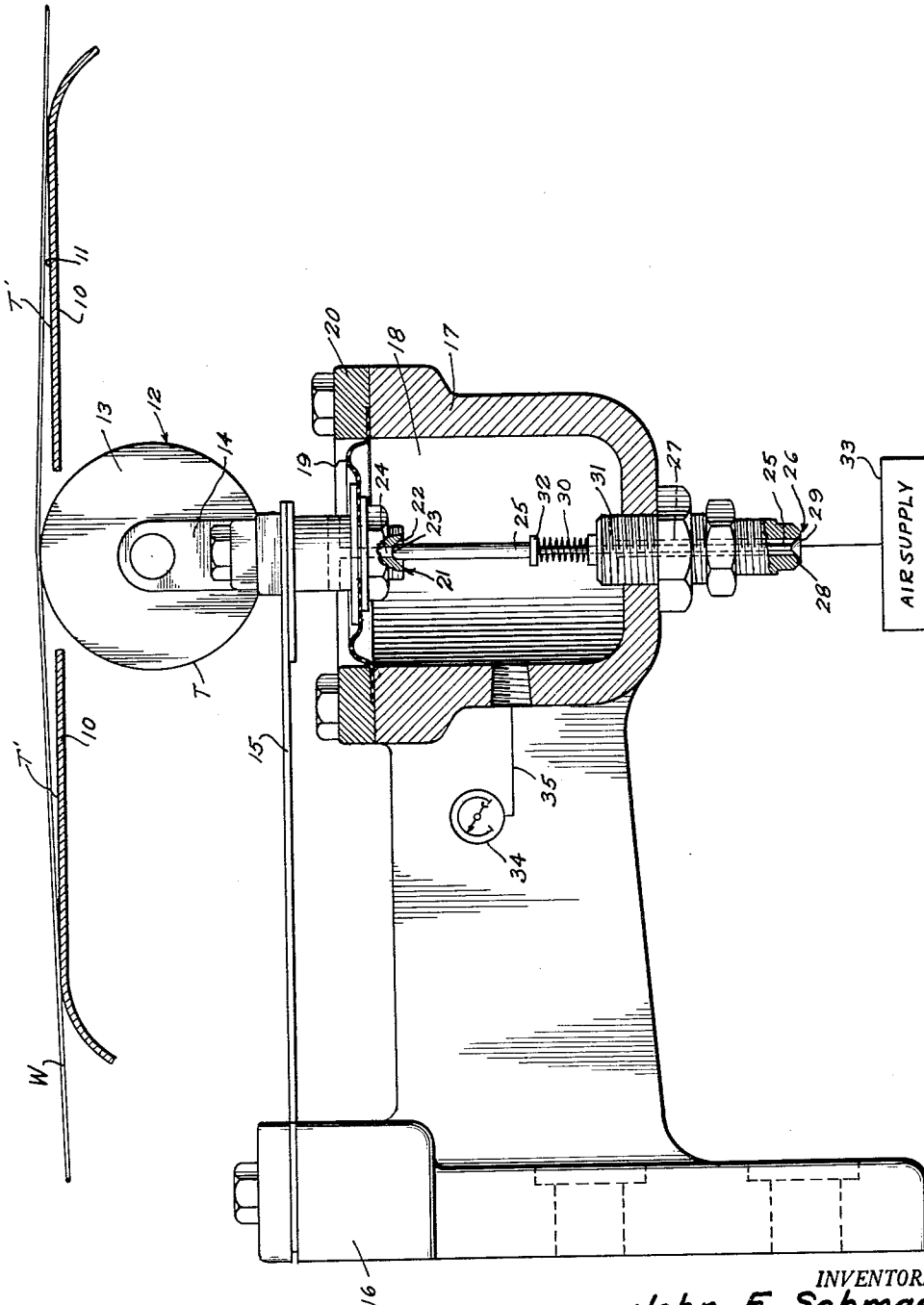


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J. F. SCHMAENG  
SHEET TENSION DEVICE  
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## SHEET TENSION DEVICE

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The present invention relates to improvements in a mechanism for measuring the linear tension in a moving web.

More particularly the invention embodies a force balance system wherein means are provided for laterally engaging and supporting a moving web to establish a reference plane, and a web engaging member such as a roller contacts the web to urge it in a direction out of the reference plane with a force dependent upon the web tension. A fluid pressure chamber is provided with a movable wall such as a diaphragm connected to the roller and the pressure in the chamber is varied by an inlet valve and an outlet valve in accordance with movement of the roller as the tension of the web changes. With decrease in web tension so that the roller temporarily deflects a greater distance the chamber pressure is decreased to reduce the force on the diaphragm, and with increase in web tension the chamber pressure is increased to increase the force on the diaphragm. An indicator is provided to measure the pressure in the chamber which is a function of web tension. Thus the force required to maintain the web engaging member in position is measured to determine the web tension.

Accordingly, an object of the invention is to provide an improved device of the above nature which is capable of measuring the tension of a moving web of material such as paper and which may be used as a sensing device to control the tension.

A further object of the invention is to provide an improved web tension measuring device of a simplified nature utilizing air pressure which is normally available in paper making machines and which may be used in adverse locations such as in wet or hot and humid environments, and can be used against coated sheets without damage to the sheet surface.

A further object of the invention is to provide a device for measuring tension or resistance force employing a force balance mechanism wherein a resistance force is changed in accordance with temporary variation in position of a tension measuring member to return it to a predetermined position and wherein the force can be measured.

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

The single figure of the drawings is an elevational view shown partially in section illustrating a tension measuring mechanism embodying the principles of the present invention.

As shown on the drawing:

A high speed moving web W, such as a traveling sheet of paper in a paper making machine, or a wire being wound, travels over guides 10 which laterally engage the web W and provide a lateral support with their smooth surface 11 establishing a reference plane. The web is deflected by a web engaging member 12 shown in the form of a roller 13. A force is applied to the web engaging member 12 in a direction lateral of or normal to the web W and the roller 13 will tend to deflect the web out of the reference plane (which is coplanar with the surface 11) a distance dependent upon the linear tension in the web W. This force is changed as the tendency to deflect

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is changed. The mechanism measures the force required to counteract web tension.

In accordance with the present invention the web engaging member 12 is urged laterally toward the web with a force balance mechanism wherein the force is decreased with increased deflection of the web and is increased with a decreased deflection of the web. In other words, as the web tension increases the lateral force is increased, and as the web tension decreases, the lateral force is decreased and the engaging member is maintained in a predetermined position.

This balancing force is measured and inasmuch as it is a function of web tension it will be used to indicate web tension. In the preferred embodiment the force is applied from pressure in a chamber acting on a movable wall and the chamber pressure is measured to detect web tension.

The roller 13 is supported on a movable post 14 having a bifurcated upper end to rotatably support the roller 13 for free rotation. When the tension of a web such as paper having a critically smooth finish or a coating is to be measured, the roller is preferably coated at T with a very smooth material such as polyfluorethylene known popularly as Teflon. The upper surfaces of the guides 10 are also coated, as shown at T', with Teflon.

The post 14 which supports the roller is guided in substantially vertical movement by a flexible guide arm 15 which is secured to a support bracket 16 provided with a suitable base for bolting to framework on a machine through which the web W runs. The bracket 16 supports a hollow casing 17 with a chamber 18 therein. The chamber 18 is manufactured to be open at the top and a movable wall preferably in the form of a flexible diaphragm is positioned to be exposed to the pressure within the chamber and is suitably secured to the post 14 to urge it upwardly in accordance with the pressure in the chamber 18. The diaphragm is secured to the chamber by an annular ring 20 bolted to the casing 17.

The chamber is provided with an exhaust or outlet valve 21 conveniently carried by the post 14 and diaphragm 19. A passage 24 leads through the base of the post communicating with the atmosphere and with the chamber 18. At the lower end of the passage 24 is a port surrounded by a valve seat 22 which coacts with a movable valve member 23 to control the valve opening. The valve member 23 is positioned at the top of a valve stem 25 within the chamber 18.

A pressurized fluid in the form of air pressure is supplied to the chamber controlled by an inlet valve 26. Air pressure is conveniently supplied from an air supply shown schematically at 33 and this may be obtained from a compressor or from an air system such as is conveniently normally available around paper making machinery.

The air flows into the chamber 18 through a passage 27 in a fitting 31. At the base of the passage is an inlet valve seat 28 which coacts with a valve head 29 mounted at the lower end of the valve stem 25.

The stem is normally urged upwardly by a coil compression spring 30 resting on the top of the fitting 31 and connected to the valve stem 25 by a collar 32.

The pressure in the chamber 18 will be a function of the tension in the web W and is measured by pressure gauge 34 connected to the chamber by a line 35. The gauge may measure directly in pounds per square inch of pressure or may be provided with a dial indicating web tension directly.

In operation, as the web tension increases it tends to force the web engaging member 12 downwardly to move the post 14 and the seat 22 of the exhaust valve 21 downwardly forcing the valve stem 25 downwardly to open the inlet valve 26 by moving the valve head 29 down-

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wardly away from the valve seat 28. The opening of the inlet valve 26 will tend to increase the pressure in the chamber 18 increasing the upward resistant force on the diaphragm and increasing the force that the roller 13 exerts upwardly against the web W.

If the tension in the web W decreases, the point of contact between the roller 13 and the web W tends to move upwardly away from the reference plane or surface 11. This moves the post 14 upwardly lifting the seat 22 away from the valve member 23 to open the exhaust valve 21 thereby reducing the pressure in the chamber 18.

During continuous operation and movement of the web W relatively stable conditions will exist so that air pressure is uniform in the chamber 18. Variations in tension of the web W will either bleed air from the chamber 18 through the outlet valve 21 or admit air through the inlet valve 26 thereby changing the pressure in the chamber 18 to change the reading on the indicator gauge 34.

Thus it will be seen that I have provided an improved mechanism for measuring web tension and for utilizing a force balance system which meets the objectives and advantages hereinabove set forth. The mechanism is reliable in operation, has fewer moving parts, and is capable of use in adverse environments, being especially well suited to operation for measuring the tension of a high speed traveling paper web in a paper making machine. The mechanism can be readily adapted to use as a tension control mechanism with the air pressure in the chamber used to control a brake or other mechanism which controls tension in the web W. The mechanism may also be adapted so that valves 21 and 26 have a constant flow feature and their setting is altered to change their rate of 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 measuring tension in a high speed moving web comprising first and second spaced shoes having planar web surface engaging surfaces for supporting a high speed moving web in a first direction laterally of the high speed web establishing a reference plane, a web surface engaging rotating wheel between said first and second surfaces in rolling engagement with the web

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supported for shifting movement laterally of the web with variation in web tension, a fluid pressure chamber, a pressurized fluid supply line connected to the chamber, a diaphragm exposed to pressure in the chamber and connected to said web engaging member and urging it laterally against the web with a force proportional to the pressure in the chamber, a first valve connected with the chamber and connected to said diaphragm and opening to permit the escape of fluid from the chamber as a function of movement of the point of engagement between the web and wheel away from said reference plane, a second valve connected to said supply line and to said diaphragm to be opened by movement of the point of contact between the wheel and web a predetermined distance toward said reference plane to admit the flow of pressurized fluid into the chamber, and means for increasing the fluid pressure in the chamber with said pressure being a function of said web tension.

2. A mechanism for measuring tension in a moving web in accordance with claim 1 and having a smooth non-friction material coating said web engaging surfaces of the shoes.

3. A mechanism for measuring tension in a high speed moving web comprising first and second spaced shoes having planar web surface engaging surfaces for supporting a high speed moving web in a first direction laterally of the high speed web establishing a reference plane, a web surface engaging rotating wheel between said first and second surfaces in rolling engagement with the web supported for shifting movement laterally of the web with variation in web tension, a fluid pressure operated force means urging said wheel against the web with a force that is a function of input fluid pressure, means varying said pressure as a function of the position of said wheel and increasing the pressure as a function of increase in web tension, and means measuring said pressure so that the tension of the web may be determined therefrom.

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