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(71) Applicant : **W.R. Grace & Co.-Conn. (a Connecticut corp.)**
Grace Plaza 1114 Avenue of the Americas
New York New York 10036 (US)

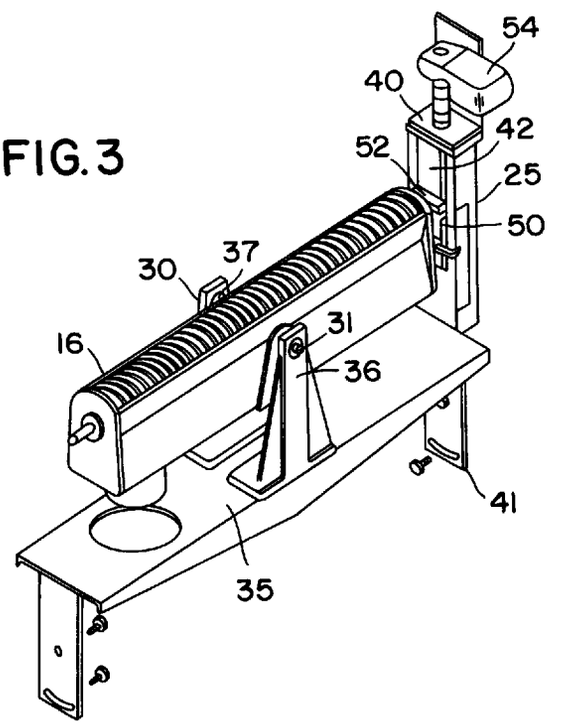
(72) Inventor : **Theyerl, Dennis**
628 North Packer Drive
Whitelaw, WI 54247 (US)
Inventor : **McIntyre, Burt R.**
2843 Brookview Court
Greenbay, WI 54313 (US)

(74) Representative : **Barlow, Roy James**
J.A. KEMP & CO. 14, South Square, Gray's Inn
London WC1R 5LX (GB)

(54) Center pivot air turn web steering assembly.

(57) A center pivot air turn web steering assembly and process for steering a web. The center pivot air turn has a drive side responsively coupled to a steering control thread rod. Web location is monitored, and as the web moves off center, the air turn is caused to pivot about its center. As a result, directionally opposite movements at each end of the web are producted in order to guide the web back to its original position.

FIG. 3



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BACKGROUND OF THE INVENTION

In web printing and drying operations where a web is contactlessly supported, it is often necessary to change the direction of web travel while maintaining the contactless environment. This is especially true where the web has printed matter on both sides; any contact with machinery or the like could mark the web. Typical air turns used to change the direction of the web include a 95° turn, which carries the web around a 95° arc, and a 20° "shallow wrap" turn, which carries the web around an arc of about 20°.

Such air turns replaced grater rollers. Grater rollers were a means to turn the web with frictional contact. As a result, web marking problems often arose. Although the use of air turns eliminated marking, the absence of the additional frictional restraint provided by the rollers led to web tracking problems, especially in the case of "baggy" or non-uniform webs. To compensate for tracking problems, the air turn was used as a steering device. By tilting one edge if ;he air turn in a direction perpendicular to and toward the web, a force is provided tending to push the web away from that side. Conversely, if that end of the air turn is moved away from the web, the resulting air pressure forces pull the web toward that end. Optical sensors are used to monitor web drift and send a signal to the steering drive motor controlling the position of the air turn. The drive motor moved the operator end of the air turn. Alternatively or additionally, the air turn could be tilted manually.

Steering control systems of this sort consisted of an adjustable screw mount with a drive motor. The system could be controlled manually through "manual steering gear" and "operator" push buttons, or could be controlled automatically with two photo-sensors mounted on a common bracket that is adjustable for different web widths. As the edge of the web drifted inside the range of either sensor, an electrical signal was sent to the steering control drive motor. In response, the drive motor moved the operator end of the air turn up or down to correct the web drift. Once the web is re-centered and not in the range of the sensors, the drive motor stopped.

The motor driven screw jack was mounted on the operator side of the air turn. The operating position of the air turn was either above, below or at horizontal, depending upon the process, the web weight, strength and tension. The gear side of the air turn was fired, but allowed to pivot by means of an end pivot bracket onto which the gear side end was mounted. Because one side of the air turn was fired, the web would move along the face of the air turn in the same direction as the web movement noted by the photosensors. Under normal operating conditions, the adjustment of the web was minimal and caused no handling problems. However, if the web movement were severe, the air turn compensation from horizontal often reached several inches. Extreme air turn movement changed the centerline of both the air turn and the web in relation to the centerline of the press. The net result was often a cycling lateral response (weaving) of the web caused by the air turn and web guide overreacting to each other due to the time interval required for each to compensate for web position. Web breaks often resulted.

SUMMARY OF THE INVENTION

The problems of the prior art have been solved by the instant invention, which provides an improved air turn steering system which changes the position of the air turn with respect to the web. The instant air turn steering system eliminates web overtravel by providing quicker responding web direction control. Specifically, the air turn steering mechanism in accordance with the present invention eliminates the fixed pivot end of the prior art air turn, and instead utilizes a fixed center pivot device. As a result, web movement is significantly reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a typical press showing various air turns in use;

Figure 2 is a front cross-sectional view of an air turn steering system in accordance with the present invention; and

Figure 3 is a perspective view of an air turn steering system in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Web support devices are known in which a web is contactlessly supported on a fluid cushion as the web changes directions during its course of travel. An example of such a device is shown in U.S. patent No. 4,182,472, the disclosure of which is herein incorporated by reference. The device, known in the art as an "air turn", provides a contactless support for a running web in which an arcuate surface is provided over which the web passes. A pair of air nozzles supply pressurized air to the space between the web and the arcuate surface so as to form a cushion of air on which the web floats. The particular air turn disclosed in the aforementioned patent includes grooves formed in the arcuate surface which act as labyrinth seals to inhibit the transverse movement of air towards the edges of the running web. As a result, less air spillage occurs, which reduces the required air flow and air horsepower that would otherwise be necessary were labyrinth seals not used. Suitable air turns for use in the instant invention include those disclosed in the Peeka patent.

By way of example, Figure 1 illustrates a typical

set up for a press. Referring to the upper pass, a web 10 is first turned by bottom 95° air turn 12, and then by top 95° air turn 14. The web continues toward dryer 20 and is supported by a 20° shallow wrap air turn 16, positioned between top 95° air turn 14 and end wrap air turn 18. A pressure blower can be located on the gear side of the press or on top of the dryer, and supplies air to the air turns through appropriate piping. The blower output damper can be regulated by means of an automatic clearance control system, which maintains the air cushion clearance between the web and each air turn. The automatic clearance control system includes a ratio controller, which senses the cushion and supply pressures on the top 95° air turn and controls the open position of the pressure blower outlet damper in response thereto. The ratio controller receives electrical signals from two pressure transducers located in an enclosure on one end of the top 95° air turn. The transducers sense the cushion and supply air pressures at the top 95° air turn. Pressure taps are located on the face and inside the air turn. The ratio of the cushion air pressure to the supply air pressure is compared to the set point ratio, and the ratio controller signals the actuating motor to move the outlet damper accordingly. The settings of the flow control dampers keep the clearance on each remaining air turn equal to the monitored clearance over the top 95° air turn. The automatic clearance control system also includes a web tension (PLI) monitor/indicator and DC power supply.

The web 10 enters dryer 20 through web slot 21, and exits in a heated state. The web is cooled by contact with chill stand 22. For the application shown, the steering control system is utilized on the middle shallow wrap air turn 16. The end wrap air turn 18 is mounted just before the dryer 20 entrance, thus the photo-sensors for optic steering are mounted on it.

Turning now to Figure 2, air turn 16 is shown coupled at one end 17 to the steering control assembly shown generally at 25 through mounting means 50 (best seen in Figure 3). The air turn end 19 is free; that is, it does not substantially inhibit the steering movement of the air turn. A center pivot bracket positioned at the substantial midpoint between fixed end 17 and free end 19 of air turn 16 is shown generally at 30, and is mounted on platform 35. The air turn 16 is rotatably mounted to center pivot bracket 30 via shaft 31 and spherical bearing .12. Shaft 33 at end 17 of air turn 16 is movably mounted to the steering control assembly 25 through shim plate 34.

Figure 3, where like numerals correspond to features previously identified, shows the steering control assembly 25 coupled to a 20° air turn through mounting means 50. The mounting means 50 include track follower 52 which is affixed to air turn 16 at end 17 and is positioned in the track 42 of housing 40. Track follower 52 is coupled to a motor driven screw jack, which in turn is responsively coupled to web position detection means, such as photo-sensors. The housing 40 is affixed to the press (not shown) through mounting bracket 41. Center pivot brackets 30, 36 are mounted on platform 35. Shafts 31, 37 extend from the body of the air turn 16 through appropriately dimensioned holes in the brackets 30, 36.

The operating position of the air turn is typically horizontal, regardless of the characteristics of the web. Once a lateral movement of the web is detected, a signal is sent to the motor 54 which drives the screw jack, which in turn adjusts the air turn either up or down depending on the particular lateral web movement detected. The movement is significantly reduced since the fired pivot is now substantially in the center of the air turn. The effect of the center pivot adjustment is that the remaining web movement alternates between side 17 of the turn and free side 19 on a very rapid cycle, which rocks the web. This "rocking" motion significantly reduces the distance the web will move off center from the press. The deleterious cycling lateral response (weaving) effect due to overreaction between the prior art air turn steering system and the web guide at the chill stand is almost completely eliminated. The present invention results in substantially increased response time with less overall movement. Where the prior art steering system would cover several inches of air turn movement, the instant system typically limits movement to 1 inch or less on either side of horizontal. Accurate web positioning and improved web control result. In addition, continuous web weave is eliminated.

EXAMPLE 1

A center pivot 15 air turn was mounted on an existing press. Butt rolls of 40# and 34#BW paper were run. Little or no movement occurred during acceleration up to approximately 1100 ft. The drive end of the turn was moved upwards 1/2″ in order to force web movement. As a result, the web shifted to the gear side 5/8 inches. The steerable turn was then allowed to compensate for the shift. The compensation occurred smoothly and quickly with no overshoot.

EXAMPLE 2

An actual print test was conducted on a web of 34#BW paper that was 33 inches wide. From start-up, there was almost no turn movement necessary. After a splice (11oo ft.), the web shifted 1/4″ to the operator side. In response, the turn moved downward 1/4″ (drive side) and then returned to its original point. The web tension (PLI) meter read 1.94 and during splice, went to approximately 2.1 before returning to 1.93.

A second splice was made at 1300 ft., and the web shift was 1/2″ each side of the set point. The turn successfully steered the web back to its original point.

Claims

1. A web steering device comprising an air turn having a free end and a fixed end; said fixed end having air turn mounting means movably mounted to a steering control assembly comprising means for changing the position of said air turn with respect to said web; said air turn having pivoting means at the substantial midpoint between said free end and said fixed end.

2. The web steering device according to claim 1 wherein said steering control assembly comprising means for changing the position of said air turn with respect to said web comprises a housing having a track into which said air turn mounting means is movably mounted.

3. The web steering device according to claim 2 wherein said means for changing the position of said air turn with respect to said web further comprises a screw jack coupled to said air turn mounting means.

4. The web steering device according to claim 1 wherein said means for changing the position of said air turn with respect to said web further comprises a screw jack responsively coupled to web position detection means.

5. The fweb steering device according to claim 4 wherein said web position detection means comprises at least one photo-sensor.

6. The web steering device according to claim 3 wherein said screw jack is motor driven.

7. The web steering device according to claim 4 wherein said screw jack is motor driven.

8. The web steering device according to claim 1 wherein said pivoting means comprises mounting brackets into which a pair of shafts affixed to said air turn are rotatably mounted.

9. A process of contactlessly steering a running web, comprising:
   a) providing an air turn over which said running web travels, said air turn having a free end and a fixed end;
   b) sensing the position of said web;
   c) adjusting the position of said web in response to the sensed position by pivoting said air turn about the substantial midpoint between said free end and said fixed end.

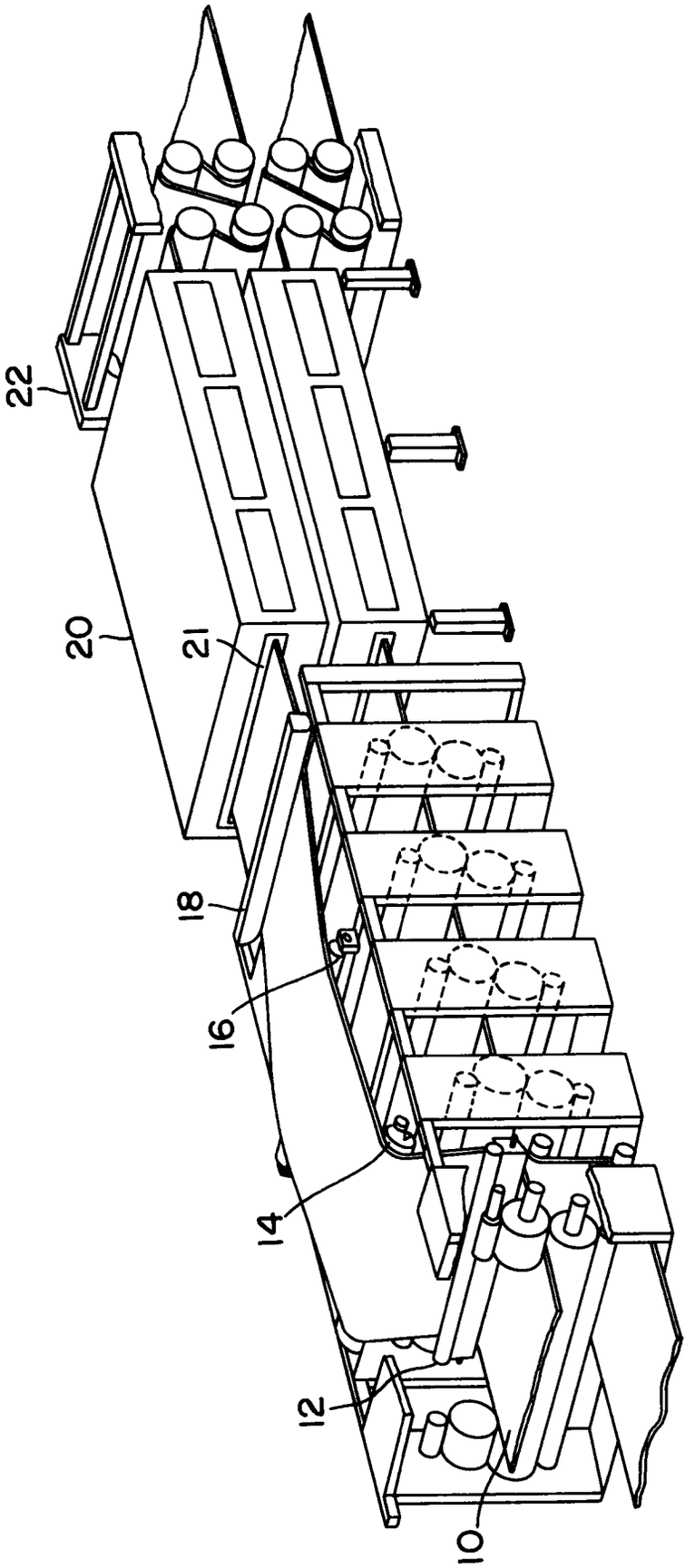


FIG.1

FIG. 2

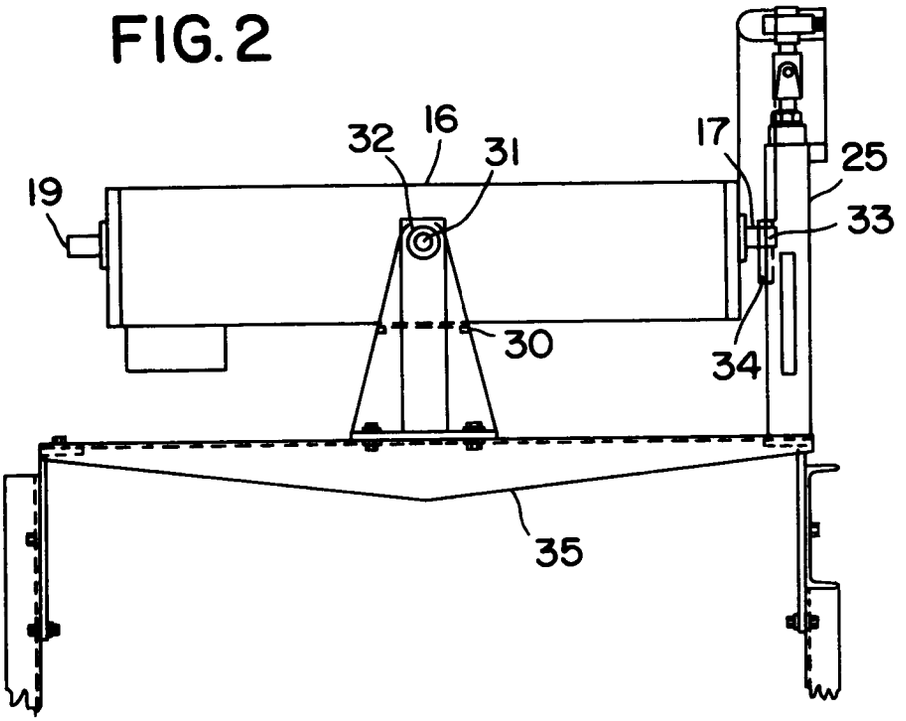
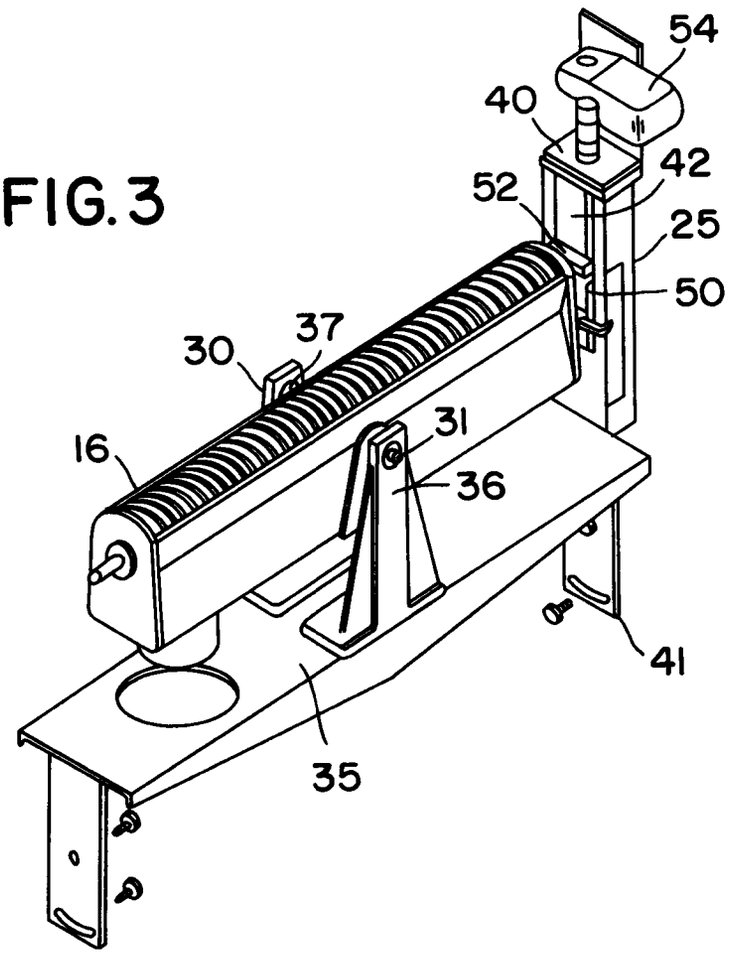


FIG. 3



European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 30 2607

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,Y	US-A-4 182 472 (W. R. GRACE & CO) * the whole document * ---	1,3,6,7, 9	B65H23/24 B65H23/035
Y	US-A-2 821 387 (TIME INCORPORATED) * the whole document * -----	1,3,6,7, 9	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	02 JULY 1992	LONCKE J.W.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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