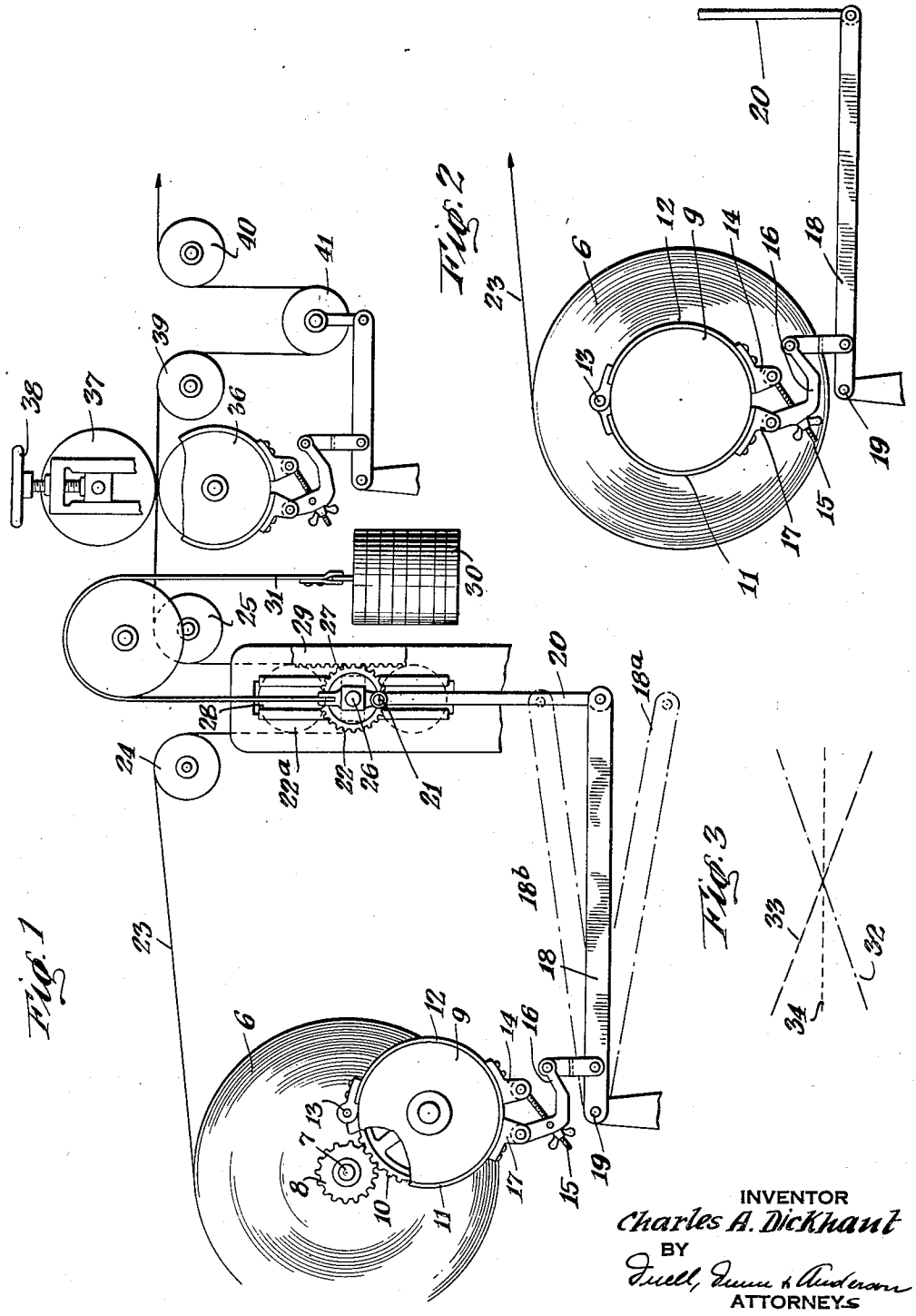
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WEB TENSIONING MEANS

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WEB TENSIONING MEANS

Original application filed April 3, 1928, Serial No. 266,908. Divided and this application filed August 12, 1931. Serial No. 556,544.

This invention relates to web tensioning devices for use in winding operations.

This is a division of my application, Serial No. 266,908, filed April 3, 1928.

The object of the invention is to provide methods of and means for applying a uniform web tension to a roll of unwinding material and automatically compensating for the variations in the load. It is apparent that if no speed controlling mechanism were employed to govern the unwinding of a roll of web material, the tension on the web for any given speed would be measured solely by the size of the roll. As the roll diminishes in diameter, the load will increase and the tension on the web will correspondingly increase. Since the load would vary indirectly in proportion to the constantly diminishing roll, the tension on the web would be ever changing.

In an endeavor to overcome this condition and obtain a uniform feed from an unwinding roll, various means have heretofore been provided for varying the tension of the web by braking the roll. However, unless the effect of such braking is to maintain a uniform tension, the web will at times unwind too fast and become loose, or will receive too much tension and be injured. The gist of applicant's invention is to provide a governing arrangement whereby a uniformly increasing load increment is removed from the uniformly diminishing load represented by the unwinding roll, so that the low speed tension on the web remains constant throughout an unwinding operation.

A feature of the invention resides in the provision of a floating roller adapted to tension the web and a counterweight for determining the tension applied by said roller. The floating roller and counterweight are designed to be variably adjusted to provide a compensating tension to the web beyond the limits of the usual load if a greater or smaller roll of material is used.

Another feature of the invention provides for tensioning a web by the use of a floating roller in combination with a hand adjusted braking means controlled by a second floating roller, the tension on the web determining the position of both rollers.

Other features for carrying out the objects of the invention in a number of forms will be brought out in the following description, read in conjunction with the accompanying drawing, of which:

Fig. 1 is a diagrammatical illustration of an arrangement in which a plurality of floating rolls, together with hand adjusted tensioning means, are employed in part to maintain a uniform tension in the web;

Fig. 2 represents an alternate arrangement for associating the braking means with the roll, and

Fig. 3 illustrates graphically the effect of the tensioning means on the web of an unwinding roll of material.

Considering the drawing, similar designations refer to similar parts. Numeral 6 represents a bundle of sheet material mounted on shaft 7, on which is fixed gear 8. Friction wheel 9 is secured to gear 10 which meshes with gear 8. Brake segments 11 and 12 are hinged at 13 and fit about the friction wheel. At extremity 14 of segment 12 is provided a turnbuckle 15, adapted to engage within arm 16, pivotally secured to extremity 17 of friction element 11. As is evident, the arm 16 and turnbuckle 15 are swingable on the pivots in the extremities of the friction element. It is patent that a downward movement of arm 16 will exert pressure on the turnbuckle, causing the elements to apply a pressure or braking effect upon the friction wheel. The position of arm 16 will be determined by the lever 18 to which it is linked, one end of the lever 18 being pivoted at 19 and the other end to the actuating element 20, secured at pivotal connection 21 to floating roller 22.

Upon leaving bundle 6, web 23 passes over fixed guiding roll 24, under floating roller 22, over a second fixed guiding roller 25, and then passes on to the hand controlled tensioning device to be described hereafter. Floating roller 22 is mounted on free shaft 26 on which is also mounted guide gear 27. To control the movement of the floating roller, guide opening 28 is provided, within which roller 22 moves. Gear 27 is adapted to mesh with the teeth of rack 29, and thus secures accurate alignment of the roller in its movement with respect to the fixed rollers.

Under some circumstances, the web 23 is not of uniform thickness, one edge being thicker than the other. Obviously, if tension is applied to a web of this character, it will be transmitted only by the thick edge of the web and not over its entire width. Under these conditions, the tension necessary to unwind the roll may be so great that a break in the web will occur. To preclude such possibilities, a hand adjusted friction roller and floating roller arrangement is combined with the floating roll 22 whereby the force tensioning the web may be made to function substantially over its entire width. After leaving the fixed roller 25, the web passes between a plurality of rollers 36 and 37 by means of which additional tension is applied to the web. The roller 37 is equipped with a hand wheel 38, by means of which it is adjustably positioned with respect to the roller 36 in such manner that pressure may be applied to the web 23 uniformly over its entire width. From these rollers, the web passes over the fixed rollers 39 and 40 and under the floating roller 41 which controls the braking effect on the roller 36, in all respects similar to the manner in which the floating roller 22 functions to apply braking effect to the roll 6. After leaving the roll 40, the web may be utilized as desired.

The weight of the floating roller 22, together with the braking effect upon the bundle, determines the tension in the web 23 as it approaches the roll 24. In order to provide variations in adjustment, the roller 22 has a counterweight 30 which may be varied in accordance with the amount of tension desired in the web.

In practice, the weight 30 is adjusted until the position of the roller 22 is such that the braking effect applied at the shaft 7 is sufficient to produce the proper tension when a constant pull is exerted upon the web leaving the roller 25. As the bundle 6 decreases in diameter, the force acting through the web to rotate the bundle increases proportionately, assuming a constant braking effect upon the shaft 7. This would increase the tension in the web and cause the roller 22 to rise, together with the bar 20 and the bar 18, to release the pressure on the brake drum 9, and, consequently, the braking effect on the shaft 7. The diminished pressure on the brake drum is just sufficient to compensate for the decrease in the diameter of the bundle so that the tension in the web is maintained constant at all times. Obviously, if for some reason the tension in the web were reduced, the roller 22 would drop, lowering the bar 18, thereby increasing the braking effect on the shaft 7, and, consequently, the force necessary to turn the bundle 6. This would return the tension to its proper value.

The counterweight 30 provides a ready means for adjusting the tension on the web 23. Obviously, for a given weight the tension in the web is constant if the roller 22 is stationary when acted upon by its own weight and tension in the web, since under these circumstances the braking in the shaft 7 is constant. Now, if the counterweight 30 is reduced, the effective weight of the roller is increased. The tension in the web must, therefore, be increased to restore equilibrium. This occurs when the roller 22 drops under the influence of its increased weight and applies additional braking effect to the shaft through the links 20, 18, and the brake bands 11 and 12.

The variations of tension in the web 23 result from the variations in the radius of bundle 6 and the variations of braking effect applied to the shaft 7. Results of these variable quantities may be illustrated by the graph shown in Fig. 3. As the bundle unrolls, its radius decreases at a constant rate and, consequently, the force applied through the web 23 necessary to turn the bundle increases at a constant rate. The increasing tension in the web 23, due to this effect, is represented by the line 32. Simultaneously therewith, the braking effect upon the shaft 7 is diminished at a constant rate. The force applied through the web 23 necessary to turn the bundle with the diminishing braking effect will also diminish at a constant rate. The tension in the web 23, due to this force, may be represented by the line 33 in Fig. 3. With proper adjustment of the machine, the amount by which these forces change may be made equal so that the resultant tension in the web 23 between the roller 24 and the bundle 6 is substantially constant, as indicated by the line 34 in Fig. 3. The counterweight 30 may be increased or diminished in weight by changing the amount of weight segments of which it is composed, and roller 22 may also be made heavier or lighter by varying the weight on shaft 26. For bundles of different sizes it may be necessary to adjust the weights of the floating roller and the counterweights to insure sufficient tension within the limits desired.

Assuming that it is desired to have the web under a constant tension as it leaves the roller 40, any fraction of this tension may

be applied by the rollers 36 and 37 where it will be uniform over the entire width of the web, while the remainder may be applied as the web leaves the bundle 6. This latter amount may be sufficiently small so that if it is applied at one edge of the web, litt'e danger of breaking will result.

It is apparent that the tension in the web leaving the fixed roller 40 is the sum of the tensions applied at the rollers 36 and 37 and that applied at the bundle 6. The floating roller 41 is adjusted to apply a braking pressure upon the roller 36 which is sufficient to maintain the desired tension in the web as it leaves the ro'ler 40. To make up the tension in the web as it leaves the roller 40, a portion of it may be applied as the roll leaves the bundle and this can be made just large enough to insure the web unwinding from the bundle. The remainder of the tension may be applied through the hand adjusted rolls 37 and, if desired, this may be by far the larger part, and as this tension may be app'ied over the full width of the web, the tension of the same leaving the roll 40 will be uniform throughout its width. As mentioned above, the floating roller 22 functions to maintain the tension in the web to the left of the roller 36 at the desired fraction of the full tension. However, should this tension vary, the variation will be immediate'y transmitted to the web at the right of the roller 36, under which circumstances the floating roller 41 will operate to vary the braking effect on the roller 36, and, consequently, the tension applied at this point. As the tension in the web leaving the bundle shaft varies, therefore, the floating rol'er actuates the roller 36 to supply the differential necessary for maintaining a constant tension on the web leaving the roller 40.

As mentioned above, this arrangement is particularly valuable if the web is not of uniform thickness, the tension being applied across the entire width of the web rather than at the bundle shaft alone. In processes where the point of tension is a considerab'e distance away from the processing machine, this auxiliary arrangement is deemed well fitted to compensate for variations of tension, as heretofore explained, if only the arrangement controlled by roller 22 were employed.

Another means of applying the braking pressure to the shaft 7 is shown in Fig. 2. In this embodiment the brake drum is applied directly to the shaft instead of through a gear train, as shown in Fig. 1. In all other respects the devices are identica'.

It will be apparent that various arrangements may be employed in which a counterweight or similar means are provided to compensate for variations of web tension. It should be understood that applicant does not limit himself to the forms herein illustrated and reserves the right to any system wherein compensating means, including a counterweight or equivalent device, are employed to control the low speed and web tension in a winding operation. This application is a division of my application for web tensioning means, Serial No. 266,908, filed April 3, 1928.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In combination for controlling web tension, a shaft, a roll of material thereon to be unwound, friction means for controlling the speed of the shaft, a movable roller against and tensioning the web of the material, said roller controlling the friction means, compensating means including a second movable roller and a second friction means controlled thereby, the web passing between said second friction means and a hand-adjusted friction means, all said movable rollers and friction means cooperating to maintain a substantially uniform web tension regardless of the constant diminution of the roll during unwinding.

2. The method of applying a predetermined constant tension to a traveling web the normal tension of which varies, which comprises applying additional tension varying with the normal tension at one portion of the web and applying sufficient tension at another portion of the web, determined by the tension at the first portion to maintain the total tension constant.

3. The method of applying a predetermined constant tension to a traveling web the normal tension of which varies, which comprises applying additional tension varying with the normal tension, at one portion of the web, and applying a differential tension substantially uniformly over the entire width of another portion of the web controlled by the tension at the first portion to maintain the total tension constant.

4. A device for controlling web tension comprising a shaft, a roll of material to be unwound positioned thereon, means for applying a braking effect to said shaft controlled by the tension in the web leaving the roll, and means for applying further tension to said web also controlled in accordance with the tension of the web leaving the roll.

5. A device for controlling web tension comprising a shaft, a roll of material to be unwound positioned thereon, means for applying a braking effect to said shaft controlled by the tension in the web leaving the roll, and friction means for applying further tension to said web, also varied in accordance with the tension of the web leaving the roll.

6. A device for applying a substantially constant predetermined tension in a traveling web unwinding from a roll which com-

prises a shaft on which said roll is mounted, braking means on said shaft, a floating roll associated with said web for controlling the braking effect on said shaft in accordance with the tension in the web, means functioning to add the difference in tension at another portion of said web to make up said predetermined tension, said means also controlled by the tension in said web.

7. A device for applying a substantially constant predetermined tension in a traveling web unwinding from a roll which comprises a shaft on which said roll is mounted, braking means on said shaft, a floating roll associated with said web for controlling the braking effect on said shaft in accordance with the tension in the web, means functioning to add the difference in tension at another portion of said web to make up said predetermined tension, said means comprising a pair of friction rollers functioning over the entire width of said web and adjustable in accordance with the position of a floating roll also controlled by the tension in said web.

8. A device for applying a substantially constant predetermined tension in a traveling web unwinding from a roll which comprises a shaft on which said roll is mounted, braking means on said shaft, a floating roll associated with said web for controlling the braking effect on said shaft in accordance with the tension in the web, means functioning to add the difference in tension at another portion of said web to make up said predetermined tension, said means comprising a second floating roller also controlled by the tension in said web.

In testimony whereof I affix my signature.

CHARLES A. DICKHAUT.