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WINDER TENSION CONTROL

Filed Nov. 18, 1966

FIG. 1

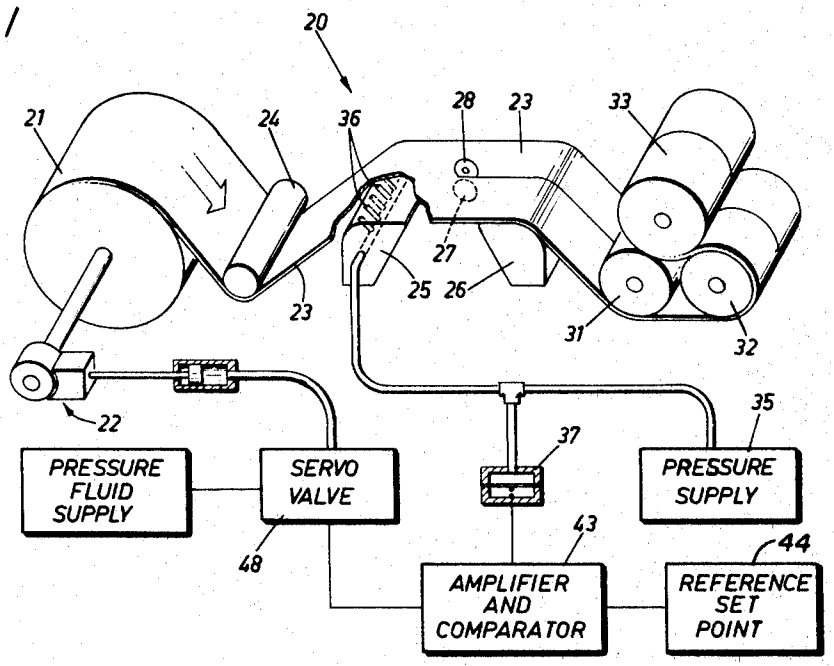
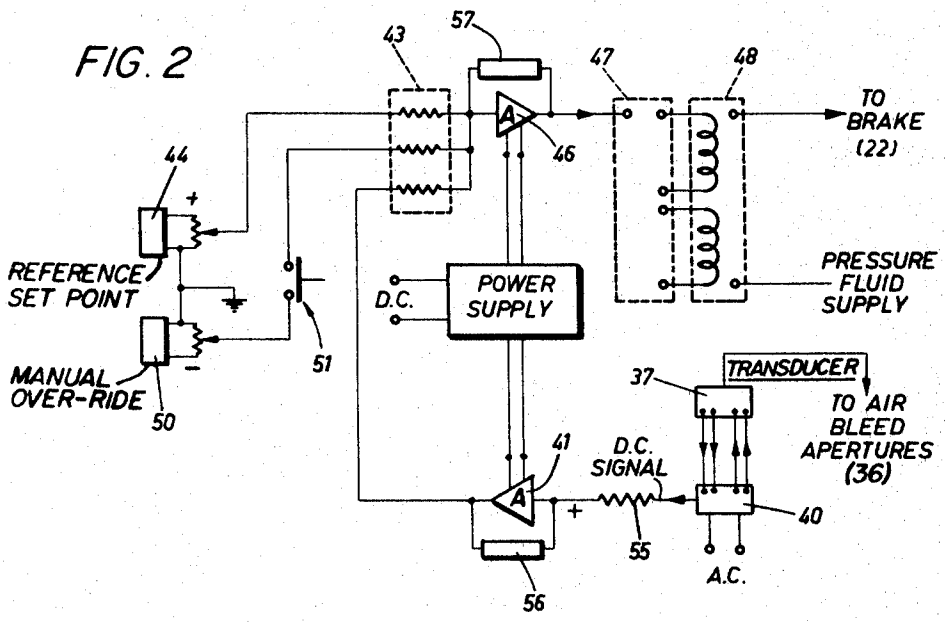


FIG. 2



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WINDER TENSION CONTROL

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ABSTRACT OF THE DISCLOSURE

In a brake-controlled web tensioning arrangement for a moving web the variation in back-pressure of air supplied to an air bleed draw table traversed by the tensioned web is sensed by a pressure transducer connected to control the actuation of the brake.

This invention is directed to an improved constant tension unreeling machine. In particular the invention relates to the maintenance of constant tension in paper unreeling apparatus.

In the operation of web handling apparatus, particularly in paper manufacturing processes, it is of vital importance to maintain the tension of the paper web at a constant value. The general method for providing constant tension is to change the braking torque exerted against the unwinding reel from which the web is being unwound by means of a brake, the braking effort being controlled by variations in the effected tension of the web. The present invention provides improved means for monitoring the tension in the web and utilizing the output signal obtained to control the reel brake.

In paper reeling, as carried out in the manufacture of sheet paper, such as newsprint, wherein machine widths in excess of 300 inches are encountered, particular problems present themselves, due to the particular environment of paper manufacture, and the mass, inertia and high winding speeds of the components involved.

Previous control systems have been characterized by a lack of sensitivity, low response times, and reduced range of operation to provide stable operating conditions.

Owing to these defects earlier machines had to be run up under hand control to avoid sheet breakage. It appears probable that the low air pressure employed in the brake servo system to provide suitable rates of brake release was not sufficient to provide emergency braking of the unwind reel, so that start-up on automatic control has not been practicable.

The present invention, by virtue of the accuracy, sensitivity, small response time, and utilization of electrical interconnection between remote components makes it possible to obtain a satisfactory response rate to permit automatic tension control throughout the cycle of winding sequence.

An object of the present invention is to provide an improved control circuit for sensing the tension in a web and applying a brake to an unreeling drum to maintain the tension substantially constant.

Certain embodiments of the present invention are described by way of example, reference being had to the accompanying drawings, wherein:

FIGURE 1 shows a general view of an unreeling apparatus incorporating a control circuit according to the present invention; and

FIGURE 2 is a circuit diagram of the electrical control circuit.

Referring to FIGURE 1, the winding apparatus 20 comprises an unwinding reel 21 having a reel control brake 22 mechanically coupled thereto, to control the unwind tension of a paper web 23, which is shown passing beneath a lead roll 24 and over a pair of opposing draw tables 25, 26 between which slitters 27, 28 are located. The web 23 in slit form passes through the nip of winder drums 31, 32, and is wound on the roll 33 illustrated.

A pressurized air supply 35 is connected to a plurality of bleed apertures 36 on the upstream draw table 25, and a differential pressure transducer 37, which senses variations in the back pressure in the system caused by variations in tension of the paper web passing over the draw table apertures 36, provides an output signal for operating a fluid servo valve to control operation of the brake 22.

Referring to the circuit diagram illustrated in FIGURE 2, a power supply 40 energizes the transducer 37 of the differential transformer type wherein variation in air pressure causes movement in the transducer core to vary the reluctance thereof and provide a signal voltage variation in accordance with the sheet tension, which the supply 40 provides as a DC output signal voltage to a feedback amplifier or preamplifier 41. The amplified signal passes to a comparator 43 which also receives a reference signal from an adjustable voltage precision power supply 44 which serves as a datum signal or reference set point for the desired web tension.

The error signal from the comparator 43, which represents the difference between desired tension and actual tension, passes to a second preamplifier or amplifier 45 and thence to a servo amplifier 47, the output of which operates a servo valve 48 to control the admission of pressure fluid to the reel brake 22, thereby controlling the tension in the web.

In the circuits of amplifiers 41 and 45 it is necessary to provide impedance filter networks 55, 56 and 57 respectively to compensate the circuits.

A manual override control 50 comprises a variable potentiometer which provides an overriding signal to effectively cancel the reference signal from the reference generator 44, thus operating the brake servo valve to the closed position and reducing brake pressure to zero. This permits manual removal of braking effect and may be adjusted to directly control the brake torque.

The switch 51, which comes into operation at the limit of travel of the manual over-ride control potentiometer handle, disconnects the manual control from the circuit, thus leaving the automatic tension control in full operation.

It is contemplated that a strain gauge type transducer may be substituted for the transducer 37 in conjunction with a deformable diaphragm.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A control circuit, for use with a web winding arrangement having an unwinding reel controlled by a power operated reel brake, an air bleed tension-sensing draw table, and a winder drum to receive the web, including an air pressure transducer for connection with the air supply circuit of said air bleed draw table, to provide an electrical output signal responsive to the rate of air bleed from the table; means to provide a reference signal representing a predetermined web tension; means for comparing the transducer signal with the reference signal to provide an output error signal representing the sense and the dimension of the variation of web tension from the predetermined value; and means responsive to said error signal to control the operation of the actuator powering said reel brake, to correct the tension of the web.

2. A control circuit as claimed in claim 1 including signal amplifier means to amplify said error signal.

3. A control circuit as claimed in claim 2 wherein said air pressure transducer comprises a variable reluctance device providing a voltage signal varying in accordance with the air pressure differential existing across the transducer.

4. A control circuit as claimed in claim 3 including signal ampilfying means actuated by the output signal from said transducer.

5. A control circuit as claimed in claim 3 including means to rectify the output signal from said transducer from alternating to direct current.

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FRANK J. COHEN, *Primary Examiner.*