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[54] **WEB ALIGNMENT DEVICE**

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[52] **U.S. Cl.**.....**226/17,** 226/22

[51] **Int. Cl.**.....**B65h 25/26**

[58] **Field of Search**.....226/17, 22

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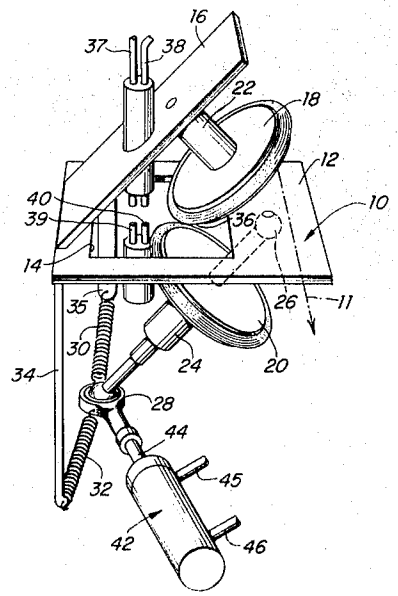
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[57] **ABSTRACT**

A device for maintaining alignment of an edge of a web in substantially parallelism with a predetermined path along which the web is moved. The device includes a pair of guide wheels which are positioned and biased so as to engage the web in a nip between the peripheries of the wheels. A fluid stream is provided adjacent the nip, and means are provided for generating a signal accordingly as the stream is obstructed or not by stream. A motor is provided, responsive to the signal for effecting pivotal movement of the axle of one of the wheels relative to the other of the wheels, so as to tend to maintain the desired parallelism.

10 Claims, 2 Drawing Figures



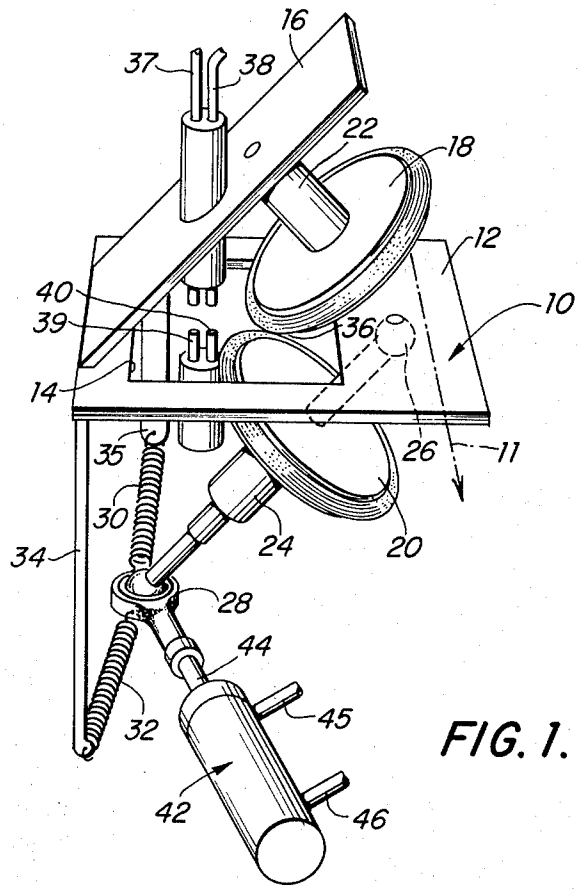


FIG. 1.

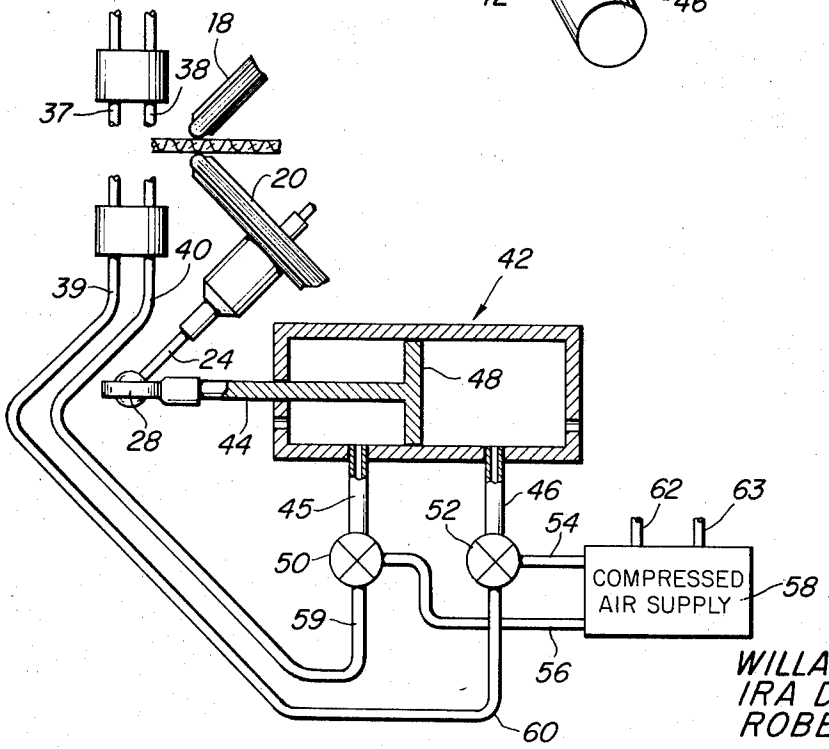


FIG. 2.

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WEB ALIGNMENT DEVICE

This invention relates to the handling of web materials and more specifically to a system in which a piece of such material is moved along a predetermined path by a device which maintains a selected edge of the material in substantially parallelism to the path.

Although automation has brought considerable economies to certain areas of the textile industry, there has been a long standing problem of guiding one or more pieces or plies of a woven or nonwoven fabric material to a work point so that a continuous seam can be effected. For example, in forming and stitching the inseam of trousers or work pants, it is necessary to maintain proper alignment between the opposing inseam edges of the pants legs as they are presented to a sewing head. One device proposed to solve the problem is the mechanical device described in our copending application Ser. No. 847,377, entitled "Web Aligning System," filed Aug. 4, 1969 now abandoned. The guide assembly for maintaining proper alignment of the edge of the material in parallelism with a fixed path described in that application is a solely position sensitive system in which a pair of coplanar guide wheels are mounted so that their axles are pivotable about a common pivotal axis perpendicular to the axle axes and thereby can restore the parallelism between the edge and the desired path.

An object of the present invention is to provide in a system for moving a web along a predetermined path, a new and improved device for maintaining alignment of an edge of the web in substantially parallelism to the path.

Another object of the present invention is to provide in a system for moving a web along a predetermined path, a guide assembly which has a feedback system which senses small displacements of the web and is operative to maintain alignment of the edge of the web in substantial parallelism to the path.

Still another object of the present invention is to provide such a guide assembly which is easy to manufacture, economical, and extremely efficient in operation.

The above and other objects are achieved in a practical embodiment in a system for moving a web along a predetermined path, by providing an alignment device which comprises a pair of rotatable guide wheels and axle means for rotatably mounting the guide wheels. The wheels are positioned at an angle to one another so as to engage the web in a nip formed by the peripheries of the wheels. Means are provided for sensing the position of the edge with respect to the nip and for providing a signal corresponding to the sensed position of the edge. Lastly, there is provided means responsive to the signal for effecting pivotal movement of one of the wheels about an axis normal to its axle axis, relative to the other of the wheels so as to alter the direction of a line tangent to the wheel ring at the nip. This alteration of direction serves to turn the web so as to tend to substantially restore the parallelism of the edge and the desired path.

Other objects of the present invention will, in part, be obvious and will, in part, appear hereinafter. The invention accordingly comprises the apparatus possessing the construction, combination of elements, and arrangement of parts which are exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the claims, for a fuller understanding of the nature and objects of the present invention, reference should be had to the following detailed description taken in connection with the accompanying drawings wherein:

FIG. 1 is a perspective view of the mechanical elements preferred embodiment of the present invention; and

FIG. 2 is a schematic view partly in fragment and partly in cross-section of the control elements of the present invention.

Referring now to FIG. 1, there is shown a guide assembly which comprises means, such as plate **10**, having a substantially flat upper surface **12**, which defines a substantially plane path along which a web or fabric is intended to be moved in a direction indicated by the broken line forming an arrow. In an intermediate portion of plate **10**, there is provided an opening **14** through the plate. Attached to plate **10** and extending at an angle to the plane of the latter so as to be suspended above opening **14**, is support beam **16**.

The guide assembly comprises a pair of guide wheels **18** and **20**. Wheel **18** is mounted adjacent to one end of axle **22** for free rotation with respect to the latter, the other end of axle **22** being substantially fixedly mounted on beam **16** such that the rim of wheel **18** extends approximately into opening **14** approximately tangent to the plane of surface **12**. Wheel **20** is mounted for rotation at an intermediate position on axle **24**. One end of axle **24** is pivotally supported on a lower surface of plate **10** adjacent to opening **14** by a ball-and-socket joint shown in phantom at **26** mounted on plate **10**. The other end of axle **24** is similarly mounted in ball-and-socket joint **28**. The latter, however, is resiliently suspended by a pair of coil springs **30** and **32** respectively having one end of each connected to joint **28**. The other ends of springs **32** and **30** are respectively connected to support members such as **34** and **35** respectively fixed to plate **10**.

The two guide wheels are positioned such that their axles lie in a common plane, but at an angle of more than 0° and less than 100° (typically 90°) to one another. The wheels are dimensioned and positioned on their respective axles such that the suspension provided by springs **30** and **32** biases wheel **20** into a position where the rim of the latter tends toward contact with the rim of wheel **20** thereby forming nip **36**. The rims of the wheels can be formed of some resilient material such as rubber, for promoting frictional contact between the wheels and a web engaged in the nip.

Means are provided for sensing the position of the edge of a web engaged in nip **36** and extending therethrough across opening **14**, it being assumed that the web is intended to move across plate **10** with the edge of the web substantially parallel to the path indicated by the arrow. In the preferred embodiment of the invention, this sensing system is in the form of a pneumatic device comprising a first pair of openings or tubes **37** and **38** supported by beam **16** and extending therefrom toward opening **14** substantially perpendicularly to the plane of surface **12**. Tubes **37** and **38** terminate short of opening **14** and are arranged so that a line drawn between the ends of tubes **38** and **37** is substantially perpendicular to the proposed proper path of the web indicated by the broken arrow. In a similar

manner, another pair of openings or tubes 39 and 40 are supported by means (not shown) typically coupled to plate 10 and supporting tubes 39 and 40 at opening 14 below plate 10. Tubes 39 and 40 are respectively coaxial with tubes 37 and 38 and terminate just below opening 14. It will, therefore, be apparent that a web extending through nip 36 can be positioned in the interspace between tubes 37 and 38 on the one hand and tubes 39 and 40 on the other.

In order to steer a web moving through nip 36, the invention includes motor means typically in the form of cylinder 42 and piston 44. Piston 44 has one end thereof attached to the socket of joint 28 and it is positioned so that movement of the piston substantially along a line parallel to arrow 11 will pivot axle 24 about an axis normal to the axle axis. It will be appreciated that, within limits, regardless of where axle 24 is pivoted by piston 44, the suspension provided by springs 30 and 32 will continue to urge wheel 20 toward contact with wheel 18. Thus, the motion of the socket of joint 28 responsive to movement of piston 44 serves to alter the direction of a line tangent to the peripheries of the guide wheels at the nip. Cylinder 42 includes a pair of gas inlet ports 45 and 46 so that a differential pressure can be set up on either side of the piston which is connected to piston rod 44.

The control system responsive to the sensory device provided by tubes 37, 38, 39 and 40 for moving axle 24 pivotally, is shown most advantageously in FIG. 2 wherein cylinder 42 has disposed for movement therein piston 48 connected to piston rod 44. Inlet ports 45 and 46 are respectively connected to piloted air valves 50 and 52. These latter may be of any well known design such as, for example, valve Model 4100 made by the Howie Corporation, Morristown, Pennsylvania. Valves 50 and 52 are connected by air tubes 54 and 56 to a source 58 of compressed air. Also, connected to valves 50 and 52 respectively are input control lines 59 and 60. Line 59 is connected to tube 40 and line 60 is connected to tube 39. Similarly, the compressed air source 58 is also coupled by tubes 62 and 63 to supply compressed air respectively to tubes 37 and 38. This latter coupling is not shown for the sake of convenience.

Operation of the above-described guide assembly using continuous fluid streams from air source 58 is as follows. Obviously, there are three positions which an edge of a moving web may assume with respect to the sensing system. The web may, as shown in FIG. 2, be positioned between the opposed ends of tubes 38 and 40, but not between tubes 37 and 39. In such condition, only the fluid stream from tube 37 is sensed by tube 39 and the web cuts of the stream from tube 38. In response, valve 50 which is normally open, closes. No air being introduced into cylinder 42, the latter will leak through ports which can be provided, and thus biased into its equilibrium or neutral position by springs 30 and 32. A second position for the web is where the web is positioned between both opposing tubes 37 and 39 as well as tubes 38 and 40. The third position is where the web is not positioned between either pair of opposing tubes. In the second position, the web cuts off the fluid stream from both tubes 39 and 40. This serves to open normally closed valve 52; permitting air to enter cylinder 42 so as to force piston 48 to move axle 24 in one direction. Of course, when the web is in its third positioned place, both tubes 39 and 40 sense the respective fluid streams from tubes 37 and 38. This serves to close valve 52 but open valve 50. Hence, air from supply 58 moves piston 48 in an opposite direction.

Cylinder 42 is preferably pivotally mounted so that movement of axle 24 by the piston displaces the spatial position of nip 36 without changing the mutually orthogonal relationship between the planes of wheels 28 and 20 or the spacing between the peripheries of the wheels. This repositioning of nip 36 serves to steer the web between the wheels in a direction which tends to restore the desired parallelism between web edge and path 11. The edge of the web is thus returned to its position between tubes 38 and 40, but not between tubes 37 and 39.

Although in the embodiment shown, wheels 30 and 32 lie in planes which are mutually orthogonal to one another, this relationship is not critical. The only requirement regarding the angular relationship between the planes of the two wheels is that the wheels not lie in the same plane or in other words be noncoplanar. The advantages of providing the wheels in mutually orthogonal planes is that the guide assembly can be made extremely compact, the sensing tubes can be located extremely close to the nip and the linear motion of the piston can be used to shift the spatial position of the nip without substantially altering the nip spacing or the angle between the planes of the wheels.

In the embodiment of the sensing system described, the fluid streams provided by supply 58 was a continuous stream. However, the assembly could be modified so that noncontinuous fluid streams in the form of bursts of air could be provided. Supply 58 could be modified so as to provide incremental bursts of air so that the piston would be moved in fixed increments rather than continuously. Thus, rather than an analog type system as described, the system could very easily be adapted to operate as a digital type system. Also, although the preferred embodiment has been described as providing a pair of fluid streams, the sensing system may be modified to employ a single fluid stream or more than two streams.

Although the described embodiment of the invention employs a pneumatic sensing system for determining the position of the edge of the web, other types of sensing systems could be employed. For example, optical, electrical, electro-optical, electromechanical, or electromagnetic sensing systems could be employed in the present invention to determine the position of the edge of the web. Use of such other sensing systems may make employment of other means (such as stepping motors or relays) for effecting pivotal movement of the axle of the pivotally movable wheel. However, such minor modifications would be obvious to one of ordinary skill in the art.

With respect to the preferred embodiment, various alternatives could be provided for the means for effecting pivotal movement of wheel 20 with respect to wheel 18. For example, instead of employing a pair of piloted air valves 50 and 52, a single air valve of any one of a number of well known designs could be employed to perform the same function. Instead of employing air valves, fluid logic comprising fluid flip-flops and fluid amplifiers could be used to initiate movement of piston

48. Small leaks may be provided for in pneumatic cylinder 42 by leak ports if desired. Alternatively, a single leak between opposing sides of piston 48 could be provided by a small hole passing through the piston.

Since certain changes may be made in the above apparatus without departing from the scope and spirit of the invention herein involved, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted in an illustrative and not in a limiting sense.

What is claimed is:

1. In a system for moving a web along a predetermined path, a device for maintaining alignment of an edge of said web in substantially parallelism to said path and comprising in combination:

a pair of rotatable guide wheels lying in respective intersecting, non-coplanar planes;

axle means for rotatably mounting said guide wheels;

said wheels being positioned so as to engage said web between a nip formed by the peripheries of said wheels;

means for sensing the position of said edge with respect to said nip and for providing a signal corresponding to the sensed position of said edge; and

means responsive to said signal for effecting pivotal movement of only one of said wheels about an axis normal to the axis of its axle means, so as to alter the direction with respect to said planes of a line commonly tangent to both the wheel peripheries at said nip, to a direction tending to restore the parallelism of said edge and said path.

2. In a system as set forth in claim 1 wherein said guide wheels lie in planes mutually orthogonal to one another.

3. In a system as set forth in claim 1 further including means for resiliently biasing the periphery of one of said wheels toward contact with the periphery of said other wheel.

4. In a system as set forth in claim 1 wherein said sensing means includes means for providing at least one continuous fluid stream and means for sensing interruptions in said fluid stream by said web.

5. In a system as set forth in claim 1 wherein said means for effecting pivotal movement includes a fluid-operated cylinder having a piston which is coupled to the axle means mounting said one of said wheels, and also includes means responsive to said sensing means for effecting movement of said piston.

6. In a system as set forth in claim 4 wherein said signal providing means includes means for providing a pair of continuous fluid flow streams each located a different distance from said nip; and said sensing means includes means for sensing interruptions by said web of said fluid streams.

7. In a system as set forth in claim 6 wherein said means for effecting pivotal movement includes a fluid-operated cylinder having a piston which is coupled to the axle means mounting said one of said wheels, and valve means responsive to said fluid streams for permitting fluid to be introduced selectively to either side of said piston to effect movement of the latter.

8. In a system as set forth in claim 1 wherein said guide wheels lie in intersecting planes.

9. In a system as set forth in claim 8 wherein one of said wheels is so mounted that said pivotal movement changes the spatial position of said nip without changing the angular relationship between the planes or the spacing of said nip.

10. In a system as set forth in claim 1 wherein said guide wheels lie in planes mutually orthogonal to one another.

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