United States Patent [19]

Kron

[11] **3,786,974**

[45] **Jan. 22, 1974**

[54] **WEB EDGE GUIDE SYSTEM**

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[73] Assignee: **Eastman Kodak Company,** Rochester, N.Y.

[22] Filed: **July 19, 1972**

[21] Appl. No.: **273,236**

[52] **U.S. Cl.** **226/19**

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

[58] **Field of Search** 226/15-23; 242/57.1

[56] **References Cited**

UNITED STATES PATENTS

3,317,101	5/1967	Himrod	226/19
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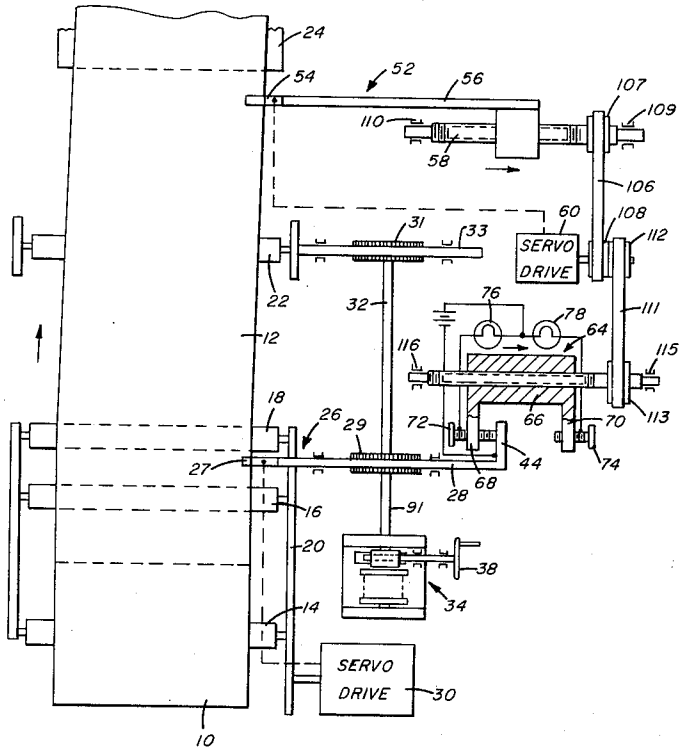
Attorney, Agent, or Firm—William T. French et al.

[57] **ABSTRACT**

Apparatus for limiting the maximum lateral web shift initiated by a web guiding system to a predetermined safe amount. A first web edge sensor adjacent the supply roll senses deviations from a normal web edge position and generates a correction signal which causes a servo-drive system to axially move the web supply roll in a direction to return the web to its normal position. A second web edge sensor longitudinally spaced along the web from the first sensor senses the web edge, and in response thereto positions stop members which limit corrective lateral shift of the first edge sensor to a predetermined safe amount.

14 Claims, 5 Drawing Figures



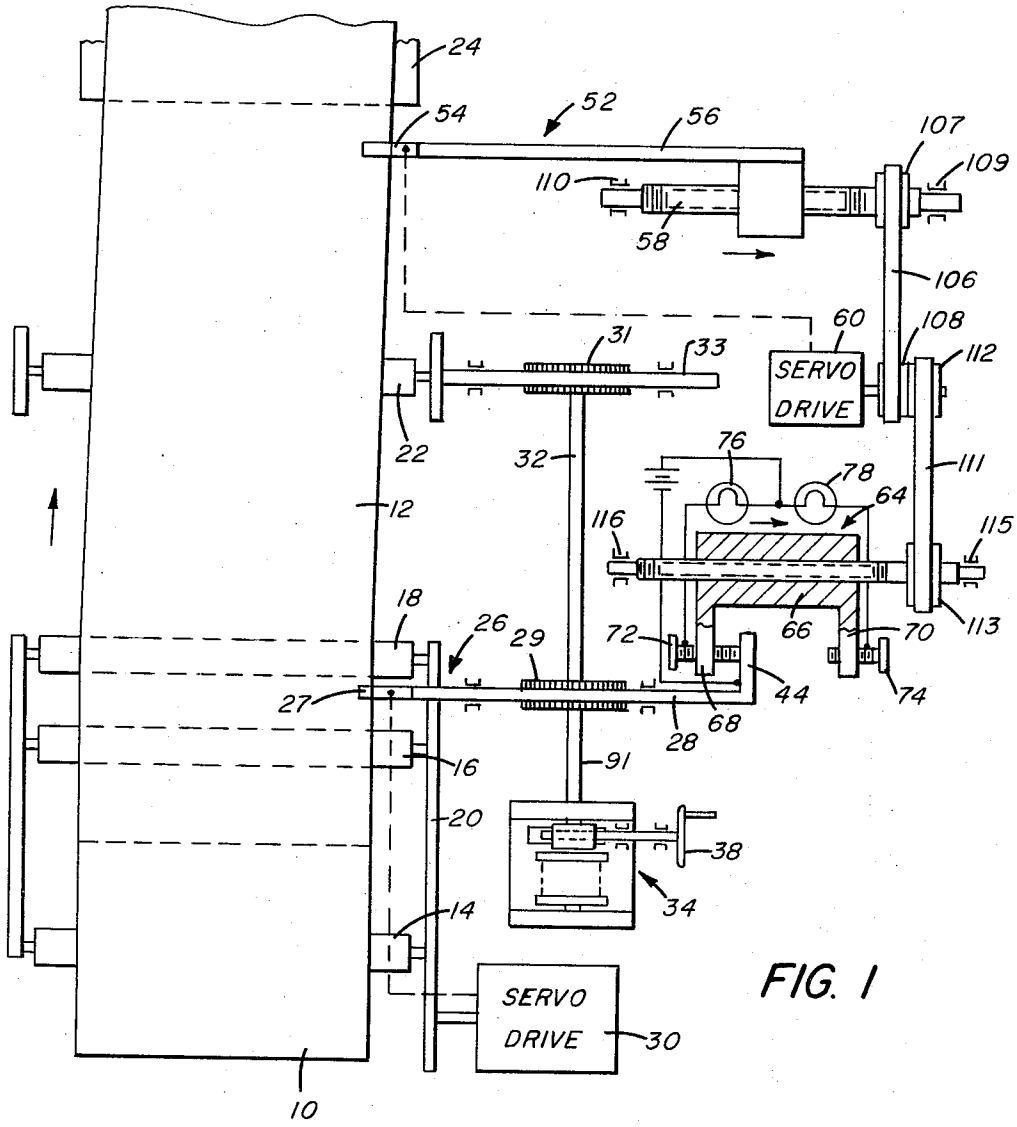

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FIG. 1

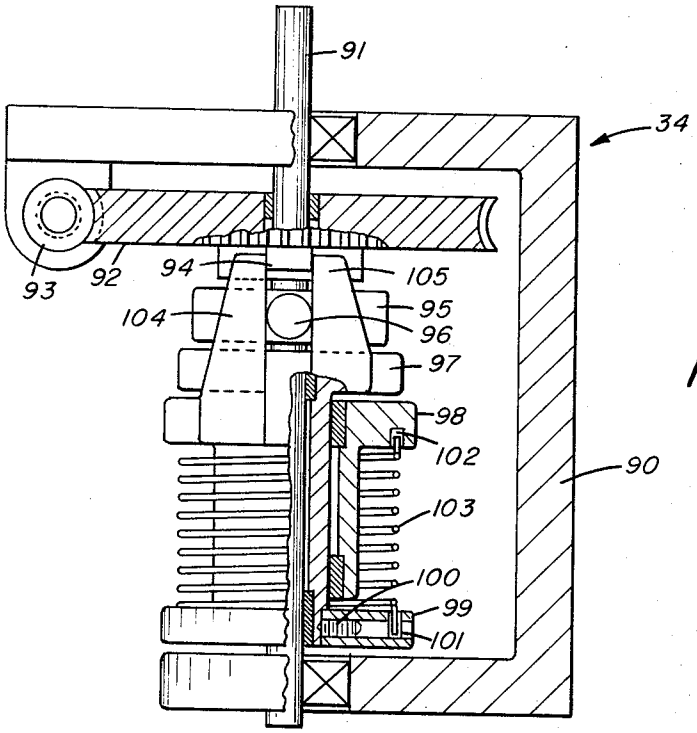

FIG. 2

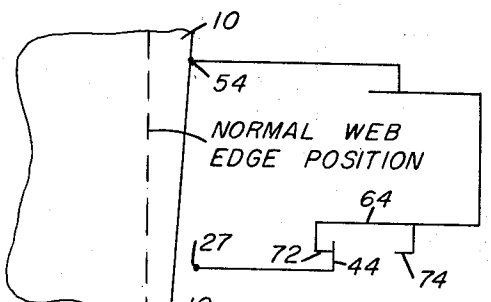

FIG. 3

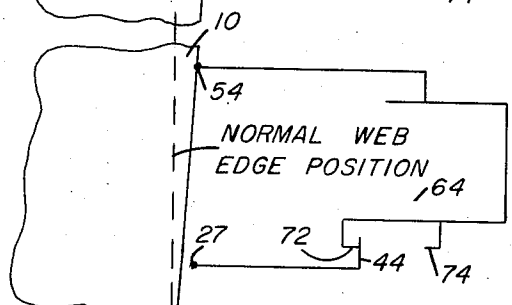

FIG. 4

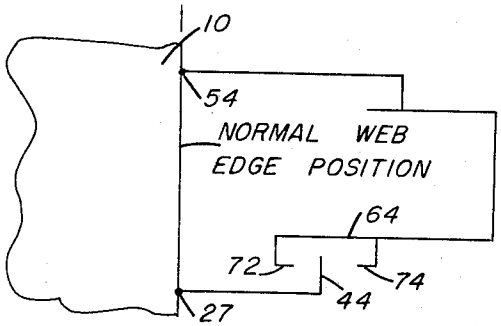

FIG. 5

WEB EDGE GUIDE SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the manufacture and processing of webs such as paper, plastic, film and the like. More particularly, the invention relates to means for continuously monitoring the lateral shift of the edge of a web from a normal desired position, and safely returning the web to the normal position.

2. Description of the Prior Art

In the production and processing of continuous webs, it is well known that web rolls are not wound with even intensity across the entire width of the roll, and that the tightness of winding may vary from side to side as the web unwinds. For this and other reasons, there is sometimes a stronger pull in one section of the web, which causes the web to move from side to side on the machine thereby producing uneven cuts or uneven transport of the web. Previous attempts to force the web to run in a selected straight path have incorporated a mechanical finger which operates gearing to shift the roll so as to keep the edge of the web in a straight line. Such mechanisms suffer from a slow response time because of the relatively massive control equipment required. Attempts to improve the tracking of the web material by controlling the position of the feed roll by a servo system actuated by a pneumatic sensor operated by the edge of the web have resulted in faster response times. However, too fast a response time can cause distortion of the web particularly when the amount of the correction introducted in the position of the feed roll is too large, thereby causing wrinkling or creasing of the web. This condition exists primarily during start-up of a machine due to the threading of the web by the operator in an off-normal or off-centered position.

SUMMARY OF THE INVENTION

In accordance with a preferred embodiment of the invention, a web edge guide system is disclosed of extremely simple construction which overcomes many of the prior art problems. The system is provided with stop members, which are sensitive to the position of the web edge, and which act to limit the amount of axial corrective movement imparted to the web supply roll. A first movable sensing means is provided for imparting axial corrective movement to the supply roll for returning the web to a normal position. A second movable sensing means senses the web edge, and in response thereto sets stop members for limiting the amount of corrective action permitted by the first sensing means to correct the position of the web edge. As the web gradually returns to its normal position, the first sensing means gradually returns the supply roll and web to its normal web edge position. The rate of return of the web edge to the normal web edge position is governed by adjustment of the limit stop members and by the rate of web travel.

It is, therefore, an object of this invention to limit the maximum amount of lateral shift correction applied to a transported web to a predetermined safe amount.

A further object of this invention is to provide an edge guide system which minimizes distortion of a web as it is unwound from a supply roll by limiting corrective movement of the supply roll.

A still further object of this invention is to provide an edge guide system wherein the allowable maximum lateral shift correction applied to the web may be quickly and easily changed, and in which the position of the web edge may be easily adjusted.

The invention and its objects and advantages will become more apparent from the detailed description of the preferred embodiment presented below.

BRIEF DESCRIPTION OF THE DRAWINGS

In the detailed description of the preferred embodiment of the invention presented below, reference is made to the accompanying drawings, in which:

FIG. **1** illustrates a schematic and diagrammatic representation of the web edge guide system of the present invention;

FIG. **2** is an enlarged, side elevational view, partly in section, of a web edge positioning device incorporated in the guide system of FIG. **1**;

FIG. **3** is a schematic representation of the web edge guide system in relation to a misaligned web illustrating how the corrective lateral shifting of the supply roll is limited;

FIG. **4** is a view similar to FIG. **3** illustrating gradual return of the web to its normal position; and

FIG. **5** is a view similar to FIGS. **3** and **4** illustrating the edge guide system and web in their normal position.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Because web production and transport equipment is well known, the present description will be directed in particular to elements forming part of, or cooperating more directly with, apparatus in accordance with the present invention. It is to be understood that elements not specifically shown or described herein may take various forms well known to those skilled in the art.

With reference to FIG. **1**, a web supply roll **10** is utilized to supply a web **12** to any form of web processing equipment. Web supply roll **10** is mounted on a supply core **14**, and web **12** from roll **10** is trained over a first idler roller **16**, a second idler roller **18** and a web drive drum **24**, preferably arranged at different elevations. Supply core **14** and idler rollers **16** and **18** are mounted on a single supply frame **20**. A movable idler roller **22** is positioned substantially half-way between idler roller **18** and web drive drum **24**.

A first web edge detector indicated generally at **26** includes a pneumatic sensor **27** of any suitable type of which the sensor shown in U. S. Pat. No. 1,982,685 is exemplary. Sensor **27** is mounted on a laterally movable arm **28** for sensing the position of the edge of web **12**, and depending on the position of arm **28**, generating an input signal through any suitable signal generating circuit for driving a servo drive **30**. Servo drive **30** serves to axially position frame **20** containing thereon supply core **14** and idler rollers **16** and **18**. A torque shaft **32** coupled by any suitable means such as gears **29, 31** to arms **28, 33** respectively via racks, not shown, axially positions idler roller **22** relative to frame **20** to prevent slippage between roller **22** and web **12**. For the configuration shown in FIG. **1**, this positioning structure is designed to move roller **22** one-half the distance that the pneumatic sensor **27** is moved by any suitable apparatus to be explained hereinafter.

In operation, sensor **27** will detect any deviation of the position of the web edge from the normal position, and will cause servo-drive **30** to move frame **20** in a di-

rection tending to return the web edge to its normal position.

A web edge positioner **34** is provided to position one edge of web **12** at a desired or normal position. The web edge positioner **34** which is shown in detail in FIG. **2** comprises a frame **90** for rotatably supporting a shaft **91** which is coupled to gear **29**. A worm wheel **92** having a radially spaced stop pin **94** is rotatably mounted on shaft **91**, and is rotatably driven by a worm **93** coupled to a hand crank **38**. A collar **95** having a radially extending pin **96** is secured to shaft **91**. An inner sleeve **97** is rotatably mounted on shaft **91**, and in turn rotatably supports an outer sleeve **98**. An adjusting collar **99** is rotatably mounted on sleeve **97** and adapted to be locked thereto by set screw **100**. The collar **99** and sleeve **98** are provided with bores **101, 102** respectively for receiving the ends of a helical spring **103** encircling sleeve **98**. By adjusting collar **99** and locking it to inner sleeve **97** with set screw **100**, spring **103** can be rotationally preloaded to rotatably urge sleeves **97** and **98** toward one another, causing stop lugs **104, 105** on sleeves **98, 97** respectively to engage pin **94**. Normally, pin **94** on wheel **92** is turned by crank **38** for moving shaft **91** and pin **96** by lugs **104, 105** for aligning sensor **27** in register with a desired position of the web edge. In such position, flange **44** is arranged substantially centrally of stop screws **72, 74**. In operation, as flange **44** is forced away from its normal position by one of the limit stop screws **72** or **74**, axial movement is imparted to arm **28** which rotates shaft **32** through gear **29**. Rotation of shaft **32** causes shaft **91**, collar **95** and pin **96** to be rotated. This, in turn, causes rotation of one of the stop lugs **104, 105** and its corresponding sleeve **98, 97** causing further tensioning of spring **103**. Tensioned spring **103** continues to apply a torque on pin **96** forcing arm **28** to return to its normal position when no longer restrained by one of the limit stop screws **72, 74**. This position is reached when both of the stop lugs **104, 105** bear against stop pin **94**. By moving stop pin **94** through worm wheel **92** and worm **93**, the position of shaft **91** and the normal running position of the web edge can be changed at will.

A second web edge detector indicated generally at **52** and longitudinally spaced along the web from detector **27** includes a pneumatic sensor **54** mounted on an arm **56** guided by any suitable means for axial movement to sense the web edge near drive drum **24**. One end of arm **56** is threaded and mounted on a threaded spindle **58** journaled for rotation in bearings **109, 110**. Spindle **58** is rotated by servo-drive **60** through belt **106** and pulleys **107** and **108** for axially positioning arm **56** and sensor **54**. The servo-drive **60** is coupled to sensor **54** and controlled by any suitable electrical or hydraulic means to continuously locate or position sensor **54** over the edge of web **12**. By means of a second belt **111** and pulleys **112** and **113**, servo-drive **60** rotates another threaded spindle **114** journaled for rotation in bearings **115, 116** for axially moving a frame **66** of a limiting device generally indicated at **64** for limiting lateral corrective movement of sensor **27** to a predetermined amount. Frame **66** is provided with integral depending fingers **68, 70**, through which adjustable threaded limit stop screws **72, 74** respectively extend. In a normal position of the web edge guide system, sensors **27, 54** are in register with a desired normal web edge position, and limiting device **64** is adjustably positioned with flange **44** extending substantially between limit stop screws **72** and **74** as best seen schematically in FIG. **5**.

If web **12** is initially threaded over rollers **16, 18** and **22** and drive drum **24** in a misaligned condition, and transport of the web commenced, edge sensor **54** will indicate a misaligned position to servo-drive **60** which thereby repositions arm **56** until sensor **54** is centered over the web edge as seen in FIG. **3**. The operation of servo-drive **60** simultaneously causes movement of limiting device **64** in the same direction as arm **56**, thereby moving fingers **68, 70** and screws **72, 74** off-center with respect to flange **44**. If the initial misalignment of web **12** is large enough, a limit screw **72** or **74**, depending on the direction of the misalignment, will engage flange **44** and move arm **28** and sensor **27** out of its normal position. Such movement also imparts movement to shaft **91**, pin **96** and one of the lugs **104, 105** against the bias of spring **103**. The maximum allowable lateral movement of flange **44** and sensor **27** is pre-set by limiting device **64** and limit screws **72** and **74**, and is generally substantially half the distance between the ends of the two limit screws minus the width of arm flange **44**. The maximum allowable lateral movement of sensor **27** depends on the characteristics of web **12**, and the physical layout of the machine between supply frame **20** and web drive drum **24**. In general, the movement should be large, but not so large that web **12** wrinkles or creases as it moves from supply roll **10** to web drive drum **24**. The pneumatic sensor **27** senses the misalignment and transmits a signal to servo-drive **30**, which in turn axially moves from **20** core **14**, rollers **16** and **18** and supply roll **10** in a direction to reposition the edge of web **12** under sensor **27**.

A few seconds after web transport is commenced, the web will tend to decrease its offset between roller **18** and drive drum **24** due to the corrective action of servo-drive **30**, among other reasons, as best seen in FIG. **4**. Sensor **54** will sense this decrease and signal servo-drive **60** to reposition both edge detector **52** and limiting device **64** to the new web edge position. Spring **103** forces pin **96** and shaft **91** in a direction moving sensor **27** toward the web edge consistent with limit screw **72**. This process continues until the web edge and sensors **27, 54** are in register with the normal web edge position as seen in FIG. **5**. In this position, lugs **104, 105** are in engagement with pin **94** and shaft **91** positioned to locate flange **44** substantially in the center of limit stops **72** and **74**.

During continued transport of web **12**, the edge guide system of this invention will limit the corrections introduced in the web position to those pre-set by adjustable limit stop screws **72, 74**, thereby limiting the maximum angle by which the web can deviate from a straight line. Since limit stops **72, 74** are each adjustable, they can be repositioned to vary the amount of lateral shift in the web edge. Sensor **27** and servo-drive **30** should be calibrated and adjusted such that flange **44** is centered between stop lugs **72, 74** when the web is transported through the machine in a straight line.

It is also possible to incorporate pilot lights **76, 78** into limiting device **64** to indicate an initial web misaligned condition and thereby assist in proper threading of the web through the machine. One terminal of each of pilot lights **76, 78** is connected to one terminal of battery **80**, and the other terminal of battery **80** connected to flange **44**, formed from a conductive material. The outer terminals of pilot lights **76, 78** are re-

spectively connected to one of the limit stops **72, 74.** An electrical circuit will be completed whenever flange **44** contacts one of the limit stops **72, 74** and the respective pilot light is lit, indicating this fact to the operator.

The invention has been described in detail with particular reference to a preferred embodiment thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

I claim:

1. Apparatus for detecting and correcting the lateral position of a longitudinally travelling web, said apparatus comprising:

first means for sensing the lateral position of said web at a first position and in response thereto for correctively laterally displacing said web, if misaligned, to a predetermined lateral position at said first position;

second means for sensing the lateral position of said web at a second position, said second position being spaced apart from said first position along the longitudinal dimension of said web; and

means interconnecting said first and second means for limiting the maximum corrective lateral displacement imparted to said web by said first mans to a predetermined amount.

2. The invention according to claim **1** wherein said first means comprises a movable sensing member, a sensor on said sensing member, and a pair of opposed resilient members coupled to said sensing member for biasing said sensor to a predetermined position corresponding to said predetermined lateral position of said web.

3. The invention according to claim **2** wherein said inter-connecting means comprises means for preventing movement of said sensing member to said predetermined position so long as the lateral displacement of said web between said first and second positions is at least as great as said predetermined maximum amount of displacement.

4. The invention according to claim **3** wherein said movement preventing means includes stop members responsive to said second means, said stop members being positionable within the path of movement of said sensing member for preventing movement thereof.

5. The invention according to claim **2** wherein said inter-connecting means comprises a pair of opposed stop members, one of said stop members being positionable within the path of movement of said sensing member to prevent movement of said sensing member to its predetermined position whenever the lateral displacement of said web between said first and second positions is at least as great as said predetermined maximum amount of lateral displacement.

6. The invention according to claim **5** wherein said inter-connecting means further comprises a pair of signal lights, each of said signal lights being responsive to movement of one of said stop members to a position wherein it prevents movement of said sensing member.

7. The invention according to claim **1** wherein said inter-connecting means comprises means for indicating whenever the lateral displacement of said web between said first and second positions is at least as great as said predetermined maximum amount of lateral displacement.

8. The invention according to claim **7** wherein said indicating means comprises a pair of signal lights.

9. The invention according to claim **1** wherein said inter-connecting means comprises a pair of opposed stop members, said stop members being responsive to said second means for movement to a position whereby said stop members inhibit repositioning of said web to said predetermined lateral position so long as the lateral displacement of said web between said first and second positions is at least as great as said predetermined maximum amount of lateral displacement.

10. The invention according to claim **9** wherein said first means comprises means responsive to movement of said stop members to said inhibiting position for partially repositioning said web.

11. The invention according to claim **10** wherein said first means comprises a movable sensing arm, a sensor on said arm, and a pair of opposed resilient members coupled to said arm for biasing said arm and sensor towards a predetermined position corresponding to said predetermined lateral position of said web, said stop members preventing movement of said arm to its predetermined position whenever said stop members are in said inhibiting position.

12. The invention according to claim **11** wherein said inter-connecting means further comprises a pair of signal lights, each of said signal lights being responsive to movement of one of said stop members to said inhibiting position.

13. Apparatus for detecting the lateral position of a longitudinally travelling web and for moving said web to a predetermined lateral position without exceeding a predetermined maximum amount of lateral displacement, said apparatus comprising:

first and second movable sensing arms, said arms sensing the lateral position of said web at first and second positions, said sensing positions being spaced apart from each other along the longitudinal dimension of said web;

a pair of opposed resilient members coupled to said first arm for biasing said first arm towards a predetermined position corresponding to said predetermined lateral position of said web;

means responsive to the position of said first arm for moving said web towards said predetermined lateral position; and

a pair of opposed stop members, said stop members being responsive to the position of said web at said second position for movement to a position within the path of movement of said first arm to prevent movement of said first arm to its predetermined position whenever the lateral displacement of said web between said first and second positions is at least as great as said predetermined maximum amount of displacement.

14. The invention according to claim **13** wherein said apparatus further comprises a pair of signal lights being responsive to movement of one of said stop members to its movement preventing position.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,786,974 Dated January 22, 1974

Inventor(s) Martin W. Kron

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 3, line 46 delete "27" and insert--26--.

Col. 4, line 31 delete "from" and insert--frame--.

Col. 5, line 25 delete "mans" and insert--means--.

Signed and sealed this 7th day of May 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents