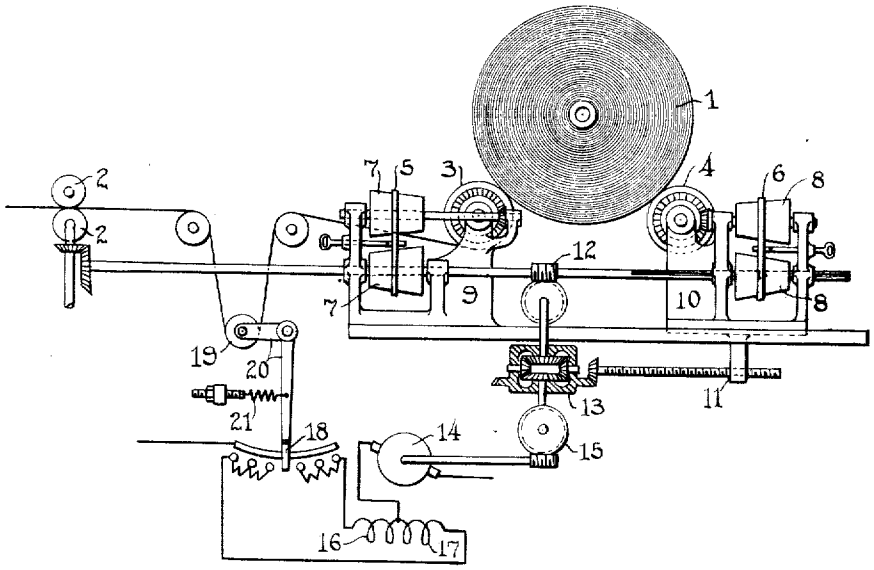
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TENSIONING MEANS FOR WEB ROLLS AND OTHER MATERIALS

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TENSIONING MEANS FOR WEB ROLLS AND OTHER MATERIALS.

Application filed May 1, 1920. Serial No. 378,162.

To all whom it may concern:

Be it known that I, WILLIAM C. STEVENS, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Tensioning Means for Web Rolls and Other Materials, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

This invention relates to tensioning means for web rolls and other materials.

As it is understood, it is desired to maintain printing press webs under constant tension in feeding the same to a press and also in winding the web for use. However, great difficulty has been experienced in maintaining constant tension either in unwinding or winding due to the variations in diameter of the roll and other variable conditions met with in practice.

It has heretofore been proposed to effect proper tensioning of the web by supporting the same upon rollers, driving the rollers in the same direction but at slightly different speeds to effect a drive of the web roll and to exert a drag on the web, and varying the speed ratio of the rollers to compensate for variations in the diameter and weight of the web roll. Such means, however, have proven unsatisfactory for unwinding and only partly successful for winding due in part to the fact that the drag which it is desired to regulate does not in general vary directly with the relative speeds of the parts which are in frictional contact and in part to inherent characteristics of the means employed for varying and controlling the relative speed of the rollers.

The present invention has among its objects to provide improved tensioning means of the aforesaid character to maintain under constant tension a printing press web or other material during either unwinding or winding thereof.

Another object is to provide means of the aforesaid character controllable automatically to maintain constant tension.

Other objects and advantages of the invention will hereinafter appear.

According to the present invention it is proposed to employ spaced supports for the roll, said supports preferably comprising rollers driven at slightly different speeds but having a constant speed ratio variable at will. Further, it is proposed to vary the distance between the supports in such a manner as to compensate for variations in diameter of the web roll and other variable conditions. With the proposed means the drag effected by the driving roller having the lower rotative speed and consequently the tension upon the web will be substantially determined by the pressure between and normal to the coacting surfaces of the web roll and such driving roller. Moreover, this pressure is determined substantially by two oppositely varying functions of the length of radius of the web roll, namely, the weight of the web roll which varies proportionately to the square of such radius, and the angle which the direction of such pressure makes with the vertical, which angle increases as the radius of the web roll decreases (assuming a fixed distance between centers of the driving rollers). If, therefore, such distance be so varied that the consequent variation of said angle shall exactly compensate for the concurrent variation in weight of the roll, the effective normal pressure will remain constant and consequently the web tension will likewise remain constant.

The accompanying drawing illustrates schematically and diagrammatically a preferred means of carrying out the invention and the same will now be described, it being understood that the means illustrated are susceptible of various modifications.

Referring to the drawing, the same illustrates a roll 1 of web or other material to be supplied to a printing press or other machine represented by a pair of rollers 2, said rollers being utilized to draw the material from its roll. The roll 1 is mounted upon and between a pair a of similar spaced rollers 3 and 4, adapted to be driven by the printing press mechanism, through similar reduction gear including belts 5 and 6 cooperating with pairs of cone pulleys 7 and 8 so adjusted that the peripheral speed of the roller 3 substantially equals the linear velocity of the material as the same is drawn into the press, whereas the peripheral speed

of the roller 4 is maintained at a value less than that of the roller 3 by a definite ratio, such, for example as 2%, such ratio, however, being amenable to preselection and adjustment at will. In practice the web is preferably passed beneath and partly about the roller 3.

Said rollers 3 and 4 are respectively provided with supports 9 and 10, the former being relatively stationary and the latter being slidable for movement of the roller 4 either toward or away from the roller 3. A screw mechanism 11 is provided for effecting such movement of the roller 4, said mechanism being operated at a reduced speed bearing a definite ratio to the speed of the printing press mechanism through suitable reduction gearing including a worm gear indicated at 12, or being capable of manual operation if desired.

In practice the driving rollers are initially spaced such a distance between centers as, under the assumed speed ratio, to provide the necessary or desired tension upon the web, assuming the diameter of the web roll to be a maximum, the pitch and speed of the screw being calculated to advance said movable roller toward the relatively fixed roller at such speed as to maintain such tension constant during unwinding of the entire roll.

It has been demonstrated that although in general the curve representing instantaneous values of the length of radius of the web roll and of the distance between centers of the two driving rollers is not entirely plain and regular, nevertheless covering the ranges involved in unwinding the web from a paper roll of ordinary size and under the conditions ordinarily obtaining in printing press operation, such curve is substantially straight, thus indicating that the necessary movement of the movable roller is continuous and constant and therefore may be satisfactorily effected by the screw mechanism described.

It has also been demonstrated that for maintaining the web tensions ordinarily employed in printing press operation, the driving rollers will be initially spaced a distance sufficient to insure against dislodgment of the web roll therefrom and said driving rollers will moreover approach one another so closely at the termination of the unwinding of any individual roll that the distance between adjacent peripheral portions thereof is materially less than the diameter of the core or mandril ordinarily employed, thus eliminating all danger of the practically exhausted roll dropping between the driving rollers.

In order to adapt the device to use in winding it is merely necessary to adjust the speed ratio of the rollers 3 and 4 by shifting the belts 5 and 6 with reference to their respective cone pulleys in such a manner that the peripheral speed of the roller 4 shall equal the linear velocity of the web to be wound, the speed of the roller 3 being sufficiently reduced to effect the necessary drag for tensioning the material it being further assumed that the rolls 2 in this instance indicate a feeding device and that therefore the direction of rotation of the various parts will be the reverse of that heretofore described.

In this operation the supporting rollers 3 and 4 will at first be arranged relatively close together to support the winding mandril and also to effect the necessary drag thereon, the space between said rollers being progressively increased to compensate for increase in diameter of the roll, the various parts performing functions similar to those afore-described but in reverse senses consistently.

Although for ordinary requirements during either unwinding or winding, the afore-described progressive regulation of the distance between centers of the supporting rollers is fully adequate for maintaining the web tension constant, nevertheless obviously such action may be supplemented by variation in the speed ratio of said rollers by means of the cone pulleys should special circumstances render such action necessary or desirable.

In practice a differential gear 13 is preferably interposed in the drive of the screw 11, said gear including an element to be directly driven by the worm gear 12 of the roller driving mechanism, and also including an element having a power connection with a reversible motor 14 through a second worm gear 15, whereby following either unwinding or winding of a roll of material said motor may be operated to drive the screw in the proper direction for positioning the roller 4 in a suitable relation to receive the next roll.

Here it may be noted that the individual worm gears 12 and 15 serve, when not positively driven, to lock their respective differential gear elements, whereby rotation of either of said elements during inaction of the other is transmitted to the screw 11 without loss due to back rotation of the other element.

To provide for reversal of the motor 14 the same is preferably provided with oppositely wound fields 16 and 17 while a conventional form of switch mechanism indicated at 18 serves to control the motor circuit and to effect selection between said fields for starting the motor and determining the direction of rotation thereof.

In practice the switch mechanism 18 is preferably controllable by a tension responsive device of known construction including a roller 19 to be raised and lowered in

response to variations in tension of the material and a lever 20 for transmitting such motion to the switch mechanism for effecting operation of the motor in a direction to compensate for such variation, whereby the operation of the device is rendered fully automatic. An adjustable tension spring 21 serves to provide for predetermination of the degree of tension to be maintained.

In the operation of the device, assuming such adjustment of the spring 21 that for the desired tension upon the material the switch arm is in the neutral position illustrated, the desired operation of unwinding or winding may be at once started without regard to any particular relative positioning of the rollers 3 and 4. If said rollers are not properly positioned initially the motor 14 is at once started in the proper direction to bring the same into suitable relation, and such condition when once established will ordinarily be maintained by the continuous drive of the screw through the worm gear 12 without further action of the motor. Such adjusted setting of the roller 4 will occur automatically whenever the roll of material is replaced or upon any other change in operative conditions which would otherwise cause the tension of the material to vary from that predetermined. Also to provide for operation of the device under conditions which differ widely from those contemplated in the design of the primary actuating mechanism for the screw, the motor may act intermittently in either sense or even continuously to effect the necessary correction, while under circumstances of sudden and extreme variation in operating conditions the continuous drive of the screw might even be suspended, the motor alone being relied upon for effecting the necessary movements of the roller 4.

What I claim as new and desire to secure by Letters Patent is:

1. In a device for tensioning material as drawn from or wound upon a roll, in combination, spaced supports for such roll, said supports being relatively movable for varying that pressure component due to gravity which is normal to the contacting portions of such roll and said supports.

2. In a device for tensioning material as drawn from or wound upon a roll, the combination with a pair of spaced supports for such roll for effecting a drag upon the material as drawn therefrom or wound thereon, of means for effecting translatory relative movement of said supports proportional to the rate of travel of the material to be tensioned to render such drag substantially constant irrespective of variations in size of such roll.

3. In a device for tensioning material as drawn from or wound upon a roll, the combination with a pair of spaced supports for such roll adapted to effect a drag upon such material substantially determined by that pressure component due to gravity which is normal to the contacting portions of such roll and said supports, of means for effecting relative movement of said supports for maintaining such pressure component substantially constant irrespective of variations in diameter and weight of such roll.

4. In a device for tensioning material as drawn from or wound upon a roll, the combination with a pair of spaced supports to receive such roll thereabove and therebetween, one of said supports being rotatable, of means for driving said support in synchronism with the material to be tensioned for effecting a drive of such roll, the other of said supports being adapted to exert upon the roll a drag substantially determined by the gravity component of the latter upon the former for tensioning the material, and means for varying the distance between said supports to maintain such component substantially constant irrespective of variations in diameter and weight of such roll.

5. In a device for tensioning material as drawn from or wound upon a roll, the combination with a pair of spaced supports to receive such roll thereabove and therebetween, one of said supports being rotatable, of means for driving said support in synchronism with the material to be tensioned for effecting a drive of such roll, the other of said supports being adapted to exert upon the roll a drag substantially determined by the pressure of the latter upon the former for tensioning the material, and means for effecting translatory relative movement of said supports at a speed bearing a definite ratio to the speed of the material to be tensioned for maintaining such pressure substantially constant irrespective of variations in diameter of such roll.

6. In a device for tensioning material as drawn from or wound upon a roll, the combination with common means for supporting and driving such roll and for tensioning such material, said means including a roll driving element to be driven in synchronism with the web and a web tensioning element to be driven at a lesser speed bearing a definite relation to the speed of said former element, and means for varying the angular relation of said latter element to said web roll to compensate for variations in size of said roll at a rate proportional to the rate of travel of the web.

7. In a device for tensioning material as drawn from or wound upon a roll, the combination with driving means for the roll, of combined roll supporting and web tensioning means adapted to exert upon the material a degree of drag dependent substantially upon the gravity component of said supply roll upon said supporting and tensioning

means, and means for maintaining such component substantially constant irrespective of predetermined variations in size of said roll.

8. In a tensioning device for material drawn from or wound upon a roll, the combination with a pair of spaced rollers for supporting and driving such roll, means for driving said rollers in the same direction at speeds differing from one another by a definite ratio, and for maintaining the speed of one of said rolls synchronous with the speed of the material to be tensioned, of means for automatically and progressively varying the distance between said rollers at a rate proportional to the rate of travel of the material to compensate for progressive variations in radius of said roll.

9. In a tensioning device for material drawn from or wound upon a roll, the combination with a pair of spaced rollers for supporting and driving such roll, means for driving said rollers at speeds differing from one another by a definite ratio and for maintaining the speed of one of said rolls synchronous with the speed of the material to be tensioned, of means for automatically and progressively varying the distance between said rollers to compensate for progressive variations in radius of said roll and means for varying the relative speed of said rollers.

10. In a tensioning device for material drawn from or wound upon a roll, the combination with a pair of spaced rollers for supporting and driving such roll, means for driving said rollers at speeds differing from one another by a definite ratio and for maintaining the speed of one of said rolls synchronous with the speed of the material to be tensioned, of means for automatically and progressively varying the distance between said rollers to compensate for progressive variations in radius of said roll, and speed varying means for said rollers for rendering the speed of either of the same selectively synchronous with the speed of the materials to adapt the device for service in either unwinding or winding.

11. In a device for tensioning material as drawn from or wound upon a roll the combination with a pair of spaced supports for such roll for effecting a drag upon the material as drawn therefrom or wound thereon, of means for effecting relative movement of said supports at a reduced speed bearing a definite relation to the linear velocity of such material, and additional power means for effecting relative movement of said supports.

12. In a device for tensioning material as drawn from or wound upon a roll the combination with a pair of spaced supports for such roll for effecting a drag upon the material as drawn therefrom or wound thereon, of means for effecting relative movement of said supports, additional power means for effecting relative movement of said supports and means responsive to variations in tension of the material for controlling said latter means.

13. In a device for tensioning material as drawn from or wound upon a roll, the combination with a pair of spaced rollers for supporting and driving such roll, means for driving said rollers at speeds differing from one another by a definite ratio and for maintaining the speed of one of said rolls synchronous with the speed of the material to be tensioned, of means for automatically and progressively varying the distance between said rollers to compensate for progressive variations in radius of said roll, speed varying means for said rollers for rendering the speed of either of the same selectively synchronous with the speed of the materials to adapt the device for service in either unwinding or winding, and additional power means for effecting relative movement of said rollers in opposite directions selectively.

14. In a device for tensioning material as drawn from or wound upon a roll, in combination, a pair of spaced supporting rollers for such roll, means for driving said rollers in the same direction at speeds bearing a definite ratio to one another for driving such roll and exerting a drag upon the material and maintaining the higher of such speeds synchronous with the speed of the material, means operable for effecting relative movement of said rollers in opposite directions selectively and associated sets of operating means for said latter means including a differential gear having an element to be driven at speeds bearing a definite ratio to the speed of the material and a second element to be operated and controlled in response to tension variations of such material.

In witness whereof, I have hereunto subscribed my name.

WILLIAM C. STEVENS.

Certificate of Correction.

It is hereby certified that in Letters Patent No. 1,455,976, granted May 22, 1923, upon the application of William C. Stevens, of Milwaukee, Wisconsin, for an improvement in "Tensioning Means for Web Rolls and Other Materials," an error appears in the printed specification requiring correction as follows: Page 3, lines 121 and 122, claim 6, strike out the words "at a rate proportional to the rate of travel of the web" and insert the same to follow the word "roll" in line 120; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 31st day of July, A. D., 1923.

[SEAL.]

KARL FENNING,
Acting Commissioner of Patents.