleeve without requiring the machining of the spindle portion which carries the same to be carried to an uneconomical degree of accuracy.

Another object is so to arrange the means used for preventing the transmission, to the stationary structure, of the oscillatory vibration producing movements of the rotating structure, as not to restrain such movements to an extent which may impose undue strain on the bearings.

A still further object is to provide a spindle structure of which the resilient vibration damping members are constituted as readily removable and replaceable elements adapted to facilitate inspection, assembling and dismantling of the spindle.

In twisting spindles of the double twist type, the yarn package supporting portion contains an internal passage or bore extending from the top to the rotor or storage wheel. During operation of the spindle, yarn drawn from the yarn supply package enters the aforesaid bore at the top, passes down through the passage, enters a radial passage in the rotor and finally emerges from said passage. It then travels up, outwardly around in spaced relation to the spindle forming

2

a so-called "balloon," the twisted yarn then passing through a gathering eye and thence to a take-up package. In order to control the pull exerted by the balloon on the supply package, a tensioning means is disposed in the path traveled by the yarn on its way from the supply package to the ballooning zone. In double twist spindles where a free balloon is formed, it is customary to provide such tensioning means at or near the point where the yarn drawn from the supply package enters the central bore of the spindle at the top.

Such a tensioning means may comprise a disk-like member reposing on a support surface on the top of the spindle, the disk being provided with a depending stem extending loosely into the bore of the spindle. The yarn, drawn from the supply package, passes between the bottom surface of the disk and its support surface, down past the loosely fitting stem and thence through the bore in the spindle to a passage in the storage wheel or rotor, from which it emerges through a peripheral port thereon, thereafter forming the balloon aforesaid. An embodiment of a tensioning arrangement of this type, applied to a double twist spindle is disclosed for example in the copending application of Chadwick B. Kingsbury, Serial No. 118,645, filed September 29, 1949.

It has been found however that oscillatory movements and vibrations are produced in the rotating portion of the spindle due to minute inaccuracies in machining, variations in density of the constructional materials used, or other causes. While such vibrations are minute and ordinarily of no consequence at their place of origin, they become amplified by lever action as a function of the length of the parts through which they are transmitted. Moreover, despite extreme care in machining and balancing the rotating portion and the use of precision bearings for mounting the same, it is practically impossible to avoid a minute amount of so-called "runout" or lack of coaxiality between the journaled bottom of the rotating member and the free or non-journaled top portion thereof. This minute amount of run-out causes oscillation of the top portion at the point where the non-rotating yarn package support portion is carried. These oscillations are imparted to the stationary portion of the spindle and propagated through the latter to the locality of the tensioning disk. The oscillatory movements at that point may be of sufficient magnitude to cause the stem of the disk to oscillate radially within the confines

of the bore in which it reposes in loosely fitting fashion. Since the yarn, as it passes from the supply package to the rotor, must also pass through the bore and alongside the aforesaid stem, the yarn may become pinched between the stem and the inner wall of the bore and sheared off or at least weakened at intervals along its length. One object of the invention therefore is to provide means for preventing the vibrations or oscillations of the rotating portion of the spindle from being transmitted to the stationary portion and propagated through the latter to the tensioning device. Such means is constituted as a resilient damping device constituted as a resilient sleeve interposed between the rotating and stationary parts of the spindle.

Furthermore, although it is theoretically possible in the case of such spindles to provide bearings rigid enough to prevent the production of vibrations or oscillations in the spindle and to use expedients for balancing the spindle, such procedures are very costly. Moreover, if the oscillations or vibrations are completely restricted by rigid bearing structures, an undue degree of strain and wear is placed on the entire spindle assembly. The resilient damping means provided by the present invention, in addition to preventing the transmission of vibrations to the tensioning device also allows the spindle structure to vibrate or oscillate to a limited degree without imposing undue strain on the bearings.

Spindles of this type are used in large quantities and it is obvious that if the manufacturing tolerances required in their production are extended to extreme limits their cost would become prohibitive. It has been found desirable therefore to machine the parts of the metallic rotating structure as accurately as is economically possible and to fabricate the stationary portion, that cooperates therewith, from synthetic resins or the like, as by molding.

However it is difficult to hold molded parts to extreme tolerance and equally difficult to mold live resilient materials such as rubber to similar tolerances. For this reason, whenever rubber vibration absorbing members have been used in spindle structures they have heretofore been applied generally in the form of pre-loaded or otherwise stressed structures usually bonded integrally to certain of the parts of the spindle or held in compressive relation between such parts.

In accordance with the present invention however, the stationary portion of the spindle that receives the resilient vibration-damping sleeve is so constructed as to permit facile insertion and removal of the sleeve while also precluding the necessity for close manufacturing tolerances in both the sleeve and the stationary portion of the spindle that carries it. The resilient member is therefore not integrally retained in vulcanized or otherwise bonded form to any portion of the spindle.

An embodiment of the invention is shown in the the acompanying drawing, where:

Fig. 1 is a side elevation partly in section of a double twist spindle provided with one suitable form of vibration damping means.

Fig. 2 is a cross section taken on line 2—2 of Fig. 1 through the central lower portion of the spindle and the vibration absorbing sleeve.

Fig. 3 is a longitudinal section corresponding to Fig. 2 showing the internal construction of the portion in which the vibration absorbing sleeve is housed.

Fig. 4 shows the resilient sleeve per se.

Referring in detail to the drawing, the invention is illustrated as applied to a double twist spindle representative of those used in the art, although the invention is not limited in its application to this particular type. In the illustrative embodiment chosen the spindle comprises a rotating portion and a non-rotating structure carried by said rotating portion, said non-rotating structure being however permitted to gyrate to and fro on the rotating structure.

The rotating portion includes the whorl 1 mounted on bearings therein (not shown) and attached as by the nut 8 on its support shaft to an arm 2 pivoted at 3 to a bracket 4 of the spindle bank of a machine. The drive system for operating the spindle includes the belt 5, idler pulley 6 mounted on rail 7 and a brake indicated by 9 and operated by handle 10. 11 is a stationary portion of the bearing system carried by the arm 2.

Associated for rotation with the whorl 1 is the socalled rotor or storage wheel 12 characteristic of this type of double twist spindle. This is provided with radial ports 13 through which the yarn issues after passing downwardly through the central bore of the spindle and it is from the rotor 12 that the so-called "balloon" of yarn proceeds upwardly and whirls in spaced relation around the spindle. The non-rotating portion of the spindle comprises a structure carried by the rotating portion through intermediary of suitable bearings. In the embodiment shown, these bearings are indicated by 14 and 15. This non-rotating portion of the spindle is constituted so as to serve as a support for the yarn that is to be twisted. To this end it is formed as a bowl-shaped structure 16 which carries the spool or sleeve 17 that holds the yarn or thread 18. The bowl-shaped structure carries a central, upwardly extending member 19 having screw threads at its upper portion upon which is screwed an upwardly extending tubular extension 20 having a flange 21 for centering the conical cap 22 of the spindle. The flange 23 of the cap 22 rests on the sleeve 17 of the yarn package 18 and an internal downwardly extending portion 24 is carried by the tubular extension 20.

The yarn, drawn from package 18, passes in the direction of arrow 25 to the top of the spindle and between the cooperating parts of the tensioning device. This comprises the support 26, carried by cap 22, and the disk 27 with its stem 28. The support member 26 has a central bore and successive coaxial and contiguously located bores 29, 30 in the center of the spindle lead to the radial passage 13 of the rotor or storage wheel 12. The yarn passes downwardly through the spindle and, upon emerging, forms the balloon, represented as if in stroboscopically stopped position, by the line 31.

The inside structure of the spindle also includes an inverted cup-like member 32 and a biasing weight 33 carried by an arm 34 retained by the central portion of the bowl-like structure. This weight serves to keep the stationary portion of the spindle in a fixed position relatively to the rotating portion represented by the whorl 1. The stationary portion, represented generally by the bowl 16, yarn package, cap 22 and parts 20, 24, and 32 is able to gyrate or perform partial rotations with respect to the rotating portion as a result of undue pull or drag exerted on the yarn leaving the package 18 and is brought back to its position of rest by the weight 33. The various parts such as the bowl-like mem-

ber 16 and cap 22 are preferably made of a suitable molded synthetic material or plastic.

In order to prevent the oscillatory movements of the rotating portion from being imparted to the stationary portion and propagated through the structure of the latter to the tensioning device, a resilient vibration damping means is interposed between the two portions. In the preferred embodiment of the invention this is constituted as a sleeve as shown separately in Fig. 4. This is preferably made of live rubber, although a suitable resilient plastic material may be used. The sleeve has a tubular upper portion 35 with an internally extending flange 36. The bottom of the sleeve has an outwardly extending portion 37 in the general form of a large chamfered flange. This sleeve is shown in cross-section and operating position in Fig. 1. In the preferred embodiment of the sleeve an internal recess is present near the top, defined by the internally extending flange and and offset portion at a short distance therebelow. This recess accommodates the bearing 14 with a sung fit and a similar recess in the large lower chamfered flange accommodates the bearing 15. In each case however no preloading stress is imposed on the sleeve or any substantial compressional stress when the sleeve is in place. Depending on the construction of the spindle and the size of the bearings used, the proportions of the sleeve and the size of the recesses may vary accordingly.

The sleeve is retained in place in the spindle as shown in Fig. 1. It fits snugly but without preloading stress into the bore of the internally upwardly extending portion 19 of the bowl-like member 16. The inside wall of this bore is provided with small ribs 38 as shown partly in Fig. 1 and in greater detail in Figs. 2 and 3. These ribs take up any irregularities present between the rubber sleeve and the walls of the bore of the member 19 without unduly compressing the rubber. The resilient sleeve can therefore be easily inserted and retained without deforming the entire mass of the rubber inasmuch as only the small ribs dig into the rubber. The ribs extend vertically in spaced relation about the inside wall of the member 19 and outwardly from said wall to the extent of approximately twenty thousandths of an inch. In the preferred embodiment they extend vertically slightly more than half way down the bore and said bore may be slightly relieved beyond that point and tapered if desired, to facilitate fitting of the sleeve. The beadings may of course also extend completely down the wall of the bore. As shown in Fig. 4 the tubular portion of the sleeve may be slightly tapered to facilitate fitting into the bore.

In assembling the spindle the resilient sleeve is arranged to embrace the bearings 14 and 15 on the rotating portion of the spindle which carry the non-driven or so-called stationary part. The internally beaded portion 19 of the bowl-like structure 16 is then forced over the tubular portion 35 of the sleeve so as to occupy the position shown in section in Fig. 1.

Due to the presence of the sleeve, any oscillation of the rotating portion of the spindle is effectively damped and is prevented from reaching the stationary structure and from being propagated therethrough in amplified form. The upstanding portion 19 of the bowl-like structure is externally threaded as at 39 to receive the tubular central portion 20 of the spindle which in turn aids in supporting the cap or top 22. The result is that the non-rotating portion of the spindle is constituted as a unit which is carried in vibration-insulated fashion by the rotating portion.

Due to the hereinbefore described method of applying the resilient sleeve and the beaded structure of the spindle portion into which it fits, the sleeve may be readily removed during the dismantling of the spindle to permit inspection of the bearings. The sleeves as well as the bore that receives it need not be finished to uneconomical size tolerances and may be manufactured in quantities for use on any spindle of a given type.

While this invention has been described in detail with respect to certain preferred embodiments it is, of course, understood that various modifications may be made therein and it is therefore not desired to limit the invention to the exact details described and shown except in so far as they are defined by the claims.

What is claimed is:

1. In a double twist spindle the combination of a stationary shaft, a driven spindle portion and a non-driven spindle portion, one end of said driven portion being arranged for rotation on said shaft, the other end of said driven portion carrying bearings for supporting said non-driven spindle portion for permissible partially rotational gyration on said bearings relatively to said driven portion, a bore in said non-driven portion, a resilient sleeve embracing said bearings, said sleeve and said bearings being carried in said bore, the wall of said bore being provided with longitudinally spaced beadings for engaging said sleeve to retain said sleeve in a non-preloaded condition of repose.

2. In a double twist spindle of the type comprising a driven portion and a stationary portion mounted on bearings on said driven portion for permissible gyratory movement relatively therewith and wherein yarn is drawn from a package carried by said stationary portion, passes through a tensioning device carried by said stationary portion and then through the driven portion and issues from the latter, thereafter forming a balloon, the improvement which comprises the provision of a bore in a portion of said non-driven portion, a rubber sleeve disposed between said driven portion and said stationary portion and embracing said bearings whereby to prevent the transmission of vibrations from said driven portion to said stationary portion and their propagation in amplified form through said stationary portion to said tensioning device, the inner wall of said bore having longitudinal beadings for engaging said sleeve in non-preloaded condition with a minimum of compressional strain.

3. In a double twist spindle wherein a driven portion carries a non-driven portion, the improvement comprising the provision of sets of bearings in spaced relation on said driven portion for carrying said non-driven portion, a single resilient sleeve having internal recesses for embracing said bearings, a bore in said non-driven portion for receiving said sleeve and longitudinal ribs extending radially outward from the inside wall of said bore for engaging said resilient sleeve at spaced substantially line-contact portions whereby to retain said sleeve in a condition of non-preloaded repose substantially devoid of compressional strain.

4. In a double twist spindle the combination of a stationary shaft, a driven spindle portion, a non-driven spindle portion, said non-driven spindle portion having a bore for receiving the

top of said driven spindle portion, upper and lower sets of bearings carried in spaced relation by said driven spindle portion in said bore, and a sleeve of resilient material fitted into said bore substantially throughout the length thereof, the outside surface of said sleeve fitting snugly against the inside surface of said bore, said sleeve having recesses in the end portions thereof for receiving and for encircling said upper and lower sets of bearings, the portion of said sleeve extending between said sets of bearings being spaced from said driven spindle portion.

5. In a double twist spindle the combination of a stationary shaft, a driven spindle portion, a non-driven spindle portion, said non-driven spindle portion having a bore for receiving the top of said driven spindle portion, upper and lower sets of bearings carried in spaced relation by said driven spindle portion in said bore, and a live rubber sleeve fitted into said bore substantially throughout the length thereof for encircling said upper and lower sets of bearings, said rubber sleeve being slightly tapered to facilitate fitting into said bore and fitting snugly into said bore without preloading stress.

6. In a double twist spindle the combination of a stationary shaft, a driven spindle portion, a non-driven spindle portion, said non-driven spindle portion having a bore for receiving the top of said driven spindle portion, upper and lower sets of bearings carried in spaced relation by said driven spindle portion in said bore, and a sleeve of resilient material fitted into said bore substantially throughout the length thereof, said sleeve having recesses in the end portions thereof for receiving and for encircling said upper and lower sets of bearings, said sleeve being slightly tapered

to facilitate fitting into said bore and fitting snugly into said bore without preloading stress.

7. In a double twist spindle the combination of a stationary shaft, a driven spindle portion, a non-driven spindle portion, said non-driven spindle portion having a bore for receiving the top of said driven spindle portion, upper and lower sets of bearings carried in spaced relation by said driven spindle portion in said bore, and a sleeve of resilient material fitted into said bore substantially throughout the length thereof, said sleeve having recesses in the end portions thereof for receiving and for encircling said upper and lower sets of bearings, the bottom portion of said sleeve being of substantially larger diameter than the upper portion thereof to provide substantially greater thickness of said resilient sleeve between said lower set of bearings and the corresponding inner surface of said bore than is provided around said upper set of bearings, the outside portion of said sleeve extending between said sets of bearings being slightly tapered to facilitate fitting into said bore and fitting snugly into said bore without preloading stress.

CHADWICK B. KINGSBURY.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
2,115,268	Klein	Apr. 26, 1938
2,127,921	Kent	Aug. 23, 1938
2,374,085	Gwaltney et al.	Apr. 17, 1945
2,379,806	Kent	July 3, 1945