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[56]

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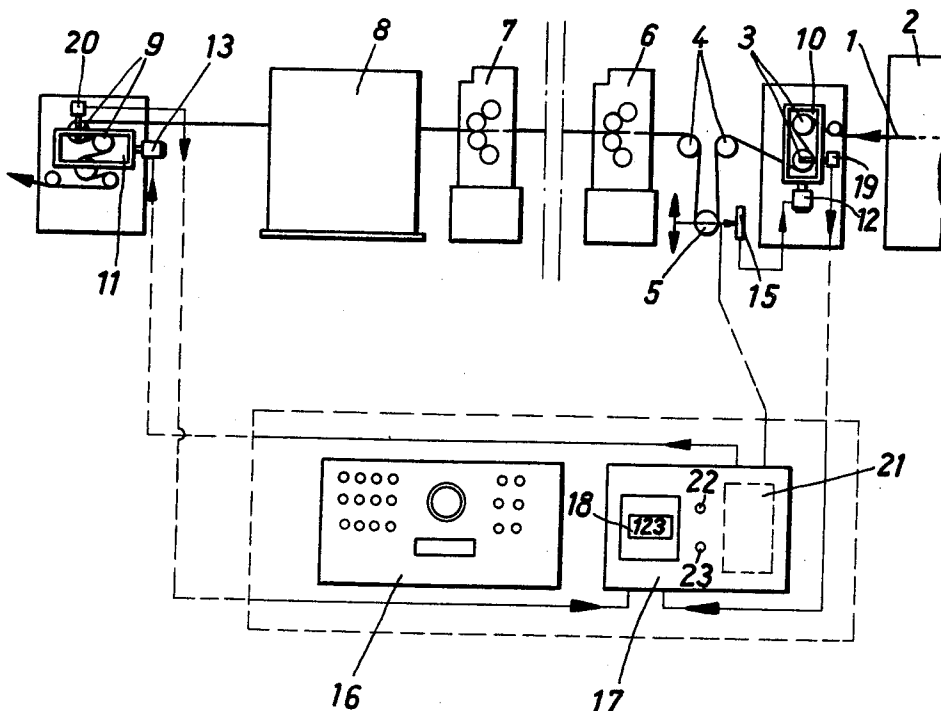
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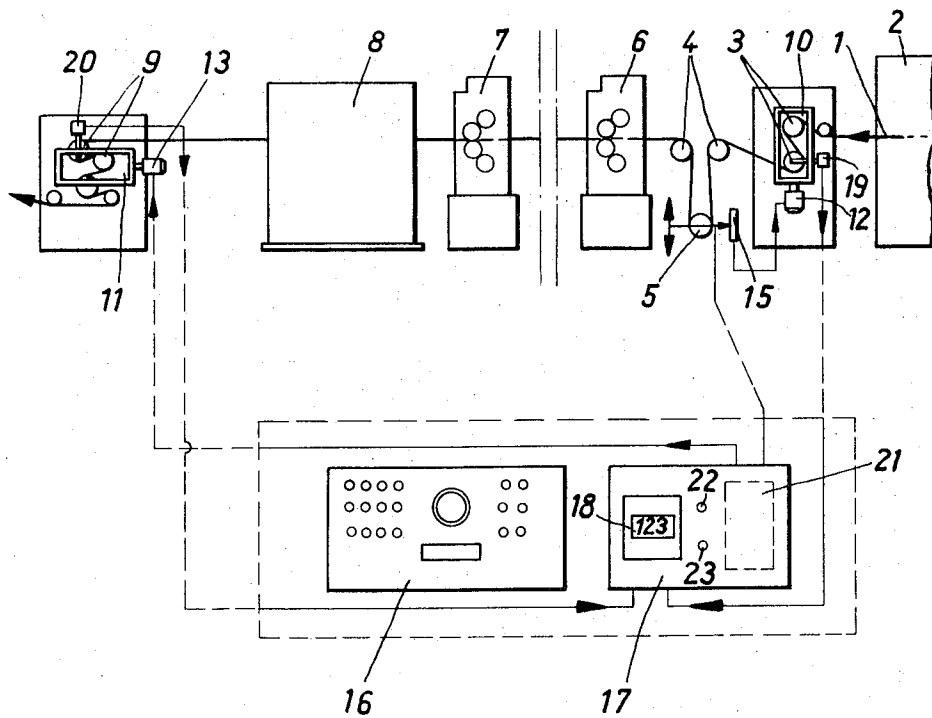
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[54] **DEVICE FOR MAINTAINING CONSTANT THE TENSION OF A WEB PULLED THROUGH PRINTING UNITS OF A PRINTING PRESS**
5 Claims, 1 Drawing Fig.

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226/40, 226/30, 226/111
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42, 30, 44, 111, 195

ABSTRACT: A device for maintaining constant the tension of a paper web withdrawn from a supply roll and conveyed through one or more printing units of a printing press by two couples of power-driven rollers disposed anterior and posterior, respectively, of the unit or units includes measuring means for measuring and visually preferably digitally indicating speed differentials between the two couples and speed regulating means for setting the relative speed of the couples for a selected value. These regulating means are complemented and act in conjunction with control means which automatically maintain the tension of the web portion between the anterior couple and the next adjacent printing unit at a selected constant value.





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DEVICE FOR MAINTAINING CONSTANT THE TENSION OF A WEB PULLED THROUGH PRINTING UNITS OF A PRINTING PRESS

The invention relates to a device for maintaining constant the tension of a web such as a paper web guided through a printing press, and more particularly, to a device for maintaining constant the tension of a web which is pulled through one or more printing units of the press by couples of conveyor rollers disposed anterior and posterior, respectively, of the printing units and power-driven at finely variable speeds.

BACKGROUND

It is known for web-fed rotary presses to withdraw the web, such as a paper web upon which printing is to be effected from a supply roll and to convey the web through one or more printing units of the press and subsequently through one or more drying and cooling units. The individual printing inks are applied to the web in succession and such application must be accurately registered. To obtain such accurate registration of the inks, it is necessary that the web is maintained at constant tension while traveling along the length of the press. As is evident, changes in the tension of the web affect directly the physical shape of the web by variations of the stretch experienced by the web due to changes in its tension—such changes in shape due to variations in the stretch are particularly pronounced with offset printing presses operating with dampeners. Moreover, changes in tension affect the conditions under which the printing operation proper is carried out such as the slip of the web between the impression cylinders. As a result, a correctly registered multiple color printing becomes impossible, or at least very difficult.

The aforepointed out technical problem is well understood in the art and many proposals have been made to overcome the same.

According to French Pat. No. 426,833 the tension of the web is regulated by changes in the rotational speed of a couple of rollers withdrawing the web from a supply roll. Such changes in speed are controlled by the deflection of a pendulum roll engaging the web with constant pressure. Such very simple and primitive web tension control is capable only of eliminating disturbances as are caused by and during the withdrawal of the web from the supply roll.

Published German Pat. Application No. 1,060,406 discloses a printing press in which couples of power-driven conveyor rollers are disposed anterior and posterior of the printing unit or units of the press. The rotational speeds of the couples are manually adjustable independently of each other. The application also refers to mean for measuring and controlling the web tension, but does not further describe such means.

A device of this kind subdivides in effect the web into several aligned and mutually separate web portions along the length of the members and these portions are adjustable independently of each other. As a result, there is no assurance that the tension of the web is stable and constant across the entire length of the web part passing through the press. Moreover, if a web is to be printed upon on both sides it is not possible to provide tension probing devices at arbitrary points of the web as a smearing of the freshly printed ink must obviously be avoided.

U.S. Pat. No. 2,897,754 discloses a device in which the withdrawal speed of the web is controlled by a friction belt drive acting upon the circumference of the web supply roll. The driving speed of the belt drive is controlled by the interposition of a finely adjustable speed variable gearing, which in turn is controlled by the displacement of a tension roller disposed posterior of the supply roll and acting upon the web as the same is withdrawn from the roll. The device according to the patent also provides that the rotational speed of the couples of conveyor rollers disposed posterior of the printing units of the press and anterior of drying units is variable by suitably connected finely adjustable variable speed gearings. The patent is silent as to the conditions which are to be taken

into account for selecting the rotation speeds of couples disposed posterior of the printing units. There are also no provisions made for comparing the rotational speed of a couple posterior of the printing units with the rotational speed of a couple anterior of the printing units, and hence adjustment on the basis of such comparison is not possible.

There are further known devices which generate voltage pulses as a function of rotational speed. The pulses are counted by a suitable counter and the sum total of pulses per unit of time is digitally indicated. The pulse counts are used for measurements of slippage and ratios of rotation. The relative rotational speeds of the conveyor rollers and the cooling rollers are then adjusted, either by automatic or manual control.

However, maintaining a definite speed ratio between the conveyor rollers and the cooling rollers is not at all sufficient to obtain an accurate and constant web tension. Selection of the ratio of the rotational speeds does not preclude that the rotational speed of the conveyor rollers, taken alone, is too high or too low with reference to the rotational speed of the press. Moreover, changes in the rotational speed, in particular of the cooling rollers—that is, the rollers disposed posterior of the printing units—do not act back fully upon the first printing unit, and accordingly substantial drops of tension may easily occur along the length of the web.

THE INVENTION

It is the broad object of the invention to provide a novel and improved device of the general kind above referred to with which a constant tension of the web can be continuously and accurately maintained.

A more specific object of the invention is to provide a novel and improved device of the general kind above referred to with which a selected ratio of the rotational speeds is maintained between a first and a second couple of conveyor rollers, that is, between a couple anterior and a couple posterior of the printing unit or units of the press, and with which further the rotational speed of the first or anterior couple is regulated in accordance with a desired tension of the web portion between said first couple and the printing unit adjacent thereto. The ratio of rotational speeds of said two couples is selected in accordance with the web material and the printing operations to be effected.

SUMMARY OF THE INVENTION

Basically, the device according to the invention comprises a first device for measuring and visually indicating differentials between the rotational speeds or the circumferential speeds of an anterior and posterior couple of conveyor rollers, said speed differentials being preferably indicated by means of digits. The digital indications are used to set the speed differential to a selected or required value by means of finely adjustable variable speed gearing means. The device further comprises a speed regulating device disposed posterior of the first or anterior couple but anterior of the first printing unit, and automatically regulating the tension of the web portion between said first couple and said first printing unit. Accordingly, the invention in effect resides in the combination and coaction of two speed controlling means each of which may be conventional as such.

Applicant has found that neither one of the two control means is singly capable of performing the required tension control, but that the coaction of the two control means in dependence one on the other results in a surprisingly successful and reliable tension control. The automatic speed control of the first or anterior couple by the second device so as to effect a constant tension of the web portion anterior of the first printing unit, has a advantageous effect, not only upon the first printing unit but also upon subsequent printing units even though such favorable effect gradually decreases. As the speed control of the second or posterior couple is based upon a comparison of the rotational speeds of the couples, and such

comparison is preceded by the speed control of the first couple, it is assured that the web tension in the press is affected at the other end of the press in accordance with the proposed solution of the problem with which the invention is concerned.

In other words, the concept of the invention resides in combining the control means of the device to a single tightly coacting control system.

The comparison of the rotational or circumferential speeds of the couples is preferably effected by photoelectric or magnetic pulses and the indication of the detected speed differential can be obtained by electronic digital counters counting the number of pulses and directly indicating the obtained sum total of the numbers. It has been found that highly accurate comparison values can be obtained in this manner.

The device for regulating the speed of the first or anterior couple of conveyor rollers may include a so-called floating roll which detects the tension of the respective web portion and reacts to the detected tension by correspondingly changing its spatial position. Such changes in position are utilized to control a suitable instrument which in turn causes the required speed regulation of the first couple. Such instrument can be mechanically, electrically, pneumatically or optically operated. If a swinging roller instead of a floating roller is used, as it is also possible, an auxiliary weight may be provided which varies the tension of the web portion and such auxiliary weight can be positionally adjusted by a electrically operated remote control device.

The invention also contemplates that the regulating means for finely adjusting the rotational or circumferential speeds of the rollers of the second or posterior couple are remote controlled. The required remote control device is preferably disposed in spatially close relationship with the device for indicating the aforescribed speed differential between the couples. Such an arrangement permits control of the web tension from a central station. By locating the device for indicating the speed differentials and the remote control device for varying the relative rotational speed of the couples next to a control board for the press itself and also next to the remote control device for the auxiliary weight, the entire operation of the press can be conveniently controlled from a central station.

DETAILED DESCRIPTION OF AN EMBODIMENT OF THE INVENTION

In the single FIGURE of the drawing, a device according to the invention is diagrammatically shown by way of illustration and not by way of limitation.

Only those components of the press and the device are indicated which are essential for the understanding of the invention.

Referring now to the FIGURE in detail, there is shown a web 1 such as a paper web which is withdrawn from a web supply device 2 including a web roll (only diagrammatically shown), and is guided to a first couple 3 of two conveyor rollers. The web supply device 2 may include means for exchanging the web roll and also means (not shown) for assuring a smooth and jerk-free withdrawal of the web from the roller.

The web after passing couple 3 is guided over guide rolls 4 to define a loop in which a floating roll 5 is suspended, the function of which will be more fully described hereinafter.

After leaving guide rolls 4 the web passes successively through printing units 6 and 7 of the press. Two such units are shown, but it should be understood that there may be only one unit or more than two. Similarly, it should be understood that there may be more than one couple 3 anterior of the first unit 6.

After leaving unit 7 the web is guided through a drying device 8 to a couple 9 of two conveyor rollers which may simultaneously constitute cooling rollers. The web may be guided from couple 9 to suitable and conventional folding and cutting mechanisms (not shown).

The rollers of both couples are driven by means of a main drive motor (not shown) which is coupled to the rollers via speed adjustable transmission means 10 and 11, respectively, such as so-called P.I.V. gearing means with finely variable transmission ratio. The transmission ratios of gearings 10 and 11 can be independently controlled by diagrammatically indicated setting motors 12 and 13, respectively, such as servo motors.

As is now evident, the relative rotational or circumferential speeds of the couples 3 and 9 can be adjusted relative to each other.

The aforementioned floating roll 5 constitutes part of a regulating device for automatically maintaining constant the tension of the web portion between couple 3 and printing unit 6. As is evident, the depth of the loop between guide rolls 4 and thus the spatial up and down position of roll 5 are a function of the tension of the web portion to be supervised for a given weight of the roll. Conversely, by changing the weight of the roll, the spatial position thereof is changed for a given tension.

The up and down movements of roll 5 as the tension of the web portion between couple 3 and unit 6 changes are utilized to control speed setting motor 12 for couple 3. As indicated before, there are well known and readily available many means for translating the up and down movements of roll 5 into a control of motor 12. There is shown by way of example, a potentiometer 15 of conventional design, the contact slider 15a of which is carried by roll 5. When the roll is in a position reflecting the correct tension of the web portion, such as a mid position, the slider is in a neutral position, but it activates motor 12 in one or the other direction as the roll, and with it the slider, move up or down thereby either increasing or decreasing the ratio of transmission of gearing 10 as required, thus eventually causing return of roll 6 into its neutral position.

There is further shown a control console or panel 16 for the printing press. A control panel 17 next to console 16 mounts the devices required for supervising and controlling the web tension. There is diagrammatically shown an instrument 18 such as a digital counter coupled to devices 19 and 20 which coact with couples 3 and 9 respectively, to detect the rotational speeds of the couples and to transmit appropriate signals, for instance voltage or magnetic pulses, to instrument 18. Control panel 17 further accommodates a remote control device 21 of conventional design which is coupled, as it is indicated by arrowed lines, to motors 19 and 20 controlling the ratios of transmissions and individually operable by suitable means such as pushbutton switches 22 and 23, one pushbutton being provided for each of the motors 19 and 20.

The control panel 17 is also coupled to the automatic speed regulating device including roll 5 and potentiometer 15. As this device brings the tension of the web portion between couple 3 and printing unit 6 to the desired value, the speed differential between couples 3 and 9 can be brought to the selected value by adjusting couple 9 via motor 13 and gearing 11.

I claim:

1. A device for maintaining constant the tension of a web conveyed from a web supply through at least one printing unit of a printing press, said device comprising in combination:
 - a first couple of power-driven conveyor rollers for conveying said web disposed anterior of the printing unit;
 - a second couple of power-driven conveyor rollers for conveying said web disposed posterior of the printing unit;
 - transmission means with variable transmission ratio coupled to each of said couples for varying the rotational speed of the rollers of the respective couple;
 - speed measuring and indicating means connected to each of the couples, said means measuring and visually indicating speed differentials between said two couples for adjusting the speed differential to a selected value by varying the transmission ratio of at least one of said transmission means; and

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automatic speed control means including detecting means detecting the tension of the web portion between the first couple and said printing unit, said control means being controlled by said detecting means and controlling the transmission ratio of the transmission means coupled to said first couple for correspondingly varying the rotational speed of the rollers thereof so as to maintain said web portion at a selected constant tension.

2. The device according to claim 1 wherein each of said transmission means comprises a gear train with finely variable gear ratio.

3. The device according to claim 1 wherein each of said measuring and indicating means comprises a digital indicating means numerically indicating said speed differentials.

4. The device according to claim 1 wherein said automatic

speed control means comprises a floating roll suspended in a loop of said web portion for up and down movement of the roll in accordance with the tension of said web portion, and electric control means controlling the transmission ratio of the transmission means coupled to the first couple, said electric control means including a potentiometer having a contact slider the position of said slider varying in accordance with variations in the up and down movements of said floating roll.

5. The device according to claim 1 and comprising remote control means connected to the transmission means coupled to the second couple for controlling the transmission ratio of said transmission means, said remote control means being located adjacent to said measuring and indicating means thereby providing a common control station.

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