July 24, 1951 I. L. FIFE 2,562,026

AUTOMATIC WEB GUIDING APPARATUS

Filed June 7, 1946 2 Sheets-Sheet 1

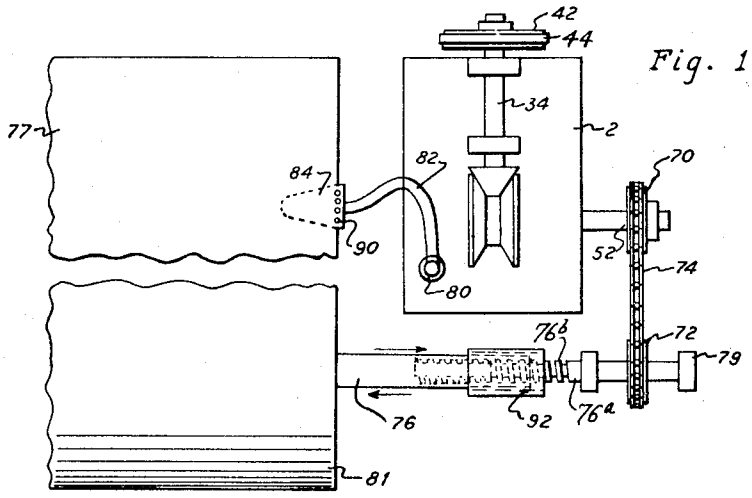

Fig. 1

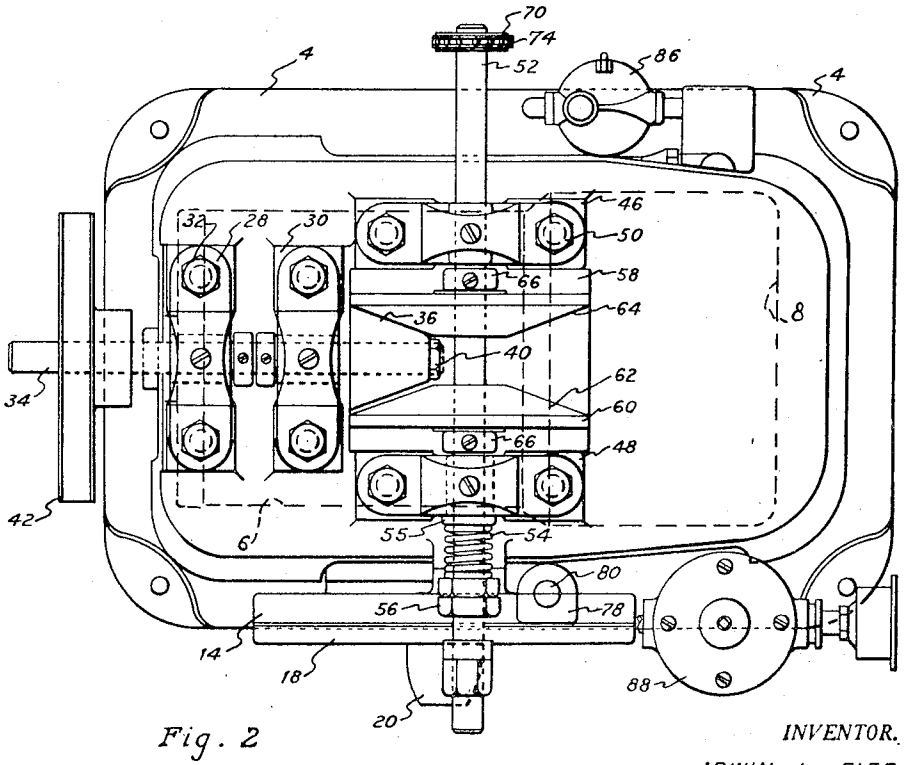

Fig. 2

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AUTOMATIC WEB GUIDING APPARATUS

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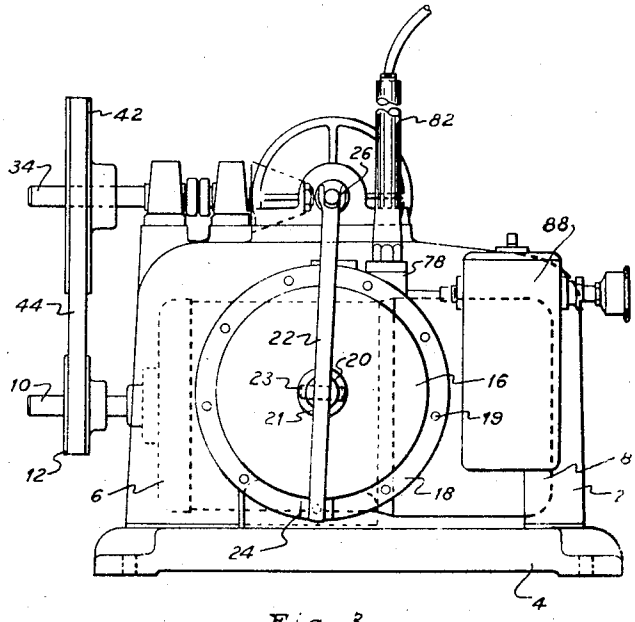

Fig. 3

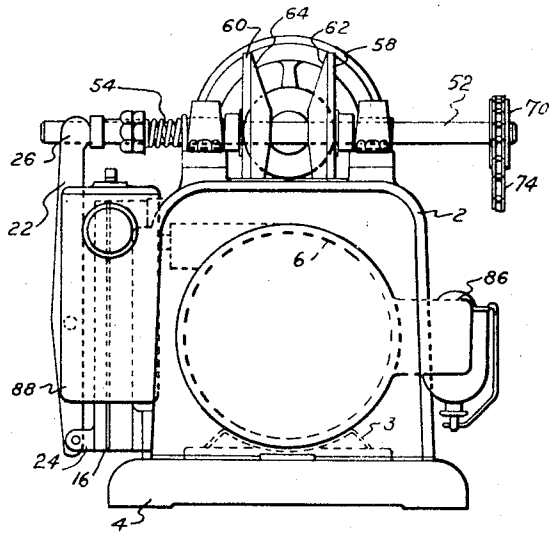

Fig. 4

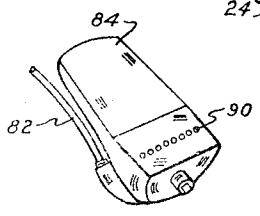

Fig. 5

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AUTOMATIC WEB GUIDING APPARATUS

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6 Claims. (Cl. 242—76)

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This invention relates to means for accurately controlling the unwinding and rewinding of a moving web of dense material, and more particularly, but not by way of limitation, to provide an accurate edge alignment of a moving web of paper, cellophane, cloth, tape, and the like from one roll to another.

Many previous web guiding devices for paper machinery or the like, such as the numerous patents to Dickout, the British patent to Moufang, No. 273,016, or Stanford, No. 2,239,472, disclose subatmospheric pneumatic control means adapted to regulate the moving web through cooperation with an orifice, feeler, or the like. However, these prior devices are all of a complex structure, utilizing intricate and costly mechanism in conjunction with the control unit.

The present invention contemplates the accurate edge alignment of a moving web of paper or the like which is efficient in its operation, simple in design, with a minimum of working parts.

It is an important object of this invention to control the side register of a moving web of material in either an unwinding or rewinding operation in order to accurately align the material with respect to a receiving roll.

A further object of this invention is to compensate for any lateral deviation during the travel of a moving web by controlling its path of travel by accurate alignment of the edges, which includes a shaft movable by a vacuum mechanism to be caused to rotate in either one of opposite directions in order to shift the moving web and bring about accurate travel thereof.

And still another object of this invention is to provide a web guiding mechanism adapted to compensate for any lateral deviation of a moving web through a series of aligned apertures in an orifice control unit cooperating with the web, wherein the apertures provide an efficient and positive actuation of the guiding mechanism, and allows maintenance of a neutral position when the web is traveling in a true path.

Other objects and advantages of the invention will be evident from the following detailed description, read in conjunction with the accompanying drawings, which illustrate my invention.

In the drawings,

Figure 1 is a schematic view in plan showing the control orifice adjacent the moving web.

Figure 2 is a plan view of the web guiding mechanism.

Figure 3 is a side elevational view of the mechanism.

Figure 4 is an end elevational view of the mechanism.

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Figure 5 is a detail of the orifice.

Referring to the drawings in detail, reference character 2 designates a housing having a unitary base 4. Disposed within the housing 2 is a constant speed electric motor 6 combined with a constant speed vacuum pump 8, both secured to a bracket support 3. A constantly rotating motor shaft 10 extends outwardly from the housing and is provided with a sheave or pulley 12 as will be hereinafter explained. One side wall of the housing 2 is provided with an apertured flange 14 adapted to receive a diaphragm 16 interposed between the flange 14 and a clamping ring 18 secured to the flange by bolts 19. The diaphragm 16 is provided with a projecting hub 20 having a groove 21 adapted to receive a rod 22 and held therein by a pin 23. The rod 22 is secured at one end to a yoke 24 provided on the lowermost portion of the clamping ring 18. The opposite end of the rod 22 is provided with a yoke 26 for receiving a reversing shaft as will be hereinafter set forth.

Referring to Figure 2, the top wall of the housing 2 is provided with a plurality of parallel aligned bearings 28 and 30 secured by bolts 32 to the housing 2. A freely rotatable shaft 34 is mounted in the bearings 28 and 30, and is provided at one end with a friction drive cone 36 secured thereto by the locking means 40. A sheave or pulley 42 is mounted on the opposite end of the shaft 34 and is directly connected with the motor sheave 12 by a belt 44 as clearly shown in Figure 3. A second pair of aligned bearings 46 and 48 are secured by bolts 50 to the housing 2. It will be apparent from Figure 2 that the bearings 46 and 48 are arranged perpendicularly to the alignment of bearings 28 and 30. A freely rotatable shaft 52 is mounted in the bearings 48 and 50. One end of the shaft is disposed in the yoke 26 of the lever 22. A helical compression spring 54 encircles the shaft 52 and is disposed between a washer 55 adjacent one face of bearing 48 and a plurality of adjustable spacer nuts 56 mounted on the shaft 52.

A pair of substantially cone shaped friction discs 58 and 60 are fixed to the shaft 52, and from Figures 2 and 4 it will be apparent that these discs are disposed with their tapered portions 62 and 64 facing each other. The discs are spaced from the bearings 46 and 48 by washers 66 secured to shaft 52. The end of the shaft 52 opposite the yoke 26 is provided with a fixed sprocket 70 adapted to be connected with a sprocket 72 through means of a chain 74. The sprocket 72 is mounted on a shaft 76 supported by bearings 78 carrying a supply roll of a web of paper 77,

plastic, cellophane, or the like, as is clearly shown in Figure 1. The shaft 76 is preferably provided with an extension shaft 76a having threads 76b cooperating with internal threads on the shaft 76 and maintained in the screw support 92 to cause the opposite rotation of the shaft 76 relative to the rotation of the sprocket 70.

From Figures 2 and 3, the housing 2 is provided with a flange 78 having an aperture 80 in communication with one side of the diaphragm 16 (not shown). The flange 78 is provided with a threaded connection (not shown) for receiving a conduit 82 providing communication with a body member 84 containing an orifice shown in detail in Figure 5.

Referring to Figure 1, the orifice is adapted to be rigidly positioned to the frame of a paper machine or the like (not shown) and disposed adjacent the edge of the moving web 77 as clearly shown in Figure 1. A lubricating device 86 is connected with the vacuum pump 8 and provides lubrication therefor. In similar manner, a liquid separator 88 is secured to the housing 2 for filtering the liquid utilized with the pump.

Referring to Figure 5, it will be apparent that the body member 84 containing an orifice is provided with a series of small, aligned apertures 90 in juxtaposition to each other. The circumference of the apertures are ground and buffed in order to provide a rounded portion along the circumference thereby preventing any shaving action on the surface of the moving web, especially in coated materials, such as waxed paper.

Referring to Figure 1, the orifice 84 extends from communication with aperture 80 into a position adjacent the edge of the moving web 77. It will be apparent that the orifice is adjustably secured to the paper machine or the like (not shown) and is preferably disposed so as to allow the paper web to be superimposed or pass over the orifice 84, particularly when the distance between the rolls of the web is sufficient whereby gravity will keep the web adjacent the orifice. However, it will be apparent that the orifice may be secured to the machine (not shown) so as to be disposed on top of the moving web. Furthermore, the orifice is arranged so that the edge of the web will either cover or uncover all of the series of apertures 90 simultaneously as shown in Figure 1.

The sprocket 72 is shown fixed to the shaft 76 of the supply roll 81 for the moving web. On the shaft 76 is mounted a screw support 92 which will cause movement of the shaft 76 in reverse directions as will be hereinafter set forth. It will be apparent that a modified worm (not shown) could be used in lieu of the screw support 92. Any variations in the transverse alignment of the moving web is compensated for by the control mechanism directly cooperating with the shaft 76.

Operation

With the moving web moving over the apertures 90 and thereby covering the orifice, the vacuum on the pump 8 communicating with one side of the diaphragm 16 builds up sufficiently to pull or move the diaphragm 16 inwardly in a direction toward the housing 2 with a simultaneous movement of the diaphragm lever 22, which in turn causes a movement of the shaft 52 to move cone disc 60 into contact with the friction drive cone 36. It will be apparent that the constantly rotating shaft 34 and friction cone 38 causes rotation of the disc 60 and consequently rotation of the shaft 52 to rotate the sprocket 70 in one direction. The rotation of the sprocket 70 similarly rotates sprocket 72 and worm 92 to cause movement of shaft 76 in one direction to adjust the web roll 81 and accurately align the moving web. If the transverse movement of the web completely uncovers the orifice apertures 90, vacuum is released on the diaphragm 16, thereby relaxing the diaphragm so that the compression spring 54 will move against the spacer nuts 56, thereby moving the shaft 52 in a direction toward the diaphragm and bringing the friction disc 58 into contact with the constantly rotating drive cone 36. In this manner the shaft 52 will be rotated in a reverse direction from that when the cone is in contact with the disc 60. Rotation of the shaft in this reverse direction similarly causes rotation of sprocket 70 and 72 to move the drive shaft 76 and web roll 81 in an opposite direction to accurately align the edge of the moving web accordingly. When the moving web is flowing normally, or in a true manner, from the supply roll, the edges of the web will flow slightly across the apertures 90 causing a slight amount of vacuum on the diaphragm in order to balance it with the compression spring 54. In this manner a neutral position is created wherein neither disc 58 or 60 on the reversing shaft 52 is in contact with the drive cone 36. Under practical tests it has been found that the position of the web over the apertures 90 is very slight, approximating about .0005 of an inch.

The particular construction of the orifice with its series of aligned apertures 90 has been found to be the most efficient means in which a fine neutral position can be obtained. A single elongated slot or one aperture orifice has been found unable to accomplish the neutral position obtained by the series of aligned and adjacent small apertures as provided in the orifice 84. It will be apparent that the total area of the apertures 90 must be sufficiently large so that when the orifice is uncovered by the moving web the supply of air to the diaphragm 16 is greater than the vacuum from the pump whereby a complete release of vacuum is prevalent on the diaphragm 16, allowing the spring 54 to function.

Due to the variations in the supply roll for various platens, the web normally reels off of the supply web constantly out of alignment. Consequently, the edge of the web is usually moving transversely over the apertures 90 and back to create a substantially constant actuation of the web aligning mechanism to provide an accurate edge alignment of the moving web.

In an application of the web guide mechanism where accurately rewound rolls are desired, for example on the rewind end of a press, the rewind shaft is moved or shifted in the direction which the moving web is weaving off. The orifice 84 is flexibly mounted relative to the web and cooperates with the worm through the web guiding mechanism so that the rewind roll will be moved in the same manner and in the same direction and at the same speed ratio. It will be apparent that the rewind edge control operation is accomplished in an opposite manner from an unwind control operation as shown in the present embodiment. The moving web is "chased" on a rewind operation in lieu of its direction being changed as is desired in an unwind operation.

The embodiment shown in Figure 1 has been described for an unwind operation from supply roll 87 with the screw support 92 moving the

shaft 76 in a direction opposite from the direction the web is weaving off to control the alignment thereof. However, it will be apparent that Figure 1 can be utilized to disclose a rewind operation by assuming that roll 81 is a rewind roll receiving the moving web from a source of supply (not shown). In this rewind operation the orifice 84 flexibly cooperates with the edge of the moving web 77 to cause the control mechanism to function, wherein the screw support 92 will move rewind shaft 76 in the direction that the web is weaving off to provide an accurate rewind of the web.

From the foregoing it will be apparent that the present invention provides an automatic web guiding apparatus which is simple in design, compact, and provides a precise and efficient operation with a minimum number of parts for accurately aligning the edges of a traveling web in either an unwind or rewind operation. Furthermore, the construction of the orifice and its series of aligned apertures, and particularly the area of each aperture with respect to the total area of all apertures provides a pilot device which on a slight covering by the traveling web will neutralize the action of the vacuum chamber relative to the action of the helical spring to provide a balanced operation as long as the web continues to travel in a substantially normal path. Furthermore, the twin friction disc arrangement cooperating with the drive cone causes efficient and instantaneous rotation of the drive shaft immediately upon any variation in the edge alignment of the web during its travel in order to move the drive shaft of the web roll and correct the side register of the web in either an unwinding or rewinding operation.

Changes may be made in the specifications and drawings without departing from the spirit of the invention within the scope of the following claims as set forth.

What I claim is:

1. In an apparatus for controlling the edge alignment of a traveling web associated with a roll of said web material, and comprising a housing enclosing a motor operated vacuum pump, a sealed diaphragm mounted on the housing and providing a vacuum chamber connected with the pump, a freely rotatable shaft mounted on the housing and associated with the diaphragm, an orifice disposed adjacent the edge of the moving web and in communication with the vacuum chamber, said orifice adapted to be covered and uncovered by the moving web to cause a variation in vacuum against the diaphragm, a pair of friction discs fixed on the shaft, a constantly rotating drive cone disposed between the disc and in spaced relation thereto, a helical spring mounted on the shaft, said diaphragm responsive to one position of the web relative the orifice to cause movement of one of the discs into contact with the drive cone to provide rotation of the shaft in one direction, said spring responsive to the other position of the web relative to the orifice to cause movement of the other of said discs into contact with the cone to cause rotation of the shaft in an opposite direction, and means between the web roll and the shaft responsive to the controlled rotation of the shaft to provide accurate alignment of the traveling web.

2. In an apparatus for controlling the edge alignment of a traveling web associated with a roll of said web material, and comprising a housing enclosing a motor operated vacuum pump, a sealed diaphragm mounted on the housing and providing a vacuum chamber connected with the pump, a freely rotatable shaft mounted on the housing and associated with the diaphragm, an orifice disposed adjacent the edge of the moving web and in communication with the vacuum chamber, said orifice adapted to be covered and uncovered by the moving web to cause a variation in vacuum against the diaphragm, a pair of friction discs fixed on the shaft, a constantly rotating drive cone disposed between the disc and in spaced relation thereto, a helical spring mounted on the shaft, said orifice responsive to a transverse movement of the web in one direction to cause the vacuum in the chamber to increase and move the shaft in one direction whereby a friction disc is brought into contact with the drive cone to rotate the shaft in one direction, and means operably connected with the shaft and web roll to move the roll for accurate alignment of the edge of the web.

3. In an apparatus for controlling the edge alignment of a traveling web associated with a roll of said web material and comprising a housing enclosing a motor operated vacuum pump, a sealed diaphragm mounted on the housing and providing a vacuum chamber connected with the pump, a freely rotatable shaft mounted on the housing and associated with the diaphragm, an orifice disposed adjacent the edge of the moving web and in communication with the vacuum chamber, said orifice adapted to be covered and uncovered by the moving web to cause a variation in vacuum against the diaphragm, a pair of friction discs fixed on the shaft, a constantly rotating drive cone disposed between the disc and in spaced relation thereto, a helical spring mounted on the shaft, said orifice responsive to a transverse movement of the web in one direction to cause the vacuum in the chamber to decrease and allow the spring to move the shaft in one direction to being a friction disc into contact with the drive cone and cause rotation of the shaft in one direction, and means operably connected with the shaft and web roll to move the roll for accurate alignment with the edge of the web.

4. In an apparatus for controlling the edge alignment of a traveling web associated with a roll of said web material, and comprising a housing enclosing a motor operated vacuum pump, a sealed diaphragm mounted on the housing and providing a vacuum chamber connected with the pump, a freely rotatable shaft mounted on the housing and associated with the diaphragm, an orifice disposed adjacent the edge of the moving web and in communication with the vacuum chamber, said orifice adapted to be covered and uncovered by the moving web to cause a variation in vacuum against the diaphragm, a pair of friction discs fixed on the shaft, a constantly rotating drive cone disposed between the disc and in spaced relation thereto, a helical spring mounted on the shaft, said shaft adapted to be movable in either of opposite directions by a variation in the vacuum to cause either the diaphragm or the spring to bring at least one of the discs into contact with the drive cone to cause rotation of the shaft, and means between the web roll and the shaft responsive to the rotation of the shaft to provide accurate alignment of the traveling web.

5. In an apparatus for controlling the edge alignment in both an unwinding and rewinding operation of a traveling web associated with a roll of said web material, and comprising a housing having a vacuum pump, a diaphragm

mounted on the housing and providing a vacuum chamber connected with the pump, a freely rotatable shaft mounted on the housing and associated with the diaphragm, an orifice disposed adjacent the edge of the moving web and in communication with the vacuum chamber, said orifice adapted to be covered and uncovered by the moving web to cause a variation in vacuum against the diaphragm, a plurality of friction discs fixed on the shaft, drive means disposed between the friction discs and in spaced relation thereto, helical means mounted on the shaft, said diaphragm responsive to one position of the web relative to the orifice to cause movement of at least one of the friction discs into contact with the drive means to provide rotation of the shaft in one direction, said helical means responsive to another position of the web relative to the orifice to cause movement of another of said friction discs into contact with the drive means to cause rotation of the shaft in an opposite direction from the first mentioned direction, and means between the web roll and the shaft responsive to the controlled rotation of the shaft to provide accurate alignment of the traveling web.

6. In an apparatus for controlling the edge alignment of a traveling web associated with a roll of said web material and comprising a housing having a vacuum pump, a diaphragm mounted on the housing, and providing a vacuum chamber connected with the pump, a rotatable shaft mounted on the housing and associated

with the diaphragm, an orifice comprising a plurality of aligned apertures disposed adjacent the edge of the moving web and in communication with the vacuum chamber, said orifice adapted to be covered and uncovered by the moving web to cause a variation in vacuum against the diaphragm, a helical spring mounted on the shaft, and means responsive to a variation of the vacuum to be moved by the diaphragm in one direction and by the helical spring in an opposite direction to cause rotation of the shaft in either one of opposite directions to provide an accurate alignment of the web, said apertures so constructed and arranged whereby a slight covering thereof by the web will provide a neutral balancing of the vacuum as long as the web is traveling in a substantially accurate path, and means between the web roll and the shaft to move the roll for accurate alignment of the edge of the web.

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