

April 6, 1965

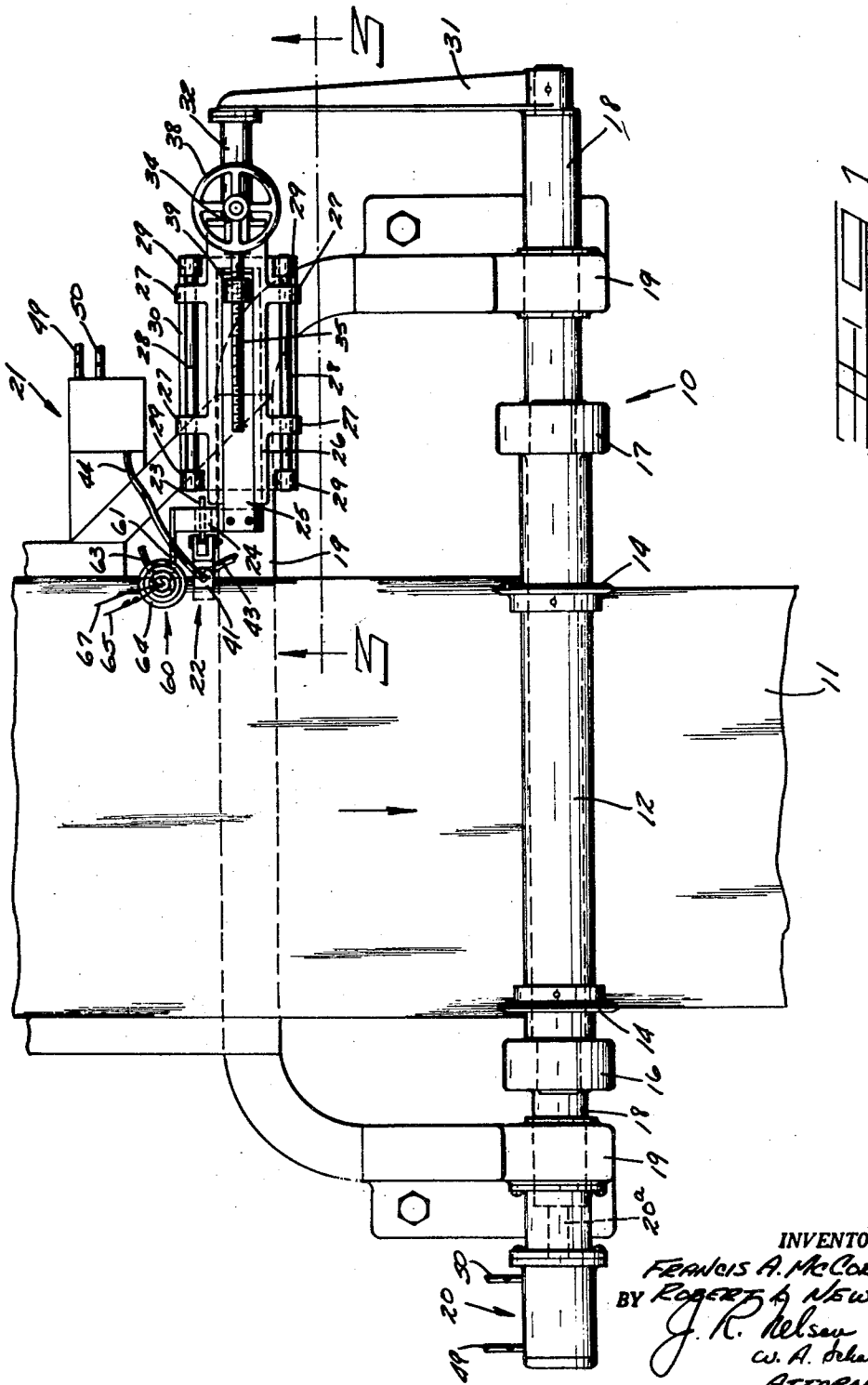
F. A. McCORMICK ETAL

3,176,567

SLITTER MACHINE WITH AUTOMATIC EDGE CONTROL

Filed May 15, 1961

3 Sheets-Sheet 1



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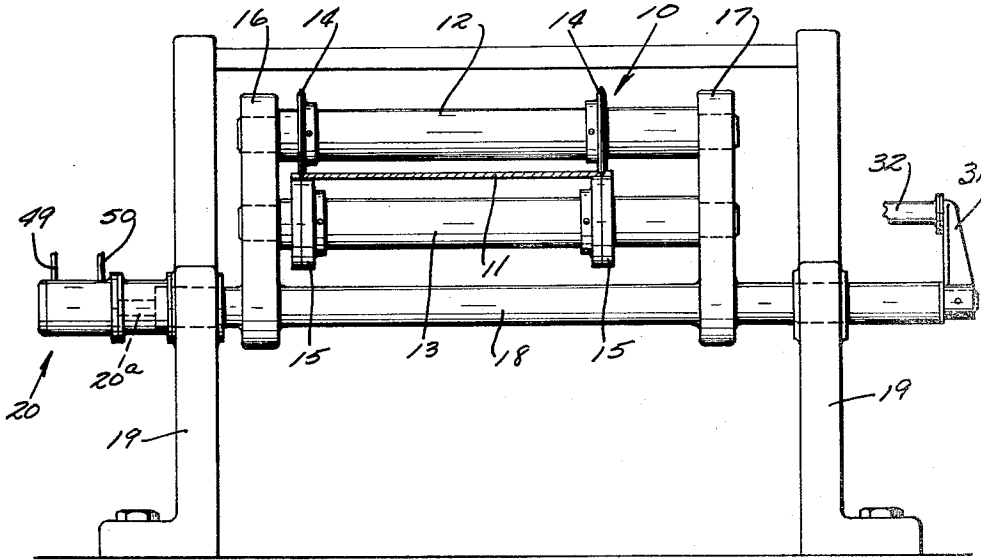
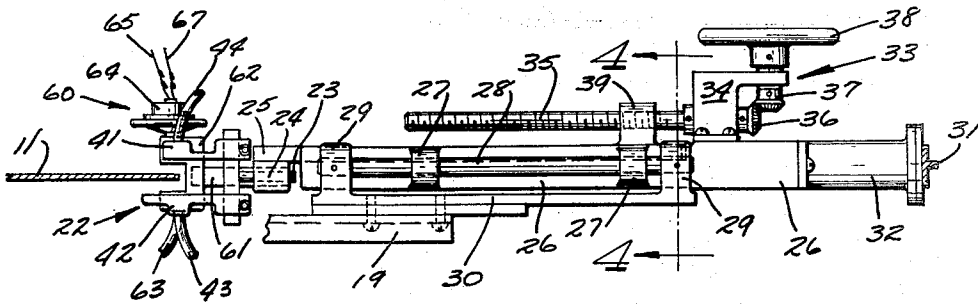
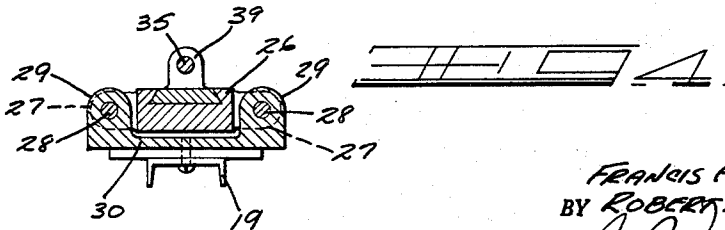
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3 Sheets-Sheet 2



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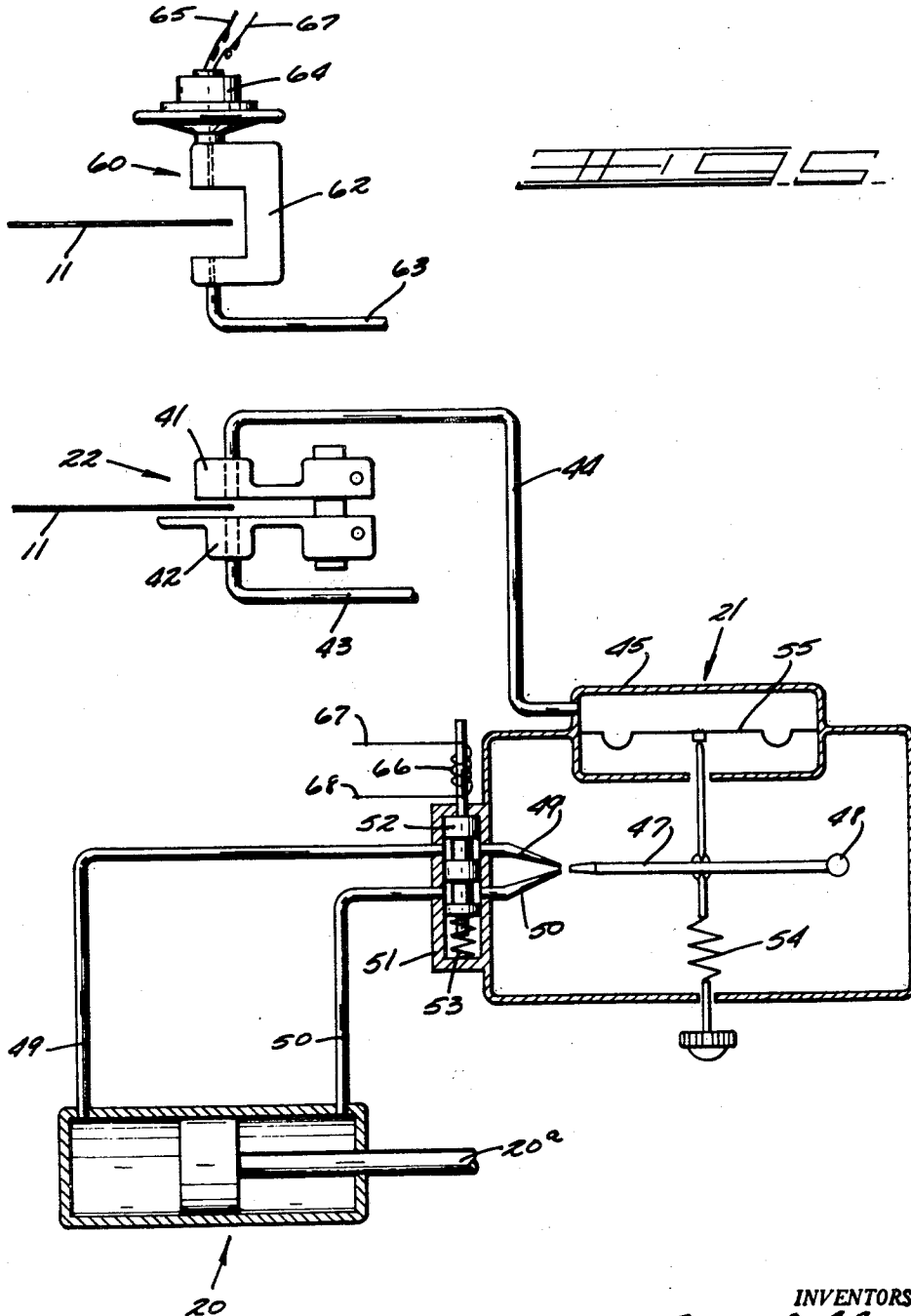
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SLITTER MACHINE WITH AUTOMATIC EDGE CONTROL

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3 Sheets-Sheet 3



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3,176,567 SLITTER MACHINE WITH AUTOMATIC EDGE CONTROL

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The present invention relates to improved trimming on a machine known as a slitter-scorer machine, wherein a web of corrugated paper board as furnished from a corrugator stand is fed through a rotary slitter knife and trimmed to a predetermined width. More particularly, the present invention involves a coupled automatic control for the slitting means which shifts the slitter laterally on the machine to follow a predetermined orientation with an edge of the web of corrugated material so that a desired minimum of trim is maintained on the web at all times.

Prior machines of this type have mounted thereon spaced rotary knives which run in fixed journals. These knives trim the edges of a web of corrugated board fed therethrough. The web being fed from the corrugator stand has a tendency to weave from side to side with respect to the fixed knives, and as a result the trim will vary with the amount of weave. This causes excessive trim and costly waste in the scrap.

It is an object of the present invention to reduce the trim to a minimum by controlling the slitter knife to maintain a desired uniform trim at the edges of the corrugated web.

Also provided, as an object of the invention, it is a proximity control for the slitter knife which compensates for a broken torn web edge by overriding the control feature for the edge trim of the web. This is provided to prevent the above slitter knife control from unnecessarily adjusting to follow an extreme broken edge or torn out span in the web, should such occur.

Another object of the invention is to provide a shiftable slitter mechanism for trimming a moving corrugated web, as aforesaid, wherein the slitter means, supported on the machine frame, is shiftable laterally of the web by a power cylinder fastened directly to the machine frame and connected to the slitter mechanism for moving the latter in response to edge-sensing control which is likewise moved by the power cylinder to follow a longitudinal edge of the web at a point ahead of the slitter mechanism.

A further object of the invention is to provide a web edge-sensing control apparatus controlling the guided slitter mechanism which is adjustable to set the edge trim to a desired amount.

Another object of the invention is to provide a driving mechanism for axially shifting the rotary edge-trimming mechanism that will respond instantaneously and eliminate hunting due to initial friction and inertia in moving the trimming mechanism laterally in following a weaving web passing therethrough.

The specific nature of this invention, as well as other objects and advantages thereof, will become apparent to those skilled in the art from the following detailed description, taken in conjunction with the annexed sheets of drawings, on which, by way of preferred example only, are illustrated embodiments of this invention.

In the drawings:

FIG. 1 is a plan view of the slitter-scorer machine provided with the invention;

FIG. 2 is a rear elevational view of the machine of FIG. 1;

FIG. 3 is a side elevational view taken along line 3-3 of FIG. 1;

FIG. 4 is an end elevational view taken along line 4-4 of FIG. 3; and

FIG. 5 is a schematic view of the web edge-sensing system and control, and includes the proximity control of the invention for the cylinder motor.

In the embodiment of the invention disclosed in the drawings, a web fed machine is shown as comprising a slitting apparatus, generally designated at 10. A continuous web 11 of corrugated paper board is shown as supplied from a corrugator stand and fed through the web slitting means of apparatus 10, which is comprised of upper slitter shaft 12 and lower roll 13 (FIG. 2). Shaft 12 has laterally spaced slitting knives 14 thereon which cooperate with discs 15 that are correspondingly, laterally spaced on roll 13. Shaft 12 and roll 13 are rotatably mounted in their end bearings on upright standards 16 and 17 which are nonrotatably fastened on the lateral carriage member 18. Carriage member 18 is supported in journals on the frame 19 of machine 10 for lateral shifting movement axially of the member 18. The shaft 12 or roll 13, or both, may be rotatably driven by a drive means suitably connected, as through a chain drive or gearing (not shown). The slitting knives 14 coact with discs 15 and are power driven to cut the web as it moves in the direction shown by the arrow on FIG. 1.

The shiftable carriage 18 for the slitter means is under the guided control of a hydraulic cylinder motor 20. The motor is operated as a reversible drive by a suitable control mechanism 21 (FIG. 1). The control mechanism 21 is associated with an edge sensing means or sensing head, indicated generally at 22, which senses the edge deviation of the web from a registered position. Control mechanism 21 and sensing means 22 may comprise pneumatically operated apparatus actuating hydraulic regulating means for controlling hydraulic motor 20. Devices of this type are known per se and a summary description of one such device, in conjunction with the invention as shown on FIG. 5, will be given hereinafter.

The sensing means 22 is slidably mounted by a member 23 that is keyed onto boss 24 on the underside of a first lateral slide 25. The lateral slide 25 is of dovetail construction and fits in a corresponding dovetail slideway in a second slide member 26. The slide member 26 has side journal bosses 27 that are slidably mounted on guide rods 28. The guide rods 28 are end mounted at bosses 29 on the lateral guide member 30. Guide member 30 is fastened to frame 19 at a location ahead of slitting knives 14 and is vertically related to web 11 such that sensing means 22 may be moved into a registered position with the adjacent edge of the web 11. Guide member 30 is also positioned on frame 19 so that guide rods 28 extend parallel with the longitudinal axis of carriage 18. This slide mounting provides a carriage for the web edge sensing means 22.

Sensing means 22 and its slide assembly 25, 26 are connected structurally to carriage member 18 so that any lateral movement of carriage 18 will cause sensing means 22 to simultaneously move laterally a like amount. Thus, the sensing means will at all times follow the movement of the carriage for the slitting means. Carriage 18 has a bracket 31 that is fastened at its one end to the end of carriage member 18. Bracket 31 also includes a right angle member 32 that is fastened to the end of slide 26. An adjusting mechanism 33 connects the dovetail slide 25 with slide member 26 and comprises a base 34 that is bolted to the upper side of slide 26. Threaded rod 35 is rotatably mounted on base 34 and has a bevel gear 36 that meshes with a bevel gear 37 on the hand wheel 38. The hand wheel 38 is likewise rotatably mounted on the base 34. The threaded rod 35 is in engagement with a

correspondingly threaded member 39 fastened to the top side of the slide 25. This structure enables moving slide 25 and sensing means 22 in the dovetail connection with slide 26 for positioning the sensing means with respect to the web 11 independently of carriage 18. This adjustment is for positioning the sensing means with respect to the edge of different widths of corrugated board fed through the machine, and also serves to vary or regulate the amount of edge trim being removed from the web.

The sensing head 22 comprises a pneumatic sensing device that has two slot-like orifices formed in the upper member 41 and the lower member 42. The orifices are spaced apart and in registry so that they may be positioned on opposite sides of web 11 at its edge. A low pressure air supply is connected through the pipe 43 on the lower nozzle member 42. This air is blown across the space to the other orifice where some of the air pressure is recovered and fed into pipe 44. As seen on FIG. 5, the air pressure recovered in the upper nozzle is fed to the diaphragm chamber 45 of the motor control unit 21. Through the use of the adjustable mechanism 33 on the slide assembly (FIG. 3), the sensing head 22 is positioned with respect to the edge of web 11 so that the center of the orifices are aligned with the edge of the web, and thus the air recovery pressure at the sensing nozzle 41 is less than maximum recovery pressure. If the web edge is moved away to uncover the recovery orifice of nozzle member 41, maximum recovery pressure will be transmitted to the diaphragm chamber 45. If the web edge moves into the path of the recovery orifice of nozzle member 41 to cover it, the minimum recovery pressure will be transmitted to the diaphragm chamber. The motor control unit 21 receives the recovery pressure from the sensing head and converts it into hydraulic force to control the movement of the motor 20. The control unit 21 has a pivoted jet pipe relay 47 connected to the hydraulic pressure fluid source at inlet 48. The hydraulic fluid as it emerges from the tip of the pipe 47 will impinge on either of two closely spaced receiver tips of fluid connections 49 and 50 that are connected to opposite ends of the cylinder of motor 20. These connections 49, 50 each extend through the valve chamber of solenoid operated valve 51. Valve spool 52 is shiftable in the valve chamber and is normally set by spring 53 to maintain the valve for opening the fluid connections to the cylinder of motor 20.

Referring again to the control 21, the jet pipe 47 is balanced between adjustable spring 54 and diaphragm 55. When the edge of web 11 is centered in orifice of the recovery nozzle member 41 at the registered position, the air pressure force on diaphragm 55 and the force of spring 54 balance each other and jet pipe 47 is disposed to discharge pressure fluid into openings 49 and 50 in equal amounts. In this condition, the motor is maintained static as no adjusting movement is necessary. If, however, web 11 weaves and thus enables the air pressure on diaphragm 55 to be changed, the jet pipe 47 moves toward one or the other of the openings 49 or 50 causing an unequal fluid pressure in the opposite ends of the cylinder of motor 20. Its piston 20a will therefore move to shift carriage 18 laterally on the machine. This will also shift the position of the sensing head 22 in the same direction and a like amount to follow web 11 until its edge is again in registered position with respect to the orifices of sensing head 40. Therefore, should web 11 weave to the left on the drawings, the recovery pressure in the sensing head 22 will increase and diaphragm 55 of the motor control 21 will be deflected to supply a greater quality of pressure fluid from jet pipe 47 into the right hand end of the cylinder of motor 20. This will cause the carriage 18 to move to the left until the edge of web 11 again is in registered position with respect to the recovery nozzle, whereupon the recovery pressure will be decreased and the control unit neutralized. If, on the other hand, web

11 weaves to the right, the diaphragm will be permitted to deflect in the opposite direction from that described above and the reverse motor reaction will result.

Should web 11 be broken out or otherwise removed suddenly from its edge relationship with the sensing head 22 so as to amount to a major deviation of edge alignment of the web, the presently described proximity control will dominate the motor operation. The proximity control includes a pneumatic sensing head 60 that is attached by a bracket 61 (FIG. 1) to the boss 24 at the underside of slide 25. This mounting locates head 60 in a fixed lateral relationship with respect to the sensing means 22. Pneumatic sensing head 60 is positioned in a direction inwardly of the edge of web 11 by a preselected amount from the registered position of the sensing means 22. This relationship is shown by the superimposed schematic illustration of the two parts 22 and 60 on FIG. 5. Head 60 consists of two orifices disposed in communicating relationship on the ends of U-shaped body 62. The orifices are, therefore, positioned on opposite sides of web 11. Low pressure air is supplied to the lower orifice by pipe 63. This air is directed toward the upper orifice which is connected to one side of a diaphragm actuator of a pneumatic, pressure-sensitive switch 64 of known construction. Switch 64 is maintained normally opened by a spring acting in opposition to the diaphragm if the air supply is shut off to the upper orifice, as is the case during normal feeding of web 11 between the two orifices shown on FIGS. 3 and 5. Switch 64 has one side electrically connected to an electrical source, such as a transformer secondary, by lead wire 65. The other side of the switch is in circuit with the solenoid coil 66 of solenoid operated valve 51, as shown by lead wire 67. The other side of coil 66 completes the circuit to the electrical source through the lead wire 68.

The pneumatic switch 64 will not close the circuit to the solenoid unless the web 11 is broken, as by a relatively large piece being torn from the edge of the web, or the web is otherwise displaced out of the sensing head 60. When this happens, the air supply from the lower orifice in body 62 is connected to the upper orifice and the diaphragm of the pneumatic switch 64 is deflected to close the circuit and energize coil 66 of the solenoid. As the solenoid coil is energized, the valve spool 52 of valve 51 is shifted against the spring 53 and the valve closes the fluid connections 49 and 50, thus locking the motor 20 in that position. By the proximity control the motor control unit 21 is rendered ineffective until the displaced edge of web 11 again passes into the proximity control sensing head. This prevents the slitting means from being unnecessarily adjusted to follow the edge of web 11 whenever it is displaced through a major deviation.

In the invention, one of the important structural features resides in the fact that the cylinder of motor 20 is mounted directly onto the frame which also supports the movable carriage 18. This eliminates any deflection of the frame as the cylinder operates for guiding the carriage to obtain correct alignment between the web and the slitting means. If the motor were supported on an external support, flexing of the frame will occur and a "stick-slip" effect will result which tends to create a continuous and unnecessary motion by the cylinder to accommodate for a delayed response as far as the sensing means is concerned. The motor 20 should be of sufficient size to provide sufficient power so that there will be no hesitation in the movement of the slitting means whenever such movement is called for by the sensing means.

While one embodiment of the present invention has been herein specifically described, other embodiments and variations may occur to those skilled in the art after a knowledge of the disclosure herein, and it is desired to include within the scope of the patent granted hereon all such embodiments and variations, and more particularly as comprehended by the appended claims.

We claim:

1. In a slitter machine having a frame, a slitter shaft, means for rotatably and axially shiftably mounting said shaft on said frame, slitting knives on the shaft adapted to cut a web of material as said web is fed through the machine, a reciprocating fluid-operated cylinder motor, means connecting said motor for reciprocally axially shifting said last-named means, means sensing the edge position of said web, motor control means for operating said cylinder motor in response to the edge-sensing means, a slide mounting for said edge-sensing means on said machine frame, and connecting means between said edge-sensing means and said slitter shaft for coupling the two for like parallel linear movement, the edge-sensing means causing the motor control means to operate the motor for shifting the slitter shaft and the edge-sensing means to maintain a registered position on the web.

2. Mechanism for maintaining slitting knives of a web trimming apparatus in a desired edge registered position with respect to a moving web passing through said apparatus comprising means sensing a deviation of the web from registered position, means operated responsive to the web sensing means for constantly guiding the slitting knives transversely of the web to registered position, comprising a fluid operated cylinder-piston assembly including a reciprocating piston and means connecting said piston to said trimming apparatus for moving the latter laterally on said web, and means connecting the slitting knives and the web sensing means together for lateral movement on said trimming apparatus, whereby the web sensing means is maintained in fixed relationship with respect to said slitting knives and is moved to the registered position by said responsive means.

3. In a corrugated paper board machine having means to form a continuous web of corrugated board, a frame, a transverse carriage mounted on said frame for axial shifting movement, a slitting means rotatably mounted on said carriage including slitting knives adapted to cut said web longitudinally as it is fed through said knives, a fluid-operated cylinder motor, means rigidly mounting said motor on said frame, a connection between said motor and the carriage for axially shifting the latter on the frame, pressure responsive means for sensing the edge position of said web including a sensing head defining spaced orifices adapted to communicate with each other, motor control means for operating said cylinder motor responsive to the pressure responsive means, a slide mounting for said sensing head comprising a support member attached to said frame and an adjustable slide member attached to said head and adapted to dispose said orifices on opposite sides of said web in advance of the slitting knives, means connecting the slide member and said carriage for parallel linear movement, the slide member including an adjusting device for positioning said sensing head independent of said carriage to establish a registered position of the slitting means and sensing head with respect to an edge of the web, the pressure responsive means causing the motor control means to reciprocate said motor to shift the carriage and sensing head together thereby retaining the slitter means and the sensing head in their respective registered positions.

4. In a corrugated paper board machine having means to form a continuous web of corrugated board, a frame, a carriage mounted on said frame for axial shifting movement, a slitting means rotatably mounted on said carriage including slitting knives adapted to cut said web as it is fed through said knives, a cylinder motor, means rigidly mounting said motor on said frame, means connecting said motor to the carriage for axially shifting the latter, pressure responsive means for sensing the edge position of said web, motor control means for said motor operated responsive to the pressure responsive means, including a source of fluid under pressure, fluid connections to opposite ends of the cylinder of said motor and a regulator for connecting said source to either of said cylinder con-

nections, a solenoid operated valve interposed in said fluid connections between the cylinder and the regulator operable for alternatively opening or closing both said connections, a proximity control comprising a sensing head and a pneumatic switch, the switch being connected in circuit with the solenoid of said valve, and means connecting the pressure responsive means, the sensing head and the carriage for simultaneous parallel linear movement, the proximity control being normally positioned in relation to the web and operated thereby to open said valve and permit the motor control means to reciprocate said motor in response to the pressure responsive means in accordance with any minor deviation of the web, the proximity control being operated to close said valve and render the motor control means ineffective by any major deviation of the web.

5. In a slitter machine having a frame, a slitter shaft, means for rotatably and axially shiftably mounting said shaft on said frame, slitting knives on the shaft adapted to cut a web of material as it is fed therethrough, a fluid-operated cylinder motor, means mounting said motor on the frame and connecting it to said first-named means, pressure sensitive means for sensing the edge position of said web including a sensing head defining spaced orifices adapted to communicate with each other, motor control means for reciprocally operating said cylinder motor responsive to the pressure sensitive means, a slide mounting for said head on said machine frame for disposing the orifices in registered position along one edge of the web and on opposite sides thereof ahead of said slitting knives, and connecting means between said head and the shaft mounting means for coupling them for simultaneous, parallel linear movement, the pressure sensitive means causing the motor control means to reciprocate the motor and shift the first-named means to retain the orifices in registered position on the web.

6. Mechanism for maintaining slitting knives of a slitter apparatus in a desired edge registered position with respect to a moving web passing through said slitter comprising first means sensing a deviation of the edge of the web from registered position, means responsive to the first web sensing means for constantly guiding the slitting knives to registered position with respect to the web, second means sensing the presence of the web in the proximity of the first web sensing means for normally rendering said responsive means operable and rendering said responsive means inoperable whenever the edge of the web deviates from said proximity of the first web sensing means, and means connecting the slitting knives and the first web sensing means for movement together by the responsive means when the latter is rendered operable, whereupon the first web sensing means is maintained in fixed relationship with respect to said slitting knives and kept in the registered position by said responsive means as said knives are guided by the latter.

7. The mechanism defined by claim 6, wherein the first and second web sensing means are mounted in fixed relationship with respect to each other and both connected to the slitting knives for movement with the latter.

8. In a web fed machine having a web working means, means for controlling the web working means in relation to the edge of the web during movement thereof through the machine comprising carriage means mounting the web working means on the machine for lateral shifting movement, a pneumatic sensing means sensitive to the edge position of the web as it enters the machine including a sensing head defining a slot through which the marginal portion of the web is to travel, a fluid-operated cylinder motor connected to the carriage means to laterally shift the latter, means connecting the web working means and said sensing means for movement together comprising a lateral guide attached to the machine, a slide assembly supported by said guide including a first slide member slidable on said guide, a second slide member slidable on said first member and connected to said sensing head,

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and an adjustable connection between said first and second slide members for independently adjusting the lateral position of the sensing head, means connecting the first slide member and the carriage means for movement together, a pneumatically operated switch means mounted on the second slide member and disposed laterally inwardly of said sensing head, said switch means being operated by the web, a source of fluid under pressure, a fluid pressure control for connecting said source and the opposite ends of said cylinder motor, the fluid pressure control being operatively connected to the pneumatic sensing means for operation in response to minor lateral deviations of the web and cause the web working means to follow the web, a normally open, solenoid-operated valve interposed between said control and the cylinder having its solenoid electrically connected in circuit with said switch means, whereby a major lateral deviation of the web closes the switch and actuates the valve to prevent further lateral movement of the web working means.

9. In a web-fed machine having a web working means, a web edge-sensing device, means connected to said de-

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vice and responsive to said device, means guiding the web edge-sensing device to a registered position and operated by said last-named responsive means comprising a reciprocating fluid pressure operated motor connected to the web working means for laterally shifting the latter on the machine, a carriage for the web edge-sensing device, and means connecting the carriage and the web working means together for simultaneous movement by said motor.

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