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COMPENSATING OR REGULATING DEVICE FOR PAPER WEBS

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My invention relates to compensating or regulating devices and has for its object to provide a novel and simple device of this character for use in connection with traveling webs of paper, or similar material, to vary the feed of the web at one portion thereof in an efficient manner without disturbance or interference with the uniform feed of the web at another portion thereof.

A further object of the invention is to construct the device in such a manner that the pulling strains required to withdraw the web from the roll of paper will be reduced to a minimum, whereby tearing and consequent waste of paper is avoided and power necessary to feed the web is conserved. Other more specific objects will appear from the description hereinafter and the features of novelty will be pointed out in the appended claims.

In the accompanying drawings, which illustrate examples of my invention defining its limits, Figure 1 is a side elevation of the device; Figure 2 is a sectional elevation on the line 2—2 of Figure 1; Figure 3 is a view, on an enlarged scale, illustrating a detail of the invention; Figure 4 is an elevation similar to Figure 1 showing another form of my invention; Figure 5 is a diagrammatic front elevation thereof; and Figure 6 is a partial elevation of a third form of my invention.

The device may be incorporated directly in the machine with which it co-operates as an inherent part thereof, or it may be constructed in the form of an attachment capable of temporary or permanent combination with the machine through which the web of paper passes or whereby it is converted into a product of merchandize. For the purposes of illustration and description, and for no other reason, the device has been shown in the form of an attachment adapted to be operatively combined with any type of paper or other machine in which a traveling web of paper is employed.

In its illustrated form the device comprises a supporting frame 10 of suitable type and dimensions and provided with brackets 11 in which a conventional roll of paper 12 may be rotatably supported. A feed roller 13 is journalled at 14 upon the frame 10 and is rotatably driven in any convenient manner, as by means of a sprocket wheel 15 connected by means of a sprocket chain (not shown) in the well known way with a suitable source of power. The web of paper a passes over the feed roller 13 and is withdrawn thereby from the roll 12 and finally passes over an idler roller 16 journalled at 17 upon the frame 10 to the paper machine or other element with which the regulating device co-operates. To bring about the surface friction between the web a and the roller 13 necessary to positively feed said web, a suitable pressure means is provided which, in the operation of the device, is automatically released at intervals to release the engagement between the web a and the feed roller 13 and thereby temporarily arrest the travel of said web over said roller. In the illustrated example, this pressure means comprises a pressure roller 18 journalled at 19 upon arms 20 which are pivotally mounted at 21 upon the frame 10, as shown in Figure 1; the pressure roller 18 is superimposed over the feed roller 13 and is arranged to engage the surface thereof or of the web a passing over the same. The means whereby the roller 18 is actuated at intervals to bring about a temporary discontinuance of the feed of the web a by the roller 13 may comprise mechanically operated elements, as shown in Figures 1, 2 and 3, or electrically actuated elements, as illustrated in Figures 4, 5 and 6. Thus, in the form shown in Figure 1, lifting members 22 are pivoted at 23 upon the frame 10 and are engaged by co-operating means connected with the roller 18, the points of engagement between said means and the lifting members 22 being to one side or forwardly of the pivots 23 thereof; as illustrated, the means referred to consists of lugs 24 pivotally connected at 25 with bosses 26 carried by the arms 20 which are continued beyond the pivots 21 for this purpose. In the preferred arrangement the lugs 24 are located within and extend beyond recesses 27 formed in the bosses 26, said lugs having their free ends pointed, as indicated at 28, and seated in depressions 29 of the lifting members 22. In order to permit the greatest freedom of pivotal movement in the latter with the least effort, said
lifting members 22 may be provided with slots 23 for the accommodation of the pivots 23. Gravity alone may be relied upon to maintain the roller 18 normally in contact with the roller 13 or with the web a passing over the same and the ends of the lugs 24 in engagement with the lifting members 22 or, as is preferred, springs 30 may be provided for the purpose. In such case, these springs 30 may be provided with one end against the arms 20 and with their other ends against bearing members 31 carried by screws 32 in screw-threaded engagement with the frame 10 and whereby the tension of the springs 30 may be adjusted; it will be understood that the parts are arranged and proportioned so that the engagement of the lugs 24 with the lifting members 22 is preferably maintained at all times without regard to the position of the pressure roller 15 relatively to the roller 13. In the forms of my invention illustrated by Figures 1 to 5, rollers 33 depend on the lifting members 22 and at their lower free ends extend transversely across vertical slots 34 formed in bars 35 attached to the frame 10 or comprising integral parts thereof. These rods 33 and the lifting members 22 together constitute levers which, because of the location of the pivots 23 in close proximity to the points of engagement of the lugs 24 with said lifting members 22 and the relatively great length of the rods 33, provide a leverage whereby a considerable lifting action may be exerted by the members 22 upon the lugs 24 with a comparatively slight pressure upon the rods 33 near their free ends; in other words, the means whereby the feeding of the web a by the roller 18 is controlled is extremely sensitive and is capable of being actuated with very little mechanical effort. The slots 34 of the bars 35 accommodate trunnions 36 which may simply comprise the opposite ends of a bight-forming rod 37 or form continuations of a roll 38, as shown in the drawings; in any case, annular flanges 39 are located upon the trunnions 36 for engagement with the bars 35 to prevent relative movement of said trunnions and connected elements in axial directions. The web a passes over the roll 38 or its equivalent in the form of a bight b which depends from the rollers 13 and 16, as shown in Figure 1, and which provides a supply of paper from which the web a may be passed over the roller 16 and whereby, through the medium of the roll 38 or its equivalent, the tension of the web a as it passes over and beyond the roller 16 is maintained at a constant point and the travel or feed thereof beyond said roller 18 may be maintained at a uniform speed without requiring the rotative speed of the roll of paper 12 to be retarded or controlled. The roll 38 used in the forms of my invention illustrated by Figures 1 to 5 actuates not only a regulating device for the feed but constitutes a tension device for the web.

In practice, in order to reduce the pull upon the web a as it passes over and beyond the roller 16 to be maintained at a minimum point consistent with the desired speed of travel of said web a, the roller 13 is caused to feed the web a into the bight b at a speed, when the rollers 13 and 18 are in normal feeding relation, somewhat greater than the speed at which said web a passes over and beyond the roller 16. Obviously, under such conditions, unless provision is made to prevent the same, this would result in a continuous and gradual increase in the depending length of the bight b, whereby the utility of the compensating device and its effect upon the web would finally be destroyed. This is prevented in the following manner: As the bight b gradually increases in length, the roll 38 or its equivalent will gradually descend and cause the trunnions 36 to travel downwardly in the slots 34 and to finally engage the rods 33. As this occurs and the increase in the length of the bight b continues, the trunnions 36 will exert a pressure upon said rods 33 and shift the same toward the left in Figure 1 and thereby correspondingly swing the lifting members 22 upon the pivots 23. Because of the fact that the latter are to one side or eccentric to the depressions 29, this pivotal movement of the members 22 will exert a lifting action upon the lugs 24, bosses 26 and arms 20 and consequently will lift the pressure roller 18 in a direction away from the feed roller 18 and thus remove the pressure from the web a at the point where it passes over said roller 13. Because of this, the surface adhesion between the latter and said web a will be lessened and the roller 13 will consequently rotate independently of or slip, as it were, relatively to the web a without causing any further feed thereof into the bight b. As the feeding of the web a into the bight b is thus arrested, the latter, because of the continued travel of said web a over the roller 16, will be shortened somewhat in depending length and consequently will cause the trunnions 36 to be lifted out of engagement with the rods 33. The latter being thus relieved of a restraining pressure will, under the weight of the parts, plus the action of the springs 30, swing toward the right in Figure 1, the lifting members 22 being correspondingly swung upon the pivots 23, whereupon the lugs 24, bosses 26 and arms 20 describe downward movements and return the pressure roller 18 into engagement with the web a and the feed roller 13. The surface adhesion between the latter and said web a being thus increased, the feed into the bight b is resumed until the trunnions 36 again actuate the rods 33 in the manner de-
scribed to again arrest the feed of said web a over the roller 13. This periodical arresting and resumption of the feed of the web a over said roller 13 into the bight b continues at successive intervals throughout any given period of operation, with the result that the depending length of said bight b varies only within restricted limits and remains approximately constant. The result of this is that the web a, as it passes over and beyond the roller 16, is maintained under a fixed tension which may be accurately predetermined to provide a uniform speed of travel of said web a at points beyond the roller 16 and may be calculated to produce a minimum pulling strain upon said web. It will be understood that such pulling strains as result from the withdrawal of the web a from the roll of paper 12 are applied to the web at points between the feed roller 13 and the roll of paper 12; because of the periodical discontinuance of the feed over said roller 13, this pulling strain is not continuous, but occurs at successive intervals and is thus easily distributed without danger of tearing the paper web a. The relatively great length of the rods 33 and the location of the pivots 23 in close proximity to the points at which the lifting action is exerted to raise the roller 18 provides a large leverage in the levers consisting of said rods 33 and the lifting members 22, so that only a very slight mechanical effort is required to bring about the described operation of the device. It will be understood that the lifting members 22, rods 33 and their co-related parts are duplicated at opposite sides of the device, as shown in Figure 2, so that all operations are balanced and conducted with a minimum of friction. In some cases it may be desirable to locate counterweights 40 upon the lifting members 22 in order to assist in the return of the parts to normal position; such weights 40, because of the location in close proximity to the pivots 23, will add comparatively little resistance to the lifting action previously set forth, although they will efficiently assist in the restoration of the elements to their normal positions.

In the form shown in Figures 4 and 5, the lifting of the pressure roller 18 away from the feed roller 13 is electrically accomplished at periodic intervals; that is to say, an armature 22a is mounted upon and extends between the arms 20 and is located in operative relation to the cores 24 of a plurality of electromagnets 26a supported upon the frame 10 at spaced intervals, as indicated in Figure 5. These electromagnets are in electrical connection with each other and are connected by means of wires c and d with a source of electrical energy and with a pivoted switch member 33a. The electrical circuit further includes a wire e which leads from a co-operating switch member 33b to said source of electrical energy. The latter switch member is stationary and is fixed upon and suitably insulated from the frame 10 while the switch member 33a is pivoted at 39 upon said frame 10 and is also insulated therefrom in any convenient manner. normally, the switch members 33a and 33b are maintained out of engagement with each other by means of a spring 33c, so that the electric circuit in which the electromagnets 26a are included is open and said magnets are de-energized. Under such conditions, the pressure roller 18 is in engagement with the feed roller 13 or with the web a passing thereover. A stop 33d, suitably insulated, is provided upon the frame 10 for arresting the pivotal movement of the switch member 33a under the influence of the spring 33c. The means whereby the switch member 33a is pivotally actuated to close said electric circuit is shown in the form of a plunger 36a mounted to slide in a guide 36b secured upon the frame 10, said plunger being suitably insulated from said guide, as indicated in the drawings. The plunger 36a is located in the path of one of the trunnions 36 so as to be capable of being operated thereby; in order to balance the operation of the mechanism and to maintain the same in equilibrium, a lever 33f is pivotally actuated at 39f on the frame 10 at a point opposite to and in registry with the switch member 33a and is under the influence of a spring 33g which corresponds in tension to the spring 33c. The lever 33f is arranged to be operated by a plunger 36c corresponding to the plunger 36a and similarly mounted upon the frame 10, so as to lie in the path of the other trunnion 36; suitable stops 33h are provided to limit the pivotal movements of the lever 33f.

With the electrical arrangement described, as the bight b of the web a is increased in length, as previously set forth, the trunnions 36 will finally engage and sidely actuate the plungers 36a and 36b and will pivotally depress the switch member 33a and the lever 33f against the tension of the springs 33c and 33f. This actuation of the plunger 36a and its lever 33f performs no function other than to maintain the trunnions 36 and the roll 38, if the same is present, in balance. As the switch member 33a is pivotally depressed, it will, however, be forced into engagement with the switch member 33b and consequently will close the electrical circuit in which the electromagnets 26a are located. The latter will thereby be electrically energized and thus cause the cores 24a to exert a magnetic influence upon the armature 22a, whereby the latter is attracted toward said cores and the arms 20 are pivotally actuated in a direction to lift the pressure roller 18 out of contact with
the web as it passes over the feed roller 13. The latter thus rotates independently of the web a or slips relatively thereto in the same way as previously described, with the result that the bight b is shortened and the trunnions 36 are moved in a direction away from the plungers 36a and 36b. As this occurs, the springs 33a and 33b will cause the switch member 33c and the lever 33b to raise said plungers and to move the switch member 33b out of contact with the switch member 33c and thereby open said electrical circuit. In this way the electro-magnets 26a are de-energized, with the result that the armature 25 is released and the pressure roller 18 is returned into engagement with the web as it passes over the feed roller 13, whereupon the feed of said web a into the bight b is resumed in the same way as previously set forth.

This alternate energization and de-energization of the electromagnets is continued throughout a given operation as the trunnions 36 are lowered and raised by reason of the variations in the depending length of the bight b and thus moves the pressure roller 18 away from and into engagement with the feed roller 13 in the same manner with the same results as is done mechanically in the form of the invention first described. All of the advantages present in the mechanically operated arrangement are to be found also in the electrically operated device, it being understood that the latter may also be incorporated directly in the machine with which it co-operates or comprise an attachment adapted to be permanently or temporarily combined with such machine.

In Figure 6 I have shown still another form of my invention, in which no roller 38 or bias weight on the bight b of the web, and in this form there is practically no tension device for the bight, except in so far as the weight of such bight itself produces a certain amount of tension. The feed regulation is obtained as follows: The loop or bight b rests on the pan 40 of a lever or scale beam 41 fulcrummed at 42 and controlling an electric circuit, for instance by means of a switch 43, 44 similar to the parts of 33a, 33b of Figures 4 and 5 and connected by wires d, e with a magnetic feed control of the same character as explained with reference to Figures 4 and 5, or with any other suitable type of feed-regulating device.

The device, in all of its forms, may be efficiently utilized in any mechanism in which any part of its operation includes a traveling web of paper which it is desired to feed at a speed sufficient to insure a constant supply of paper to the machine receiving such web from the feeding device. In practice, the invention has been found particularly useful in connection with machines for making paper bags, it being obvious that it may be used to advantage in wall-paper and embossing machines, web printing presses and the like.

Various modifications may be made within the scope of the claims without departing from the nature of my invention.

I claim:

1. A tension device comprising a frame, an idler roller, and a feed roller on said frame over which a web of material travels and from which it depends in a bight, said feed roller feeding said web into said bight at a speed in excess of its speed of travel over said idler roller, a pressure roller whereby said web is pressed into operative contact with said feed roller, a tension roller located in said bight for maintaining said web under a predetermined tension, said tension roller projected in opposite directions from said tension roller beyond said web, lifting devices operatively connected with said pressure roller and rods depending from said lifting devices extending diagonally across the path of said trunnions and engaged thereby to actuate said lifting devices and periodically adjust the pressure roller away from said feed roller to arrest the feeding action thereof, and means whereby said pressure roller is restored into engagement with said feed roller to restore the feeding action therefrom of said bight is maintained at approximately a constant depending length.

2. A tension device comprising a frame, an idler roller and a feed roller on said frame over which a web of material travels and from which it depends in a bight, said feed roller feeding said web into said bight at a speed in excess of its speed of travel over said idler roller, a pressure roller whereby said web is pressed into operative contact with said feed roller, arms pivotally mounted on said frame and carrying said pressure roller, lugs pivotally connected with said arms and depending therefrom, tension means located in said bight for maintaining said web under a predetermined tension, lifting means controlled by said tension means and cooperating with said pivoted lugs to periodically actuate said arms and lift said pressure roller away from said feed roller and a weight connected with said lifting means for returning said pressure roller into engagement therewith to alternately arrest and restore the feed of said web into said bight, whereby the depending length of the latter remains approximately constant.

3. A tension device comprising a frame, rollers over which a web of material travels and from which it depends in a bight, one of said rollers constituting a feed roller whereby said web is fed into said bight at a speed in excess of its speed of travel beyond said bight, a pressure roller associated with said feed roller for pressing the web into operative surface engagement thereon.
with, arms carrying said pressure roller, lifting members pivoted upon said frame, bosses depending from said arms, lugs pivotally mounted upon said bosses and resting upon said lifting members, guiding means located upon said frame, a tension device located in the bight of said web for maintaining the latter under a predetermined tension and movable lengthwise of said guiding means, and means controlled by said tension device for periodically actuating said lifting members, lugs and arms to adjust said pressure roller away from and toward said feed roller to alternately arrest and restore the feeding action thereof, whereby the depending length of said bight remains approximately constant.

4. A tension device comprising a frame, rollers over which a web of material travels and from which it depends in a bight, one of said rollers constituting a feed roller whereby said web is fed into said bight at a speed in excess of its speed of travel beyond said bight, arms pivotally mounted upon said frame, a pressure roller carried thereby and arranged to press said web into surface engagement with said feed roller, slotted members fixed upon said frame, a rolling tension device located in said bight to maintain said web under a predetermined tension, trunnions on said tension device movable lengthwise of said slots, lifting members pivoted upon said frame, devices carried by said arms and resting upon said lifting members, rods depending from the latter, and extending diagonally across the path of said trunnions and periodically movable thereby to pivotally rock said lifting members and lift said devices and arms to thereby move said pressure roller away from said feed roller to temporarily arrest the feed thereof, whereby the depending length of said bight remains approximately constant.

5. In a tension device, the combination of feed and pressure rollers between which a web of material is fed, pivoted lugs connected with one of said rollers, pivoted lifting levers having recesses in which the ends of said lugs are adapted to rest for separating said rollers to arrest the feeding action thereof, the pivots of said levers being in close proximity to the points at which the lifting force is exerted, tension means whereby said web is maintained under a predetermined tension and whereby said levers are periodically actuated to separate said rollers, weights carried by said levers for returning the same to normal position, and springs whereby said rollers are returned into contact with each other.

In testimony whereof I have hereunto set my hand.

JAY G. SWAB.