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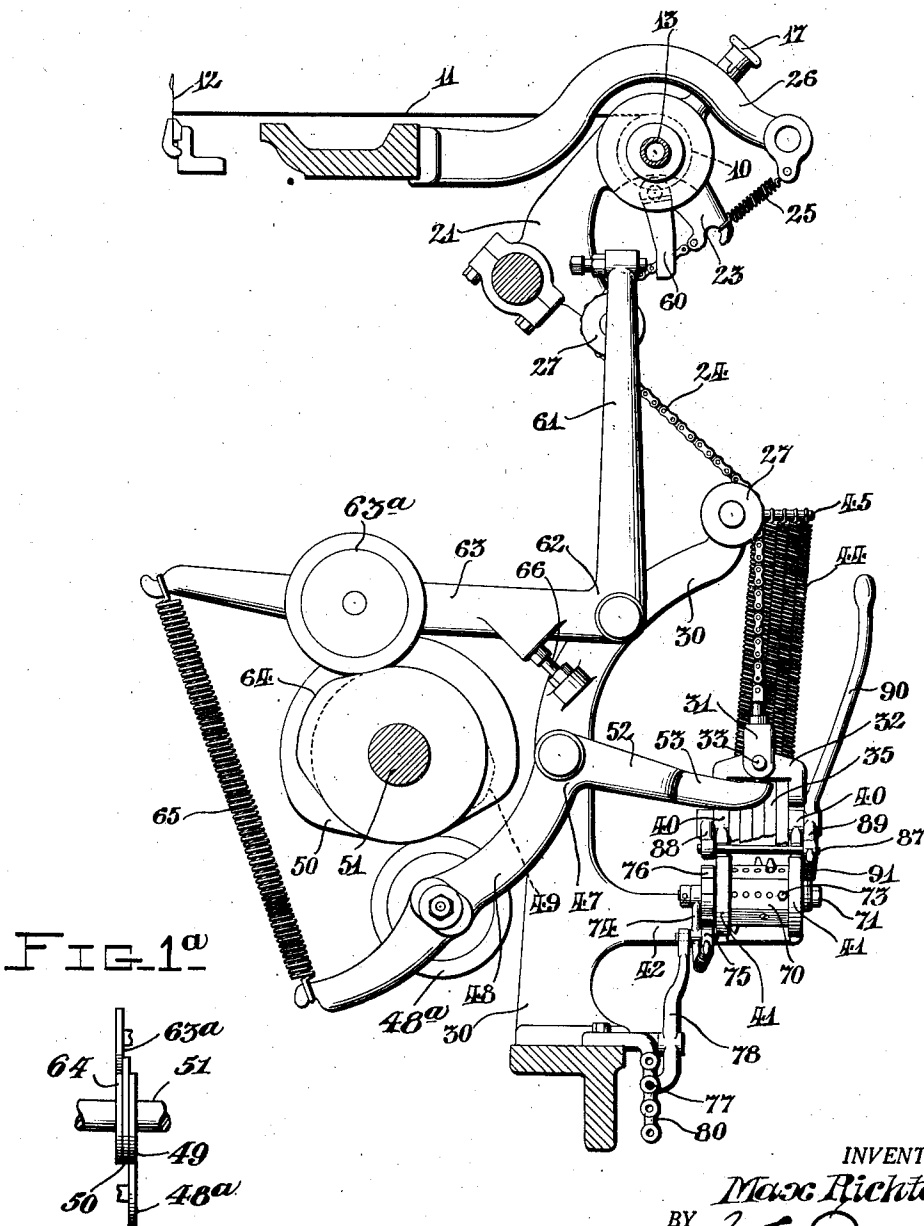
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AUTOMATICALLY VARIABLE TENSIONING DEVICE FOR DRAW-OFF REELS

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2 Sheets-Sheet 1

FIG. 1



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AUTOMATICALLY VARIABLE TENSIONING
DEVICE FOR DRAW-OFF REELS

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My invention relates to full fashioned knitting machines and particularly to means for automatically varying the tension applied to the fabric by the usual draw-off reel of such machines.

It is necessary in knitting full-fashioned fabrics, such as stockings, to vary the fabric tension during the knitting process in order to knit loops of uniform size throughout the length of the stocking. Full-fashioned stockings are narrowed in the course of knitting and hence do not require so great a fabric tension as the length increases and the provision of a uniform tension would result in knitting loops of various sizes. Heretofore, such variations in tension as are necessary have been effected by adding or removing weights for increasing or decreasing the tension on the fabric, such weights being usually suspended on a cable acting on the draw-off reel. In most cases it has been necessary to add or remove the weights by hand, thus requiring attention by the machine operator and involving an expenditure of time which might otherwise be devoted to the supervision of other parts of the machine. In addition, such weight actuated tension devices are cumbersome and take up considerable space because it is necessary to provide for sufficient weight travel to permit the tensioning device to act on the draw-off reel throughout the knitting of the entire length of the stocking.

In carrying out my invention I provide a plurality of springs any number of which may be initially operatively connected to the draw-off reel to provide the desired fabric-tension and which may be successively and automatically disconnected from the draw-off reel to vary the fabric tension at desired times in the knitting process. I utilize relatively short springs connected to the draw-off reel for providing the desired fabric tension and inasmuch as short springs are effective to cause only a limited angular movement I provide means for rendering the springs effective to cause the required rotative movement of the reel. I also provide for holding the reel in the rotative position to which it has been moved by the springs and further provide for the release of the spring tension when this is necessary during restoration of the springs to insure continued rotative movement of the draw-off reel or is otherwise desirable during operation of the knitting machine.

A feature of my invention resides in the provision of spring means acting on the draw-off reel of a full fashioned knitting machine to produce the desired fabric tension.

A second feature resides in automatically varying the spring tension during the knitting process.

A third feature resides in reducing the space occupied by actuating devices for the draw-off reel in a knitting machine.

A fourth feature resides in utilizing relatively short springs to turn the draw-off reel and compensating for the limited angular movement effected by such short springs.

A fifth feature is the provision of means for relieving the fabric tension at certain times in the knitting process.

A sixth feature is the provision of means for holding the draw-off reel in its rotated position to prevent development of slack in the fabric.

Other features and advantages will be apparent upon consideration of the following description and claims when read in conjunction with the accompanying drawings in which:

Figure 1 is an end view of a portion of a full fashioned knitting machine embodying my invention;

Fig. 1a is a diagrammatic front view illustrating certain details of Fig. 1.

Figure 2 is a front view of portions of the knitting machine.

Figure 3 is a longitudinal sectional view of a combined clutch and brake associated with the draw-off reel of a full fashioned knitting machine;

Figure 4 is a sectional view of the brake on the line 4—4 in Fig. 3;

Figure 5 is a sectional view, taken on the line 5—5 in Fig. 3, of the clutch.

Referring to the drawings, the numeral 10 designates the usual draw-off reel which is rotatively biased to maintain the fabric 11 under tension while drawing the fabric from the needles 12 as it is knit in well known manner on a full fashioned knitting machine. Suitable bearings, not shown, are provided for journalling a shaft 13 on which reel 10 is fixedly mounted.

As shown in Figures 3 and 5, also fixed to shaft 13 is the part 14 of a ball clutch 29, the complementary part 15 of which is adjustably connected to a surrounding sleeve 16 by a spring pressed plunger 17. As best seen from Fig. 5, clutch members 14 and 15 have a plurality of coacting surfaces 5 and 6 which diverge relative to each other and between each pair of these surfaces is a roller or pin member 7 biased by means of spring members 8 into wedging engagement with the surfaces 5 and 6, so that upon rotation of the member 15 in clockwise direction, as viewed

in Fig. 5, the clutch members 14 and 15 are in locked engagement and rotate as a unit. When member 15 is rotated in a counter-clockwise direction, however, the curved surface 6 is rotating in a direction such that it tends to provide the requisite clearance between that surface member and wedge member 7 and thus member 15 may rotate freely in this direction relative to member 14. Clutch part 15 and sleeve 16 are rotatively mounted in a groove between the flange 18 of a collar 19, secured to shaft 13 with clutch part 14, and a spacing ring 20 which is connected to a bracket 21 and supported on shaft 13 by a ball bearing 22. A lever 23 on sleeve 16 is connected to one end of a chain or other flexible member 24 to which tensioning devices are applied for operating clutch 14, 15 to maintain reel 10 under desired tension. Lever 23 is also connected to a spring 25 anchored on a bracket 26 for reversely operating the clutch to obtain a new operating purchase on shaft 13 when the tension is released.

Chain 24 extends over guide rollers 27 mounted on brackets 21 and 30 and is adjustably attached at its other end to a clevis 31 connected to a yoke member 32 by a pin 33, the ends of pin 33 extending beyond the sides of clevis 31 for a purpose which will later be described. Yoke 32 supports a stud 34 on which a plurality of latches 35 are loosely mounted in side by side relation between the bifurcations of the yoke. Latches 35 are connected by individual springs 36 to levers 37 pivoted intermediate their ends on a stub shaft 38 supported by spaced lugs 40 on projecting portions 41 of an arm 42 of bracket 30. One end of each lever 37 engages a shoulder or lug 43 on the related latch 35 and their other ends are connected to individual springs 44 also connected to an anchoring pin 45 on bracket 30. The levers 37 are provided with a plurality of notches 46 so that springs 44 may be adjustably connected thereto to exert a varying pull which is transmitted to chain 24 through the engagement of the ends of levers 37 with the shoulders 43 on the latches 35, which provide a releasable connection between the springs and chain as will hereafter appear.

From the foregoing it will be seen that the aggregate adjusted force of springs 44 is transmitted through levers 37, latches 35 and chain 24 to clutch part 15 which acts on the part 14 thereof to turn shaft 13 and draw-off reel 10 for drawing fabric 11 under tension from needles 12. During the knitting of a full fashioned fabric such as a stocking it is desirable at times to relieve the tension on the draw-off reel. For this purpose I provide a bell crank 47 pivoted on bracket 30 and having an arm 48 supporting a roller 48a engageable by cams 49 or 50 on the usual cam shaft 51. The other arm 52 of the bell crank has bifurcations 53 extending beneath the projecting ends of the pin 33 which connects clevis 31 to yoke 32 so that when the bell crank is rocked, either by cam 49 or by cam 50, the bifurcations 53 engage pin 33 and raise yoke 32. Thus, chain 24 and consequently draw-off reel 10 may be relieved of the tension exerted by the springs 44 operatively connected to the yoke.

Inasmuch as the angle through which springs 44 may move lever 23 to turn draw-off reel 10 is limited, it is desirable to reset clutch 29 at intervals. This is effected by spring 25 which acts when the chain 24 and lever 23 are relieved of the tension of springs 44, as described above, to move clutch part 15 reversely in order

to obtain a new operating purchase on shaft 13 through clutch part 14. A brake 54 is provided to maintain draw-off reel 10 in the position to which it has been turned in order to prevent the development of slack in the fabric when the clutch is reset.

As best shown in Figures 3 and 4, brake 54 comprises a brake drum 55 fixed to shaft 13 and enclosing a brake shoe comprising a split ring 56. Between the ends of brake shoe 56 is the squared end 57 of a stud 58 pivotally mounted in the ring 20 which spaces brake 54 from clutch 29. A brake operating lever 60 is secured to stud 58 and projects from ring 20 to be engaged by the end of an arm 61 of a bell crank 62 pivoted on bracket 30. The arm 63 of the bell crank carries a roller 63a engageable by a cam 64 on cam shaft 51 for operating bell crank 62 to cause the end of arm 61 thereof to engage and actuate lever 60 to apply brake 54.

A spring 65 connecting the arms 48 and 63 of bell cranks 47 and 62, respectively, maintains the rollers 48a and 63a carried thereby in engaging relation with the associated cams on the cam shaft, an adjustable stop 66 also being provided for arm 63. The cam shaft 51, during its usual axial movement in narrowing operations, moves cam 49 from engagement with the roller 48a of arm 48 of bell crank 47 and positions cam 50 to operate bell crank 47, by engagement of said cam 50 with the roller 48a. The brake 54, normally operated through the bell crank 62 and roller 63a, will thus be rendered inoperative by reason of the disengagement of the roller 63a and cam 64 (see Fig. 1a). At such time the brake will be held in its idle position by engagement of the arm 63 with the adjustable stop 66. By the means just described, the tension releasing means will be operative in both narrowing and plain knitting positions of the cam shaft, while the brake will be operative only in the plain knitting position.

As mentioned above, in knitting a full fashioned stocking less tension is required as the length increases because of the narrowing of the fabric. Accordingly I have provided mechanism for automatically varying the fabric tension at desired times during the knitting process. A drum 70 secured to a shaft 71 mounted in the projections 41 of arm 42 on bracket 30 is provided with a plurality of studs 73 arranged axially and peripherally of the drum, a stud being provided for engaging and moving each of the latches 35 to release the end of the associated lever 37 and disconnect the corresponding spring 44 from chain 24. An arm 74 loosely mounted on shaft 71 carries a pawl 75 engaging a ratchet 76 fixed to the shaft and is connected to a rod 77 by a lever 78 pivoted on bracket 30. Rod 77 extends through a guide 80 and is connected to a lever 81 pivotally mounted on a bracket 82 and having a lug 83 engageable by buttons 84 on a pattern chain 85 guided over a rotatively mounted sprocket 86.

A bail 87 extends beneath levers 37 for restoring the ends of the latter to engagement with the shoulders 43 of latches 35. Bail 87 is supported by arms 88 and 89 secured to shaft 38. A lever 90, which may be a continuation of arm 89, is provided for raising the bail, which is normally held away from levers 37 by a spring 91 connected to arm 89.

In operation, the springs 44 may be adjusted in the notches 46 of levers 37 to exert varying forces and as many of the levers as are required to pro-

vide the desired initial fabric tension have their ends engaged with the shoulders 43 of latches 35 to operatively connect the springs 44 to chain 24 and draw-off reel 10. Springs 44 then act on lever 23 to turn shaft 13 and rotate draw-off reel 10 to draw the fabric 11 from needles 12. On each revolution of cam shaft 51 cam 49 rocks bell crank 47 raising yoke 32 to relieve chain 24 from the tension of springs 44. Bell crank 62 is also rocked by cam 64 to operate lever 60 and apply brake 54 to hold shaft 13 and reel 10 in their rotated position as spring 25 acts on lever 23 for reversely operating clutch 29 to obtain a new operating purchase on shaft 13. Thus, although the angle through which the relatively short springs 44 may rotate reel 10 is limited, the resetting of the clutch restores the full rotative force of the springs before they have contracted to such an extent as to be inoperative to turn the reel. Consequently, the periodic resetting of the clutch 29 enables the springs 44 to impart the full rotative movement to the reel required to maintain a stocking under tension throughout the knitting of the entire length thereof.

Pattern chain 85 is intermittently advanced in well known manner on rotation of cam shaft 51 during the knitting process and each time that a button 84 engages lug 83 lever 81 is rocked moving rod 77 and levers 78 and 74 to cause pawl 75 to advance ratchet 76 and turn drum 70. On each step movement of drum 70, a stud 73 thereon engages the corresponding latch 35 and moves the latter from contact with the end of the associated lever 37. Thus, the springs 44 are individually disconnected from chain 24 to reduce the tension acting on draw-off reel 10 and consequently reduce the fabric tension at various times as the knitting of the fabric progresses. The amount by which the fabric tension is reduced at any time depends on the force normally exerted by the spring which is disconnected and this in turn is determined by the adjustable connection of the springs 44 in the notches 46 of the levers 37. If desired several of the springs may be simultaneously disconnected to reduce the fabric tension. It will be apparent that the adjustable connection of springs 44 to levers 37 provides for a nicety of adjustment which together with the capability for releasing several springs simultaneously as well as successively enables reduction of the fabric tension by varying desired amounts at various stages of the knitting process.

When cam shaft 51 is shifted axially in narrowing, as is usual, the cam 49 is moved from engagement with the roller 48a of bell crank 47 and the cam 50 acts to rock the bell crank for raising yoke 32 to relieve the tension applied to the fabric through draw-off reel 10 during narrowing. Cam 64 is also moved from engagement with the roller 63a of brake operating bell crank 62 so that brake 54 is not applied during narrowing.

The improvements specifically shown and described, by which the results above set forth are obtained, may be modified in various ways, without departing from the spirit and scope of the invention as disclosed, and as set forth in the appended claims.

What I claim is:

1. In a knitting machine including mechanism for laying and preselecting the laying of thread courses, a fabric draw-off reel, means associated with said reel for applying tension thereto, and mechanism responsive to operation of said course-

selector mechanism in accordance with a selection thereof for causing said tensioning means to apply different degrees of tension to said reel during the knitting of different portions, respectively, of said fabric.

2. In a knitting machine, a pattern-control mechanism, a knitting mechanism, a fabric take-off device, means including a source of variable force releasably connected to said device for yieldingly biasing the same to tension the fabric, cooperating means for rendering said biasing means ineffective to affect the fabric, and means controlled by said pattern-control mechanism in accordance with a pattern for actuating said biasing means to vary the tension on the fabric in a manner to be unaffected by the fabric.

3. In a straight knitting machine, the combination of loop forming mechanism, a cam shaft controlling said mechanism, fabric take-off mechanism operating in time relation with respect to said cam shaft, means for applying tension to said take-off mechanism, and mechanism controlled by, and operative after a predetermined number of revolutions of, said cam shaft for causing said tension means to apply different degrees of tension to said take-off mechanism during the knitting of different portions respectively of the fabric.

4. In a knitting machine including a draw-off device, tensioning spring means, means operatively connecting said spring means to said device, and means for automatically affecting one or more elements of said spring means to vary the tension applied to said device.

5. In a knitting machine having a pattern chain; a draw-off reel; a plurality of tensioning devices; means including latches for severally connecting said tensioning devices to said reel; and means controlled by said pattern chain for automatically and successively releasing said latches to progressively vary the tension applied to said reel by said tensioning devices.

6. In a knitting machine having a draw-off reel, a plurality of tensioning springs, means operatively connecting said springs to said reel; means for automatically disconnecting one or more of said springs to reduce the tension applied to said reel; and means for resetting one or more of said disconnected springs.

7. In a knitting machine having a draw-off reel; a plurality of tensioning devices; means including latches for severally connecting said tensioning devices to said reel; and means for automatically and successively releasing said latches to progressively vary the tension applied to said reel by said tensioning devices.

8. In a straight knitting machine, the combination of loop forming mechanism, a cam shaft controlling said mechanism, fabric take-off mechanism operating in time relation in respect to said cam shaft, means for applying tension to said take-off mechanism, and mechanism controlled by the shaft in preselected courses during the knitting of the stocking blank for progressively decreasing the tension applied to the fabric by said take-off mechanism.

9. In a straight knitting machine, the combination of loop forming mechanism, a cam shaft controlling said mechanism, fabric take-off mechanism operating in time relation in respect to said cam shaft, means for applying tension to said take-off mechanism, a plurality of tension devices for actuating said take-off mechanism in a direction to draw off the fabric, and mechanism controlled by, and operative in predetermined revolutions of, said cam shaft during the knitting of

the stocking blank for progressively decreasing the tension applied to the fabric by said take-off mechanism.

10. In a straight knitting machine, the combination of loop forming mechanism, a cam shaft controlling said mechanism, fabric take-off mechanism operating in time relation with respect to said cam shaft, means for applying tension to said take-off mechanism, a plurality of tension devices for actuating said take-off mechanism in a direction to draw off the fabric, and mechanism controlled by, and operative after a predetermined number of revolutions of, said cam shaft for selectively operating said tension devices to apply different degrees of tension to said take-off mechanism during the knitting of different portions respectively of the fabric.

11. In a knitting machine having a draw-off reel; a plurality of tensioning springs; means operatively connecting said springs to said reel; and means for automatically disconnecting one or more of said springs to reduce the tension applied to said reel.

12. In a knitting machine; a draw-off reel; a plurality of levers operatively connected to said reel; and tensioning means adjustably connected to said levers for exerting varying forces on said reel.

13. In a knitting machine; a draw-off reel; a plurality of levers, means including latches for operatively connecting said levers to said reel; means adjustably connected to said levers for exerting varying tensioning forces on said reel; and means for releasing said latches to reduce the tension applied to said reel by varying amounts during the knitting process.

14. In a straight knitting machine, the combination of a cam shaft, a loop forming mechanism including a series of knitting needles, a series of loop forming points adapted to engage selected needles to produce loops caused by coaction between said points and needles, fabric take-off mechanism for applying tension to the fabric, tension means yieldably connected to said take-off mechanism for urging said take-off mechanism in a direction to draw off the fabric, mechanism controlled by the cam shaft in preselected courses during the knitting of the stocking blank for causing said tension means to apply different degrees of tension to the take-off mechanism during the knitting of the different portions respectively of said fabric, and mechanism for automatically releasing the tension applied to the take-off mechanism during coaction between the loop engaging points and selected needles.

15. In a knitting machine; a cam shaft; a draw-off reel; a uni-directional clutch associated with

said reel; tensioning means including a spring and yieldably connected to said clutch through said spring for biasing the same to turn said reel through a limited angle and means to automatically vary the effect of said tensioning means; means for resetting said clutch to effect further turning of said reel; cam shaft controlled means distinct from said resetting means controlling said tensioning means for relieving said clutch of the tension applied thereto to enable resetting thereof; a brake associated with said reel; and cam shaft controlled means for operating said brake to hold said reel in its rotated position during resetting of said clutch.

16. In a knitting machine having a draw-off reel; tensioning means including a spring and yieldably connected to said reel through said spring for rotating the latter under tension; a cam shaft; cam shaft controlled means for operatively disconnecting said tensioning means from said reel and for storing energy in said tensioning means; and a cam shaft operated brake for holding said reel in its rotated position during the storing of energy in said tensioning means, and means adapted to automatically vary the effect of said stored energy of the tensioning means upon the fabric being knitted.

17. In a knitting machine having a cam shaft shiftable from a knitting position to a narrowing position, a draw-off reel and tensioning means yieldably connected to said reel for rotatively operating the latter under tension; means operable to relieve said reel of the tension applied thereto by said tensioning means; means operable to hold said reel in its rotated position on said relief of tension; cam means on said cam shaft operative in either position of said shaft for operating said tensioning means to relieve said reel of tension; and cam means on said cam shaft operative only in the knitting position of said shaft for operating said holding means to hold said reel in its rotated position.

18. In a knitting machine; a draw-off reel; a uni-directional clutch associated with said reel; biasing means including a spring and yieldably connected to the driving member of said clutch through said spring for turning said reel through a predetermined angle and means for automatically varying the effect of said biasing means; means for resetting said clutch for causing said biasing means to effect further turning of said reel; a cam shaft and cam shaft controlled means distinct from said resetting means controlling said biasing means to enable resetting of said clutch in each course of the fabric as it is knit.

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