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H. N. DURHAM

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WEB TENSION APPARATUS

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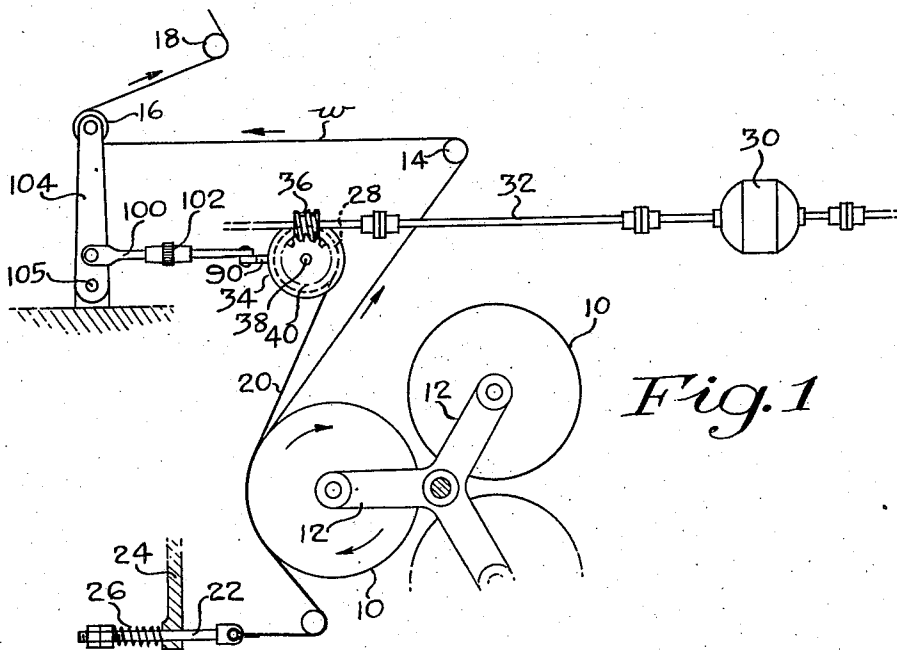


Fig. 1

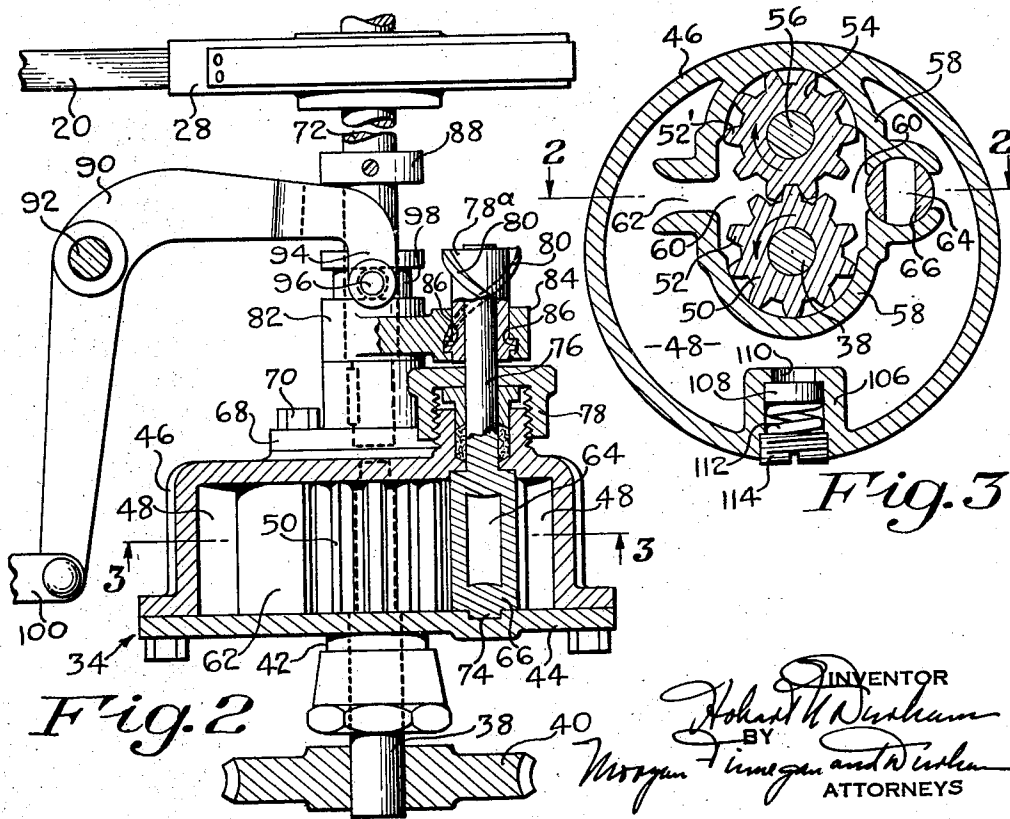


Fig. 2

Fig. 3

INVENTOR
Robert H. Durham
BY
Morgan Finnegan and Wilson
ATTORNEYS

UNITED STATES PATENT OFFICE

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WEB TENSION APPARATUS

Hobart N. Durham, Manhasset, N. Y., assignor to
The Goss Printing Press Company, Chicago, Ill.,
a corporation of Illinois

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5 Claims. (Cl. 242—75)

The present invention relates to new and useful improvements in web tension apparatus and is particularly adapted for use in connection with the supply web to high speed rotary printing presses.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claims.

The invention consists in the novel parts, constructions, arrangements, combinations and improvements herein shown and described.

The accompanying drawing, referred to herein and constituting a part hereof, illustrates embodiments of the invention, and together with the description, serves to explain the principles of the invention.

Of the drawing:

Fig. 1 is a diagrammatic side elevation of a typical and illustrative embodiment of the present invention;

Fig. 2 is a horizontal sectional view taken on the line 2—2 of Fig. 3 and showing a fluid clutch as used in connection with the present invention; and

Fig. 3 is a cross sectional view taken along the line 3—3 of Fig. 2.

The present invention has for its object the provision of a novel and improved web tensioning apparatus which provides a precise and continuous control of the tension of a web fed from a web roll to a printing press or other web consuming equipment. A further object of the invention is the provision of a novel and improved web controlling device in which friction is applied to the surface of a web roll from a source of power through a fluid coupling so as to effect a continuous, constant control of the web regardless of variations in power supply, which may tend to cause a variation in the tension of the web. The invention also provides a web tensioning apparatus particularly adapted for use with high speed printing presses which can be operated from any prime mover, and requires the introduction of no other external power to effect the desired control. Still another object of the invention is the production of an improved web tension device in which a constant tension is maintained by varying the pressure of a friction member against the surface of the web roll, the variation in pressure being induced by transmit-

ting varying quantities of power from a constantly operating motor through a fluid clutch.

It has heretofore been proposed to employ a torque motor of other form of stalled motor for pressing the friction member against a web roll, the pressure between the friction member and the web roll being varied in some cases to approximate a constant tension on the web. However, such installations have not only required the provision of a relatively large source of direct current, but have failed to give accurate and precise control of the web tension by reason of the fact that the torque or other form of stalled motor moved by definite increments due to the fact that the current was supplied to it through a commutator. Furthermore, such motors have necessarily been of relatively large size in order to provide the proper heat dissipation as all of the excess power was converted into heat by parts which did not have any relative rotation. Purely mechanical systems have also been proposed which have failed to be satisfactory, due in part to the fact that they are slow to respond as their action was largely dependent upon the acceleration of gravity, and the systems employed had a relatively large inertia. The use of fluid pressure alone as power has also been tried but failed to be a success, as it requires a large amount of the special power, employs an extensive system of piping which is liable to leakage, and is sluggish and inflexible in operation, and is not subject to precise control.

In accordance with the present invention, the defects of the prior art are avoided and highly satisfactory system is provided which is capable of regulating the tension of the web with a high degree of precision. A compact fluid clutch is employed to transmit the power from an ordinary motor to the tension strap for the web roll, and no outside power other than that for the motor is required. The most minute differentials in power transmission may be quickly affected by the fluid clutch so as to maintain the tension of the web at a substantially constant value from the beginning to the end of the web roll.

It will be understood that the foregoing general description and the following detailed description as well, are exemplary and explanatory of the invention but are not restrictive thereof.

Referring now in detail to the illustrative embodiment of the invention as shown by the accompanying drawing, the web tension apparatus is shown as applied to the control of the tension of a web of paper being fed to the printing press from one of several web rolls 10 supported by a

magazine reel 12, the web being led over a guide roller 14, a pilot roller 16 and another guide roller 18 and thence to a high speed rotary printing press.

The tension of the web of paper being fed to the press is created by friction developed between one or more straps or other flexible elements 20 bearing against the outer surface of the web roll 10, and these straps are preferably anchored to spring mounted rods 22 which have some movement in anchor brackets 24 securely fastened to the floor or machine frame, the rods being provided with compression springs 26 which resist the pull of the straps 20. The upper ends of straps 20 are connected to a roller or drum 28 which is adapted to be rotated and subjected to a continuous strain so as to keep the straps 20 pressed against the surface of roll 10 with the required degree of pressure. Thus, an increased force applied to the roller 28 causes an increased pull on the straps 20 to increase the pressure between the straps 20 and the roll 10, and thereby cause an increased tension in the web W being fed from the roll to the press. As the diameter of the roll 10 decreases as the paper is used up, it is necessary that the pressure between the strap 20 and the web roll 10 be increased gradually to maintain a constant web tension, and this is accomplished by gradually increasing the force applied to and tending to rotate the roller 28.

In accordance with the present invention, the force applied to and tending to rotate the roller 28 is derived from a motor or other relatively high speed source of power, and while any rotating shaft may be used, I conveniently employ an electric motor 30 as the source of this power. Motor 30 drives a shaft 32 which extends along the printing press and over one or more of the supply mechanisms, and this shaft drives one element of an hydraulic clutch, such as the clutch 34 while the other element of the clutch is connected to rotate the roller 28. The power transmitted from shaft 32 to roller 28 is preferably varied so as to maintain the pull on the straps 20 substantially constant for any given web roll diameter, but is gradually increased as the web roll 10 diminishes in size, and is greatly and rapidly increased when the press is to be stopped or when a break occurs in the web.

In Fig. 2 of the drawing is shown one form of an hydraulic clutch suitable for use in the present invention, and as there shown the shaft 32 drives worm gear 36 which rotates shaft 38 by gear 40 fixedly mounted thereon, said shaft entering and freely turning within a stuffing box 42 in the center of a cover 44 of the inclosed annular casing 46 of the clutch. Within said casing 46 is a main chamber 48 which may be filled with any suitable non-elastic fluid. Within said main chamber 48 gear 50 is mounted on shaft 38 and keyed thereto so that it rotates with said shaft. Coacting with gear 50 having teeth 52 is the gear 54 its teeth 52' meshing with teeth 52. Gear 54 is rotatably mounted on shaft 56, said shaft being journaled in suitable bearings in casing 46 and cover plate 44.

The teeth 52 and 52' are so positioned as to rotate closely adjacent to the curved inner faces of the walls 58 of the smaller chamber 60 lying within the main chamber 48. In order to provide a means for conducting the fluid within the clutch into the chamber 60 there is provided a passage 62, the opening of which lies near the inner periphery of the casing 46 to insure the entrance of the fluid to the chamber 60. The fluid is impelled

through said chamber by the rotation of gears 50 and 54 and out through opening 64, the size of said opening being variable by valve 66 which is journaled in walls 58.

It will be seen that if the gear 50 is rotated in a counter-clockwise direction as indicated by the arrow thereon in Fig. 3 by means of the shaft 38 the movement is communicated by means of teeth 52 to gear 54, driving said gear in a clockwise direction as indicated by the arrow thereon, thus drawing the fluid into chamber 60 through passage 62, carrying it around between the teeth 52 against the inner surface of walls 58 and delivering it from said chamber through passage 64 and projecting it against the inner surface of the casing 46. If the fluid is permitted to freely pass from chamber 48 through chamber 60 and back to chamber 48 there will be no movement of the casing 46 about the shaft 38, but if the valve 64 is partially closed the movement of the fluid will be obstructed and gear 54 not being able to rotate as freely as gear 50 will begin to carry its own axis of rotation about the axis of rotation of gear 50, thus rotating casing 46 upon shaft 38 in a counter-clockwise direction.

This movement of casing 46 is communicated to flange 68 secured to said casing by bolts 70, and thence to the actuated shaft 72 which is keyed to rotate with said flange as shown in Fig. 2. As there shown the valve 64 is rotated on its trunnion 74 extending within a bearing in the cover 44 by means of a shaft 76 integral with said valve, shaft 76 extending through a stuffing box 78 upon the casing 46 and being freely rotatable therein. Shaft 76 has mounted thereon and keyed thereto a member 78^a having upon its surface a spiral thread 80. To cause the member 78^a to rotate there is slidably mounted upon the actuated shaft 72 a member 82 having an extension 84 which surrounds the member 78^a, said extension having a spiral recess 86 which co-acts with spiral thread 80.

With this construction it will be seen that a movement of the member 82 along shaft 72 will cause member 78^a, by reason of the engagement of spiral thread 80 in groove 86, to rotate within the extension 84 and turn the valve 64. The movement of the member 82 along shaft 72 is limited by any suitable means, such as collar 88 adjustably secured to said shaft and limiting the movement of member 82 so that the valve 64 is not moved beyond its fully open position.

To transmit movement to member 82 and thus to valve 64 a lever arm 90 is provided, said arm being pivoted on shaft 92 which is fixed to the press frame or any other stationary foundation and having forked ends 94 on each fork of which is mounted stud 96 engaging a circumferential groove 98 in member 82. The other end of lever arm 90 is pivotally attached to one end of arm 100, which is provided with turn buckle 102 so that its length may be adjusted. The other end of arm 100 is pivotally attached to lever arm 104 carrying the governor roller 16 at one end thereof and being pivotally mounted at the other end on shaft 105 attached to the press frame.

In order to fill the clutch with liquid there is projected within the main chamber 48 a boss 108 having a filling orifice, said boss forming an integral part of casing 46. This orifice is closed by means of piston 108, the movement of said piston being limited by the stop face 110 and the spring 112. The spring is backed by screw plug 114 within casing 46. With this construction

it will be apparent that when the clutch is completely filled with liquid and the filling orifice closed by screw plug 114, piston 108 will be forced by the pressure of the liquid back against the compression of spring 112. Thus small losses of liquid from the clutch are provided for since the contents of the filling orifice will be ejected into the main chamber as the need for it arises.

A separate clutch unit and pilot control therefor is provided for each of the other web tensioning devices on the particular printing press, and these parts are preferably duplicates of those described in connection with the first unit. Thus, each unit will employ its own pilot roller 16 to effect different positions of valve 64 in its own clutch unit 34, but motor 30 through shaft 32 will provide the necessary actuating power to all of the clutch units.

In the operation of the illustrative embodiment, web is fed from web roll 10 over guide rollers 14 and 18 and is looped around pilot roller 16 in passing through the press. Pilot roller 16 is pivotally mounted on shaft 105, and is spring biased so that it resiliently tends to enlarge the loop in the web against the tension of the web, being moved in a clockwise direction (Fig. 1) by increased web tension, and in a counter-clockwise direction by decreased tension of the web.

Before the printing press is started, power has been applied to the motor 30, and this motor is preferably of the conventional polyphase alternating current type and of sufficient power so as to enable it to rotate at a substantially constant speed under all types of operating conditions. Motor 30 drives shaft 32 and gear 50 of the hydraulic clutch of each of the web tension devices connected to and receiving power from shaft 32, and substantially any number of such tension devices may be powered by a single motor 30.

The length of arm 100 is set by the operator by operation of turn buckle 102 in order to cause an initial basic setting of the valve 64 which will give the desired tension on the surface of a full web roll of paper when the pilot roller is in operating position, it being understood that web rolls of different widths are of different weights and thus require different degrees of tension for proper operation. As the web is fed to the press pilot roller 16 assumes a normal intermediate position which will cause the desired initial setting of valve 64 described above, and there will be a tendency for gear 54 to carry its own axis about the axis of gear 50, thus applying power to the actuated shaft 72 to cause a rotation of drum 28 and apply to straps 20 the desired tension as soon as motor 30 has been started. It will be understood that adjustment of the length of arm 100 may be made by turn buckle 102 at any time while the press is in operation, when a different degree of tension is found to be desirable.

The position of closure of valve 64 accurately determines the amount of power transmitted from the motor driven gear 50 to the gear 54, and thereby to casing 46, shaft 72, drum 28 and friction straps 20, causing these straps to be applied against the surface of the web roll 10 with a definite and substantially constant pressure to create a substantially constant web tension during the normal operation of the printing press. As the web roll 10 decreases in size, the pull on the straps 20 must be increased slightly to main-

tain a constant tension on the web, and this is taken care of by corresponding slight movement of the pilot roller 16 in a counter-clockwise direction, thereby further closing valve 64, causing an increase in the power transmitted from motor 30 through the hydraulic clutch to the straps 20.

Unevenness in the web roll 10, or an out of round condition of the web roll does not cause an appreciable variation in the web tension, as the straps 20, drum 28 and casing 46 actuated by gear 54 are free to move in either direction to maintain a constant pull on straps 20, and thereby create a constant tension on the web W being fed from the web roll 10.

When the press is to be slowed down for normal stop, or for an emergency stop, as when the web breaks, the tension of web W decreases, allowing pilot roller 16 to move counter-clockwise and substantially or completely close valve 64, thereby causing maximum resistance to the movement of liquid through chamber 60 so as to cause a great increase in the power transmitted by the clutch. This increased power transmission rotates drum 28 so as to tighten the straps 20 against the surface of the web roll 10, thereby creating a greatly increased braking force on the web roll to stop the rotation of the web roll with the required degree of deceleration, the amount of force transmitted to straps 20 being limited only by the strength of materials used, the power of the motor 30 and the power transmitting capacity of clutch 34.

The apparatus of the present invention is particularly adapted for use in connection with the making of flying pasters in which the web from the new web roll is joined to the web being fed to the press from the active web roll without stopping the feeding of the web. In such an operation the magazine reel 12 is rotated in a counter-clockwise direction (Fig. 1) so as to bring the new web roll firmly into contact with the running web from the expiring web roll, and this operation requires that the straps 20 be readily displaced, as by unwinding from the drum 28, without materially interfering with their degree of pressure against the web. This is ideally accomplished by the present invention due to the uniformity of power transmitted by the hydraulic clutch regardless of the angular or rotational position of the casing 46 actuated by gear 54.

The invention in its broader aspects is not limited to the specific mechanisms shown and described but departures may be made therefrom within the scope of the accompanying claims without departing from the principles of the invention and without sacrificing its chief advantages.

What I claim is:

1. In a web tensioning device a flexible friction member bearing against the surface of the web roll from which the web is fed, a continuously operating motor, an hydraulic clutch interconnecting the motor and the friction member for transmitting power from the motor to the friction member to press the friction member against the web roll, and means controlled by the tension of the web fed from the roll for varying the power transmission of the clutch.

2. In a web tensioning device a strap bearing against a rotatable web roll, a roller to which the strap is connected to pull the strap into contact with the web roll, a continuously rotating motor, an hydraulic clutch connecting the motor with the roller, and means for varying the power trans-

mitted by the clutch for varying the pressure of the strap bearing against the roll.

3. In a web tensioning device a strap bearing against a rotatable web roll, a roller to which the strap is connected to pull the strap into contact with the web roll, a continuously rotating motor, a fluid coupling connecting the motor with the roller, and a mechanical control for the clutch controlled by the tension of the web fed from the roll for varying the pressure of the strap against the web roll by variation of the power transmitted through the clutch to maintain a constant web tension.

4. In a web tensioning device, a strap bearing against a rotatable web roll, a roller to which the strap is connected to pull the strap into contact with the web roll, a continuously rotating motor, an hydraulic clutch having a variable power transmission, a pilot roller controlled by the tension of the web fed from the roll, a valve in the

clutch regulated by the pilot roller, and means interconnecting the motor and strap roller so that an increase in power transmitted through the clutch presses the straps against the roll with increased pressure.

5. In a web tensioning device, a flexible friction element bearing against a rotatable web roll, rotary means connected to one end of the friction element to pull the friction element into contact with the web roll, a rotary motor, a pair of relatively rotatable members one connected to the motor and the other connected to the rotary means, hydraulic means for transmitting power from the rotatable member connected to the motor to the rotatable member connected to the rotary means, and means for varying the amount of power transmitted to the rotatable member connected to the rotary means in accordance with the tension of the web fed from the roll.

HOBART N. DURHAM.