April 6, 1937. H. M. OSTERTAG 2,076,413

BELT GUIDE

Filed Nov. 19, 1934 4 Sheets-Sheet 1

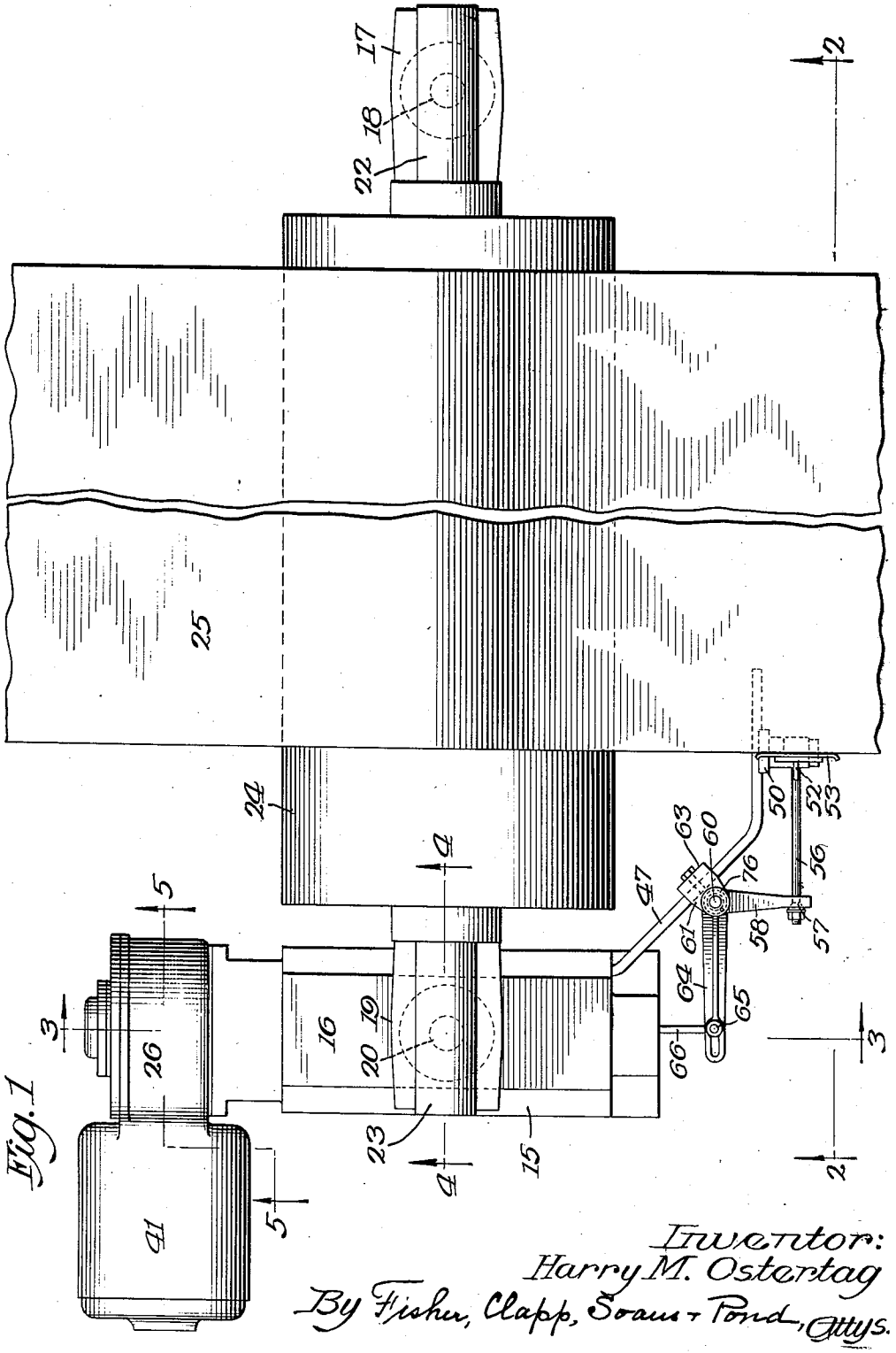

Fig. 1

Inventor:
Harry M. Ostertag
By Fisher, Clapp, Soans & Pond, Attys.

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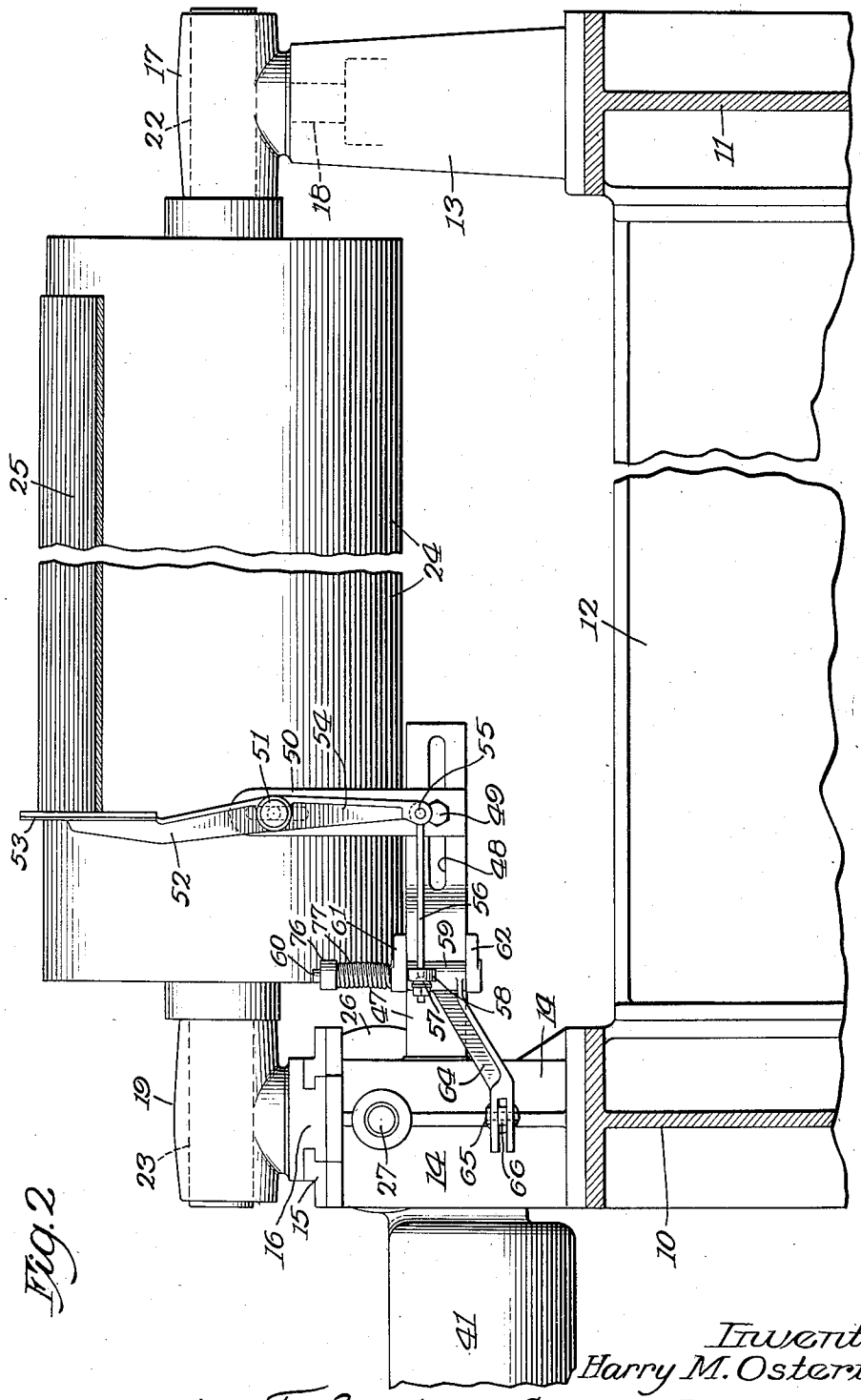

Fig. 2

Inventor:
Harry M. Ostertag
By Fisher, Clapp, Soans & Pond, Attys.

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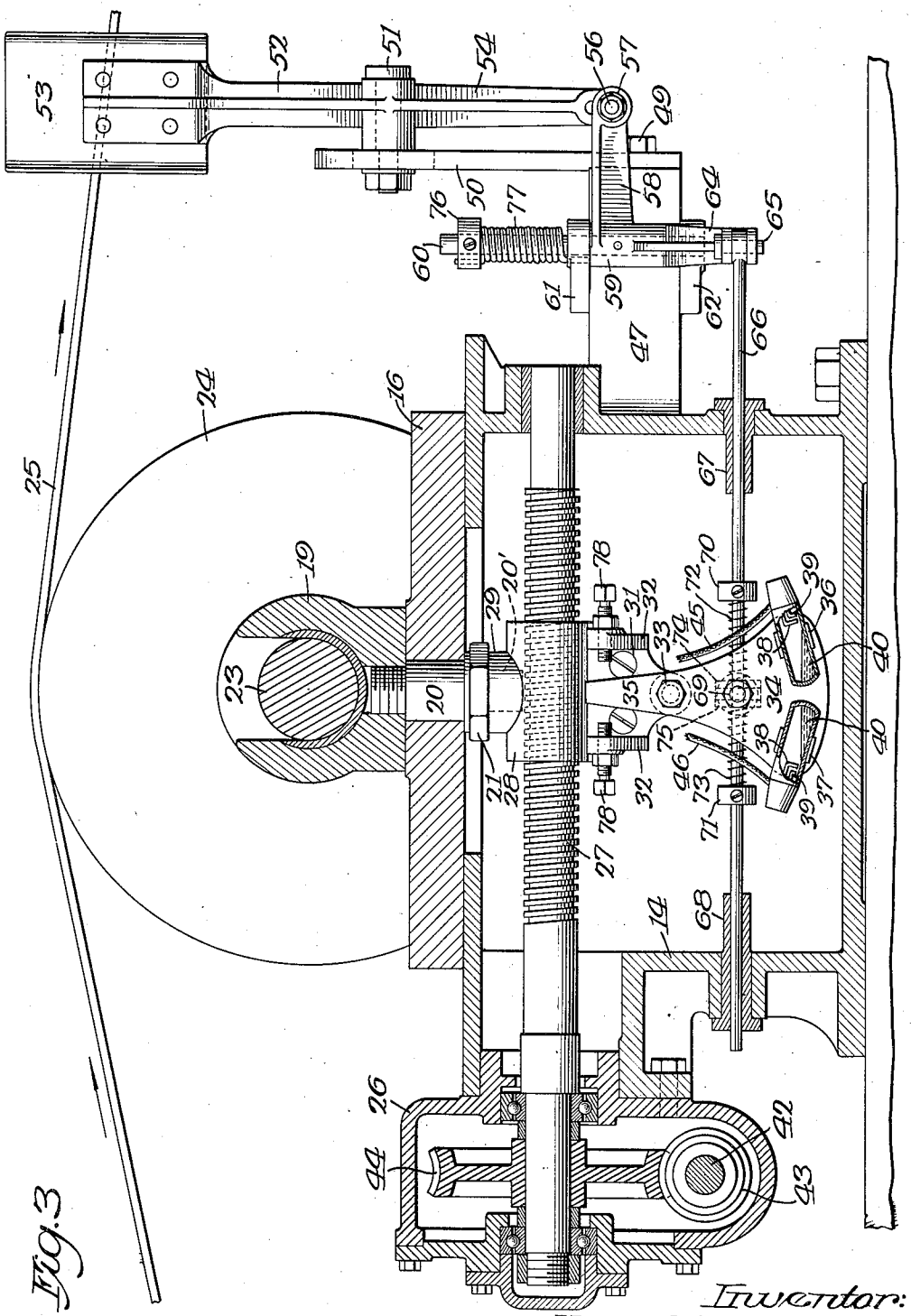

Fig. 3

Inventor:
Harry M. Ostertag
By Fisher, Clapp, Soans & Pond, Attys.

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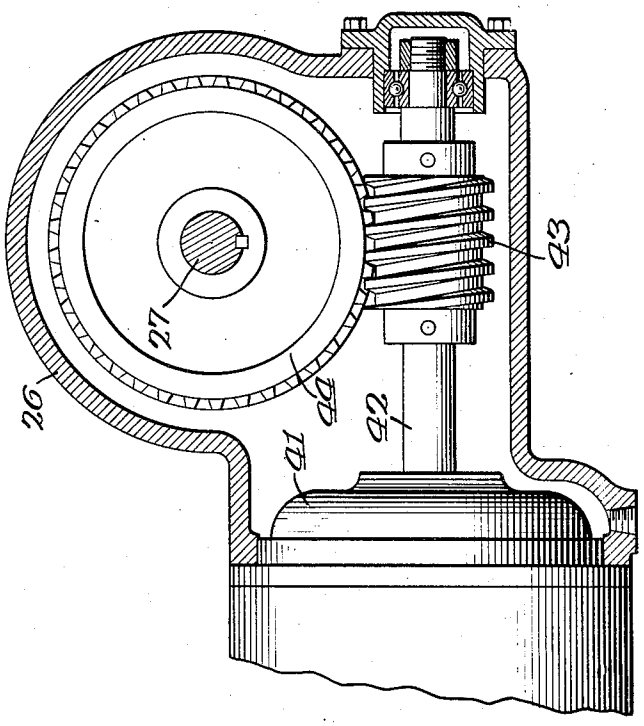

Fig. 5

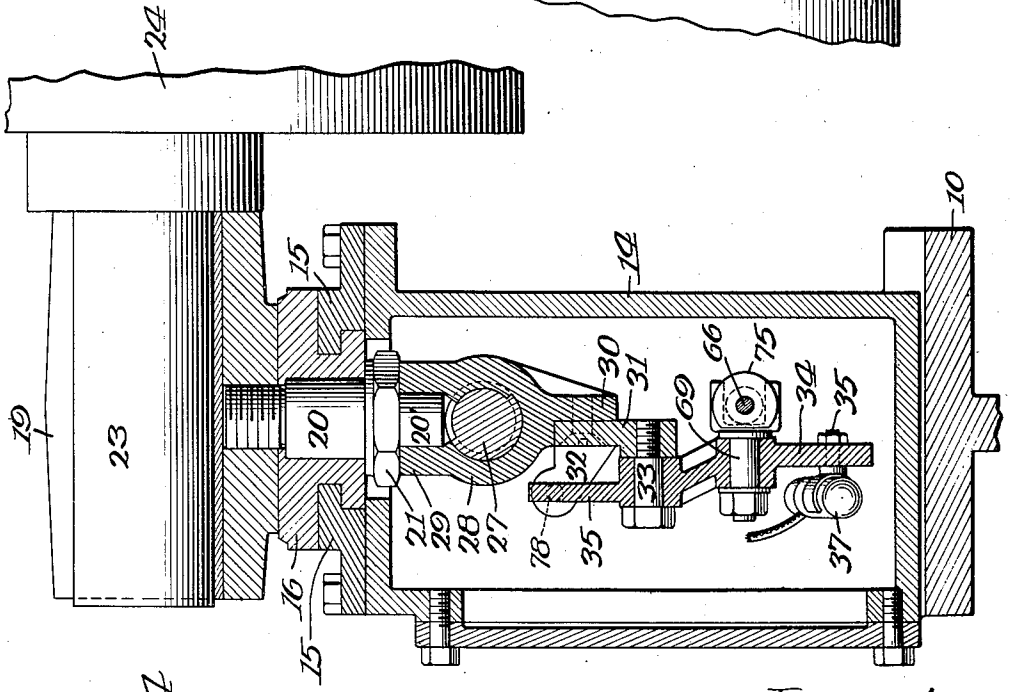

Fig. 4

Inventor:
Harry M. Ostertag
By Fisher, Clapp, Sears & Pond, Attys.

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UNITED STATES PATENT OFFICE

2,076,413

BELT GUIDE

Harry M. Ostertag, Neenah, Wis., assignor to Paper Patents Company, Neenah, Wis., a corporation of Wisconsin

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10 Claims. (Cl. 74—241)

The present invention relates to a class of endless belt guides, the purpose or object of which is to automatically correct a tendency of the belt to run off-center; that is, to one side or the other of its true path of travel. The invention has been designed by me more particularly for use on paper making and paper coating machines, as an adjunct to the Fourdrinier wires, dryer felts, press felts, and the like of such machines, but it is capable of useful application in any situation where it is desirable to maintain an endless belt or the like of any character running substantially central and true to its proper path of travel.

In the case of paper machines equipped with various types of endless felts, wires, etc., it is highly desirable to provide means to insure the felts and wires running continuously substantially central on the particular machine section or sections with which they are associated. This is commonly accomplished by means of a roll termed a guide roll. The felt or wire is supported by the guide roll and arrives at and leaves the roll at slight angles to provide the required amount of contact or wrap on the roll to cause the roll to have sufficient influence on the felt or wire to hold it central on the machine. The theoretically correct position of such a guide roll is, of course, with its axis exactly at right angles to the true path of travel of the felt or wire.

One journal of the guide roll is supported on the back side of the machine in a bearing mounted on a vertical pivot. The bearing of the front journal of the guide roll is also pivoted vertically, and this front pivot is usually mounted on a slide mounted in guides to permit the bearing to move forward or backward parallel to the center line of the machine. This shifting of the angular position of the guide roll in the proper direction acts to automatically return the sidewise running felt or wire to central position.

A common practice in the past has been to shift the front bearing of the guide roll by means of a screw actuated in either direction by a ratchet wheel on the screw by means of pawls which are so mounted as to not engage the ratchet wheel when the felt or wire is running central, but which are thrown into operative engagement with the ratchet wheel so as to revolve the screw and thus shift the front bearing of the guide roll in the proper direction when the felt or wire diverts from the central operating position on the paper machine. Motion is transmitted to the pawls from an arm actuated by an eccentric on the end of the guide roll. The pawls are bodily moved into and out of engagement with the ratchet wheel by a system of levers which are moved by the edge of the felt or wire. The parts, with the exception of the ratchet wheel, are continuously in operation, and due to their continuous operation, whether or not the felt or wire requires guiding, the joints and bearings and other parts of the guide apparatus are continuously wearing, and the fine adjustment necessary to good operation must be continuously maintained. The tips of the pawls and ratchet teeth also rapidly wear down and become blunt. In the past it has frequently occurred that when the felt or wire required guiding, the mechanical guides now in use have been unable to function properly, as they have worn to a point that they could not do the full amount of work for which they were designed.

The object of the present invention is to provide an improved and simplified belt guide of the type employing an angularly shiftable guide roll, and to this end, and to avoid the difficulties encountered with a continuously operated mechanical guide, I have designed a guide which is operated by a reversing electric motor, the circuits of which are normally open so long as the belt is running substantially true, said motor being geared to the rotary screw that actuates the shiftable bearing of the guide roll, and its circuits being momentarily closed when the belt runs off-center to one side or the other, by a switch that, in turn, is actuated to circuit-closing position by a feeler engaged with an edge of the belt.

The present invention, its operative principle and manner of working, and the benefits and advantages inherent therein will be readily understood by persons skilled in the art from the following detailed description, taken in connection with the accompanying drawings, in which I have illustrated one practical and approved embodiment of the invention, and wherein—

Fig. 1 is a top plan view of the guide mechanism as applied, for example, to a traveling felt band of a paper machine.

Fig. 2 is a vertical transverse section, on the line 2—2 of Fig. 1.

Fig. 3 is an enlarged vertical longitudinal section, on the line 3—3 of Fig. 1.

Fig. 4 is an enlarged detail vertical transverse section, on the line 4—4 of Fig. 1.

Fig. 5 is an enlarged detail vertical transverse section, on the line 5—5 of Fig. 1.

Referring to the drawings, 10 and 11 designate front and rear frame members that may be connected and spaced by a beam 12. On the rear frame member 11 is mounted a pedestal 13, and on the front frame member 10 is mounted a hous-

ing 14 on top of which is a slideway 15 in which is a slide 16. A rear bearing member 17 is mounted by a vertical pivot 18 on the pedestal 13, and a similar front bearing member 19 is swiveled on the threaded upper end of a pivot stud 20 that is fitted to a hole in the slide 16, and formed with a nut 21 that bears against the underside of the slide 16. In the bearings 17 and 19 are supported the end journals 22 and 23 of the guide roll 24, over which roll passes the belt 25.

Referring to Fig. 3, to one end of the housing 14 is rigidly attached a gear casing 26, in the side walls of which and in the opposite end wall of housing 14 is journaled a threaded shaft 27. On shaft 27 is a nut 28 formed on its upper side with a round boss 29 having a hole to receive the lower reduced end portion 20' of the stud 20. Integral with the lower side of the nut 28 is a depending boss 30 having a flat vertical front face to which is secured a bracket 31 formed on its ends with forwardly projecting ears 32. The bracket 31 carries a pivot stud 33, on which is pivoted a depending sector-shaped plate 34 formed with an integral upwardly extending arm 35 above the pivot 33. On the front face of plate 34 are mounted on studs 35 a pair of angularly adjustable mercury tube electric switches 36 and 37, each containing a pair of spaced circuit contacts 38, 39 and a body of mercury 40. The plate 34, equipped as above described has the function of a motor-controlling member, as will later appear.

Referring to Figs. 1, 2, and 5, one end of the gear casing 26 supports the frame of an electric motor 41 of the reversing type, and the armature shaft 42 is extended into and at its end journaled in the lower portion of gear casing 26, as clearly shown in Fig. 5. Fast on shaft 42 is a worm 43 meshing with and driving a worm gear 44 that is fast on the threaded shaft 27. This worm gearing constitutes a speed reducing and self-locking transmission from the motor 41 to the shaft 27. Circuit leads 45 and 46 (Fig. 3), in which the contacts 38 and 39 are included, connect the field of the motor with a source of current, one lead, when closed, driving the motor in one direction and the other, when closed, driving the motor in the reverse direction. Both leads are open when the belt 25 is running in or close to its normal central position.

Turning now to a description of the mechanism for automatically momentarily energizing the motor when the belt shifts too far edgewise, to thereby correct the position of the roll 24 by shifting its bearing 19, 47 designates a diagonal bracket secured to and projecting rearwardly beyond one end of housing 14 (Fig. 1). As shown in Fig. 2, the free end portion of this bracket, which lies substantially parallel with the axis of roll 24, has a longitudinal slot 48 through which extends a clamp bolt 49 by which a post 50 is adjustably mounted on the bracket 47. Post 50 carries a vertically adjustable pivot stud 51 on which is pivoted at substantially midlength a feeler lever, the upper arm 52 of which carries a hand 53, the palm of which is polished and lies against an edge of the belt 25. The lower arm 54 is pivoted at 55 to a link 56, and the other end of said link is articulated at 57 to one arm 58 of an elbow lever, the hub 59 of which is keyed to a vertical shaft 60 mounted in the arms 61 and 62 of a U-shaped bearing bracket 63 attached to the diagonal bracket 47, the hub being confined endwise between said arms. The other arm 64 of the elbow lever has a slotted forked end that is connected by a pivot pin 65 with one end of a rod 66 that, as best shown in Fig. 3, is slidably mounted in a pair of bearing sleeves 67 and 68 supported in the end walls of the housing 14. These bearing sleeves 67 and 68 extend some distance inwardly of the housing for a purpose later disclosed. As best shown in Fig. 4, the rod 66 extends between the arms of a yoke stud 69 mounted on the rear side of the plate 34. Keyed to the rod 66 on opposite sides of the yoke stud 69 are collars 70 and 71, and encircling the rod 66 are opposed light coil springs 72 and 73 which abut at their outer ends against the collars 70 and 71 and at their inner ends against washers 74 and 75 that bear against opposite sides of the yoke head of stud 69.

Referring to Fig. 3, keyed on the upper end of vertical shaft 60 is a collar 76, and encircling the shaft between said collar and the bracket arm 61 is a torsion spring 77, anchored at its upper end to collar 76 and at its lower end to arm 61. This spring 77 is under sufficient tension to constantly lightly urge the hand of the feeler lever against the edge of the traveling belt 25. In the ears 32 are mounted stop screws 78 that cooperate with arm 35 to limit the maximum swing of plate 34 in an obvious manner.

Describing the operation, it may be assumed that in the position of the parts shown in Fig. 3 the belt is running substantially central or true, in which position the two oppositely acting springs 72 and 73 on rod 66 hold the motor-controlling plate 34 central or in a position where both motor circuits are open. If, now, the belt shifts edgewise toward the observer, the feeler lever will be rocked in a direction to move rod 66 to the right, and if the movement is sufficient to cause spring 73 to tilt the plate 34 sufficiently to close the circuit through switch 37, the motor and screw will then shift the nut 28 a short distance to the right. This will correct the angular position of the guide roll 24, and the belt will gradually shift back edgewise from the observer, and the plate 34 will by gravity resume its vertical or centered position since its suspension point 33 has been shifted to the right with the nut and the center of gravity of the plate and its load (switches 36 and 37) is below the suspension point 33. If the belt creeps edgewise away from the observer, the hand of the feeler lever, under the urge of spring 77, will follow the retreating edge of the belt, which action will move rod 66 to the left; and if the movement is sufficient to cause spring 72 to tilt the plate 34 sufficiently to close the other circuit through switch 36, the motor and screw will then shift the nut to the left, which will correct the angular position of the guide roll, and the belt will then gradually shift edgewise back toward the observer, and the plate 34 will again by gravity resume its vertical or centered position. Thus any substantial divergence of the belt to either side from its central path or a path parallel with and close to its central path, is automatically corrected, and the mechanism for effecting such correction is not continuously working and wearing out, but is called into action and functions only when it is needed.

The light springs 72 and 73 on rod 66 absorb slight reciprocating movements of the rod without tilting the switch-carrier 34 sufficiently to close one of the motor circuits, thus keeping the device out of operation so long as the belt is running only slightly displaced edgewise from its true central path of travel. And manifestly,

the extent of swinging or tilting movement of the switch carrier **34** necessary to close a circuit can be varied by varying the angular set of the switches **36** and **37**.

It may here be noted that the motor can never jam the nut at the end of the screw by overtravel, since the collar **70** or **71** would strike the inner end of the bearing sleeve **67** or **68** before the nut reached an end of the screw, and the thrust of the spring **72** or **73** on the switch plate **34** would bring the latter to a vertical or centered position, and this would stop the motor.

Manifestly, if a condition tending to make the belt drift or creep continually to one side exists permanently and is sufficiently pronounced, the position of the bearing **19** must be shifted permanently a sufficient distance to correct the drifting tendency. Hence, the center line of the belt travel will be proportionately displaced. If this displacement is only an inch or so, this is immaterial, so long as there is no further drifting of the belt. However, if the permanent off-center displacement of the belt becomes too pronounced, the belt may be re-centered in any convenient manner such as is customary in manually correcting a drifting tendency. For example, another of the belt rollers may have one of its end bearings similarly arranged for sliding movement with manual rather than automatic control. The words "drift" or "creep" as used herein mean a continuous tendency to produce an accumulated displacement of the belt.

The arrangement constitutes in effect a form of servo-motor mechanism, but for a different purpose, since, whereas in the usual servo-motor arrangement it is desired to shift a remote or ponderous member to any desired position corresponding with that of a primary controlling member, in the present arrangement the position of the primary controlling member is merely incidental to the proper functioning of the controlling mechanism.

It is to be understood that the term "belt" as used herein is intended to cover any endless traveling member in the general nature of a belt or apron, such as the Fourdrinier wire or felts of a paper machine, conveyor belts, power-transmitting belts, etc., and is not limited to the paper machine art, although it is contemplated that the chief application of the improvement will be in the paper making and paper coating arts.

This invention may be developed within the scope of the following claims without departing from its essential features, and the specification and drawings are to be read as merely illustrative of one embodiment of the operative principle of the invention and not in a limiting sense, except as necessitated by the prior art.

I claim:

1. In a belt guide of the character described, the combination of a belt guide roll, a bearing in which one end of said roll is journaled, a mounting for said bearing, an electric motor geared to said mounting so as to effect a radial shift of one end of said roll relative to the other end of the roll, a switch plate pivotally suspended from said mounting, a mercury tube electric switch mounted on said plate, the center of gravity of said plate and switch being below the pivot of said plate, a feeler for engaging the edge of the belt, and means operatively connecting said feeler with said plate.

2. In a belt guide of the character described, the combination of a belt guide roll, a bearing in which an end of said roll is journaled, a slide on which said bearing is mounted, a rotatable screw, a nut on said screw connected to said slide, a reversible motor drivingly connected to said screw, a movable self-centering motor-controlling member carried by said nut, a feeler spring-urged against an edge of the belt, operating connections between said feeler and said motor-controlling member, and means rendered active by said motor-controlling member when moved a predetermined distance from its central position for energizing said motor.

3. In a belt guide of the character described, the combination of a belt guide roll, a bearing in which an end of said roll is journaled, a slide on which said bearing is pivoted, a rotatable screw, a nut on said screw connected to said slide, a reversible motor drivingly connected to said screw, a motor-controlling member pivotally suspended from said nut, a feeler lever spring-urged against an edge of the belt, operating connections between said feeler lever and said motor-controlling member, and means rendered active by said motor-controlling member when swung a predetermined distance to one side or the other of its central position for energizing said motor.

4. In a belt guide of the character described, the combination of a belt guide roll, a bearing in which an end of said roll is journaled, a slide on which said bearing is mounted, a rotatable screw, a nut on said screw connected to said slide, a reversing electric motor geared to said screw, a movable self-centering motor-controlling member carried by said nut, a feeler spring-urged against an edge of the belt, operating connections between said feeler and said motor-controlling member, and switches carried by said motor-controlling member operative to close the respective motor circuits when said motor-controlling member is moved a predetermined distance from its central position.

5. In a belt guide of the character described, the combination of a belt guide roll, a bearing in which an end of said roll is journaled, a slide on which said bearing member is pivoted, a rotatable screw, a nut on said screw connected to said slide, a reversing electric motor, a speed-reducing gear drive between said motor and screw, a motor-controlling member pivotally suspended from said nut, a feeler lever spring-urged against an edge of the belt, operating connections between said feeler lever and said motor controlling member, and switches carried by said motor-controlling member operative to close the respective motor circuits when said motor controlling member is swung a predetermined distance from its central position.

6. In a belt guide of the character described, the combination of a belt guide roll, a bearing in which an end of said roll is journaled, a slide on which said bearing member is pivoted, a rotatable screw, a nut on said screw connected to said slide, a reversing electric motor, a speed-reducing gear drive between said motor and screw, a motor-controlling member pivotally suspended from said nut, a feeler lever spring-urged against an edge of the belt, operating connections between said feeler lever and said motor controlling member, and a pair of mercury tube electric switches mounted on said motor-controlling member adapted to connect spaced contacts in

the motor circuits when said motor-controlling member is swung a predetermined distance to one side or the other of its central position.

7. A specific embodiment of claim 5 wherein the operating connections between the feeler lever and the motor-controlling member permit sufficient lost motion to prevent closing of a motor circuit under slight edgewise displacement of the belt.

8. A specific embodiment of claim 5 wherein the operating connections between the feeler lever and the motor-controlling member include a pair of opposed springs respectively acting to swing said motor-controlling member is opposite directions and permitting sufficient lost motion to prevent closing of a motor circuit under slight edgewise displacement of the belt.

9. A specific embodiment of claim 5 wherein the operating connections between the feeler lever and the motor-controlling member include a rod mounted to slide in the direction of swing of said motor-controlling member and extending past the latter, and a pair of light compression springs encircling said rod, said springs anchored at their outer ends to said rod and at their inner ends in thrust engagement with said motor-controlling member.

10. A specific embodiment of claim 6 wherein the mercury tube electric switches are mounted on the motor-controlling member with capacity of angular adjustment, whereby to vary the extent of swing of the motor-controlling member necessary to effect the closing of a motor circuit.

HARRY M. OSTERTAG.