March 10, 1959 H. L. WENDSHUH ET AL 2,877,013

GUIDE FOR A TRAVELING WEB

Filed April 5, 1957 4 Sheets-Sheet 1

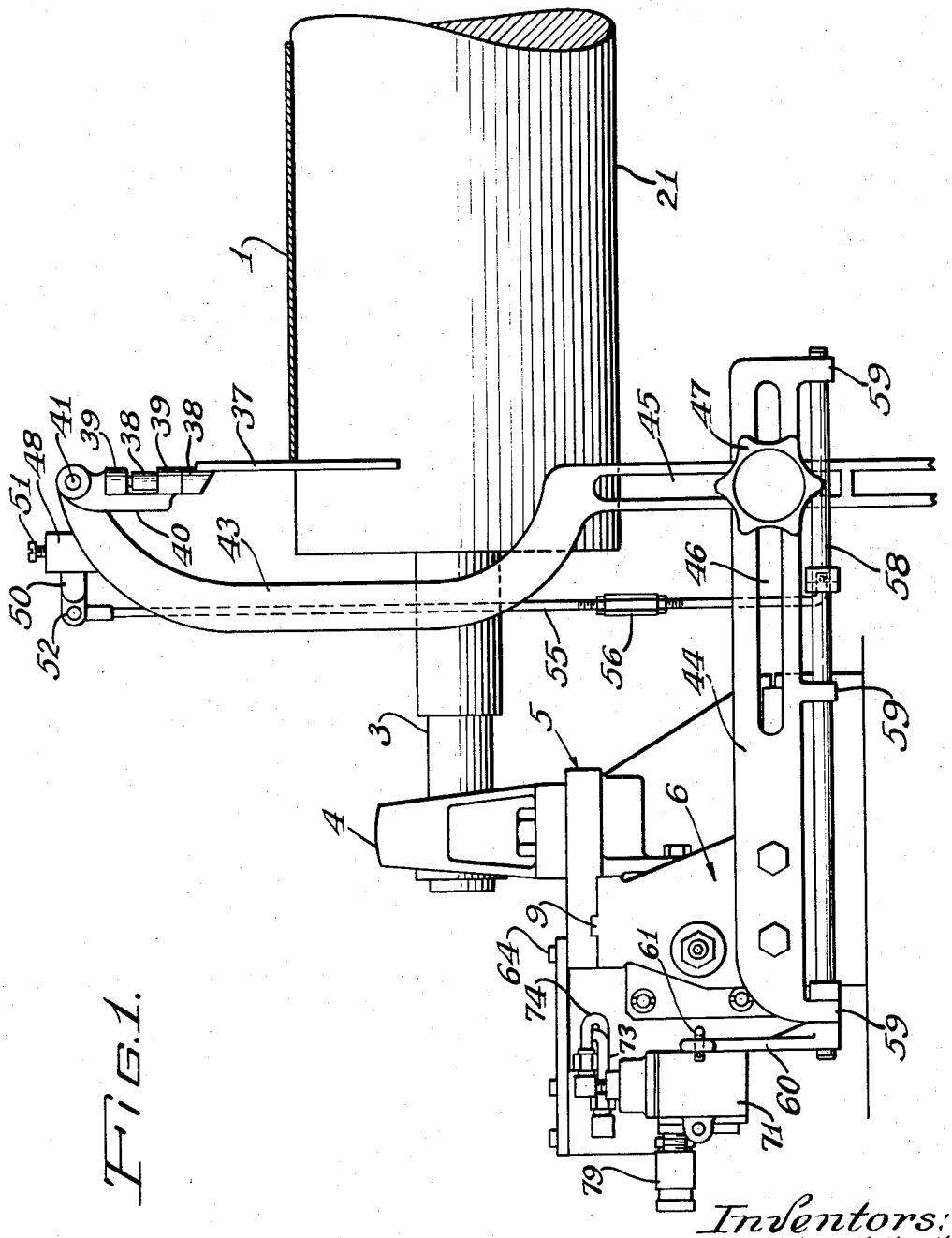

FIG. 1.

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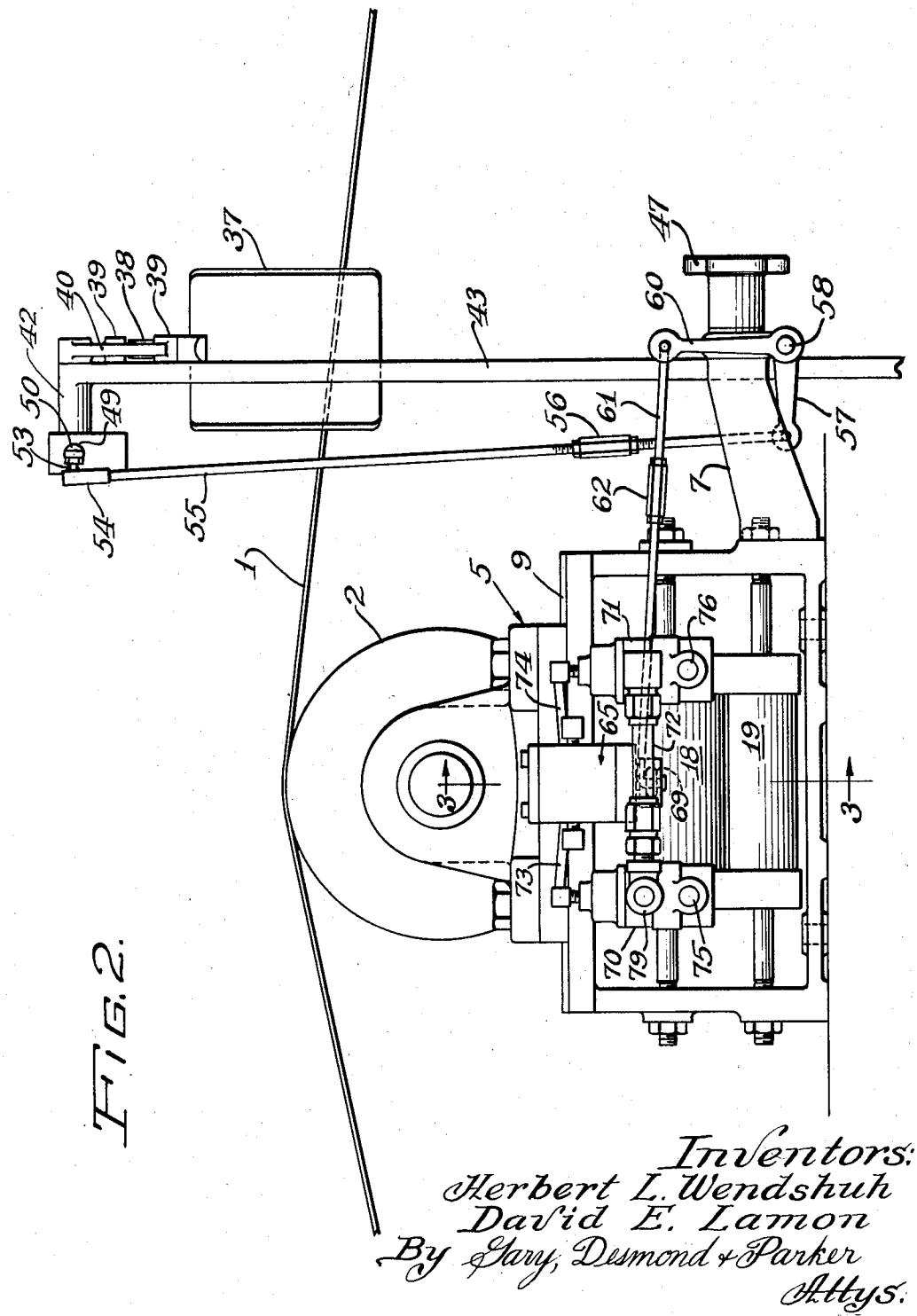

FIG. 2.

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Fig. 3.

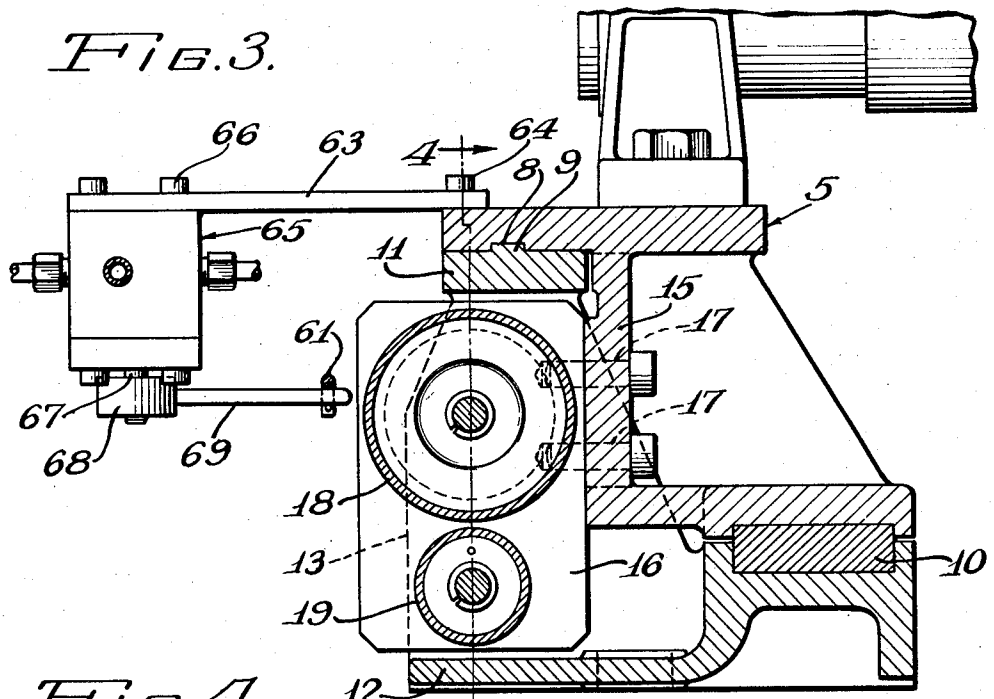
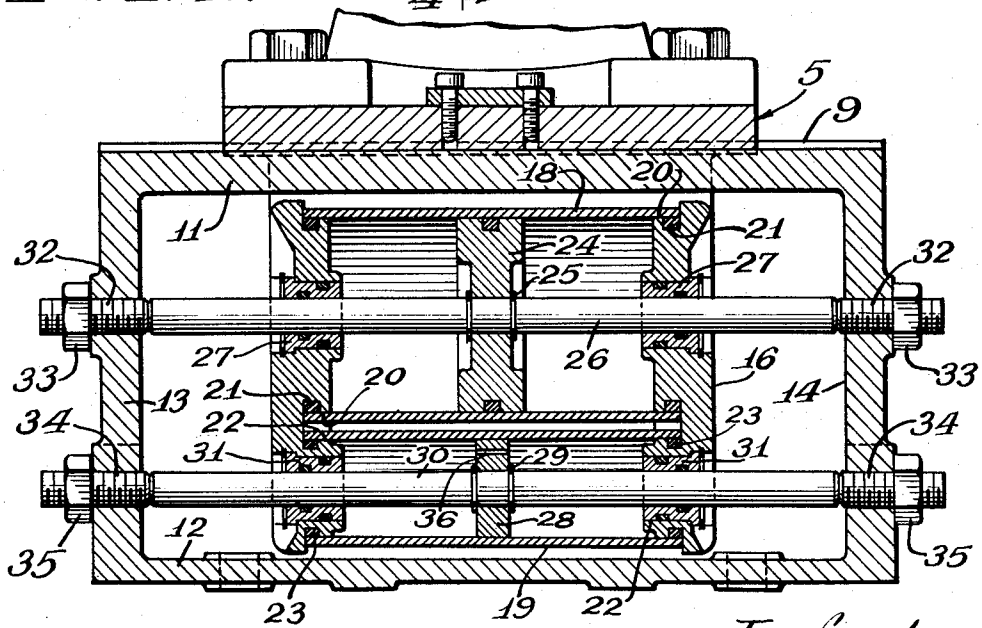


Fig. 4.



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GUIDE FOR A TRAVELING WEB

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Fig. 5.

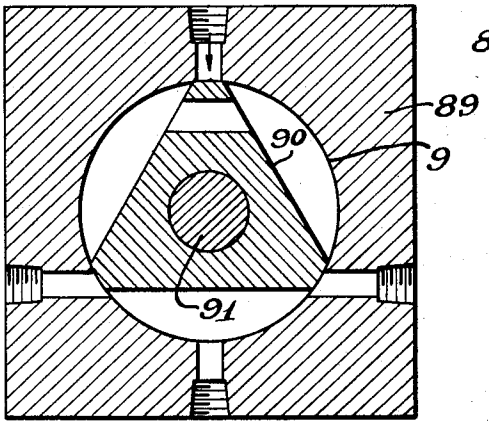


Fig. 6.

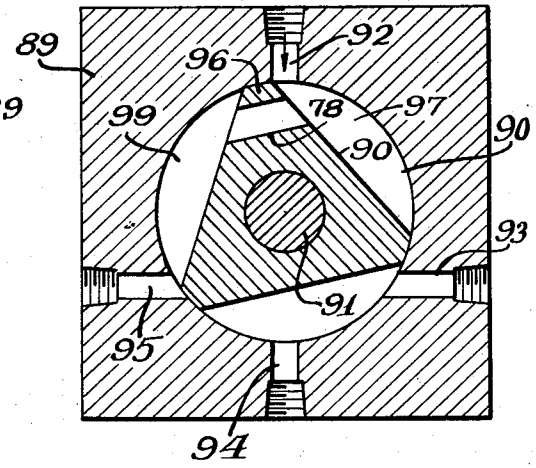


Fig. 7.

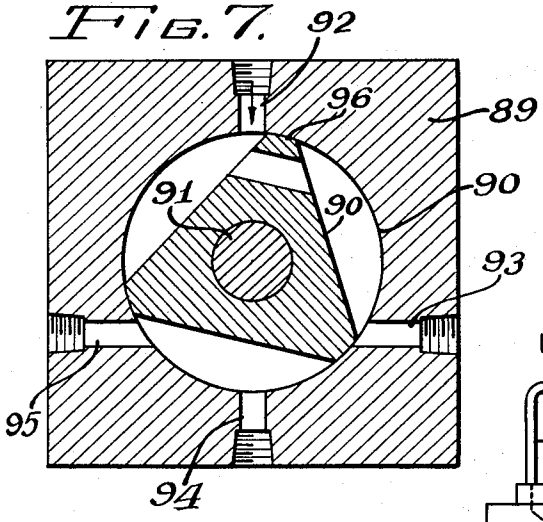
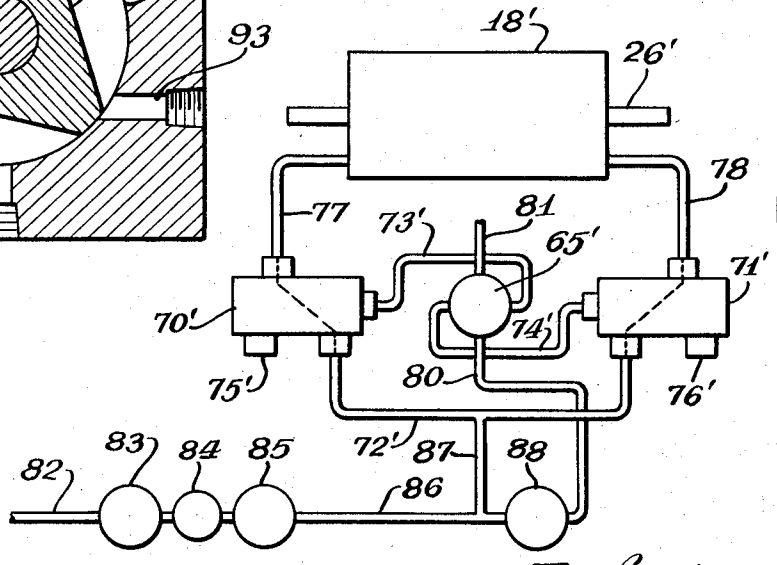


Fig. 8.



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2,877,013

GUIDE FOR A TRAVELING WEB

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Application April 5, 1957, Serial No. 651,008

7 Claims. (Cl. 271—2.6)

This invention relates to improvements in a guiding mechanism for paper forming wires or screens, blankets or other traveling webs, and refers particularly to a device for sensing misaligned movement of the web, the sensing mechanism functioning to actuate an aligning mechanism which in response to said actuation realigns the web.

One of the important features of the present invention resides in a mechanism which, in response to a relatively small amount of work exercised by a misaligned web upon a sensing device, results in the exercise of a relatively large amount of work by a web-realigning mechanism in restoring the web to its properly aligned path.

Another important feature of the invention resides in the provision of a pneumatic web-aligning mechanism which is prevented from making continuous abrupt changes, or hunting, by the provision of an hydraulic damper.

A further important feature of the invention resides in a sensing mechanism and valve mechanism associated with the web realigning mechanism which when said realigning mechanism moves properly to align the web simultaneously acts to close the actuating valve which the sensing mechanism previously opened to initiate the realigning movement.

An additional important feature of the present invention resides in a rugged sturdy mechanism of the class described which is simple in construction and operation.

Other objects, advantages and features of the invention will be more apparent from the accompanying drawings and following detailed description.

In the drawings,

Fig. 1 is an end elevational view of a device embodying the concepts of the present invention.

Fig. 2 is a side elevational view of the device shown in Fig. 1.

Fig. 3 is an enlarged sectional view taken on line 3—3 of Fig. 2.

Fig. 4 is a detailed sectional view taken on line 4—4 of Fig. 3.

Figs. 5, 6 and 7 are detailed sectional views illustrating different positions of the control element of the four-way valve employed.

Fig. 8 is a diagrammatic view of the pneumatic system employed in the device.

Referring in detail to the drawings, 1 indicates a traveling web which may comprise a paper forming wire or screen, a traveling blanket or other type of web or belt which it may be desired to maintain in a substantially constant path during its travel. In some conventional types of wire guides a guide roll is employed to control the lateral movement of the web and such a roll 2 is contemplated herein. The roll 2 is disposed transversely to the axis of the web and the web will normally assume a position such as to bring its longitudinal axis at right-angles to the axis of the guide roll. Hence, by inclining the axis of the roll 2 in one direction or the other a force

is exerted upon the web to move it laterally in a predetermined direction.

The device comprising the present invention is directed to a mechanism which so inclines the roll 2 in response to an undesired lateral movement of the web, such inclination functioning to return the web to its desired path.

The roll 2 is carried upon an axle 3, only one end portion of which is illustrated, the opposite end portion being journaled in a bearing (not shown) which has a degree of freedom to move as the axis of the roll is inclined. Such self-aligning bearings are well known in the art. The opposite end portion of the axle 3 is journaled in a self-aligning bearing 4 which is mounted upon a movable carriage 5 which, as will be hereinafter more fully described, functions to move the bearing 4 so as to incline the axis of the roll 2 relative to its normal position.

The movable carriage 5 is slidably mounted upon a stationary frame member 6 which is secured to a stationary portion of a paper making machine or the like (not shown). The movement of the carriage 5 is substantially parallel to the general direction of travel of the web and in order to restrain the carriage for movement in this direction, the upper portion of the carriage is provided with a groove 8 which registers with a guide rib 9 carried by the stationary frame 6. In addition, the carriage is also supported and guided by seat 10 carried by the stationary frame 6.

The stationary frame 6 comprises a box structure, shown best in Fig. 4, which comprises upper rail 11, lower rail 12 and end rails 13 and 14. The carriage 5 comprises a downwardly extending panel 15 (Fig. 3) to which a cylinder-supporting block 16 is secured by means of screws 17. The block 16 carries a pair of cylinders 18 and 19 which are disposed substantially parallel to each other and are disposed lengthwise within the box frame. The wall of the cylinder 18 at its opposite ends rests upon shoulders 20, carried by the block 16 and packing rings 21 function to render the cylinder fluid-tight at its ends. Similarly, the ends of the cylinder 19 rest upon shoulders 22 and the ends of said cylinder are sealed by rings 23.

A piston 24 is positioned in cylinder 18 and is rigidly secured by locking rings 25 to a shaft 26 which extends through the cylinder and projects outwardly at each end through packing glands 27. Similarly, a piston 28 is positioned in cylinder 19 and is rigidly mounted by means of locking rings 29 to a shaft 30 which extends through the cylinder and projects outwardly at each end through packing glands 31.

The cylinders 18 and 19, as has been hereinbefore described, are carried by the cylinder-supporting block 16 which in turn is carried by the movable carriage 5. Hence, the cylinders are disposed within the box frame in desired position therein. Set screws 32 are positioned in the opposite ends 13 and 14 of the box frame in substantial alignment with the longitudinal axis of shaft 26. The set screws are threadedly positioned in the frame members and may be locked in desired position by means of lock nuts 33. The desired position of the set screws is such as to normally leave a relatively small degree of clearance between the inner ends of the set screws and the opposite ends of the shaft 26 whereby the possibility of misalignment of the shaft within the cylinder and the possibility of buckling of the shaft is avoided.

In similar fashion set screws 34 are threadedly positioned in the end members 13 and 14 in axial alignment with the longitudinal axis of shaft 30, the set screws 34 being locked in desired position by means of lock nuts 35. The relationship of the set screws 34 to the ends of the shaft 30 is the same as the relationship between the set screws 32 and the ends of shaft 26, hereinbefore

described, and the purpose accomplished by the structural arrangement described is the same as has been hereinbefore described with respect to shaft 26.

The arrangement is such that when fluid under pressure is introduced into cylinder 18 on one or the other side of piston 24, the cylinder 18 will be moved. That is, the piston is stationary but the cylinder moves relative thereto. Of course, when the cylinder 18 moves, block 16 moves therewith and hence carriage 5 moves relative to the stationary frame 6. In this fashion, by the selective introduction of fluid under pressure to cylinder 18 the bearing 4 may be moved relative to the stationary frame of the machine and relative to the opposite bearing in which shaft 3 is journaled, the movement taking place substantially parallel to the longitudinal axis of the web 1.

The piston 28 is provided with a bleed hole 36. As will be hereinafter more fully described, the cylinder 19 on both sides of the piston 28 is filled with a liquid and the bodies of liquid on each side of the piston 28 are in communication through the bleed hole 36. When fluid under pressure is introduced into cylinder 18, causing said cylinder to move in one direction or the other, such movement is damped by the transfer of liquid through the bleed hole 36 from one side of piston 28 to the other side thereof. Accordingly, abrupt movements of the carriage 5 are avoided and, as will be hereinafter more fully described, hunting is substantially eliminated.

To detect lateral movement of web 1 from its normal position, a sensing element is employed, the sensing element comprising a palm or feeler 37. The palm 37 is carried by a rotary pin 38 which is journaled in sleeves or bearings 39 carried by an arm 40, the latter being carried by a rotatable shaft or pin 41 journaled in a bearing 42. The bearing 42 is carried at the upper end of a stationary bracket 43 which, in turn, is secured to a supporting bracket 44 mounted by means of screws upon the stationary portion of the machine. Brackets 43 and 44 are respectively provided with slots 45 and 46 and a locking screw having a hand wheel 47 for its convenient manipulation functions adjustably to secure bracket 43 to bracket 44. Thus, palm 37 is held in a fixed position relative to the stationary portion of the machine, but is free to swing or pivot about arm 40 to dispose its surface in alignment with the adjacent edge of the web 1.

An arm (not shown) is connected to the opposite end of shaft or pin 41 and carries at its end a connecting block 48. Block 48 is provided with an aperture 49 into which a pin 50 is slidably positioned, said pin being locked in a desired position in aperture 49 by set screw 51. Pin 50, at its outer end, is flattened and is provided with an eye 52 in which a pin 53, carried by sleeve 54 is pivotally positioned. Sleeve 54 is mounted upon one end of a connecting link, interposed in the length thereof is a turnbuckle 56 for varying the effective length of the link.

At its opposite end, link 55 is pivotally connected to an arm 57 which, in turn, is rigidly mounted upon a shaft 58 journaled in bearings 59 formed integral with the stationary bracket 44. An arm 60 is rigidly secured to the opposite end portion of shaft 58 and the opposite end of said arm is pivotally connected to an end of a link 61. A turnbuckle 62 is interposed in link 61 and functions to vary the effective length of said link.

A supporting plate 63 is secured to the movable carriage by screws 64 and carries a four-way valve 65 secured to said plate by screws 66. The structural features of valve 65 will be hereinafter more fully described, but in general it is manipulated by the rotation of a shaft 67 (Fig. 3). A block 68 is mounted upon valve control shaft 67 and carries an arm 69 which is pivotally connected to the link 61.

A pair of pilot valves 70 and 71 are mounted upon the movable carriage and hence, it can be understood that the four-way valve 65 and both pilot valves move together with the movable carriage 5. The pilot valves 70 and 71 are connected together by pipe 72 and pilot valve 70 is connected to valve 65 by pipe 73 and pilot valve 71 is connected to valve 65 by pipe 74. In addition, pilot valves 70 and 71 each have a vent opening 75 and 76, respectively, to the atmosphere. In addition, each of the pilot valves is connected to cylinder 18 by pipe means shown diagrammatically in Fig. 8 at 77 and 78, respectively. The common connection 72 is connected to a source of fluid under pressure through the connecting nipple 79.

The four-way valve 65 in addition to being connected to each of the pilot valves is also connected to a source of fluid under pressure by pipe 80, best shown diagrammatically in Fig. 8, and a vent pipe 81 also connects into said four-way valve.

A better understanding of the operation of the valves hereinbefore referred to may be gained by reference to Fig. 8. In said figure pipe 82 connects with a source of air or other fluid under pressure. The pipe 82 connects into a conventional filter 83 which is connected with a conventional pressure regulator 84 and which, in turn, connects with a lubricator 85. From the lubricator 85 a pipe 86 connects into branch pipe 87 which connects pipe 86 with the common connecting pipe 72', corresponding to the pipe 72 shown in Fig. 2. Thus, fluid under a pressure determined by the regulator 84 feeds directly into pipe 72'. In the operation of the present device air under pressure is preferred and the pressure of the air as determined by the regulator 84 is preferably in the neighborhood of fifty pounds per square inch. Pipe 86 also connects with a pressure regulator 88 which, in turn, is connected by pipe 80 to the four-way valve 65', corresponding to valve 65. The air under pressure delivered to the regulator 88 is at a pressure determined by the pressure regulator 84. However, the pressure regulator 88 reduces this pressure to a pressure in the neighborhood of fifteen pounds per square inch. Thus, the air delivered through pipe 80 to the four-way valve 65' is reduced relative to the pressure of the air fed to the pilot valves 70 and 71'.

Block 48 functions as a counterweight to move the linkage connected to the palm 37 so that said palm lightly contacts and follows the edge of the web 1. In the normal position of the device, that is, when the web moves along the desired path, the four-way valve 65 is closed and pipe 80 is connected to neither pipe 73 nor 74. Hence, the pilot valves, which normally connect pipes 72 and 77 and 72 and 78, respectively, together remain in their normal position and the pressure on each side of piston 24 is equal, being the same as the pressure in pipe 72. However, when the web 1 deviates in either lateral direction from its normal path, palm 37 is either moved by the web edge or is caused to follow the web edge thereby moving the palm linkage, the arm 69 of valve 65 is moved and valve 65 thereby triggers valves 70 or 71 to vent cylinder 18 on one or the other side of piston 24, as will be hereinafter more fully described.

The construction of valve 65 is diagrammatically shown in Figs. 5, 6 and 7, wherein 89 comprises the valve body which is provided with a cylindrical bore 90. A substantially prismatic rotor 91 positioned upon a hub 91 is rotatably positioned in the bore 90, the valve-control shaft 67 being connected to the hub to rotate the rotor in response to movement of the palm linkage. The body 89 is provided with four ports 92, 93, 94 and 95, and referring particularly to Fig. 8, port 92 is connected to air inlet pipe 80; port 93 is connected to connecting pipe 73'; port 95 is connected to connecting pipe 74', and port 94 is connected to vent pipe 81.

In Fig. 5 the normal position of the rotor 90 is illustrated. It will be noted in the normal position port 92 is closed by the truncated corner 96 of the rotor 90 and both ports 93 and 95 are connected to vent port 94. In this position neither valves 70' nor 71' are triggered and said valves remain in their normal position

whereby pipe 72 is, in effect, connected to both ends of cylinder 18, and, hence, the carriage is stationary.

In Fig. 6 the rotor 90 has been rotated by the movement of the palm linkage due to a lateral shifting of the web 1 in a predetermined direction. The rotor in its rocked position shown in Fig. 6 causes the truncated corner 96 to uncover port 92. Thus air under pressure from pipe 80 passes into the sectoral space 97. The rotor 90 is provided with a transverse bore 98 whereby the zone 97 connects with the sectoral space 99 which in turn is connected to port 95. In this position it will be noted that ports 93 and 94 remain in communication whereby pilot valve 70' remains in its normal position connecting pipes 72' and 77 together. However, in this position of rotor 90 air under pressure from port 92 moves to port 95 and hence valve 71' is triggered.

In triggering valve 71' the connection between pipes 72' and 78 is broken and pipe 78 then connects with vent 76'. Consequently one side of piston 24 in cylinder 18 is vented and the cylinder 18 together with the carriage 5 moves in the direction of the high pressure side of the piston.

As has been hereinbefore described, this movement is damped by cylinder 19 moving relative to piston 28 and comprises a relatively slow controlled movement. As the cylinders move, the carriage 5 moves and hence bearing 4 shifts the end of shaft 3 to cant or incline the roll 2 relative to the web 1. It can readily be seen that when the cylinders and movable carriage thus move, valve 65 moves therewith and consequently although the palm linkage functioned to initiate the movement, the movement of the valve relative to the linkage functions to return the rotor 90 to its normal position. Hence, there is no tendency for the device to perform an over-correcting action, the device having, what may be referred to, as a self-zeroing action.

Referring particularly to Fig. 7, it will be noted that the rotor 90 has been rocked or rotated in the opposite direction from that shown in Fig. 6. In this position ports 94 and 95 remain connected but ports 92 and 93 are connected through the transverse bore 98. Hence, the cylinders and the movable carriage move in the opposite direction in response to the opposite lateral deviation of the edge of the web 1. Of course, as the carriage 5 moves in one direction or the other a force is exerted upon the web 1 which tends to return it to its normal path.

Although the device comprising the present invention is shown as controlling the path of travel of a substantially horizontally moving web, and wherein the carriage moves in a substantially horizontal manner to effect such control, it is to be understood that a substantially vertically moving web may also be controlled merely by disposing the mechanism at right-angles to its shown position. To effect the control of such a vertically moving web the carriage 5 will, in reponse to the sensing mechanism, move in a substantially vertical manner.

The pilot valves 70 and 71 are of conventional construction and a conventional four-way valve may be employed as the valve 65. However, in view of the excellent sealing characteristics of the valves illustrated in Figs. 5, 6 and 7 this type of valve is preferred.

One of the important advantages of the invention resides in the fact that the palm 37 can be made to bear relatively gently upon the edge of the web 1 and that the valve 65, controlling the passage of relatively low pressure air, can be moved very easily by the movement of the palm. Hence, the force exerted by the palm upon the edge of the web will not tend to wear the web unduly. Yet, by the provision of the pilot valves 70 and 71, air under relatively high pressure is controlled. The valving arrangement embodied in the present invention resembles the operation of a conventional relay wherein by the exercise or release of a relatively small quantity of energy, a large quantity of energy may be proportionately controlled.

It is to be understood that the device comprising the present invention may be employed in guiding paper-forming wires and screens, traveling blankets, belts and the like all of which are referred to as "webs." For purposes of convenience and clarity, the four-way valve 65, which functions as a control valve, is referred to in the appended claims as a "control valve."

In view of the fact that many of the components of the present device are similar to those used in conventional web or wire guides, it is to be understood that the present device may be modified to conform with different types of conventional equipment and hence it is not intended that the present invention be limited to the exact details shown and described except as necessitated by the appended claims.

We claim as our invention:

1. In a web guiding device wherein a guide roll in surface contact with a traveling web is shifted in response to the movement of a feeler palm in contact with the lateral edge of the web, the combination of a stationary frame, a carriage movably mounted on said frame for carrying one end of said guide roll, a control valve and a pair of pilot valves mounted on said carriage, pipe means connecting said pilot valves to a source of fluid under relatively high pressure, pipe means connecting said control valve to a source of fluid under relatively low pressure, a cylinder rigidly mounted on said carriage and movable relative to said frame, a piston carried in said cylinder and fixedly mounted relative to said frame, pipe means connecting each of said pilot valves to a respective end of said cylinder, pipe means connecting said control valve to each of said pilot valves to selectively control said pilot valves under the influence of said fluid under relatively low pressure to pass fluid under said relatively high pressure to and from the respective ends of said cylinder, and means for connecting said control valve to said palm to selectively actuate said control valve in response to movement of said palm.

2. In a web guiding device wherein a guide roll in surface contact with a traveling web is shifted in response to the movement of a feeler palm in contact with the lateral edge of the web, the combination of a stationary frame, a carriage movably mounted on said frame for carrying one end of said guide roll, a control valve and a pair of pilot valves mounted on said carriage, said pilot valves being actuated under relatively low fluid pressure, pipe means connecting said pilot valves to a source of fluid under relatively high pressure, a cylinder rigidly mounted on said carriage and movable relative to said frame, a piston carried in said cylinder and fixedly mounted relative to said frame, pipe means connecting each of said pilot valves to a respective end of said cylinder, pipe means connecting said control valve to a source of fluid under relatively low pressure, pipe means connecting said control valve to each of said pilot valves selectively to pass fluid under said relatively low pressure to said pilot valves to actuate said pilot valves and pass fluid under said relatively high pressure to and from the respective ends of said cylinder, and link means for connecting said control valve to said palm to selectively actuate said control valve in response to movement of said palm.

3. In a web guiding device wherein a guide roll in surface contact with a traveling web is shifted in response to the movement of a feeler palm in contact with the lateral edge of the web, the combination of a stationary frame, a carriage movably mounted on said frame for carrying one end of said guide roll, a control valve and a pair of pilot valves mounted on said carriage, said pilot valves being actuated to opened and closed position by fluid under relatively low pressure, pipe means connecting said pilot valves to a source of gaseous fluid under relatively high pressure, a cylinder rigidly mounted on said

carriage and movable relative to said frame, a piston carried in said cylinder and fixedly mounted relative to said frame, an hydraulic snubber carried by said carriage for damping the movement of said carriage, pipe means connecting each of said pilot valves to a respective end of said cylinder to pass fluid under relatively high pressure thereto, pipe means connecting said control valve to a source of gaseous fluid under relatively low pressure, pipe means connecting said control valve to each of said pilot valves to pass fluid under relatively low pressure thereto to selectively control said pilot valves to pass fluid under relatively high pressure to and from the respective ends of said cylinder, and means for connecting said control valve to said palm to actuate said control valve selectively to pass fluid under relatively low pressure to said pilot valves in response to movement of said palm.

4. In a web guiding device wherein a guide roll in surface contact with a traveling web is shifted in response to the movement of a feeler palm in contact with the lateral edge of the web, the combination of a stationary frame, a carriage movably mounted on said frame for carrying one end of said guide roll, a four-way control valve and a pair of pilot valves mounted on said carriage, said pilot valves being actuated by the selective passage of fluid under relatively low pressure thereto, pipe means connecting said pilot valves to a source of fluid under relatively high pressure, a cylinder rigidly mounted on said carriage and movable relative to said frame, a piston carried in said cylinder and fixedly mounted relative to said frame, pipe means connecting each of said pilot valves to a respective end of said cylinder selectively to pass fluid under relatively high pressure thereto, pipe means carried by said control valve for connecting said control valve to a source of fluid under relatively low pressure, separate means connecting said control valve to the atmosphere, pipe means connecting said control valve to each of said pilot valves to selectively pass fluid under said relatively low pressure to said pilot valves to open and close said pilot valves selectively to control said pilot valves to pass fluid under relatively high pressure to and from the respective ends of said cylinder, and link means for connecting said control valve to said palm to selectively actuate said control valve in response to movement of said palm.

5. In a web guiding device wherein a guide roll in surface contact with a traveling web is shifted in response to the movement of a feeler palm in contact with the lateral edge of the web, the combination of a stationary frame, a carriage movably mounted on said frame for carrying one end of said guide roll, a control valve and a pair of pilot valves mounted on said carriage, said pilot valves being actuated by the selective passage of fluid under relatively low pressure thereto to pass selectively fluid under relatively high pressure therefrom, pipe means connecting said pilot valves to a source of fluid under relatively high pressure, a cylinder rigidly mounted on said carriage and movable relative to said frame, a piston carried in said cylinder and fixedly mounted relative to said frame, pipe means connecting each of said pilot valves to a respective end of said cylinder selectively to pass said fluid under relatively high pressure to the respective ends of said cylinder, said pilot valves normally affording communication from said relatively high pressure fluid source to said cylinder, pipe means connecting said control valve to a source of fluid under relatively low pressure and to each of said pilot valves selectively to pass fluid under said relatively low pressure to said pilot valves to actuate one of said pilot valves to close communication with said relatively high pressure fluid source and open communication between one end of said cylinder and the atmosphere, and means for connecting said control valve to said palm to selectively actuate said control valve in response to movement of said palm.

6. A device for guiding a traveling web along a substantially constant path comprising, a stationary frame for disposition adjacent a traveling web, a carriage movable upon said frame in a direction generally parallel to the path of travel of said web, a guide roll for making transverse surface contact with said web, one end of said guide roll being mounted upon said carriage, a feeler palm carried upon said frame for making following contact with a lateral edge of said web, and means mounted on said carriage and connected to said palm for moving said end of the guide roll in response to the movement of said palm, said means comprising a fluid pressure cylinder carried by said carriage and movable with said carriage relative to said frame, a control valve carried by said carriage and connected to said palm for manipulation in response to movement of said palm, a pair of pilot valves carried by said carriage, means for connecting said pilot valves to a source of fluid under pressure, connections between each pilot valve and a respective end of said cylinder, connections between said control valve and each of said pilot valves to actuate said pilot valves to control passage of fluid under pressure to and from the respective ends of said cylinder to move said cylinder and carriage in response to the movement of said palm, and a second cylinder carried by said first-mentioned cylinder with their respective axes parallel to each other, a piston carried in said second cylinder and means rigidly connecting said piston to said frame, said piston being provided with an opening permitting communication of portions of said cylinder on each side of said piston for the passage of liquid carried by said second cylinder when said carriage moves.

7. A device for guiding a traveling web along a substantially constant path comprising, a stationary frame for disposition adjacent a traveling web, a carriage movable upon said frame in a direction generally parallel to the path of travel of said web, a guide roll for making transverse surface contact with said web, one end of said guide roll being journaled upon said carriage, a feeler palm carried upon said frame for making following contact with a lateral edge of said web, and means mounted on said carriage and connected to said palm for moving said end of the guide roll in response to the movement of said palm, said means comprising a fluid pressure cylinder carried by said carriage and movable with said carriage relative to said frame, a piston positioned in said cylinder, means rigidly connecting said piston to said frame, a control valve carried by said carriage and connected to said palm for manipulation by said palm in response to its movement, means connecting said control valve to a source of fluid under relatively low pressure, a pair of pilot valves carried by said carriage, means connecting said pilot valves to a source of fluid under relatively high pressure, connections between each pilot valve and a respective end of said cylinder to pass fluid under said relatively high pressure to said respective cylinder ends, and connections between said control valve and each of said pilot valves to pass selectively fluid under said relatively low pressure to said pilot valves selectively to actuate said pilot valves to control passage of fluid under said relatively high pressure to and from the respective ends of said cylinder to move said cylinder and carriage in response to the palm's manipulation of the control valve.

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