April 27, 1937. M. C. MILLER 2,078,265

FABRIC TAKE-UP MECHANISM

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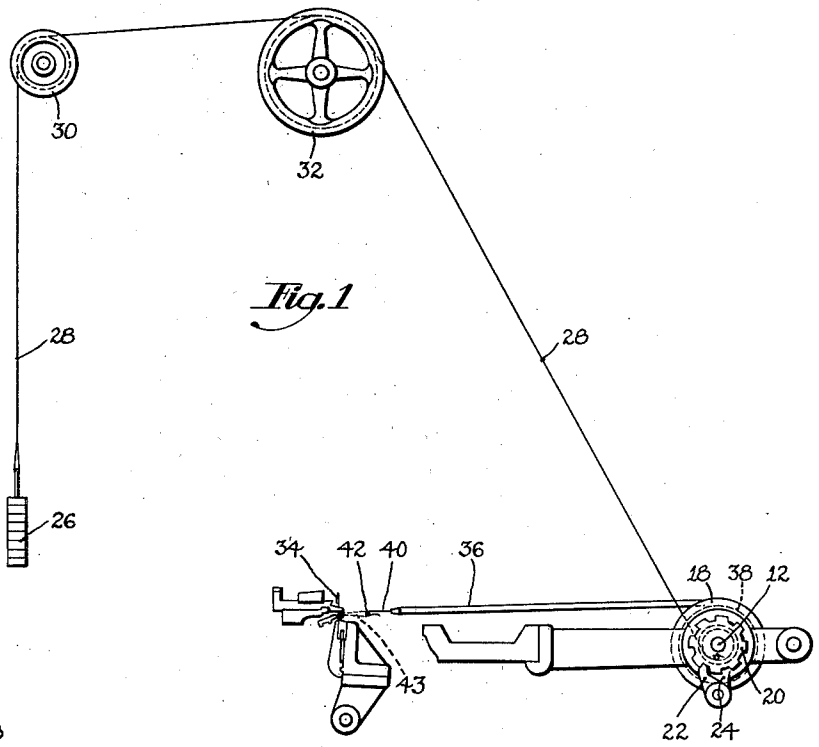


Fig. 1

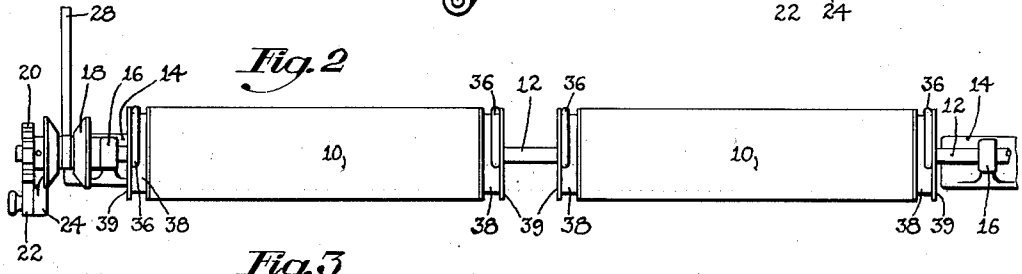


Fig. 2

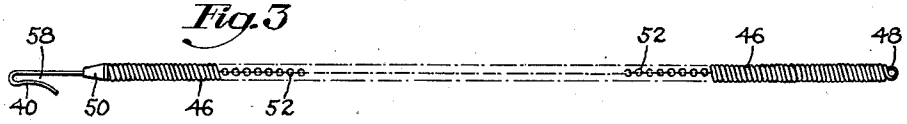


Fig. 3

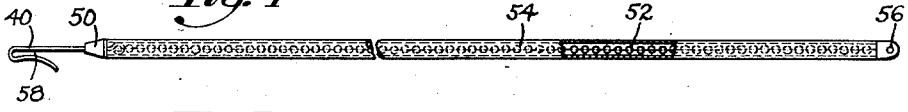


Fig. 4

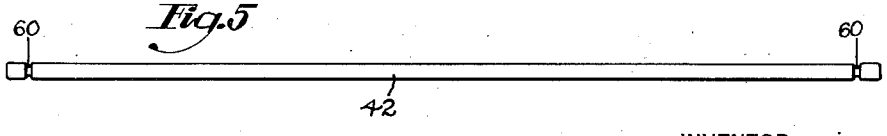


Fig. 5

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FABRIC TAKE-UP MECHANISM

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18 Claims. (Cl. 66—149)

The present invention relates to improvements in fabric take-up mechanisms for flat knitting machines, and more particularly for flat full-fashioned hosiery machines of the Cotton type, in which the needles are moved as a unit toward and away from a fixed press edge and relatively to a series of knockover bits to knock over and to position the newly formed loops to the backs of the needles. There is also provided with machines of this general description a fabric tension take-up mechanism which includes a take-up roller onto which the fabric is wound, and tensioning means for holding the successively knitted courses of the fabric in a clear position to the backs of the rising needles subsequent to the knockover.

Fabric tensioning devices of this description must have flexibility to follow the needles in their forward and back movements, and must also be carefully adjusted to provide a maximum tensioning pull which will not at the same time interfere with the proper functioning of the needles in the machine.

It is a principal object of the present invention to provide a novel and improved fabric tensioning and take-up mechanism of the general type above described which will have greater flexibility than such mechanisms previously developed to insure the proper operation of the machine, and is further constructed and arranged to permit the use of a heavier take-up tension than heretofore found feasible for certain types of knitting to clear the fabric to the backs of the needles and also to reform the newly finished loops as the needles are moved rearwardly at the knockover.

It is another object of the invention to provide tensioning means for the fabric take-up roller which is well adapted to exert a relatively heavy take-up tensioning strain on the fabric, and at the same time is sufficiently flexible to permit a yielding action to take place to prevent any excessive increase in the fabric tension particularly during or immediately following the rapid backward movement of the needles at the knockover and prior to the movement of the needles upwardly between the sinkers.

It is another object of the invention to provide a novel and improved resilient take-up connection between the take-up rollers and a newly set up fabric in which the amount of resiliency is reduced as subsequent courses are knitted and the resiliency of the newly knitted fabric is added to that provided by the take-up connection to maintain at a substantially constant value the tension and amount of stretch available between the take-up roller and the loops held on the needles.

It is a further object of the invention to provide a novel fabric tensioning and take-up mechanism of the general type set forth including applicant's improved resilient take-up connection in combination with applicant's flexible take-up roller tensioning means to provide a smoother and more efficient tensioning and take-up action during all stages in the knitting of a fabric, and more particularly to permit the use of a relatively heavier tensioning strain to draw the fabric to the backs of the needles and to reform each successively knitted course of loops subsequent to the knockover without in any way interfering with the proper operation of the needles or their cooperating knitting elements.

With these and other objects in view, as may hereinafter appear, a principal feature of the invention consists in the provision of a fabric take-up roller and a tensioning take-up therefor including a counterweight constructed and arranged to provide a mechanical advantage in favor of the fabric take-up roller against the take-up, so that any movement of the fabric and take-up roller in either direction will produce an extremely slight variation in the position of the take-up, and thus to secure a relatively greater degree of flexibility and resiliency in the operation of the take-up.

Another feature of the invention consists in the provision of a take-up connection between the take-up roller and a new fabric set upon the needles which is constructed of elastic material over substantially its entire length and is further provided with means to restrict the lengthening of the connection beyond a predetermined limit.

Another feature of the invention consists in the provision of a take-up connection of this general description which is connected to the fabric take-up roller to be wound thereon to increase the elastic tension thereof on the fabric, and to reduce the limit of stretch as additional fabric is knitted.

The several features of the present invention consist also in the combinations, devices and arrangement of parts hereinafter described and claimed, which together with the advantages to be obtained thereby, will be readily understood by one skilled in the art from the following description taken in connection with the accompanying drawing, in which Fig. 1 is a fragmentary view in side elevation illustrating the needle support of a full-fashioned hosiery machine, the fabric take-up straps, the fabric take-up rolls, and the take-up tensioning means for the rolls, only so much of the machine being shown as is necessary to show the connection of the present invention therewith; Fig. 2 is a detail view in front elevation illustrating two take-up rolls and the take-up counterweight drum shown in Fig. 1; Fig. 3 is a view in side elevation showing one form of take-up connection or strap; Fig. 4 illustrates another form of take-up connection; and Fig. 5 is a view in side elevation of applicant's preferred form of welt wire.

The invention is disclosed in a preferred form as embodied in a fabric take-up and tensioning mechanism which is particularly adapted for use in a flat, full-fashioned hosiery knitting machine of the Cotton type. The take-up mechanism normally employed in machines of this description comprises a shaft supported on the machine frame having mounted thereon a take-up roll for each section onto which the fabric is wound, and take-up tensioning means for rotating the shaft to take up the fabric in the form of a take-up drum which may be connected to turn with the shaft and is actuated by means of a counterweight and a connecting cord or strap wound onto the drum.

As ordinarily constructed, the take-up rolls are small as compared with the counterweight drum, the diameter of the take-up roll being normally 2 to 2½ inches, and that of the drum being about 6 inches, so that a leverage advantage of approximately 3 to 1 is obtained to assist the action of the counterweight to take up the fabric, and at the same time a sharp resistance is provided against any yield of the take-up rolls during the rapid rearward movement of the needles at the knockover. The necessary resiliency in the mechanism to prevent excessive strain upon the needles during the rearward movement at the knockover and subsequent needle rise is provided during the earlier stages in the production of a fabric by the use of resilient take-up straps and thereafter by the resiliency inherent in the knitted fabric.

It has been found with the construction above described that the rapid oscillatory movement imparted to the take-up rolls and the take-up counterweights connected thereto as the needles move forwardly and then rearwardly during the knockover, causes the counterweights to jerk in such a manner as to place an excessive strain on the needles precisely at the moment when the needles are moved upwardly between the sinkers. Inasmuch as the fabric tends to contract laterally and to draw the selvage edges inwardly, any excessive take-up strain on the fabric operates also to pull the end needles inwardly out of alignment, with consequent interference with the adjacent sinkers and injury to the machine. To avoid possible injury to the machine through misalignment of the needles as above described, it is the usual commercial practice to lighten the counterweights used to an extent which is objectionable, and is likely to result in uneven or imperfect knitting due to insufficient take-up action at other points in the knitting cycle.

In accordance with the present invention, a novel and improved arrangement of the take-up mechanism is provided which is well adapted to permit the use of a heavier take-up tension on the fabric than previously employed, and will at the same time eliminate the objectionable bobbing or jerking action of the counterweights as the fabric or take-up straps reach the limit of their elastic stretch during the rearward movement of the needles at the knockover.

In carrying out the present invention, applicant employs a relatively large take-up roll 10 as shown in the drawing, having a diameter preferably of four inches or more, although diameters ranging from 3 to 6 inches may be employed, one such roll for each section of the machine being secured to a take-up shaft 12 of ordinary construction which extends the entire length of the machine and is supported at intervals along its length by the usual bracket 14 and bearings 16 on the machine frame. With the present construction there is also provided a counterweight drum 18 having a diameter preferably of one inch loosely supported on the shaft 12, although any diameter which is smaller than that of the roll 10 may be employed. The drum is connected to turn with the shaft in the usual manner by means of a ratchet 20 rigidly secured to the shaft 12 and a pawl 22 carried on an arm 24 formed on the drum 18. A tensioning strain is applied to the drum 18 by means of counterweights 26 attached to a tape 28 which passes over pulleys 30 and 32 which may be of any well known construction, and is secured at its other end to be wound onto the drum 18.

With this construction and arrangement of the take-up mechanism in which the take-up rolls 10 have a considerably larger diameter than the drum 18, a considerably heavier counterweight must be employed to produce the usual take-up tensioning strain which for purposes of illustration may be assumed to be approximately 22 ounces for each section. It will also be evident that a relatively small oscillatory movement is imparted to the shaft 12 and the take-up roll 10 and drum 18 attached thereto, as the fabric is wound onto the take-up roll or is slightly unwound therefrom following the forward and back movements of the needles 34. The small diameter of the counterweight drum 18 serves to reduce still further the length of movement imparted to the counterweights 26 during the reciprocatory movements of the take-up rolls 10, and also operates to greatly reduce the rate of movement of the weights, so that the bobbing or jerking action previously described, is substantially eliminated.

A further advantage of applicant's structure consists in the fact that the use of a large take-up roll having a diameter of 4 inches or more, substantially twice that of the take-up rolls now in commercial use, operates to double the leverage exerted by the fabric or take-up straps to turn the take-up shaft 12 in its bearings, and thus greatly minimizes any resistance to the turning of the shaft which may result from tight or inadequately oiled bearings. This feature has been found to be of great assistance to insure a smooth and substantially frictionless operation of the take-up mechanism, particularly in multiple section machines in which the shaft 12 is necessarily supported in a number of bearings spaced at frequent intervals along the length of the machine. Because of the elimination of

the jerking action, and the elimination of objectionable frictional resistance to the movement of the take-up mechanism as above described, it has been found possible under certain conditions, as for instance, in the knitting of relatively heavy yarns, to considerably increase the total amount of the tensioning take-up strain exerted against the fabric beyond what would normally be considered feasible to position the newly formed loops to the backs of the needles without in any way interfering with the proper operation of the machine.

The present invention contemplates the provision of a novel and improved take-up connection or strap which is resilient throughout its entire length for connecting the fabric to the take-up rolls 10 during the early stages in the knitting of a fabric. The manner in which applicant's overall resilient strap may be employed in the machine, is illustrated in Figs. 1 and 2, which show take-up connections or straps 36 which are at their rear ends attached in grooves 38 formed in the peripheral surfaces of rolls or disks 39 secured to each end of the take-up rolls 10, and at their forward ends provided with hooks 40 to engage with opposite ends of a welt wire 42 extending through the looped welt portion of the fabric indicated at 43. Applicant's take-up strap or connection comprises a member which is resilient or elastic over substantially its entire length, and a nonelastic member preferably supported therein and of a predetermined greater length to provide a positive limit to the amount which the take-up connection may be stretched at any point during the knitting.

Figs. 3 and 4 illustrate two preferred forms of take-up strap which may be employed, that in Fig. 3 comprising a coil spring 46 provided at one end with a loop 48 by which it may be attached to the take-up roll 10, and at its other end with a ferrule 50 and the hook 40 for engagement with the welt wire 42 above described. Within the coil spring there is also provided a link chain 52 which is connected at one end to the ferrule 50 and hook 40, and at its other end to the loop 48, the chain being of predetermined greater length than the coil spring member 46 to provide a positive check to the lengthening of the connection under increased tension.

An alternative form of applicant's take-up strap or connection is illustrated in Fig. 4, in which the strap takes the form of a hollow rubber tube 54 which is provided at one end with the ferrule 50 and hook 40, and at its other end with an eye 56 for attaching the strap to the take-up roll 10. There is also provided in this construction, the link chain 52 which extends through the hollow portion of the tube 54, and is attached thereto at its opposite ends to permit a limited amount of stretch in the connection.

Another feature of the invention consists in the construction and arrangement of applicant's take-up straps and welt wire to provide a connection between these elements which will permit the straps to be readily connected or disconnected from the welt wire by the operator, and at the same time will provide a tight and reliable connection therebetween during machine operation. To this end the hooks 40 of applicant's take-up straps are arranged to fit into annular grooves 60 formed adjacent each end of the welt wire 42, and are provided with restricted throat portions 58 to provide a yielding spring fit of the hooks onto the welt wire.

As compared with the usual take-up strap comprising a wide non-resilient tape having a short resilient section made up of fine springs to secure the requisite delicacy of take-up action, and having a portion of the tape looped around the resilient section to limit the amount of stretch, applicant is able by the use of an overall resilient member to secure the same or greater delicacy of action with a heavy spring or rubber band which depends for its resiliency upon its great length, and at the same time provides a far stronger and more sturdy construction.

Another advantage of applicant's construction consists in the fact that a take-up member considerably narrower in width than the usual take-up tape or strap may be employed, which is particularly well adapted for use with automatic or welt turning mechanism of the general type illustrated in applicant's copending application Serial No. 726,285, filed May 18, 1934, to permit the insertion of the straps without interference with the welt turning mechanism which necessarily extends over the entire width of each section.

A principal advantage of applicant's structure rests in the novel and improved mode of operation of the fabric take-up and tensioning mechanism which is secured. In operation, as additional fabric is knitted and the take-up straps are shortened by coiling on the take-up roll 10, the resiliency of the take-up connection or straps 36 is proportionally decreased to offset the resiliency and stretch inherent in the newly knitted fabric, so that the total amount of resiliency and stretch between the needles and the take-up rolls 10 is maintained at a substantially constant value throughout the knitting of the entire fabric. It therefore becomes unnecessary for the operator to so often adjust the tension on the take-up rolls by adding counterweights to compensate for the increased stretch as is the usual commercial practice with the take-up tensioning straps now in use.

It will be understood that the invention is not limited to the specific embodiment shown, and that various deviations may be made therefrom without departing from the spirit and scope of the appended claims. More particularly, it will be understood that fabric take-up rolls and counterweight drums having other dimensions than those specifically stated may be used, in which the diameter of the take-up roll is greater than that of the counterweight drum to produce a relatively small movement of the counterweights, and in which the diameter of the take-up roll is also greater than that now in commercial use to reduce so far as possible the effect of friction and inertia in the take-up mechanism.

The invention having been described, what is claimed is:—

1. A fabric tensioning take-up connection for connecting the fabric to the fabric take-up roll of a flat full-fashioned knitting machine comprising a connecting element constructed for elasticity over substantially its entire length between the fabric and said roll, and having a predetermined limit of stretch.

2. A fabric tensioning take-up connection for connecting the fabric to the fabric take-up roll of a flat full-fashioned knitting machine comprising a connecting element constructed for elasticity over substantially its entire length between the fabric and said roll, and means to restrict the lengthening of the connection within a predetermined limit.

3. A fabric tensioning take-up connection for connecting the fabric to the fabric take-up roll of a flat full-fashioned knitting machine com-

prising a connecting element constructed for elasticity over substantially its entire length between the fabric and said roll, and a non-elastic element to restrict the lengthening of the connection within a predetermined limit.

4. A fabric tensioning take-up connection for connecting the fabric to the fabric take-up roll of a flat full-fashioned knitting machine comprising a connecting element constructed for elasticity over substantially its entire length between the fabric and said roll, and a non-elastic element of a predetermined greater length to restrict the lengthening of the connection.

5. A fabric tensioning take-up connection for connecting the fabric to the fabric take-up roll of a flat full-fashioned knitting machine comprising a connecting element constructed for elasticity over substantially its entire length between the fabric and said roll, and a non-elastic element of a predetermined greater length embodied within said elastic element and attached to each end thereof to restrict the lengthening of the connection.

6. A fabric tensioning take-up connection for connecting the fabric to the fabric take-up roll of a flat full-fashioned knitting machine comprising a hollow connecting element constructed for elasticity over substantially its entire length between the fabric and said roll, and a non-elastic connecting element within said hollow portion connected at each end to the corresponding ends of the elastic element and of a predetermined greater length to restrict the lengthening of the connection.

7. A fabric tensioning take-up connection for connecting the fabric to the fabric take-up roll of a flat full-fashioned knitting machine comprising a coiled spring connecting element arranged to be connected at one end of the fabric and at its other end to a take-up roll, and a non-elastic element of a predetermined greater length supported within said spring element and connected to each end thereof to restrict the lengthening of the connection.

8. A fabric tensioning take-up connection for connecting the fabric to the fabric take-up roll of a flat full-fashioned knitting machine comprising a hollow rubber connecting element arranged to be connected at one end to the fabric and at its other end to the take-up roll, and a no-elastic element of a predetermined greater length supported within said rubber connection and secured to each end thereof to restrict the lengthening of the connection.

9. A fabric take-up and tensioning device for flat knitting machines comprising a welt wire having an annular groove formed in the periphery thereof adjacent each end, and a pair of resilient take-up connections, each having secured thereto a spring hook with a restricted throat portion to provide a spring fit of said hook onto the groved portion of said welt wire.

10. A fabric take-up and tensioning device for flat knitting machines comprising a fabric take-up roll, means for exerting a take-up tensioning pull on the roll, and fabric tensioning take-up connections for connecting the fabric to the roll, each comprising an element elastic over substantially its entire length connected at one end to the fabric and at its other end to be wound onto the roll and a non-elastic element of a predetermined greater length similarly connected at each end of the connection to restrict the lengthening of the connection.

11. A fabric take-up and tensioning device for flat knitting machines comprising a fabric take-up roll, means for exerting a take-up tensioning pull on the roll, and fabric tensioning take-up connections for connecting the fabric to the roll, each comprising an element elastic over substantially its entire length connected at one end to the fabric and at its other end to be wound onto the roll, and having embodied therein a non-elastic element of a predetermined greater length, said elements having their ends attached to each other to restrict the lengthening of the connection.

12. A fabric take-up and tensioning device for flat knitting machines comprising a fabric take-up roll, means for exerting a take-up tensioning pull on the roll, and fabric take-up tensioning connections connected at one end to the fabric and at their other end to be wound onto the roll, each of said connections comprising an element elastic over substantially its entire length to provide a degree of resiliency between the fabric and the roll which is proportionally decreased as the connections are wound onto the roll.

13. A fabric take-up and tensioning device for flat knitting machines comprising a fabric take-up roll, means for exerting a take-up tensioning pull on the roll, and fabric take-up tensioning connections connected at one end to the fabric and at their other end to be wound onto the roll, each of said connections comprising an element elastic over substantially its entire length and having a predetermined limit of stretch to provide a degree of resilient stretch between the fabric and roll which is proportionally decreased as the connections are wound onto the roll.

14. A fabric take-up and tensioning device for flat knitting machines comprising a counterweight, a counter weight drum connected to turn with the roll, a counterweight supporting strap connected to be wound onto the drum, said drum having a proportionately smaller diameter than that of the roll, and fabric tensioning take-up connections connected at one end to the fabric and at their other end to be wound onto the roll and having a predetermined limit of resilient stretch to provide a degree of resilient stretch between the fabric and roll which is proportionally decreased as the connections are wound onto the roll.

15. A fabric take-up and tensioning device for flat knitting machines comprising a counterweight, a counterweight drum connected to turn with the roll, a counterweight supporting strap connected to be wound onto the drum, said drum having a proportionately smaller diameter than that of the roll, and fabric tensioning take-up connections connected at one end to the fabric and at their other end to be wound onto the roll and having a predetermined limit of stretch, and means rendered operative as additional fabric is produced to proportionally decrease the resilient stretch of said connections to maintain a substantially constant factor of resiliency between the needles and the take-up roll.

16. A fabric take-up and tensioning device for flat knitting machines comprising a fabric take-up roll, a counterweight, a counterweight drum connected to turn with the roll, a counterweight supporting strap connected to be wound onto the drum, said drum having a smaller diameter than that of the roll so that any movement of the peripheral surface of the roll will produce a proportionately smaller movement of the counterweight.

17. A fabric take-up and tensioning device for

flat knitting machines comprising a fabric take-up roll, a counterweight, a counterweight drum, a counterweight supporting strap connected to be wound onto the drum, means connecting said drum to impart a take-up tensioning strain to the roll, said roll, drum and connecting means being constructed and arranged so that a movement of the peripheral surface of the roll will produce a proportionally smaller movement of the peripheral surface of the drum.

18. A fabric take-up and tensioning device for flat knitting machines comprising a fabric take-up roll having a diameter of approximately 3 to 6 inches, a counterweight, a counterweight drum having a proportionately smaller diameter, a counterweight supporting strap connected to be wound onto the drum, and means connecting the roll to turn with the drum.

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