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CONTROL APPARATUS

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FIG. 1

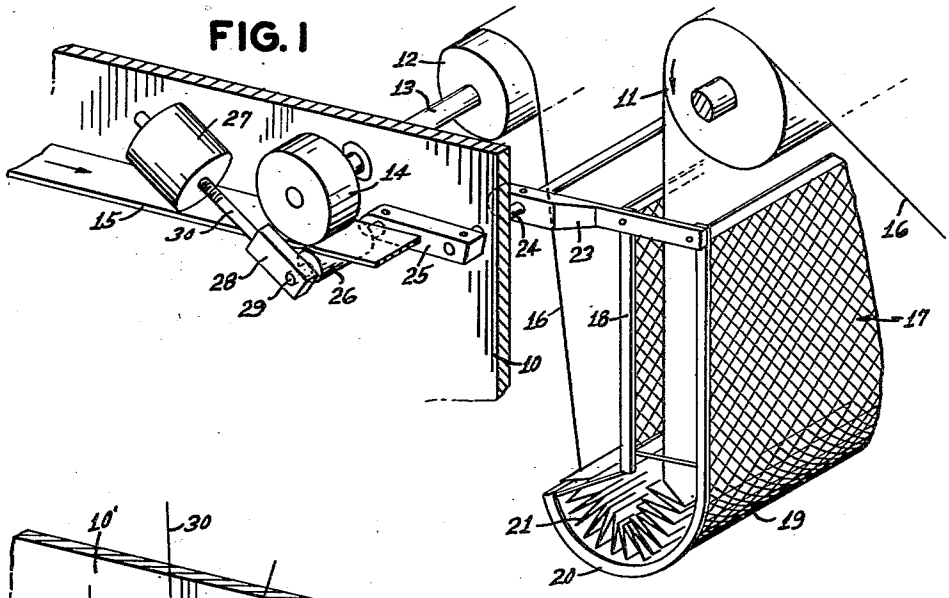
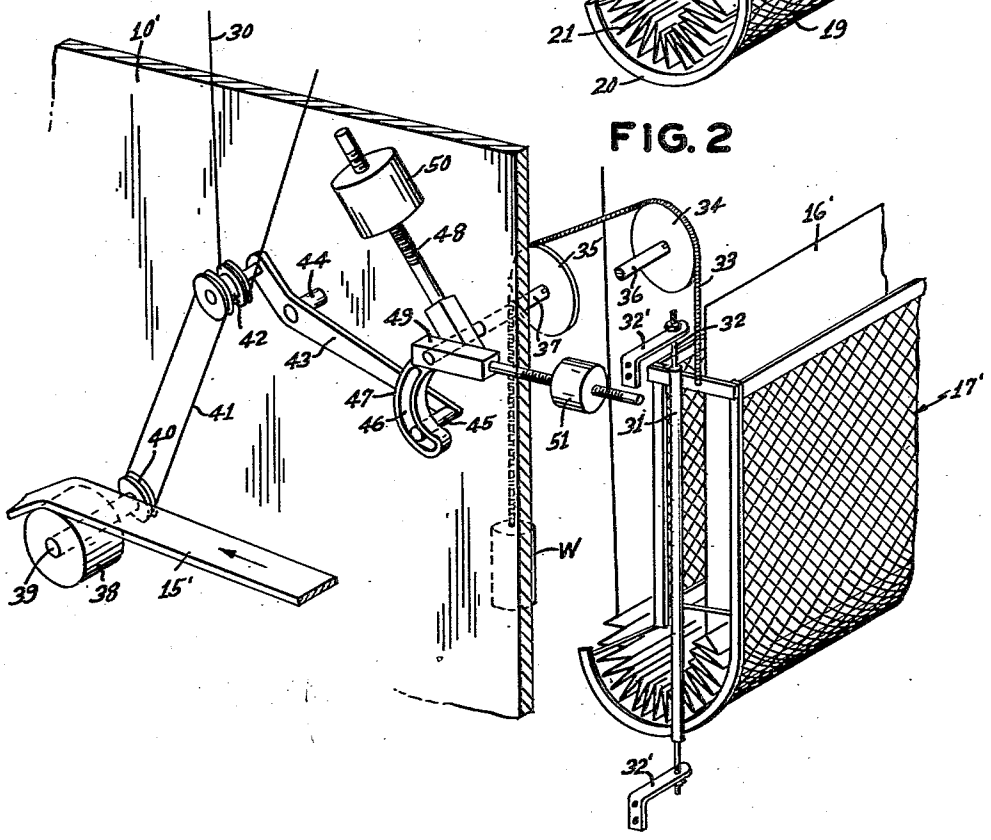


FIG. 2



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CONTROL APPARATUS

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This invention relates to control apparatus for regulating the speed of a travelling web of material, for example, a continuous length of tubular knitted fabric, and more particularly is concerned with such a control apparatus for regulating the speed of advance of a travelling length of material, whose length varies as it is advanced, in such a manner that no tension is imposed thereby upon the travelling web whereby the web is always in relaxed condition during its advance. More specifically, the present invention relates to control apparatus which continuously receives and discharges successive portions of the length of a travelling web and controls the rate of discharge thereof in accordance with the rate at which it receives the web and entirely independently of the tautness of the travelling web.

It has heretofore been the practice to employ as control means for the regulation of the speed of travelling webs, the lengths of which have varied throughout the progress of travel, dancer or compensator rolls located at various points along the path of travel of the webs and adapted to engage the webs and control the speed of subsequent propelling rolls, or the like, in accordance with the tautness or slackness of the web adjacent the dancer rolls. Such means of control frequently require considerable operating force which can result only from the imposition of considerable tension upon the material of the travelling web. In many instances the imposition of such tension upon a travelling web of material for controlling the rate of advance of that material through an apparatus is in direct conflict with the end sought to be achieved by the passage of said web through that apparatus. Furthermore the degree of tension required to properly operate such control apparatus is generally constant, and if different types of material are successively passed through the apparatus for treatment, such degree of tension, while not being harmful to the treatment of one type of material, may be very harmful to the treatment of another. Frequently such control apparatus is adjustable to operate in response to forces of different magnitude resulting from varying degrees of tension imposed thereon by travelling webs and can thus be adjusted differently for operation by travelling webs of different kinds of material. Even with such adjustability, however, dancer roll controls are unsatisfactory because the operator of the apparatus is apt to forget to adjust the control for the various different types of fabric to be treated. Additionally, no matter how fine the adjustability or how little the tension imposed, the fact remains that from the very nature of a dancer roll control some tension must be imposed on the web, the rate of travel of which is being controlled.

By way of specific example, reference may be had to our copending applications Ser. No. 314,907, filed October 15, 1952, and Ser. No. 316,422, filed October 23, 1952, now Patent No. 2,750,679, wherein are disclosed apparatus for treating continuous lengths of tubular knitted fabric. In the drying of such fabric as well as in other treating operations, it is desirable, and even essential, that the

fabric be permitted to shrink as much as possible in order that when subsequently cut into garments, such garments will not shrink appreciably. It has been one of the main desires of the textile industry particularly, for years, to acquire some control device which, for operation, is in no way dependent upon tensioning of the material being treated so that the maximum shrinkage can be obtained during treatment.

It is therefore the primary object of this invention to provide control apparatus for regulating the speed of advance of a travelling web of material, particularly a travelling web of textile fabric, through a treating apparatus in which the length of the travelling web changes, in such a manner that no resistance to such change is imposed thereon by the control apparatus.

Broadly our invention contemplates the provision at spaced intervals along a path of travel of a travelling web and between successive feeding means therefor of means for controlling the rate of feed of each successive feed means in accordance with the rate at which the web is discharged from the previous feeding means without imposing any tension upon the web between such successive feeding means, and in fact, to the contrary, permitting complete relaxation and even compression thereof between the successive feeding means. More specifically, our invention comprises the provision between each successive feeding means of a control means adapted to receive successive portions of the web discharged from one feeding means and to discharge to or permit to be withdrawn therefrom by the succeeding feeding means such portions of the web, such control means being operatively connected to the succeeding feeding means to control the speed thereof in accordance with the amount of web which it contains, whereby a predetermined amount of material may be always maintained in completely relaxed condition between each pair of successive feeding means to thereby prevent any tension being imposed upon the travelling web during the course of its travel.

For a more detailed description of our invention, reference may be had to the accompanying drawing illustrating a number of embodiments thereof in which:

Fig. 1 is a fragmentary perspective view of one form of apparatus according to our invention; and

Fig. 2 is a similar fragmentary perspective view of another form of apparatus embodying our invention.

Referring first to Fig. 1, there is illustrated a portion of an apparatus through which a travelling web may be continuously passed for any of a variety of treatments. The apparatus comprises a frame **10** supporting an initial feed roll **11** and a succeeding feed roll **12** supported on a shaft **13** journaled in said frame **10**. The outer end of the shaft **13** carries a drive wheel **14** which is adapted to be engaged and rotated at various speeds by a continuously driven drive belt **15**. A travelling web **16** of tubular knitted fabric or the like is adapted to be drawn into the apparatus by feed roll **11** and discharged downwardly therefrom into a J-box **17** made up of a forward section **18** and a rearward section **19** spaced from one another in parallel relation, the latter being provided with a curved bottom portion **20**. The web material **16** is adapted to pile up, as indicated at **21**, in the curved lower portion **20** of the J-box **17** as well as between member **18** thereof and the upright portion of member **19** thereof in some instances. The web material is then withdrawn from the J-box by the rotating feed roll **12**.

The J-box **17** is pivotally supported by a pair of supporting lever arms **23** (only one shown) attached to its upper end and fixedly secured to a rotatable shaft **24** journaled in frame **10** whereby the movement of J-box **17** is arcuate. Since shaft **24** rotates about an axis located wholly to one side of the J-box in the direction of movement of the web through the machine and the movement

of the J-box under the weight of the web accumulated in it is very small, the vertical component of the movement will be much greater than the horizontal component thereof and the movement of the J-box will be responsive solely to the weight of the web therein and the disposition of the accumulated web in the J-box will not be a factor in the movement of the J-box. A second lever arm made up of an arm 25 and an arm 28 carrying a counterweight 27 is provided to balance the weight of J-box 17. Arm 25 carrying a pressure roller 26 on its outer end is fixedly secured to the outer end of shaft 24 and is adapted, upon rotation by the shaft 24, to move pressure roll 26 toward or away from drive roll 14 to respectively press the continuously driven feed belt 15 into driving contact with the drive roll 14 or to permit movement of the drive belt out of contact therewith. Counterweight 27 is adjustably mounted on arm 28 the inner end of which is in turn fixedly secured to a shaft 29 which carries for rotation thereon the pressure roll 26. Shaft 29 is non-rotatably secured to lever arm 25. The outer portion 30 of arm 28 is threaded, whereby counterweight 27 may be adjusted toward or away from the supporting shaft 29.

For operation of the control apparatus the counterweight 27 is initially so adjusted on the arm 28 that the weight of the empty J-box is insufficient to move the pressure roll 26 toward the drive wheel 14 with sufficient force to establish a driving connection between the latter and drive belt 15. However, when web material 16 is being fed through the apparatus, it will accumulate in the J-box until the combined weight of the J-box and the accumulated material therein is sufficient to overcome the counterbalancing effect of counterweight 27, whereupon the J-box will rock about the axis of shaft 24, thereby turning this shaft which moves pressure roll 26 toward drive wheel 14, pressing the drive belt 15 thereagainst to effect a driving connection which causes the rotation of feed roll 12 to withdraw web material from the J-box.

The withdrawal of the web from the J-box by feed roll 12 continues until the weight of material therein has decreased to the point where counterweight 27 again moves feed roll 26 away from drive wheel 14, thereby interrupting the driving connection and the rotation of feed roll 12. Actually, as the driving connection illustrated is a frictional one, it is variable and the speed of rotation of drive wheel 14 may vary from zero when the drive belt 15 is out of contact therewith to full speed when the drive belt 15 is urged into tight contact therewith and the peripheral speed of the drive wheel equals the linear speed of the belt. This results from the nature of the driving connection. Generally, however, drive wheel 14 is continuously rotated as is therefore feed roll 12, and its speed of rotation is varied in accordance with the variation in the pressure with which pressure roll 26 is urged against drive wheel 14 through drive belt 15. Hence there is generally a continuous movement of the web material through the apparatus, the speed of each feed roll being controlled solely by the rate at which the web material is discharged from the previous feed roll. As will be clear, the control apparatus does not depend in any way upon tensioning of the web material, but to the contrary permits complete relaxation thereof between the feed rolls.

Referring now to Fig. 2, there is illustrated another form of control apparatus according to our invention. This form is very similar to that illustrated in Fig. 1 and described above and comprises a J-box 17′ mounted between a feed roll, not shown, adapted to feed web material 16′ into the J-box, and another feed roll (also not shown) adapted to withdraw the web material therefrom. This second feed roll is mounted in frame 10′ and is continuously rotated by a drive belt 30, the speed of which is controlled as hereinafter set forth.

The J-box 17′ is provided at opposite ends with tubular members 31 secured thereto (only one of which is shown) which are adapted to confine movement of the J-box to a vertical direction by surrounding guide rods 32 (only one of which is shown) which are fixed by brackets 32′ to frame 10′. The J-box 17 is supported by a pair of chains 33 (only one shown) which pass over pairs of sprockets 34 and 35 mounted on and fixed to shafts 36 and 37, respectively, which are journaled in the frame 10′. One end of each chain 33 is secured to the J-box, the other end thereof supporting a counterweight W. Shaft 36 and its supported sprockets 34 are merely idlers.

The driving power for drive belt 30 is provided by a main drive belt 15′ through drive wheel 38, shaft 39 to which it is affixed, a pulley 40 also secured to shaft 39, a drive belt 41 and a variable speed pulley 42. Driving wheel 38 is adapted to be continuously driven by the drive belt 15′, the speed of the drive belt 30 being variable depending upon the position of variable speed pulley 42. The latter pulley is mounted on one end of lever 43 which is pivotably supported by shaft 44 mounted on frame 10′. The other end of lever 43 is provided with a transversely projecting pin 45, the free end of which is received in guideway 46 of guide member 47 which is fixedly secured to shaft 37. Also fixedly secured to shaft 37 are threaded counterweight supporting members 48 and 49 on which are adjustably mounted counterweights 50 and 51 respectively.

The operation of the control apparatus of Fig. 2 is very similar to that of Fig. 1 except that movement of J-box 17′ is in a vertical direction. The counterweights 50 and 51 are initially set so that when the J-box 17′ is empty, or, more accurately, is supporting the weight of no web material, the position of the variable speed pulley is such that the feed roll driven by drive belt 30 is so driven thereby at a speed considerably less than the speed of the feed roll by which the web material is fed to the J-box 17′. When an accumulation of web material results in J-box 17 by reason of the speed differential of the feed rolls, the J-box will descend, thereby effecting rotation of shaft 37 and guide member 47 to effect pivotal movement of lever arm 43 in a clockwise direction (as viewed in Fig. 2) about shaft 44 whereby the driving speed of drive belt 30 Is increased, causing its driven feed roll (not shown) to withdraw the web material 16′ from the J-box at a greater rate.

When the increased rate of withdrawal of the web material from the J-box 17′ has been sustained for a sufficient amount of time, the accumulation of material in the J-box will have been decreased, permitting the J-box to rise as a result of counterweights W and 50, whereby the lever arm 43 will be pivoted in a counterclockwise direction, moving the variable speed pulley 42 to effect a slowing down of the rate of movement of drive belt 30. Thus the control apparatus illustrated in Fig. 2 is effective, as is that of Fig. 1, to control the rate of rotation of the forward feed roll (that driven by drive belt 30) in response to the rate at which the travelling web material is fed into the J-box 17′ and without imposing any tension whatever upon the travelling web.

Various changes and modifications may of course be made in either form of control illustrated without departing from the scope of my invention as set forth in the appended claims. Also it will be clear that other types of feeding means in addition to feed rolls are contemplated as being equally as readily controllable by our control device.

We claim:

1. Apparatus for advancing a continuous web of material including first and second feed rolls adapted successively to engage and advance a web, driving means for each said roll, a J-box adapted to receive continuously successive portions of the continuous web from said first feed roll and to discharge continuously such portions of the web in response to the demand of said second feed roll, means floatingly supporting said J-box between said first and second feed rolls for limited up-and-down movement such that the vertical component of such movement

is much greater than any horizontal component thereof, said supporting means including an element which is responsive solely to downward forces exerted by and on the J-box, and means operatively connected to said J-box through said element to increase the speed of said second feed roll when a predetermined weight of said web has accumulated in said J-box and to decrease the speed of said second feed roll when the weight of accumulated web in said J-box has decreased below a predetermined value.

2. Apparatus for advancing a continuous web of material as defined in claim 1 in which the J-box is supported for arcuate movement about an axis located outside of vertical planes at the outer extremities of the J-box in the direction of travel of the web.

3. Apparatus according to claim 1 in which said element is a lever arm on one end of which said J-box is supported, the other end of said arm being fixedly secured to a rotatably supported pivot shaft, and a second lever arm fixedly secured to said pivot shaft and adjustably supporting at its distal end a counterweight, said second lever arm also having means intermediate its length forming part of said speed varying means to alter the speed of said second feed roll.

4. Apparatus for advancing a continuous web of material including first and second feed rolls adapted successively to engage and advance a web, driving means for each said roll, a J-box adapted to receive continuously successive portions of the continuous web from said first feed roll and to discharge continuously such portions of the web in response to the demand of said second feed

roll, means floatingly supporting said J-box between said first and second feed rolls for limited up-and-down movement, a counterweight operatively connected to said J-box normally to urge it in an upward direction, means for confining movement of the J-box to a substantially vertical direction comprising a pair of fixed vertical guide rods, one adjacent each end of the J-box, and a pair of tubular guides each of which is secured to an opposite end of the J-box and surrounds an adjacent rod for movement therealong, said supporting means including an element which is responsive solely to downward forces exerted by and on the J-box, and means operatively connected to said J-box through said element to increase the speed of said second feed roll when a predetermined weight of said web has accumulated in said J-box and to decrease the speed of said second feed roll when the weight of accumulated web in said J-box has decreased below a predetermined value.

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