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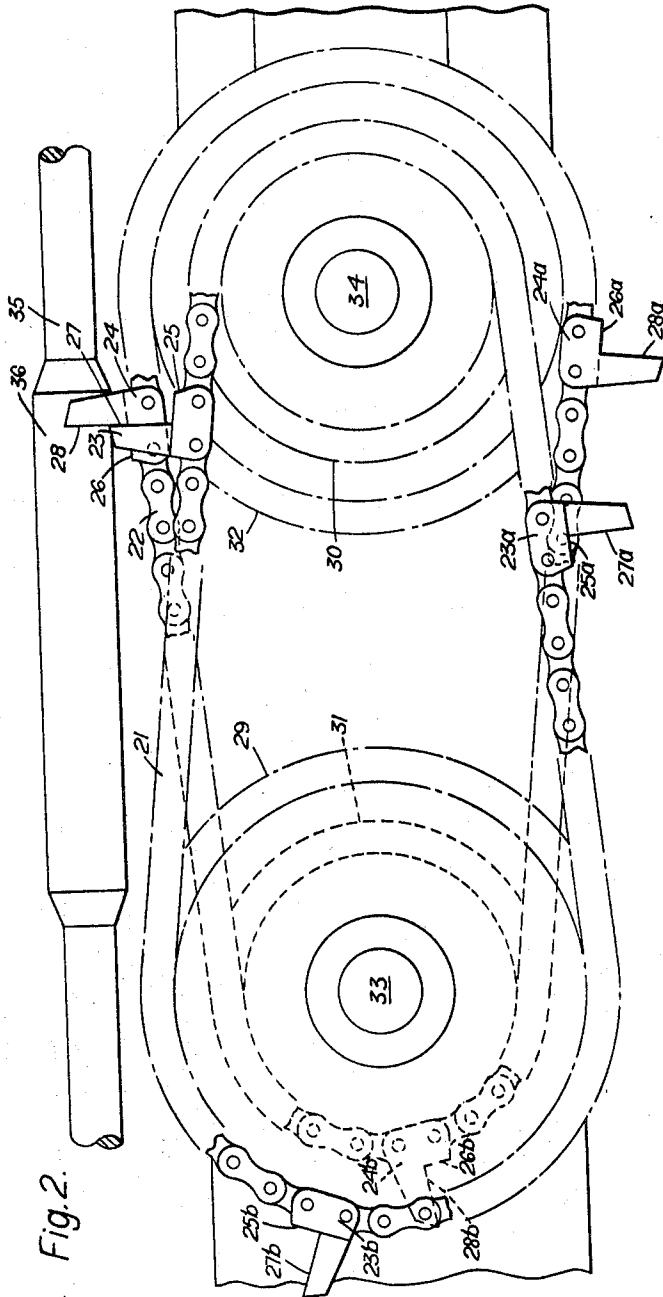


Fig. 2.

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YARN WINDING MACHINE

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5 Claims. (Cl. 242-43)

This invention relates to improvements in yarn winding machines and is particularly directed to those yarn winding machines in which a yarn is traversed across the face of a revolving package, during winding, by yarn guides. The term yarn as used in this specification includes continuous filament and staple type yarns and other yarn-like structures e.g. threads and plied structures.

In melt spinning processes, in which molten polymer is extruded through orifices into filaments which are solidified and subsequently wound-up onto revolving packages, the yarn is commonly traversed across the face of the package by means of a reciprocating or oscillating yarn guide mounted on a traverse bar. Whilst such traversing means are satisfactory at lower traversing speeds and reversal rates, at high traverse speeds and correspondingly high reversal rates the traverse bar is subjected to very high stresses during reversals of direction of traverse which would often result in the bar fracturing. Thus the maximum yarn winding speed is limited by the strains imposed on the traverse bar.

To overcome such disadvantage of the aforementioned traversing means it has been proposed to lay yarn on a revolving package by means of one or more helically grooved traverse rollers the yarn running in the grooves. In this system the maximum speed of winding is limited because of the tendency of the yarn to leave its groove, particularly during reversals, at high speeds.

In yet another system it has been proposed to traverse the yarn by means of yarn guides mounted on parallel endless bands in the form of chains moving in opposite directions or rotating discs, one guide traversing the yarn in one direction and then releasing the yarn which is then traversed in the opposite direction by second yarn guide. These systems suffer from either one of, or a combination of, two major disadvantages. The rate at which the yarn traverses the face of the package is frequently not linear thus producing a package having an unacceptable build, and additionally at reversal the yarn is frequently allowed to exist for a finite time without being controlled by a yarn guide, again this produces a package having an unacceptable build. Furthermore because of the increasing size of the package as winding progresses the yarn guides have to be positioned at a certain minimum distance from the package and thus, particularly during the early stages during winding, there is a considerable lag path between the guide and the yarn package which again results in poor package builds at reversal points, particularly since this lag path shortens as the package increases in diameter.

The present invention seeks to overcome the aforementioned disadvantages by providing an apparatus in which yarn guides are mounted on endless bands moving in opposite directions and is so designed that at reversals the yarn is instantaneously transferred from one guide to a guide moving in the opposite direction, means being provided to ensure that the effective lag path between the guides and the yarn package is always minimal.

Accordingly therefore the present invention provides an apparatus for laying yarn on a rotating yarn package comprising at least two yarn guiding members adapted to traverse yarn in opposite directions across a yarn package at constant speed and means for causing the yarn to

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be disengaged from the yarn guiding member guiding the yarn at the end of each traverse across the yarn package and simultaneously to be engaged by another guiding member moving in the opposite direction to traverse the yarn across the yarn package in that direction.

Preferably the apparatus also provides a freely rotatable roll over which the yarn passes on its path from the yarn guiding members to the package, positioned a fixed distance from the yarn guiding members and having its axis parallel to the axis of the yarn package, which roll allows the yarn to be laid effectively directly into the yarn package, the effective unconstrained path being limited to the distance between the yarn guiding members and the said roll.

In one form of the invention the yarn guiding members are mounted on endless belts moving in the same direction parallel to the axis of the yarn package.

In another form of the invention the yarn guiding members are mounted on endless belts moving in opposite directions in adjacent planes, the direction of movement of the yarn guiding members being at equal angles but in the opposite sense to the axis of the yarn package said directions of movement thereby intersecting at a point on a line substantially midway along and perpendicular to the yarn package, such that at the end of each yarn traverse the yarn moves out of contact with the yarn guiding member guiding the said yarn and simultaneously moves into contact with a yarn guiding member moving in the opposite direction to guide the yarn in that direction.

Two convenient forms of apparatus according to the invention will now be more fully described with reference to the following drawings, which forms are intended to be illustrative and not limitative of the invention.

In the drawings:

FIGURE I is a rear elevation of one design of apparatus according to this invention.

FIGURE II is a rear elevation of another design of apparatus according to this invention.

In FIGURE I, intergeared driven sprockets 1 and 2 of equal diameter rotate in the same direction and drive endless chains 3 and 4 (of equal length) which are maintained under tension by idler sprockets 5 and 6 of the same diameter as sprockets 1 and 2, around which the chains pass. Yarn guiding members 7, 7a, 8 and 8a having blade portions, 11, 11a, 12 and 12a, are mounted on chains 3 and 4 respectively. The distance between 7 and 7a and 8 and 8a is the same, i.e. half a chain length. Reversal plates 13 and 14 having inclines 15 and 16 are mounted on bars 17 and 18 respectively. The plates 13 and 14 are adjustable vertically to allow correct initial setting of the reversal action. The incline 16 of reversal plate 14 is longer than that of plate 13 to assist in stringing up the apparatus. A small diameter freely rotatable roll (not shown) is mounted behind the gap between the chains as close as practicable to the reversal plates and in contact with the drive roll for a peripherally driven yarn package. The said roll is of a length sufficient to extend for a distance at least equal to the distance between the sprockets 1 and 5.

In operation yarn is passed between the sprockets 5 and 6 and onto the incline 16 of reversal plate 14 and thence through the nips between the freely rotatable roll and the drive roll and drive roll and yarn package. The freely rotatable roll apart from its primary function in reducing the free path of the yarn also ensures that the yarn moves laterally along a path parallel to the axis of the package. The yarn slides down the incline 16 and is picked up by the blade 11 of the yarn guide member 7 and traversed across the yarn package in a direction right to left. As the yarn nears the end of its traverse it contacts incline 15 of the reversal plate 13 which causes the

yarn to be deflected so as to move towards the tip of blade 11 of yarn member 7. At the reversal point the tip of the blade 11 and the incline 15 are flush with each other this freeing the yarn from the control of the guide member 7, simultaneously control of the yarn is taken over by the tip of blade 12a of guide member 8a moving in the opposite direction and thus reversing the direction of traverse of the yarn instantaneously, the yarn always being under the control of one or other of the guide members 7 and 8. The process is repeated at the other reversal point, the yarn moving up the blade 12a under the action of the incline 16 of reversal plate 14 and control of the yarn being taken over by the blade 1a of guide member 7a at the point of reversal to traverse the yarn in the reverse direction.

Since the traversing motion is non-reciprocating high traverse speeds may be employed to give a package of satisfactory build.

The reversal plates 13 and 14 may be replaced by any other suitable system, e.g., cams. If the chains are of sufficient length the apparatus may be used to lay yarn on more than one package at a time, the only required addition being the requisite number of yarn guides and reversal plates or like systems.

In the embodiment shown in FIGURE 2 endless chains 21 and 22 which move in opposite directions carry spaced apart yarn guiding members 23, 23a, 23b and 24, 24a, 24b respectively, the yarn guiding members comprising leading edges as 25, 25a, 25b, 26 and 26a, 26b and blades 27, 27a, 27b, and 28, 28a and 28b. Chain 21 passes round sprockets 29 and 30 and chain 22 round sprockets 31 and 32. Sprockets 29 and 32 are of equal diameter and are fixed to drive shafts 33 and 34, and sprockets 31 and 30 are also of equal diameter but smaller than 29 and 32 and are arranged to be freely rotatable about shafts 33 and 34. A freely rotatable roll comprising shaft 35 and chromed steel roll portion 36 is mounted with its axis parallel to the axis of the yarn package and as close as practicable to the path of travel of the yarn guiding members and is in contact with the drive roller (not shown) of a peripherally driven yarn package (not shown).

In this embodiment yarn to be wound onto the package is passed under the roll portion 36 of the freely rotatable roll and thence round the driving roll and finally onto the package. Control of the yarn is initially taken over by one of the yarn guiding members say, member 23 moving in a direction from left to right. Because the chain 21 which carries the yarn guiding member 23 passes round two sprockets 29 and 30 of different diameter the path of the guiding member is at an angle to the axis of the yarn package. Therefore as the guide member traverses the yarn across the package the yarn, because it is constrained to move laterally in path or parallel to the yarn axis of the yarn package, moves relatively towards the tip of the blade 27 of the guide member 23. At the reversal point the yarn slips off the tip of the blade 27, which has moved below the line of the yarn path and simultaneously control of the yarn is taken over by the blade 28 of the yarn guiding member 24 which proceeds to traverse the yarn in the opposite direction, the reversal of direction of traverse having been instantaneous. At the reversal point at the other end of the yarn package an exactly similar action takes place, the yarn slips off the tip of the blade 28, which moves below the yarn path, and simultaneously the control of the yarn is taken over by the yarn guiding member 23b which traverses the yarn in the opposite direction again.

Since in this apparatus there may be a tendency for the yarn not to slip off the tip of the blade of the guide member at exactly the right point, the leading edge of each of the yarn guiding members may be arranged to make an obtuse angle with the blade portion thereof in order to assist in accurately locating the point of reversal of the direction of yarn traverse. In this man-

ner the yarn becomes momentarily under the control of both the traversing guiding member and the guide member which will take over control of the yarn at the reversal point.

The use of the freely rotatable roll in connection with the apparatus of both FIGURES 1 and 2, as aforesaid, to reduce the effective free or unconstrained path to the distance between the said freely rotatable roll and the guide members. Because the freely rotatable roll is of small diameter only, compared with the yarn package driving roller, it can be brought very close to guide members of the free path and is then effectively reduced to little more than the radius of the freely rotatable roll. The yarn in passing from the traversing apparatus to yarn package is first laid on the freely rotatable roll and then directly onto the yarn package driving roller, with which it is in contact, and finally from the driving roll onto the yarn package. There is a high coefficient of friction between the surface of the freely rotatable roll and the yarn and the surface of the drive roll and the yarn so as to ensure that slippage of the yarn on these surfaces is practically non-existent and therefore for all practical purposes the yarn is laid into the yarn package in exactly the same manner that it is laid on the freely rotatable roll.

Although it has been stated that the use of a freely rotatable roll is preferred in connection with the yarn traversing mechanisms of this invention it can, of course, be used without such a roll. In this case however some other control means must normally be provided to ensure that the yarn is constrained to move laterally along a path parallel to the axis of the yarn package. Such a control means may, for example, be in the form of a ceramic pin having its axis parallel to the axis of the package and it may be mounted before or after the traversing device.

The invention is not limited to the use of chains to carry the yarn guide members and any other suitable transport-medium, e.g., inextensible rubber bands, mounted on pulleys, may be employed in their place.

Pattern winding may be avoided when using the apparatuses of this invention to cyclically varying the speed of the motor driving the sprockets carrying the chains.

What I claim is:

1. Apparatus for laying a yarn on a driven rotating yarn package comprising: two oppositely driven endless members disposed in adjacent planes in positions such that at least a portion of one run of each member travels in a path which is inclined to the axis of the yarn package, said inclined paths being at equal angles relative to the axis of the yarn package but in the opposite sense and being disposed such that the directions of said paths intersect at a point on a line substantially midway along and perpendicular to the yarn package; a plurality of yarn guiding members mounted on each of said endless members in such spaced-apart positions that two oppositely moving guiding members on said run portions pass each other at spaced apart traverse points, each of which corresponds to an opposite end of the yarn package; and means mounted adjacent said run portions of said endless members for constraining the yarn being guided by one of said guiding means to move in a yarn traverse path which is parallel to the axis of the yarn package whereby whichever yarn guiding means is guiding the yarn along said yarn path toward one of said traverse points moves out of said yarn path at said one traverse point so as to allow the yarn to slip off the tip of said one guiding member and simultaneously into contact with an oppositely moving yarn guiding member.

2. Apparatus as in claim 1 wherein said yarn constraining means includes a freely rotatable roll disposed with its axis parallel to the axis of the yarn package.

3. Apparatus as in claim 2 wherein said freely rotatable roll is disposed a fixed distance from said endless members and is adapted to be in peripheral proximity with

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a driven roll arranged to drive the yarn package by peripheral contact therewith whereby said freely rotatable roll will receive the yarn from said yarn guiding members and will lay the yarn on to the driven roll for transfer to the yarn package.

4. Apparatus as in claim 2 wherein each endless member is an endless chain, said apparatus further comprising a set of at least two sprockets of different diameters associated with each chain, the larger diameter sprocket of one set being mounted coaxially with the smaller diameter sprocket of the other set and means for driving at least one sprocket of each set.

5. Apparatus as in claim 2, wherein each of said endless members is an inextensible band, said apparatus further comprising a set of at least two pulleys of different diameters associated with each band, the largest diameter

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pulley of one set being mounted coaxially with the smaller diameter pulley of the other set and means for driving at least one pulley of each set.

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