May 18, 1965 J. H. PEARSON 3,184,374

APPARATUS FOR OSCILLATING A TRAVELING WEB IN PAPER MACHINERY

Filed Sept. 24, 1962 2 Sheets-Sheet 1

FIG-1

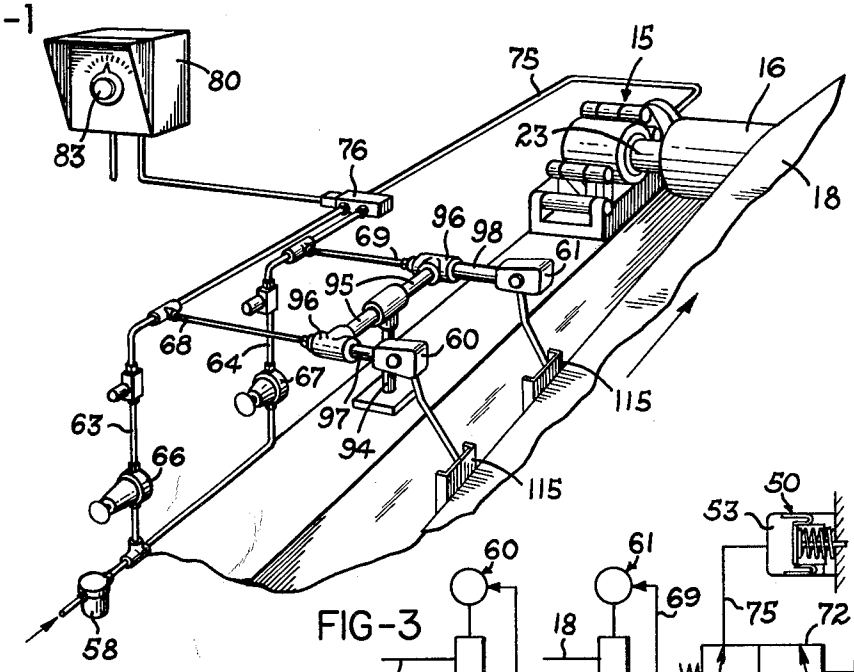


FIG-3

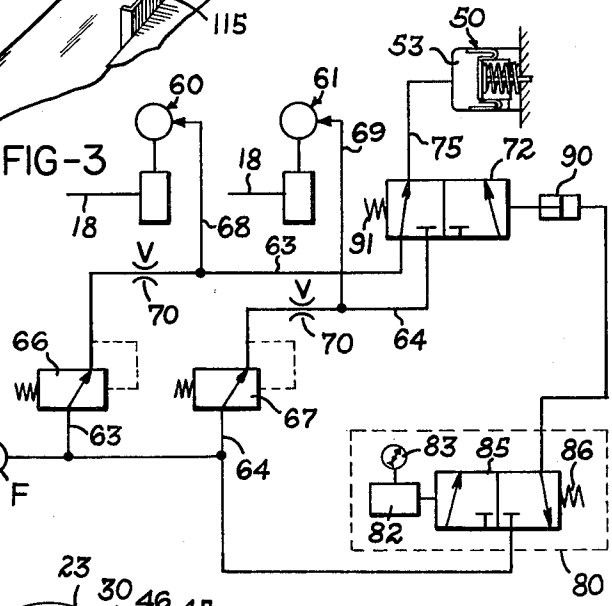
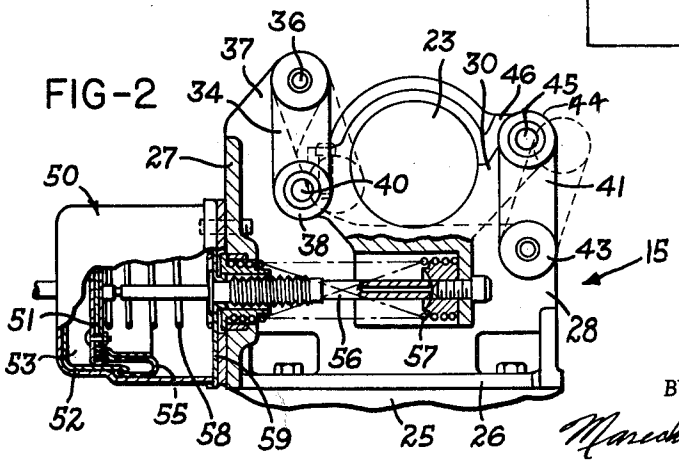


FIG-2



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FIG-4

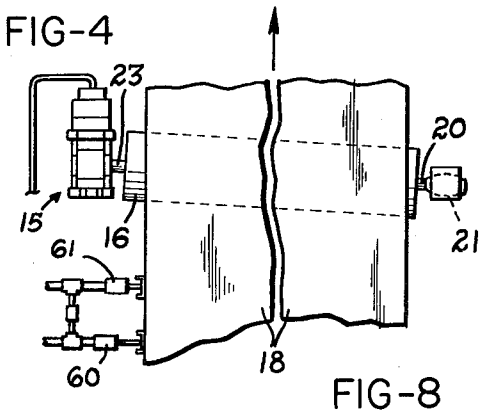


FIG-5

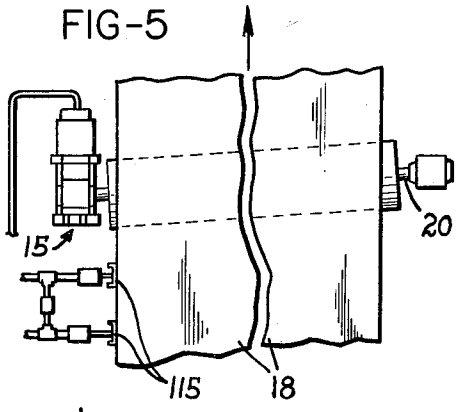


FIG-8

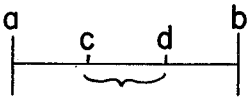


FIG-6

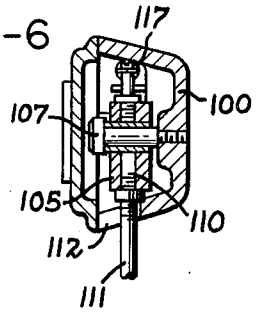


FIG-9

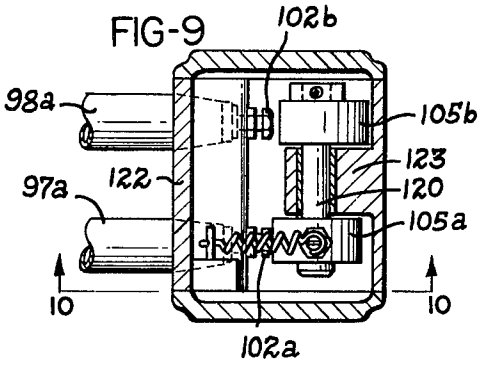


FIG-7

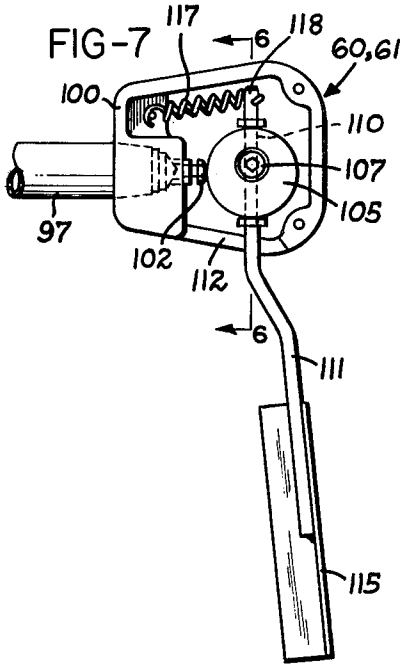
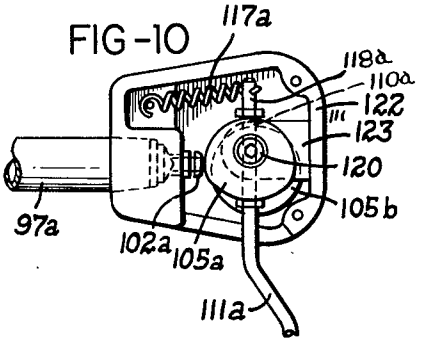


FIG-10



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United States Patent Office 3,184,374 Patented May 18, 1965

3,184,374

APPARATUS FOR OSCILLATING A TRAVELING WEB IN PAPER MACHINERY

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Filed Sept. 24, 1962, Ser. No. 225,530
8 Claims. (Cl. 162—257)

This invention relates to web guides and particularly to a control system for use with a web guide for laterally oscillating a felt or wire web on a paper making machine.

When a belt or web moves continuously over a surface for a protracted period of time, wearing of this web and its supporting surface often occurs, thus adding unanticipated variables to the operation of the associated machinery. This problem is especially acute when the web is delicate, such as the wire used in a Fourdrinier paper machine, and elimination of such wearing will minimize the formation of ridges in the web or the suction box covers over which the wire passes with consequent improvement in the uniformity and quality of the paper. These difficulties can be substantially eliminated by laterally oscillating the wire with respect to its path of travel so that this wearing is evenly distributed over larger areas, greatly reducing the amount of wear that can occur at any one location.

Accordingly, one of the principal objects of the present invention is to provide web guide apparatus of simple construction which will oscillate a web, such as a Fourdrinier wire, in a lateral direction for preventing the wearing of grooves or ridges in certain parts of the web and associated equipment.

Another object of the invention is to provide a control system for a web guide which can be adapted to effect oscillatory operation of most web guides regardless of whether they control a web which is moving horizontally or vertically, or a combination of these directions.

Another object of the invention is to provide a wire or web guide with a simple compact automatic control system capable of actuating the web guide for effecting lateral oscillatory movement of the web regardless of the path of movement of the web wherein the entire system comprises only a few moving parts and which is entirely mounted on one side of the web.

A further object of this invention is to provide a novel web guide system for laterally oscillating a web which will revert to the non-oscillatory type of web guide if a portion of the system becomes inoperative for one reason or another thereby insuring that the web will remain within the permissible range of lateral movement.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

In the drawings—

FIG. 1 is a perspective view of a web guide and associated control mechanism constructed in accordance with the invention;

FIG. 2 is a view in side elevation, partly broken away, of the web guide of FIG. 1;

FIG. 3 is a schematic illustration of the control system for the web guide;

FIG. 4 is a somewhat schematic plan view illustrating the operation of the web guide of FIG. 1 and showing the guide roll in one limit position of its guiding movement;

FIG. 5 is a view similar to FIG. 2 showing the guide roll in its other limit position;

FIG. 6 is a section view taken essentially along the line 6—6 of FIG. 7;

FIG. 7 is a side elevation view of one of the palms and valve assemblies for controlling the operation of the web guide, looking from left to right in FIG. 6 with one side removed;

FIG. 8 is a graphic illustration of the operation of the palm assemblies;

FIG. 9 is a view similar to FIG. 7 but illustrating another embodiment of the palm assembly; and

FIG. 10 is a sectional view essentially along the line 10—10 of FIG. 9.

Referring to the drawings, which illustrate preferred embodiments of the invention, FIG. 1 shows a guide 15 mounted in conjunction with a guide roll 16 for a web 18, which may be, for example, the forming wire of a Fourdrinier paper machine. As illustrated diagrammatically in FIGS. 4 and 5, one journal 20 of the roll 16 is supported for swinging movement by a suitable bearing, such as a spherical bearing 21, while the guide 15 supports the other journal 23 for movement back and forth in response to operation of the hereinafter described control system for effecting lateral oscillatory movement of the web 18 with respect to its path of travel.

The web guide 15 is one of many types which can be utilized with this invention and the embodiment shown is substantially identical to the construction described and claimed in the copending application of Walter E. Rojecki, Serial No. 69,582, filed November 16, 1960, now Patent No. 3,079,805, issued March 5, 1963, and assigned to the assignee as this application. The guide 15 includes a supporting frame 25 comprising a base 26, end wall 27, and opposed side walls 28 (only one of which is shown) which extend substantially higher at one end than the other.

A carriage 30 is supported on the frame 25 for swinging movement in a controlled path wherein the axis of the journal 23 moves in a substantially straight line parallel to the base 26. One end of the carriage 30 is supported by a first linkage 34 pivoted by a shaft 36 on the raised portions 37 of the walls 28, and the depending end 38 of the linkage 34 is pivoted by a shaft 40 to the adjacent end of the carriage 30. A second linkage 41 similar to linkage 34 is pivoted on the other end of side walls 28 by a shaft 43, and its opposite end 44 is pivoted by a shaft 45 to ear portion 46 on the carriage 30.

Mounted on the end wall 27 is a fluid motor 50 which is utilized to shift the position of the carriage 30 laterally as viewed in FIG. 2. The motor 50 includes a piston 51 reciprocally mounted in the housing 52 and defining a chamber 53 in conjunction with the housing 52, and the rolling diaphragm 55 provides a seal between the housing 52 and the piston 51. The piston rod 56 which interconnects the piston 51 and the carriage 30 has a tension spring 57 disposed therearound between the connections with the wall 27 and the carriage 30 for urging the piston 15 and the carriage 30 to the left, as viewed in FIG. 2. A compression spring 58 positioned between the piston 51 and end wall 59 of the housing 52 also aids in urging the carriage 30 and piston 51 to the left. Movement of piston 51 is controlled by the pressure in the chamber 53, and when such pressure is equal to the biasing effect of the springs 57 and 58, the piston 51 and the carriage 30 are held in a central or neutral position wherein the axis of roll 16 is perpendicular to the path of travel of the web 18 and consequently does not impart lateral force to the web 18.

When the pressure in the chamber 53 increases above the biasing effect of the springs 57 and 58, the journal 23 will be moved toward the right to the position indicated in broken lines in FIG. 2, wherein the roll 16 is positioned as shown in FIG. 5 for effecting lateral movement of the web to the left. Similarly if the pressure in the chamber 53 falls below the biasing effect of the springs 57 and 58, the journal 23 of the roll 16 will be moved to the left, as viewed in FIG. 2, to the position shown in

FIG. 4 wherein the roll effects lateral movement of the web **18** to the right. Thus the position of the lateral movement of roll **16**, and consequently the lateral position of the web, are controlled by the pressure in the chamber **53**.

The control system for effecting oscillating movement of the web guide and web is shown schematically in FIG. 3 and includes a source P of pressurized fluid which is connected through a filter F to each of the palm-actuated valve assemblies **60** and **61** by the lines **63** and **64** having the pressure regulating valves **66** and **67** therein, and the lines **68** and **69**, respectively. Variable restrictions **70** may be located in each of the lines **63** and **64** for further regulation of the flow of pressurized fluid. Lines **63** and **64**, and consequently the valve assemblies **60** and **61**, are also connected to the three-way valve **72** which at all times connects one or the other of the lines **63** or **64** to the line **75** and the fluid motor **50**. It is also within the scope of the invention to insert an air volume boosting device in line **75** to increase the response of the apparatus. For example, the valve assemblies could be utilized to operate a valve which in turn controls the flow of high pressure air to the chamber **53**.

The timing mechanism **80** is operable to shift valve **72** continuously and alternately and includes a solenoid **82** which is energized and deenergized at preset intervals by a timer **83**. When the solenoid **82** is energized it shifts the valve **85** against the bias of spring **86** to connect the source P to the pneumatic actuator **90** which is connected to and positions the valve **72**. When solenoid **82** is deenergized, the spring **86** returns the valve **85** to the position shown in FIG. 3 wherein the source of pressure is no longer connected to the actuator **90**, and spring **91** shifts the valve **72** to the right to the position shown in FIG. 3. Thus the timing mechanism **80** supplies fluid pressure periodically to the actuator **90** to shift the valve **72** between its alternate positions and thereby to connect the lines **63** and **64** alternately to the line **75**.

Referring to FIG. 1, the palm-actuated valve assemblies **60** and **61** are mounted in offset relation on the floor or frame of the machine by a post **94** having a pair of arms **95** projecting from the upper end thereof. On the outer end of each arm **95** is a T-connection **96**, and short pipe sections **97** and **98** project from the connections **96** and carry the valve assemblies **60** and **61**, respectively. The section **97** is shorter than the section **98** so that the assembly **61** is positioned closer to the edge of the web **18** for purposes to be described in detail hereinafter. Otherwise the valve assemblies **60** and **61** are identical, and only one is described in detail.

Referring to FIGS. 6 and 7, the assembly **60** includes a housing **100** mounted on the end of the pipe section **97** which terminates in a hollow screw **102**. This screw **102** forms a leak port in combination with a valve element formed by an eccentric cam **105** which is mounted for rocking movement on the pivot pin **107** set in the housing **100** so that the amount of fluid escaping through the hollow screw is dependent upon the position of the cam **105**.

A bore **110** is formed in the cam **105** for threadedly receiving a rod **111** which depends therefrom through a slot **112** in the under side of the housing **100** and carries the palm **115** which engages the edge of the web **18**. A spring **117** is connected to pin **118** also threaded into bore **110** on the top side of the valve element **105** and extends to a connection with the housing **100** for urging the palm **115** in a counterclockwise direction, and as viewed in FIG. 7, to hold it against the edge of the web **18** for sensing the lateral position thereof.

The operation of the control system shown in FIGS. 1 and 3 is best described by reference to the diagrammatic showing of FIG. 8 wherein the lateral movement of the left edge of the web **18** is indicated by the horizontal line. The assemblies **60** and **61** are substantially identical so that without their relatively offset mountings, they would effect movement of the web **18** to the same lateral position. When the assembly **60** is offset with respect to assembly **61** an amount equal to the distance between the points *c* and *d*, assembly **60** will effect lateral movement of the web edge to a position corresponding to the point *c* whereas the cam of assembly **61** will effect movement of the web edge to a position corresponding to the point *d*. Thus by alternately connecting these palm assemblies **60** and **61** to the web guide **15** the web **18** can be laterally shifted betwen points *c* and *d*.

Specifically, when the valve **72** is in the position shown in FIG. 3, the valve assembly **60** is connected to and controlling the operation of the web guide **15**, and if the web **18** is positioned between the points *a* and *c*, the cam **105** of assembly **60** is positioned to increase the amount of air being bled from the lines **63** and **68** to cause the web guide **15** to shift the journal **23** to the left, as viewed in FIG. 2 ,thereby effecting movement of the web **18** to the right, as viewed in FIG. 4. As the web moves toward a position corresponding to point *c*, the palm **115** follows and proportionally moves the cam of assembly **60** to decrease the air being bled from the line **63**, so that when the web reaches the position corresponding to point *c*, the journal **23** is in its central or neutral position wherein it no longer exerts lateral forces on the web **18**.

Similarly, when the web edge is between the positions *b* and *c*, the cam **105** of the assembly **60** decreases the amount of air escaping from the line **64** to cause the web guide **15** to move the journal **23** to the right, as viewed in FIG. 2, with consequent movement of the web to the left, as viewed in FIG. 5. When the web reaches the point *c*, the element **105** of assembly **60** is once again in the neutral position, and the web guide **15** no longer effects the lateral position of the web **18**.

When the timing mechanism shifts the valve **72** to the left from the position shown in FIG. 3, the valve assembly **61** is connected to and controlling the operation of motor **50** which urges web **18** toward a position corresponding to a point *d*, in the same manner that the assembly **60** moves the web to a position corresponding to point *c*. As indicated, the only difference between the assemblies **60** and **61** is the offset mounting thereof and, in all other respects, the operation of the valve assembly **61** is substantially identical with that of the valve assembly **60**.

The interval set on the timer **83** is preferably such that as soon as the web **18** reaches the position corresponding to the point *c* the solenoid **82** is energized to shift valve **85** and communicates pressure to the actuator **90** and thus shift the valve **72** to the left, as viewed in FIG. 3. In this position, the palm assembly **61** is now in control and immediately makes appropriate adjustments to move the web **18** to a position corresponding to the point *d*. When the point *d* is reached the valve **72** is shifted to the right, as shown in FIG. 3, and the palm assembly **60** moves the web **18** back to the position corresponding to the point *c*. This cycling continues indefinitely. The range of lateral movement of the web **18** is governed by the offset between the assemblies **60** and **61** and by the time interval set on the timer **83**, and the range of lateral movement can be shortened by decreasing the time interval set on the timer **83** so that the valve **72** is shifted before the web **18** has reached the position corresponding to the valve assembly then in control.

If for any reason the timer mechanism **80** should become inoperative, the valve assembly **60** or **61** which is then connected to the web guide **15** will remain in this position and move the web to and maintain it in the position corresponding to valve assembly then in control. If either of the valve assemblies **60** or **61** should become inoperative for any reason, the other assembly will continue to operate as a web guide to maintain the web **18** in a predetermined path of travel. For example, assume a

fluid leak occurs in line 63 so that when valve assembly 60 is connected to the motor 50, the pressure in chamber 53 is decreased and the journal 23 is shifted to the left, as shown in FIG. 2 with consequent movement of the web to the right, as viewed in FIG. 1. However, when the valve assembly 61 is shifted into control, the web 18 is returned to the left to the position corresponding to point *d* thus continuing the oscillatory movement of the web 18.

FIGS. 9 and 10 illustrate another embodiment of the valve assemblies which are actuated by a single palm and wherein the eccentric cams 105*a* and 105*b* are rigidly mounted in angularly offset relation on the same shaft 120 is supported for rotation in the housing 122 by the boss 123. Thus the cams, 105*a* and 105*b* rotate together about the same axis and, as will be seen, effect operation of the web guide 15 in the same manner as the offset mounted valve assemblies 60 and 61. As shown in FIG. 10, cam 105*a* is contoured on its lower portion to permit clockwise movement thereof after it has substantially closed the associated leak port in screw 102*a* while allowing the cam 105*b* to rotate additionally in a clockwise direction before it can close its associated leak port in screw 102*b*.

The pipe sections 97*a* and 98*a* communicate with the housing 122 and are aligned with the cams 105*a* and 105*b*, respectively, for cooperation therewith to regulate the amount of fluid escape from the leak ports in the screws 102*a* and 102*b*. The cam 105*a* has a rod 111*a* secured thereto with a palm (not shown) on its lower end, and a spring 117*a* positioned between the housing 122 and the pin 118*a* secured in the bore 110*a* urges the cams 105*a* and 105*b* in a counterclockwise direction, as viewed in FIG. 10, to position the palm against the adjacent edge of the web 18.

The rod 109*a* and its associated palm could be secured to the other valve element 105*b* or the shaft 120 since rotation of one effects corresponding rotation of the other two components. Similarly, the spring 117*a* could be eliminated and other biasing means used so long as the cams 105*a* and 105*b* and rod 111*a* are urged in a counterclockwise direction.

Operation of the valve assembly shown in FIGS. 9–10 differs slightly from that of the FIGS. 1, 6 and 7 embodiment as the eccentric cams 105*a* and 105*b* are mounted on the same axis in angular offset relation for actuation by a single palm, rather than being mounted in offset relationship with respect to the edge of the web 18 and actuated by separate palms as are the assemblies 60 and 61. That is, the angular position of cam 105*a* on shaft 120 is such that it effects movement of the web 18 to a position corresponding to point *c* whereas the angular positioning of cam 105*b* on shaft 120 effects movement of the web 18 to a position corresponding to the point *d*. In all other respects the operation of this embodiment is substantially identical to that of the FIGS. 1, 6 and 7 embodiment.

The present invention has provided a web guide system which is capable of laterally oscillating a web thereby preventing excessive wear of the web, guide rolls, suction boxes in the case of a Fourdrinier paper machine, and other associated apparatus. When one of the valve elements or its associated circuitry is damaged and fails to operate in the designed manner the opposite elements will insure that the web remains within a permissible range of lateral movement.

While the forms of apparatus herein described constitute a preferred embodiment of the invention, it is to be understood that the invention is not limited to these precise forms of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In a web guide assembly for controlling the lateral position of a traveling web, the combination of actuating means for controlling the lateral position of the web, a pair of substantially identical control means responsive to the position of the web for said actuating means, the first of said control means being responsive to the lateral position of the web for effecting the movement of said actuating means to position the web in a first position, the second of said control means being responsive to the lateral position of the web for effecting movement of said actuating means to position the web in a second position spaced from said first position, and timer means for alternately connecting said first and second control means to said actuating means for continually shifting the web between said first and second positions.

2. In a web guide assembly for controlling the lateral position of a traveling web, the combination of actuating means for controlling the lateral position of the web, a pair of control means for said actuating means, the first of said control means being responsive to the lateral position of the web for effecting the movement of said actuating means to position the web in a first position, the second of said control means being responsive to the lateral position of the web for effecting movement of said actuating means to position the web in a second position spaced from said first position, and a timing mechanism for connecting said first control means to and disconnecting said second control means from said actuating means when the web is in said second position and for connecting said second control means to and disconnecting said first control means from said actuating means when the web is in said first position.

3. In a web guide assembly of the character described for laterally oscillating a traveling web, the combination of actuating means for controlling the lateral position of the web, a pair of control means for said actuating means, the first of said control means being responsive to the lateral position of the web for effecting movement of said actuating means to position the web in a first position, the second of said control means being responsive to the lateral position of the web for effecting movement of said actuating means to position the web in a second position spaced from said first position, means for alternately connecting said control means to said actuating means, valve means movable between one position wherein said first control means is connected to and said second control means disconnected from said actuating means and another position wherein said second control means is connected to and said first control means disconnected from said actuating means, and timing means for automatically shifting said valve means between said positions at predetermined intervals to effect oscillatory movement of said web between said first and second positions.

4. Apparatus for laterally oscillating a traveling web with respect to its path of travel, comprising fluid motor means for laterally changing the position of the web between spaced first and second positions, a control system for said motor means including a source of fluid pressure, a first control circuit for interconnecting said source and said motor means, first valve means in said first control circuit positioned in response to the lateral position of the web to vary the pressure in said first circuit for causing said motor means to locate the web in said first position, a second control circuit for interconnecting said source and said motor means, second valve means in said second control circuit positioned in response to the lateral position of the web to vary the pressure in said second circuit for causing said motor means to locate the web in said second position, and means for alternately connecting said first and second control circuits to said motor means.

5. Apparatus for laterally oscillating a traveling web with respect to its path of travel, comprising fluid motor means for laterally changing the position of the web between spaced first and second positions, a control system for said motor means including a source of fluid pressure, a first control circuit for interconnecting said source and said motor means, first valve means in said first circuit positioned in response to the lateral position of the web to vary the pressure in said first circuit for causing said

motor means to move the web to said first position, a second control circuit for interconnecting said source and said motor means, second valve means in said second circuit positioned in response to the lateral position of the web to vary the pressure in said second circuit for causing said motor means to move the web to said second position, timer mechanism for connecting said first circuit to and disconnecting said second circuit from said motor means when said web is in said second position and connecting said second circuit to and disconnecting said first circuit from said motor means when said web is in said first position.

6. Apparatus for laterally oscillating a traveling web with respect to its path of travel, comprising fluid motor means for laterally changing the position of the web between spaced first and second positions, a control system for said motor means including a source of fluid pressure, a first control circuit for interconnecting said source and said motor means, first valve means in said first circuit positioned in response to the lateral position of the web to vary the pressure in said first circuit for causing said motor means to locate the web in said first position, a second control circuit for interconnecting said source and said motor means, second valve means in said second circuit positioned in response to the lateral position of the web to vary the pressure in said second circuit for causing said motor means to locate the web in said second position, control valve means movable between a first position wherein said first circuit is connected to and said second circuit disconnected from said motor means and a second position wherein said second circuit is connected to and said first circuit disconnected from said motor means, and timing means for automatically shifting said control valve means between said first and second positions at predetermined intervals to effect oscillatory movement of said web between said first and second position.

7. Apparatus for laterally oscillating a traveling web with respect to its path of travel, comprising fluid motor means for laterally changing the position of the web between spaced first and second positions, a control system for said motor means including a source of fluid pressure, a first control circuit for interconnecting said source and said motor means and having a first leak port therein, first valve means in said first circuit including a first palm biased against one edge of the web for sensing the lateral position thereof and a first eccentrically mounted valve element pivoted by said palm for controlling flow of

fluid through said first leak port to cause said motor means to move the web toward said first position, a second control circuit for interconnecting said source and said motor means and having a second leak port therein, second valve means in said second circuit including a second palm biased against the one edge of the web for sensing the lateral position thereof and a second eccentrically mounted valve element pivoted by said second palm for controlling flow of fluid through said second leak port to cause said motor means to move the web toward said second position, and means for alternately connecting said first and second circuits to said motor means.

8. Apparatus for laterally oscillating a traveling web with respect to its path of travel, comprising fluid motor means for laterally changing the position of the web between spaced first and second positions, a control system for said motor means including a source of fluid pressure, a first control circuit for interconnecting said source and said motor means and having a first leak port therein, first valve means in said first circuit including a palm biased against one edge of the web for sensing the lateral position thereof and a first eccentrically mounted valve element pivoted by said palm for controlling flow of fluid through said first leak port to cause said motor means to move the web toward said first position, a second control circuit for interconnecting said source and said motor means and having a second leak port therein, second valve means in said second circuit including a second eccentrically mounted valve element pivoted by said palm for controlling flow of fluid through said second leak port to cause said motor means to move the web toward said second position, and means for alternately connecting said first and second circuits to said motor means.

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