

[54] TRAINING IDLER

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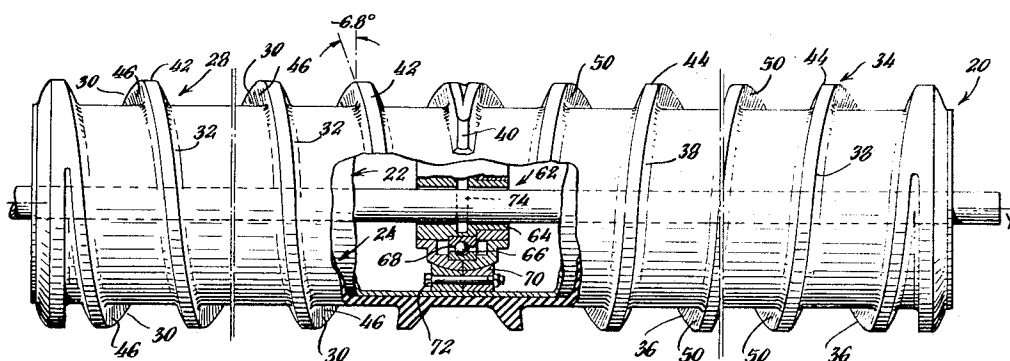
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[57]

ABSTRACT

A skewing, rigid urethane spiral training idler and method of forming the same wherein the idler has right and left hand threads with continuous helical lands extending from the ends of the roll to the center of the roll where the threads merge and terminate. The training idler is pivotally mounted on a bearing in such a manner that the idler automatically skews to produce a training effect when a belt starts to detrain. For any longitudinal cross-sectional normal to a first plane that includes the longitudinal centerline of the idler, the sidewalls of the threads are substantially normal to the plane with a slight positive draft and as a result of this configuration the roots of the threads are offset with respect to each other at this plane even though the thread lands are continuous spirals. The idler roll is cast by injecting urethane compound between a pair of mold sections having their parting line coincident with the plane and an internal steel tube coated with a bonding agent. Due to the unique thread configuration relative to the mold parting line, the mold halves are readily separated from the idler once the initial curing operation is completed even though the idler has the left-and right-hand threads thereon.

8 Claims, 8 Drawing Figures



TRAINING IDLER

BACKGROUND OF THE INVENTION

This invention relates to training idlers and in particular to skewing, rigid urethane spiral training idlers and the method of casting the same. Spiral training idlers are known in the art as evidence by the B. M. Armstrong U.S. Pat. No. 2,743,810, issued May 1, 1956 and so are skewing idlers as evidence by the S. D. Robins U.S. Pat. No. 1,833,180 issued Nov. 24, 1931. However neither the unique combination of a skewing, rigid urethane spiral training idler with the thread structure of the present invention nor the method of forming such an idler with this unique thread structure is shown or suggested by the prior art.

It is an object of the present invention to enhance the training effects of a skewing idler by providing the surface of the idler with right-hand and left-hand threads having continuous spiral lands of uniform width.

It is a further object of the present invention to form the right-and left-hand threads of the idler with a urethane compound or the like rather than metal to increase the friction and, consequently, the training forces generated between the idler and the belt being trained.

It is a further object to have idlers that exhibit the above characteristics cast by utilizing only two mold sections rather than four sections even though the idlers are provided with right-hand and left-hand threads.

It is a further object to provide an idler that will prevent material buildup on a conveyor belt.

BRIEF DESCRIPTION OF THE INVENTION

Briefly, the invention comprises a skewing, rigid, urethane, spiral training idler which is cast by injecting a urethane compound into a cavity formed between a two-part mold and a metal tube coated with a bonding agent and then curing the compound until it becomes bonded to the tube. The peripheral surface of the idler is provided with right-hand and left-hand spiral lands extending respectively from the ends of the roll to the center where they merge and terminate. To enable the casting of the idler with a two-part mold, the configuration of the thread sidewalls must be such that for any cross-section of the threads taken normal to the mold parting line or plane the sidewalls are substantially normal to the mold parting line or plane so that the mold sections can be separated from the finished product in spite of the right-hand and left-hand thread spirals. This configuration causes the roots of the thread sections to be offset with respect to each other at the mold parting line even though the lands of the sections form a continuous uninterrupted spiral.

The skewing of the idler is facilitated by rotatably mounting the tubular roll on an axle by means of a bearing which is affixed to the axle and can pivot about a selected axis relative to the roll. With this arrangement, the idler is automatically positioned by the friction of the traveling belt to produce a training force on the belt.

The above objects and advantages of the present invention will become more apparent and other objects and advantages of the present invention will become apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

FIG. 1 is a section of the two-part mold taken perpendicular to the mold parting plane and illustrating a fragmentary sectional view of an idler formed in accordance with the present invention;

FIG. 2 is a view of the idler roll per se, taken perpendicular to the view of FIG. 1, with a portion of the roll broken away to illustrate the pivotal bearing assembly;

FIG. 3 is a transverse vertical section of the idler roll and pivoted bearing assembly;

FIG. 4 is an end view of the mold illustrating the idler, in phantom line, and the planes along which the sectional views of FIGS. 5, 6 and 7 are taken;

FIGS 5, 6 and 7 are fragmentary sectional views of the idler illustrating the unique configuration of the treads forming the spiral lands of the present invention; and

FIG. 8 is a view illustrating the training idler of the present invention when used with a belt and, in phantom line, one position the idler can assume when training a belt.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings and in particular to FIG. 1 of the drawings, an idler roll 20, comprising a steel tubular member 22 with an urethane casing 24 bonded thereto, is shown within a two-part mold 26. The casing is formed with right-hand threads 28 thereon made up of sections 30, 32 and left-hand threads 34 thereon made up of sections 36, 38. The threads 28 and 34, as viewed in FIGS. 1, 2 or 8 extend respectively from the left and right ends of the idler roll 20 to the center of the roll where the threads merge and terminate at a plane 40 preferably located 45° from the plane x—x where the juncture of thread sections 30, 32 and 36, 38 occurs.

As indicated above the threads 28 and 34 are made from sections 30, 32 and 36, 38. These thread sections form continuous right-hand and left-hand spiral lands 42, 44 respectively with the helix angle of a typical land being approximately 6.8° and the width of the land being uniform or substantially uniform throughout its length. However, even though the spiral lands are continuous, at the junctures of these thread sections the roots of thread sections 30 and 32 overlap but are offset with respect to each other forming shoulders 46, 48 which lie in plane x—x. In a similar manner the roots of sections 36, 38 overlap but are offset with respect to each other forming shoulders 50, 52 which also lie in plane x—x. This construction results from the design of the threads, necessitated by the unique molding procedure utilized to form the idler 20, that will be explained more fully hereinafter. According to the invention, the sidewalls 54 of the threads are substantially perpendicular to or have a slight positive draft relative to the plane x—x as viewed in any longitudinal plane parallel to the longitudinal axis y—y of the idler and perpendicular to plane x—x (see FIGS. 5, 6, 7). It is to be understood that views taken in planes designated 5a, 6a and 7a, in FIG. 4, or any similarly oriented plane would be similar to FIGS. 5, 6 and 7 and that the sidewalls of thread sections 30, 32 which form thread 28 also have surfaces substantially perpendicular to plane x—x or with a slight positive draft relative to plane x—x for such planes. While the sidewalls 54 of thread sections 30, 32 and 36, 38 are perpendicular to plane x—x or have a positive draft relative to plane x—x (e.g., 2° positive draft) as viewed in planes 5—5, 6—6 and 7—7 or similarly oriented planes, in other planes the thread sidewalls do not necessarily have positive drafts. This can be clearly seen in FIG. 2 wherein one sidewall of each of the thread sections has a negative draft of for example 6.8° so that the lands 42, 44 are maintained at a specific width throughout their length and at a given helical angle.

As best illustrated in FIGS. 2 and 3 the roller can be pivotally supported on a bearing in such a manner that the idler is automatically positioned by the friction of the traveling belt to produce a training effect on the belt. While the manner of mounting the idler illustrated is the same as that illustrated in the above mentioned U.S. Pat. No. 1,833,180 it is to be understood that the other preferred constructions can be utilized for mounting the idler to skew the idler in response to belt detraining such that the angular relation of the idler to the belt produces a counteracting lateral thrust to return the belt to its proper position.

Referring to the FIGS. 2, 3 and 8, 56 designates the parallel stringers of a conveyor structure; 58 designates a shaft fixed at its ends to the respective stringers, as by the set screws or equivalent fastening means, and 20 designates the idler roll which is concentric with the shaft and arranged to support the conveyor belt 60. This roll 20, which as set forth above is preferably an open end tube 22 with a urethane casing 24 hav-

ing spiral threads 28 and 34 thereon, has secured within it, midway of its ends, a bearing structure 62. In the present instance the bearing 62 is of the anti-friction type and embodies an inner race or sleeve member 64; a complementary sectional race member 66; anti-friction balls 68 between the respective members; and a pair of lateral clamp rings 70 encircling the members 64, 66 and fixed in relation thereto and to the inner wall of the roll by cross-bolts 72 and a press fit or equivalent fastening means.

The inner race or sleeve member 64 is slightly spaced from the shaft 58, and is pivotally mounted at its center on the shaft by means of a pin 74 which extends through and transversely of the shaft 58 to permit skewing of the idler about the axis of pin 74 in response to detraining of the belt. The axis of the pin 74 is centered relative to the idler and lies in the same vertical plane as the longitudinal centerline of the conveyor belt when the belt is properly trained. The pin may occupy a position perpendicular to the belt or be forwardly inclined in relation to the direction of travel of the belt as explained more fully in the above cited Robins U.S. Pat. No. 1,833,180.

The idler roll is preferably formed by inserting the metallic sleeve, such as steel tube 22, within a mold 26 made up of mold halves 78, 80 which are shown in section in FIG. 1. The mold halves can be aluminum, steel or of some other suitable material, but as illustrated each mold section has a steel casing 82 with a urethane lining 84 that forms the outer surface of the mold cavity. To prevent the molding compound from becoming bonded to the lining 84, the lining is coated with a silicone release agent or other commercially available anti-bonding agent. Each mold section comprises a semi-cylindrical cavity with grooves in the cavity surface complementary in form to the contour of the thread sections 30, 36 or 32, 38 which were described in detail heretofore. Since the sidewalls of the thread grooves, for any plane parallel to the longitudinal axis $y-y$ of the mold and perpendicular to the plane $x-x$, have contours which are substantially normal to plane $x-x$ or with a positive draft (e.g. 2°) relative to the plane $x-x$ and since the terminus of the threads in plane 40 has a positive draft relative to the plane $x-x$, the mold sections 78, 80 can be separated from the finished product by pulling them apart in a direction perpendicular to plane $x-x$ even though there are right- and left-hand thread segments in each mold section having lands which cooperate with the lands of the thread segments in the other mold section to form continuous spirals.

The halves of the steel casing 82 are joined by bolt assemblies 86 or equivalent fastening means which pass through pairs of flanges extending along the mold parting plane $x-x$. In addition, the mold sections are provided with an inlet port 88 for injecting, pouring, or otherwise introducing the molding material into the mold cavity and a vent 90 for venting air from the mold cavity. The inlet port 88 and air vent 90 are located at opposite ends of the mold 26 along the mold parting line with the casting of the outer casing 24 of the roll to be effected with the longitudinal axis of the roll in a vertical position and the inlet port 88 at the base of the mold. While one preferred mold form is shown, it is contemplated that other types of molds can be used which either have the inlet port at the base and the vent at the top or equivalent conventional means to ensure that all of the air is expelled from the mold and replaced by the molding compound.

The sleeve or tube 22 is maintained in proper coaxial and longitudinal alignment within the mold 26 by steel cylindrical guide elements 92 or equivalent aligning means commonly used when casting. The guide elements make a tight sliding fit with the interior of the steel tube, are vented by vents 94, 96 to permit the sliding movement, and are provided with silicone coated rubber seals or O-rings 98, capable of withstanding the molding temperatures. The vents 94, 96 extend longitudinally through the guides 92 and permit the passage of air between the interior and exterior ends of the guides during the adjusting of the guides to effect the alignment of the tube and the sealing of the tube ends. The seals or O-rings 98 engage and cooperate with the mold end walls 100, 102 and the tube 22 to

prevent urethane molding compound from entering the interior of the tube during the molding operation. The sliding movement of the cylindrical guide elements after the tube 22 is in place within mold 26 is effected by bolt assemblies 104, 106 which pass through the guides 92 and the respective end walls 100, 102.

The idler 20 is cast with the longitudinal axis $y-y$ of the mold vertically oriented and the steel tube 22 centered within the cylindrical cavity of mold sections 78, 80 by guides 92 or other suitable means. The centering and sealing of the tube 22 within the mold is effected by tightening bolt assemblies 104, 106 after the mold halves are secured together. The tightening of the bolt assemblies draws the guides 92 toward the end walls of the mold until a good seal is formed between the mold end walls 100, 102 and the guides through seals 98.

Prior to insertion into the mold cavity, the tube 22 is cleaned and then preferably coated with a bonding agent such as Thixon XA, B-1153, or some other commercially available bonding agent. In addition to cleaning the outer surface of tube 22, if desired, the outer surface can be sand-blasted to create a rough surface to facilitate bonding. Due to the shrinkage of the urethane casing 24 relative to the steel tube 22 as the idler roll is cured, it is also contemplated that in some instances the bonding agent can be omitted.

The mold and tube are heated by conventional means such as an oven to a temperature of 212°F . and a urethane compound, such as A85 Urethane compound of American Cyanamid, or another commercially available compound having a high coefficient of friction is injected, poured or otherwise introduced into the cavity between the steel tube 22 and the mold 26 at 212°F . through inlet port 88. As the compound is injected, poured or otherwise introduced into the bottom of the mold through inlet port 88 it causes the force venting of air through the vent 90 provided in the top section of the mold. Once the molding cavity formed between the steel tube and the mold sections is completely filled with the urethane compound, there is an initial cure for thirty minutes at 212°F . Then the idler roll is removed from the mold 26 by parting the sections in a direction perpendicular to plane $x-x$ and a post cure is performed for 24 hours at a temperature of 212°F . During the post cure the idler roll 20 is not rested on its threads so that the lands of threads 28 and 34 do not become flattened or otherwise deformed.

In operation should the belt 60 start to detraining either to the right or the left the inwardly directed thrusts developed on the belt by the spiral lands 42, 44 and/or their inner edges becomes unbalanced with a greater inward thrust being developed on the side to which the belt has drifted. As a result the belt 60 is moved back laterally across the surface of the roll 20 until the forces acting on the belt are again balanced and the belt is centered on the idler. The formation of the spiral threads from urethane or similar compounds enhances the performance of the roll due to the greater co-efficient of friction between the spiral and belt and the greater return thrust developed. In addition to developing inwardly directed thrusts, the right- and left-hand threads tend to minimize material buildup on the belt.

By pivotally mounting the idler on a bearing, as illustrated in FIGS. 2 and 3, in such a manner that the idler roll 20 skews in response to the detraining of the belt 60 or by mounting the idler roll 20 in some equivalent manner to effect the skewing of the idler in response to the detraining of the belt, the training characteristics of the idler are even further enhanced. If the belt 60 should begin to creep to the right or left of the idler central line, the resulting increased force of the belt on that side of the pivotally supported idler will tend to skew the idler into such angular position relative to the belt so as to counteract the lateral thrust and thereby automatically produce a training effect which returns the belt to its proper position as occurs with the idler assembly disclosed in the above cited Robins patent. At the same time the change in the orientation of the idler tends to increase the effective angle of the spiral, relative to the direction of travel of the belt, on the side to

which the belt has crept and reduce the effective angle of the spiral on the other side to thereby generate a greater net return thrust on the belt by the thread lands and edges.

While preferred forms of the invention have been shown and described, it is to be understood that suitable modifications and equivalents can be resorted to without departing from the spirit and scope of the invention as defined in the following claims.

What is claimed is:

1. An idler roll comprising:
 - a. a cylindrical roll;
 - b. first and second thread means formed on said cylindrical roll;
 - c. said first thread means having first land means;
 - d. said second thread means having second land means;
 - e. said first land means being a right-hand helix extending from a first end of said roll;
 - f. said second land means being a left-hand helix extending from a second end of said roll;
 - g. said first and second land means merging and terminating at substantially the center of said roll;
 - h. said first and said second land means having side edges;
 - i. said side edges being substantially continuous for the lengths of their respective helices;
 - j. said first and second thread means having sidewalls;
 - k. said sidewalls for each of said first and second thread means being formed by a plurality of discontinuous side surfaces contoured so that said side walls join said first and second land means at said side edges while at the same time extending substantially perpendicular to a predetermined plane which encompasses the longitudinal centerline of said cylindrical roll.
2. The idler roll of claim 1 wherein said side surfaces form shoulders offset from each other in said predetermined plane.

3. The idler roll of claim 1 wherein said sidewalls of said first and second thread means having only positive drafts relative to said first plane.

4. The idler roll of claim 1 wherein each of said land means being continuous and of substantially constant width.

5. The idler roll of claim 1 wherein said thread means being non-metallic.

6. The idler roll of claim 1 wherein said cylindrical roll being mounted on a skewing means to permit angular adjustment of said roll relative to the normal direction of travel of a belt in response to detraining of the belt.

7. An idler roll comprising: a cylindrical roll, said cylindrical roll having first and second urethane thread means thereon for training a belt, said first thread means having first continuous land means of substantially constant width, said second thread means having second continuous land means of substantially constant width, said first land means being a right-hand helix extending from a first end of said roll, said second land means being a left-hand helix extending from a second end of said roll, said first and second land means merging and terminating at substantially the center of said roll, said first and second thread means having sidewalls, said sidewalls being perpendicular only, with respect to a predetermined plane which encompasses the longitudinal centerline of said cylindrical roll, and each of said thread means comprising first and second segments which abut at said predetermined plane with root portions of said first and second segments being offset with respect to each other at said predetermined plane and forming shoulders.

8. In the idler roll of claim 7: said cylindrical roll being mounted on a skewing means to permit angular adjustment of said roll relative to the normal direction of travel of a belt in response to detraining of the belt.

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