Dec. 4, 1962 R. A. EVANS ET AL 3,066,547

BELT TRAINING IDLER

Filed Dec. 14, 1959

3 Sheets-Sheet 1

Fig. 1.

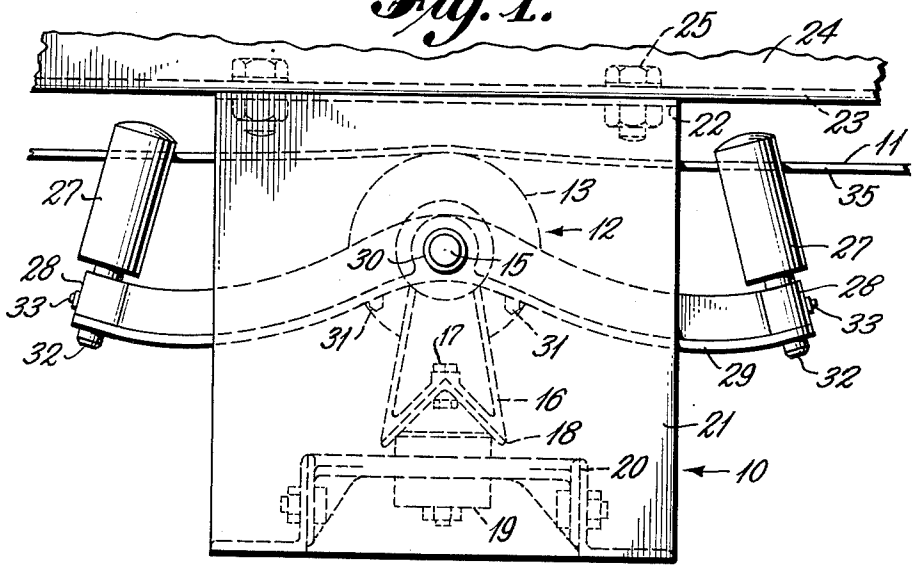
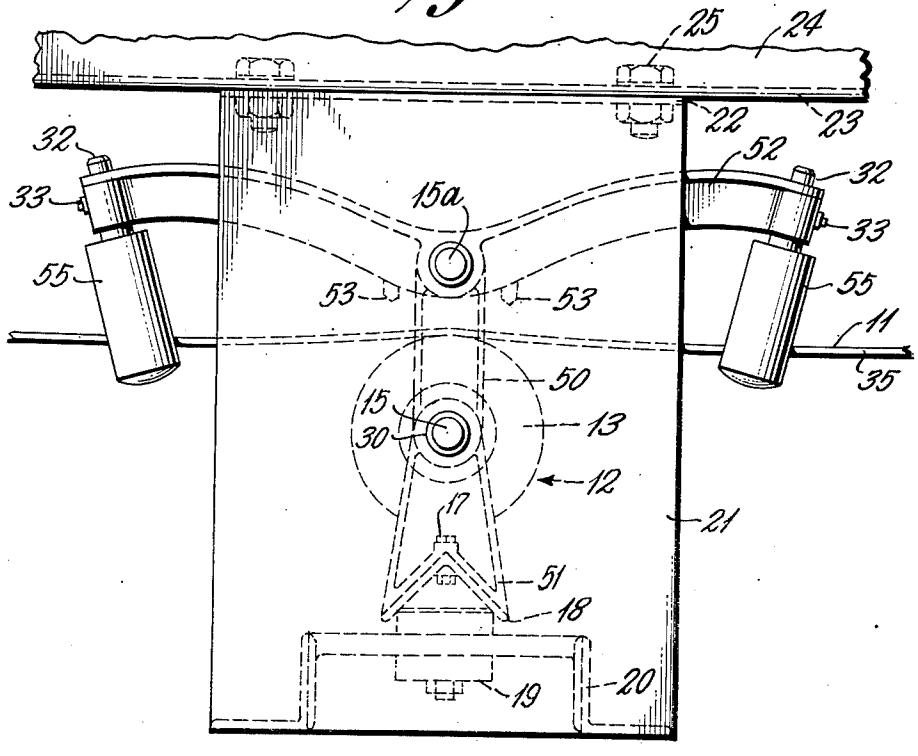


Fig. 3.



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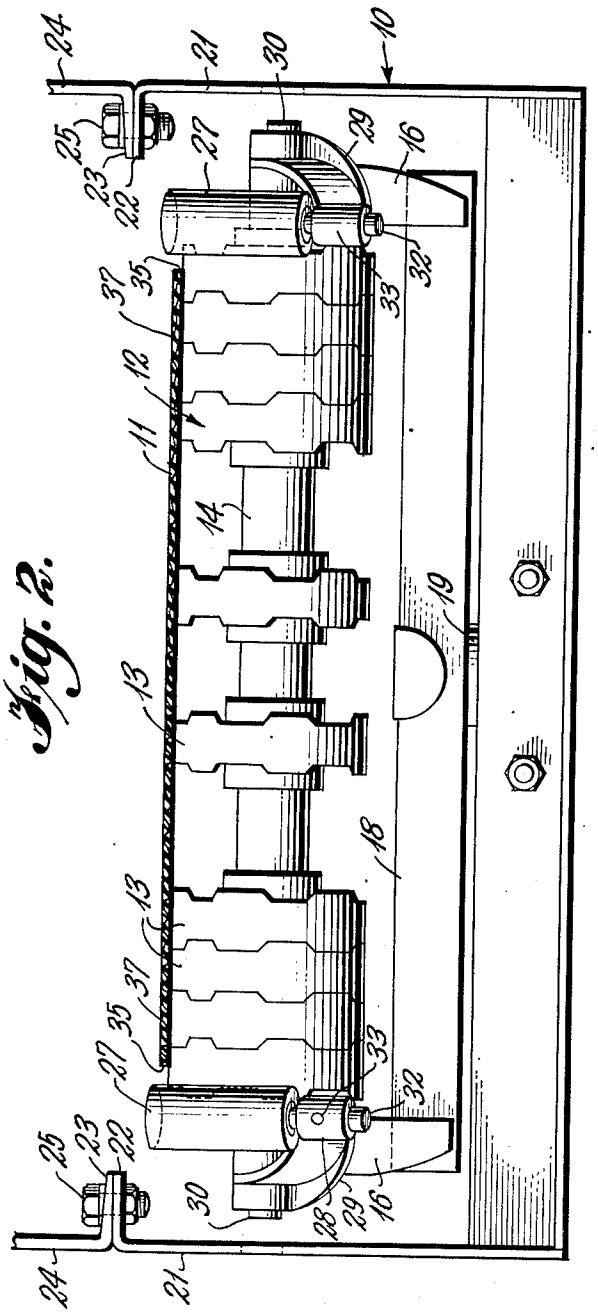


Fig. 2.

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Fig. 4.

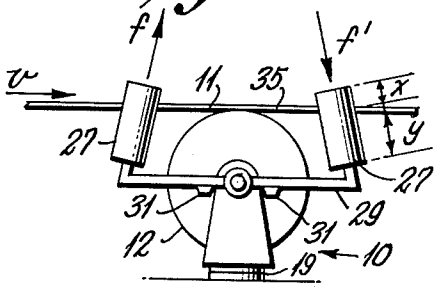


Fig. 7.

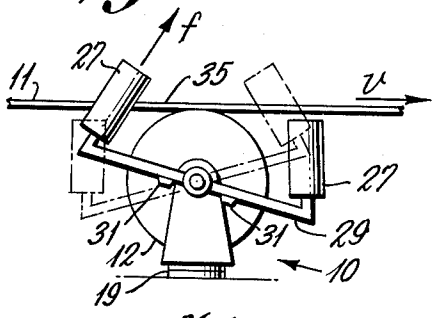


Fig. 5.

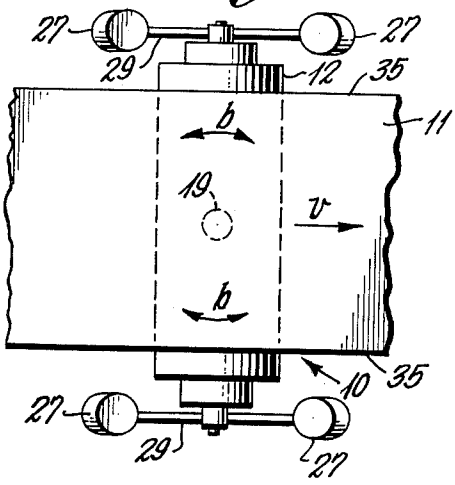


Fig. 6.

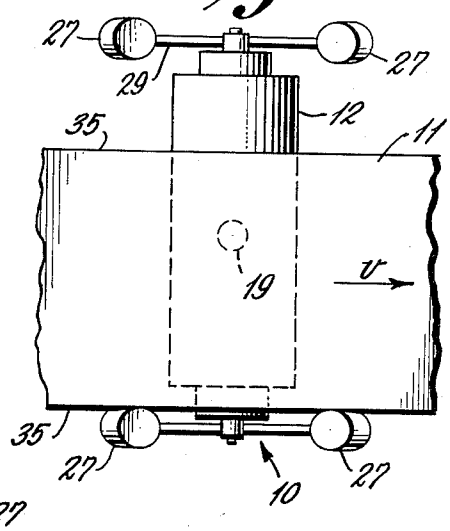
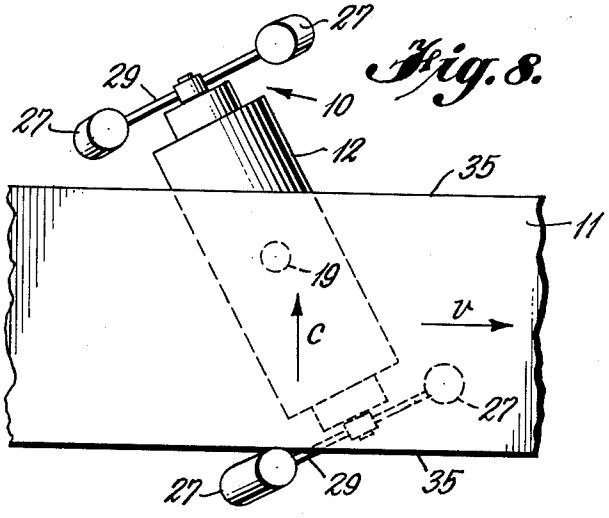


Fig. 8.



United States Patent Office

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3,066,547
BELT TRAINING IDLER

Ralph A. Evans, Beech Grove, Louis J. Stephanoff, Indianapolis, and Rolland G. McCullum, Richmond, Ind., assignors to Link-Belt Company, a corporation of Illinois

Filed Dec. 14, 1959, Ser. No. 859,348
8 Claims. (Cl. 74—241)

This invention relates to belt conveyors and deals more particularly with a new and improved training idler for correcting misalignment of reversible belts.

In belt conveyors, it is well known that one of the most frequent causes of belt damage is misalignment of the belt on the supporting idler assemblies. For proper operation, the belt, through both the active and return runs, should travel centrally over the idlers. However, because of uneven loading across the width of the belt; misalignment or skewing of some of the idlers; unequal stretching and shrinking as a result of being saturated by rain or snow and dried by the sun; and for other reasons, the belt will become misaligned on the idlers. It, therefore, is standard practice to provide a belt conveyor, at regular intervals of about 100 feet along both of its runs, with training idlers which function to detect such misalignment and to exert a realigning force against the proper edge of the belt which will return the latter to a centered position on the idlers.

One common form of belt training idler, as exemplified by the William W. Sayers patent, No. 2,012,089, includes an idler assembly supported for swiveling movements about a vertical axis, and a guide roll mounted on each end of the idler assembly in a laterally offset position on the approach side with respect to the direction of belt travel. When a belt shifts laterally in either direction from its properly aligned position, the leading edge of the belt engages the adjacent guide roll and causes the idler assembly to be pivoted into a skewed position. The rolls of the skewed idler assembly then exert a laterally, inwardly directed friction force on the belt which returns the belt to its aligned position. This type of training idler assembly has been found to perform satisfactorily for installations in which the belt always travels in the same direction. Because the guide rolls must be offset on the approach side of a training idler assembly of the above mentioned type to effect automatic realignment of a belt, the form of belt training idler covered by the above patent is not suitable for use in a belt conveyor installation which is required to transport material in opposite directions at different periods during a work shift, or even during a work week. In other words, under such operating conditions, the direction of travel of the belt must be reversed every time the direction of movement of the material is changed and the locations of the offset guide rolls must be modified accordingly.

One significant improvement directed toward overcoming the above difficulty is covered by the Charles D. Schott patent, No. 2,821,291, wherein each training idler includes a pair of guide rolls positioned at each end of the assembly with the two rolls of each pair being supported by a rockable arm which positions the two rolls on opposite sides of the idler assembly. The two arms are connected so they will move simultaneously and are so shaped and located that they may be moved into two operative positions. In one such position, one guide roll of each pair will be located in the proper offset relationship to one side of the idler assembly to effect realignment of the belt when the latter is traveling in one direction. In the other operative position of the two arms, the remaining guide roll of each pair will be located to effect realignment of the belt when the direction of travel of the latter is reversed. Each

training idler assembly includes latch mechanism for holding its connected arms, and their guide rolls, in either of their two operative positions. The training idler assembly of the above patent must have its belt guiding mechanism manually changed from one operative position to another every time the direction of travel of the belt is reversed. For short conveyors and installations where the direction of belt travel is not changed frequently, this type of training idler has been found to be very satisfactory. However, when a conveyor is long and/or the direction of its belt travel is changed frequently, the time and labor required to manually reset all of the training idlers each time the direction of travel of the belt is reversed becomes an impractical mode of operation.

It, therefore, is the primary object of this invention to provide a belt training idler which will function automatically to apply a realigning force to its belt regardless of the direction of travel of its belt.

A further important object of this invention is to provide an idler of the above mentioned type in which the energy of the moving belt and its direction of travel are utilized to arrange the belt guiding mechanism of the idler in the proper one of its two operative positions to effect realignment of its belt regardless of the direction of travel of the latter.

Still another object of this invention is to provide a belt training idler structure which will apply the proper realigning force to a misaligned belt regardless of the direction of travel of the belt and which requires no manual manipulation or attention when the direction of travel of the belt is reversed.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification and in which like numerals are employed to designate like parts throughout the same,

FIGURE 1 is an end elevational view of a belt training idler embodying the invention and shown associated with a flat run of a conveyor belt,

FIGURE 2 is a side elevational view of the idler of FIG. 1,

FIGURE 3 is a view similar to FIG. 1 showing a modified form of a belt training idler which embodies the invention, and

FIGURES 4 to 8 are diagrammatic views which illustrate the operation of the belt training idler of FIGS. 1 and 2.

In the drawings, wherein for the purpose of illustration are shown the preferred embodiments of this invention, and first particularly referring to FIGS. 1 and 2, there is shown a belt training idler 10 associated with a conveyor belt 11. For supporting the belt, the training idler includes a roll assembly 12 comprising a plurality of rubber treads 13 fixed in any desirable manner to a live center tube or hollow shaft 14. This tube or shaft 14 is rotatably supported at its opposite ends by antifriction bearings, not shown, which in turn are mounted on a stationary, solid shaft 15, see FIG. 1. End brackets 16 support the opposite ends of the shaft 15 and the brackets are fastened by bolts and nuts 17 to the opposite ends of the crossbar 18.

In order that the treads 13 of the roll assembly 12 may apply a realigning force to the belt 11, this assembly is supported at its midpoint for swiveling movement about a vertical axis located at the transverse middle portion of the belt 11 when the latter is centered. In the present instance, therefore, the crossbar 18 is connected at its center by a suitable swivel bearing structure 19 to a base 20.

The base 20 extends transversely of the belt 11 and is connected in any suitable manner at each of its ends to

an upwardly extending plate 21 having an inwardly turned flange 22 formed along its upper end portion. The flanges 22 of the plates are fastened to the lower flanges 23 of stringers 24 by bolts and nuts 25 so that the training idler 10 is supported below the stringers 24 which constitute a part of the main frame of the conveyor.

To cause swiveling movement of the idler roll assembly 12 about its pivot axis in the event of belt misalignment, the assembly is provided on each of its end portions with a pair of cylindrical guide rolls 27. As shown in FIG. 1, the two guide rolls 27 on each end of the idler roll assembly are mounted on the opposite end portions 28 of a guide arm 29 which extends in both directions along the belt path from the associated end of the assembly 12. Each guide arm 29 is pivotally supported intermediate its ends on the adjacent end of the solid, stationary shaft 15 and is held in its proper location by the collar 30, fixed on the shaft 15, and the adjacent end of the tube 14. The guide arms 29 are each limited in its pivotal movements in opposite directions from the position shown in FIGS. 1 and 2 by the stops 31 which alternately engage the sides of their adjacent end brackets 16. Each guide roll 27 is carried by and rotates about a spindle 32 which is fixed to the associated end portion 28 of its guide arm by a set screw 33.

As viewed in FIG. 1, the rolls 27 of each arm 29 are of such an axial length that, when the arm is located horizontally, or midway between its two positions of extreme pivotal movement, the upper end portion of each roll extends slightly above the adjacent edge 35 of the belt 11. When in this position, both of the guide rolls 27 of an arm 29 are so arranged as to be engaged by the adjacent edge 35 of the belt if the latter becomes sufficiently misaligned on its roll assembly 12. When an arm 29 is moved into either of its positions of extreme pivotal movement, as determined by the proper stop 31, the guide roll 27 on the lower end of the arm 29 will be positioned entirely below the adjacent belt edge 35, and out of operative relationship therewith, while the guide roll 27, on the other end of the arm 29, will be raised into a position where it will extend a greater distance above the adjacent edge 35 of the belt.

For a purpose which will hereinafter be made apparent, the two guide rolls of each guide arm are inclined toward each other so that the rolls rotate about axes which converge upwardly. From FIG. 2, it should also be apparent that each guide arm moves about its pivot axis in a plane which is parallel to the adjacent edge 35 of the belt 11 and is normal to the upper surface of the adjacent edge portion of the belt. The converging spindles 32 of each pair of guide rolls 27 are oriented in the plane of movement of their guide arm 29 and therefore any pivotal movement of the guide arm will not change the lateral spacing between the guide rolls and the adjacent belt edge 35.

The realigning operation of the belt training idler 10 is illustrated by the diagrammatic views of FIGS. 4 to 8, inclusive, which show the idler in various operating positions. In each of these figures the belt 11 is assumed to be moving towards the right as shown by the arrows *v*.

FIGURE 4 shows the idler 10 with the guide arm 29 at one end thereof oriented midway between its two extreme pivotal positions. From this figure it will be noted that each of the rolls 27 is so positioned that the upper portion *x* thereof, which extends above the belt 10, is shorter than the lower portion *y*, which extends below the belt. This enables the guide arm 29 to be pivoted in one direction or the other to move one guide roll in to a position entirely below the adjacent belt edge 35 without moving the other guide roll out of a position in which it will contact the belt edge if the belt becomes misaligned, as seen in full and broken lines in FIG. 7.

In describing the mode of operation of the idler of FIGS. 1 and 2, and starting with the illustrations of FIGS. 4 and 5 in which the belt is centered on the roll assembly 12, it will be noted that the guide arms 29 are horizontally arranged and the axes of the two guide rolls 27 of each guide arm converge in an upward direction. The assumed direction of travel of the belt is indicated by the arrow line *v* and the directions of pivotal movement of the roll assembly about the axis of the swivel bearing structure 19 are indicated by the double arrow lines *b*—*b*.

In FIG. 6, the belt 11 is illustrated as having moved into a misaligned position in which its edge 35, seen in FIG. 4, is engaging the two guide rolls 27 of the associated arm 29. The angles formed by the plane of the belt 11 and the axes of the two guide rolls 27 are best illustrated in FIG. 4. With the belt traveling in the direction indicated, the engagement of the belt edge with the surfaces of the two guide rolls will cause both of the latter to rotate in a clockwise direction, as seen in FIG. 7. Because of the helix angles that are formed between the belt, as the driving member, and the two guide rolls, as the driven members, the resulting actions or forces developed may be compared with those of two screw threads.

The helix angle formed by the belt and the left-hand guide roll 27, in FIG. 4, is comparable in its action to a lefthand thread exerting a force on its guide roll in the direction of the arrow line *f*. This force will cause the guide roll to be moved or fed upwardly, carrying its guide arm 29 with it, or causing said arm to pivot about its supporting shaft 15.

The helix angle formed by the belt 11 and the right-hand guide roll 27, in FIG. 4, is comparable in its action to a right-hand screw thread and will exert a force on its guide roll in the direction of the arrow *f'*. This guide roll, under the influence of such force, will be moved or fed downward.

This downwardly exerted force applied to the right-hand guide roll will continue until the said roll has been moved below, or out of engagement with the belt edge 35. The left-hand guide roll then will continue to function until the guide arm 29 has been moved to the position shown in solid lines in FIG. 7, or until the right-hand stop 31 engages the side of the adjacent end bracket 16. When this occurs, the various elements will occupy the positions illustrated in solid lines in FIG. 7.

The solid line showing of FIG. 7 illustrates the belt 11 misaligned on the roll assembly 12 to an extent which will cause the right-hand guide roll 27 to be moved to the position entirely below the belt while the left-hand guide roll is in its fully raised position and still in engagement with the edge 35 of the belt. The training idler assembly, so far, has not applied any force to the belt which would tend to realign the latter.

As the belt continues to move off center, or toward the extreme position of FIG. 8, the force applied to the elevated guide roll 27 by the belt will cause the roll assembly 12 to pivot about its swivel bearing structure 19 until the assembly finally assumes the skewed position illustrated in FIG. 8. The frictional drag created by the belt moving over the skewed peripheral surfaces of the rubber treads 13 will produce a force acting in the direction of the arrow *c* in FIG. 8 and this force will result in returning the belt to the centered position of FIG. 5. This return movement of the belt will cause the idler assembly to be pivoted about its bearing 19 until the assembly is in its normal position relative to the direction of travel of the belt.

It will be understood that the guide arm 29, with its guide rolls 27, once it has been moved into the position illustrated in the solid line showing of FIG. 7, will remain in that position as long as the belt continues to travel in the direction indicated in FIGS. 4 to 8. However, when the direction of travel of the belt is reversed and the belt moves out of its centered position in the direction indicated in FIG. 6, the helix angle formed by the belt edge engaging the elevated guide roll 27, combined with the direction of travel of the belt from right-to-left, will result in the turning of the roll in a counter-

clockwise direction. The resulting action will still simulate that of a left-hand screw thread but the roll feeding or moving force will be reversed to that of the arrow line *f* in FIGS. 4 and 7, and will move the left-hand guide roll downwardly until the right-hand guide roll **27** is moved upwardly into engagement with the edge **35** of the belt. Because this last mentioned engagement will effect a guide roll moving action which is reversed to that of the arrow line *f'* in FIG. 4, the right-hand guide roll will be moved into the elevated position shown in broken lines in FIG. 7. Of course, the guide arm **29** and the left-hand guide roll also will be moved into the broken line positions of FIG. 7.

It will be noted, by comparing the belt edge and the left-hand guide roll illustrated in FIG. 4 and in solid lines in FIG. 7, that the helix angle in FIG. 7 is greater than that of FIG. 4. Therefore, when the direction of travel of the belt is reversed while one of the guide rolls is in its fully elevated position, the latter guide roll will be moved downwardly at a sufficiently rapid rate to move the other guide roll mounted on the same arm **29** upwardly into engagement with the edge of the belt before the belt moves so far out of alignment that its edge will obstruct the upward movement of the last mentioned guide roll.

The first time the belt **11** moves out of alignment in the direction opposite to that illustrated in FIGS. 6 and 8, the guide rolls **27** and guide arm **29** will function in the same manner as described above. That is, the guide roll **27** on the approach side of the idler assembly, regardless of the direction of travel of the belt, will be moved into its fully elevated position and the guide roll on the departure side will be moved to a position entirely below the belt.

In the modification of FIG. 3, the guide arms **52** are independently mounted on stub shafts **15***a* located above the belt **11** and the axes of the spindles **32** converge downwardly. This belt training idler will function in the same general manner as the idler structure of FIGS. 1, 2 and 4 to 8. The only difference between the functioning of the two embodiments is that the helix angles formed by the belt **11** and the axes of the four guide rolls **55** will cause the guide rolls on the approach side of the idler, regardless of the direction of travel of the belt, to be moved downwardly, by the misalignment of the belt, until their associated stops **53** engage the adjacent, extensions **50** of the end brackets **51** and the guide rolls on the belt departure side of the idler will be moved upwardly, entirely above the plane of the belt.

All of the remaining elements of the modification of FIG. 3 are the same as the corresponding elements of FIG. 1 and the same reference characters have been applied thereto.

The two embodiments of the invention have been illustrated and described as consisting of belt training idlers which are associated with flat runs of belt conveyors. Therefore, these may be considered as the active runs of flat belt conveyors or the return runs of either flat belt or troughed belt conveyors.

The aforementioned patent to C. D. Schott, No 2,821,291, illustrates the use of flat rolls for training both flat and troughed belt runs. This is accomplished merely by changing the construction or shape of the guide arms which support the guide rolls in proper operative relation to the edges of the run of a belt to be trained. It will be appreciated that the teachings of the aforesaid Schott patent, with reference to the training of troughed belt runs can be applied to the present invention by employing the end brackets **51** of FIG. 3 with extensions **50** of sufficient height to properly locate the guide rolls **27** of FIG. 1, or **55** of FIG. 3, relative to the edges of the belt. With such an arrangement, the spindles **32** of the guide rolls should be positioned with their axes inclined from the horizontal toward the centerline of the belt, as well as converging in the manner now illustrated, so that the faces of the guide rolls will flatly engage the edge surfaces of the troughed belt.

It is to be understood that the forms of this invention herein shown and described are to be taken as the preferred examples of the same, and that various changes in the shape, size, and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described the invention, we claim:

1. A training idler adapted for use with a belt which may travel in opposite directions, comprising an idler roll assembly mounted for pivotal movement about an axis normal to the transverse middle portion of the belt, a guide arm independently pivotally supported on each end of said idler roll assembly and having end portions extending in opposite directions longitudinally of and vertically spaced relative to the level of the adjacent edge of the belt, a guide roll rotatably supported on each of said guide arm end portions, the two guide rolls on each guide arm extending from their guide arm toward the adjacent belt edge and being arranged with their axes converging in a direction also extending away from their guide arm toward the adjacent belt edge, said guide rolls, when their guide arm is horizontally positioned, being so arranged relative to the adjacent belt edge that a helix angle is formed between such belt edge and each guide roll axis, and means for limiting the pivotal movement of each guide arm in opposite directions relative to the idler roll assembly so that in every position assumed by each guide arm at least one of its guide rolls will be engaged by the adjacent edge of the belt when the latter is sufficiently misaligned in the direction of such guide arm, each of said helix angles being such that an axially exerted force will be applied by the rolling engagement between the belt edge and the angularly related guide roll with the direction of travel of the belt determining the direction in which the said axial force is exerted, whereby the guide roll on the approach side of the idler roll assembly will be automatically positioned to be engaged by the edge of the misaligned belt so as to pivot the said assembly, upon further misaligning movement of the belt, into a skewed position which will realign the belt.

2. A training idler as defined in claim 1 further characterized by the guide roll on the departure side of the idler assembly being automatically positioned out of the path of misaligning movement of the belt to permit the aforesaid guide roll to move into a position in superimposed relationship with the belt when the idler roll assembly is pivoted into the skewed position which will realign the belt.

3. A training idler as defined in claim 2 further characterized by the said helix angles formed between the belt edges and the axes of the guide rolls engaged by the latter being such that axially exerted forces will be applied to the guide rolls so that when the direction of travel of the belt is reversed the guide arm at a given end of the idler roll assembly will be pivoted from one extreme position to the other the first time the belt is misaligned in the direction of such guide arm.

4. A training idler as defined in claim 1 further characterized by the means for limiting the pivotal movement of each guide arm in opposite directions, comprising a stop mounted on each end portion of the guide arm, said stops alternately engaging their end of said idler roll assembly when their guide arm is pivoted in opposite directions to its two positions of extreme pivotal movement, said guide arm in each of such two positions being arranged to support one of its guide rolls in the path of, and its other guide roll out of the path of, misaligning movement of the adjacent belt edge.

5. A training idler as defined in claim 1 further characterized by the guide rolls supported on both of the guide arms having cylindrical peripheral surfaces which engage the surfaces of the adjacent belt edges throughout the thickness of the belt.

6. A training idler as defined in claim 5 further characterized by the guide arms pivotally supporting their guide rolls so that the axes of all of the guide rolls move in planes which are parallel to the surfaces of the adjacent belt edges.

7. A training idler adapted for use with a belt which may travel in opposite directions, comprising a crossbar mounted for pivotal movement about an axis normal to the transverse middle portion of the belt, bracket means mounted on the ends of the crossbar, a stationary shaft supported at its opposite end portions on the bracket means, a hollow shaft journaled on the stationary shaft, roll means mounted on the hollow shaft for supporting the belt and relative to which the traveling belt may become misaligned in either direction, a guide arm independently pivotally supported on each end portion of said hollow shaft and having end portions extending in opposite directions longitudinally of and vertically spaced relative to the level of the adjacent edge of the belt, a guide roll rotatably supported on each of said guide arm end portions, the two guide rolls on each guide arm extending from their guide arm toward the adjacent belt edge and being arranged with their axes converging in a direction also extending away from their guide arm toward the adjacent belt edge, said guide rolls, when their guide arm is horizontally positioned, being so arranged relative to the adjacent belt edge that a helix angle is formed between such belt edge and each guide roll axis, and means for limiting the pivotal movement of each guide arm in opposite directions relative to its associated bracket means so that in every position assumed by each guide arm at least one of its guide rolls will be engaged by the adjacent edge of the belt when the latter is sufficiently misaligned in the direction of such guide arm, each of said helix angles being such that an axially exerted force will be applied by the rolling engagement between the belt edge and the angularly related guide roll with the direction of travel of the belt determining the direction in which the said axial force is exerted, whereby the guide roll on the approach side of the belt supporting roll means will be automatically positioned to be engaged by the edge of the misaligned belt so as to pivot the belt supporting roll means, upon further misaligning movement of the belt, into a skewed position which will realign the belt.

8. A training idler as defined in claim 7 further characterized by the means for limiting the pivotal movement of each guide arm in opposite directions, comprising a stop mounted on each of the two arm portions extending in opposite directions longitudinally of the belt edge, said stops alternately engaging the bracket means when their guide arm is pivoted in opposite directions to determine its two positions of extreme pivotal movement, said guide arm in each of such two positions being arranged to support one of its guide rolls in the path of, and its other guide roll out of the path of, misaligning movement of the adjacent belt edge.

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