

June 11, 1940.

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DRIVE MECHANISM FOR TWISTER FRAMES

2,203,665

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3 Sheets-Sheet 1

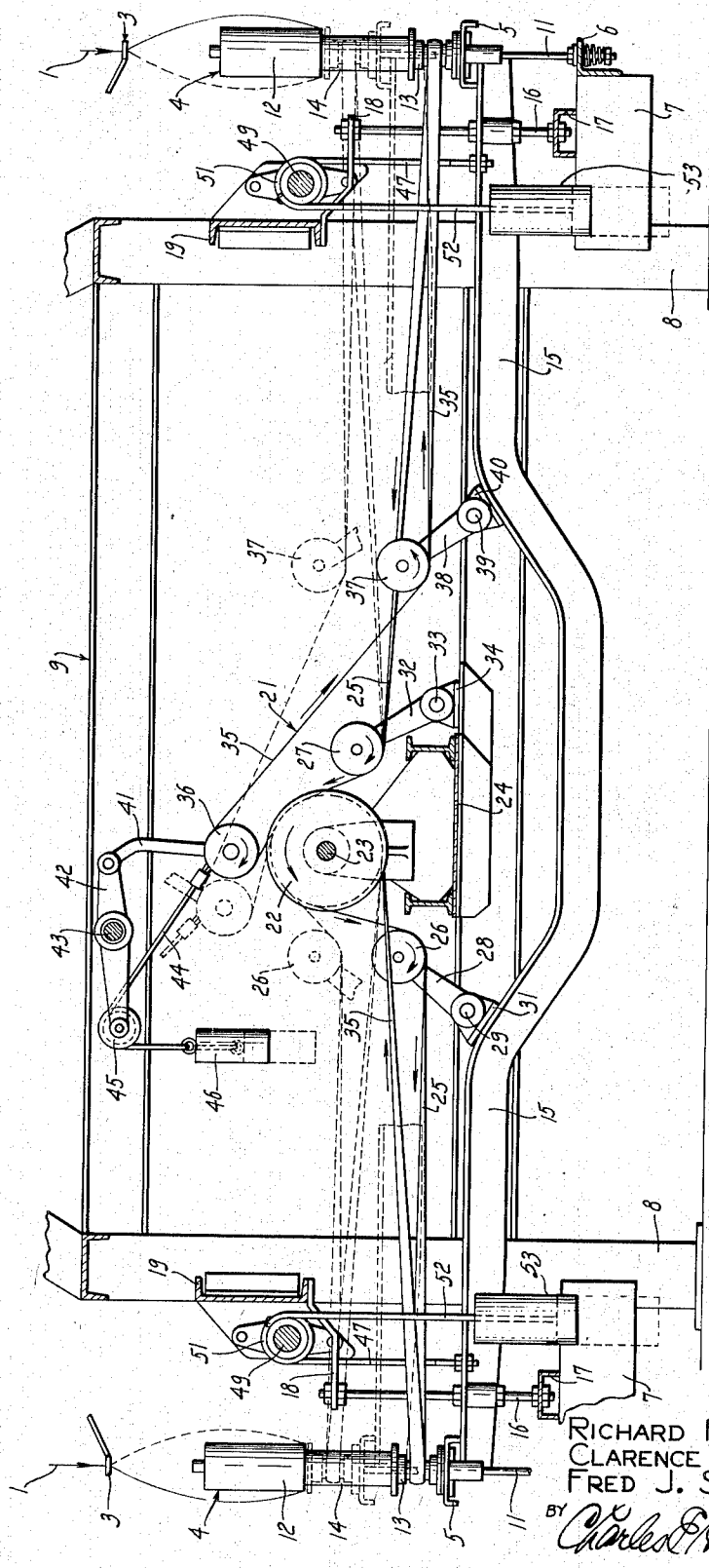


FIG. 1

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3 Sheets-Sheet 2

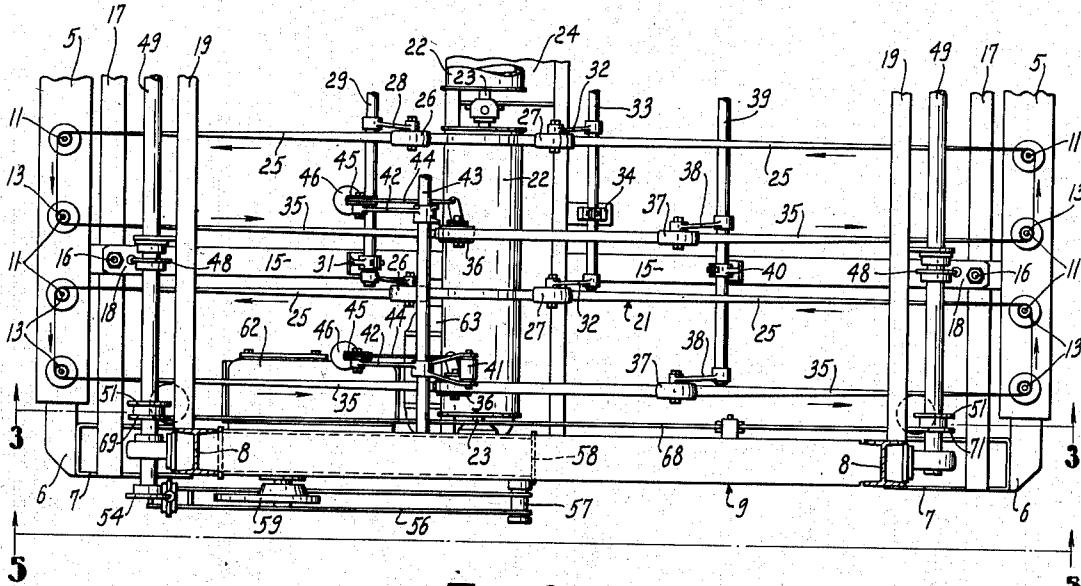


FIG. 2

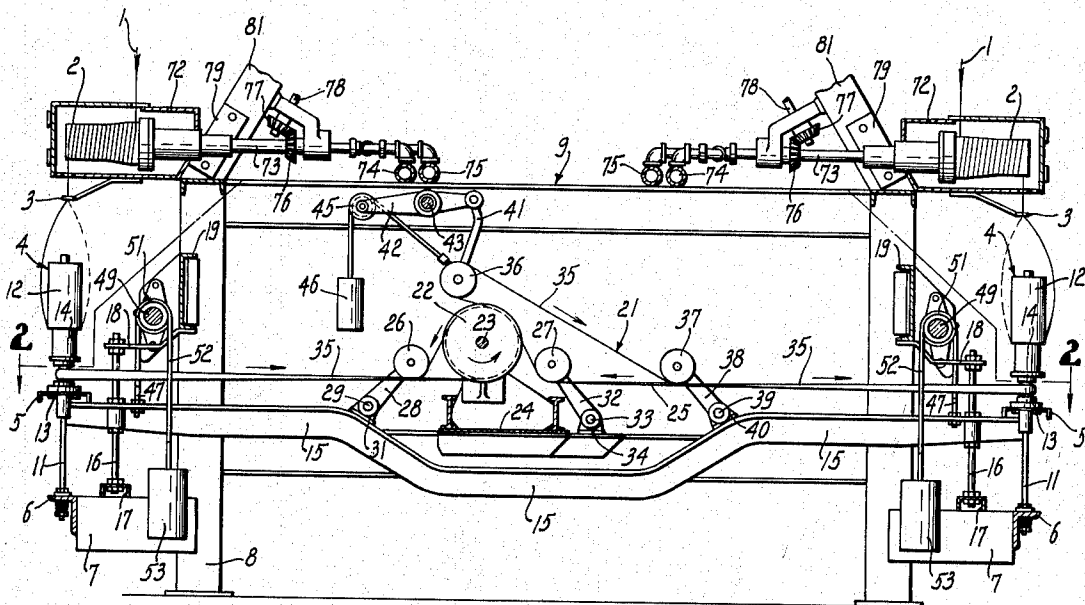


FIG. 3

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3 Sheets-Sheet 3

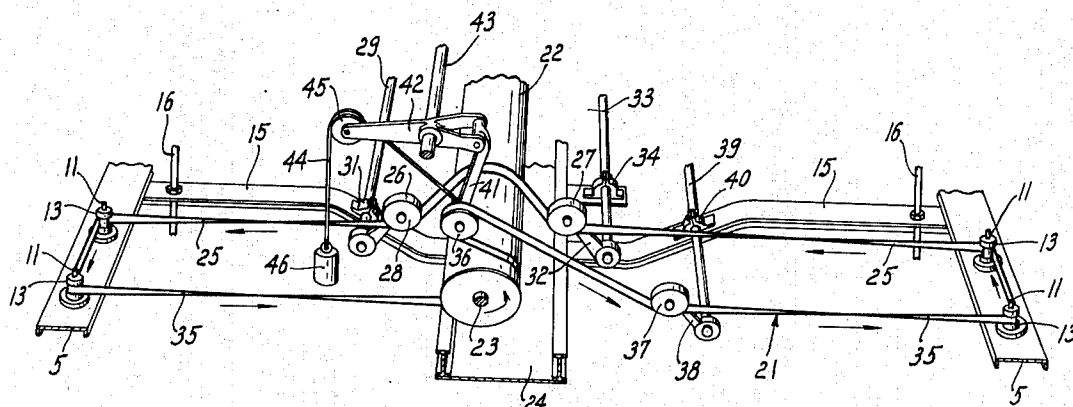


FIG. 4

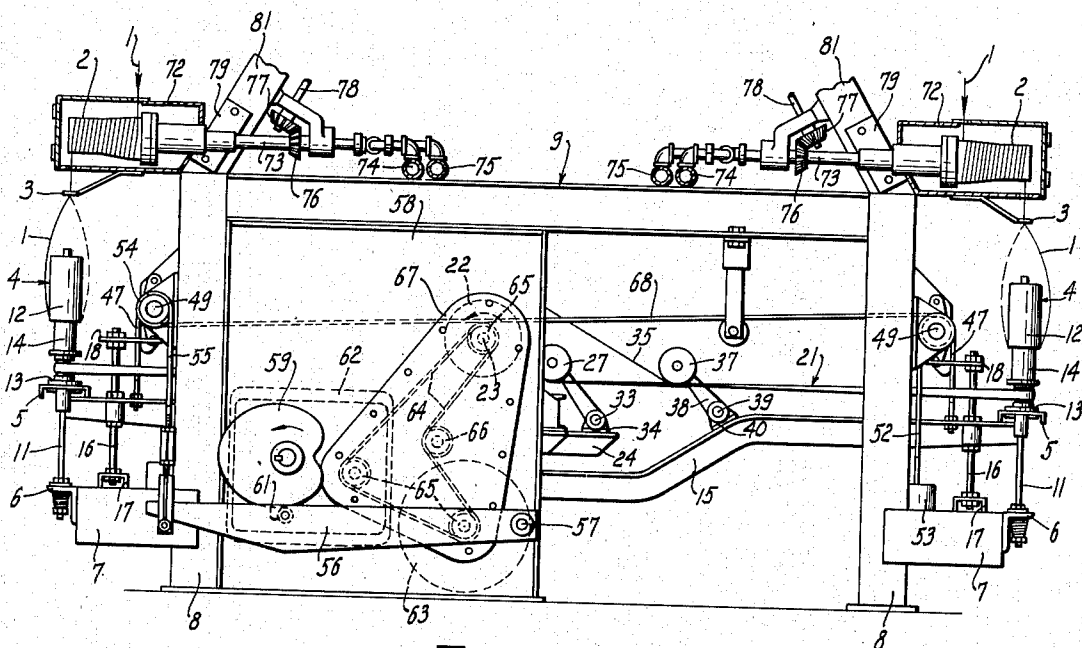


FIG. 5

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2,203,665

DRIVE MECHANISM FOR TWISTER FRAMES

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Application November 18, 1938, Serial No. 241,222

26 Claims. (Cl. 57—99)

This invention relates to apparatus for driving spindles in twisting apparatus, doubling apparatus, etc., by means of an endless flexible member, such as a belt or tape. The invention has particular applicability to means for rotating spindles mounted on lifting rails which reciprocate vertically during the operation of the apparatus; for instance, in the operation of cap-twisting apparatus. The invention provides apparatus which may be readily adapted to rotate the spindles in either direction, thus making it possible in twisting apparatus to obtain a right- or left-hand twist without changing the direction of rotation of the drum.

Other features of the invention will be apparent from the following description.

Among other things, the invention provides driving apparatus which is of simple and inexpensive construction and which operates very efficiently with a minimum of slip. It further provides apparatus in which spindles on opposite sides of the apparatus are driven by a single endless belt from a single driving member; e. g., a drum, disposed between the spindles, in which apparatus the oppositely moving runs of the belt are disposed at points spaced lengthwise of the driving member itself. The present invention also contemplates apparatus of this type in which both runs of the belt are in contact with and driven by a single drum, as a result of which is obtained a particularly efficient drive.

For purposes of illustration, but in no sense of limitation, the invention will be described in connection with cap-twisting apparatus employed in the manufacture of multiple filament viscose artificial silk thread by the continuous process.

In the accompanying drawings, Figure 1 shows the invention as embodied in cap-twisting apparatus forming the lower part of a machine for the manufacture of multiple filament viscose artificial silk thread, such figure comprising a section transversely of the apparatus as a whole. Figure 2 is a plan of the apparatus of Figure 1 as seen from line 2—2 of Figure 3. Figure 3 is an elevation, corresponding generally to that of Figure 1, as seen from line 3—3 of Figure 2. Figure 4 is a perspective corresponding substantially to Figure 3 showing somewhat more clearly the path of the belt. Figure 5 is an end elevation of the apparatus as seen from line 5—5 of Figure 2, showing among other things the means for actuating the lifting rails. In the drawings, like reference characters refer to like parts throughout.

The invention is illustrated as embodied in a

machine generally similar to that shown, described and claimed in copending application Serial No. 7,114, filed February 18, 1935, by Walter F. Knebusch and Alden H. Burkholder. In said machine, each thread is subjected after its formation to suitable processing treatment on a descending series of thread-advancing thread store devices which conveniently take the form of thread-advancing reels. Each of said reels is of cantilever form; i. e., it is supported from one end only. On each the thread is advanced toward the unsupported end of the reel in a plurality of generally helical turns, the thread passing from the unsupported end of each reel to the supported end of the succeeding reel. On the last reel the thread is dried, after which it is twisted and collected in package form.

In the drawings appear only the reels 2, on each of which a thread 1 from the preceding reels is dried and from which it passes through guide 3 to a cap-twister 4.

The cap-twisters 4 are mounted on each side of the apparatus, being supported by lifting rails 5 and stationary rails 6. Stationary rails 6 on both sides of the apparatus are supported by brackets 7 fixed to the vertical frame members 8 forming part of the frame of the machine indicated generally as 9. The stationary vertical spindle shafts 11 on which the caps 12 of the cap-twisters 4 are mounted are connected at their lower ends to stationary rails 6. The rotatable whirls 13 of the cap-twisters, which support the thread-collecting bobbins 14, are rotatably mounted on the lifting rails 5. During operation of the cap-twisters, the bobbins 14 are rotated and vertically reciprocated within the caps 12.

The lifting rails on opposite sides of the machine are rigidly connected by cross members 15, of which one is shown in Figure 2. Two spaced cross members 15 are usually sufficient for each pair of opposite lifting rails. The cross members 15 are slidably supported on stationary guide rods 16, one such guide rod being provided near each end of each cross member. The guide rods 16 are fixed at their lower ends to beams 17 carried by the brackets 7, while at their upper ends they are fixed to brackets 18 connected to a beam 19 forming part of the frame of the machine and connected to vertical frame members 8.

The lifting rails 5 on both sides of the apparatus, being connected together by cross members 15, thus form a substantially rigid frame which may be reciprocated vertically in the desired manner.

Corresponding whirls 13 on opposite sides of the machine are rotated by belts 21 from a rapidly rotating drum 22 disposed longitudinally of the apparatus between the whirls. The drum 22 rotates about a fixed axis and is mounted on a shaft 23 supported by a frame structure 24 disposed beneath the drum and rigidly fixed to the frame 9 of the machine. Each belt 21 drives four spindles, two on each side of the machine, although it is apparent that more or less spindles may be rotated from a single belt. A plurality of belts may be driven from a common rotating drum, as shown.

It can be seen from Figures 1 to 4, inclusive, and particularly from Figure 4 that the two opposite runs of each endless belt 21 are spaced from each other lengthwise of the drum 22, one run passing over the drum and the other passing under the drum. The drum is thus enclosed between the runs of the belt. Both runs contact with and are driven from the drum, the relation of the belt to the drum being such that the surface of the drum contacted by each run of the belt is moving in the same direction as the belt. Suitable means, such as rollers or pulleys, are provided in close proximity to the drum to provide a substantial angle of wrap of the belt on the drum and to maintain it during movement of the lifting rails.

For the indicated direction of rotation of the drum 22, the belt 21 will travel in the direction shown by the arrows, thus imparting to the spindles a counterclockwise rotation when viewed from above. In the illustrated embodiment of the invention, the run of the belt passing over the drum 22, which run will for convenience be indicated as 25, is urged downward onto drum 22 by means of pulleys 26 and 27 mounted on opposite sides of the drum. Pulley 26 is supported by arm 28 mounted on a rod 29 connected by bracket 31 to each cross member 15.

Rod 29, which may extend between and be connected to spaced cross members 15 of the reciprocatory frame, may conveniently support corresponding pulleys 26 for adjacent belts. Pulley 27 is mounted on the arm 32 carried by rod 33 connected to the stationary frame structure 24, as by brackets 34. Rod 33, like rod 29, may extend lengthwise of the apparatus and support corresponding pulleys 27 for adjacent belts.

The other run 35 of the belt 21 passes under driving drum 22, over movably mounted pulley 36, and thence under the pulley 37 as it passes to a whirl 13. Pulley 37 is mounted on arm 38 carried by rod 39 mounted by bracket 40 on cross member 15. As is the case with rod 29 carrying pulleys 26, rod 39 for pulley 37 may extend lengthwise of the apparatus and be supported by the other cross member 15 included in the reciprocatory frame. Rod 39 may therefore be used to support corresponding pulleys 37 for adjacent belts 21.

Pulley 36 is designed to maintain a substantially constant tension on belt 21 and to take up slack in the belt during reciprocation of the lifting frame. Thus in the apparatus shown, pulley 36 is mounted on an arm 41 which is pivotally connected to a bracket 42 rigidly fixed to a rod 43 which is rigidly connected to the frame of the apparatus and which likewise extends lengthwise of the apparatus, supporting in a similar manner pulleys 36 for other belts. A tension member such as cable 44 passing over sheave 45 mounted on bracket 42 is connected at one end to the pivotally mounted arm 41 supporting pulley 36 and has

connected thereto at the other end a suitable counterweight 46.

Pulleys 26 and 37 for opposite runs of the belt are mounted to move in unison with the lifting rails and in fixed relation with respect to the plane of the belt starting on the whirls. These pulleys are shown as mounted in fixed relation with respect to the lifting rails 5, although they might be suitably movably mounted thereon to take up slack in the belt without interfering with their guiding function. The pulleys 27 and 36 are supported by the rigid frame of the machine and aid in increasing the angle of wrap of the belt around the driving drum 22. In the illustrated embodiment of the invention, pulley 26 also performs this function.

The movement of the various portions of the belt 21 and associated apparatus during reciprocation of the lifting rails can be understood by reference to Figures 1 and 4.

Thus when the lifting rails 15 are in the lowermost position, as is shown by full lines in Figure 1, pulleys 26 and 37 serve to guide their respective runs of the belt 25 and 35 onto the whirls 13 toward which the belt is passing, since said pulleys are fixed to and move downward with the lifting rails 15. After the belt leaves the whirls on each lifting rail and is passing toward the drums 22, it is not necessary that it be guided with respect to the whirls, and hence these portions of the runs 25 and 35 of the belt have no guide pulleys mounted on the reciprocatory frame and are upwardly inclined toward the drum. Similar conditions occur when the lifting rail is in the uppermost position, as shown by the dotted lines in Figure 1. In this position the pulleys 26 and 37, being in fixed positions with respect to the whirls 13 to which the belt passes, guide the belt passing to said whirls, while the portions of the runs 25 and 35 leaving the whirls and passing to the driving drum are downwardly inclined toward the driving drum.

During reciprocation of the lifting rails, therefore, the belt is at all times positively guided as it starts on the whirls and consequently moves in a fixed path with respect to each whirl toward which it is traveling. Furthermore, during such reciprocation the tension pulley 36 moves to take up the slack in the belt caused by the reciprocation of the lifting rails, as shown by the positions indicated in full and dotted lines in Figure 3, thus maintaining a substantially constant tension in the belt. The arrangement of the pulleys is such that very little change occurs in the angles of wrap of the two runs of the belt on the drum.

In the illustrated embodiment of the invention, there is obtained a substantial degree of wrap of each run of the belt around driving drum 22 as a result of the fact that at least one pulley contacts each of the runs of the belt and causes it to wrap around said driving drum in an open loop in the bight of which is disposed the driving drum itself. By an "open loop" is meant a loop such that the run of the belt does not cross upon itself in such manner as to enclose the driving drum completely. Since neither run of the belt crosses upon itself, all portions of each run of the belt, whether in contact with or in the immediate vicinity of the drum, are disposed in a plane perpendicular to the axis of rotation of the drum, thus eliminating any bending of the belt in the plane of the belt. Moreover, in the illustrated embodiment of the invention, pulley 36 is disposed in a bight in run 21 of the belt between driving drum 22 and pulley 37.

To change the direction of rotation of the whirls, the various pulleys 26, 27, 36 and 37 may be moved lengthwise of the driving drum 22 to positions in which they are in contact with the runs of the same belt opposite from the runs which they originally contacted. This may be accomplished by bodily sliding lengthwise of the drum the various rods 29, 33, 39 and 43 supporting the pulleys and the pulleys supported thereby. This end can be effected by loosening the brackets 31, 34, 40, etc., which may be designed for this purpose, and clamping said rods to the cross members 15 or to the frame of the machine, as the case may be.

Furthermore, the runs of the belt should be interchanged with respect to the drum; that is, the run which originally passes over the drum should be passed under the drum and the run which passes under the drum should be passed over the drum. This may readily be accomplished without severing the belt after the belt has been removed from the pulleys so that it is slack, by lifting the belt from the whirls at opposite sides of the apparatus, and turning the belt over bodily so that the runs are interchanged. After the pulleys and the runs of the belt have been thus interchanged, the direction of rotation of the spindles will be changed although the direction of rotation of the driving drum 22 is the same. These and similar changes may be made in only a very few minutes.

Referring now to other details of the illustrated apparatus, the reciprocatory frame comprising lifting rails 5 and cross members 15 is moved up and down by means of flexible tension members 47, such as chains, each fastened at one end to one end of the cross members 15 and at the other to a sprocket 48 (Fig. 2) rigidly fixed to a shaft 49 extending longitudinally of the apparatus along each side thereof. Each such shaft 49 may be connected by such tension members 47 to a plurality of cross members 15 disposed at intervals along the length of the apparatus. Each of said shafts 49 may have rigidly connected thereto one or more sprockets 51, each having connected thereto and adapted to wind therearound a tension member 52 supporting a counterweight 53. The tension members 47 and 52 for each shaft 49 are, as shown, mounted on their corresponding sprockets on opposite sides of said shaft 49 so that as one unwinds from its sprocket the other winds on its corresponding sprocket. The counterweights 53 serve to counterbalance a portion of the weight of the reciprocating parts.

The shaft 49 on the left-hand side of the machine in the figures is provided at one end with a sprocket 54 (Figs. 2 and 5) having connected thereto and adapted to wind thereabout a tension member 55 which is connected at its other end to a lever 56. One end of lever 56 is connected to said tension member 55 while the other end is pivotally mounted as at 57 on the frame 9 of the machine. In the illustrated embodiment the drive end of the frame 9 of the machine is provided with a housing 58 on which the lever 56 is pivotally mounted and which further rotatably carries a suitably shaped cam 59. Pressure of cam 59 as it rotates against a rotatable follower 61 carried by lever 56 actuates the reciprocatory frame.

Cam 59 is rotated by a speed reducer 62 (Figures 2 and 5) fixed on the back of the housing 58, which speed reducer is driven by a motor 63 likewise rigidly mounted on the back of said housing 58. Motor 63 drives speed reducer 62,

cam 59 and driving drum 22 by a chain 64 contained in housing 58, as shown, which chain 64 interconnects suitable sprockets 65 mounted on the shafts of motor 63, speed reducer 62, and drum 22. A suitable tension sprocket 66 is provided to maintain the desired tension in the chain 64. Access may be had to the interior of the housing 58 and to the chain 65 and associated mechanism by removal of cover plate 67. Since the chain 64 and its associated mechanism is contained within the housing member 58, it is adequately protected and lubricated.

Thus driving drum 22 is rotated at a high speed while the cam 59 is rotated at a low speed from the same motor.

A flexible cross tension member 68 connected at one end to a sprocket 69 on the left-hand shaft 49 and at the other end thereof to a sprocket 71 connected to the shaft 49 on the right-hand side of the machine, as shown, serves to actuate the shaft 49 on the right-hand end of the machine. Therefore the reciprocatory frame and lifting rails on opposite sides of the apparatus forming a part thereof are reciprocated in unison. The flexible tension member 68, as well as members 47, 52, and 55 are preferably chains, although other types of such members may be employed.

In the illustrated embodiment of the invention, as shown in Fig. 5, the reels 2 on which the thread is dried are enclosed in suitable housings 72 to protect them from external influences and are heated internally through the agency of heating fluid circulated into the interior of the reel through the reel drive shafts 73 by means of supply and return pipes 74 and 75. The reels are shown as being rotated by means of gears 76 mounted on their respective drive shafts 73 rotated by gears 77 mounted on drive shafts 78. The reels are supported by means of suitable brackets 79 on inclined members 81 forming part of the frame of the illustrated apparatus. The reels 2 and their appurtenant apparatus, however, form no part of the present invention.

The present invention thus provides spindle driving apparatus particularly adaptable for use in cases in which the spindles are mounted on reciprocatory frames, which apparatus is simple in construction, efficient in operation, and, because it provides a design in which the opposite runs of the belt travel in spaced, substantially parallel planes, minimizes belt wear due to excessive bending of the belt in the plane of the belt. Since both runs of the belt may be positively driven by the driving drum, belt slip is reduced to a minimum. While the lifting rails on opposite sides of the apparatus are shown as connected together by cross members, it is apparent that this is not strictly necessary, since the lifting rails may be otherwise moved in unison. The term "reciprocatory frame" as used in the claims is intended to cover such a construction.

It is intended that the patent shall cover, by suitable expression in the appended claims, whatever features of patentable novelty reside in the invention.

What is claimed is:

1. Apparatus for rotating the spindles of twisting or doubling apparatus comprising a rotatable driving member; spindles mounted on opposite sides of the axis of rotation of said driving member; an endless belt passing around said spindles on opposite sides of said driving member enclosing said driving member between opposite runs thereof, each of the opposite runs of said

belt contacting said driving member but passing across said driving member only once; and a pulley contacting each of said runs of said belt mounted to urge said run of said belt against said driving member to provide a substantial angle of wrap of said run of said belt on said driving member.

2. Apparatus of the character described in claim 1 in which at least one of said pulleys is movably mounted to maintain a substantially constant tension on said belt.

3. Apparatus for rotating the spindles of twisting or doubling apparatus comprising a rotatable driving member; spindles mounted on opposite sides of the axis of rotation of said driving member; an endless belt passing around said spindles on opposite sides of said driving member enclosing said driving member between opposite runs thereof, both opposite runs of said belt contacting said driving member at points spaced lengthwise thereof in such manner that each run passes only once across said driving member and the surface of the driving member contacting each run of the belt moves in the same direction as such run of the belt; and a pulley contacting each of said runs of said belt mounted to urge said run of said belt against said driving member to provide a substantial angle of wrap of said run of said belt on said driving member.

4. Apparatus of the character described in claim 3 in which at least one of said pulleys is mounted for restrained movement in response to variations in the tension of said belt.

5. Apparatus for rotating the spindles of twisting or doubling apparatus comprising a rotatable driving member; spindles mounted on opposite sides of the axis of rotation of said driving member; an endless belt passing around said spindles on opposite sides of said driving member enclosing said driving member between opposite runs thereof, each of the opposite runs of said belt contacting said driving member; pulleys mounted on opposite sides of said driving member contacting opposite runs of the belt, each pulley guiding the corresponding run of the belt to the spindle to which the belt passes from said driving member; and pulleys mounted in close proximity to said driving member contacting opposite runs of the belt urging the belt against said driving member to provide a substantial angle of wrap of each run of the belt on said driving member.

6. Apparatus for rotating the spindles of twisting or doubling apparatus comprising a rotatable driving member; spindles mounted on opposite sides of the axis of rotation of said driving member; an endless belt passing around said spindles on opposite sides of said driving member enclosing said driving member between opposite runs thereof, each of the runs of said belt contacting said driving member; but passing across said driving member only once; and one or more pulleys contacting each run of said belt on the side of said belt opposite the side of the belt which contacts said driving member to urge the belt against said driving member, at least one of said pulleys being mounted to form a bight between a spindle and said driving member in the run of the belt which said pulley contacts.

7. Apparatus for rotating spindles comprising a rotatable driving member; spindles mounted on opposite sides of the axis of rotation of said driving member; an endless belt passing around said spindles on opposite sides of said driving

member enclosing said driving member between opposite runs of said belt, both runs of said belt contacting said driving member; and pulleys contacting opposite runs of said belt, said pulleys being mounted so that one run of the belt passes under one of said pulleys and over the driving member while the other run of the belt passes over another of said pulleys and under the driving member, whereby a substantial angle of wrap of each run of the belt on said driving member is provided.

8. Apparatus for rotating spindles comprising a rotatable driving member; spindles mounted on opposite sides of the axis of rotation of said driving member; an endless belt passing around said spindles on opposite sides of said driving member enclosing said driving member between opposite runs of said belts, both runs of said belt contacting said driving member; pulleys contacting one of said runs of said belt on opposite sides of said driving member to urge said run of the belt against the driving member, one of said pulleys guiding the belt onto the spindle to which said run of the belt passes; and pulleys contacting the other run of the belt, one of said pulleys guiding the belt onto the spindle to which said run of the belt passes and another pulley forming a bight on said run of the belt between said first-mentioned pulley contacting said run and said driving means.

9. Apparatus of the character described in claim 8 in which said last-mentioned pulley is movably mounted to maintain a constant tension on said belt.

10. Apparatus for rotating reciprocatory spindles comprising a stationary frame; a driving member mounted for rotation about an axis fixed with respect to said stationary frame; a reciprocatory frame associated with said stationary frame; spindles mounted on said reciprocatory frame on opposite sides of the axis of said driving member; an endless belt passing around said spindles on opposite sides of said driving member enclosing said driving member between opposite runs thereof, each of the runs of said belt contacting said driving member but passing across said driving member only once; and pulleys carried by said stationary frame and said reciprocatory frame contacting the opposite runs of said belt and urging said runs of said belt against said driving member, thereby providing a substantial angle of wrap of each run of the belt on said driving member.

11. Apparatus for rotating reciprocatory spindles comprising a stationary frame; a driving member mounted for rotation about an axis fixed with respect to said stationary frame; a reciprocatory frame associated with said stationary frame; spindles mounted on said reciprocatory frame on opposite sides of the axis of said driving member; an endless belt passing around said spindles on opposite sides of said driving member, both opposite runs of said belt contacting said driving member at points spaced lengthwise thereof in such manner that each run passes only once across said driving member and the surface of the driving member contacting each run of the belt is moving in the same direction as such run of the belt; and pulleys carried by said stationary frame and said reciprocatory frame contacting the opposite runs of said belt and urging said runs of said belt against said driving member, thereby providing a substantial angle of wrap of each run of the belt on said driving member.

12. Apparatus for rotating reciprocatory spindles comprising a stationary frame; a driving member mounted for rotation about an axis fixed with respect to said stationary frame; a reciprocatory frame associated with said stationary frame; spindles mounted on said reciprocatory frame on opposite sides of the axis of said driving member; an endless belt passing around said spindles on opposite sides of said driving member, said endless belt passing in two spaced runs between said spindles in such manner that one of said runs passes over said driving member and the other of said runs passes under said driving member but with both runs of said belt contacting said driving member; and pulleys contacting both runs of said belt in close proximity to said driving member to urge each run of said belt against said driving member, the pulleys contacting at least one of said runs of said belt being disposed on opposite sides of said driving member and at least one of said pulleys being mounted on said reciprocatory frame.

13. Apparatus for rotating reciprocatory spindles comprising a stationary frame; a driving member mounted for rotation about an axis fixed with respect to said stationary frame; a reciprocatory frame associated with said stationary frame; spindles mounted on said reciprocatory frame on opposite sides of the axis of said driving member; an endless belt passing around said spindles on opposite sides of said driving member enclosing said driving member between opposite runs of said belt, one run of said belt passing under said driving member and the other run of said belt passing over said driving member but both runs of said belt contacting said driving member; and pulleys carried by said stationary frame contacting each run of said belt, said pulleys being mounted so that the belt in the run passing over the driving member passes under one of said pulleys while in the other run the belt passing under said driving member passes over another of said pulleys.

14. Apparatus for rotating reciprocatory spindles comprising a stationary frame; a driving member mounted for rotation about an axis fixed with respect to said stationary frame; a reciprocatory frame associated with said stationary frame; spindles mounted on said reciprocatory frame on opposite sides of the axis of said driving member; an endless belt passing around said spindles on opposite sides of said driving member enclosing said driving member between opposite runs of said belt, one run of said belt passing under said driving member and the other run of said belt passing over said driving member but both runs of said belt contacting said driving member; pulleys carried by said stationary frame contacting each run of said belt, said pulleys being mounted so that the belt in one of said runs passes over one of said pulleys and under the driving member while in the other of said runs the belt passes under another of said pulleys and over the driving member; and pulleys mounted on said reciprocatory frame contacting each run of said belt, each of said last-mentioned pulleys guiding the belt onto the spindle to which the belt passes.

15. Apparatus of the character described in claim 14 in which at least one of said pulleys is mounted for movement in a predetermined path in response to changes in the tension of the belt.

16. Apparatus for rotating reciprocatory spindles comprising a stationary frame; a driving member mounted for rotation about an axis fixed

with respect to said stationary frame; a reciprocatory frame associated with said stationary frame; spindles mounted on said reciprocating frame on opposite sides of the axis of said driving member; an endless belt passing around said spindles on opposite sides of said driving member enclosing said driving member between both opposite runs of said belt, both runs of said belt contacting said driving member; pulleys on opposite sides of said driving member contacting one run of said belt to urge it against said driving member, one of said pulleys being mounted on said reciprocatory frame and the other of said pulleys being carried by said stationary member; and pulleys contacting the other run of said belt, one of said pulleys being mounted on the reciprocatory frame and the other pulley being carried by said stationary frame member and forming a bight in the belt between said first-mentioned pulley contacting said run of the belt and said driving member.

17. Apparatus of the character described in claim 16 in which said last-mentioned pulley carried by said stationary member is movably mounted to maintain a substantially constant tension in said belt.

18. Apparatus of the character described in claim 16 in which at least one of said pulleys is capable of restrained movement independently of its supporting means to maintain a substantially constant tension in said belt.

19. Apparatus for rotating reciprocatory spindles comprising a stationary frame; a driving member mounted for rotation about an axis fixed with respect to said stationary frame; a reciprocatory frame associated with said stationary frame; spindles mounted on said reciprocatory frame on opposite sides of the axis of said driving member; an endless belt passing about said spindles on opposite sides of said driving member, both runs of said belt contacting said driving member but with one run of said belt passing over said driving member and the other run of said belt passing under said driving member; a pulley carried by said reciprocatory frame under which pulley the run of the belt passing over said driving member passes to a spindle; a pulley carried by said stationary frame on the other side of said driving member under which the same run of the belt passes; a pulley carried by said reciprocatory frame contacting the other run of the belt under which pulley the belt passes from said driving member to a spindle; and, carried by said stationary frame, a pulley over which said run of the belt passes between said driving member and said last-mentioned pulley.

20. Apparatus of the character described in claim 19 in which said last-mentioned pulley carried by the stationary frame is movably mounted to maintain a substantially constant tension in the belt.

21. Apparatus for rotating the spindles of twisting or doubling apparatus comprising a rotatable driving member; spindles mounted on opposite sides of the axis of rotation of said driving member; an endless belt passing around said spindles on opposite sides of said driving member enclosing said driving member between opposite runs of said belt each of which contacts said driving member, all portions of each run in the vicinity of and contacting said driving member lying in a plane perpendicular to the axis of rotation of said driving member; and at least one pulley contacting each of said runs of said belt mounted to urge said run of said belt against said driving member.

22. Apparatus for rotating the spindles of twisting or doubling apparatus comprising a rotatable driving member; spindles mounted on opposite sides of said driving member; an endless belt passing around said spindles on opposite sides of said driving member enclosing said driving member between opposite runs of said belt; and at least one pulley contacting each of said runs of said belt in close proximity to said driving member to form an open loop in said run in the bight of which said driving member is disposed, whereby said driving member contacts each of said runs of said belt in driving relation.

23. Apparatus for rotating the spindles of twisting or doubling apparatus comprising a rotatable driving member; spindles mounted on opposite sides of the axis of rotation of said driving member; an endless belt passing around said spindles on opposite sides of said driving member enclosing said driving member between opposite runs of said belt each of which runs contacts said driving member in driving relation, said runs being spaced longitudinally of said driving member; and, associated with at least one of the runs of said belt, pulleys mounted on opposite sides of said driving member urging said run of said belt against said driving member, said pulleys being mounted to form an open loop in said run in the bight of which said driving member is disposed.

24. Apparatus for rotating reciprocatory spindles comprising a stationary frame; a driving member mounted for rotation about an axis fixed with respect to said stationary frame; a reciprocatory frame associated with said stationary frame; spindles mounted on said reciprocatory frame on opposite sides of the axis of said driving member; an endless belt passing around said spindles on opposite sides of said driving member enclosing said driving member between opposite runs of said belt each of which contacts said driving member, all portions of each run in the vicinity of and contacting said driving member lying in a plane perpendicular to the axis of rotation of said driving member;

and at least one pulley contacting each of said runs of said belt mounted on one of said frames to urge said run of said belt against said driving member.

25. Apparatus for rotating reciprocatory spindles comprising a stationary frame; a driving member mounted for rotation about an axis fixed with respect to said stationary frame; a reciprocatory frame associated with said stationary frame; spindles mounted on said reciprocatory frame on opposite sides of the axis of said driving member; an endless belt passing around said spindles on opposite sides of said driving member enclosing said driving member between opposite runs of said belt; and, mounted on one of said frames at least one pulley contacting each of said runs of said belt in close proximity to said driving member to form an open loop in said run in the bight of which said driving member is disposed, whereby said driving member contacts each of said runs of said belt in driving relation.

26. Apparatus for rotating reciprocatory spindles comprising a stationary frame; a driving member mounted for rotation about an axis fixed with respect to said stationary frame; a reciprocatory frame associated with said stationary frame; spindles mounted on said reciprocatory frame on the opposite sides of the axis of said driving member; an endless belt passing around said spindles on opposite sides of said driving member enclosing said driving member between opposite runs of said belt, each of the runs of said belt contacting said driving member; and, associated with at least one of said runs of said belt, pulleys mounted on opposite sides of said driving member urging said run of said belt against said driving member, said pulleys being mounted to form an open loop in said run in the bight of which said driving member is disposed.

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