

Jan. 19, 1954

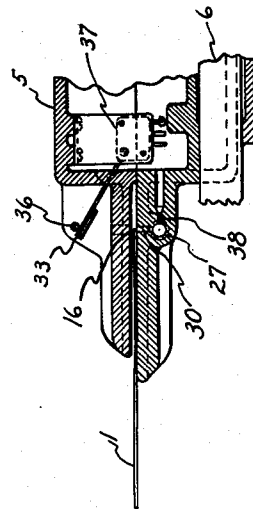
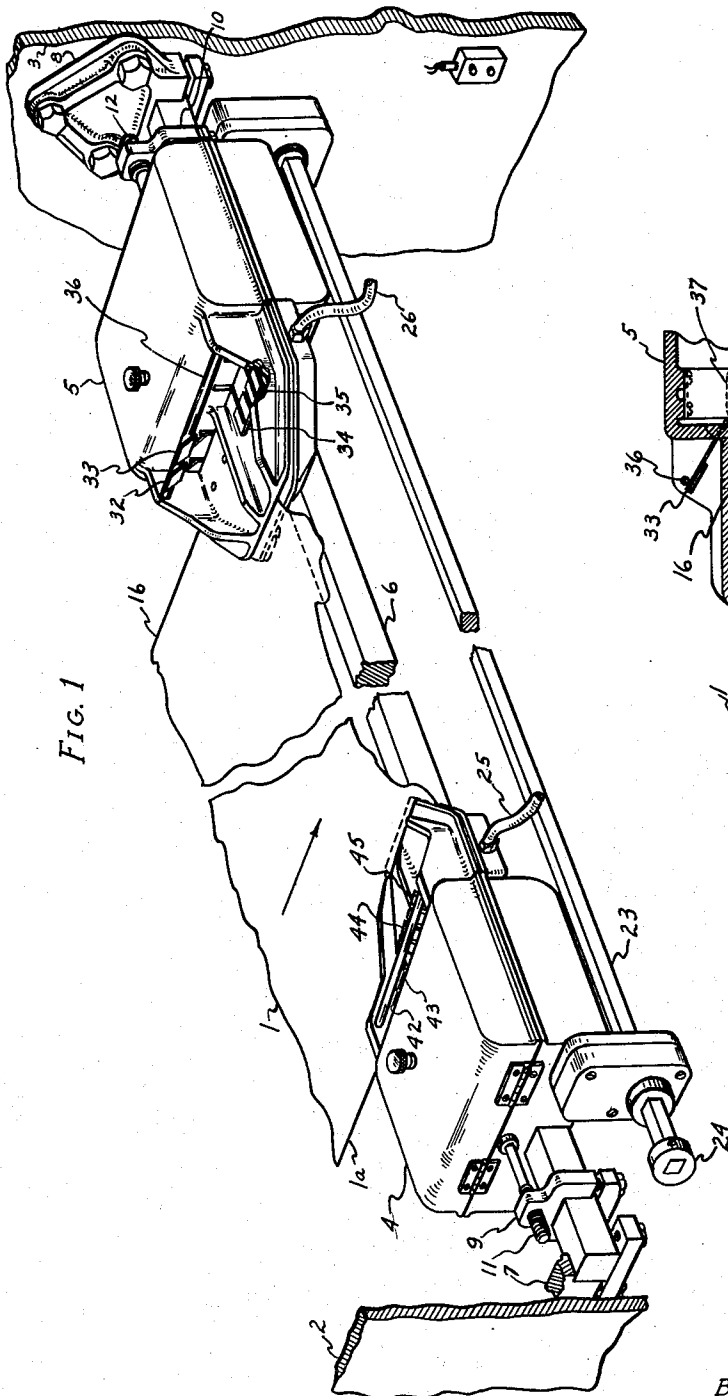
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2,666,639

WEB CENTERLINE CONTROL DEVICE

Filed May 14, 1951

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

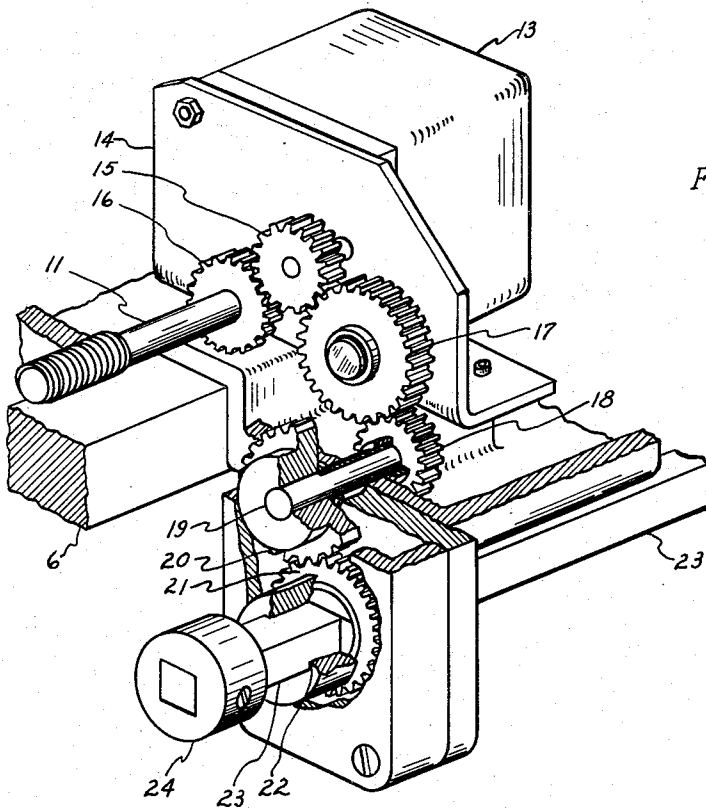


FIG. 3

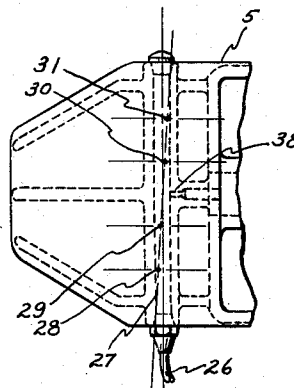


FIG. 4

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3 Sheets-Sheet 3

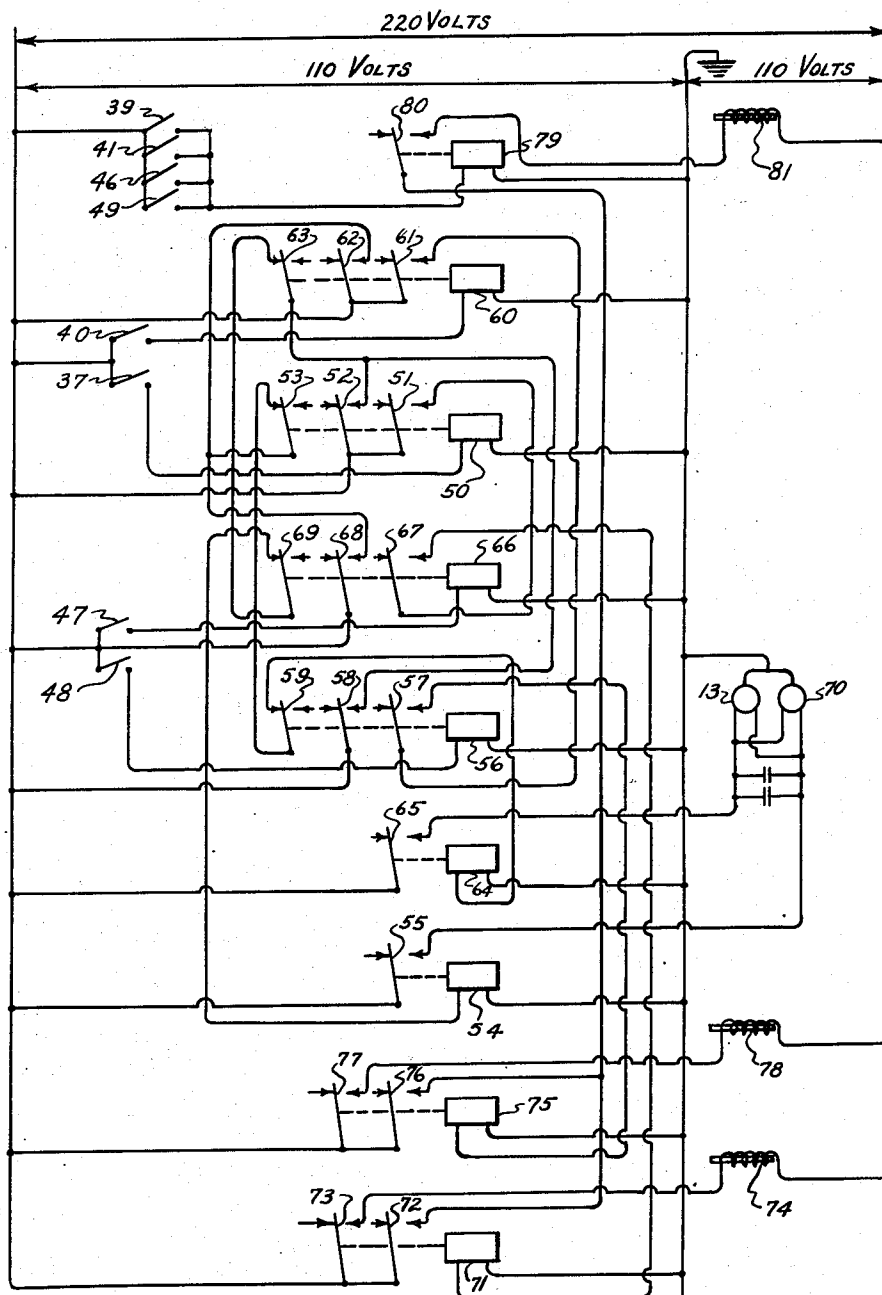


FIG. 5

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2,666,639

WEB CENTERLINE CONTROL DEVICE

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Application May 14, 1951, Serial No. 226,158

5 Claims. (Cl. 271—2.6)

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This invention relates generally to a method and device for centering a moving web in order to control an operation thereon. More specifically, it relates to a device used to detect the lateral position of a continuous moving web of paper as it travels through a printing press, and to initiate corrections which will cause the centerline (that is, the line midway between the two edges) of the web to be returned to a constant position relative to the press frame or other fixed point of reference.

While the device is specifically useful on a multi-color printing press which prints on a paper web, it can be used as well on any machine carrying a continuous web, and will control any solid web material, opaque or transparent, such as cellophane, plastic, metal, coated cloth, and the like and maintain such webs centered on a predetermined reference line or point.

In one important embodiment of my invention the detecting portion of the device comprises two scanners, one located at each edge of the web. These scanners detect the location of the web to operate a control circuit in such a way that, if there is any variation in the width of the web, the scanners move together or apart to adapt themselves to the change in width.

If the web moves sidewise, the scanners detect this fact, and operate a control circuit which will cause an aligning means, such as a set of pivoted rolls to operate to return the web to its proper position. There are many different types of aligning means in common use, and this description does not apply to any particular means, but works equally well with any of them. My invention is in the centering of a web regardless of variation in width by moving the two scanners to always stay symmetrically with respect to the desired centerline and to follow the width of the web, and this has hitherto not been accomplished.

My invention can be further understood by referring to the drawings. These drawings represent details of a system using pneumatic scanners and electrical control circuits. In these drawings:

Fig. 1 is a general view of the mechanism used to detect the position of the web.

Fig. 2 is a cross-section view of part of one of the scanners, showing the relation of the edge of the web to an air orifice and a vane switch.

Fig. 3 is a cut-away perspective view showing the relation of the scanner positioning electric motor, and the gears and position screw operated by the motor.

Fig. 4 is a partial view of the scanner showing

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the relative location of the four air orifices of one scanner.

Fig. 5 is a wiring diagram showing the basic parts of the electrical circuit.

Referring to Figures 1 and 2, the web 1, with edges 1a and 1b, is shown as moving in the direction of the arrow, through a machine having frame sides 2 and 3. The scanners 4 and 5 are supported by a square metal bar 6, which in turn is supported by bracket assemblies 7 and 8, attached to the machine frame sides 2 and 3 by screws. Clamp blocks 9 and 10 are rigidly fastened to bar 6, while scanners 4 and 5 are free to slide on bar 5 and are located on this bar by positioning screws 11 and 12, which engage female threads tapped into clamp blocks 9 and 10.

Referring to Figure 3, a cut-away view of part of scanner 4 shows a reversible electric motor 13, mounted within scanner 4 on bracket 14. Gear 15 is fastened to the output shaft of motor 13, and meshes with gear 16 attached to positioning screw 11. Rotation of the motor output shaft thus causes rotation of the positioning screw 11 and this causes movement of the scanner 4 toward or away from the web, depending on the direction of rotation of the motor. A similar motor and gear train are enclosed in scanner 5 to cause rotation of screw 12. The electric motors in both scanners 4 and 5 are wired in parallel, so that they operate at the same time, and their direction of rotation is such that the scanners simultaneously move toward the web, or "close," or else they both move away from the center of the web, or "spread."

To make sure the scanners always remain equidistant from the desired centerline, and are not allowed to vary their location due to minute but cumulative differences in speed or deceleration, the scanners are connected mechanically by gearing and a spline bar. Referring to Figure 3, gear 17 is an idler which transmits motion from gear 16 to 18, thence to shaft 19 and gear 20, which drives gear 21 having a square hole 22 in its center. A square "spline" bar 23 passes through this hole and is caused to rotate by the rotation of gear 21. This bar 23 is also shown in Figure 1. A similar gear train exists in scanner 5. Thus it will be seen that one revolution of positioning screw 11 must be accompanied by exactly one revolution of positioning screw 12, since screws 11 and 12 are mechanically connected by gearing and by spline bar 23. A collar 24 is fastened to each end of bar 23 to prevent bar 23 from sliding out of the square hole 22.

Referring to Figures 1 and 2, compressed air

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at a pressure of about 20 pounds per square inch is admitted to the scanners through flexible air lines 25 and 26. Referring to Figures 2 and 4, this air is carried by air line 26 to hole 27, from which it passes through orifices 28, 29, 30 and 31 (each about $\frac{1}{2}$ inch in diameter). As air passes the edge 1b of the web, it strikes vanes 32, 33, 34 and 35, each of which is positioned to be operated by one of the orifices. Figure 2 shows how air striking vane 33 causes it to move to a stop 36 and operate switch 37. Orifices 28, 29, 30 and 31 are arranged on a diagonal line, relative to the edge of the web, so that when the edge of the web is in normal position, orifices 28 and 29 are covered, and orifices 30 and 31 are uncovered. In this normal position, vanes 34 and 35 are down, and vanes 32 and 33 are held against stop 36 by air from orifices 31 and 30. If the edge of the web moves to cover orifice 30, vane 33 will move away from stop 36, due to spring action within switch 37, and contacts will close within switch 37. If the edge of the web moves to uncover orifice 29, vane 34 will be forced against stop 36 by air from orifice 29, and this will close contacts within the switch attached to vane 34. Each of the four vanes in each scanner operates an individual switch, and each switch is wired in such a manner that when the web is in normal position, the switch contacts are open. A hole 38 is provided in each scanner, to allow air from passage 27 to be admitted to the interior of the scanner, pressurizing it and retarding the entrance of dirt from the atmosphere.

I have described compressed air detecting means but it is to be understood that other detecting means such as electrical contacts, magnetic means, photoelectric devices and the like can also be used.

In the wiring diagram (Figure 5) all switches and relays are shown in condition in which they would be found when the web is running in its normal position, i. e., with orifices 30 and 31 in scanner 5 and the corresponding orifices in scanner 4 uncovered. Thus, the switches are all open and the relays de-energized.

Referring to Figure 5 and Figure 1, vane 32 operates switch 39, vane 33 operates switch 37, vane 34 operates switch 40, and vane 35 operates switch 41, all on scanner 5. On scanner 4, vane 42 operates switch 46, vane 43 operates switch 47, vane 44 operates switch 48, and vane 45 operates switch 49.

Switches 37, 40, 47, and 48 determine the direction and type of correction while switches 39, 41, 46 and 49 affect the speed of web corrections. Four corrections may be caused to occur. The scanners may close. The scanners may spread. The web may be moved toward scanner 4. The web may be moved toward scanner 5.

To further illustrate my invention, the operation of my device is described if the edges of the web move from their normal position. A movement causing one of the switches to depart from its normal position is referred to as "violation".

The physically possible violations are listed below. In addition to the violations listed, there are several other possibilities. These may be found by taking all the possible combinations of switches 37, 40, 47, and 48. These violations cannot take place, however, when the system is operating properly.

A. If vane 33 falls, switch 37 closes. This causes relay 50 to be energized, which closes contacts 51 and 52 and opens contact 53. When contact 52 closes, relay 54 is energized and closes

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contact 55. This energizes the reversible scanner motors 13 and 70 and causes them to run in such a direction that the scanners spread.

B. If vane 44 falls, switch 48 closes. This energizes relay 56 which causes contacts 57 and 58 to close and contact 59 to open. When contact 58 closes, relay 54 is energized and contact 55 closes. This again causes the motors 13 and 70 to run in such a direction that the scanners spread.

C. If vane 34 is caused to rise by air from orifice 29, switch 40 will close and energize relay 60 which will cause contacts 61 and 62 to close and contact 63 to open. When contact 62 closes, relay 64 is energized and contact 65 is closed. The closing of contact 65 energizes the scanner motors 13 and 70 and causes them to run in such a direction that the scanners close.

D. If vane 43 is caused to rise, switch 47 will close and energize relay 66 which will cause contacts 67 and 68 to close and contact 69 to open. When contact 68 closes, relay 64 is energized and contact 65 is closed. The closing of contact 65 energizes the scanner motors 13 and 70 and causes them to run in such a direction that the scanners close.

E. If vanes 33 and 44 both fall, switches 37 and 48 both close. Relays 50 and 56 are energized, closing contacts 51, 52, 57, and 58 and opening contacts 53 and 59. This completes the circuit through contacts 52, 58, 63 and 69 and energizes relay 54. Contact 55 again closes and causes the scanner motors 13 and 70 to run and the scanners to spread.

F. If vanes 34 and 43 are both caused to rise, switches 40 and 47 both close. Relays 60 and 66 are energized, closing contacts 61, 62, 57, and 68 and opening contacts 63 and 69. This completes the circuit through contacts 62, 68, 53, and 59 and energizes relay 64. Contact 65 closes and causes the scanner motors 13 and 70 to run and the scanners to close.

G. If vane 33 falls and vane 43 rises, switches 37 and 47 will close and energize relays 50 and 66. Contacts 51, 52, 67 and 68 will close and contacts 53 and 69 will open. Contacts 53 and 69 open the circuits to relays 54 and 64, respectively, so that the closing of contacts 68 and 52 will not cause the scanner motors to operate. Contacts 51 and 67 are wired in series with relay 71, and this relay is therefore energized. Contacts 72 and 73 are closed. When contact 73 is closed, the circuit to solenoid valve 74 is completed. Energizing the solenoid 74 causes the compensating mechanism to move the web toward scanner 4.

H. If vane 34 rises and vane 44 falls, switches 40 and 48 will close and energize relays 60 and 56. Contacts 61, 62, 57, and 58 will close and contacts 63 and 59 will open. Contacts 63 and 59 open the circuits to relays 54 and 64 respectively, so that the closing of contacts 58 and 62 will not cause the scanner motors to operate. Contacts 61 and 57 are wired in series with relay 75, and this relay is therefore energized. Contacts 76 and 77 are closed. When contact 77 is closed, the circuit to solenoid valve 78 is completed. Energizing the solenoid 78 causes the compensating mechanism to move the web toward scanner 5.

I. If one or more of the switches 39, 41, 46 and 49 close, the circuit to relay 79 will be completed. When relay 79 is energized, contact 80 closes. If compensation is taking place when relay 79 is energized, i. e., if either relay 71 or relay 75 is energized at the same time, the circuit to solenoid valve 81 is completed through contacts 72

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and 80 or through contacts 76 and 80. Energizing solenoid valve 81 causes an increase in the rate of compensation. For example, if hydraulic compensating motors are used, solenoid valve 81 (when it is energized) increases the rate of flow of oil through these motors. The closing of one or more of these switches does not increase the rate at which the scanners close or spread.

The violations listed under "A" and "B" above indicate that the web has become wider and also is off center. The scanners are first caused to spread, and by so doing will give an indication causing the web to be moved in the proper direction to center it. With the connections as shown, the positioning of the scanners is first corrected, and after this move is completed, the web is properly positioned. By rearranging the relay contacts, it is possible to reverse this sequence and compensate first, with the scanner adjustment taking place when compensation is completed. Another connection makes it possible to make both corrections simultaneously.

The violations listed under "C" and "D" above indicate that the web has become narrower and also is off center. The scanners are first adjusted to the new web width and, when so adjusted, will give an indication which will cause the web to be centered. As in the case of a wider web, the order of these corrections may be reversed or both may be accomplished at once by a change in the wiring of the relays.

A pulsing amplifier may be used in conjunction with this system to give a pulsing compensation. In this case, relays 71 and 75 are energized pulsating by placing the contacts of a pulsing relay in series with the coils of these relays. The pulsing relay coil is energized and de-energized at the proper rate by being connected in the plate circuit of the pulsing amplifier. This amplifier is a special multivibrator-type circuit. When it is used in conjunction with this system, an increased rate of compensation is obtained by using relay 79 to change the amount of resistance in the grid circuit of one of the multivibrator tubes.

Referring to Figure 1, the operation of the system may be summarized as follows: When one or both of vanes 33 and 44 are caused to fall, the scanners spread. When one or both of vanes 34 and 43 are caused to rise, the scanners close. When vane 33 falls and vane 43 rises, the web is moved toward scanner 4. When vane 34 rises and vane 44 falls, the web is moved toward scanner 5. When one or more of vanes 32, 35, 42, and 45 depart from their normal positions, the web compensation rate is increased.

I claim:

1. A device for centering a moving web varying in width along a longitudinal center-line comprising signal sending means positioned adjacent each edge of said web, signal receiving means positioned with respect to said web and said signal sending means so as to be responsive to the transverse position of the edges of said web with respect to said signal sending means, means adjusting the distance between said signal sending means disposed on each side of the web along a line generally transverse to said center line, means responsive to signals received by either or both of said signal receiving means controlling said width adjustment of said signal sending means in accordance with varying widths

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in said web independent of the centering of said web, and means responsive to signals received by both of said signal receiving means indicating the center of said web relative to said center-line.

2. The device of claim 1 further defined by means for initiating the movement of said web laterally in response to signals received by said signal receiving means thereby maintaining said center of said web substantially on said center line.

3. A device for keeping a web in center position with respect to a fixed center line comprising two exploring heads having each at least one reference means sensitive to lateral displacement of the edge of said web with respect to said means and positioned near the two edges of said web, means responsive jointly to signals from each of said exploring heads indicating lateral displacement of said edges of said web in directions non-opposite to each other and including means for initiating lateral movement of said web, and means responsive jointly to signals from either or both of said exploring heads indicating lateral displacement of said edges of said web in directions opposite to each other and including means to move said two exploring heads simultaneously and symmetrically with respect to said centerline.

4. The device of claim 3 further defined in that said reference means is operated in response to pneumatic pressure.

5. A device for centering a moving web varying in width along a longitudinal centerline comprising signal sending means positioned adjacent each edge of said web, said signal sending means comprising a scanner provided with four orifices arranged on a diagonal line relative to the edge of said web and positioned so that when the edge of said web is in normal position said web covers two of said orifices and including means for admitting compressed air to said orifices, signal receiving means positioned with respect to said web and said signal sending means so as to be responsive to the transverse position of the edges of said web with respect to said signal sending means, said signal receiving means comprising a vane member associated with each of said orifices and operated in response to the passage of air through its associated orifice, means adjusting the distance between said signal sending means disposed on each side of the web along a line generally transverse to said centerline, means responsive to signals received by either or both of said signal receiving means controlling said width adjustment of said signal sending means in accordance with varying widths in said web independent of the centering of said web, and means responsive to signals received by both of said signal receiving means indicating the center of said web relative to said centerline.

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