Aug. 12, 1941. P. H. SLAUGHTER 2,252,419

AUTOMATIC TENSION CONTROL

Filed Aug. 1, 1938 4 Sheets-Sheet 1

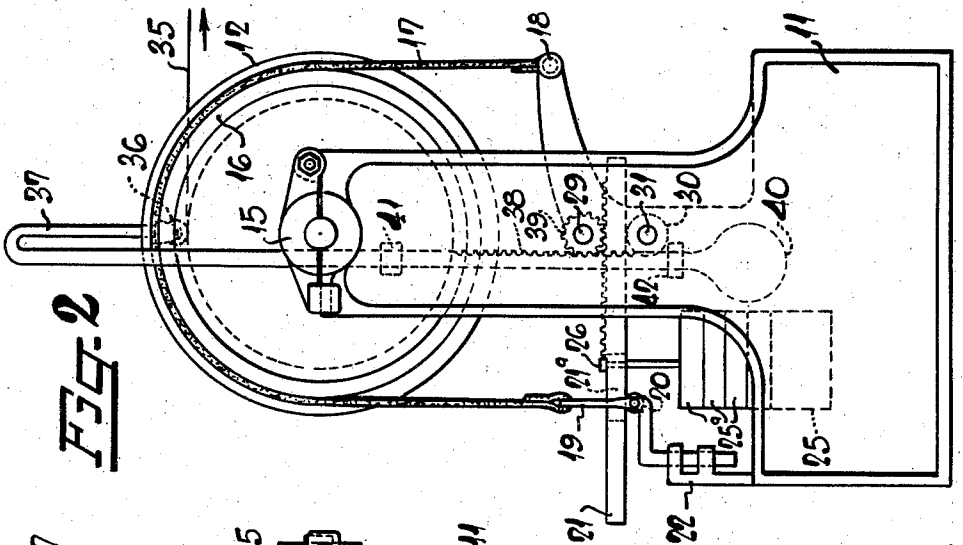


Fig. 2

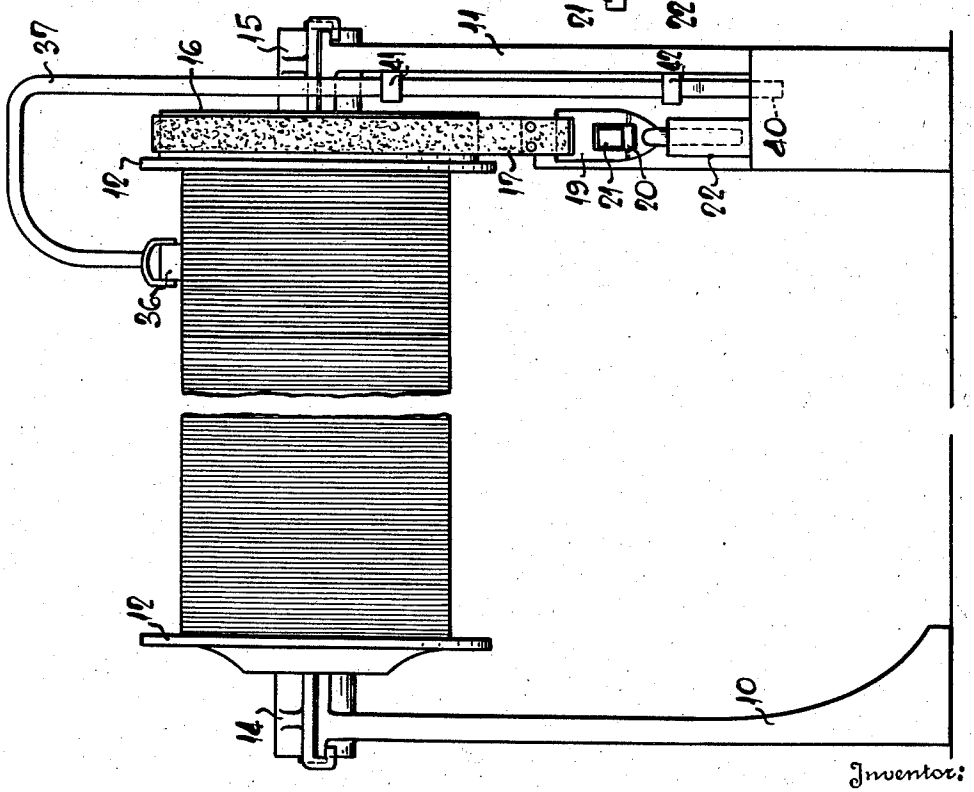


Fig. 1

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AUTOMATIC TENSION CONTROL

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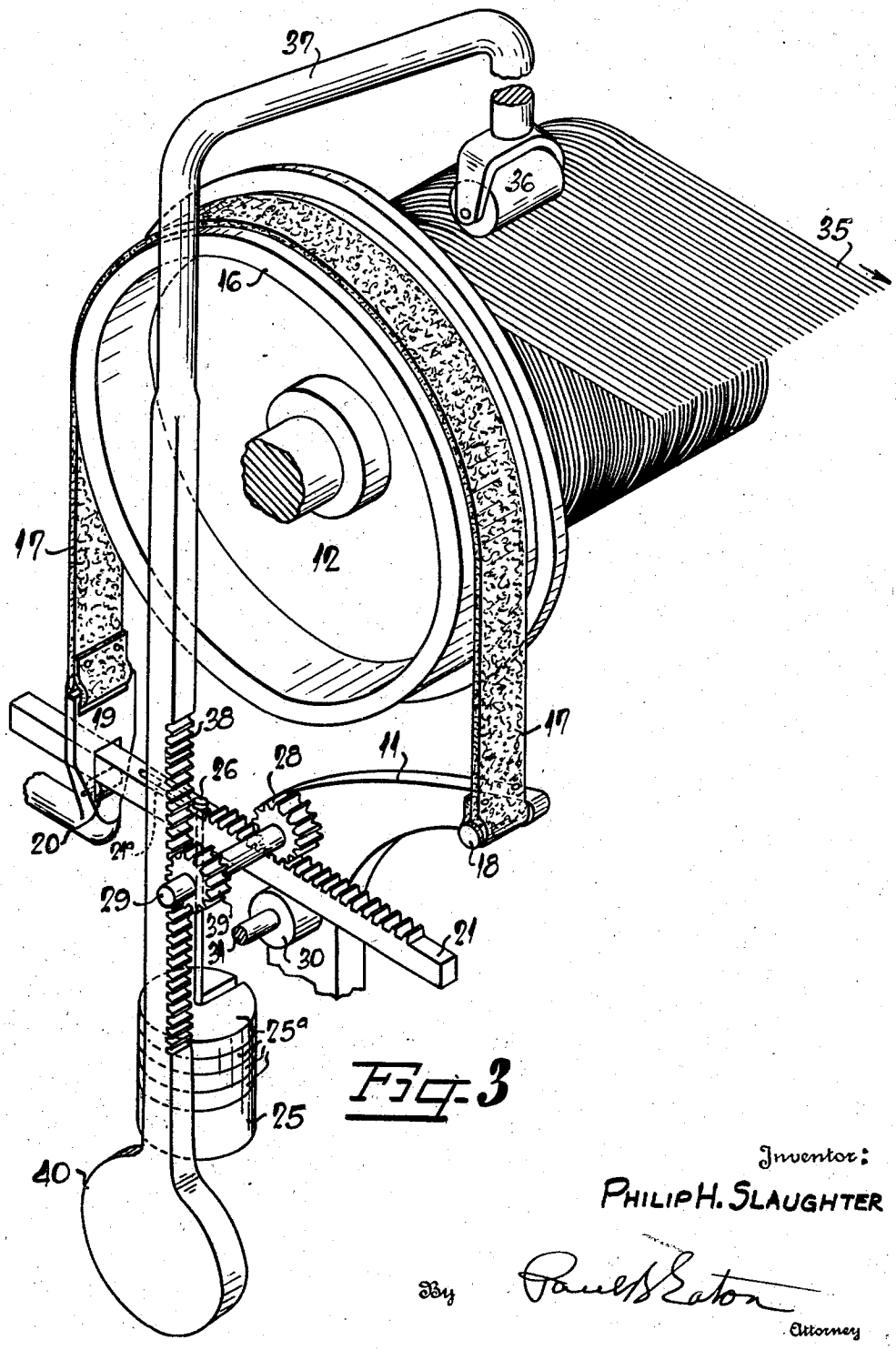


Fig. 3

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AUTOMATIC TENSION CONTROL

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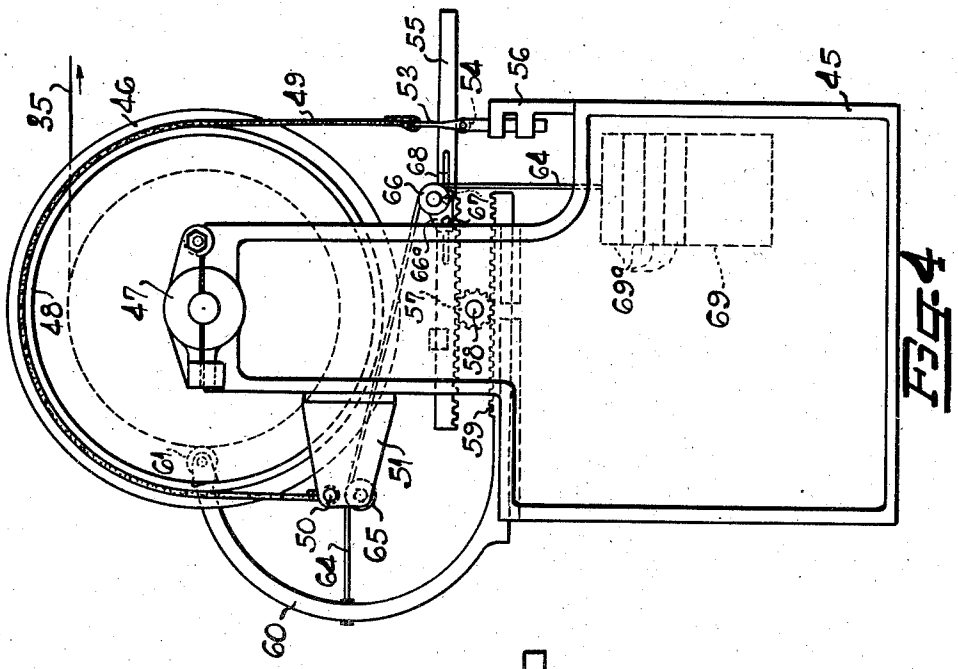


Fig. 4

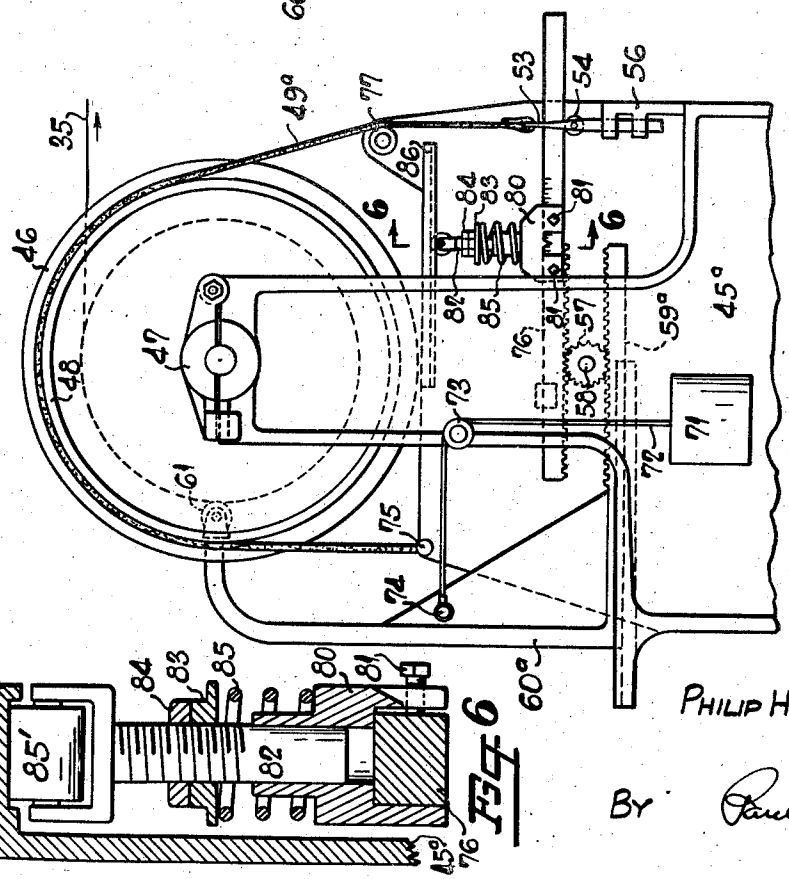


Fig. 5

Fig. 6

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AUTOMATIC TENSION CONTROL

Filed Aug. 1, 1938 4 Sheets-Sheet 4

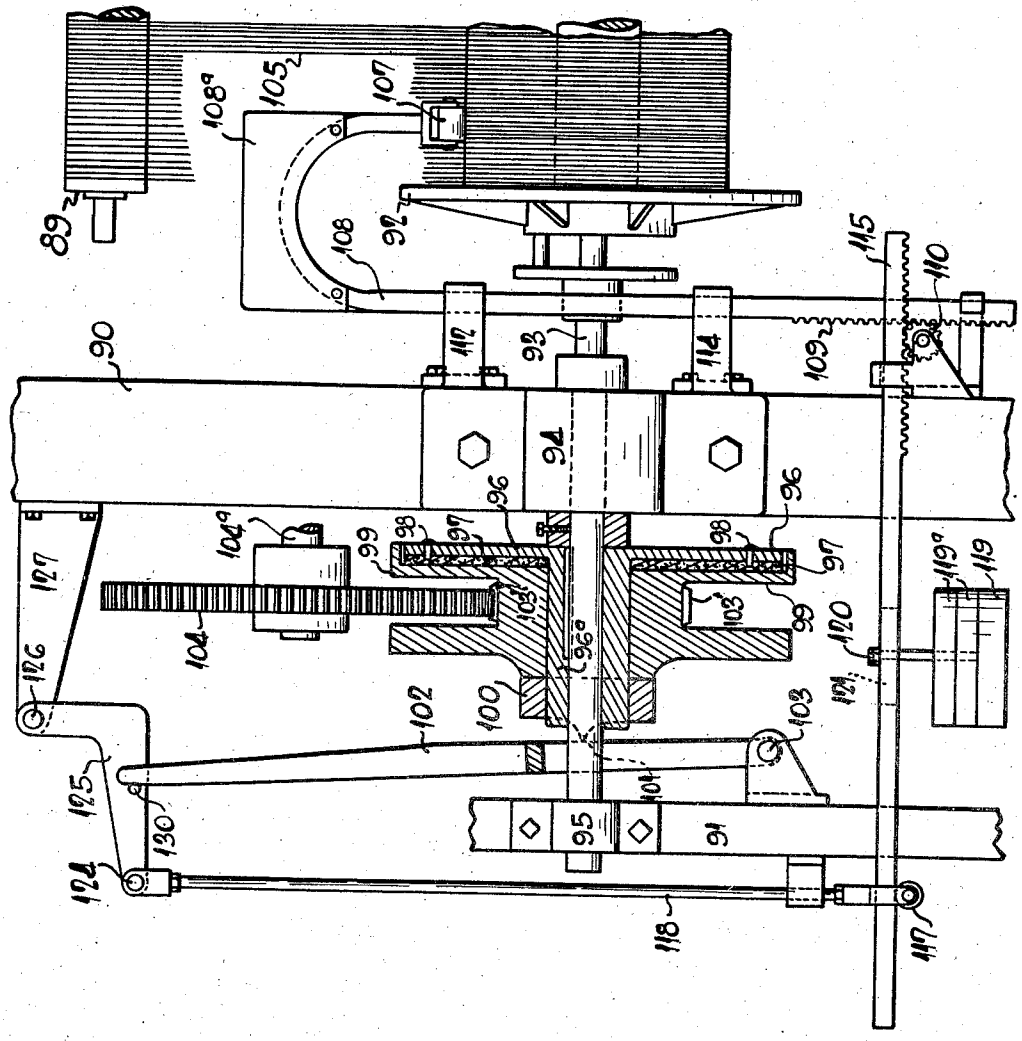


Fig. 7

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2,252,419

UNITED STATES PATENT OFFICE

2,252,419

AUTOMATIC TENSION CONTROL

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Application August 1, 1938, Serial No. 222,542

8 Claims. (Cl. 242—75)

This invention relates to an apparatus and method for controlling automatically the tension of a substance being wound or unwound on or from respectively a core, beam, spool, reel or the like. This tension control is applicable to any mechanism where it is desirable to wind or unwind a sheet, or substantially a sheet of material on or from a core, beam, spool, reel or the like, as warp yarn, cloth and the like, in various processes, as beaming, slashing, dyeing, bleaching, printing, finishing etc., as paper in a paper-making machine, printing press let-off roll, etc., to Cellophane, screen wire, or the like in various manufacturing processes.

It is a well known fact that when material such as a warp is being wound upon a beam by virtue of a clutch mechanism engaging the beam head, that it is very desirable for the material to be wound thereon at a constant speed and with a constant tension. Heretofore, a suitable clutch mechanism has been provided whereby the rate of winding would remain substantially the same, but when the tension exceeded a predetermined amount on the material being wound a slippage would occur in the clutch mechanism to allow for the difference in the rate of travel of the yarn being wound and the driving mechanism for the beam. When such an apparatus is used for winding sheet material a very much smaller force will be necessary to be applied to the clutch while the material is winding on a small diameter than will be necessary while the same material is being wound on a greater diameter. The ideal condition in such cases is to provide a means whereby the resistance to the turning movement of the beam will always remain substantially the same, or slightly greater than the tension in the sheet of a material which is being wound.

It is, therefore, an object of this invention to provide means associated with a beam, spool, reel or the like for maintaining a uniform tension upon the material being wound thereon, during the entire winding of the package. More specifically, the invention comprises a device for varying the resultant propulsive force on the winding beam in direct proportion to the radius of the material on the beam.

It is another object of this invention to provide means for maintaining a uniform tension upon the material being unwound from a beam which comprises the combination of a beam and means for frictionally restraining the beam to prevent rotation, and further means for applying a pull to the friction restraining means that is in direct proportion to the tension on the material being unwound. By providing such a mechanism, the amount of friction between the beam and the restraining means must be varied from a maximum when the beam is full, to a minimum when the beam is empty. For example, when the package of material is being unwound from a small diameter, then much less pressure is necessary to be applied to the friction restraining means to maintain uniform tension in the material than is necessary when the material is being unwound from a package of a larger diameter.

It is another object of this invention to provide means for automatically varying a force on any type take-up mechanism or let-off mechanism where applied to a particular point on the mechanism in direct proportion to the radius of the material on the beam, it will result in a uniform tension, or substantially uniform tension, on the material coming onto a winding beam or the material being drawn from an unwinding beam.

It is a further object of this invention to provide an automatic control device, comprising a follower roll for engaging the periphery of the material being wound with a friction restraining means for preventing rotation of the beam, a single weight for applying pressure to both the follower roll and the friction restraining means, and means controlled by said follower roll for varying the amount of weight which is applied to the friction restraining means in direct proportion to the radius of the wound material.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings, in which—

Figure 1 is an elevation of a suitable let-off beam for textile machinery embodying my invention;

Figure 2 is an elevation looking at the right-hand side of Figure 1;

Figure 3 is an isometric view of the let-off mechanism as applied to the apparatus shown in Figures 1 and 2;

Figure 4 is an end elevation of a let-off beam showing a slightly modified form of my invention applied thereto;

Figure 5 is a view similar to Figure 4 but showing still another slightly modified form of the invention;

Figure 6 is a vertical sectional view taken along the line 6—6 in Figure 5;

Figure 7 is an elevation, with certain portions

thereof shown in section, showing still another modified form of the invention as applied to the take-up beam on a slasher.

Referring more specifically to the drawings, the numerals 10 and 11 denote suitable supports which have rotatably mounted in the upper portions thereof, the ends of a warp beam 12. The ends of the warp beam 12 are normally confined upon the upper end of the supports 10 and 11 by means of caps 14 and 15, respectively. The beam 12 has a drum 16 integral with one end thereof which is engaged by brake band 17, said band having one end secured as at 18 to the support 11, whereas its other end is secured to link 19. The link 19 has a roller 20 therein which roller supports one end of rack 21, and the lower end of the link 19 is mounted for vertical slidable movement in bracket 22 which is an integral part of the support 11.

The rack 21 has a weight 25 secured thereto as at 26 and a plurality of removable weights 25a are adapted to be placed on top of the weight 25 in order to vary the amount of downward pressure exerted by the rack 21 upon the roller 20, link 19 and the left-hand end of brake band 17 in Figure 2. A slot 21a is provided in rack 21 whereby the initial position of the weights 25 and 25a may be adjusted.

The rack 21 meshes with a pinion 28 said pinion being fixedly mounted on shaft 29 which, in turn, is rotatably supported by support 11 (see Figure 3).

The rack 21 is held in engagement with pinion 28 by means of a roller 30 which is rotatably mounted upon a shaft 31 directly beneath pinion 28. This shaft is likewise rotatably mounted in the end support 11. It is thus seen that the weights 25 and 25a are carried by the rollers 20 and 30 and of course the nearer the weight 25 is disposed to the roller 20 the greater proportion of this weight will be carried by it. Also the nearer the weight 25 is disposed to the link 19, and roller 20, the greater will be the friction that is applied to the drum 16, and, therefore, the greater will be the resistance offered to the turning of the beam 12.

The beam 12 is adapted to have a warp or web or other suitable material 35 wound or unwound therefrom. The periphery of this warp or web after it has been wound upon the beam, is contacted by a roller 36 which, in turn, is rotatably mounted in one leg of U-shaped member 37. The other leg of member 37 has a rack 38 integral therewith which meshes with a pinion 39, said pinion also being fixedly secured on shaft 29 previously described.

The lower end of the rack 38 has an enlarged portion 40 integral therewith to supply the necessary weight to hold the roller 36 into contact with the periphery of the material on the beam. The weight 40 also supplies the necessary force to move the rack 21 and the weight 25 horizontally, the amount of such movement being determined by the diameter of the material 35, which is wound upon the beam 12. Lugs 41 and 42, extend from the side of support 11 to serve as guides for rack 38.

By referring to Figure 2, it is seen that when the roller 36 is disposed on a very large diameter, that is, when beginning to wind warp 35 from the beam, the point 26 and weight 25 will be disposed farther to the left, than is now shown, whereas when the diameter has decreased and the beam is ready to be doffed, the weight 25 and its associated rack will be disposed considerably farther to the right, that is closer to the roller 30. In any event the distance from the point 26 to a vertical center line passing through the shafts 29 and 31 will always be equal to the radius of the material on the beam. In other words, when the weight 25 is nearest the roller 20 the amount of friction between the brake band 17 and the drum 16 will be greatest and will decrease as the diameter becomes smaller to insure that the tension on the warp 25 will remain substantially constant as the diameter of the roll is being decreased.

Figure 4 shows a slightly modified form of the invention in which one weight is provided for supplying the necessary pressure for frictionally restraining rotation of the beam and also for holding the follower roll in contact with the periphery of the material which is being unwound therefrom. In this form, an end support 45 is shown which has a beam 46 mounted thereon, it being understood that there is a similar support on the other end of the beam. The ends of the beam are removably mounted in the upper end of these supports by means of caps 47. The beam 46 likewise has a drum 48 integral therewith upon which a brake band 49 is mounted. As the warp 35 is drawn from the beam 46, the brake band 49 supplies the necessary friction to the drum to insure that the tension in the warp will be uniform.

One end of the brake band 49 is pivoted as at 50 to bracket 51 whereas the other end is secured to a link 53. Link 53 has a roller 54 therein for supporting one end of a rack 55 and the lower end of the link 53 is mounted for vertical sliding movement in upstanding bracket 56.

The left-hand end of rack 55 is supported by a meshing pinion 57, said pinion being fixedly secured upon stud shaft 58. This pinion also meshes with another rack 59 which has an upstanding arc shaped arm 60 integral therewith. The upper end of the arm 60 has a follower roll 61 rotatably mounted therein which contacts the periphery of material on the roll. In order to hold the roller 61 in contact with the periphery of the material at all times, a suitable cable 64 is secured to the intermediate portion of arm 60 and this cable passes over a roller 65. The cable is also mounted upon another roller 66 which roller is mounted upon plate 66a. The plate is adjustably secured to rack 55 by means of suitable bolts 67, which bolts penetrate slots 68 in this rack. Disposed on the lower end of the cable 64 are weights 69 and 69a.

In this form, it is seen that the weights serve a double purpose, that is to hold the roller 61 in contact with the periphery of the material on the beam and also to apply the necessary downward pull upon the link 53 to retard the rotation of the beam. As the material 35 is being unwound from the beam, the radius of the package decreases and, consequently, the roller 61 moves toward the center of the beam. This movement will cause the rack 59 to move to the right and the rack 55 to move to the left (see Figure 4), thereby causing the amount of weight which is applied to the roller 54 and the right-hand end of brake band 49 to gradually decrease along with the decrease in radius of the material on the beam. This type of mechanism will provide a uniform tension, the amount of which is governed by the radius of the material on the roll.

Figure 5 shows another modified form of the invention which is very similar to Figure 4, and like reference characters will apply to like parts. In this form, an end frame 45a is provided which is slightly wider than the frame 45 in the preceding form but constructed along similar lines. A brake band 49a is provided for engaging the drum 46, said band having one end secured as at 75 on frame 45a and its other end secured to the upper end of link 53. This link and its supporting means are similar to that of the preceding form. Likewise a pinion 57 is provided which is adapted to support one end of a horizontally disposed rack 76. The other end of the rack 76 is supported by the roller 54. In order that the more space will be available between the roller 54 and the pinion 57, the frame 45a has been extended and another roller 77 has been provided over which the brake band 49a is adapted to be mounted.

As the material 35 is unwound from the beam 46 the follower roll 61 moves toward the center of the beam thereby causing the rack 59a to move to the right in Figure 5. This motion will cause the rack 76 to move to the left. A weight 71 is suspended by cord 72 which cord passes over roller 73 and has its other end attached to member 60a as at 74. This weight holds the roller in contact with the periphery of the wound material at all times.

The main difference between this form and the form shown in Figure 4 is the apparatus for applying the weight to the rack 76. The means for supplying this weight in this form of the invention comprises a U-shaped bracket 80, which bracket is secured to the rack 76 by means of suitable set screws 81. This rack has a pin 82 mounted for vertical sliding movement therein, said pin having a pair of nuts 83 and 84 threadably secured thereon for confining a compression spring 85 therearound. The upper end of the rod 82 has a U-shaped bracket secured thereon, in which is mounted a roller 85', said roller being adapted to contact or press upwardly against the lower side of trackway 86. This trackway is stationary and forms a part of the end frame 45a. By manipulating the nuts 83 and 84, the amount of pressure exerted upon the compression spring 85 can be increased or decreased, and consequently the amount of load applied to the roller 54 and pinion 57 through rack 76 can be varied.

Figure 7 shows still another modified form of the invention in which the same principle is applied to a slasher beaming device. This slasher has a delivery roll 89 which is driven at the same surface speed as the drying cylinders (not shown). The numerals 90 and 91 denote end supports for a slasher take-up beam 92, said beam being removably supported by the right-hand end of shaft 93. This shaft is rotatably secured in bearings 94 and 95 on end supports 90 and 91, respectively. The shaft 93 has keyed thereto a disk 96 which disk has a friction lining 97 secured to one face thereof by means of suitable rivets 98. The disk 96 has a hub 96a integral therewith which hub slidably supports another disk 99 for engaging the friction lining 97. Also slidably mounted upon the hub 96a is a collar 100 having a fulcrum point 101 and this point is engaged by the intermediate portion of vertically disposed lever 102 the lower end of which is pivoted as at 103 to the support 91.

The hub of disk 99 has a gear portion 103' cut therein which gear is adapted to mesh with a driving gear 104 disposed on shaft 104a and driven by the slasher. As the gear 104 turns, rotative movement will be imparted to disk 99 which in turn will impart rotary movement to beam 92 through the friction lining 97 and the disk 96 which is secured to shaft 93. This, of course, will cause the warp or other material 105 to be drawn from delivery roll 89 and be wound upon the beam 92. It is evident that a much greater force must be exerted by the gear 104 to wind the material on the beam after the diameter of the roll has been increased to the doffing point, than is necessary to exert when the roll is just being started. Since the driving gear 104 rotates at a constant speed and since the rate of travel of the yarn must be substantially the same throughout the formation of the roll it is necessary for slippage between the friction disks 99 and the lining 97 to take place as the diameter increases. Heretofore, it has been the practice to apply more friction between members 96 and 97 than was necessary when starting the warp on the beam because the resistance offered by the warp to the turning of the beam gradually increased with the diameter of the material thereon.

This form of the invention provides a means for constantly and uniformly increasing this friction as the material 105 builds up upon the beam. In order to do this, a roller 107 is provided in one leg of inverted U-shaped member 108, said member 108 having a rack 109 integral with the lower portion thereof which meshes with a pinion 110. A weight 108a is mounted on member 108 to normally force roller 107 in contact with the periphery of the wound material on the beam. The intermediate portion of the member 108 is slidably mounted in brackets 112 and 114. The pinion 110 also meshes with a horizontally disposed rack 115 and the other end of this rack is supported by a roller 117 which roller is disposed in the lower end of vertically slidable rod 118. Weights 119 and 119a are secured to the intermediate portion of the rack 115 as at 120. This weight may be adjusted in slot 121 to vary the amount of pressure initially exerted upon the roller 117 and pinion 110.

The upper end of the rod 118 is pivoted as at 124 to lever 125, said lever being pivoted as at 126 to bracket 127 and this bracket is supported by end support 90. The lever 125 has a laterally projecting pin 130 extending therefrom which is engaged by the upper end of the lever 102. As the material 105 builds up upon the beam 92 the rack 109 moves upwardly thereby causing the rack 115 to move to the left and apply a greater percentage of its weight upon the roller 117 and the rod 118. This will cause the pin 130 to press harder against the upper end of lever 102 and thereby cause the disk 99 to press harder against lining 97.

It is thus seen that I have provided an apparatus of this type which is capable of operating with a let-off beam or a take-up beam and in combination with various restraining devices.

In the drawings and specification there has been set forth a preferred embodiment of the invention, and although specific terms are employed, they are used in a generic and descriptive sense only, and not for purposes of limitation, the scope of the invention being set forth in the appended claims.

I claim:

1. Apparatus for maintaining a constant tension on warp threads as they are withdrawn

from a warp beam mounted for rotation in a suitable machine, comprising a brake drum on the warp beam, a brake band engaging said drum and having one end secured to the machine, a lever slidably engaging the free end of said band and having a rack integral therewith, a pinion mounted for rotation at a fixed point in the machine and engaging said rack, a member having a roller in one of its ends for engaging the warp on the beam at all times and having a rack near its other end in engagement with said pinion, means for applying pressure to the lever to hold said lever against said pinion and also for exerting pressure on the free end of the brake band, means for moving said roller and the member carrying the same towards the warp on the beam at all times, whereby as the diameter of the warp on the beam decreases the pinion will be rotated to thereby lengthen the distance between the point where the lever engages the brake band and the point where pressure is applied to the lever to thereby lessen the amount of pressure applied by said band to said brake drum.

2. Apparatus for maintaining a constant tension on warp threads as they are withdrawn from a warp beam mounted for rotation in a suitable machine, comprising a brake drum on the warp beam, a brake band engaging said drum and having one end secured to the machine, a lever slidably engaging the free end of said brake band and having a rack integral therewith, a pinion mounted for rotation at a fixed point in the machine and engaging said rack, a member having a roller in one of its ends for engaging the warp on the beam at all times and having a rack near its other end in engagement with said pinion, means for applying pressure to the lever to hold said lever against said pinion and for exerting pressure on the free end of the brake band and for moving said roller and the member carrying the same towards the warp on the beam at all times, whereby as the diameter of the warp on the beam decreases the pinion will be rotated to thereby lengthen the distance between the point where the lever engages the brake band and the point where pressure is applied to the lever to thereby lessen the amount of pressure applied by said band to said brake drum.

3. Apparatus for maintaining constant tension on warp threads as they are withdrawn from a warp beam mounted for rotation in a suitable machine, comprising means for restraining the warp beam against rotation under influence of the pull of the yarn being withdrawn therefrom, a lever having sliding engagement with the restraining means, a rack on said lever, means for engaging the periphery of the warp beam and having a rack thereon, a driving connection between the two racks, means for applying force to the lever to in turn apply force to the restraining means, means for supporting the lever for sliding movement, means for applying force to the means for engaging the periphery of the warp to cause it to be in contact with the warp at all times, the last means for applying force causing, through the driving connection between the two racks, a shifting of the lever to thereby vary the force applied to the restraining means in direct proportion to the diameter of the warp on the warp beam.

4. Apparatus for maintaining constant tension of the warp threads as they are withdrawn from a warp beam mounted for rotation in a suitable machine comprising restraining means for engaging the warp beam, a lever slidably engaging the restraining means and having a rack integral therewith, a pinion mounted for rotation at a fixed point in the machine and engaging said rack, a member having a roller in one of its ends for engaging the warp on the beam at all times and having a rack near its other end and in engagement with said pinion, means for holding said lever against said rack and also for exerting pressure on the restraining means, and for moving the roller and the member carrying the same towards the center of the warp beam at all times, whereby as the diameter of the warp on the beam decreases, the pinion will be rotated to thereby lengthen the distance between the point where the lever engages the restraining means and the point where pressure is applied thereto to thereby lesson the amount of pressure applied to the restraining means.

5. Apparatus for maintaining constant tension on warp threads extending from a beam which is mounted for rotation in a suitable machine, comprising friction means associated with the warp beam for regulating rotation of the warp beam, a lever having operative engagement with the friction means, a rack on said lever, means for engaging yarn on the warp beam and having a rack thereon, a driving connection between the two racks, means for applying force to the lever to in turn apply force to the friction means, means for supporting the lever for sliding movement relative to the friction means, means for causing the means engaging the warp on the beam to press against the warp on the beam at all times and through the driving connection between the two racks causing a shifting of the lever relative to the friction means to thereby vary the force applied to the friction means in direct proportion to the diameter of the warp on the warp beam.

6. Apparatus for maintaining a constant tension on warp threads extending from a warp beam mounted for rotation in a suitable machine, comprising friction means associated with the warp beam and governing rotation of the warp beam, a lever slidably engaging the friction means and having a rack integral therewith, a pinion mounted for rotation at a fixed point in the machine and engaging said rack, the member having a roller on one end for engaging the warp on the beam at all times and having a rack near its other end for engagement with said pinion, means for holding said lever against said pinion and also for exerting pressure on the friction means, means for moving the roller and member carrying the same towards the center of the warp beam at all times, whereby as the diameter of the warp on the beam decreases, the pinion will be rotated to move the lever to thereby lengthen the distance between the point where the lever engages the friction means and the point where pressure is applied thereto and thereby varying the amount of pressure applied to the friction means in direct proportion to the radius of the mass of warp threads on the warp beam.

7. In mechanism for maintaining a constant tension on a web extending from a web roll wound on a beam, friction means on one end of the beam, other friction means frictionally engaging the first friction means, means for applying pressure to the second friction means to move the second friction means against the first friction means, comprising a member engaging the web on the beam, a slidably mounted lever

having a pressure applying means engaging an intermediate portion thereof, one end of the lever being slidably and operatively connected to the second friction means, an operative connection between the other end of the lever and the member engaging the web, the operative connection between the member engaging the web and the lever serving to move the lever in proportion to the increase or decrease of size of the web roll to thereby vary the distance between the point where pressure is applied to the lever and the point where the lever engages the second friction means to vary the amount of friction present between the two friction means.

8. Apparatus for maintaining a constant tension on warp threads as they are withdrawn from a warp beam mounted for rotation in a suitable machine, means for applying a constant restraint on the warp beam to resist rotation thereof under the pull of the warp threads being withdrawn therefrom comprising a lever, friction means engaging one end of the beam, and having a sliding engagement with one end of the lever, means for slidably supporting the other end of the lever, means for applying force to an intermediate portion of the lever to apply force to the friction means, a slidably mounted member having one end in engagement with the warp on the beam and having an operative connection between its other end and the other end of the lever for moving the lever, means for applying force to the member engaging the warp to cause it to engage the warp at all times and to move the lever to thereby vary the distance between the point where the lever engages the friction means and the point where force is applied to the lever to thereby vary the amount of pressure on the friction means in proportion to the diameter of the warp on the beam.

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