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WEB CONTROL DEVICE

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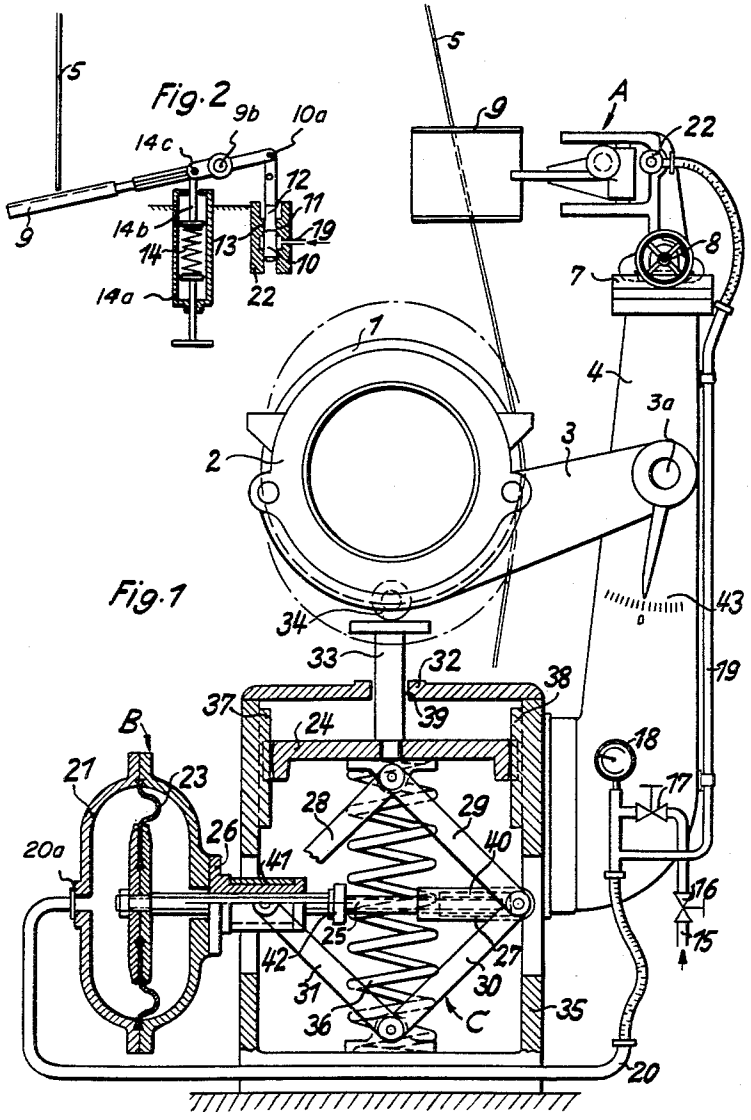

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WEB CONTROL DEVICE

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The present invention relates to a control device for adjusting the course of a web. More in particular the present invention relates to a control device for adjusting the course of the web in paper machines.

It is known to effect the adjustment of the course of a web by means of a guide roller which is arranged below the web and contacts the latter from below. The guide roller is hingedly fixed at one of its ends and its other end can be displaced in one direction of the course of the web or the opposite direction thereby correcting the course of the same so as to follow a straight, linear direction. The guide roller is displaced by means of a hydraulically or pneumatically operated servo motor. This motor is actuated by feel means scanning the edge of the web and the impulses thus obtained are transmitted to the motor via hydraulic or pneumatic transmission means. Frequently a pressure membrane is used as the servo motor, which substantially consists of a pressure chamber communicating with a pressure pipe. Within this pressure chamber there is arranged a membrane which is attached to the casing surrounding the pressure chamber. The membrane is fastened to a membrane rod and this membrane rod, in turn, is connected to transmission means, as, for example, gear means or the like. The impulses obtained from the feel means are transmitted to the servo motor by the hydraulic or pneumatic transmission means within the pressure pipe. Within the motor, the membrane is actuated, and the movement of the membrane is communicated to the membrane rod and from thereto the transmission means and finally to the guide roller. Whenever the web deviates from its prescribed, straight course, the feel means registrates this movement and transmits an impulse via the hydraulic or pneumatic transmission means to the guide roller, which thereby is displaced in one direction or the other so as to readjust the web to its straight course.

The control device just described operates entirely automatically. There are, however, also known control devices, which are operated manually. These devices are not provided with the feel means just described and substantially comprise a support block carrying the guide roller. The support block can be moved by means of a manually operated threaded spindle in the direction of the course of the web or in the opposite direction, thereby adjusting the course of the latter to the prescribed straight line.

Finally, there are also known control devices which are both operated automatically and manually as the situation may require. According to these constructions the guide roller is positioned upon a carriage which is mounted upon rolls upon the frame of the paper machine. The carriage is driven by means of a threaded spindle which is mounted in the longitudinal axis of the carriage. The spindle is actuated by a water wheel mounted upon the latter which, in turn, is impelled by a stream of water and caused to rotate in one direction

or the other according to the deviation of the web from its prescribed course. In addition, the threaded spindle is provided with a hand wheel and by turning this hand wheel the guide roller can be manually displaced in one direction or the other as the situation requires in order to adjust the web to its prescribed course.

It is an object of the present invention to provide a control device for adjusting the course of a web, particularly in paper machines, which can be operated both automatically and manually.

It is another object of the present invention to provide a control device for adjusting the course of a web, particularly in paper machines, in which the single parts can be replaced very easily.

It is still another object of the present invention to provide a control device for adjusting the course of a web, particularly in paper machines, which works very sensitively.

It is a further object of the present invention to provide a control device for adjusting the course of a web, particularly in paper machines, in which the oscillation of the web due to its deviation from and readjustment to its prescribed course is reduced to a minimum.

It is still a further object of the present invention to provide a control device for adjusting the course of a web, particularly in paper machines, which has a very long life time.

It is yet another object of the present invention to provide a control device for adjusting the course of a web, particularly in paper machines, which can be easily built into the given structure of paper machines with a minimum of available space.

Further objects and advantages will become apparent as the description of the present invention proceeds.

These objects are achieved by the control device of the present invention which can be operated both automatically and manually as the situation requires.

According to one embodiment of the invention the membrane rod transmitting the rocking movements of the control lever to the guide roller can be shortened or elongated. For this purpose the membrane rod consists at one of its ends of a spindle which can be turned in a threaded sleeve. It is also possible to devise a membrane rod composed of several portions connected to each other by means of a turnbuckle.

According to another embodiment of the control device of the present invention a part of the membrane rod constitutes the diagonal rod of a four-lever linkage attached with its four corners to the membrane casing, the membrane rod, the support plate carrying the bearing for the guide roller and the casing enclosing the four-lever linkage, respectively. This four-lever linkage transmits the pressure from the membrane to the guide roller. It is fixedly attached to the casing, with one of its joints, whereas the other three joints can be displaced in one plane. The four-lever linkage can thus be narrowed or drawn apart depending upon the advancing or retreating movement of the membrane rod.

The present invention will be better understood upon the following detailed description of the accompanying drawings, wherein—

Figure 1 is a front view partly in section of the control device of the present invention;

Figure 2 is a diagram illustrating the rocking control lever of the control device of the present invention.

Referring now to the drawings more in particular, the control device comprises the guide roller 1 which is rotatably positioned around bearing 2. The bearing 2 is hingedly supported by the branch 3 which is hingedly attached to support 4 at fulcrum 3*a* and can be lowered or raised in order to adjust the course of the web 5

passing over the roller 1. Deviations of the web 5 from its prescribed course are detected by the feel means A. The impulses created therein are transmitted by means of a pneumatic or hydraulic pressure medium via a transmission means comprising a membrane device B and a transmission gear C to the bearing 2 for the guide roller 1. Upon a corresponding displacement of the guide roller 1 the web is readjusted to its normal position.

The entire feel means A is arranged upon a carriage 7 which can be displaced upon the support 4 by means of a spindle 8. A feel lever 9 constantly scans the edge of the web 5. The web 5 leaving its prescribed course displaces the feel lever 9 and thus moves a control piston 10 which alternatingly closes and reopens an exhaust opening 11 in cylinder 22 and thus exerts a varying pneumatic or hydraulic pressure upon membrane 23. The control piston 10 is provided with a conically shaped upper portion having an edge 13. Because of the conical shape of this upper portion 12, the control piston leaves the exhaust opening 11 sufficiently unclosed in the central and normal position of the feel lever 9 so as to permit of an exhaust through the opening 11. The control piston 10 is hingedly fastened at 10*a* to the right end of feel lever 9, i.e. opposite to the scanning end of the latter. The feel lever 9 is fulcrumed at 9*b*. Particles of dirt and other undesirable substances are exhausted without causing any damage to the control device. The feel lever 9 is reset to its normal position by an adjustable pressure spring 14, arranged in cylinder 14*a*, via lever 14*b* hingedly fastened at 14*c* to the feel lever 9.

In Figure 2 of the drawings the feel lever 9 is shown in a displaced position caused by a deviation of the web 5 from its prescribed course. In this case the exhaust opening is entirely closed and the maximum pressure prevails within the pressure system.

The pressure medium is blown into the pipe conduit 15 (see Figure 1) by means of a blower device (not shown). Within this pipe conduit 15 there is arranged a locking cock 16, a reduction valve 17, and a manometer 18 for measuring the operating pressure. The conduits 19 and 20 are connected to the conduit 15 and through these conduits the pressure medium is conveyed to the feel means A and the membrane box B. The conduit 19 is connected to the control cylinder 22 and the conduit 20 is connected to the membrane casing 21 at 20*a*. According to the position of the control piston 10 the opening 11 is partly closed or entirely closed or entirely open and accordingly varying amounts of the pressure medium can be exhausted through opening 11 depending upon the respective position of the control piston. The pressure prevailing within the conduit 20 and hence the pressure conveyed to the control cylinder 22 varies accordingly. The same applies to the pressure within conduit 20 and within the membrane casing 21. The change of the pneumatic or hydraulic pressure results in a relative movement of the membrane 23 and the membrane casing 21. Due to an increase of the pressure exerted upon the surface of the membrane from the normal pressure to the maximum pressure the support plate 24 is displaced from its upper to its lower end position within the box 35. If the pressure drops to its minimum value which must be greater than the atmospheric pressure the support plate 24 reaches its upper end position.

The combined weight of the guide roller 1 and the bearing 2 exerted upon the support plate 24 is counteracted by resilient means which urge the guide roller in a longitudinal direction relative to the movement of the web. The resilient means incorporate two juxtaposed springs 36 of which only one has been shown in Figure 1 for the sake of clarity. The support plate 24 supporting the bearing 2 for the guide roller 1 is positioned within the box 35 in such a manner that the smallest possible amount of friction is produced during its ascending or descending movement. This can be done by positioning the support plate 24 in rails 37 and 38 and by providing a frictionless guide 39 for the support bolt 33 provided in the top portion of box 32.

The movement of the membrane is imparted to a membrane rod 25 which glides in a guide 26 fixedly connected to the membrane casing 21 and moves with one of its ends in a threaded sleeve 27. From there the movement is transferred to an operating mechanism in the form of a four-lever linkage having four hinge joints and composed of levers 28, 29, 30 and 31. From this linkage the movement is finally transferred to support plate 24. A support bolt 33 guided through the cover of the casing 32 is fixedly connected to the support plate 24. A support rod 34 positioned in bearing 2 runs upon the upper surface of this support bolt 33 and transfers the weight of the guide roller to the support bolt 33.

The linkage is connected with its four corners to the membrane casing 21 through the intermediary of a sleeve 41, the membrane rod which is composed of the rod proper indicated at 25 and a threaded sleeve 27 which receives the threaded end 40 of the rod 25, the entire membrane rod thus being composed of the threaded together parts 25 and 27, the support plate 24, and the box 35, respectively. The point of attachment at the box 35 is fixed whereas the other three points of connections are each displaceable in one and the same plane and depending upon a displacement of each of the other of the three corners.

According to the present invention the transmission means constituted by the above-described elements is constructed in such a manner that in addition to the automatic control of the course of the web the same can also be controlled manually.

For the sake of manual operation the membrane rod 25 carries at one of its ends the spindle 40 which can be rotated within the threaded sleeve 27. The rotation of the membrane rod 25 is done by turning the rotatable membrane casing 21 which is fixedly connected with the membrane rod 25 via the membrane 23. The levers 29 and 30 are attached to the threaded sleeve 27.

The guide sleeve at the left end of membrane rod 25 is composed of two portions one being the exterior sleeve 41. The levers 28 and 31 are hingedly fastened to this sleeve 41. The other portion consists of a portion 26 which is fixedly attached to the membrane casing 21. This portion 26 receives the square drag link. The membrane rod 25 is furthermore provided with a detent 42. By turning the membrane casing 21 around its axis coinciding with the axis of the membrane rod 25 the latter is turned within the threaded sleeve 27 until the detent 42 meets the guide sleeve 26. Whenever the membrane 23 is actuated by the minimum pressure only, the detent 42 automatically contacts the guide sleeve 26 since because of the decrease of the pneumatic or hydraulic pressure the support plate 24 is pressed to its upper end position under the influence of the springs 36, and the four-lever linkage moves the membrane rod 25 in leftward direction. If the membrane casing 21 is continued to be turned around its axis the threading 40 of the membrane rod pushes the threaded sleeve 27 to the outside and thus drags the support plate 24 to the lower position against the influence of the springs 36. Thereby the guide roller 1 is again adjusted to its desired position.

Since a large membrane is chosen comparatively low pressures are sufficient in order to transmit the impulses from the feel lever 9 to the guide roller 1. The pressure conduit 20 is so connected with the membrane casing 21 that the latter can be manually turned in clockwise or counterclockwise direction without twisting the pipe conduit 20. The degree of deviation of the guide roller 1 from its normal position can be read from a scale 43.

The pneumatic adjustment of the guide roller 1 is effected in such a manner that in the normal position of the web 5 the force of the pre-tensioned springs 36 is equal to the pressure exerted upon membrane 23 plus the weight of the guide roller 1 and the bearing 2. If the

membrane pressure decreases the excess force of the pre-tensioned springs **36** pushes the support plate **24** in upward direction. If the membrane pressure increases the four-lever linkage is pushed apart by membrane rod **25** and the support plate is pulled in downward direction against the counteracting influence of springs **36**. At any rate the pressure exerted upon membrane **23** is greater than the atmospheric pressure. If, for example, a membrane is chosen having a diameter of 250 millimeters the pressure is from 1.5 to 20 lbs./in.^{2}. In this case the normal pressure is 10.7 lbs./in.^{2}. The springs **36** are pre-tensioned to such a degree that the force of the spring amounts to 400 kilograms in the upper end position of support plate **24**, provided the combined weight of the guide roller and the bearing **2** amounts to 350 kg. Thus the membrane **23** has to transmit not more than 50 kg. in order to pull the support plate **24** in downward direction. Since the membrane works with comparatively small amounts of pressure the entire control device operates very sensitively. At the same time, a rocking or oscillating motion of the guide roller **1** is avoided during the adjusting operation and the control device soon reassumes its resting position.

It is also possible to effect the adjustment of the guide roller with the control device of the present invention by pre-tensioning springs **36** to such a degree that the weight of the guide roller **1** and the bearing **2** slightly exceeds the influence of the springs. In this case the pressure transmitted by the membrane **23** to bearing **2** acts in the same direction in which the springs act. In the lower end position of the support plate **24** caused by an extreme displacement of the feel lever **9** the guide roller **1** comes to rest upon a detent. Thereby the burden acting upon the membrane **23** is reduced.

It will be seen from the above that the transmission means constituted by the membrane rod, the operating mechanism and the resilient means is so arranged that upon rotation of the membrane casing, the length of the membrane rod is changed which, in turn, is concomitant with a change in the position of the guide roller, so that manual rotation of the membrane casing allows adjustment of the guide roller independently of that effected by the feel means.

In other words, the membrane casing forms part of a work motor, with the arrangement of the parts being such that this work motor is capable of operation within a predetermined overall range the limits of which are set by the dimensions of the parts. This work motor has a reciprocatory output, and by rotating the membrane casing, it can be moved axially in the direction of reciprocation and this will shift the position of the predetermined overall range without confining the effectiveness of the work motor to a range smaller than this overall range. It is in this way that if and when the web assumes a position at which automatic control is not effective, the work motor can be moved into a position in which the automatic control is once again effective to control the position of the web.

The control device of the present invention offers considerable advantages.

In the first place the automatic adjustment of the course of the web can also be effected manually both during the operation and in case the automatic adjustment does not work. This is particularly important if there is a defect in the pressure system. The degree of deviation of guide roller **1** from its normal position can be read from the scale **43** also if the adjustment is done manually. A separate manual adjustment of the guide roller **1** directly is unnecessary and the manual operation applied to the membrane casing **21** is sufficient in order to adjust the guide roller.

Furthermore, the control device can be inserted into the structure of paper machines with a minimum of available space. Especially if the control device is so positioned that the axis of the membrane runs vertically relative to the range in which the bearing for the guide roller moves the control device can be easily added to the structure of paper machines even if a plurality of guide rollers are positioned very close to each other. The rotatable membrane can be arranged at any available location outside of the range in which the adjustable guide roller moves. Due to this circumstance it is possible to use membranes having a comparatively large surface and consequently a comparatively low pressure of the pressure medium within the pressure system is sufficient for transmitting the impulses from the control lever to the guide roller.

Because of this low pressure attaining a maximum of 20 lbs./in.^{2} the membrane has a long life time.

The entire control device can be arranged in the paper machine in any desirable position provided the springs are accordingly dimensioned. It is easily accessible and therefore can be repaired without difficulty.

The control device works very sensitively and elastically and the oscillation of the edge of the web is reduced to a minimum.

The feel lever actuates only the control piston directly which has a comparatively small mass and the pressure exerted against the edge of the web is very small.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions, and, accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

What I claim is:

1. In a paper machine, a control device for adjusting the course of the web, comprising, in combination, an adjusting guide roller contacting the web across the lateral extension of the latter and abutting against at least one spring, feel means scanning the edge of the web, a cylinder and piston connected to said feel means, a rotatable membrane casing, a pressure medium, a pressure membrane rotatable with said casing and actuated by said feel means via said cylinder and piston, and transmission means interposed between said membrane and said guide roller, said transmission means incorporating a membrane rod fixed in the center of said membrane and rotatable therewith, resilient means incorporating a spring and urging said guide roller in a longitudinal direction relative to the movement of said web, and an operating mechanism interposed between and inter-connecting said membrane rod and said resilient means in such a manner that rotation of said membrane casing produces a change of length of an element of said transmission means other than said spring which, in turn, is concomitant with a change in the length of said spring as well as with a change in the position of said guide roller so that manual rotation of said membrane casing allows adjustment of said guide roller independently of that effected by said feel means.

2. In a paper machine, a control device for adjusting the course of the web, comprising, in combination, an adjusting guide roller contacting the web across the lateral extension of the latter, feel means scanning the edge of the web, a cylinder and piston connected to said feel means, a rotatable membrane casing, a pressure medium, a pressure membrane rotatable with said casing and actuated by said feel means via said cylinder and piston, and transmission means interposed between said membrane and said guide roller, said transmission means incorporating a membrane rod fixed in the center of said membrane and rotatable therewith, resilient means urging said guide roller in a longitudinal direction relative to the movement of said web, and an operating mechanism interposed between and interconnecting said membrane rod and said resilient means in such a manner that rotation of said membrane casing produces a change of length of said membrane rod which is concomitant with a change in the position of said guide roller so that manual rotation of said membrane casing allows adjustment of said

guide roller independently of that effected by said feel means.

3. A control device as described in claim 2, said membrane rod carrying a threaded sleeve and a spindle engaging said threaded sleeve.

4. A control device as described in claim 2, said membrane rod being composed of a plurality of portions which are threaded together.

5. In a paper machine, a control device for adjusting the course of the web, comprising, in combination, an adjusting guide roller contacting the web across the lateral extension of the latter, a displaceable bearing for said roller, a support plate carrying said bearing, feel means incorporating a cylinder and piston means, a rotatable membrane casing, a pressure pipe system intermediate said cylinder and piston means and said membrane casing, a pressure medium, a pressure membrane rotatable with said casing and actuated by said feel means via said cylinder and piston, a longitudinally adjustable membrane rod fixed in the center of said membrane and rotatable therewith, said membrane rod being longitudinally adjusted by turning said membrane casing, a gear box, transmission gear means in said gear box actuated by said pressure membrane via said membrane rod and displacing said guide roller, and a four-lever linkage composed of four bars which are so fastened to said membrane casing, said membrane rod, said support plate and said gear box as to form a pivoted parallelogram linkage, the attachment to said membrane casing being such as to leave the same free for rotation, a portion of said membrane rod forming the diagonal rod of said four-lever linkage.

6. A control device as described in claim 5, with the axis of said membrane situated substantially at right angles to the direction in which said guide roller is displaced.

7. In a paper machine, a control device for adjusting the course of the web, comprising, in combination, an adjusting guide roller contacting the web across the lateral extension of the latter, a displaceable bearing for said roller, a support plate, a support bolt mounted upon said support plate and having a smooth top surface, a roll mounted upon said bearing and contacted by the top surface of said support bolt, said support plate supporting said guide roller via said support bolt and said roll on said bearing, feel means incorporating a cylinder and piston means, a rotatable membrane casing, a pressure pipe system intermediate said cylinder and piston means and said membrane casing, a pressure medium, a pressure membrane rotatable with said casing and actuated by said feel means via said cylinder and piston, a longitudinally adjustable membrane rod fixed in the center of said membrane and rotatable therewith, said membrane rod being longitudinally adjusted by turning said membrane casing, a gear box, transmission gear means in said gear box actuated by said pressure membrane via said membrane rod and displacing said guide roller, and a four-lever linkage composed of four bars which are so fastened to said membrane casing, said membrane rod, said support plate and said gear box as to form a pivoted parallelogram linkage, the attachment to said membrane casing being such as to leave the same free for rotation, a portion of said membrane rod forming the diagonal rod of said four-lever linkage.

8. A control device as described in claim 7, the interior vertical walls of said gear box being provided with guides, said support plate being slidably arranged upon said guides in said gear box and said support bolt being slidably guided through the top portion of said gear box.

9. In a paper machine, a control device for adjusting the course of the web, comprising, in combination, an adjusting guide roller contacting the web across the lateral extension of the latter, a displaceable bearing for said roller, a support plate carrying said bearings, feel means incorporating a cylinder and piston means, a rotatable membrane casing, a pressure pipe system intermediate

said cylinder and piston means and said membrane casing, a pressure medium, a pressure membrane rotatable with said casing and actuated by said feel means via said cylinder and piston, a longitudinally adjustable membrane rod fixed in the center of said membrane and rotatable therewith, said membrane rod being longitudinally adjusted by turning said membrane casing, a gear box, transmission gear means in said gear box actuated by said pressure membrane via said membrane rod and displacing said guide roller, a pair of springs mounted within said gear box underneath said support plate and supporting said plate, said guide roller and said bearing, and a four-lever linkage composed of four bars which are so fastened to said membrane casing, said membrane rod, said support plate and said gear box as to form a pivoted parallelogram linkage, the attachment to said membrane casing being such as to leave the same free for rotation, a portion of said membrane rod forming the diagonal rod of said four-lever linkage.

10. A control device as described in claim 9, said springs being pre-tensioned to such a degree that they at least counteract the weight of said guide roller and said bearing, said membrane acting upon said bearing via said four-lever linkage against the force of said springs.

11. A control device as described in claim 9, said springs being pre-tensioned to such a degree that they do not wholly counteract the weight of said guide roller and said bearing, said membrane acting upon said bearing via said four-lever linkage against the force of said springs.

12. A control device as described in claim 9, further comprising a detent on said membrane rod, and a sleeve mounted against said membrane casing, said detent coming to rest against said sleeve unless pressure is exerted upon said membrane by said pressure medium.

13. A control device for adjusting the course of a vertically moving web as described in claim 9, with the gear box positioned underneath said adjusting guide roller.

14. In a paper machine, a control arrangement for adjusting the course of the web, said control arrangement comprising, in combination: an adjustable guide roller arranged in the path of the web and adapted to be contacted thereby; and automatic control means responsive to the position of the web and operatively associated with said guide roller for controlling the position thereof in response to the position of the web, said automatic control means incorporating a work motor having a reciprocatory output and being capable of operation within a predetermined overall range, said work motor being movable in the direction of reciprocation for shifting the position of said predetermined overall range without confining the effectiveness of said work motor to a range smaller than said predetermined overall range, whereby when the web assumes a position at which said automatic control means are not effective, said work motor may be moved into a position in which said automatic control means are once again effective to control the position of the web.

15. The combination defined in claim 14 wherein said work motor is manually movable in said direction of reciprocation.

16. The combination defined in claim 14 wherein said work motor incorporates a rotatable membrane casing which is so mounted that rotation of said membrane casing causes axial movement thereof in said direction of reciprocation.

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