Apparatus for reciprocating a yarn guide including a carriage mounted for reciprocating movement on a frame, a pinion wheel rotatably mounted on the carriage, a rack slidably mounted on the carriage meshing with the pinion wheel and having a follower sliding in an elongate track to control movement of the rack to rotate the pinion wheel, and a rack carrying a yarn guide and meshing with the pinion wheel such that rotation of the pinion wheel moves the yarn guide with adjustment of the angular orientation of the elongate track relative to the reciprocating path of the carriage controlling the distance of reciprocating travel of the yarn guide.

10 Claims, 5 Drawing Figures
YARN GUIDE RECIPROCATING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention
The present invention pertains to winding of yarn and, more particularly, to apparatus for reciprocating a yarn guide during winding.

2. Discussion of the Prior Art
In the textile industry, yarn is wound on supports by means of a yarn guide which is moved in a reciprocating path along the length of the winding support to evenly distribute the yarn wound on the support. The obtainment of precise reciprocating movement of the yarn guide has presented a problem in the prior art, which problem is compounded by the requirement that the reciprocating path be adjustable or modified for various applications, many times during winding of a single yarn bundle.

In U. S. Pat. application Ser. No. 886,214 filed Dec. 18, 1969, now U.S. Pat. No. 3,696,862 apparatus for reciprocating a yarn guide having a variable distance of reciprocating travel is described, such apparatus utilizing a follower travelling along an inclined track or cam to control reciprocating movement between zero and double the movement of normal travel directly provided by a carriage. To provide such variable travel, this apparatus includes a pair of orthogonally disposed racks having interengaging inclined teeth such that movement of one of the racks mounted on the reciprocating carriage causes orthogonal movement of the other rack which carries a yarn guide. The teeth of the racks are inclined normally at a 45° or greater angle with the angle of the teeth of the two racks being complementary. When the track is inclined in the same direction as the incline of the teeth of the racks, reciprocating travel of the yarn guide is reduced; and when the track is inclined in a direction opposite to the incline of the teeth of the racks, the reciprocating travel of the yarn guide is increased.

While the above described apparatus provides an effective manner in which to control or vary the distance of reciprocating travel of a yarn guide, it has a disadvantage concomitant with the direct meshing of the inclined teeth of the two racks in that the force required to obtain the variation in reciprocating travel is great due to the friction between the directly meshed inclined teeth.

SUMMARY OF THE INVENTION
Accordingly, it is an object of the present invention to provide apparatus for varying the reciprocating travel of a yarn guide with reduced force.

It is another object of the present invention to provide an improvement of the apparatus of the above mentioned patent application by providing intermediate pinion meshing with a pair of orthogonal racks.

A further object of the present invention is to utilize orthogonally oriented racks in engagement with a pinion in apparatus for reciprocating a yarn guide with the racks being resiliently biased toward the pinion.

An additional object of the present invention is to provide simplified apparatus for accurately controlling the distance of reciprocating travel of a yarn guide with a minimum of moving parts.

The present invention has another object in that apparatus for controlling the reciprocating travel of a yarn guide is adapted for programmed control during winding of a yarn bundle.

Some of the advantages of the present invention over the prior art are that the apparatus is relatively simple with a minimum of moving parts and therefore is economical and can be operated at high speeds, that the apparatus is simple to mount on a textile machine, that the apparatus is easily operated and maintained and therefore can be used with various textile machines particularly twisting and winding machines as well as all machines requiring a reciprocating yarn guide, that the apparatus provides precise control, and that the apparatus is easily adapted for programmed control of the reciprocating travel of a yarn guide.

The present invention is generally characterized in apparatus for reciprocating a yarn guide including a frame, a carriage supported on the frame for movement back and forth along a reciprocating path, a pinion rotatably mounted on the carriage, guide means mounted on the carriage slidably receiving a first rack which engages the pinion, a follower carried by the first rack and slidably received in a channel in an elongate track, an adjustment mechanism pivotally mounting the track on the frame to permit adjustment of the track in parallel and oblique positions relative to the reciprocating path of the carriage, and a second rack carrying the yarn guide and engaging the pinion whereby the follower slides along the track to control rotation of the pinion and, accordingly, movement of the second rack and the yarn guide as the carriage is moved back and forth along the reciprocating path such that the distance of reciprocating travel of the yarn guide is controlled by the angular position of the track.

Other objects and advantages of the present invention will become apparent from the following description of the preferred embodiment taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS
FIG. 1 is a broken side elevation of reciprocating apparatus according to the invention.
FIG. 2 is a broken perspective of the track of FIG. 1 with the follower disposed therein.
FIGS. 3 and 4 are diagrammatic illustrations of the operation of the apparatus of FIG. 1 with minimum and maximum reciprocating travel of the yarn guide, respectively.
FIG. 5 is a broken section of a modification of the apparatus of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT
Apparatus for reciprocating a yarn guide according to the present invention is illustrated in FIG. 1 and includes a carriage 10 having ears 12 extending from the corners thereof to slidably engage a pair of parallel rods 14 and 16 carried by a frame 18. Carriage 10 is moved linearly back and forth along a reciprocating path by any conventional means such as a rotating cylinder having a helical groove therein receiving a follower fixed to the carriage.

A pinion wheel 20 has teeth 21 around the periphery thereof and is rotatably mounted on carriage 10 by means of a shaft 22 and suitable bearings such that the axis of rotation of pinion 20 is transverse to the reciprocating path of carriage 10. At the end of carriage 10 is fixed a guide member 24 U-shaped in cross-section to...
define a channel extending therethrough having a sliding surface 27 along the bottom thereof. A rack member 28 is received in the channel in guidemember 24 and has a rear surface 30 sliding on surface 26 in the channel. Rack 28 has teeth 32 protruding therefrom to directly mesh with teeth 21 of pinion 28, and rack 28 is arranged to slide in a path transverse to the reciprocating path of carriage 10 and transverse to the axis of rotation of pinion 20.

A block-shaped follower 34 is mounted on the side of rack 28 and, as shown in FIG. 2, is received in a channel 36 in an elongate track 38 pivotally mounted on frame 18 at a position intermediate rods 14 and 16 and between the ends of the reciprocating path by adjustment means including a pivot pin 40 and clamping means such as a nut 41 such that the track is adjustable to parallel and oblique positions relative to the reciprocating path of carriage 10. The track 38 operates as a cam having an adjustable incline such that rack 32 is moved in accordance with the incline of track 38 due to movement of the follower in the channel 36 in the track.

A rack member 42 is slidably mounted on a slide bar 44 disposed in parallel relation with rods 14 and 16 and the reciprocating path of carriage 10 and in transverse relation with the sliding path of rack 28, and a yarn guide 46 is carried by rack 42. Rack 42 has teeth 48 protruding therefrom directly meshing with teeth 21 of pinion 20 such that rotational movement of pinion 20 due to movement of rack 28 causes movement of rack 42 and, accordingly, yarn guide 46 parallel to the reciprocating path of the carriage 10.

The operation of the yarn guide reciprocating apparatus will be described with reference to FIGS. 3 and 4 wherein the reciprocating path of the carriage 10 has a constant length L0 and the reciprocating travel of yarn guide 46 ranges from a minimum L1 to a maximum L2, as shown in FIG. 3, to a maximum L3, as shown in FIG. 4. With track 38 disposed at a position parallel to the reciprocating path of carriage 10, as shown in dashed lines at C, follower 34 will experience no movement in the direction of sliding movement of rack 28; and since rack 28 does not move other than with the carriage along the reciprocating path, pinion 20 will not rotate and rack 42 will be maintained at a central position relative to the pinion 20. Accordingly, the distance of reciprocating travel of yarn guide 46 with track 38 at position C corresponds with the length L0 of the reciprocating path of the carriage 10.

When track 38 is adjusted to position A oblique to the reciprocating path of carriage 10, follower 34 will be moved upward as the carriage moves to the right looking at FIG. 3 such that pinion 20 rotates counterclockwise to move rack 42 to the left toward the center of the reciprocating path. As carriage 10 is moved to the left, follower 34 is moved downward such that pinion 20 rotates clockwise to move rack 42 to the right toward the center of the reciprocating path. Accordingly, since the end of travel of rack 42 is moved inward at each end of the reciprocating path, the distance L0 of reciprocating travel of yarn guide 46 is reduced due to the incline of track 38 in the A position.

Similarly, the distance L0 of reciprocating travel of yarn guide 46 is increased when track 38 is adjusted to position B oblique to the reciprocating path of carriage 10 since, looking at FIG. 4, pinion 20 will rotate counterclockwise to move rack 42 to the right as the carriage moves to the right. Thus, the ends of travel of rack 42 are extended at the ends of the reciprocating path to increase the distance of reciprocating travel of the yarn guide 46.

Thus, during operation, either due to increase in the size of a yarn bundle being wound or due to operation of a suitable control mechanism provided with a predetermined program, track 38 can be angularly disposed at any intermediate position between A and B to control the linear distance of reciprocating travel of yarn guide 46 without deformation, and the oscillation of track 38 about pin 40 permits yarn bundles of varying predetermined configurations to be formed. The control mechanism for angularly adjusting the track can take any convenient form, such as a clamp connected through a link with movable member, such as a piston, armature, or rotor, of a motor.

A modification of the apparatus of FIG. 1 is illustrated in FIG. 5 to reduce play between rack 28 and pinion 20. The modification of FIG. 5 biases the rack 28 toward the pinion 20 by means of a coiled spring 50 mounted in compression between a wall of a recess 52 in the sliding surface 26 of guidemember 24 and a piston 52 having an end engaging the rear surface 30 of rack 28. The spring 50 provides a constant force on the rack 28 and its resiliency reduces vibration in the apparatus.

The track 38 can be adjusted to any angular position required to obtain any desired distance of reciprocating travel for the yarn guide due to the orthogonal relationship between racks 28 and 42, and any suitable rotatable means can be utilized in place of pinion 20, it being of primary importance only that movement of rack 28 engage an intermediate means which converts the movement of rack 28 to move rack 42 in a different direction, preferably transversely. For instance, a number of interconnected elements could be utilized to provide the movement conversion; and, while the use of a single element, such as pinion 20, is preferred, the periphery need be toothed only at those areas which engage the racks and other configurations of pinions could be used. The engagement between the rack and the pinion is desirable of a non-slip type nature. Thus, toothed engagement is preferred. However, other types of mechanical and frictional engagement can be utilized in accordance with the present invention.

Inasmuch as the present invention is subject to many modifications, variations and changes in detail, it is intended that all matter described above or shown in the drawings be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. Apparatus for reciprocating a yarn guide comprising a frame; a carriage supported on said frame and movable back and forth along a reciprocating path; pinion means rotatably mounted on said carriage; guide means mounted on said carriage; first rack means slidably received in said guide means and engaging said pinion means; a follower carried by said first rack means; elongate track means having a channel slidably receiving said follower; adjustment means pivotally mounted said track means on said frame to permit adjustment of said track means in parallel and oblique positions relative to said reciprocating path; and second rack means carrying the yarn guide engaging said pinion means whereby said follower slides along said track
means to control rotation of said pinion means and movement of said second rack means and said yarn guide as said carriage is moved back and forth along said reciprocating path such that the distance of reciprocating travel of said yarn guide is controlled by the angular position of said track means.

2. The apparatus as recited in claim 1 wherein said pinion means includes a wheel having a toothed periphery, and said first and second rack means each have teeth engaging said peripheral teeth of said wheel.

3. The apparatus as recited in claim 1 wherein said first and second rack means are orthogonally aligned.

4. The apparatus as recited in claim 1 wherein said pinion means has teeth projecting therefrom and said first and second racks each have teeth directly meshing with said teeth of said pinion means.

5. The apparatus as recited in claim 1 and further comprising bias means disposed between said guide means and said first rack means for biasing said first rack means toward said pinion means.

6. The apparatus as recited in claim 5 wherein said guide means includes a sliding surface with a recess therein, said first rack means includes a rear surface sliding on said sliding surface of said guide means, and said bias means includes a piston and a coiled spring mounted in compression in said recess between said recess and said piston to force said piston against said rear surface of said first rack means.

7. The apparatus as recited in claim 1 wherein said frame includes a pair of parallel rods slidably mounting said carriage, and a slide bar in parallel relation with said rods mounting said second rack means.

8. The apparatus as recited in claim 1 wherein said guide means and said first rack means are disposed transverse to said reciprocating path, and said second rack means is disposed parallel to said reciprocating path.

9. The apparatus as recited in claim 8 wherein said frame includes a slide bar disposed in parallel relation with said reciprocating path, said pinion means is a toothed wheel rotatably mounted on a shaft having an axis transverse to said reciprocating path and said first rack means, said first rack means is a toothed member directly meshing with said toothed wheel, and said second rack means is a toothed member slidably carried by said slide bar and directly meshing with said toothed wheel.

10. The apparatus as recited in claim 9 and further comprising spring means biasing said first rack toothed member into engagement with said toothed wheel.

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