

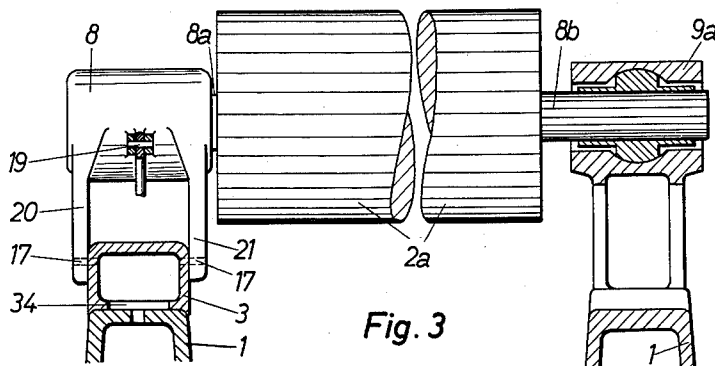
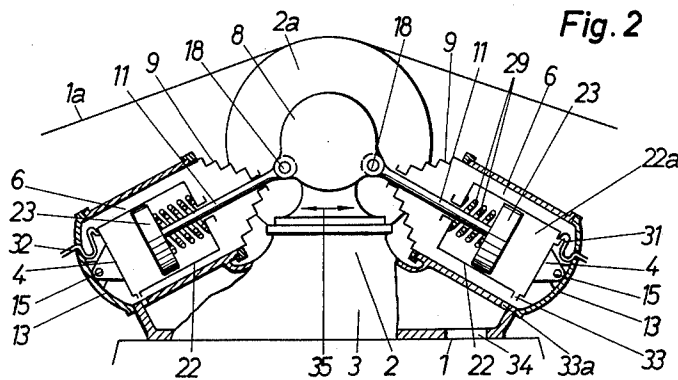
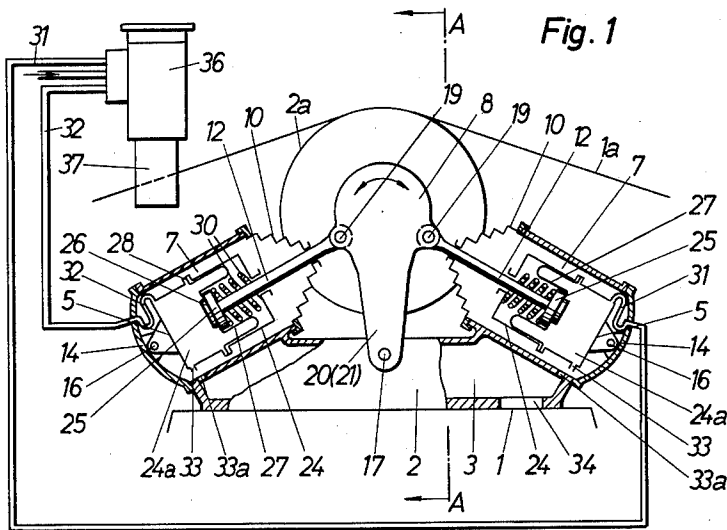
Aug. 20, 1963

W. MITTAG

3,101,005

BELT-ALIGNING STRUCTURE

Filed March 22, 1961



INVENTOR.
WALTER MITTAG

BY
Toulmin & Toulmin
Attorneys

1

3,101,005

BELT-ALIGNING STRUCTURE

Walter Mittag, Heidenheim (Brenz), Germany, assignor to J. M. Voith Gesellschaft mit beschränkter Haftung, Heidenheim (Brenz), Germany

Filed Mar. 22, 1961, Ser. No. 97,525

Claims priority, application Germany Mar. 26, 1960

11 Claims. (Cl. 74—241)

The present invention relates to a belt aligning arrangement, more particularly, to a mechanism for actuating a guide roller over which a belt runs to correct for any lateral deviation in the belt.

Many forms of machinery and apparatus employ an endless belt wherein the belt is supported by at least two cylindrical rollers having parallel axes. These belts may be conveyor belts, wire mesh screens, or felts such as employed in paper-making machinery. A guide roller is usually employed to support a reach of the belt with one end of the guide roller being journaled for pivoting movement and the other end being connected to a mechanism for pivoting the guide roller with respect to the direction of movement of the belt. The normal position of the guide roller is for the longitudinal axes thereof to be approximately parallel to the afore-mentioned supporting rollers. However, to correct any lateral deviation in the belt the guide roller is mounted so as to be deviated from this parallelism. This angular positioning of the guide roller tends to return the belt to its normal position.

A hydraulically automatically operated servomotor, which is actuated in response to the lateral deviation of the belt, is used to position the guide roller. The lateral deviation of the belt actuates controls to regulate the supply of the pressure medium to the servomotor so as to correctly position the guide roller to compensate for lateral deviations of the belt.

One of the conventional arrangements for positioning the guide roller comprised the use of a double-acting fluid pressure servomotor wherein the cylinder thereof is connected to the frame of the machine and the piston rod is connected to the moveable bearing housing of the guide roller. Means are provided to introduce a pressure medium on either side of the piston depending upon the direction in which it is desired to move the guide roller in order to compensate for lateral deviations of the belt.

One form of a guide roller actuating mechanism comprised the use of a crank lever which is pivotally mounted on the apex thereof with one arm being connected to the moveable journal housing of the guide roller and the other arm being connected to the piston rod of a fluid pressure servomotor. A damping cylindrical arrangement may be connected to the arm of the crank lever which is connected to the bearing housing. The disadvantage of this construction, however, is that it is quite expensive and that, when used in paper machinery, it must be partially disassembled when it is desired to change the screen.

Another form of an actuating mechanism for the guide roller comprised a single-acting servomotor which acts against a spring.

In the afore-mentioned known constructions there exists the disadvantage that when the supply of pressure medium to the servomotors is interrupted, the guide roller bearing will be positioned in one of its end positions. In this end position the axis of the guide roller is at its greatest angle with respect to the direction of movement of the endless belt. As a result, the belt may eventually be moved off of the supporting rollers and may be damaged or even destroyed.

It was therefore proposed to provide a double-acting fluid pressure servomotor wherein the piston rod is pivotally

2

connected to the moveable bearing housing of the guide roller. A pair of similar springs were positioned to act upon the piston rod of the servomotor in opposite directions so as to center the guide roller in its normal position when no fluid pressure medium is introduced into the servomotor. The admission of fluid pressure into the servomotor easily overcomes the action of one of the springs depending on which direction the guide roller is to be moved.

A similar construction which was particularly developed for controlling the path of the endless wire mesh screen in paper-machinery comprised a pair of chambers each having a built-in flexible membrane. These chambers are coaxially opposed with respect to each other and are rigidly mounted on the frame of the machinery. The adjustable guide roller which supports the screen is attached to a supporting member which is pivotally mounted on the frame of the paper machinery by two pairs of parallel members which are of a pantograph construction. This structure, however, has the disadvantage that it has a considerable number of pivoting joints and therefore requires careful attention during the operation thereof. In addition, the field of application of the structure is limited since, for example, it is not suitable for use in the dryer part of the paper machine.

While the last-described mechanisms for positioning guide rollers are so actuated by compressed air and usually achieve a satisfactory aligning of the endless belt, they do have several drawbacks. The principal drawback is that the overall size of the adjusting mechanism is quite large with respect to the range of adjusting movement thereof. Usually, very little space is available for mounting these control mechanisms, particularly in paper-making machinery. It is therefore extremely desirable to reduce the overall size of the guide roller positioning mechanism without decreasing the range of adjustment thereof. In fact, in some applications it is important to obtain a very large range of adjusting movement without enlarging the dimensions of the mechanism.

It is therefore the principal object of this invention to provide a novel and improved arrangement for correcting the lateral deviation of a moving belt.

It is another object of this invention to provide an arrangement for positioning a guide roller for a belt wherein the roller will return to its normal position when there is an interruption in the supply of power to the positioning means.

It is a further object of this invention to provide an arrangement for correcting the lateral deviation of a belt which occupies a minimum of space but which has a large range of adjustment.

It is still a further object of the present invention to allow the endless belt to be run out without interfering with the actuating mechanism which can remain in place on the machine upon exchange of the endless belt.

The afore-mentioned objects are achieved and the disadvantages of the prior art are eliminated by the belt-aligning mechanism disclosed as the present invention.

The present invention essentially comprises a pair of fluid pressure servomotors which are positioned to operate in directions opposed to each other. The servomotors are pivotally mounted on a frame and the actuating members are pivotally connected to a pivotally mounted bearing structure supporting a bearing housing in which is journaled one end of a guide roller. The servomotors are so positioned with respect to the pivotally mounted bearing structure that the angle between the actuating rod and the arm when the arm is in its normal vertical position is at least 30° and less than 90°.

The servomotors may comprise pressure cylinders having pistons therein which are moveable along the axis of the cylinder. As an alternative, the servomotors may

comprise pressure chambers having a flexible diaphragm therein which diaphragm is connected by an actuating rod to the pivotally mounted bearing structure supporting the bearing housing.

The actuating shafts of the servomotors are symmetrically positioned with respect to a vertical plane passing through the center line of the guide roller when it is in its normal position. This vertical plane passes through the pivot point of the adjusting mechanism and also through the axis of the pivotally mounted roller bearing housing. The axes of rotation of the pivotally mounted cylinders and the axes of rotation of the pivoting connections of the actuating rods to the bearing structure and of the latter to the supporting frame are all parallel to each other and are also parallel to the longitudinal axis of the bearing housing.

Other objects and advantages of the present invention will be apparent upon reference to the accompanying description when taken in conjunction with the following drawings, wherein

FIGURE 1 is a front elevational view, partly in cross-section, of a guide roller adjusting mechanism according to this invention;

FIGURE 2 is a front elevational view, partly in cross-section, of a modified embodiment of the invention; and

FIGURE 3 is a side elevational view, partly in cross-section, of both end portions of the guide roller and the bearing housings in which the ends are journaled, with portions of the frame and of the pivotally mounted bearing structure being shown in section along the line A—A of FIG. 1, the entire adjusting mechanism being slidably mounted upon the machine frame.

A specific embodiment of this invention will next be described with reference to the drawings wherein like reference symbols indicate the same parts throughout the various views.

Returning to FIGURE 1 there is shown at 1 a portion of the frame of a piece of machinery such as a paper-making machine which supports a movable endless belt or screen 1a. The remaining structure of the machine and the supporting rollers for the belt are not described in detail since they are conventional and would depend upon the specific nature of the machinery.

The guide roller adjusting mechanism is generally indicated at 2 and is mounted upon the frame 1. The adjusting mechanism comprises a hollow frame 3 which has mounted on the ends thereof cylindrical enclosures 7 with each enclosure having an open end, the two ends facing each other. A servomotor 5 is positioned in each of the enclosures 7.

Positioned between the servomotors 5 is a pivotally mounted bearing housing 8 in which is journaled one end 8a of the guide roller 2a as shown in FIG. 3, the other end 8b being rotatably and pivotally supported in a conventional manner in a bearing 9a on the frame 1 of the paper making machine.

In FIGS. 1 and 2 the open ends of the enclosure 6 and 7 are closed by flexible, expansible membranes 9 and 10. These membranes are sealingly engaged to the walls of the cylindrical enclosures 6 and 7 and to actuating rods 11 and 12 which extend outwardly from the respective servomotors 4 and 5. The servomotors are of the fluid pressure type and may either be hydraulically or pneumatically actuated. The membranes 9 and 10 reduce the maintenance of this apparatus since they function to enclose the servomotors within the cylindrical enclosures. These expansible membranes are cone-shaped and are similar to a bellows since the membrane is capable of expansion along the center axis of the servomotor to accomplish the rectilinear movement of the actuating rods. Suitable fastenings are provided to sealingly fasten the outer peripheries of these membranes to the cylindrical enclosures 6 and 7, and the central portions of the membranes to the actuating rods 11 and 12.

The closed ends of the enclosures 6 and 7 are formed by plates or covers 13 and 14 to which are pivotally connected the servomotors 4 and 5 by the pivotal mountings 15 and 16. Since the cylindrical enclosures 6 and 7 are integral with the frame 3, the servomotors are in effect pivotally mounted on the frame 3.

The adjustable bearing housing 8 of the guide roller 2a has a pivotal mounting 17 by which the bearing housing is pivotally connected to the frame 3. In addition, there are joints 18 and 19 by which the actuating rods 11 and 12, respectively, of the servomotors are pivotally connected to the bearing housing 8.

Instead of pivotally mounting the bearing housing 8, this housing can also be mounted on a frame 3 for sliding movement in a direction substantially perpendicular to the normal position of the guide roller 2a as shown in FIG. 2 and indicated by arrow 35.

As shown in FIGS. 1 and 3, the bearing structure comprises a bearing housing 8 carrying a pair of upright arms 20 and 21 that straddle the frame 3, as shown in FIGURE 3. The two arms 20 and 21 essentially form a fork structure which is pivotally connected to the frame 3 at 17, as also shown in FIGURE 3.

The frame 3 of the guide roller adjusting mechanism is formed as a closed hollow object and has openings through which the pressure medium lines may be passed to be connected to the servomotors. As a result of this construction only enough space is provided to obtain the desired range of pivoting movement of the guide roller. Consequently, this adjusting mechanism can be constructed so as to be very compact and to be sealed against all foreign matter.

The actuating rods of the servomotors are generally arranged to form an angle smaller than 180° . If these actuating rods are so positioned that in the normal position of the guide roller, as indicated in FIGURE 1, these rods are substantially parallel to the reaches of the belt 1a, then the actuating rod of each servomotor in this position will form an angle of less than 90° with the arm 20 of the bearing housing 8. Further, if these actuating rods are positioned on opposite sides of the pivotally mounted arm 20, so as to form an angle of preferably 60° , then only one type of construction of the guide roller adjusting mechanism would be sufficient for all angles at which the belt engages the guide roller 2a.

By arranging the servomotors in this manner the outline of the adjusting mechanism can be circumscribed by a triangle the base-line of which is the base of the frame and the other sides of which are formed by the conveyor belt coming up onto and then passing off of the guide roller. As a result, the belt is not crossed at any place by any portion of the adjusting mechanism without decreasing the angle which the belt forms in passing around the guide roller.

As a result of this construction of the actuating mechanism the endless belt can be laterally run out without interfering with the actuating mechanism. Further, the actuating mechanism can remain in place on the machine when it is desired to exchange or replace the endless belt.

The servomotor 4 comprises a pressure cylinder 22 within which is slidably mounted a piston 23. The piston 23 is fixedly connected to the actuating or piston rod 11. The servomotor 5 is different in construction in that it comprises a cylinder 24 within which is a plate 25 which is fixedly connected to the actuating rod 12. The plate 25 does not contact the interior wall of the cylinder 24 but is connected to the middle portion 26 of an expansible, highly flexible diaphragm 27 whose outer edge 28 is sealingly fastened to the wall of the cylinder 24. There are coil springs 29 and 30 surrounding the actuating rods 11 and 12, respectively, outwardly of the pressure side of the piston 23 and of the diaphragm 27. The springs are so selected that they exert forces against the forces exerted by the fluid pressure medium introduced into the cylinders of the servomotors.

5

As a result, each of the servomotors has a predetermined resiliency which is dependent upon the characteristics of the springs selected. Since the forces of the springs are in opposite directions and these forces are approximately equal, it is apparent that these springs will position the bearing housing 8 in its normal vertical position, as shown in FIGURE 1, if the supply of pressure medium to the servomotors should be interrupted.

The fluid pressure medium which is usually compressed air is supplied to the pressure chambers 22a and 24a of the cylinders 22 and 24 through control valve 36 and conduits 31 and 32, parts of which may be flexible, and is exhausted from the pressure chambers through openings 33 in the cylinders. From these openings the compressed air can then be exhausted through openings 33a in the walls of the enclosures 6 and 7 and through a further opening 34 in the frame 3 so as to be returned to a reservoir or to be exhausted to the atmosphere. The path of this air provides a simple and effective cooling of the adjusting mechanism and especially of the diaphragms 27 and the enclosing membranes 9 and 10.

This arrangement of the actuating mechanism which provides a continuous and effective cooling, particularly when the pressure medium is compressed air, is particularly important in cooling the pressure-sensitive sealing means. This cooling arrangement is also important in those applications of the adjusting mechanism where the mechanism is subjected to high temperatures such as below the cover of the dryer of a paper machine. As a result, the pressure medium will flow around and cool all of the resilient sealing elements of the adjusting mechanism.

This cooling arrangement is especially effective for servomotor 5 which uses an expansible diaphragm instead of a piston sliding back and forth on the walls of the cylinder. This type of servomotor has a larger stroke with respect to the outer diameter of the diaphragm housing than was the case in previously known pressure chambers employing substantially flat, platelike flexible members.

Conventional and well-known means are provided which are responsive to lateral deviation of the endless belt 1a and which control the supply of pressure medium to the servomotors. The admission of the pressure medium to a particular servomotor is determined by the direction in which it is desired to pivot the guide roller in order to compensate for lateral deviation of the endless belt.

From a compressed air source (not shown) compressed air is continuously admitted to control valve 36 and uniformly or non-uniformly distributed to the two pressure chambers 24a under the control of a conventional palm 37 which is influenced by the lateral deviation of the belt run. In this manner, a continuous flow of compressed air is directed from the compressed air source to the pressure chambers of the servomotor cylinders 24 and through the enclosures 7, the compressed air flow being uniformly distributed to both servomotors 5 with the guide roller 2a in its normal position. In this case, the compressed air in the two servomotors 5 creates forces which are balanced so that the adjustable guide roller remains in position. In the event of a lateral deviation of the belt 1a from its proper run, palm 37 acts on control valve 36. As a result in the control valve 36 the free cross section which controls the flow of compressed air to the corrective servomotor, is enlarged while the free cross section in the line to the other servomotor is reduced.

It is thus apparent that in this arrangement for adjusting a guide roller, the force for adjusting the roller is provided in a conventional manner by introducing a carefully regulated amount of pressure medium into the pressure chambers of the servomotors. The difference in pressures in the pressure chambers of the servomotors determines the direction in which the bearing housing 8 will be pivoted and accordingly the direction in which the guide roller will be adjusted.

Thus it can be seen that the present invention provides

6

a simple and effective mechanism for positioning a guide roller so as to correct the lateral deviation of an endless belt or any other band such as wire or felt bands of paper-making machinery.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions.

The application of this invention is therefore not limited to an essentially horizontal band run, as illustrated in the accompanying drawing. This invention may be used at random direction of the band run and thus may be installed in a corresponding manner.

Accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

What I claim is:

1. An arrangement for correcting the lateral deviation of an endless belt and comprising a frame, a guide roller for said belt, means for pivotally journaling one end of said guide roller, an upright arm whose lower end is pivotally mounted on said frame and having a bearing housing at its upper end journaling the other end of said guide roller, a pair of fluid pressure motors pivotally mounted on said frame and symmetrically positioned on opposite sides of said arm with respect to the direction of the belt over said guide roller, each of said motors having a rectilinearly moveable actuating rod pivotally connected to said arm near the upper end thereof and actuated by the fluid pressure to push said arm about its pivot, said rods forming an angle of from 30° to less than 90° with said arm when said arm is in its normal vertical position, and means for selectively actuating said fluid pressure motors in response to the lateral deviation of said belt.

2. An arrangement as claimed in claim 1 wherein the angle between an actuating rod and the arm when said arm is in its normal position is of the order of 60°.

3. An arrangement for correcting the lateral deviation of an endless belt and comprising a frame, a guide roller for said belt, means for pivotally journaling one end of said guide roller, an upright arm whose lower end is pivotally mounted on said frame and having a bearing housing at its upper end journaling the other end of said guide roller, a pair of fluid pressure motors pivotally mounted on said frame and symmetrically positioned on opposite sides of said arm with respect to the direction of the belt over said guide roller, each of said motors having a rectilinearly moveable actuating rod pivotally connected to said arm near the upper end thereof and actuated by the fluid pressure to push said arm about its pivot, resilient means on each of said motors acting against the force exerted by the fluid pressure on said actuating rods, said rods forming an angle of from 30° less than 90° with said arm when said arm is in its normal vertical position, and means for selectively actuating said fluid pressure motors in opposition to the resilient means in response to the lateral deviation of said belt.

4. An arrangement for correcting the lateral deviation of an endless belt and comprising a frame, a guide roller for said belt, means for pivotally journaling one end of said guide roller, an upright arm whose lower end is pivotally mounted on said frame and having a bearing housing at its upper end journaling the other end of said guide roller, a pair of fluid pressure motors pivotally mounted on said frame and symmetrically positioned on opposite sides of said arm with respect to the direction of the belt over said guide roller, the pivotal mounting of said arm being midway between said fluid pressure motors, each of said motors having a rectilinearly moveable actuating rod pivotally connected to said arm near the upper end thereof and actuated by the fluid pressure to push said arm about its pivot, said rods forming an angle of from 30° to less than 90° with said arm when said arm is in its normal vertical position, and means for selectively actuating said fluid pressure motors in response to the lateral deviation of said belt.

5. An arrangement for correcting the lateral deviation of an endless belt and comprising a frame, a guide roller for said belt, means for pivotally journaling one end of said guide roller, a bearing structure pivotally mounted on said frame and having a bearing housing thereon journaling the other end of said guide roller, said bearing structure comprising a cylindrical bearing housing and a pair of axially spaced similarly shaped arms extending downwardly therefrom, said arms receiving said frame therebetween and being pivotally connected thereto so that said bearing housing is pivotally mounted on said frame, a pair of fluid pressure motors pivotally mounted on said frame on opposite sides of said bearing structure with respect to the direction of the belt over said guide roller, each of said motors having a rectilinearly moveable actuating rod connected to said bearing structure, said rods forming an angle of from 30° to less than 90° with said bearing structure when said bearing structure is in its normal vertical position, and means for actuating said fluid pressure motors in response to the lateral deviation of said belt.

6. An arrangement for correcting the lateral deviation of an endless belt and comprising an endless belt supported for longitudinal movement, a frame formed as an integral unit and having a pair of cylindrical enclosures thereon with the ends of the enclosures facing each other being open, a guide roller for said belt, means for pivotally journaling one end of said guide roller, an arm pivotally mounted on said frame between said cylindrical enclosures and having a bearing housing thereon journaling the other end of said guide roller, a pair of fluid pressure motors pivotally mounted in said enclosure on opposite sides of said arm, each of said motors having a rectilinearly moveable actuating rod connected to said arm, said actuating rods extending outwardly of said enclosures through the open ends thereof, said rods forming an angle of from 30° to less than 90° with said arm when said arm is in its normal vertical position, and means for actuating said fluid pressure motors in response to the lateral deviation of said belt.

7. An arrangement for correcting the lateral deviation of an endless belt and comprising an endless belt supported for longitudinal movement, a frame formed as an integral unit and having a pair of cylindrical enclosures thereon with the ends of the enclosures facing each other being open, a guide roller for said belt, means for pivotally journaling one end of said guide roller, an arm pivotally mounted on said frame between said cylindrical enclosures and having a bearing housing thereon journaling the other end of said guide roller, a pair of fluid pressure motors pivotally mounted in said enclosures on opposite sides of said arm, each of said motors having a rectilinearly moveable actuating rod connected to said arm, said actuating rods extending outwardly of said enclosures through the open ends thereof, flexible means interconnecting said actuating rods with the edges of the respective enclosure open ends to sealingly close said open ends, said rods forming an angle of from 30° to less than 90° with said arm when said arm is in its normal vertical position, and means for actuating said fluid pressure motors in response to the lateral deviation of said belt.

8. An arrangement as claimed in claim 1 wherein a fluid pressure motor comprises a cylinder having an opening in one end thereof through which said actuating rod projects, and a flexible membrane sealingly connected to the inner end of said actuating rod and the cylinder wall to form a piston-like member, said membrane being expansible in the direction of movement of the actuating rod.

9. An arrangement for correcting the lateral deviation of an endless belt and comprising an endless belt supported for longitudinal movement, a frame formed as an

integral unit and having a pair of cylindrical enclosures thereon with the ends of the enclosures facing each other being open, a guide roller for said belt, means for pivotally journaling one end of said guide roller, an arm pivotally mounted on said frame between said cylindrical enclosures and having a bearing housing thereon journaling the other end of said guide roller, a pair of fluid pressure motors pivotally mounted in said enclosures on opposite sides of said arm, each of said motor having a rectilinearly moveable actuating rod connected to said arm, said actuating rods extending outwardly of said enclosures through the open ends thereof, said rods forming an angle of from 30° to less than 90° with said arm when said arm is in its normal vertical position, means for supplying a fluid pressure medium to the pressure sides of said fluid pressure motors, means for exhausting the fluid pressure medium from said motors into said enclosures for cooling said motors, and means for actuating said fluid pressure motors in response to the lateral deviation of said belt.

10. An arrangement for correcting the lateral deviation of an endless belt and comprising an endless belt supported for longitudinal movement, a frame formed as an integral unit and having a pair of cylindrical enclosures thereon with the ends of the enclosures facing each other being open, a guide roller for said belt, means for pivotally journaling one end of said guide roller, an arm pivotally mounted on said frame between said cylindrical enclosures and having a bearing housing thereon journaling the other end of said guide roller, a pair of fluid pressure motors pivotally mounted in said enclosures on opposite sides of said arm, each of said motors having a rectilinearly moveable actuating rod connected to said arm, said actuating rods extending outwardly of said enclosures through the open ends thereof, said rods forming an angle of from 30° to less than 90° with said arm when said arm is in its normal vertical position, means for supplying a fluid pressure medium to the pressure sides of said fluid pressure motors, means for exhausting the fluid pressure medium from said motors into said enclosures for cooling said motors, means for exhausting the fluid pressure medium from said enclosures, and means for actuating said fluid pressure motors in response to the lateral deviation of said belt.

11. An arrangement for correcting the lateral deviation of an endless belt and comprising a main frame, a slidably mounted frame, a guide roller for said belt, means for pivotally journaling one end of said guide roller, an upright arm whose lower end is pivotally mounted on said slidably mounted frame and having a bearing housing at its upper end journaling the other end of said guide roller, a pair of fluid pressure motors pivotally mounted on said slidably mounted frame and symmetrically positioned on opposite sides of said arm with respect to the direction of the belt over said guide roller, each of said motors having a rectilinearly moveable actuating rod pivotally connected to said arm near the upper end thereof and actuated by the fluid pressure to push the arm about its pivot, said rods forming an angle of from 30° to less than 90° with said arm when said arm is in its normal vertical position, and means for selectively actuating said fluid pressure motors in response to the lateral deviation of said belt.

References Cited in the file of this patent

UNITED STATES PATENTS

471,631	Aldrich	Mar. 29, 1892
1,835,686	Allan et al.	Dec. 8, 1931
2,199,893	Norton et al.	May 7, 1940
2,782,765	Robinson	Feb. 26, 1957

FOREIGN PATENTS

93.242	Switzerland	Mar. 1, 1922
--------	-------------	--------------