United States Patent [19]

Reime et al.

[11] **3,753,381**

[45] **Aug. 21, 1973**

[54] **WEB EDGE CONTROL FOR STRIP PROCESSING LINES**

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[22] Filed: **Dec. 10, 1971**

[21] Appl. No.: **206,791**

[52] **U.S. Cl.** **83/364,** 83/365, 83/368

[51] **Int. Cl.** **B23d 19/06**

[58] **Field of Search** 83/364–368, 72, 75; 226/20

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[57] **ABSTRACT**

Web edge control apparatus for corrugated paperboard cutting and grooving apparatus, for example, wherein two electro-optical sensing devices (preferably photocells) are positioned on the same side of the web so that one device normally sights on the relatively dark web while the other sights on a lighter background adjacent the web. If the web should shift to one side or the other, either both devices will sight on the dark web as when the web moves toward one side, or both devices will sight on the lighter background as when the web moves in the opposite direction. When either one of these events occurs, the cutting and grooving apparatus is caused to move in the same direction as the movement of the web to maintain a fixed relationship of the cutting and grooving apparatus with respect to the edge of the web.

3 Claims, 2 Drawing Figures

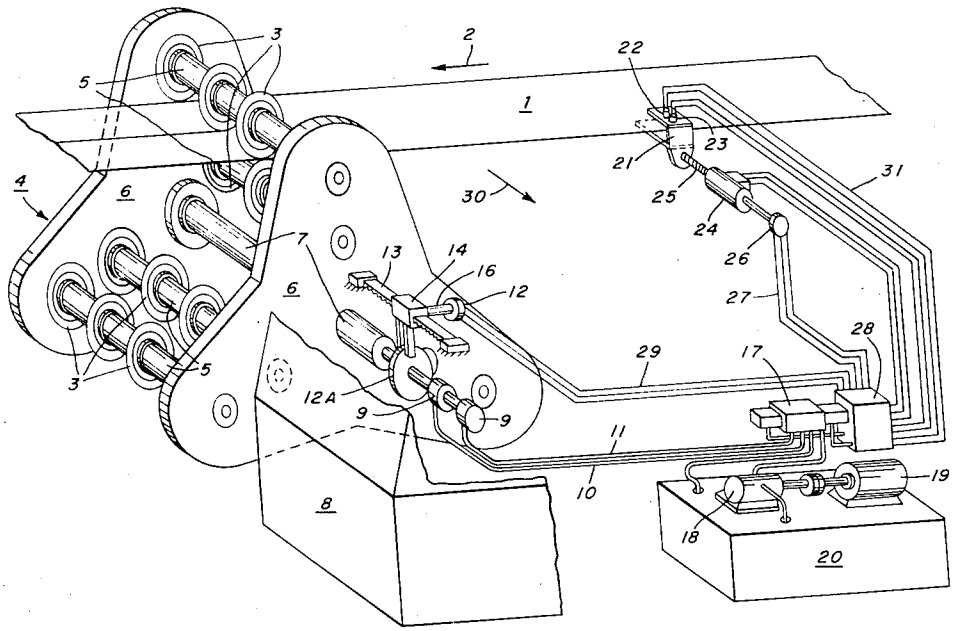
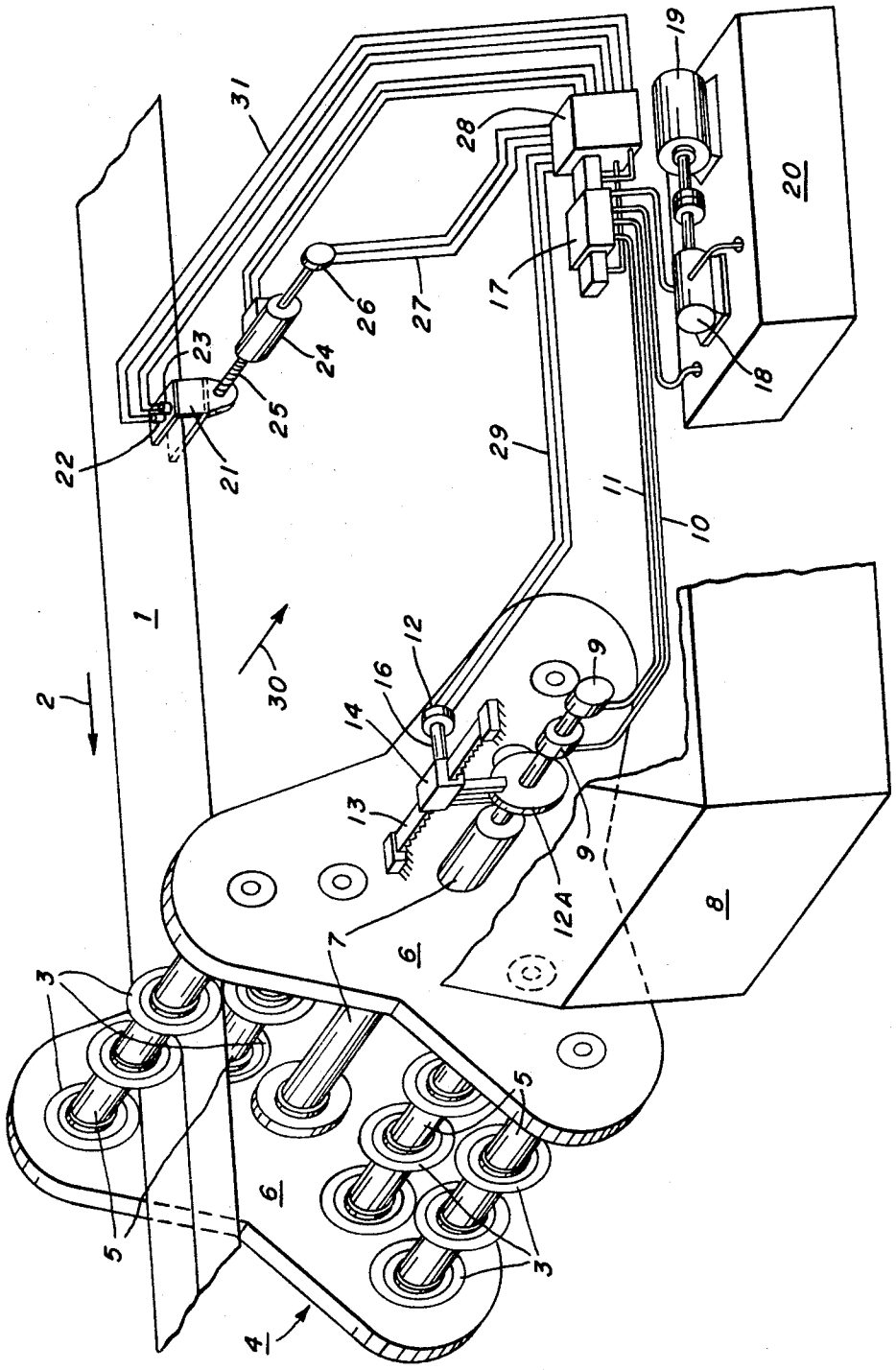


FIG. 1.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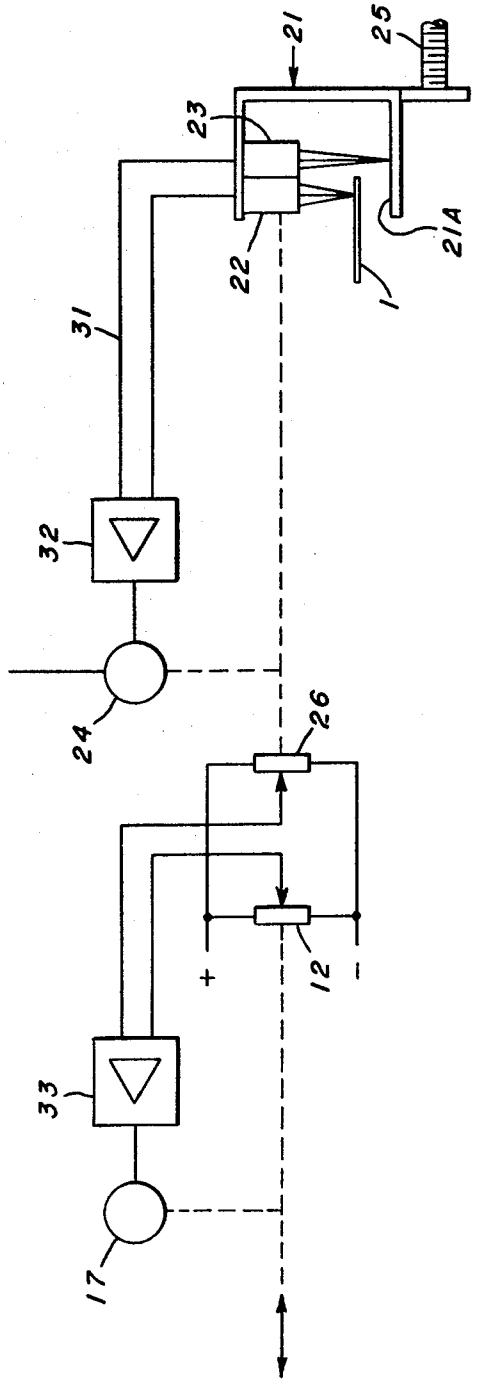

FIG. 2.

WEB EDGE CONTROL FOR STRIP PROCESSING LINES

BACKGROUND OF THE INVENTION

In the past, web edge control devices have been provided wherein a pair of nozzles, both on the same side of a web, are directed toward the web such that one intercepts the web while the other does not. On the side of the web opposite the nozzles are orifices which are adapted to receive jets of air from the nozzles, the arrangement being such that when the jet or stream of air travels from a nozzle to an orifice, it is known that the web is not between that nozzle and orifice.

Normally, only one of the orifices is covered by the web while the other is not. HOwever, if the web should move in one direction transverse to its direction of forward movement, both orifices can be covered. Alternatively, when the web moves in the other direction transverse to its direction of forward movement, both orifices can be exposed. In either case, whenever a condition exists where both nozzles are exposed or both are covered, corrective action is taken to move cutting tools for the web to one side or the other so as to maintain a fixed distance between the cutting tools and the edge of the web. In the usual case, the nozzles and the orifices are mounted on a carriage which is caused to shift in one direction or the other, depending upon the direction of movement of the web. As the carriage moves, so also do the cutting tools until a condition again exists where one nozzle is covered and the other is not. As long as this condition persists (i.e., one nozzle covered and the other exposed), the cutting tools are at the correct position with respect to the edge of the web.

A pneumatic system of the type described above, while workable, sometimes encounters difficulties because of obstructions of the orifices opposite the air jets by paper dust and the like. Furthermore, the system requires extensive piping and control valves, as well as an air compressor for producing the desired air jet.

SUMMARY OF THE INVENTION

In accordance with the present invention, the disadvantages of a pneumatic edge control system are obviated with the use of photocells, one of which is normally directed onto the web and another of which is directed onto a light background adjacent the web. Specifically, there is provided apparatus for cutting moving webs wherein at least one tool is carried on a first movable carriage which can move transverse to the direction of movement of the web to maintain a fixed distance between the tool and the web edge. A pair of photocells are positioned ahead of the cutting tool in the direction of movement of the web and at one side of the web, one of the photocells being sighted on the web and the other being sighted on a light background adjacent the web.

The photocells are mounted on a second carriage also movable transverse to the forward direction of movement of the web. Means are provided for moving the second carriage in one direction transverse to the direction of movement of the web when the web moves transversely in one direction such that both photocells sight on the web and for moving the second carriage in the opposite direction when the web moves in the opposite direction transverse to its forward direction of movement. Means, preferably potentiometers connected to the first and second movable carriages, and a comparator are provided for moving the first carriage to a position corresponding to the second carriage on which the photocells are mounted whenever the two positions are not the same. In this manner, it will be appreciated that the cutting tool is always maintained at a fixed distance from the edge of the web.

The above and other objects and features of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings which form a part of this specification, and in which:

FIG. 1 is a perspective, schematic illustration of the invention; and

FIG. 2 is a schematic circuit diagram of the control apparatus of the invention.

With reference now to the drawings, and particularly to FIG. 1, a corrugated paperboard web is identified by the reference numeral 1 and moves in the direction of arrow 2. It is slit and, if necessary, also grooved by tools 3 of cutting and grooving apparatus, generally indicated by the reference numeral 4. The apparatus 4 includes cutter spindles 5 mounted at their opposite ends in two plates 6. The plates 6, in turn, are pivotal about a central rocking shaft 7 so that one of three sets of tools 3 can be moved into position to work upon the moving strip 1. The two plates 6 are mounted for sliding movement on the rocking shaft 7, the opposite ends of the shaft 7 being supported by housings 8, only one of which is shown in FIG. 1. Means, such as hydraulic cylinders 9, are provided to move the shaft 7 axially from one side or the other. Alternatively, the cylinders 9 can be replaced by an electric motor and screw drive arrangement or any other device which will produce an axial sliding motion. The hydraulic cylinders 9 are supplied with hydraulic fluid by means of conduits 10 and 11.

Affixed to the rocking shaft 7 and slideable therewith is a disc 12A connected through a rack and pinion arrangement 13, 14 and shaft 16 to a potentiometer 12, the arrangement being such that as the shaft 7 and plates 6 move from side-to-side, the position of a movalbe tap in the potentiometer 12 will move a corresponding distance. The rack 13 is fixed in position. Hence, as the shaft 7 and disc 12A move, rotational movement will be imparted to the shaft 16 and the movable tap in the potentiometer 12.

The cylinders 9 are connected through conduits 10 and 11 and solenoid valves 17 to a hydraulic pump 18 driven by motor 19, the motor 19 and pump 18 being mounted on a block 20. The arrangement is such that, depending upon the position of the solenoid valves 17, one or the other of the cylinders 9 can be actuated to shift the rocking shaft 7, the plates 6 and the tools 3 to the left or right.

Ahead of the tools 3 in the path of travel of the corrugated board web 1, moving in the direction of arrow 2, is a U-shaped sensing head 21, perhaps best shown in FIG. 2. The sensing head 21 fits over an edge of the corrugated board 1 and is provided with two photocells 22 and 23 carried on the upper arm of the head 21. One of the photocells, specifically photocell 22, is directed onto the corrugated board 1; while the other photocell 23 normally does not intercept the corrugated board 1 and is directed onto a light background 21A. The light background 21A may, for example, be a white surface, a mirror or may incorporate an electric lamp, not

shown. The arrangement is such that due to the darker color of the corrugated paperboard **1**, the light sensed by the photocell **22** will be less than that sensed by photocell **23**, assuming that the edge of the paperboard is in the position shown in FIG. **2**. If, however, the paperboard should move to the left or right as viewed in FIG. **2**, either both photocells **22** and **23** will be exposed to the light background **21A** or both photocells will intercept the edge of the paperboard **1**. In either case, the relationship between the output signals from the photocells **22** and **23** will be altered. This, in turn, is sensed by a comparator or amplifier **32** carried within a housing **28** shown in FIG. **1** and connected to the photocells through leads **31**.

When the relationship between the output signals from photocells **22** and **23** is thus varied by movement of the web **1** to alter the positions shown in FIG. **2**, an electric motor **24** rotates a threaded shaft **25** to cause movement of the U-shaped sensing head **21** toward or away from the edge of the paperboard **1**. That is, as long as photocell **22** intercepts the edge of the paperboard **1** and photocell **23** is directed onto the light background **21A**, the motor **24** will not rotate. However, if both photocells intercept the light background **21A**, indicating that the edge of the paperboard hs moved to the left as viewed in FIG. **2**, then the motor **24** will be rotated in one direction to move the sensing head **21** toward the edge of the paperboard until photocell **22** again intercepts the edge of the paperboard; whereupon the motor **24** stops. On the other hand, if both photocells **22** and **23** intercept the paperboard, then the motor **24** is caused to rotate in the opposite direction to move the sensing head **21** to the right as viewed in FIG. **2** until photocell **23** again is directed against the light background **21A**, whereupon the motor **24** again stops.

As will be appreciated, the motor **24** is mounted on a fixed mounting and is connected to a threaded member which receives the shaft **25** such that when the motor rotates, the sensing head **21** will move toward or away from the web **1**. Connected to the shaft **25** is a second potentiometer **26** connected through leads **27** to the housing **28** where it is compared with the signal from potentiometer **12** in a sum and difference amplifier **33** (FIG. **2**). If the voltages derived from the potentiometers **12** and **26** are not the same, the amplifier **33** actuates the solenoid valves **17** to pressurize one or the other of the cylinders **9**, thereby shifting the rocking shaft **7**, the plates **6** and the cutting tools **3** to the left or right.

The operation of the system is such that if, for example, the web **1** should move in one direction to expose both of the photocells to the light background, the balance between the potentiometers **12** and **26** will be upset, causing the shaft **7** and the cutting tools **3** to move in the same direction as the movement of the sensing head **21**. When the sensing head reverses, so also will the tools **3** such that the spacing between the tools and the edge of the web **1** is always maintained constant.

Although the invention has been shown in connection with a certain specific embodiment, it will be readily apparent to those skilled in the art that various changes in form and arrangement of parts may be made to suit requirements without departing from the spirit and scope of the invention.

We claim:

1. In apparatus for cutting moving webs of the type wherein at least one cutting tool is carried on a first movable carriage which can move transverse to the direction of movement of the web to maintain a fixed distance between the tool and the web edge; the combination of a pair of photocell devices positioned ahead of said cutting tool in the direction of movement of the web and at one side of the web, one of said photocells being sighted on said web and the other being sighted on a lighter background adjacent the web, a second carriage movable transverse to the forward direction of movement of the web and on which said photocell devices are mounted, means for moving said second carriage in one direction transverse to the direction of movement of the web when the web moves transversely in said one direction to a position where both photocell devices sight on the web and for reversing movement of the second carriage when the web moves in the opposite transverse direction to a position where both photocells sight on said lighter background, means for causing said first carriage to move in unison with the second carriage to maintain an essentially fixed distance between said cutting tool and the edge of the web, potentiometer means connected to said first and second carriages for producing output signals indicative of the reflective positions of said carriages in regard to the web, and means for comparing said output signals to derive an error signal for moving said cutting tool in the same direction as movement of the sensing head.

2. The combination of claim **1** wherein said photocells are carried on the upper arm of a U-shaped sensing head, said lighter background being on the lower arm of the sensing head.

3. The combination of claim **1** including hydraulic cylinder means for moving said first carriage, and valve means in a hydraulic circuit and responsive to said error signal for actuating said hydraulic cylinder means.

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