July 1, 1969 J. J. VIEGAS 3,452,945

WEB TENSION CONTROL

Filed Feb. 15, 1968 Sheet 1 of 2

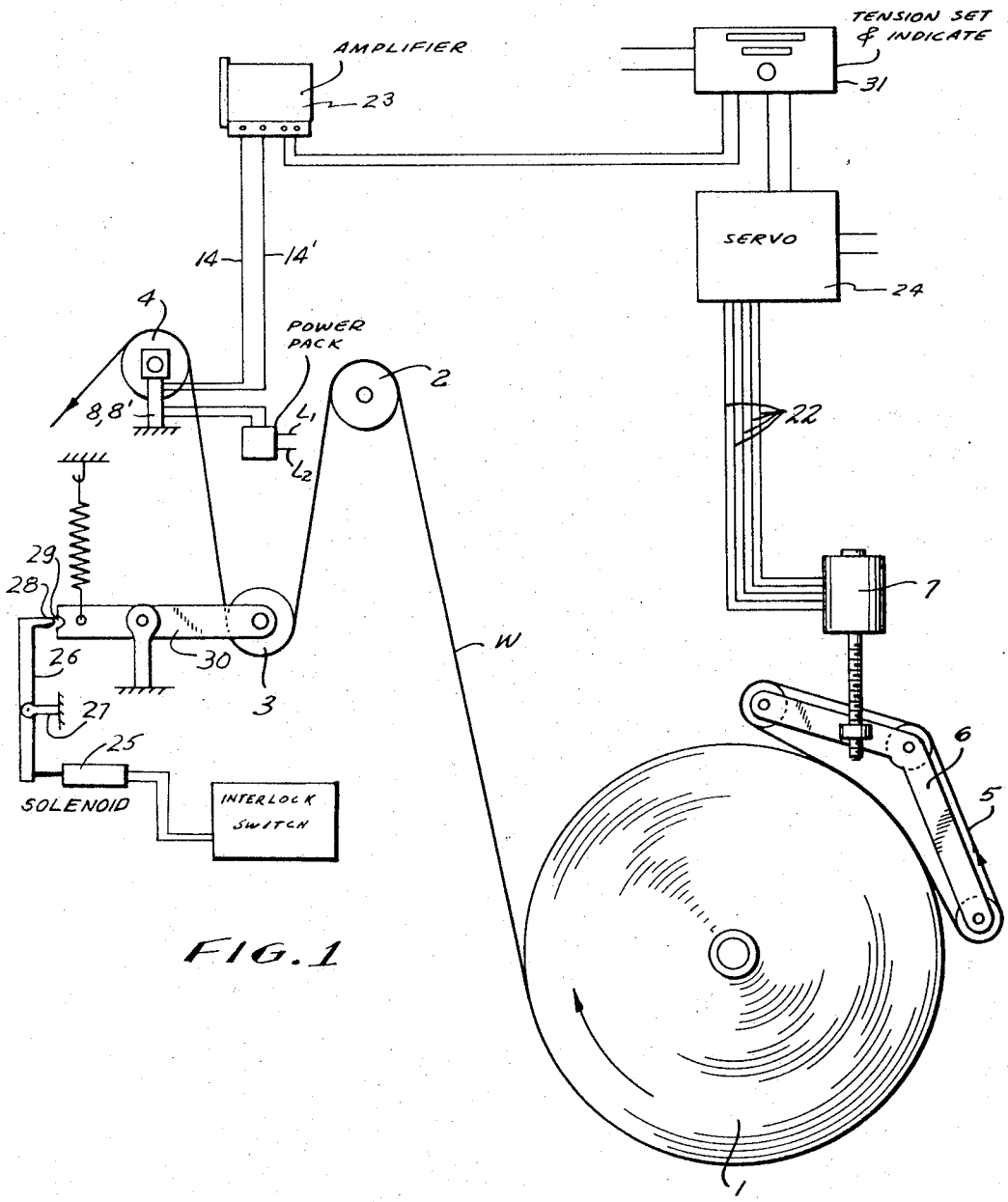


FIG. 1

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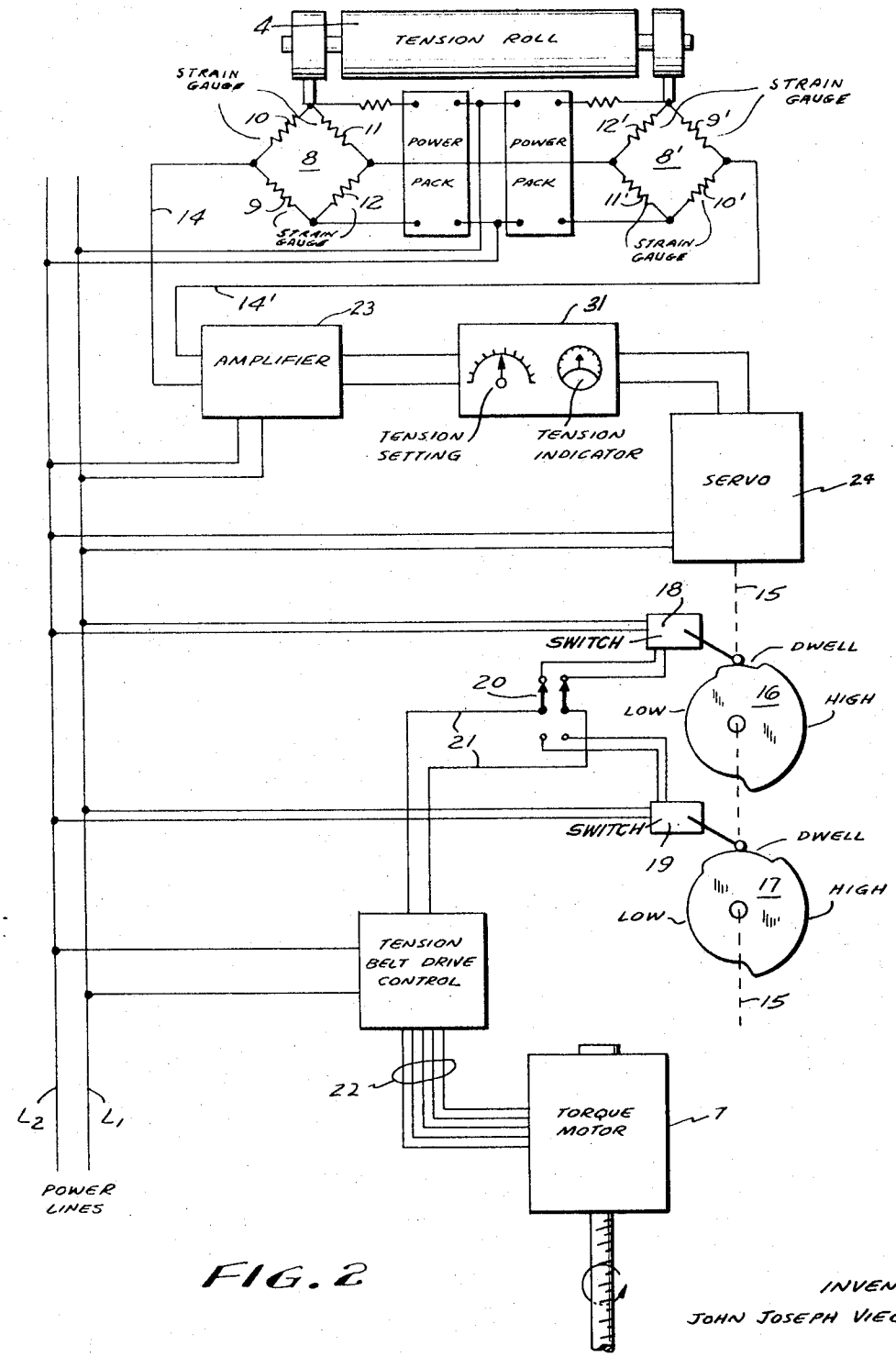


FIG. 2

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3,452,945

WEB TENSION CONTROL

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U.S. Cl. 242—75.42 2 Claims

ABSTRACT OF THE DISCLOSURE

A system for controlling the tension of a web for rotary printing machines through the use of pressure responsive elements mounted on supports for a web roller, and which produce signals proportional to changes in the web tension. The signals are used to initiate operation of a torque motor which in turn causes press driven belts to be moved toward or away from a web roll thereby increasing or decreasing the tension of the web.

Background of the invention

This invention relates to web tension controls and, more particularly, to web tension controls for rotary printing machines.

In web tension controls now generally in use, the tension is sensed by a so-called pilot or floating roller, the swing of which from a neutral point creates an error signal which is utilized to control the tensioning belts, brakes or straps so as to maintain the set tension. Such devices are positioned responsive and necessarily somewhat slow in operation. Also, since the mass of the roller is considerable and it is yieldingly urged against the web tension, the sensing system has vibration periods which cannot be damped out without slowing the response. For these reasons, it has been found difficult to obtain accurate, rapid control under the various press operating conditions without introducing hunting into the system.

The general object of the present invention is to provide a web tension control which is free of the foregoing disadvantages.

In a system according to the invention in a preferred form, pressure responsive elements are associated with the mountings of a web roller for producing an error signal of an instantaneous character and without perceptible displacement of the roller. The sensing elements now having a response time constant of a definitely lower order of magnitude than the tension mechanism and even the floating roller, effective control is provided under all conditions of operation without any tendency to hunt.

A system embodying the invention will now first be described with reference to the accompanying drawings and the features forming the invention will then be pointed out in the appended claims.

Brief description of the drawings

In the drawings:

FIG. 1 is a schematic elevation of a web tension control embodying the invention in a preferred form; and

FIG. 2 is a schematic circuit diagram thereof.

Description of the preferred embodiment of the invention

FIG. 1 indicates schematically a web roll **1**, the web W from which feeds to a printing machine around rollers **2**, **3** and **4**. Press driven belts **5**, carried on a frame **6** are moved up and down by a torque motor **7**, increasing pressure of the belts **5** on the roll **1** tending to increase the tension while decreasing pressure tends to decrease the tension.

Mechanism of the character indicated is fully disclosed in prior Patents 2,155,430; 2,344,952; 2,617,610 and 2,682,027, reference to which is made for the details of such mechanism, as such details form, in themselves, no part of the present invention.

Rollers **2** and **4** are rotatable in fixed supports, while roller **3** may be, and preferably is, of the floating type, being yieldingly urged (downwardly) against the tension of the web W by its own weight, plus the assistance of an additional weight or spring, where required. In conjunction with the present invention operation of this floating roller **3** is silenced in its neutral position during the normal running of the press and is allowed to become operative only during start up and stopping of the press unit as these are the times when operation of the floating roller is required to control the large variation in web tension. This is accomplished by providing a solenoid **25** to actuate an arm **26** about a pivot point or fulcrum **27**. The arm **26** carries a locking pin **28** which will fit into detent **29** on the roller carrier **30**. Solenoid **25** is connected to an interlock switch on the press drive and will be actuated by the switch closing when the press is up to speed. FIG. 1 shows the condition of the floating roller when the press is idle. When the press comes up to speed and the solenoid is actuated, the floating movement of the roller **3** will be silenced by locking pin **28** engaging the detent on carrier **30**. When the press falls below running speed the interlock switch will open releasing the solenoid and allowing the floating roller to become operative.

The fixed supports for roller **4** comprise load carrying cells **8**, **8'**, typically of a strain gauge type. The pressure on these cells under ordinary web tension condition amounts to only about one hundred to two hundred pounds, and the tension variation is a fraction of this, so that the cells may readily operate without any appreciable movement whatsoever of the roller axis. An output signal of the order of millivolts is readily produced and is readily amplified to provide the required error signal. As indicated in FIG. 1 the load cell signal is fed to an amplifier **23**, the output of which goes to a tension indicating and setting device **31**, which, in turn, controls a servo **24** supplying the required operating current for the belt torque motor **7**.

Each of the cells **8**, **8'** is located in a pedestal or support for an end of the roller **4**. As shown in FIG. 2, the cell **8** (**8'**) comprises strain gauges **9**, **10**, **11**, and **12** (**9'** **10'**, **11'** and **12'**) arranged in a bridge connection. The power supply for the load cell comprises a power pack connected to the cell between elements **10**, **11** and **9**, **12** (**10'**, **11'** and **9'**, **12'**), the power pack being supplied with current from the power lines L_1 and L_2. Connection between points **11**, **12** and **11'**, **12'** ties the cell bridges together and the output signal is taken off by line **14** connecting to the point between elements **9** and **10** and line **14'** connecting to the point between elements **9'** and **10'**, the signal being fed through connections **14** and **14'** to the amplifier **23**.

The strain gauges comprising the load cells **8**, **8'** are arranged so that an increase or decrease of load on either cell will vary the voltage in connection **14** or **14'**, the voltage change produced in one cell by an increase of load corresponding to that produced in the other by a decrease of load, so that the signal voltage across connections **14**, **14'** is proportional to the algebraic sum of the voltage changes in the two cells. An increase of pressure on one cell, balanced by a decrease of pressure on the other, will, accordingly, produce no signal change, since the over-all tension on the web remains correct. Under other conditions, a net signal corresponding to the over-all tension change in the web will be produced and initiate the required correction.

The output of the amplifier **23** is supplied to the

tension setting and indicating unit **31**, and the output of this unit, corresponding to the web tension above or below set value controls the servo **24**, causing rotative movement of its output shaft **15**. This shaft carries two cams **16** and **17**, each having high, low and dwell sectors, and cooperating with one of the switches **18** and **19**. A two-way, two-pole switch **20** connects the switches **18** and **19** selectively through lines **21** to the tension belt motor control, from which lines **22** lead to the torque motor. As will be apparent to those skilled in the art, the invention permits the modification of existing equipment or designs, by providing a fixed web guiding roll, such as the roll **4**, which supports including the pressure responsive cells **8**, **8'**, and the substitute thereof for the error signal generating means previously associated with the floating roller so as to control the existing tension control mechanism. While the circuit is shown in a form suitable for incorporation in the mechanism of Wieking Patent No. 2,344,952, it may be utilized in conjunction with any of the presently used floating roller control web tension mechanisms. With switch **20** in the position indicated, cam **16** is operative. This cam has a comparatively small dwell sector, thus providing a comparatively small dead zone for the error signal, e.g., a variation of tension of 10% above or below set value before the tensioning mechanism is actuated to decrease or increase tension, as required. With switch **20** in its other position, the cam **17**, having a larger dwell sector, is active, so that the dead zone may now be greater as, for example, 20% above or below set value.

During start up and slow down of the press it is apparent that the tension control by means of the cells **8**, **8'** is capable of responding to a sudden change in tension before any appreciable movement of the roller **3** has had time to occur, thus anticipating overload on the tension regulating capacity of this roller which is limited by its inertial lag. On the other hand, a slower change of tension conditions, being followed by the floating roller, will produce less pressure change in the cells **8**, **8'**. The operation of the load cells is specifically advantageous in detecting and indicating instantaneous and minute variations in the web tension. During the running speeds of the press when such changes are prevalent the floating roller is silenced, as discussed above, so as not to interfere with the precise and delicate operation of the load cells. However, during start-up and slow-down it is desirable to have the floating roller operational so as to detect the relatively large changes in tension.

As will be understood, the error signal in amplifier inputs **14**, **14'** may be subjected to any desired modification in accordance with conventional principles of automatic control engineering, so that the ultimate error signal supplied to the servo may contain differentiated or intergrated components as well as components proportional to the original error signal, so as to provide for selective response to the particular operating conditions involved in any given installation.

What is claimed is:

1. In a web supply mechanism having means for supporting a running roll and adjustable tension belts for controlling the roll rotation to regulate its tension, the combination with said tension belts and web of a guide roller for the web, rigid supports for the guide roller comprising pressure responsive load cells in each of said supports, each cell producing a signal proportional to the pressure exerted on each of said supports, means for controlling said adjustable tension belts in accordance with the algebraic sum of said signals comprising a tension setting and indicating unit, a servo motor mechanism electrically connected to said unit, first and second switch means operated by said servo mechanism, a third switch means for connecting either said first or second switch means to a tension belt motor control, and a torque motor energized by said tension belt motor control for operating said adjustable tension belts to maintain the web under substantially constant tension.

2. The combination according to claim **1** further comprising a floating roller between the running roll and rigid supported guide roller, means yieldably urging the floating roller against the tension of the web during start-up and slow-down operations, and means for silencing said floating roller during running of said web supply mechanism whereby the floating roller displaces in proportion to changes of web tension only during start-up and slow-down.

References Cited

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2,682,027	6/1954	Willis	242—75.42 X

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