Sept. 23, 1958 A. W. WESTERN ET AL 2,852,986

COUCH ROLL STRUCTURE FOR PAPER MAKING MACHINES

Filed June 22, 1953 3 Sheets-Sheet 1

FIG. 1.

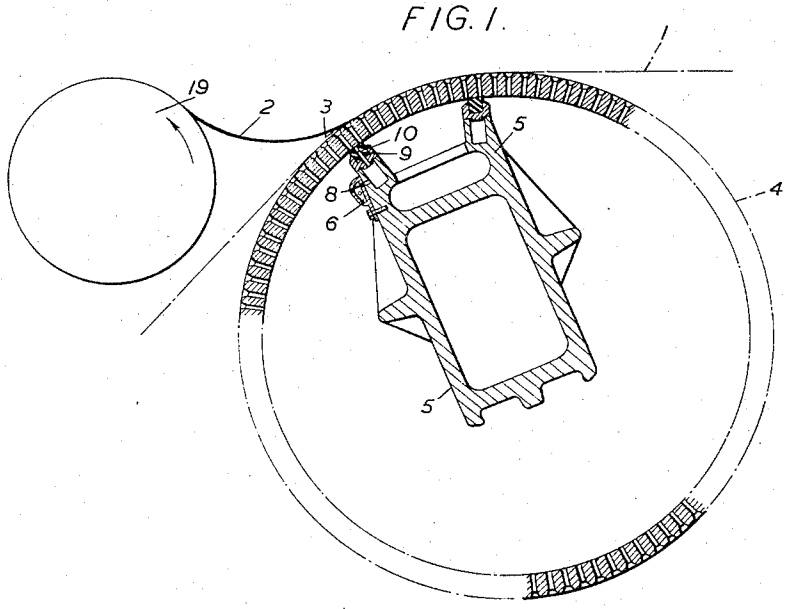
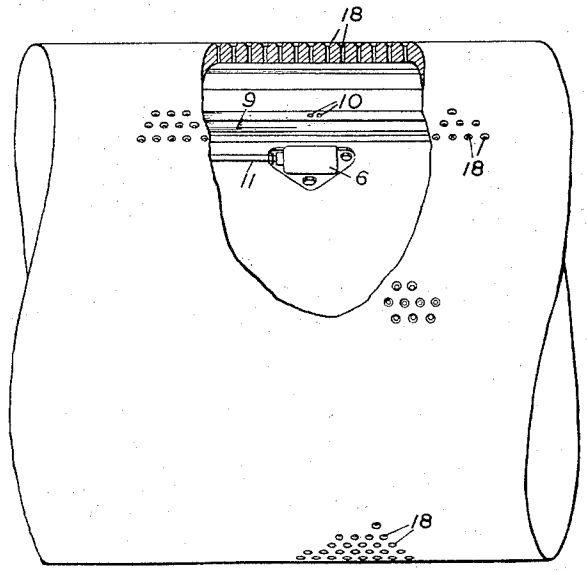


FIG. 2.



Inventors
ARTHUR WILLIAM WESTERN
WALTER TAYLOR
By
Bacon & Thomas
Attorneys

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FIG. 3.

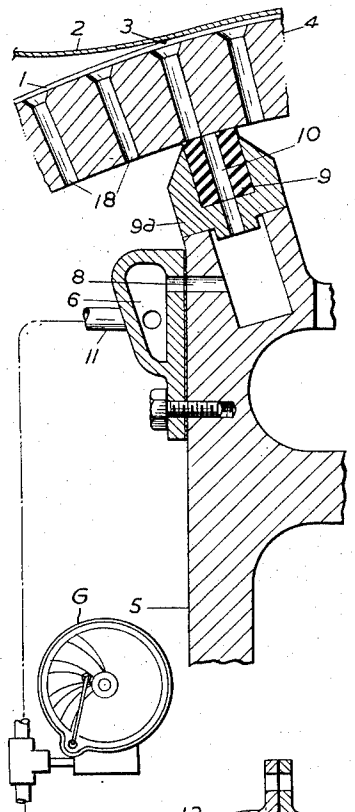


FIG. 4.

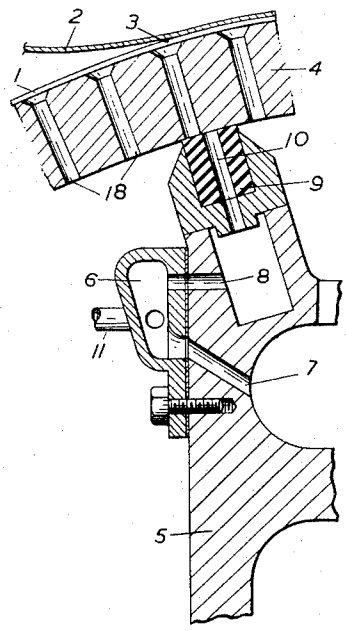
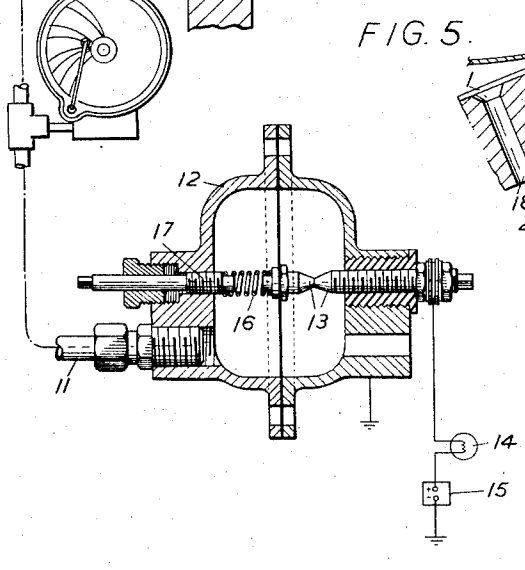
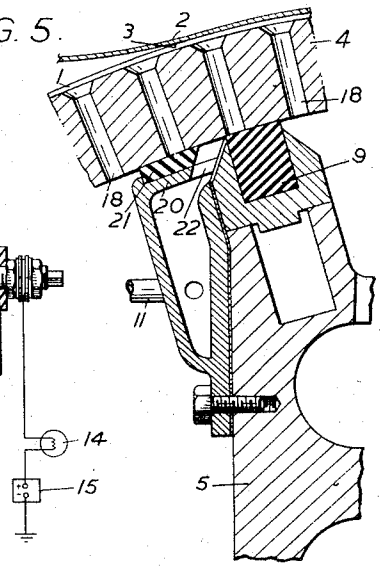


FIG. 5.





ARTHUR WILLIAM WESTERN Inventors
WALTER TAYLOR

By Bacon & Thomas
Attorneys

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FIG. 6.

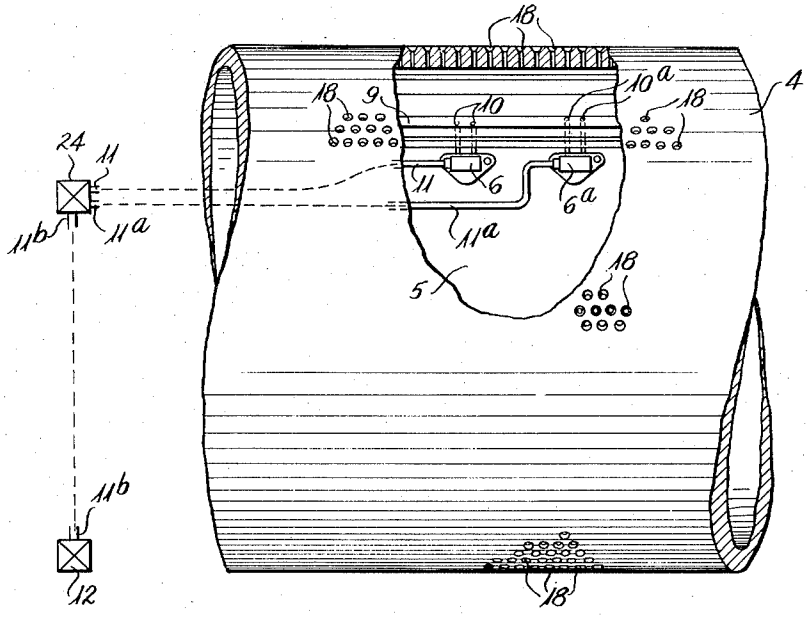
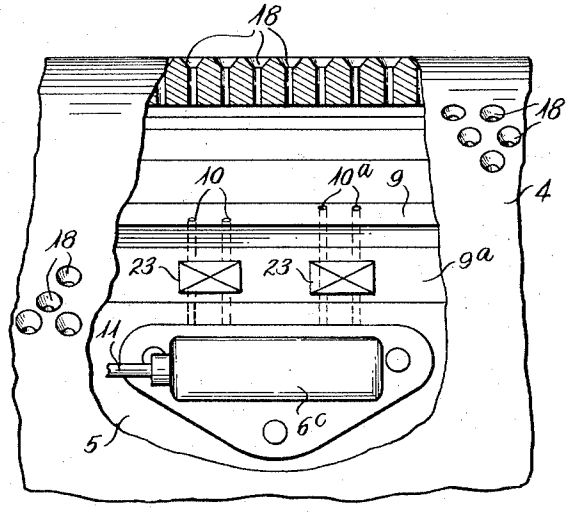


FIG. 7.



INVENTOR.
Arthur William Western
BY Walter Taylor
Bacon & Thomas
ATTORNEYS

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COUCH ROLL STRUCTURE FOR PAPER MAKING MACHINES

Arthur William Western and Walter Taylor, Greenhithe, England, assignors to Empire Paper Mills Limited, Greenhithe, England, a British company

Application June 22, 1953, Serial No. 363,188

Claims priority, application Great Britain June 26, 1952

16 Claims. (Cl. 92—47)

This invention relates to improvements in or relating to paper-making machines, and more particularly to devices for supervising the position of "draw" of the wet paper web from the forming belt or wire.

In conventional paper-making machines, it is usual to provide a suction couch roll around which the forming belt or wire passes, the wet paper web being drawn off this couch roll on to a press roll whereafter it is dried in a known manner. The position at which the newly formed wet paper web leaves the forming belt is known as the position of "draw" and the actual draw position of the web in relation to the couch roll is critical, if the draw occurs too early, while the web is still over the suction box within the couch roll, the effect known as "plucking" is produced, i. e. the portions of the web in register with the perforations of the couch roll are held back by the suction, and if the draw is too late the web tends to run down the couch roll and break. In the first event the quality of the paper produced by the machine is impaired and in the latter event machine stoppages due to web breakage occur with excessive frequency. It will be appreciated that the correct draw position may well vary on a given paper machine according to the particular grade or type of paper being made.

It is an object of the present invention to provide a supervisory device whereby a continuous indication of the position of draw may be given so that deviations in either sense or in both senses are immediately made known.

According to the invention therefore, there is provided a supervisory device for indicating the position of draw of a wet paper web, comprising a chamber adapted to be maintained at low pressure, and to communicate with the interior surface of a suction couch roll at a detecting position in the region of the required position of draw, whereby in operation air may be admitted to said chamber whenever the couch roll at said detecting position is not covered by the paper web, and pressure-responsive means associated with said chamber.

The said chamber may be formed integrally with the suction box of a suction couch roll for example by adaptation of that portion of the suction box which carries the sealing strip at the trailing edge of the vacuum box. We prefer however to provide a separate chamber which is adapted to be mounted on a convenient part of the suction box e. g. the wall thereof at the trailing side, and to make communication with the interior surface of the couch roll either through the sealing strip at the trailing edge of the suction box or via passage means associated with the chamber, dependent upon whether the desired detecting position lies within the width of the sealing strip of the suction box or forwardly thereof in the direction of travel of the paper web.

In one form of the invention the said chamber is provided with a connection to the interior of the normal suction box to produce the desired low pressure in the chamber. However, it is preferred to omit such a connection as it is normally possible for the device to operate merely by the pressure reduction produced by the pumping action of

the couch roll perforations. As the latter leave the region above the suction box, they are normally covered by the wet paper web and are at a sub-atmospheric pressure as a result of the vacuum provided by the suction box. If they are immediately placed in communication with the chamber, the latter will become progressively exhausted until it reaches a pressure nearly as low as that in the suction box.

If now the draw occurs before the detecting position, no reduced pressure can be established in the chamber while if it occurs after the detecting position, a steady low pressure will be maintained. In the case where the web leaves the roll at the detecting position, a pressure fluctuation may be established.

The said pressure-responsive means may take various forms but we prefer to employ a diaphragm-operated electric switch which may be connected in circuit with any desired lamps, bells, buzzers or other warning devices. Such a switch may be situated in a wall of the chamber itself, or may be remote therefrom and connected thereto by suitable piping. It is desirable that the switch or other pressure-responsive means should be able to respond to the pressure fluctuations which may be established when draw takes place at the detecting position, so that with an indicating lamp for example a flickering light is obtained. Then if the detecting position is the desired draw position, a flickering light will indicate correct operation, while a light extinguished or steadily burning indicates a high or low draw (or vice versa, according to the switch response).

Where a draw position anywhere within a given range is satisfactory, two detecting positions may be used each with its associated chamber and pressure-responsive means, and the latter may be interconnected to give no indication when the one chamber is at low pressure while the other is at atmospheric pressure, but to give visual or aural signals when the condition of either chamber changes.

Normally an attendant will be present to correct the draw by suitable adjustments of the machine upon an adverse indication being given by the device according to the invention, but it is within the scope of the invention to connect the device to control means for the machine to make automatic correction, e. g. by varying the speed of the couch roll and/or regulating a stock inlet valve.

It is to be noted here that if due to opening of the stock inlet valve the substance weight increases the draw of the web from the couch roll will occur earlier since the added strength of the wet web more than counteracts the increased weight and there is less sag in the web between the couch roll and the press roll. Conversely if the substance weight decreases then the draw will occur later. Thus where corrections in response to the device are to be made by regulation of the stock inlet valve, the control means will be so connected with the said valve and the device as to take these factors into account.

The chamber may be maintained in communication with the interior surface of the couch roll by various means: for many grades of paper the desired position of draw will be within the width of the trailing edge of the suction box and it is then convenient to provide a bore through the rubber sealing strip bounding the suction box. Where a single machine may be operated at different times with various draw positions, a number of such bores may be provided at correspondingly different angular positions relative to the couch roll, and means may be provided for selectively employing different bores as required. It may be convenient to fit fluid valves whereby any one of the bores may be connected to a single chamber, or each may have its own chamber and the various chambers may be selectively connectible to a single pressure-responsive means. Where the couch

roll has perforations in staggered rows, two or more bores may be employed for each angular position to avoid dead spots. Alternatively, a slot may be provided in place of such two or more bores, the length of the slot being sufficient to cover the distance by which the perforations in successive rows of the couch roll are staggered.

It is often valuable to make a continuous record of the draw position, and for this purpose devices embodying the present invention may include a vacuum recording gauge connected to the chamber. This has been found to provide a record of considerable value, as apart from affording a means of verifying an operator's alertness and competence in correcting draw variations, by comparison with other records, e. g. of the speed of the couch roll, changes in the various factors governing the draw position can be analysed.

In order that the invention may be fully understood, preferred embodiments thereof will now be described, by way of example only, referring to the accompanying drawings, in which:

Figure 1 shows an end section through a suction couch roll incorporating a device according to the invention,

Figure 2 is a side elevation of part of the couch roll of Figure 1 broken away to show the mounting of the said device.

Figure 3 shows in vertical section and to an enlarged scale a preferred form of device according to the invention,

Figure 4 shows a similar view of part of a modified form of device,

Figure 5 shows a similar view of yet another form of device, and

Figures 6 and 7 are similar to Figure 2 but, respectively, show further modifications of the invention.

Referring first to Figures 1, 2 and 3, a paper-making machine includes a forming belt or wire **1** upon which a paper web **2** is continuously formed, said web **2** leaving the belt **1** at a draw position **3**, to proceed to drying rolls of which one felt roll **19** only is shown. Below the belt **1** at the draw position **3** is a suction couch roll **4** having a suction box **5** therein. A casting bolted to the wall on the trailing side of the suction box **5** encloses a chamber **6** which is connected by a drilling **8** to a space below the rubber sealing strip **9** at the trailing edge of the suction box **5**. Two laterally spaced bores **10** (see Figure 2) through the strip **9** and its backing **9***a* make communication between the chamber **6** and the inner surface of the roll **4**.

The chamber **6** is also connected, by a pipe **11**, which extends out through the end of the couch roll **4**, to a diaphragm type pressure-responsive electric switch **12**. Chamber **6** is also connected, through pipe **11**, to a vacuum recording gauge G, shown schematically in Figure 3. The switch **12** has its contacts **13** connected in series with a warning lamp **14** across a low-voltage supply **15**, the contacts **13** being held open and the lamp **14** thus remaining unlit whenever a sufficiently low pressure exists in the chamber **6**. The diaphragm of the switch **12** is provided with a biasing spring **16** having an adjusting screw **17**, so that the pressure required to hold the switch open may be set to a desired value. The said switch **12**, lamp **14** and low voltage supply **15** are all preferably mounted clear of the couch roll **4** on any convenient panel.

The surface of the couch roll **4** has as is known, a plurality of perforations **18** through which suction is applied to the wet web between the leading and trailing edges of the suction box **5**. It will be observed (Fig. 2) that the perforations **18** are disposed in staggered rows, and one bore **10** is aligned with an "even" row while the other bore **10** is aligned with an "odd" row. As these perforations move past the trailing edge of the suction box **5** they will normally be at sub-atmospheric pressure due to the suction effect of the suction box and to the

fact that they are covered by the web up to the draw off point. This low pressure will therefore exercise a pumping effect on the chamber **6** via bores **10** and drilling **8** and will reduce the pressure in chamber **6**, the two bores **10** operating alternately so that dead spots, when the chamber **6** is blanked off by the roll, are substantially eliminated.

When the machine is in operation, if the paper web remains on the forming belt **1** until it has passed the trailing edge of the suction box, then the bores **10** have no access to the atmospheric air at their outer ends and the chamber **6** is maintained at the reduced pressure mentioned above. When however, the web leaves the belt before passing over the trailing edge, then the bores **10** are opened to the atmosphere and pressure in the chamber **6** rises to atmospheric whenever a perforation **18** of the couch roll passes a bore **10**. The diaphragm of the switch **12** is adjusted so that, in the former case, its contacts are open while in the latter case they are closed, the lamp **14** being respectively unlit and lit. If now the paper web leaves the belt just above the bores **10**, the chamber **6** will be open to the atmosphere for a very short time, through a restricted opening, each time a perforation **18** passes, and a cyclical pressure fluctuation is established which with a suitable adjustment of the switch diaphragm gives repeated opening and closing of the switch contacts **13**, and hence the lamp **14** flickers.

Thus, by locating the bores **10** so that they lie at the required position of draw or within a permitted region of draw it will be seen that when the lamp **15** is flickering the draw is correct whilst when it is steadily lit or unlit the draw is either too high or too low.

In a modified form of chamber shown in Figure 4 an additional drilling **7** is provided which connects the inside of the chamber **6** to the interior of the suction box and thus provides a low pressure which is communicated to the bores **10**.

It will be understood that the detecting position as represented by bores **10** in Figures 3 and 4 may be varied within the width of the sealing strip as may be required on any given paper machine. If however a detecting position outside the width of the sealing strip is required a device as shown in Figure 5 may be provided. The couch roll **4** has a suction box **5** with a sealing strip **9** at its trailing edge. Chamber **6** is bolted to the wall of the suction box. It is in contact with the inner side of the couch roll **4** via an upper wall **20** having a sealing strip **21** therealong a perforation or drilling **22** connecting the interior of the chamber to the inner end of the perforations **18** of the couch roll **4**. The said chamber is similarly connected to pressure-responsive means as have been described above and the device operates in an analogous manner thereto, the chamber being maintained at low pressure by the pumping action of the couch roll perforations **18** referred to with reference to Figure 3.

In any of the above described devices, the pipe **11** may be of any desired length, within reason, so that the switch **12** may be installed in any convenient position remote from the chamber **5** and said pipe **11** may if desired extend through the open end of the couch roll.

In Figure 6 a modified couch roll according to the invention is shown. On the trailing side of the suction box **5** two chambers **6** and **6***a* are mounted. Each of these chambers **6**, **6***a* is similar to chamber **6** above described. The sealing strip **9** of the suction box has two pairs of laterally spaced bores **10**, and **10***a*, which communicate, respectively, with chambers **6** and **6***a*. As shown, bores **10**, and **10***a* are located, respectively, near the front and rear sides of the said strip **9** so that they define two detecting positions spaced circumferentially of the couch roll. Chambers **6**, and **6***a* are connected by pipes **11**, **11***a* to a valve means shown schematically at **24**, which enables either chamber to be selectively connected via pipe **11***b* to the common pressure respon-

sive switch **12** depending upon which draw position is to be used.

In Figure 7 a further modified construction is shown in which a single chamber **6***c* is mounted on the trailing side of the suction box **5**. The sealing strip **9** has two pairs of bores **10**, **10***a* therethrough each of which communicates with the said chamber **6***c*. Valve means **23** are provided for each pair of bores, **10** and **10***a*, respectively, which enable either one of said pairs of bores **10**, **10***a* to be selectively disconnected from chamber **6** whilst the other is connected therewith. The two pairs of bores **10**, and **10***a* are located respectively near the front and rear sides of the sealing strip **9** so that they are circumferentially spaced with respect to the couch roll. Hence by closing one of the valves **23** the chamber **6** can be placed in communication with a selected one of two detecting positions provided by bores **10** and **10***a* depending upon which position of draw is required.

It will be understood that only preferred embodiments of the invention have been described above by way of example and that variations and modifications may be made therein without departing from the scope of the invention. Thus for instance two lamps or other warning devices may be connected to a source of current through the pressure responsive device, so that when one warning device is operated an indication of a high draw is given whilst the other warning device indicates a low draw, the draw being correct when neither warning device is operating.

What we claim is:

1. In a suction couch roll for a paper making machine which roll includes a perforated shell and a suction box having an open side against the inner surface of said roll and extending a relatively large circumferential distance therein, said machine including means for drawing a paper web from said roll substantially tangent to said roll at a predetermined circumferential position, the improvement constituting a web-detecting device which comprises; means defining a chamber, means defining a passageway providing direct communication between said chamber and the interior surface of said shell at said predetermined circumferential position of small circumferential extent located adjacent but spaced from the trailing edge of said suction box, and pressure responsive indicating means controlled by pressure in said chamber, whereby in operation atmospheric air is admitted to said chamber whenever said paper web is drawn from said roll in advance of said predetermined position.

2. A suction couch roll as set forth in claim 1 including a sealing strip between the trailing edge of said suction box and the inner periphery of said shell, and means defining a radial opening through said sealing strip on the trailing side of said suction box and defining at least a portion of said passageway.

3. A suction couch roll as set forth in claim 1 in which said pressure responsive means is a diaphragm-operated electric switch connected by pipe means to said chamber.

4. A suction couch roll as set forth in claim 1 in which a vacuum recording device is connected to said chamber to record variations in pressure occurring therein in operation.

5. In a suction couch roll for a paper making machine which roll includes a perforated shell and a suction box having an open side against the inner surface of said roll and extending a relatively large circumferential distance therein, said machine including means for drawing a paper web from said roll substantially tangent to said roll at a predetermined circumferential position, the improvement constituting a web-detecting device which comprises; means defining a chamber, means defining a passage on the trailing side of said suction box providing direct communication between said chamber and the interior surface of said shell at said predetermined circumferential position, means defining a further passage connecting said chamber with the interior of said suction box and pressure responsive means controlled by pressure in said chamber, whereby in operation air is admitted to said chamber whenever said paper web is drawn from said roll in advance of said predetermined position.

6. A suction couch roll as set forth in claim 5 including sealing strips between said suction box and said shell, said passage means being formed in said sealing strip on the trailing side of said suction box.

7. A suction couch roll as set forth in claim 5 in which said pressure responsive means is a diaphragm-operated electric switch connected by pipe means to said chamber.

8. A suction couch roll as set forth in claim 5 in which a vacuum recording device is connected to said chamber to record variations in pressure occurring therein in operation.

9. In a suction couch roll for a paper making machine which roll includes a perforated shell and a suction box having an open side against the inner surface of said roll and extending a relatively large circumferential distance therein, said machine including means for drawing a paper web from said roll substantially tangent to said roll at a predetermined circumferential position, the improvement constituting a web-detecting device which comprises; means defining a chamber on the trailing side of said suction box, said chamber having a wall in contact with the inner surface of said shell, means defining a passage through said wall providing direct communication between said chamber and the said inner surface at said predetermined circumferential position, and pressure responsive means controlled by pressure in said chamber, whereby in operation air is admitted to said chamber whenever said paper web is drawn from said roll in advance of said predetermined position.

10. A suction couch roll as set forth in claim 9 including means defining a further passage connecting said chamber to the interior of said suction box.

11. A suction couch roll as set forth in claim 9 in which said pressure responsive means is a diaphragm-operated electric switch connected by pipe means to said chamber.

12. A suction couch roll as set forth in claim 9 in which a vacuum recording device is connected to said chamber to record variations in pressure occurring therein in operation.

13. In a suction couch roll for a paper making machine which roll includes a perforated shell and a suction box having an open side against the inner surface of said roll and extending a relatively large circumferential distance therein, said machine including means for drawing a paper web from said roll substantially tangent to said roll at a predetermined circumferential position, the improvement constituting a web-detecting device which comprises; means defining a chamber, means defining at least two passages at the trailing side of said suction box, said passages being circumferentially spaced, with respect to the shell and each providing direct communication between said chamber and the interior surface of said shell at different detecting positions adjacent to but respectively ahead of and rearwardly of said predetermined position, pressure responsive means controlled by pressure in said chamber, and valve means for selectively disconnecting all but one of said passages from said chamber whereby in operation air is admitted to said chamber whenever said selected passage is not covered by paper.

14. A suction couch roll as set forth in claim 13, including sealing strips between said suction box and said shell, said spaced passage means being formed in said sealing strip on the trailing side of said suction box.

15. A suction couch roll for a paper making machine comprising a perforated shell, a suction box having an open side against the inner surface of said roll and extending a relatively large circumferential distance therein,

said machine including means for drawing a paper web from said roll substantially tangent to said roll at a predetermined circumferential position, means defining at least two chambers, each chamber having passage defining means at the trailing side of said suction box providing direct communication between its respective chamber and the interior surface of said shell at detecting positions adjacent to but respectively ahead of and rearwardly of said predetermined position the respective passage defining means being circumferentially spaced with respect to said shell, pressure responsive means, and valve means for selectively connecting one of said chambers to said pressure responsive means whereby in operation air is admitted to said one chamber to actuate said pressure responsive means whenever said shell at the detecting position associated with said one chamber is not covered by the paper web.

16. A suction couch roll as set forth in claim 15 including sealing strips between said suction box and said shell, said respective passage defining means being in said sealing strip at the trailing side of said suction box.

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