AUTOMATIC STOP SPINDLE MECHANISM

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AUTOMATIC STOP SPINDLE MECHANISM

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This invention relates to yarn twisting machines and more particularly to a novel and improved spindle and automatic stop spindle mechanism for use on such machines.

In textile operations, extensive use is made of a yarn twisting machine, wherein yarn is fed from a plurality of single strand yarn packages to a yarn trap, twisted into a single multi-ply strand, and then wound upon a bobbin rotated by a spindle. In this operation the yarn or the strand frequently breaks, and some means must be provided for immediate detection of the break and stoppage of the spindle carrying the rotating bobbin. In these machines it is essential that only the spindle associated with the break be stopped without stoppage of the other spindles driven by the general drive mechanism of the machine. In most standard machines the spindles are associated in groups of from two to four spindles, and a single drive belt, tape or band drives one of these groups. This drive belt is powered by the general drive mechanism of the machine.

In previously known structures a break is applied automatically to a single spindle when a break in the yarn occurs, and this break stops both the whorl and the spindle. However, the belt driving the group of whorls and spindles continues to turn. This tends to interfere with the speed of the remaining operative spindles, causing slack twist and other work deficiency. An alternative problem is that the belt may burn out from friction if the stoppage is too long.

It is an object of the present invention to provide a new and more efficient spindle and spindle stop which eliminates many deficiencies of the prior structures, including those just noted.

It is another object of the invention to provide a spindle stop which simultaneously applies a break to the spindle and disconnects the whorl from the spindle blade, permitting the whorl to move freely with the belt, avoiding any interference with the other spindles, and enabling an operator to patrol more spindles than was previously possible.

Still another object of the invention is to provide a low cost spindle stop having only two moving units and which is operated by the compressed air system which is found in the operating areas of practically all textile mills.

Another object of the invention is to provide an improved spindle wherein the spindle blade, whorl and friction disc can be removed as a unit from the machine by the simple unfastening of a pair of spring clips.

Another object is to provide a new and improved spindle in which spring clips and grommets effect full floating action of the spindle blade, reducing vibration, and which spring clips are adjustable for control of spindle tension.

Another object is to provide a spindle stop wherein only one friction surface is required for clutching and braking.

Other advantages of the present invention include the provision of a cushioning effect when the brake is applied, eliminating grabbing or sudden shock, the use of the standard yarn trap mechanism for actuating the stop mechanism control, and the adjustment of brake tension by simple regulation of an air valve.

With the above and other objects in view, as will be presently apparent, the invention consists in general of certain novel details of construction and combinations of parts hereinafter fully described, illustrated in the accompanying drawings and particularly claimed.

In the drawings, like characters of reference indicate like parts in the several views, and

Figure 1 is a fragmentary view of a yarn twisting apparatus embodying the present invention, showing a side elevation of the improved spindle, the air switch for controlling the spindle stop as it cooperates with the yarn trap, and the manner in which the yarn is fed from the yarn packages to the yarn trap and thence to the spindle driven bobbin; Figure 2 is a fragmentary view generally similar to Figure 1, but showing an alternate form of the invention wherein an electrical control circuit is used for controlling the spindle brake air valve; Figure 3 is a horizontal longitudinal section taken through the air valve shown in Figure 1; Figure 4 is an enlarged fragmentary view of the spindle and spindle stop structure shown in side elevation and partly broken away to show details of the structure; Figure 5 is a top plan view of the spindle base, taken on the line 5—5 of Figure 1, with the spindle blade assembly, brake plate and pistons removed therefrom, and showing the air supply passages to the spindle stop cylinders; Figure 6 is a top plan view of the spindle cap with spring clips and grommets removed; and

Figure 7 is a fragmentary perspective view of a pair of spindles, showing the manner in which a pair of spindles and their whorls are driven by a single belt, tape or band.

In Figure 1 of the drawings, the letter A indicates the new and improved spindle and the automatic stop spindle structure which is incorporated therewith. The letter B indicates the yarn trap of the yarn twisting machine, most of the operative details of which in themselves are not a part of the present invention. It is necessary to show this structure, however, in order to fully disclose the operation of the present invention and particularly the relation of the yarn trap to the air valve which controls the operation of the spindle stop. The letter C indicates the yarn packages which feed yarn to the yarn trap.

Spindle structure

The spindle structure A will now be more specifically
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3. described, with particular reference to Figures 1, 4, 5 and 6 of the drawings.

The reference numeral 10 indicates a base rail on the yarn twisting machine which supports the spindle base 11. A spindle rail 12 supports other portions of the spindle structure. The spindle base 11 extends through an opening 13 in the spindle rail which is larger in diameter than the spindle base. A spindle blade 14 is supported in the spindle base 11, the lower shank 15 extending into an elongated vertical bore 16 in the base. The lower shank 15 of the spindle blade is pointed as at 17, and it provides a contact seat 18 in the spindle base. The spindle blade 11 is further provided with a roller bearing 19 so that the spindle blade may easily rotate in the base 11 at very high speed.

On the spindle rail 12 and positioned around the upper end of the spindle base is positioned a brake base 20. This is preferably a casting which is formed of a generally circular bottom plate 21 with upwardly projecting posts 22 and 22'. These posts 22 and 22' are provided with bores 23 and 23' which extend the length of the posts. A plug 24 seals the lower end of each of the bores. Each post 22 is provided with an outwardly projecting boss 25. These bosses are drilled and threaded to receive the screws 26, for a purpose later described. The bottom plate is provided with an aperture 27 through which the spindle base 11 freely extends.

As shown in Figure 5, the bottom plate 21 is provided with two diagonally directed bores 28 and 29. The bore 28 is drilled from a notch 30 in the side of the bottom plate to intersect the bore 23 of the post 22. The bore 29 is also drilled from the side wall so as to intersect both bore 28 and bore 23' in post 22'. The side wall end of bore 29 is plugged as at 31 to seal the end. The end of the bore 28 at the notch 30 is enlarged and threaded as at 32 for the air conduit fitting.

The post bores 23 and 23' are provided with short sleeves 33 and 33' which are so tightly fitted as to rest end thrust within the bore 23. A piston rod 34 reciprocates in said bore 23, which is provided with the usual head 35 and washer 36. A coil compression spring 37 is placed between the head 35 and sleeve 33, tending to bias the piston rod 34 downwardly into the bore 23. A vent 98 is provided in the side wall of each of posts 22 and 22' to release air from the spring cavity, preventing a cushioning effect when air is applied to operate the<br>

4. against the disc 52 and normally bias the brake disc 46 and facing 47 against the whorl. Thus, the brake disc 46 is also a clutch which normally places the whorl and spindle in driving relationship. A flat spring may be used instead of the separate springs just described.

The disc 52 bears against an inner bearing race 55 which is attached to blade 14. An outer bearing race 56 is fixed in a cap structure 57, a top view of which is shown in Figure 6. The cap has a domed portion 58, a circular center portion 59, and outwardly and oppositely directed ears 60 and 60'. Each ear is provided with a hem of rubber, plastic or the like, the grommets having openings 62 which are larger than the diameter of the pins 39 and 39' and through which said pins extend.

To the ears 60 and 60' are hingedly attached resilient arcuate latch arms 63 and 63'. These latch arms engage keeper hooks 64 and 64'. These keeper hooks are attached to the bosses 25 by the bolts 26. The bolts 26 pass through slotted apertures 65 and 65'. This is important because it enables the keeper hooks 64 and 64' to be adjusted vertically on the bosses. This controls the tension applied by the resilient latch arms 63 and 63' and in turn this determines the resilient downward force which is applied.

A disc 52 is positioned on the spindle base 11. The disc 52 is pivoted in a cap 57, the brake disc 46 and whorl 44.

Spindle brake control

It will be noted from Figure 1 that the yarn strands from the packages C pass to the yarn trap B, then to a flyer D and thence to a bobbin E.

While the details of the yarn trap B are not a part of the present invention, it will be described sufficiently to show its coaction with the air valve V which controls the spindle stop.

The roller 66 and 67 are the top rolls of the trap B, and 68 indicates the under roll or feed roll. The trap body 69 is pivotally mounted as at 70. The member 72 is a drop wire box which has a yarn receiving drop wire 73 thereon. The reference numeral 74 indicates a trip cam which oscillates about its center in a limited forward and reverse arc. A trap finger 75 is pivotally attached to the trap stand 71 at 70, and carries the trap body 69. In the present invention the pivot 76 is made to project so that it serves as an actuating pin. To the known trap structure is also added a valve operating lever 77 which is pivotally attached to the trap stand 71 in the path of the actuating pin 76. The drop wire box 72 is pivotally attached to the trap stand 71 at 78 and has an inner hooked end 79 which is normally biased into engagement with a locking pin 80 by a spring 81.

The valve V is preferably a spool type valve with an air source inlet 82 and outlet 83. A plunger 84 is attached to and projects from the spool valve body 85. The valve body is mounted on the trap stand 71 so as to be in the path of the valve operating lever 77.

A spring 86 in the valve casing 87 normally biases the spool valve body 85 toward the inlet end of the casing, so as to force the plunger 84 to maximum projection from the casing 87. The spool valve body has an axial bore having portions 88 and 88' and radial spool openings 89, 90 and 91, respectively, and there is an exhaust opening 92 in the casing. When in normally closed position, as shown in Figure 3, the valve body blocks the inlet 82 and the outlet opening 83 is in connection with the atmosphere through the exhaust opening 92.

A conduit 93 brings compressed air from an air supply source to the inlet 82. The outlet 83 has connected thereto a conduit 94 which has its opposite end attached to the enlarged opening 32 of the bore 28.

An alternative form of valve control is shown in Figure 2. Instead of the air valve, the plunger 84 actuates a switch 95. This is in electrical connection with a
solenoid operated valve 96, the solenoid of which is connected to a power source 97. The valve structure may be similar to that of Figure 3. When the switch 95 is closed by the plunger 84, air from the conduit 93 passes through the valve 96 and to the conduit 94 as in the other form. When the plunger is released, switch 95 opens, breaks the circuit, and the valve 96 closes, cutting off the air supply and opening conduit 94 to exhaust to the atmosphere.

Operation

An important advantage of the present invention is that the spindle blade 14, the cap 57, the brake disc 46, and the whorl 44 may be lifted as a unit by releasing the resilient latch arms 63 and 63'. This is highly advantageous in servicing and repair. Further, when in assembled operative position, the spindle blade assembly is held downwardly in its spindle base 11 by a resilient force which permits the desired play in the blade assembly and cushions vibration. This resilient holddown also coacts with the braking action, in that when the brake plate 41 is applied, grabbing or sudden shock is prevented by the straightening of the acute latch arms 63 and 63'. The entire structure coacts to give better spindle performance and improved instant braking. The threaded studs 39 and 39'projecting through the resilient grommets, hold the cap against rotation without interfering with the resilient holddown.

When assembled, the spindle units are usually placed in groups of at least two, which group is driven by a single belt F, as shown in Figure 7. The belt drives the whorls 44.

If the yaw breaks between the packages C and the top roll 66, the drop wire 73 falls, engaging the oscillating trip cam 74. Pressure of the trip cam 74 forces drop wire 73 upward, disengaging the hooked end 79 from the locking point 80. This releases trap body 69 to move forward. The actuating pin 76 moves with the trap body, pivoting the upper end of the valve operating lever 77 outwardly. The opposite end of the lever 77 moves inwardly to press plunger 84 into the valve casing 87.

If the yarn should break between the feed roll 68 and the bobbin E, pressure is released on the trap finger 75. The weight W on the trap finger tilts it down and to the rear where it will be engaged by oscillating trip cam 74. Pressure from the cam forces the drop wire box 72 upward, releasing the hooked end 79 from the locking point 80. Again, the trap body moves forward and the plunger 84 is depressed in the manner as described for the yarn break if it occurs between the top rolls and yarn packages.

Thus any yarn break immediately causes the valve plunger 84 to move inwardly. This causes radial opening 91 to take a position opposite the inlet 82. The exhaust port 92 is closed and air flows through the axial bore 85 to the outlet 83 and through the conduit 94 to the bores 23 and 29 of the bottom plate 21. This air enters the bores 23 and 23', forcing the piston rods 34 upwardly. The piston rods 34 force the brake plate 41 upwardly against the frictional face 47 of the brake disc 46. This causes the keyed brake disc 46 to move upwardly along the blade 14 against the springs 54, disengaging the disc 46 from the upper face of the whorl 44. Thus, the single movement of the brake plate upwardly immediately brakes rotation of the spindle blade as well as blade from driving relation with the whorl. The whorl then spins freely about the blade, and it will be seen in Figure 7 that the belt F may continue to drive without loss of speed in the remaining spindles or damage to the belt F. The spindle where the break occurred will remain locked at rest while the brake is released.

When the break is repaired, the yarn trap will be reset, the actuating pin 76 moves rearwardly, and the plunger 84 will be free to be biased outwardly by its spring. The valve body 85 will move to the position shown Figure 3. The air in the bores 23 and 23' will exhaust through the conduit 94 and exhaust opening 92 of the valve V. The springs 37 will pull the brake plate 40 downwardly. This plate will disengage from the brake disc 46 and the disc 46 will drop to engage the driving whorl 44. Thus the entire repair operation occurs without affecting the shutting down of the machine or without affecting the operation of the other spindles.

While there is herein shown and described the preferred embodiment of the invention, it is nevertheless to be understood that changes may be made therein without departing from the scope of the invention as claimed.

What is claimed is:

1. In a stop spindle mechanism for yarn twisting machines, a spindle base, a spindle blade rotatably mounted in said base, a whorl for driving said spindle blade, clutch means connecting said whorl and spindle in releasable driving relation, brake means for stopping said spindle, and compressed air means automatically responsive to a yarn break for releasing said clutch means and for actuating said brake means.

2. In a stop spindle mechanism for yarn twisting machines, a spindle base, a spindle blade rotatably mounted in said base, a whorl for driving said spindle blade, clutch means connecting said whorl and spindle in releasable driving relation, brake means for stopping said spindle, and compressed air means automatically responsive to a yarn break for simultaneously releasing said clutch means and applying said brake means.

3. In a stop spindle mechanism for yarn twisting machines, a spindle base, a spindle blade rotatably mounted in said base, a whorl freely journaled for rotation about said spindle blade, clutch means forming a releasable driving connection between said whorl and said spindle blade, brake means for stopping said spindle, compressed air means for actuating said brake means and for releasing said clutch means, a compressed air supply for said compressed air means, a valve means interposed between said compressed air supply and said compressed air means, and means automatically responsive to a yarn break for opening said valve means to actuate said compressed air means.

4. In a stop spindle mechanism for yarn twisting machines, a spindle base, a spindle blade rotatably mounted in said base, a whorl freely journaled for rotation about said spindle blade, clutch means forming a releasable driving connection between said whorl and said spindle blade, brake means for stopping said spindle, compressed air means for simultaneously actuating said brake means and releasing said clutch means, a compressed air supply for said compressed air means, and means automatically responsive to a yarn break for opening said valve means to actuate said compressed air means.

5. In a stop spindle mechanism for yarn twisting machines, a spindle base, a bearing socket in said base, a spindle blade rotatably mounted in said socket, a whorl freely journaled for rotation about said spindle blade, clutch means on said spindle blade forming a releasable driving connection between said whorl and said blade, resilient holddown means resiliently pressing said spindle blade into said bearing socket, brake means for stopping said spindle blade, operating means for releasing said clutch means and for applying said brake means, and means automatically responsive to a yarn break for actuating said operating means.

6. In a stop spindle mechanism for yarn twisting machines, a spindle base, a bearing socket in said base, a spindle blade rotatably mounted in said socket, a whorl freely journaled for rotation about said spindle blade, clutch means on said spindle blade forming a releasable driving connection between said whorl and said blade, resilient holddown means resiliently pressing
said spindle blade into said bearing socket, brake means for stopping said spindle blade, operating means for releasing said clutch means and for applying said brake means simultaneously therewith, and means automatically responsive to a yarn break for actuating said operating means.

7. In a stop spindle mechanism for yarn twisting machines, a spindle base, a spindle blade rotatably mounted in said base, a whorl freely journaled for rotation about said spindle blade, a clutch plate slidably mounted on said spindle blade and keyed for rotation therewith, means to normally bias said clutch plate to driving relation with said whorl, a support adjacent said spindle blade, movable operating means positioned on said support adjacent said plate and movable into braking engagement with said plate to stop said plate and spindle blade and to force said clutch plate out of driving relation with said whorl, and means automatically responsive to a yarn break for actuating said operating means.

8. In a stop spindle mechanism for yarn twisting machines, a spindle base, a spindle blade rotatably mounted in said base, a whorl freely journaled for rotation about said spindle blade, a clutch plate slidably mounted on said spindle blade and keyed for rotation therewith, means to normally bias said clutch plate into driving relation with said whorl, resilient holddown means biasing said spindle blade into engagement with said spindle base, operating means movable into braking engagement with said plate to stop said plate and spindle blade and to force said clutch plate out of driving relation with said whorl, and means automatically responsive to a yarn break for actuating said operating means.

9. In a stop spindle mechanism for yarn twisting machines, a spindle base, a spindle blade rotatably mounted in said base, a whorl freely journaled for rotation about said spindle blade, a clutch plate slidably mounted on said spindle blade and keyed for rotation therewith, means to normally bias said clutch plate against said whorl, resilient holddown means biasing said spindle blade into engagement with said spindle base, operating means movable in a direction against the force of said resilient holddown means into braking engagement with said plate to stop said plate and spindle blade and to force said clutch plate out of driving relation with said whorl, and means automatically responsive to a yarn break for actuating said operating means.

10. In a stop spindle mechanism for yarn twisting machines, a spindle base, a spindle blade rotatably mounted in said base, a whorl freely journaled for rotation about said spindle blade, a clutch plate slidably mounted on said spindle blade and keyed for rotation therewith, means to normally bias said clutch plate against said whorl, a support adjacent said spindle blade, brake plate means on said support, said brake plate means being positioned adjacent said clutch plate, piston means in said support, said brake plate means being attached to said piston means for movement into engagement with said clutch plate, resilient holddown means for biasing said spindle blade into engagement with said spindle base, means for supplying compressed air to said piston means, valve means interposed between said compressed air means and said piston means for controlling admission of compressed air to said piston means, and means automatically responsive to a break in said yarn for actuating said valve means.

13. In a stop spindle mechanism for yarn twisting machines, a spindle base, a spindle blade rotatably mounted in said base, a whorl freely journaled for rotation about said spindle blade, a clutch plate slidably mounted on said spindle blade and keyed for rotation therewith, means to normally bias said clutch plate against said whorl, a support positioned around said spindle blade and said whorl, a plurality of cylindrical bores in said support substantially parallel to said spindles, means for pushing said spindles into said bores, means for holding said spindles in said bores, each of said cylindrical bores, spring means Normally biasing each of said pistons downwardly into said bores, brake plate means attached to said pistons, said brake plate means being maintained in normal position being adjacent but slightly spaced from said clutch plate, a cap around said spindle blade adjacent said clutch plate exerting an axial force on said spindle blade in the direction of said spindle base, resilient latch means connecting said cap to said support, means for supplying compressed air to said cylindrical bores, valve means interposed between said compressed air means and said cylindrical bores, and means automatically responsive to a break in said yarn for actuating said valve means.

14. In a stop spindle mechanism for yarn twisting machines, a spindle base, a spindle blade rotatably mounted in said base, a whorl freely journaled for rotation about said spindle blade, clutch means forming a releasable connection between said whorl and said spindle blade, brake means for stopping said spindle blade, compressed air means for actuating said brake means and for releasing said clutch means, said compressed air means comprising at least two cylinders and pistons in the said cylinder, a common compressed air supply for said pistons, valve means interposed between said compressed air supply and said compressed air means, and means automatically responsive to a yarn break for opening said valve means to actuate said compressed air means, said valve means having an exhaust port for releasing the compressed air from said compressed air means when said yarn break is repaired and said valve means is closed.

15. In a stop spindle mechanism for yarn twisting machines having a plurality of yarn packages, a yarn trap receiving yarn from said packages, and a spindle driven bobbin receiving twisted yarn from said yarn trap; a spindle base, a spindle blade rotatably mounted in said base, a whorl freely journaled for rotation about said spindle blade, clutch means forming a releasable driving connection between said whorl and said spindle blade, brake means for stopping said spindle blade, compressed air means for releasing said clutch means and for applying said brake means, valve means for controlling the compressed air flow to said compressed air means, an actuating pin on said yarn trap, a lever on said yarn trap engaging with said actuating pin upon a break in said yarn, said lever being in engagement with said valve means whereby when said lever is moved by a break in said yarn, said valve means will be actuated to admit compressed air to said compressed air means.

16. In a stop spindle mechanism for yarn twisting machines having a plurality of yarn packages, a yarn trap receiving yarn from said packages, and a spindle driven bobbin receiving twisted yarn from said yarn trap; a
spindle base, a spindle blade rotatably mounted in said base, a whorl freely journaled for rotation about said spindle blade, a clutch plate on said spindle blade forming a releasable driving connection between said whorl and said spindle blade, means to normally bias said clutch plate into driving engagement with said whorl, brake means movable into engagement with said clutch plate to stop said spindle blade and to disengage said clutch plate from said whorl, compressed air means for actuating said brake means, a compressed air supply for said compressed air means, an actuating pin on said yarn trap, a lever on said yarn trap engageable with said actuating pin upon a break in said yarn, a valve adjacent said yarn trap having operating means in the path of movement of said lever, said valve being interposed between said compressed air supply and said compressed air means whereby when said yarn breaks, said brake means will stop said spindle blade and disengage said clutch plate from said whorl.

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