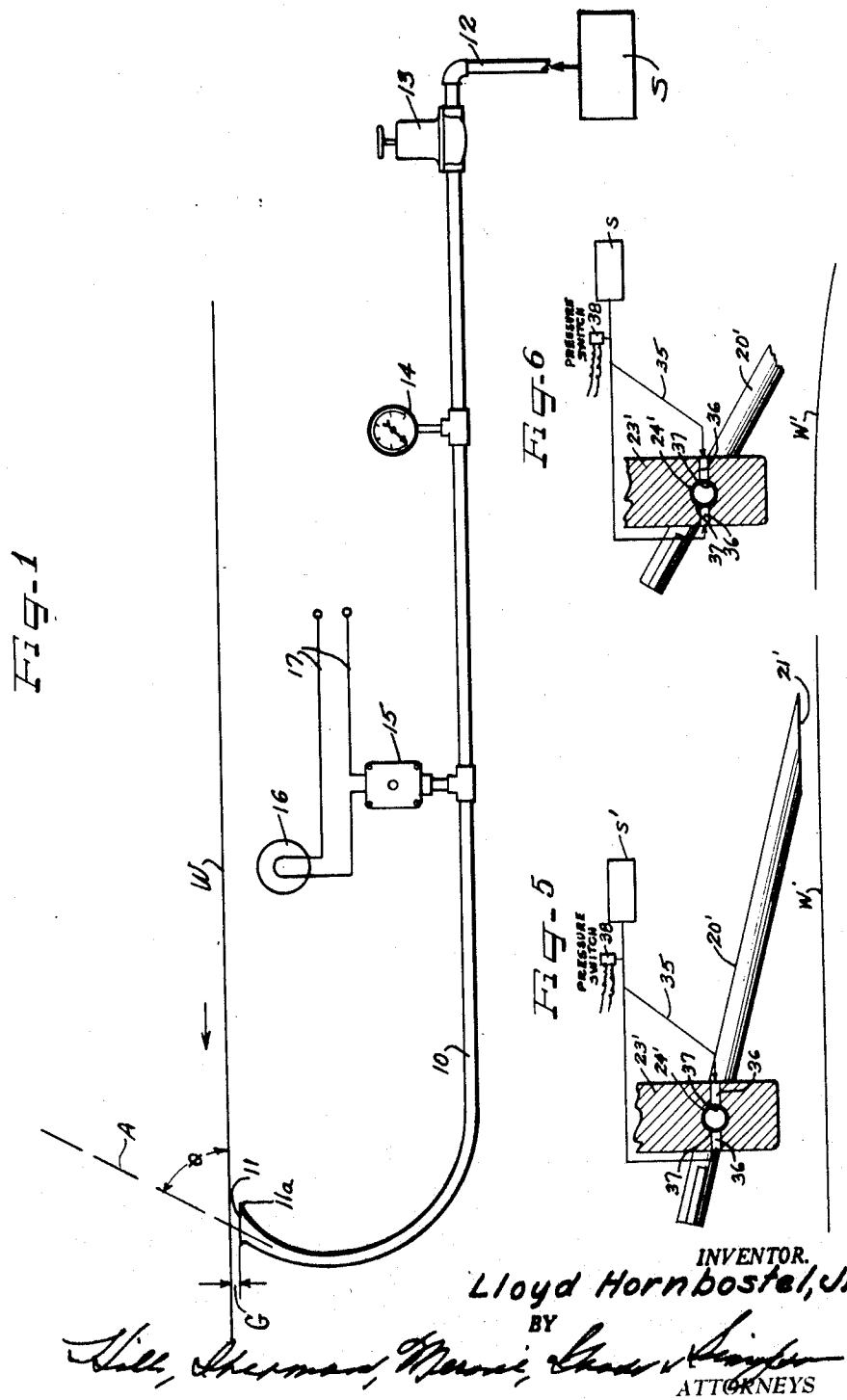
Dec. 1, 1964 L. HORNBOSTEL, JR 3,159,028

SHEET BREAK DETECTOR

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SHEET BREAK DETECTOR

Filed Feb. 15, 1961 2 Sheets-Sheet 2

Fig-2

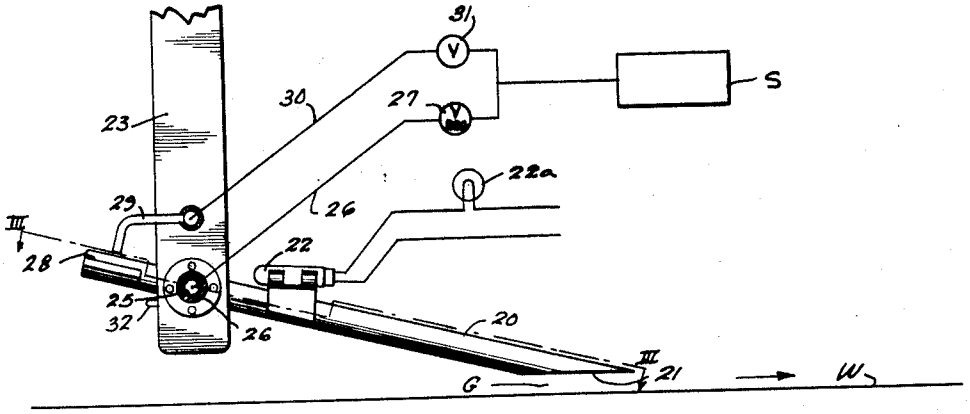


Fig-3

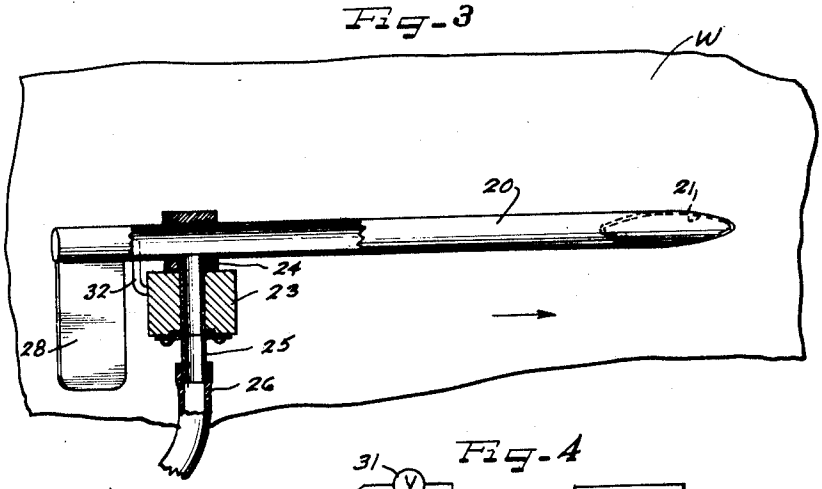
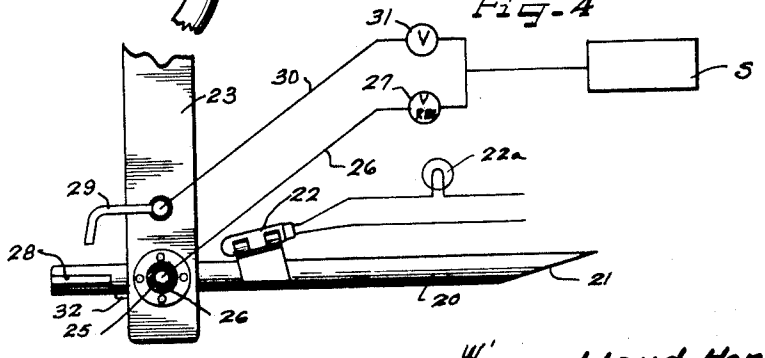


Fig-4



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SHEET BREAK DETECTOR

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The present invention relates to improvements in mechanism for detecting breaks in a sheet such as a travelling paper web in a paper machine.

Sheet or web break detectors have been employed for detecting a break in a travelling sheet of material and used in winding and unwinding machines in the paper industry, in printing presses, and in other fields and for other materials. The embodiment of the present invention finds uses in these various fields but is well suited to use for detecting a break in a travelling paper web and will be described for this use.

Break detectors have been employed which require engagement with the moving sheet and these have not been wholly satisfactory in that they fail from interference with foreign materials and engagement with a fast running sheet is disadvantageous such as with circumstances where damage to the sheet can occur. Light beam type detectors have also been employed and these have disadvantages in that they will fail from interruption of the beam by foreign materials, will detect breaks only when an actual tear reaches the unit, and cannot be used in all environments.

An object of the invention is to provide an improved sheet break detector utilizing a stream of air flowing against the travelling sheet wherein movement of the sheet out of its normal running plane can be simple and immediately detected so that loss in tension in the sheet resulting from the break will enable detection before the actual tear reaches the detecting unit.

Another object of the invention is the provision of an improved sheet break detector which eliminates the need for contact with the travelling sheet and cannot damage or mar sheets which are coated or have a finished surface.

A further object of the invention is to provide an improved mechanism for detecting breaks in a moving web which can be simply and quickly removed from the operating position for rethreading of the machine.

A feature of the invention is the provision of a sheet break detector employing a first means for directing a stream of air against the surface of a moving web travelling in a predetermined running plane with second means for detecting the effect on the first means of movement of the web out of the running plane so that breaks in the web and other conditions which cause the sheet to move out of its running plane are immediately detected.

Other objects, advantages and features will become more apparent with the teaching of the principles of the invention in connection with the disclosure of the preferred embodiments thereof in the specification, claims and drawings, in which:

FIGURE 1 is a side elevational view shown in somewhat schematic form of a sheet break detector embodying the principles of the present invention;

FIGURE 2 is a side elevational view shown partially in section and illustrated somewhat schematically of another form of sheet detector embodying the principles of the present invention;

FIGURE 3 is a vertical sectional view taken substantially along line III—III of FIGURE 2;

FIGURE 4 is a side elevational view similar to FIGURE 2 showing the parts of the mechanism in position for threading a fresh web into place; and

FIGURES 5 and 6 are vertical sectional views taken through a modified form of the mechanism shown in FIGURES 2 through 4.

As shown on the drawings:

As shown in FIGURE 1 the travelling sheet or web W moves in the direction indicated by the arrowed line. During normal operation the web is positioned in a normal running plane, but if the web should tear it will lose its tension and be free to shift laterally of the running plane. In accordance with the invention, a jet of air is directed laterally against the web and the normal running tension resists the force of the air. However, when the sheet breaks, the sheet loses its tension and the effect on the air stream of the reduction in resistance is detected. A tubular conduit **10** is provided with an orifice or nozzle **11** positioned adjacent the surface of the web W in its running plane. The nozzle is positioned so that the direction of the air stream as indicated by the broken line A forms an acute angle θ with the web W and is directed toward the oncoming web.

The conduit **10** is supplied with a continual flow of air under substantially constant pressure through a supply line **12** from an air supply S. If used in a paper machine the air supply may be taken from the pressurized supply S that is normally available in paper making machines.

The supply line **12** connects to the conduit **10** through a pressure regulating valve **13**. A pressure gauge **14** may be conveniently connected in a line downstream of the pressure regulating valve **13** to indicate the pressure in the conduit **10**.

Also connected to the conduit **10** downstream of the pressure regulating valve **13** is a pressure switch **15** which is responsive to the pressure in the conduit **10** and may be connected to operate mechanism in response to a change in pressure in the conduit **10**. As shown, the pressure switch **15** is connected to a signal **16** supplied with electricity through a line **17**.

In operation, the presence of the web W, prevents the free escape of air from the conduit **10**, and the pressure in the conduit **10** will be dependent upon the size of the gap G between the opening of the nozzle **11** and the web W. With breakage of the web the tension is lost and the web is immediately free to move away from the nozzle **11** resulting in a drop in pressure in the conduit **10** and in actuation of the pressure switch **15**. The pressure switch may be attached to a warning device as shown or to cut off traverse mechanism or other control mechanism which operates in response to breakage of the web or a loss of tension thereof.

Thus the nozzle **11** with the conduit **10** and air supply provide a first means for directing a stream of air against the surface of the web W in its normal running plane and the pressure responsive mechanism **15** provides a second means for detecting the effect on the first means of movement of the web out of the running plane.

As an example of operation a preferred structure has been found in an arrangement wherein the gap between the nozzle **11** and the running plane of the web W is within the range of ⅛ to ½ inch using a ½ inch conduit **10** and providing a 1 inch diameter flare to the edge **11***a* of the nozzle **11**. The angle θ is in the range of 60° to 80° and the air supply S of 60–90 pounds per square inch is reduced to 3 pounds per square inch by the valve **13**. The pressure switch **15** is adjustable between 1.0 and 1.8 pounds per square inch.

The arrangement of FIGURES 2 through 4 shows a hollow tube **20** cut off at an angle at its end to provide an orifice or nozzle **21** for directing a stream of air against a travelling paper web W. The reaction force of the air supports the nozzle **21** above the web with a gap G. With breakage of the web W and a resultant loss of tension the web is free to move downwardly and the nozzle **21** of the tube **20**, which is pivotally mounted, will move downwardly to actuate a switch **22** mounted

on the tube. The switch 22 may take various forms and as illustrated a mercury switch is provided which will be connected to a signal device 22*a* or other mechanism to be actuated in response to breakage of the web W.

As shown in FIGURE 3, the tube 20 is supported on a hollow supply shaft 24 which communicates with the hollow inside of the tube 20 and is pivoted in a vertical support bracket 23. The support bracket is provided with a fitting 25 for connection of an air supply hose 26 so that the inside of the tube 20 is provided with a continuous flow of pressurized air.

Air is supplied from an air pressure source S to which is connected a line or a tube 26 and the supply is furnished at a constant pressure through a pressure reduction valve 27. The flow of air out through the nozzle 21 of the tube 20 holds the end of the tube above the moving web W so that only a flow of air engages the web. The tube and its nozzle provide a first means for directing a stream of air against the surface of the moving web and the pivotal support for the tube and its switch provide a second means for detecting the effect on the first means of movement of the web out of the running plane, and as the web drops downwardly, the tube will immediately pivot downwardly to actuate the switch 22.

The tube 20 is shown in a running position in FIGURE 2 and is movable to a threading position, as shown in FIGURE 4, for threading a fresh web W' into the machine. A tube support is provided for simply raising the nozzle 21 and holding it in a raised position out of the way of the web. For this purpose, a threading air nozzle 29 is mounted on the bracket 23 and supplied with air through a line 30 connected to the air supply S. A valve 31 when opened permits air to flow through the nozzle 29 against a reactance surface on a reactance plate 28 secured to the end of the tube 20. The reactance plate 28 is positioned on the end of the tube opposite the nozzle 21 so as to lift the nozzle.

As the valve 31 is opened the emerging air from the nozzle 29 forces the reactance plate 28 downwardly to pivot the tube against a stop 32 on the bracket 23 and the tube will be held in that position, as shown in FIGURE 4, until the valve 31 is closed whereupon it will pivot back to the running position of FIGURE 2.

In brief summary of operation, with reference to FIGURE 1, the web W moves under tension in a machine in a reference plane as controlled by rollers or other support members and air escaping from a nozzle 11 builds up a reactance air pressure in the conduit 10. When the web breaks so that it loses tension and moves away from the nozzle 11 then the air pressure in the conduit 10 immediately drops to actuate a pressure switch 15.

Thus it will be seen that I have provided improved mechanism meeting the objectives and advantages above set forth for detecting the breakage of a sheet. The mechanism is uncomplicated and reliable in construction and is capable of operating in adverse environments. The mechanism requires only a supply of air under pressure and it is well suited to operation over a range of pressures. It will be understood that the mechanism can be placed in various positions relative to a moving web and is suited to use for detecting of breakage and lose tension of various moving elements.

In FIGURES 5 and 6 a modification of the arrangement of FIGURES 2 through 4 is illustrated. A movably supported conduit 20' has an open nozzle 21' at its end with a flow of air emitting from the nozzle and the reaction of the air stream on the web W' supports the nozzle in the position shown in FIGURE 5. With breakage of the web the nozzle and its supporting conduit 20' swing down to the position of FIGURE 6.

Air flows into the conduit 20' in somewhat the same manner as the arrangement of FIGURES 2 through 4 and a hollow tube 24' is pivotally supported in a horizontal cylindrical opening in a bracket 23' in the same manner as the arrangement illustrated in FIGURES 2

through 4. Instead of the air being supplied through the end of a tube however, air is supplied laterally through passages 36 in the bracket to flow into the tube 24' through valve ports 37 and the passages 36 are supplied from an air supply line 35 connected to a supply S'. The tube 24 with its ports constitutes a valve and the position of the ports 37 permits air to flow into the conduit 20' in the first position of the conduit as shown in FIGURE 5, and restricts or cuts off the flow of air in the position of the conduit shown in FIG. 6. The result of the cutting off of the air flow creates an increase in pressure in the supply line 35 actuating a pressure switch 38 to thereby manifest the break in the web W'. It will be recognized that while the pressure switch 38 is the preferred form of detecting the effect on the flow of air through the line 35 due to the shutting off of the valve provided by the tube 24', other means of detecting the effect on air flow may be used. Similarly while the pressure sensitive switch 15 of the arrangement of FIGURE 1 is the preferred form of detecting the change in air flow due to breakage of the web, other means may be provided to detect the effect on air flow.

The drawings and specification present a detailed disclosure of the preferred embodiments of the invention, and it is to be understood that the invention is not limited to the specific forms disclosed, but covers all modifications, changes and alternative constructions and methods falling within the scope of the principles taught by the invention.

I claim as my invention:

1. A mechanism for detecting a break in a web comprising a flow conduit having an orifice for directing a stream of air against the surface of a web moving in a normal running plane with said stream forming an angle with said running plane and directed toward the oncoming web with the web surface providing a resistance to the escaping air, an air supply source connected to said conduit, a pressure regulator in said conduit to maintain the air supply at a substantially uniform pressure, and a pressure responsive device connected to the conduit downstream of the pressure regulator indicating change in pressure due to movement of the web out of said running plane so that a break in the web will be detected.

2. A mechanism for detecting a break in a web normally travelling in a predetermined running plane comprising a fluid flow conduit having an escape nozzle for directing a stream of fluid against the surface of a web in a normal running plane, a pivotal mounting for said conduit supporting the conduit for free pivotal movement about an axis generally parallel to said plane of the web so that the reactive flow of the fluid emerging from the nozzle will support the nozzle at a position spaced from the surface of the web, and an electrical switch connected to the conduit and actuated by movement thereof for detecting movement of the web out of said plane.

3. A mechanism for detecting a break in a web normally travelling in a predetermined running position comprising a flow nozzle having an orifice for directing a stream of fluid against the surface of the web, means movably supporting said nozzle so that the running position of the nozzle will be determined by the reactive force of fluid flowing against the web, means responsive to the running position of said nozzle so that movement of the web from said running plane is detected, said nozzle movable between a running position adjacent the web and a threading position away from said running position so that a fresh web may be placed in said running plane without interference with the nozzle, and a releasable support for holding said nozzle in said threading position.

4. A mechanism for detecting a break in a web normally travelling in a predetermined running position comprising an air flow conduit having an escape nozzle for directing a stream of air against the surface of the web in a normal running plane, a pivotal mounting for said

conduit supporting the conduit for free pivotal movement about an axis parallel to said plane of the web so that the reactive force of the air emerging from the nozzle will support the nozzle at a position spaced from the surface of the web, an air supply connected to said conduit, means responsive to the pivotal position of the conduit for detecting movement of the web out of the running plane, a reactance member having a surface connected to said conduit positioned to pivot the conduit and nozzle to a threading position away from said plane, and a valve controlled threading air nozzle connected to the air supply and positioned to direct the flow of air against said reactance surface for moving the nozzle to threading position.

5. A mechanism for detecting a break in a web comprising a flow conduit having an orifice for directing a stream of air against the surface of a web moving in a normal running plane with said stream forming an angle with said running plane and directed toward the oncoming web at an angle being in the range of 60° to 80° with the web surface providing a resistance to the escaping air, an air supply source connected to said conduit, a pressure regulator in said conduit to maintain the air supply at a substantially uniform pressure, and a pressure responsive device connected to the conduit downstream of the pressure regulator indicating change in pressure due to movement of the web out of said running plane so that a break in the web will be detected.

6. A mechanism for detecting a break in a web normally travelling in a predetermined running position comprising, a fluid pressure device having a pivotally supported member with an orifice thereon positioned adjacent said running position to direct the flow of fluid against the surface of the web and support a pivotal running position of the member due to the reaction of the air against the web, said orifice spaced from the pivotal support of the member in a direction of web travel away from said pivotal support, fluid supply means connected to said device, an operating circuit, an operating switch connected in said circuit, and a switch actuator connected to said device and operated by changes in the device

produced by movement of said web away from said running position and affecting the flow of fluid from said orifice.

7. A mechanism for detecting a break in a web normally travelling in a predetermined running position comprising, a pivotally supported elongate member extending in the direction of web travel having an orifice at its free end positioned adjacent said running position to direct a flow of fluid against the surface of the web and held in its pivotal position by the reactive force of the flowing fluid due to its engagement with the surface of the web, means acting in response to a change in distance between the web and nozzle to manifest the change in position of the web from the running position, and a control circuit operated by said means when said web changes its position to affect the flow of fluid from the orifice.

8. A mechanism for detecting a break in a web normally travelling in a predetermined running plane comprising, a fluid flow nozzle tube having an escape nozzle for directing a stream of fluid against the surface of a web in a normal running plane, a pivotal mounting for said tube supporting the tube for free pivotal movement so that the reactive flow of the fluid emerging from the nozzle will support the nozzle at a pivotal position spaced from the surface of the web, and an electrical mercury switch mounted on the nozzle tube and actuated by movement thereof for detecting movement of the tube due to movement of the web out of said plane.

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