

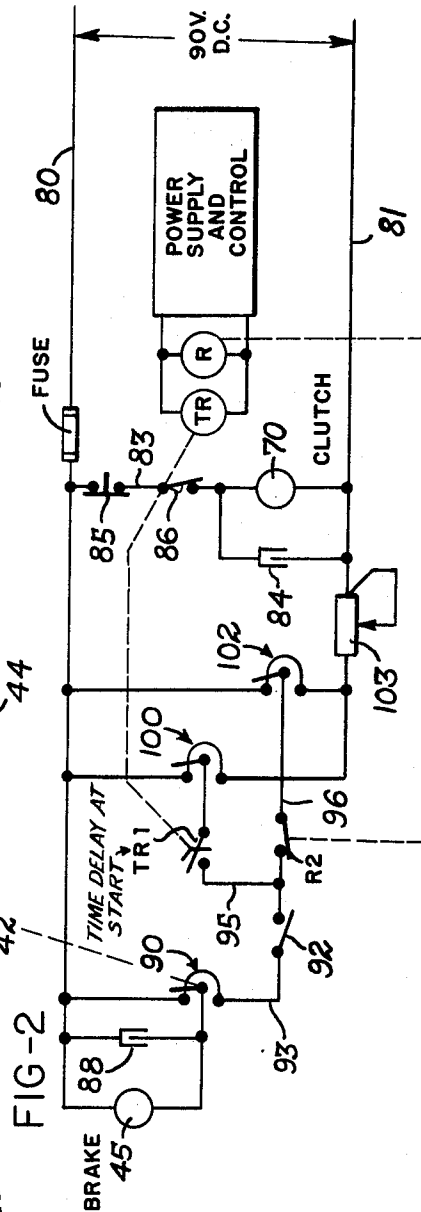
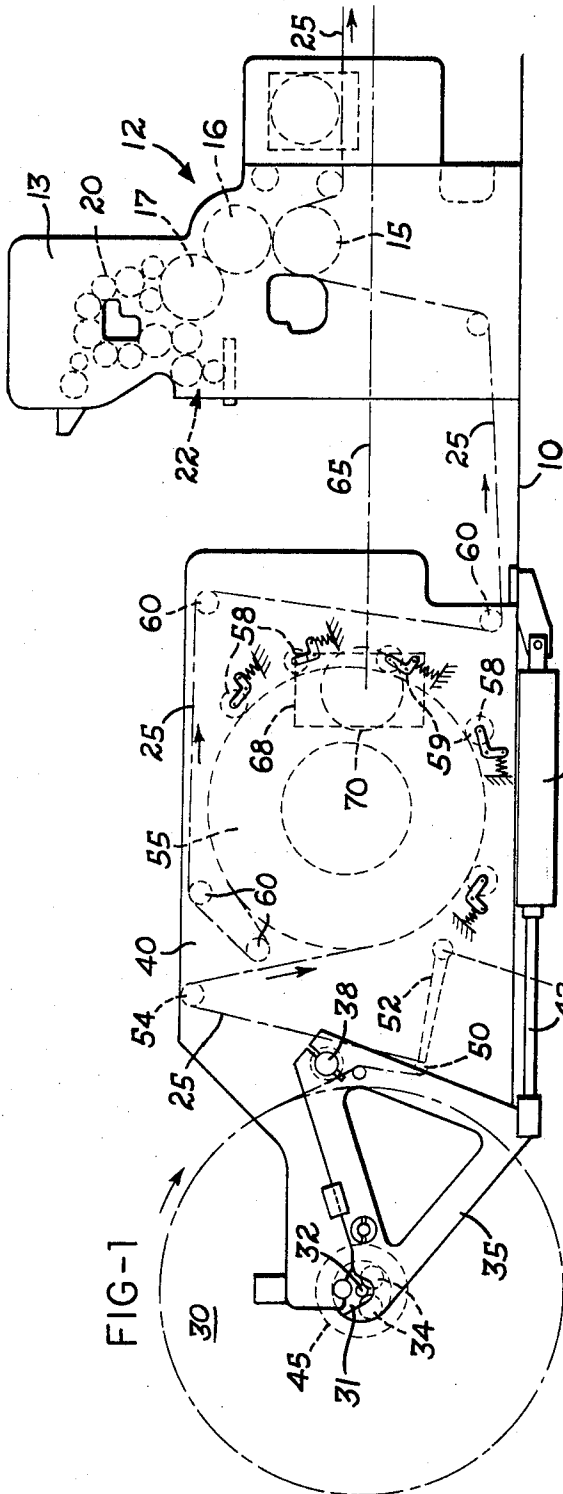
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WEB TENSION CONTROL

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## WEB TENSION CONTROL

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This invention relates to machines for operating on web material, such as a printing press for printing on a web of paper or the like, and particularly to controls for regulating the supply of the web material from a roll thereof.

The present invention, as noted, is particularly concerned with the control of the feed of web material, from a supply roll, into a machine for operating on the web material, especially where proper registration is an important factor in the operation or operations performed on the web material. As an example, web machines used to print continuous lengths of business forms may operate to print the form itself on a paper web, and also to perforate a margin or margins of the material at regularly spaced intervals. The unwind control provided by the invention provides accurate control of the feeding of the web material, and its registration in the various operations, such that these perforations, which may form feed holes in some cases, are essentially identically spaced in different webs run on the machine, whereby this registration of spacing of the holes provides for easier assembling in a collating machine, and for better positioning of the form when it is used in a business machine.

In apparatus of this kind, it is thus necessary to maintain a steady and closely controlled feed of the web material, which is usually supplied from a roll thereof, and which roll will necessarily diminish in size as the material is drawn therefrom. The present invention is concerned particularly with the feeding of the web material at a desired constant rate, preferably at a rate which is closely correlated to the operating speed of the units of the machine which operate on the web, as to print or perforate.

The primary object of this invention is to provide an improved unwind control for machines which operate on web material, which control is capable of feeding the web material at a predetermined constant tension, and thereby regulating the length of the web material accurately, such that lengths of material obtained from different runs of the machine are essentially identical to each other.

Another object of this invention is to provide a novel unwind control in web printing presses and like machines, wherein the web material is supplied at a predetermined constant rate from supply rolls, and unwind speed of the operation is controlled by an automatically actuated brake to correct the unwinding speed of the supply roll to the speed of an unwind feed control drum or cylinder which in turn regulates the feeding of the web material to the press.

A further object of the invention is to provide a control for the braking system of the supply roll in which the braking power is differently regulated during running of the press and during a stopping operation.

An additional object of the invention is to provide in such a braking control as mentioned above a regulating system which automatically reduces the braking effect on the supply roll to a negligible amount, or effectively releases the brake, during a starting operation, whereby the unwind apparatus can be started without overcoming the braking effect on the supply roll, and thereby reducing any hunting tendency of the tension control for the brake.

Other objects and advantages of the invention will be apparent from the following description, the appended claims and the accompanying drawing.

In the drawing:

FIG. 1 is a schematic diagram illustrating the application of the present invention to a web printing press; and FIG. 2 is a schematic wiring diagram illustrating the principles of the present invention as applied to the unwind control apparatus shown in FIG. 1, utilizing a magnetic unwind control brake and magnetic clutch, together with appropriate electrical controls.

Referring to the drawing, which illustrates a preferred embodiment of the invention, and particularly with reference to FIG. 1, the invention is illustrated by way of example as incorporated in a web printing press having a base 10 and at least one printing couple designated by the general reference numeral 12. This couple includes side frames, one of which is shown at 13, forming a support for a lithographic offset printing press section, including an impression cylinder 15, a blanket cylinder 16, a plate cylinder 17, an inking system 20 and a dampener apparatus 22. It is understood that the presses of this kind may incorporate one or more such printing couples, and it is also possible to provide couples which perform rotary letterpress or gravure printing, as well as apparatus for performing perforating, punching, and/or slitting operations on web material. The path of web material is indicated generally by the line 25, which, it will be seen, passes over a number of guide rolls (not numbered in the printing couple section) and between the impression cylinder 15 and blanket cylinder 16. The present invention is particularly concerned with the supply of the web material prior to our upstream of the direction of web travel from the first printing couple.

The web material, such as paper, is supplied from a roll thereof illustrated generally at 30. Such rolls are conventionally supplied on a supporting core 31 into which a mandrel or shaft 32 can be connected and fastened for controlling rotation of the roll 30. The support for the ends of the mandrel 32 is provided by a pair of movable rollers 34 mounted in the yoke of frames 35 (only one side shown), which are in turn pivotally mounted about the support stud 38 on the side frame member 40 of the unwind apparatus. The position of the frame 35 is controlled through its connection to the piston rod 42 of a suitable cylinder actuator 44 (pneumatic or hydraulic, as desired). Thus, in the usual manner, a supply roll can be moved up to the unwind mechanism with the frames 35 lowered, the mandrel 32 engaged with core 31, and thence power is applied to the cylinder 44 to raise the roll into operative position.

The mandrel 32 is connected to a brake 45, in the present case an adjustable magnetic brake of conventional construction, which can be controlled by regulating the supply of electrical power to it. The web passing from roll 30 extends around an idler roll 50 carried on the end of a pivotally supported arm 52, this type of construction commonly being called a "dancing idler." The motion of the idler roll 50 is dependent upon the tension in the web 25, thus providing an indicator or "feed-back" which may be coupled to a regulating potentiometer which is connected to follow the motion of the arm 52. This control is described further in connection with the wiring diagram, FIG. 2.

The web 25 passes from the dancing idler around a guiding roller 54 to an unwind feed control drum 55 which is journaled between the side frame members 40. The web is snubbed against the surface of the drum 55 by a number of snubber rolls 58, each of which are carried on spring-loaded arms 59, tending to promote a minimum-slippage frictional contact with the surface of the drum 55. Leaving the drum 55 the web 25 passes around the guide rollers 60 which direct it to the first printing couple. It will be noted that the web passes around and contacts a substantial portion of the surface

of the drum 55, for example in excess of 270° extent of the drum periphery.

The unwind drum 55 is power driven from the main motor driven line shaft 65 which also supplies power to the press couples, etc., and this line shaft is connected to the unwind drum 55 through a fixed gear reduction unit 68 incorporating a magnetically operable clutch 70.

Referring to FIG. 2, the major portion of the electrical control and power supply for the press is shown in block form, indicated by the legend "Power Supply and Control." This control may be of any conventional form, and details thereof are well known and form no specific part of the present invention except as interrelated to the unwind controls described hereinafter. The control according to the present invention includes a time delay relay, the actuating coil of which is identified by the legend TR, and a control relay whose actuating coil is identified by the legend R. As indicated, these relay coils are energized or deenergized from the main control of the press. It will be understood that during running of the press, electrical power will be supplied to these coils to energize the two aforementioned relays.

The unwind control circuit is indicated as including a power supply, lines 80 and 81, across which a suitable electrical supply is connected, for example 90 volts D.C. The first circuit line 83 incorporates and supplies power to the actuating coil of the unwind clutch 70, and connected in parallel with this coil is a conventional surge controlling capacitor 84. Power through the circuit line 83 is controlled by a manually operable normally closed switch 85 for releasing the clutch if desired, and in series therewith, an automatically operable switch 86, normally open, but which is closed whenever the main drive clutch (not shown) to the line shaft is actuated to drive the press.

The remainder of the circuit is connected to provide various controls for energizing the field coil of the unwind brake 45. This brake has a surge controlling capacitor 88 connected in parallel across it. The ultimate control of power to the brake armature is exercised by the potentiometer 90 which is connected to the arm 52 of the dancing idler control. The arrangement, as is conventional, is such that when tension in the web increases, to raise the idler roll 50 as seen in FIG. 1 the arm of potentiometer 90 will move in a direction to decrease the electrical power to the brake, thus tending to reduce the braking power.

Thus, the voltage applied to brake 45 is finally controlled by the position of the dancing idler 50, and hence the effective position of the dancing idler roll 50 will determine the tension in the web as it passes to the unwind drum 55. In systems of this type, as a general rule, the weight of the dancing idler system effective on the web will be approximately twice the amount of tension in the web. If this tension decreases, i.e. the web becomes slack, the idler roll 50 will drop, and potentiometer 90 will be moved to increase the voltage across the brake 45 thereby increasing the effective braking force and increasing the tension in the web which causes the idler roll 50 to rise. Obviously, an equilibrium condition will result at which the web tension reaches the proper amount for the system.

The manually operable switch 92 is provided in the line 93 connected to the potentiometer 90, thereby giving the operator a control by which he can deenergize the brake 45 for set-up purposes or the like. The other side of this switch leads through branch circuit lines 95 and 96 to manually adjustable potentiometers 100 and 102 each of which are connected across the supply voltage source (80, 81) through a regulating resistor 103. The circuit line 95 includes the contacts TR<sub>1</sub> of the time delay relay TR. As shown, this relay contact is normally open, when the coil TR is deenergized. Being of the time delay type, when the coil TR is energized the contacts TR<sub>1</sub> will

close after a predetermined delay, for example approximately two seconds delay.

The other branch circuit 96 includes the contacts R<sub>2</sub> of the relay R. These contacts are illustrated as normally closed with the relay coil R deenergized, thus when the coil R is energized, contacts R<sub>2</sub> will open the circuit through line 96.

Assuming for purposes of explanation that the apparatus is at rest, and both relay coils TR and R are deenergized, upon starting the press the main control will supply energizing power to both these relay coils. Likewise, it will be assumed that the operator has closed switch 92 to make the brake circuit operative. Relay R will immediately open its contacts R<sub>2</sub>, and since the contacts TR<sub>1</sub> are open, there will be no power supplied to the brake 45, and the press will start up with no braking force exerted against a rotation of the supply roll 30.

After a short delay (according to the delay time of the delay relay TR), the contacts TR<sub>1</sub> will close and the voltage of the power supply to line 93, and hence supplied across the idler control potentiometer 90, will be determined through the branch circuit 95, which is the running circuit, according to the manual setting of the potentiometer 100. The operator may adjust this potentiometer with the machine running, to regulate the desired position at which the dancing idler control reaches equilibrium, thereby obtaining the desired tension in the web. Variations in this tension will be automatically adjusted by appropriate control of the potentiometer 90 from the idler arm during continued operation.

The braking power obtainable through the above-described running circuit in many cases will be inadequate to overcome the inertia of the relatively heavy supply roll, for example if it is desired to stop the apparatus while there is still a substantial amount of material on the supply roll. Thus, when the main control is operated (automatically or manually), to shut down the machine, relays TR and R will be deenergized. Contacts TR<sub>1</sub> will open immediately, thus opening the running circuit 95, and contacts R<sub>2</sub> will close immediately to complete the stopping circuit 96, which includes the potentiometer 102. At this time, the applied voltage across the idler controlled potentiometer 90 will be increased according to the manual setting of potentiometer 102, and this setting is such that a substantially increased electrical power is applied to the brake 45, regardless of the position of the idler potentiometer 90, but the idler still maintains control to such extent over the brake 45. Therefore, a substantially increased brake force is obtained to retard the supply roll 30 and thus to avoid its overruning the unwind drum 55, and the dancing idler roll 50.

It will be understood, of course, that when the unit is shut down there is a separate brake (not shown) acting through the line shaft 65 to stop the printing unit or units as well as the unwind drum 55. The braking system for the supply roll, however, provides for increased braking force on the mandrel 32 to retard the supply roll immediately, while still providing for control of the web tension between the supply roll and the unwind drum by the dancing idler system during normal running operation.

While the form of the apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In apparatus of the character described for operating on web material, the combination of means for supporting a supply roll of the web material including a rotatably mounted shaft and an adjustable brake connected to control rotation of said shaft, means such as a printing couple mounted in spaced relation to said shaft and adapted to perform an operation on the web material,

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means for feeding the web material from a roll mounted on said shaft to said means for operating on the material including an unwind drum arranged to receive the web against its surface and to provide a friction unwind drive for the web material, a motor drive connected to rotate said drum and to drive said means operating on the web material at a correlated speed, idler means movably mounted to contact the web material between the supply roll and said unwind drum and to follow the web material in response to changes in tension thereof, a controller for said brake including a variable control means responsive to movement of said idler means to adjust the retarding force applied by said brake to maintain a desired tension during unwinding of the web material from the supply roll, and a control circuit connected to said controller to modify the operation thereof by applying a substantially greater retarding force with said brake to the supply roll when the driving power to said unwind drum is stopped.

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2. Apparatus as defined in claim 1 including a separate control circuit operative on said brake and including a time delay device arranged to delay the application of power to said brake during starting of said motor drive to said drum for starting unwinding of the roll.

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