A drive means for a yarn knotter mechanism for knotting together two ends of broken or otherwise separated yarn at selected spindle assembly locations of a textile yarn processing machine, such as a twister, spinning frame or the like, as follows. A drive shaft is operatively connected with the knotter mechanism for driving the knotter mechanism during rotation thereof. A flexible belt is coiled intermediate the ends thereof around the drive shaft for rotating the drive shaft. A movable thrust mechanism is connected to one end of the belt for stretching the belt upon actuation thereof and movement away from the one end of the belt for tightening the coils of the belt around the drive shaft and pulling the belt therewith for rotating the drive shaft. A tensioning and resetting device is connected to the other end of the belt for maintaining tension in the belt during movement of the thrust mechanism and for moving the belt for resetting in the position previously occupied upon deactuation of the thrust mechanism. Preferably, the drive further includes releasable locking mechanisms operatively connected with the drive shaft and with the thrust device for deactuating the thrust device and stopping operation thereof when the drive shaft has been rotated a predetermined amount for driving the knotter mechanism through one complete cycle of operation thereof and for locking the drive shaft to prevent further operation of the drive until released.
DRIVE MEANS FOR KNOTTER MECHANISM OF A TEXTILE YARN PROCESSING MACHINE

This invention relates to a drive for a knottor mechanism for knotting two ends of broken or otherwise separated yarn at selected spindle assembly locations of a textile yarn processing machine, such as a twister, spinning frame or the like.

Heretofore, in the operation of a yarn processing machine in which a single end of yarn is processed at each spindle assembly location on the machine, if the yarn broke forming two ends of broken yarn or if the yarn was otherwise separated, it has been customary to use a commercially available, portable, manually operated knottor mechanism for piecing together or knotting together two ends of separated yarn for further processing at the spindle assembly location. More recently, it has been found that such yarn knottor mechanisms may be mounted directly on a carriage supported by the yarn processing machine for movement along the spindle assemblies and positioning at a selected spindle assembly for performing a yarn knotting operation. In this regard, reference is made to copending application, Ser. No. 381,767, filed July 23, 1973, and assigned to the assignee of the present invention.

In all of these prior operations of knottor mechanisms on yarn processing machines, operation of the knotting members of the knottor mechanism were driven manually by an operator moving a lever or other device for manually moving the knotting members of the yarn knottor mechanism. This manual operation suffered many drawbacks which are common with manual drives and also provided no means for insuring only one cycle of operation of the knottor mechanism during each manual actuation and movement of the knottor members.

Accordingly, it is the object of this invention to overcome the above deficiencies and to provide a drive for a yarn knottor mechanism for use on a textile yarn processing machine which automatically drives the knottor mechanism through its cycle of operation upon manual actuation of the drive.

Further, it is an additional object of this invention to provide the above described drive with mechanisms for stopping operation of the drive and locking the drive when the drive has been operated to complete one cycle of knotting operation in the knottor mechanism and to insure that only one cycle of operation is performed by the knottor mechanism upon each actuation of the drive.

It has been found by this invention that the above objects may be accomplished by providing a drive for a yarn knottor mechanism for knotting two ends of broken or otherwise separated yarn at selected spindle assembly locations of a textile yarn processing machine, such as a twister, spinning frame or the like, in which the drive comprises the following. A drive shaft is operatively connected with the knottor mechanism for driving the knottor mechanism during rotation thereof and a flexible belt means is coiled intermediate the ends thereof around the drive shaft for rotating the drive shaft. Movably thrust means are connected to one end of the belt means for stretching the belt means upon actuation thereof and movement away from the other end of the belt means for tightening the coils of the belt means around the drive shaft and pulling the belt means therewith for rotating the drive shaft. Tensioning and resetting means are connected to the other end of the belt means for maintaining tension in the belt means during the movement of the thrust means and for moving the belt means for resetting in the position previously occupied upon deactuation of the thrust means.

Preferably, the drive means includes releasable locking means operatively connected with the drive shaft and the thrust means for deactuating the thrust means and stopping operation thereof when the drive shaft has been rotated one complete revolution and for locking the drive shaft to prevent further operation of the drive means until released.

Some of the objects and advantages of this invention having been stated, other objects and advantages will appear as the description proceeds, when taken in conjunction with the accompanying drawings, in which FIG. 1 is a partial perspective view taken generally from the front of a portion of a two-for-one twister yarn processing machine including a plurality of spindle assemblies and having a yarn knottor mechanism mounted thereon with the drive of this invention therefor incorporated thereon;

FIG. 2 is an enlarged sectional view taken generally along the line 2—2 of FIG. 1;

FIG. 3 is a further enlarged elevational view taken generally along the line 3—3 of FIG. 2; and

FIG. 4 is an elevational view taken generally along the line 4—4 of FIG. 3.

While the drawings and specific description to follow will be related to a two-for-one twister having a yarn knottor mechanism, which is the preferred form of apparatus utilizing the improvements of this invention, it is to be understood that the improvements of this invention could also be utilized on other machines and other yarn processing machines.

Referring now to the drawings, there is shown in FIG. 1, a portion of a two-for-one twister yarn processing machine having a plurality of spindle assemblies, generally indicated at 10, positioned in side-by-side relationship. A full illustration and description of the entire two-for-one twister yarn processing machine and the various spindle assemblies 10 thereof is not given herein and is not believed to be necessary for an understanding of the present invention, the operation and structure of such a two-for-one twister yarn processing machine and the plurality of spindle assemblies thereof being well understood by those with ordinary skill in the art.

Generally, each of the spindle assemblies 10, which are conventionally mounted in side-by-side relationship in a two-for-one twister, comprises a rotatably driven rotor mechanism, generally indicated at 11. The rotor mechanism 11 includes a whorl 12 suitably rotatably mounted on the twister frame portion 13 and rotated by a continuous drive belt 14. The rotor mechanism 11 further includes a horizontally extending reserve disc 16 (see FIG. 2) and hollow axle 17 defining therewithin a vertically extending yarn passageway (not shown) and a horizontally extending yarn passageway (not shown) mating with each other.

The spindle assembly 10 further includes a yarn carrier mechanism 25 for carrying a hollow package P of yarn Y and being rotatably mounted on the rotor mechanism 11 so that the rotor mechanism may rotate relative thereto. The carrier mechanism 25 may include a yarn entry tube 30 and a balloon limitor device 33 sur-
rounding the package of yarn P. A yarn guide eyelet 40 is positioned above and in axial alignment with the hollow axle 17 and the yarn entry tube 30. There is further provided a pre-take-up roll 42, a yarn traversing mechanism 43, and a take-up or package roll 44 upon which the yarn Y is wound after being processed or twisted by the spindle assembly 10. Package roll 44 is rotated by a friction drive roll 45.

With the above described mechanisms, the yarn Y passes from the package P and is threaded through the yarn entry tube 30, through the yarn passageways of hollow axle device 17 and the reserve disc 16 and out of the reserve disc 16 in a horizontal direction (as shown in FIG. 2). The yarn Y then passes upwardly on the inside of balloon limitor device 33 and is threaded through yarn guide eyelet 40, over pre-take-up roll 42 and is traversed by traversing mechanism 43 onto the package roll 44 to complete its travel through the respective spindle assembly 10. As is well understood by those with ordinary skill in the art, a two-for-one twist is inserted in the yarn during the above noted path of travel.

If during the travel of the yarn, as noted above, the yarn Y breaks or a new supply package P of yarn Y is placed in the spindle assembly 10, two separated ends of yarn Y are formed which must be knotted or pieced together for continued operation of the spindle assembly 10. When the yarn Y passing through the spindle assembly 10 is thus broken or otherwise separated, the separated ends are so positioned that one separated end extends downwardly from the eyelet 40 and the other separated end of yarn Y extends upwardly from the inside of balloon limitor device 33. For knotting together the two ends of broken or otherwise separated yarn Y, a knotter mechanism, generally indicated at 50 is mounted on a carriage mechanism, generally indicated at 51 which is supported by wheels 52 on a longitudinally extending rail 53 carried by the yarn processing machine. The carriage 51 is further supported by a U-shaped frame member 55 into which a guiding member 56 extends from the carriage mechanism 51. Thus, the carriage mechanism 51 and yarn knotter mechanism 50 carried thereby are mounted for longitudinal movement along the front of the spindle assemblies 10 of the yarn processing machine for being positioned at a selected spindle assembly 10 for knotting together of the broken or otherwise separated yarn Y. For knotting together of the separated yarn ends Y, these separated yarn ends are manually inserted into slots 57 and 58 (see FIG. 3) on either side of separator 59 of the yarn knotter mechanism 50. The yarn knotter mechanism 50 and the operation of the specific knotter members (not shown) therein for knotting together the two ends of separated yarn is well understood by those with ordinary skill in the art and does not require detailed explanation herein for an understanding of the present invention. Yarn knotter mechanisms are commercially available from many sources, e.g. Wildt Mellor Bromley, Ltd., 82 Princess Street, Manchester M. 16 WL, England.

In accordance with the present invention, a drive for the yarn knotter mechanism 50 is provided which comprises a drive shaft 60 extending through the yarn knotter mechanism 50 and protruding from each side thereof. One end of the drive shaft 60 carries a pulley or winch-like extension 61 around which is coiled a belt 62 which preferably has a circular cross section. The belt 62 is flexible and elastic and preferably comprises leather, plastics materials or other suitable flexible and elastic materials.

One end of the belt 62 is connected by a clamp and lever 64 to the end of a piston 65 of a pneumatic piston 65-cylinder 66 device mounted on the side of the yarn knotter mechanism 50. The piston-cylinder mechanism 65, 66 includes a compression spring 68 for biasing the moveable piston 65 in the position shown in dotted lines in FIG. 3. The cylinder 66 is constructed to receive pressurized air at the upper end thereof by a pressurized air conduit and supply line 69 so that when pressurized air is supplied to the top of the cylinder 66 the piston 65 is moved to the position shown in dotted lines in FIG. 3 and upon the release of pressurized air being supplied to the cylinder 66, the piston will be retracted to its original position, shown in solid lines in FIG. 3, by the compression spring 68.

The other end of the belt 62 is secured to a tension and resetting device in the form of a tension spring 71 which is secured to a stationary frame portion 72 for maintaining tension in the belt 62, during movement of the piston-cylinder thrust means 65, 66 and for moving the belt 62 for resetting in the position previously occupied upon deactivation of the piston-cylinder 65, 66 (as shown in solid lines in FIG. 3). The tension spring 71 has an effective force less than the effective force of the piston-cylinder mechanism 65, 66 so that upon movement of the piston 65 to the dotted line position of FIG. 3, the tension spring 71 will be stretched to its dotted line position of FIG. 3. Upon stopping of the supply of pressurized air to the piston-cylinder mechanism 65, 66 the compression spring 68 will return the piston 65 to the solid line position of FIG. 3 and the tension spring 71 will return the belt 62 to its solid line position of FIG. 3.

For supplying pressurized air to the piston-cylinder mechanism 65, 66, through the air supply and conveying line 69, an air valve 80 is provided through which the pressurized air supply and conveying line 69 passes to any convenient source of supply of pressurized air (not shown). The valve 80 is normally closed and therefore does not allow the passage of pressurized air through the line 69 until it has been moved to an open position, as will be described below.

Preferably, the knotter mechanism drive of this invention further includes releasable locking means cooperatively connected with the drive shaft 60 and the thrust means 65, 66 for deactuating the thrust means 65, 66 and stopping operation thereof when the drive shaft 60 has been rotated one revolution for causing one complete cycle of operation of the knotting mechanism 50 and for locking the drive shaft 60 to prevent further operation of the knotter mechanism drive of this invention until the locking means is released.

This locking means comprises a generally circular cam 81 mounted on the other end of drive shaft 60 and having a cutout 82 therein. A cam follower locking member 83 is carried by a lever 84 pivotedly mounted by stub shaft 85 to the knotter mechanism 50 for allowing pivotal movement of the lever 84 and the follower 83. The other end of the lever 84 carries a rod 85 which is connected to a further pivotally mounted lever 87 which is also pivotally mounted at 88 to a stationary portion of the carriage mechanism 51. The lever 87 is biased into the position shown in FIGS. 3 and 4 by a compression spring 89 and is adapted to be manually
moved against the compression of spring 89 to move the lever 84 and thus cam follower 83. The lever 87 is positioned to contact the plunger 91 extending from the pneumatic air valve 80 to hold the plunger 91 in position for closing of the valve 80 during normal positioning of the lever 87 and to move away from the plunger 91 to allow opening of the valve 80 when the lever 87 is manually moved against its bias.

In operation of the drive mechanism of this invention, as above described, an operator will manually move the lever 87 against the bias of the spring 89 to in turn move the lever 84 and thus move the cam follower 83 out of engagement with the cutout 82 and free the drive shaft 60 for rotation. Simultaneously, the air valve 80 will be opened allowing the flow of pressurized air through the pressurized air supply and conveying line 69 to the upper portion of the cylinder 66 to move the piston 65 downwardly to the dotted line position of FIG. 3. This will cause the belt 62 to stretch and cause the coils of the belt 62 around the pulley mechanism 61 on the drive shaft 60 to tighten and cause rotation of the pulley 61 and drive shaft 60 to effect operation of the knotted mechanism 50. The belt 62 will move to the dotted line position of FIG. 3 stretching the tensioning and resetting spring 71 to the dotted line position of FIG. 3.

Promptly after movement of the cam follower locking member 83 out of the cutout 82 of the cam 81, the lever 87 will be released by the operator and the cam follower locking member 83 will ride around the outside surface of cam 81 holding the lever 87 out of engagement with the plunger 91 of the valve 80 and thus allow the flow of pressurized air to continue to the piston-cylinder 65, 66. When the drive shaft has completed one complete revolution to accomplish one complete cycle of the knotting mechanism operation, the cam follower 83 will again drop into the cutout 82 stopping rotation of the cam 81 and the drive shaft 60 at the end of one revolution. This will also cause the lever 87 to again engage the plunger 91 and close the air valve 80 to shut off the supply of pressurized air to the piston-cylinder mechanism 65, 66.

When this occurs, the piston 65 will retract in the cylinder 66 due to the action of compression spring 68 and the tension spring 72 will reset the belt 62 into the position it previously occupied. Thus, the drive will be reset to its previous position and locked in place until another cycle of operation is desired.

In the drawings and specification there has been set forth a preferred embodiment of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation.

What is claimed is:
1. In a textile yarn processing machine, such as a twister, spinning frame or the like having a plurality of spindle assemblies and having a yarn knitter mechanism for knotting together two ends of broken or otherwise separated yarn at selected spindle assembly locations, the improvement of drive means for driving said knitter mechanism comprising:
   a drive shaft operatively connected with said knitter mechanism for driving said knitter mechanism during rotation thereof;
   flexible belt means coiled intermediate the ends thereof around said drive shaft for rotating said drive shaft;
   movable thrust means connected to one end of said belt means for stretching said belt means upon actuation thereof and movement away from the one end of said belt means for tightening the coils of said belt means around said drive shaft and pulling said belt means therewith for rotating said drive shaft; and
   tensioning and resetting means connected to the other end of said belt means for maintaining tension in said belt means during the movement of said thrust means and for moving said belt means for resetting in the position previously occupied upon deactuation of said thrust means.
2. In a textile yarn processing machine, as set forth in claim 1, in which said thrust means comprises a pneumatically operated piston-cylinder unit.
3. In a textile yarn processing machine as set forth in claim 1, in which said tensioning and resetting means comprises a tension spring having an effective force less than the effective force of said thrust means.
4. In a textile yarn processing machine as set forth in claim 1, in which said belt means comprises leather.
5. In a textile yarn processing machine as set forth in claim 1, in which said belt means comprises plastics material.
6. In a textile yarn processing machine, as set forth in claim 1, in which said drive means further includes releasable locking means operatively connected with said drive shaft and said thrust means for deactuating said thrust means and stopping operation thereof when said drive shaft has been rotated one revolution and for locking said drive shaft to prevent further operation of said drive means until released.
7. In a textile yarn processing machine, as set forth in claim 6, in which said locking means comprises a generally circular cam mounted on said drive shaft and having a cutout therein, a cam follower locking member movably mounted on said machine for engaging said cam during rotation thereof with said drive shaft and for engaging said cutout after one complete revolution of said cam and said drive shaft to stop said drive means and for movement out of said cutout when operation of said drive means is again desired, and means connecting said cam follower locking member with said thrust means for actuating said thrust means when said cam follower member is out of said cutout of said cam member and for deactuating said thrust means when said cam follower member is in said cutout of said cam member.
8. In a textile yarn processing machine, as set forth in claim 7, in which said means connecting said cam follower locking member with said thrust means comprises manually movable lever means pivotally mounted on said machine and carrying said cam follower locking member for manual movement thereof and including biasing means biasing said lever means and said cam follower locking member into engagement with said cam and said cutout therein, a pneumatic valve means positioned for actuation by said lever means upon manual movement thereof against said biasing means for movement of said cam follower locking member out of said cam cutout, and pressurized air supply and conveying means connected through said valve means and to said thrust
means for supplying pressurized air to said thrust means for actuation thereof only when said valve means is actuated by said lever means.

9. In a textile yarn processing machine, such as a twister, spinning frame or the like having a plurality of spindle assemblies and having a yarn knitter mechanism for knotting together two ends of broken or otherwise separated yarn at selected spindle assembly locations; the improvement of drive means for driving said knitter mechanism comprising:

a drive shaft operatively connected with said knitter mechanism for driving said knitter mechanism for one cycle of knotting operations during one revolution of said drive shaft;

flexible belt means coiled intermediate the ends thereof around said drive shaft for rotating said drive shaft;

movable thrust means comprising a pneumatically operated piston-cylinder unit connected to one end of said belt means for stretching said belt means upon actuation thereof and movement away from the one end of said belt means for tightening the coils of said belt means around said drive shaft and pulling said belt means therewith for rotating said drive shaft;

tensioning and resetting means comprising a tension spring having an effective force less than the effective force of said thrust means and connected to the other end of said belt means for maintaining tension in said belt means during movement of said thrust means and for moving said belt means for resetting in the position previously occupied upon deactuation of said thrust means;

releasable locking means operatively connected with said drive shaft and said thrust means for deactuating said thrust means and stopping operation thereof when said drive shaft has been rotated one complete revolution for locking said drive shaft to prevent further operation of said drive means until released, said locking means comprising a generally circular cam mounted on said drive shaft and having a cutout therein, a cam follower locking member movably mounted on said machine for engaging said cam during rotation thereof with said drive shaft and for engaging said cutout after one complete revolution of said cam and said drive shaft to stop said drive means and for movement out of said cutout when operation of said drive means is again desired, manually movable lever means pivotally mounted on said machine and carrying said cam follower locking member for manual movement thereof and including biasing means biasing said lever means and said cam follower locking member into engagement with said cam and said cutout therein, pneumatic valve means positioned for actuation by said lever means upon manual movement thereof against said biasing means for movement of said cam follower locking member out of said cutout of said cam member.

10. A drive means for a yarn knotting mechanism adapted for use on a textile yarn processing machine comprising:

a drive shaft for driving said knotter mechanism through one complete cycle of operation during a predetermined amount of rotation thereof;

flexible belt means coiled intermediate the ends thereof around said drive shaft for rotating said drive shaft;

movable thrust means connected to one end of said belt means for stretching said belt means upon actuation thereof and movement away from the other end of said belt means for tightening the coil of said belt means around said drive shaft and pulling said belt means therewith for rotating said drive shaft;

tensioning and resetting means connected to the other end of said belt means for maintaining tension in said belt means during the movement of said thrust means and for pulling said belt means for resetting in the position previously occupied upon deactuation of said thrust means; and

releasable locking means operatively connected with said drive shaft and said thrust means for deactuating said thrust means and stopping operation thereof when said drive shaft has been rotated a predetermined amount and for locking said drive shaft to prevent further operation of said drive means until released.

11. A drive means for a yarn knitter mechanism, as set forth in claim 10, in which said thrust means comprises a pneumatically operated piston-cylinder unit and said tensioning and resetting means comprises a tension spring having an effective force less than the effective force of said thrust means.

12. A drive means for a yarn knitter mechanism, as set forth in claim 11, in which said locking means comprises

a generally circular cam mounted on said drive shaft and having a cutout therein,

a cam follower locking member movably mounted on said machine for engaging said cam during rotation thereof with said drive shaft and for engaging said cutout after one complete revolution of said cam and said drive shaft to stop said drive means and for movement out of said cutout when operation of said drive means is again desired, and

means connecting said cam follower locking member with said thrust means for actuating said thrust means when said cam follower member is out of said cutout of said cam member and for deactuating said thrust means when said cam follower member is in said cutout of said cam member.

13. A drive means for a yarn knitter mechanism, as set forth in claim 12, in which said means connecting said cam follower locking member with said thrust means comprises

manually movable lever means pivotally mounted on said machine and carrying said cam follower locking member for manual movement thereof and including biasing means biasing said lever means and said cam follower locking member into engagement with said cam and said cutout therein, pneumatic valve means positioned for actuation by said lever means upon manual movement thereof against said biasing means for movement of said
cam follower locking member out of said cam cut-
out, and
pressurized air supply and conveying means con-
ected through said valve means and to said thrust
means for supplying pressurized air to said thrust
means for actuation thereof only when said valve
means is actuated by said lever means.