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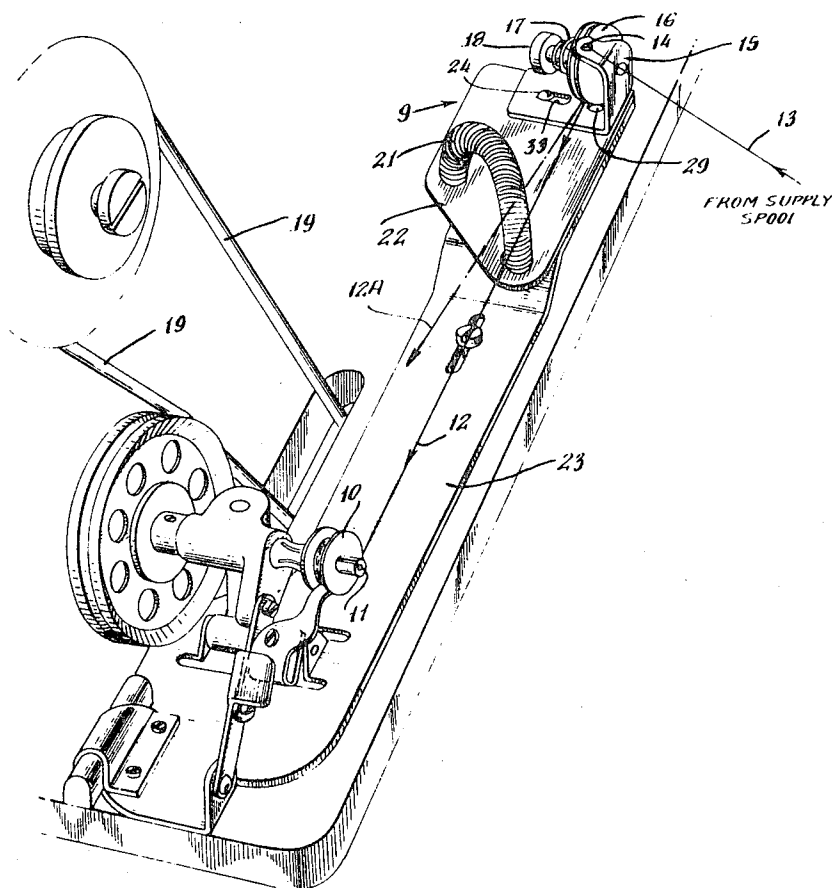
[54] **THREAD CONTROLLER DEVICE**
7 Claims, 6 Drawing Figs.

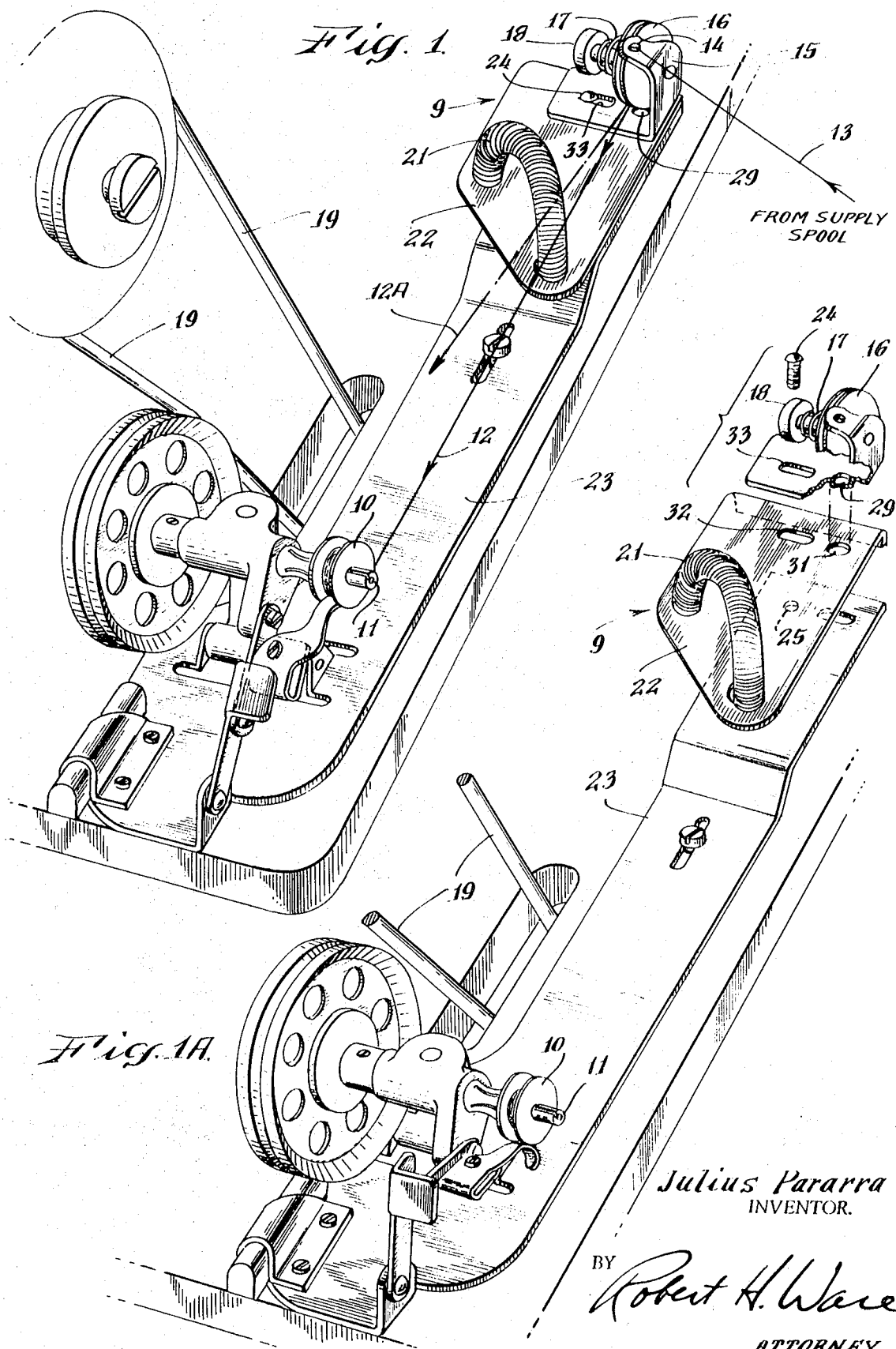
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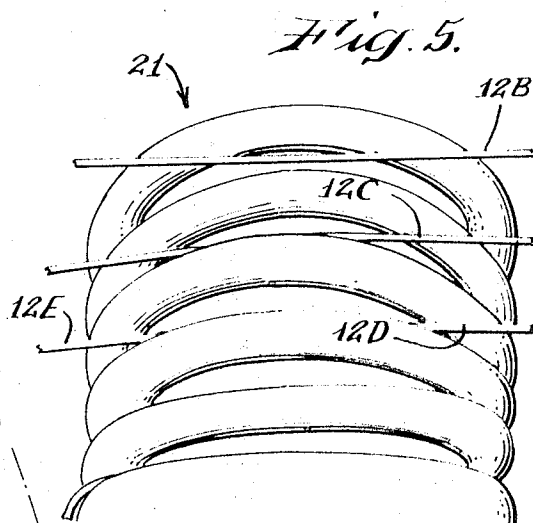
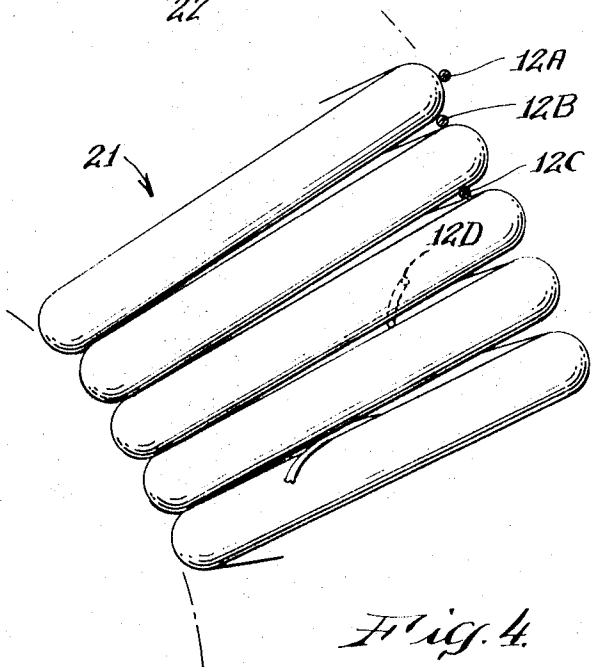
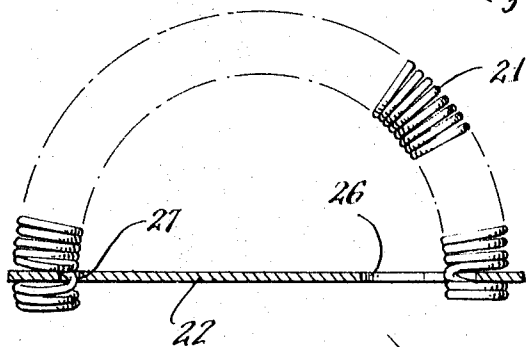
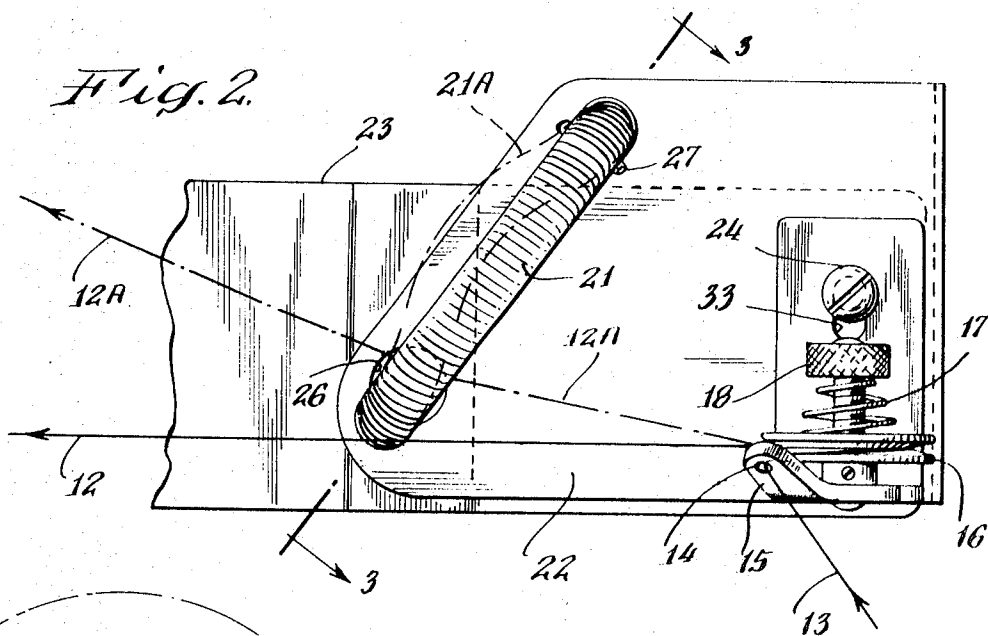
ABSTRACT: Thread controller devices for incorporation in bobbin winding mechanisms and other strand- or thread-carrying machines where a fast moving strand may be inadvertently caught and seized by a rapidly moving drive belt or gear train, which often develops a charge of static electricity strongly attracting the nearby thread, quickly drawing in large quantities of thread and producing a tangled jam of thread in the drive mechanism of the device before the operator can react to stop the machine. A helical coil spring is arched in an arcuate configuration with the radially innermost portions of the spring turns in contact while the radially outermost portions of the spring turns are angularly separated, creating a fanned array of wedge-shaped apertures with their openings presented laterally toward the endwise-moving strand rapidly passing the device. Inadvertent deflection of the strand from its path of endwise movement deflects the endwise-moving strand into one of the wedge-shaped apertures between the spring turns, producing immediate, automatic halting and breaking of the deflected moving strand, and thus avoiding tangled masses of thread tightly jammed on sheaves and drive belts.





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THREAD CONTROLLER DEVICE

BACKGROUND OF THE INVENTION

Conventional bobbin winding mechanisms employed on all forms of lock stitch sewing machines utilize an elongated span of thread, drawn by the operator from a supply spool through and over suitable guides or sheaves to be wrapped on a bobbin rotated at high speed. The high-speed drive of these machines is customarily produced by an elastic rubber belt, and one or more drive belts may be employed closely adjacent to the unsupported span of thread being wound rapidly on the bobbin. Inadvertent deflection of the thread by the operator or others frequently causes the unsupported span of thread to touch the racing drive belt. The rapidly moving drive belt often carries such a deflected "runaway" thread with it into the drive mechanism, producing a readily accumulated tangled mass of thread, twisted and jammed around belts, sheaves, shafts and adjacent frame structures of the machine.

The operator's normal reaction time is often insufficient to prevent such runaway thread jams, and machines are often shut down for many minutes or hours while skilled maintenance personnel disassemble the device and pry or cut off the tangled jam of thread. Lost production time and wasted man hours caused by such runaway thread jams significantly increase manufacturing cost and consumer prices for textile products.

Similar tangled runaway jams occur in other types of machines where unsupported strands of fast moving thread, yarn, or similar strand materials pass close to high speed driving mechanisms such as elastic drive belts.

Thus there exists an important unfilled need for strand-controlling devices capable of instantaneous severing of a deflected thread or strand in order to minimize or eliminate such jams by reducing to an insignificant minimum the length of strand which may be drawn into the drive mechanism of the machine.

Accordingly, a principal object of the present invention is to minimize or eliminate jams in strand-handling machines, such as sewing machine bobbin winders.

A further object of the invention is to provide strand-controlling devices capable of gripping and breaking a deflected unsupported strand in response to its lateral deflection from its predetermined path of endwise movement.

Another object of the invention is to provide such strand controller devices capable of producing immediate and substantially instantaneous severing of this unsupported strand when it is laterally deflected from its intended path of endwise movement.

A further object of the invention is to provide thread controller devices incorporating an arched helical coil spring, having its turns splayed to form wedge-shaped spaces between them capable of receiving, seizing and causing prompt breaking of the deflected span of thread.

Other and more specific objects will be apparent from the features, elements, combinations and operating procedures disclosed in the following detailed description and shown in the drawings.

THE DRAWINGS

FIG. 1 is a perspective view of a sewing machine bobbin winding attachment in its engaged winding mode incorporating a thread controller device embodying the present invention;

FIG. 1A is a corresponding perspective view of the same bobbin winding attachment in its disengaged, nonwinding mode, shown partially disassembled;

FIG. 2 is a fragmentary top plan view of the thread controller device shown in FIG. 1;

FIG. 3 is a slightly enlarged, diagonal elevation view, partially in cross section, showing the arched helical coil spring incorporated in the thread controller device of FIGS. 1 and 2;

FIG. 4 is a greatly enlarged fragmentary elevation view, corresponding to the view of FIG. 3, showing a short thread-engaging portion of the arched helical coil spring of FIG. 3; and

FIG. 5 is a similar, fragmentary, end elevation view of the arched helical coil spring of FIG. 4.

DESCRIPTION

The thread controller devices of the present invention are typified by the embodiment illustrated in FIG. 1, positioned at the rear of a sewing machine bobbin winding attachment and assembled with the rear thread guide sheave support. This thread controller 9 underlies the unsupported, endwise-moving strand of thread spanning the space between the thread guide sheave and the bobbin mounted before the operator on the bobbin winder at the front of the bobbin winding work station, at the left side of FIG. 1. As there shown, a bobbin 10 is mounted on a power-driven shaft 11 on which it is rotated at high velocity to achieve high speed winding of thread on the bobbin 10. A thread 12 being delivered for winding on the bobbin is led in a delivery segment 13 from a supply reel above the bobbin winding mechanism (not illustrated in the drawings) through a suitable guide aperture 14 in a guide sheave support 15 and over a tensioning guide sheave 16. The guide sheave is generally formed as two facing clutch plates biased together by a resilient spring 17 mounted on a stud 18 protruding from support 15, to provide a thread gripping clutch or brake device to tension the thread being fed to bobbin 10. The thread loop is inserted to force the two facing clutch plates forming this sheave 16 apart against the resilient bias of the spring 17, and permitting the thread loop to slide between the two clutch plates where it is tensioned by friction to produce the desired winding tension as the thread is wound on bobbin 10.

After passing around tensioning guide sheave 16, the strand of thread travels endwise along the unsupported span 12 toward the front of the work station, to be wound on bobbin 10. Since the drive belt 19 providing driving torque for the bobbin winding attachment and for the sewing machine itself is generally positioned beside the unsupported thread span 12, inadvertent deflections of this span in the direction of the drive belt 19 often result quickly in the costly runaway thread jams described above.

ARCHED HELICAL COIL SPRING

The thread controller of the present invention is positioned beside the intended endwise path of the unsupported thread span 12, and between this path and the nearby plane of the drive belt 19 creating the risk of seizing and capturing the thread. As indicated in FIGS. 1 and 2, the preferred embodiments of the invention incorporate a "compressed" helical coil spring 21 with tightly coiled contacting turns. Spring 21 is upwardly convexly arched to resemble the Gateway Arch Monument in St. Louis, Missouri, a roughly semicircular, up-standing arch. The thread span 12 does not pass through the arch of spring 21, but instead passes outside and closely adjacent to the arched helical coil spring 21.

During normal bobbin-winding operations, the path of unsupported thread span 12 is spaced from the nearest turns of the arched helical coil spring 21 by a substantial distance, on the order of an eighth to a quarter of an inch or more, for example, and the thread controller spring 21 does not interfere with normal bobbin winding in any way.

Lateral deflection of the unsupported thread span 12 toward the viewer in FIG. 1, away from belt 19 and spring 21, may provide slight friction against the near flanges of bobbin 10 or sheave 16, slowing the endwise advance of the thread 12, but otherwise has no significant effect on the bobbin-winding operation unless such deflection proceeds to the point where the arriving thread is angularly diverted over the flange of the bobbin.

Inadvertent lateral deflection of the unsupported thread span 12 toward belt 19 and spring 21, upward in the top view of FIG. 2, constitutes the deflection creating the serious risk of belt jamming. Accordingly, the thread controller 9 is positioned so that as thread 12 is deflected toward spring 21, from path 12 toward the deflected thread path 12A shown in dash

lines in FIG. 2, the thread reaches and engages the exposed periphery of coil spring 21 before it reaches the vicinity of drive belt 19.

As shown in the drawings, the spring 21 is held in its upward convexly arched configuration by the anchoring of its ends on a base plate 22 anchored between a bobbin winder base 23 forming the platform for the bobbin winder attachment, and an upstanding guide sheave support 15. These assembled parts are anchored by such means as a screw 24 fitting through suitable aligned apertures in guide sheave support 15, base plate 22 and the bobbin winder base 23.

As indicated in FIGS. 1-3, the forward end of the spring 21, comprising the last two or three turns of the spring, is positioned on the diagonally foremost corner of plate 22 closest to thread 23, engaged in a circular aperture 26 in plate 22, having an inside diameter slightly greater than the outside diameter of spring 21. The edge of aperture 26 fits between two adjacent turns of spring 21, which sandwich and grip the plate 22 between themselves, firmly anchoring the front end of spring 21 in position on one edge of aperture 26. The diagonally rear-most end of spring 21 is similarly anchored in position by having its final few turns "threaded" through a differently shaped rear anchoring aperture 27, which may be formed as an elongated slot having a width slightly greater than the wire diameter of the resilient spring wire of which helical coil spring 21 is formed, as shown in the top view of FIG. 2.

CONSTRUCTION AND ASSEMBLY

The assembly of the thread controller device shown in the drawings thus comprise the upright positioning of a predetermined short length of the helical coil spring 21 with its lower end juxtaposed with slot aperture 27, and the rotative, downward, helical advance of the spring 21 with its lowermost free end being inserted through slot aperture 27 and being turned to thread this free end through slot 27 to reach the threaded, installed position illustrated in FIG. 3. The uppermost end of this predetermined short length of helical coil spring is then bent forward to form the upright arch shown in the drawings, and this free end is then inserted through the forward aperture 26 and urged outwardly, away from slot aperture 27, to form the sandwiched-anchoring engagement illustrated in FIG. 3, firmly positioning the helical coil spring 21 in a stiff resilient upstanding arch diagonally positioned beside and close to the unsupported thread span 12.

In the preferred embodiments of the invention, the helical coil spring 21 is formed of American Steel Wire (Washburn & Moen or Roebling) Gage number 48 spring steel wire 0.0048 inch OD, coiled into a tight helix having an outside diameter of approximately 3/8th of an inch. The predetermined short length of this helical coil spring employed to form spring 21 is about 2 and 7/8 inches-long, electroplated or hot dipped zinc galvanized spring steel. The preferred dimensions of spring 21 may of course be varied as desired, and the angular diagonal position of the arched spring 21 relative to the thread span 12 may also be changed if desired.

RUNAWAY THREAD CONTROL OPERATION

As the thread 12 at position 12A (FIG. 4) is deflected further to position 12B, as shown in FIG. 4, it enters a wedge-shaped space between two adjacent turns of spring 21. Further sidewise deflection, toward rear aperture 27 and the drive belt 19 to be protected by the device, causes further descent of the thread toward the position 12C shown in FIG. 4 and FIG. 5 causing the span of thread to be engaged more deeply in the wedge-shaped space between the spread turns of spring 21.

As indicated in FIG. 5, as the deflected thread descends deeper between the spring turns into the wedge-shaped aperture therebetween, it eventually reaches a position where the spacing between the turns of spring 21 is insufficient to permit further inward movement of the thread 12, which thus finds itself in frictional engagement with the facing surfaces of the spring turns. This frictional engagement produces drag forces

tending to impede the advance of the thread 12, and these drag forces are increased with further lateral deflection of the thread, ultimately causing the thread 12 to be seized at a point 12D between two turns of spring 21 with sufficient tractive drag force to create tensile stress within the thread causing it to break, when this tractive drag opposes the winding tension produced by rotation of bobbin 10 or the runaway tension produced by snagging of the thread on drive belt 19.

If the lateral deflection of the unsupported thread span 12 has progressed sufficiently far to bring the thread into contact with belt 19, the thread may be drawn rapidly along with belt 19 into its drive sheaves, but the tractive engagement and breaking of the span 12 permits only an extremely short length or runaway thread to be drawn along with the belt 19. The remainder of the thread halts its endwise movement, and the short thread span 29 between spring 21 and sheave 16 is presented in convenient position for manipulation by the operator for rethreading a fresh span 12 from sheave 16 to shuttle 10. The short length of runaway thread drawn into belt 19 will normally be only a foot or two in length, and has no significant effect upon the drive belts or sheaves in the adjacent drive mechanism of the nearby machinery.

The arched spring 21 presents a large plurality of wedge-shaped apertures fanned or splayed in an arc facing the predetermined path of endwise movement of the strand 12. When strand 12 is deflected to bring it into engagement with spring 21, as at path 12A, each of the protruding rounded peripheries of the intervening spring turns (FIG. 5) provide smooth guide ridges over which strand 12 slides instantly into the nearest wedge-shaped aperture, as at path 12B.

In the position illustrated in FIG. 2, with a "rake" angle of about 60° between the central plane 28 forming the "arch plane" of the arched spring 21 and the thread span 12, the deflected thread, moving toward deflected path 12A, reaches its first contact with spring 21 at a point nearer to guide sheave 16 than the arch plane 28.

The rake angle between spring 21 and thread 12 shown in FIG. 2, producing this first contact of thread 12A with spring 21 at a part of spring 21 closer to sheave 16 than central arch plane 28, places the point 12D of tractive engagement and seizure of the thread between the turns of spring 21 at a point of "entry" of the advancing thread between the turns of the spring. This provides a "fail safe" factor in that a second point of engagement 12E, shown at the left-hand side of FIG. 5, is also available at a subsequent position along the path of travel of the thread 12, where the thread again passes between the turns of spring 12 on its "exit" therefrom. The second seizure point 12E may serve to provide the required tractive engagement and breaking force on thread 12 if the arch of the spring 21 should be rearwardly deflected toward sheave 16 by the operator's hand, for example.

It will be evident from an inspection of FIGS. 1 and 2 that the upward convex arch of spring 21 provides a large multiplicity of wedge-shaped gaps between adjacent turns of the spring, all facing directly outward toward the various alternative positions of the deflected path 12A of the thread. Accordingly, deflections downward, rearward or laterally sidewise toward the belt 19 all move the thread 12 toward the outermost periphery of spring 21, eventually causing the thread 12 to enter a wedge-shaped space between two adjacent turns of the spring 21, in the manner shown in FIG. 4. When spring 21 is arched along a curved axis substantially coinciding with a circular arc, the resulting even distribution of distortion along spring 21 produces these similar wedge-shaped apertures arrayed around the entire exposed periphery of spring 21. If the arch departs notably from a circular arc, one or more "straighter" portions of the spring 21 then fail to provide wedge-shaped apertures because the turns of the spring are not spread apart angularly over such straight portions.

The "compressed" arched helical coil springs utilized in the preferred embodiments of the invention exhibit a balance of stiffness and flexibility providing a slight forward flexing capa-

bility. This permits spring 21 to lean or bend toward the bobbin 10 to a flexed position such as 21A shown in dashed lines in FIG. 2. Such bending is normally produced by the tractive friction drag force tensioning the thread as it engages the spring turns at seizure point 12D, causing the wedge-shaped spaces between the turns of spring 21 to revolve or roll away from sheave 16 counterclockwise as viewed in FIG. 5, as the spring deforms flexibly and leans away from sheave 16. As a result, the points of closes contact of the spring turns move out of central arch plane 28, revolving counterclockwise toward sheave 16. This produces an even tighter grip of the two spring turns seizing thread 12 at seizure point 12D, further increasing friction and resulting thread tension to achieve the desired thread-breaking tensile stress promptly and effectively in thread 12.

The simplicity of construction of the thread controller devices of the present invention is illustrated by the embodiment shown in the drawings, where only two additional parts, plate 22 and spring 21, are required for fabrication, assembly and insertion between conventional existing structures 15 and 23 of a standard bobbin winding assembly. The manufacturing economy of the assembly of parts 21 and 22 as illustrated in the FIGURES provides a significant advantage over prior art thread controller devices such as those shown in U.S. Pat. Nos. 840,887; 1,187,071; 2,261,680; 2,752,872 and 2,867,184. Several of these patents show helical coil springs surrounding elongated cutter blades used for severing a span of thread. These prior art devices fail to utilize the tractive frictional engagement of the span of thread between adjacent turns of the spring to provide the thread controlling, guiding, gripping and breaking action of the devices of the present invention. Instead a sharpened cutter blade is positioned for engagement with the thread and provides a far less reliable and far more expensive device for controlling deflected thread.

A further advantage of the thread controllers of this invention is their thread-severing capability. A quick, intentional, manual deflection of thread 12 into engagement between the turns of spring 21 causes the spring to seize and break the thread. The operator may thus remove the filled bobbin while the free end of thread 29 is held, convenient for threading and winding on the next bobbin.

Another advantage of these devices is their combined safety and versatility. No knife blades or sharp cutting edges are employed, but manual depression of the strand laterally or downward toward spring 21 from any angle produces quick, safe and highly effective cutting operation, while also gripping and presenting the freshly severed strand-end for manual withdrawal whenever required.

Loosening of the clamping screw 24 in its thread screw-receiving aperture 25 formed at the rear end of base 23 permits lateral adjustment of tension guide sheave 16 to centralize strand 12 on bobbin 10 for evenly distributed winding thereon. To assure corresponding lateral movement of spring 21 simultaneously, a lug 29 depending from support 15 is aligned to engage a hole 31 formed in plate 22, and a lateral adjustment slot 32 formed in plate 22 receives screw 24 as it protrudes downward through a corresponding aligned lateral adjustment slot 33 formed in support 15. Support 15 and plate 22 may thus be moved together laterally, guided by their adjustment slots and by a downturned rear flange 33 of plate 22 embracing the rear edge of base 23. Pivoting movement of plate 22 is thus substantially eliminated, avoiding inadvertent engagement of the arched thread controller spring 21 with the adjusted strand 12 until the strand is deflected toward the spring.

The devices of the present invention are primarily useful with bobbin winding attachments of lockstitch sewing machines but similar textile machines incorporating an unsupported span of yarn or thread passing close to a high speed drive device such as a belt or a gear train may likewise be protected by the devices of the present invention, merely requiring that the arched spring 21 should be mounted beside and convexly bowed toward the normal path of endwise travel of the unsupported span.

Since the foregoing description and drawings are merely illustrative, the scope of the invention has been broadly stated herein and it should be liberally interpreted so as to obtain the benefit of all equivalents to which the invention is fairly entitled.

15 What is claimed is:

1. In a sewing machine bobbin winder incorporating a strand guide sheave and a bobbin drive shaft carrying a drive sheave engageable with an adjacent exposed sewing machine drive belt, the improvement comprising a strand-controlling device for engaging and breaking a strand traveling in endwise movement through a strand zone from said guide sheave to a bobbin on said bobbin drive shaft past said exposed drive belt comprising a convexly arcuate controller interposed adjacent to said strand zone and between said zone and said exposed drive belt with its outermost periphery formed into a plurality of fanned wedge-shaped apertures.

A. having their innermost ends narrower than the diameter of the unsupported strand, and

B. having their outermost ends opening outward toward the vicinity of the adjacent strand zone and arrayed in an arc spaced closely adjacent to the strand zone in an arch plane transversely intersecting the strand zone,

whereby deflected lateral movement of the endwise moving strand toward the arcuate controller and into interfering engagement therewith brings the deflected strand into one of the wedge-shaped apertures and into jamming engagement with the controller at the narrow end of said one aperture, automatically breaking the strand and preventing the catching and tangling of the strand in said exposed drive belt.

2. The device defined in claim 1 wherein the arcuate strand controller is formed as a helical coil spring attached in the arch plane closely adjacent to the predetermined strand zone.

3. The device defined in claim 2 wherein the arched spring has both of its ends secured to a support plate anchored to a portion of said bobbin winder near said strand guide sheave.

4. The device defined in claim 3 wherein the support plate is a thin, rigid plate provided with a pair of spring end-engaging apertures, a first aperture having its narrowest dimension greater than the wire diameter of the wire coiled to form the spring for threaded engagement with a first free end of the spring therein, and a second aperture having its minimum dimension greater than the outside diameter of the spring itself for receiving the second opposite free end of the spring inserted therethrough for sandwiching engagement of the aperture rim between two adjacent spring turns near the spring's second free end.

5. The device defined in claim 2 wherein the arched helical coil spring is resiliently deformable by strand tensile force and by manual force exerted by an operator.

6. The device defined in claim 2 wherein the helical coil spring is arched along a curved axis substantially coinciding with an arc of a circle.

7. The device defined in claim 5, wherein said strand guide sheave is mounted on the support plate.