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YARN TENSIONING

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Fig. 1.

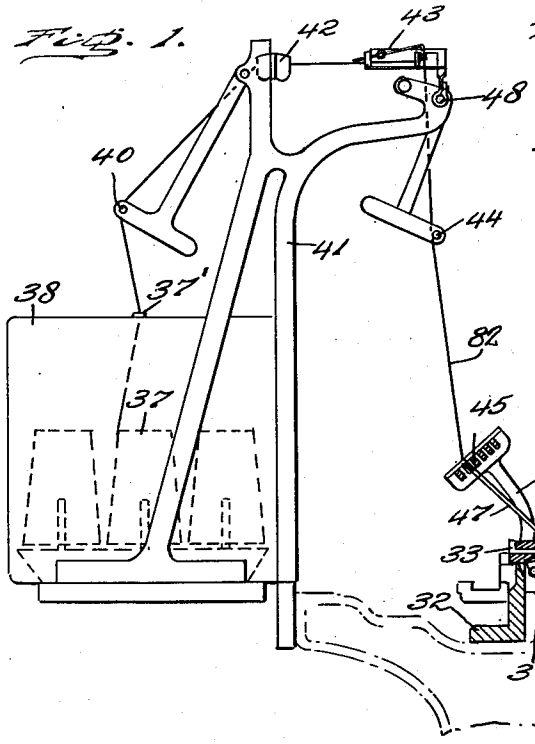


Fig. 3.

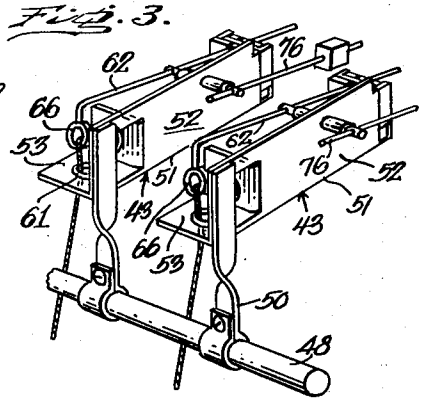


Fig. 12.

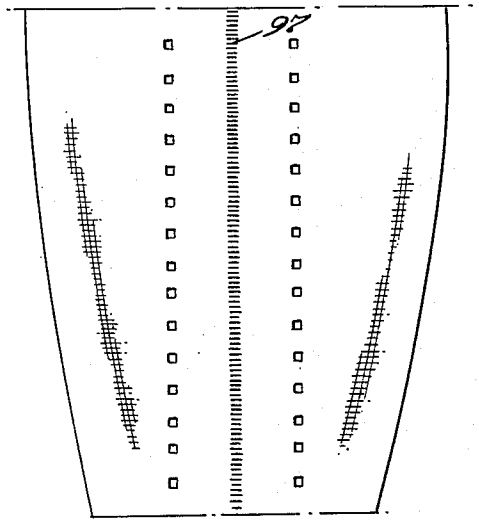
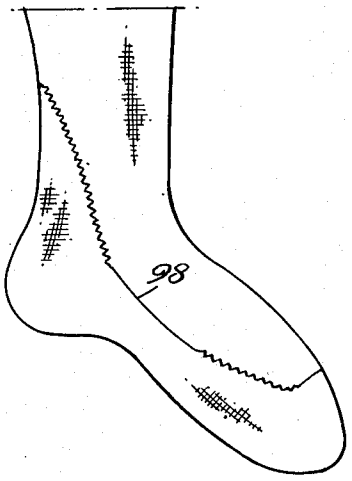


Fig. 13.



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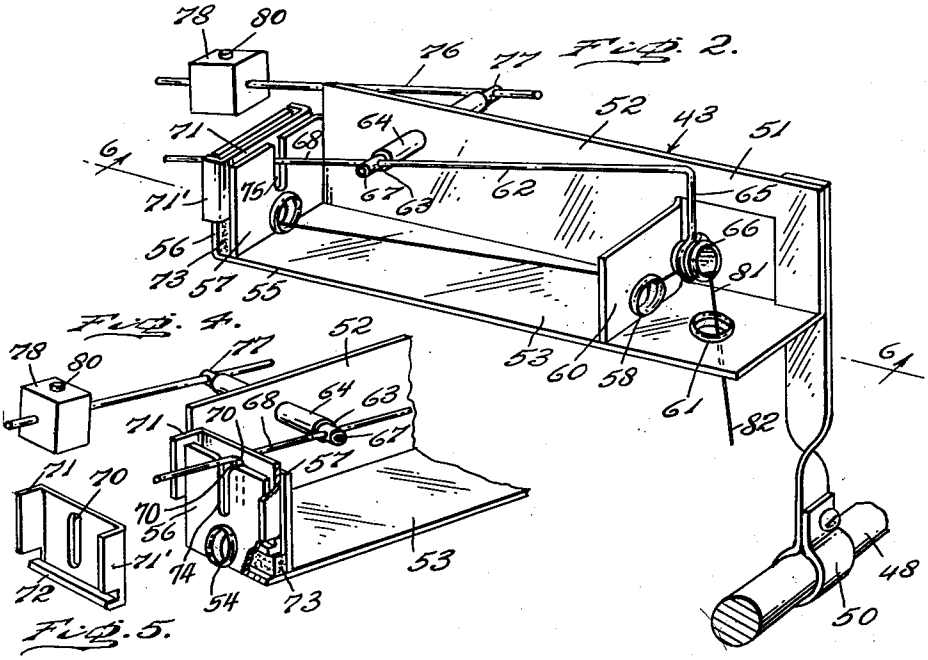


Fig. 2.

Fig. 4.

Fig. 5.

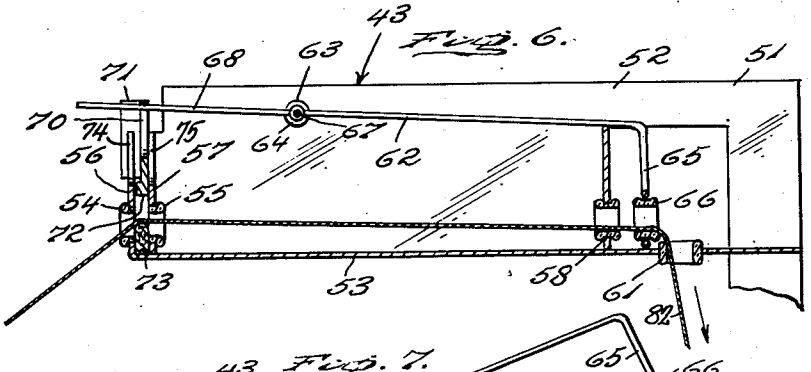


Fig. 6.

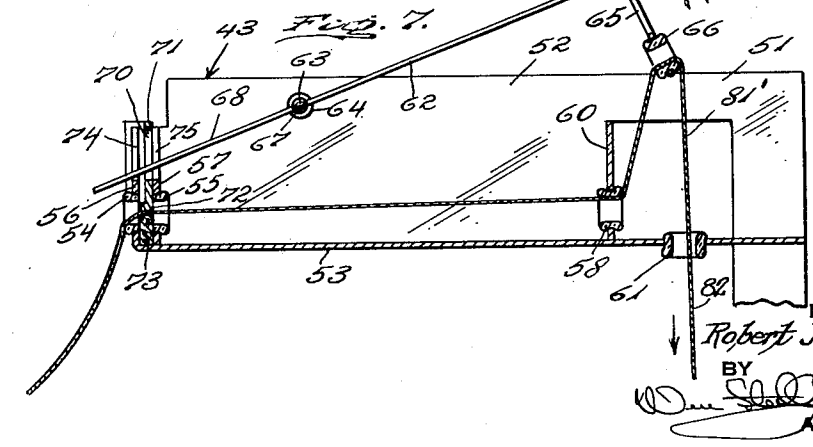


Fig. 7.

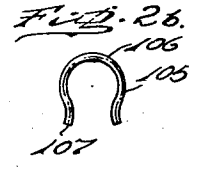


Fig. 2b.

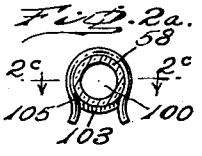


Fig. 2a.

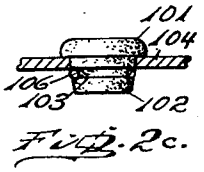


Fig. 2c.

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YARN TENSIONING

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Fig. 8.

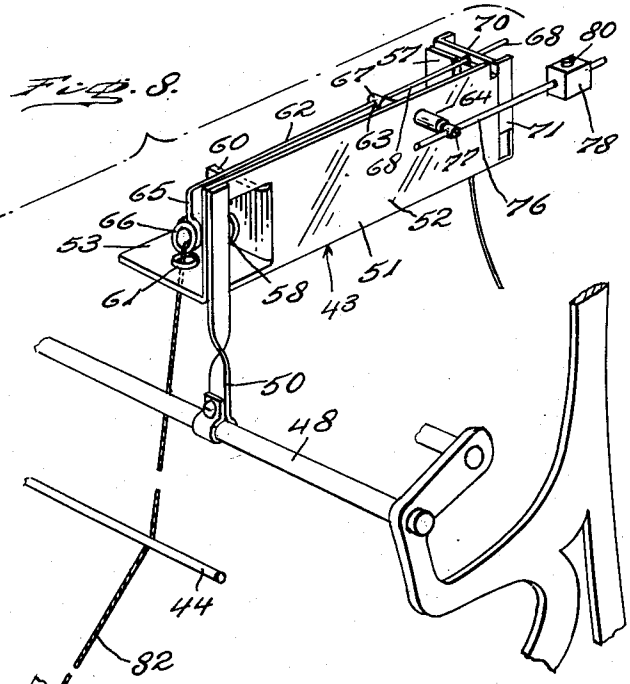
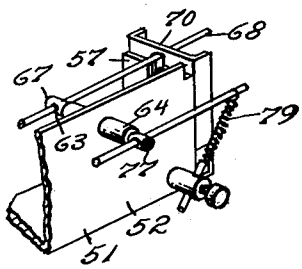


Fig. 8a.



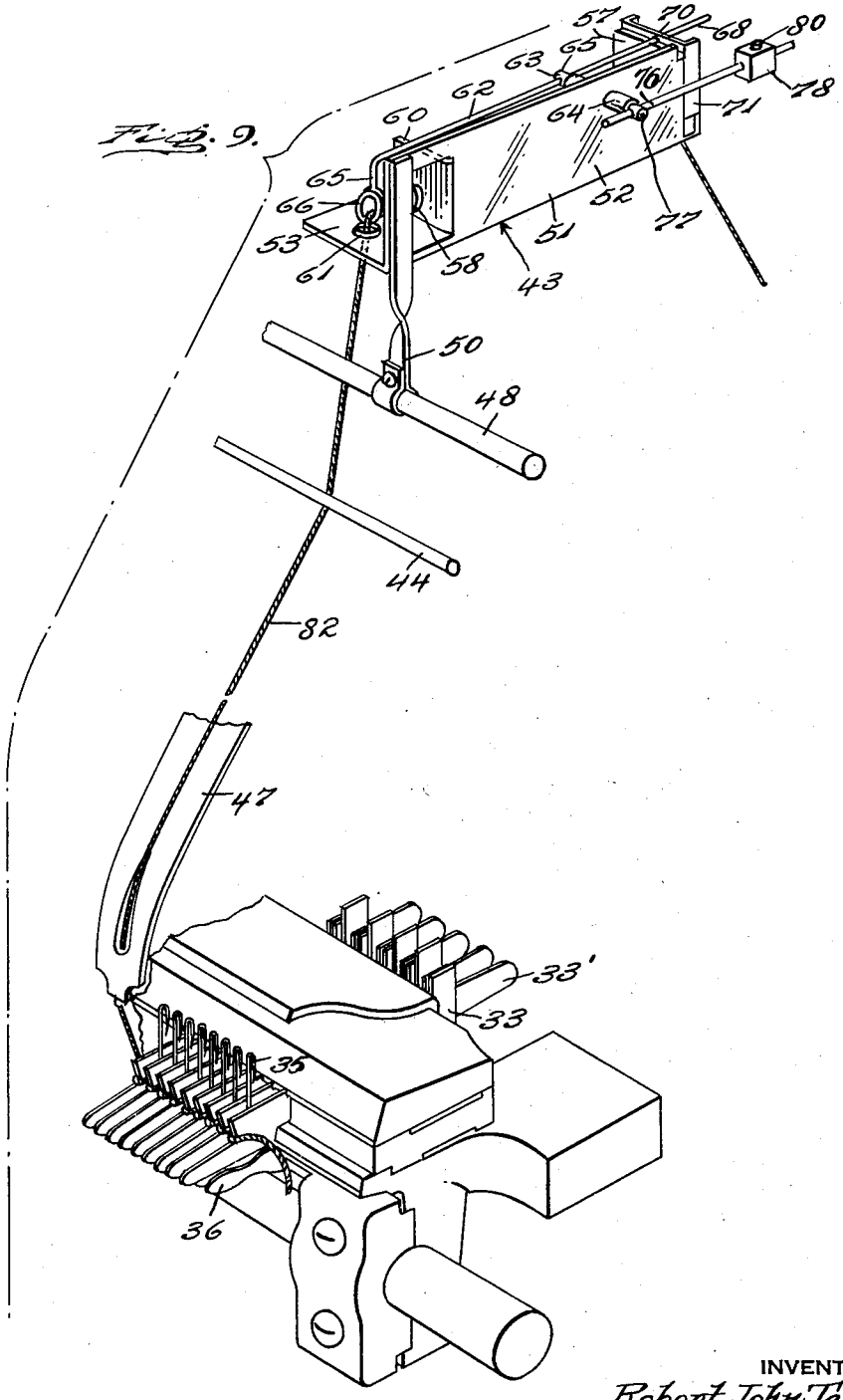
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YARN TENSIONING

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Fig. 9.



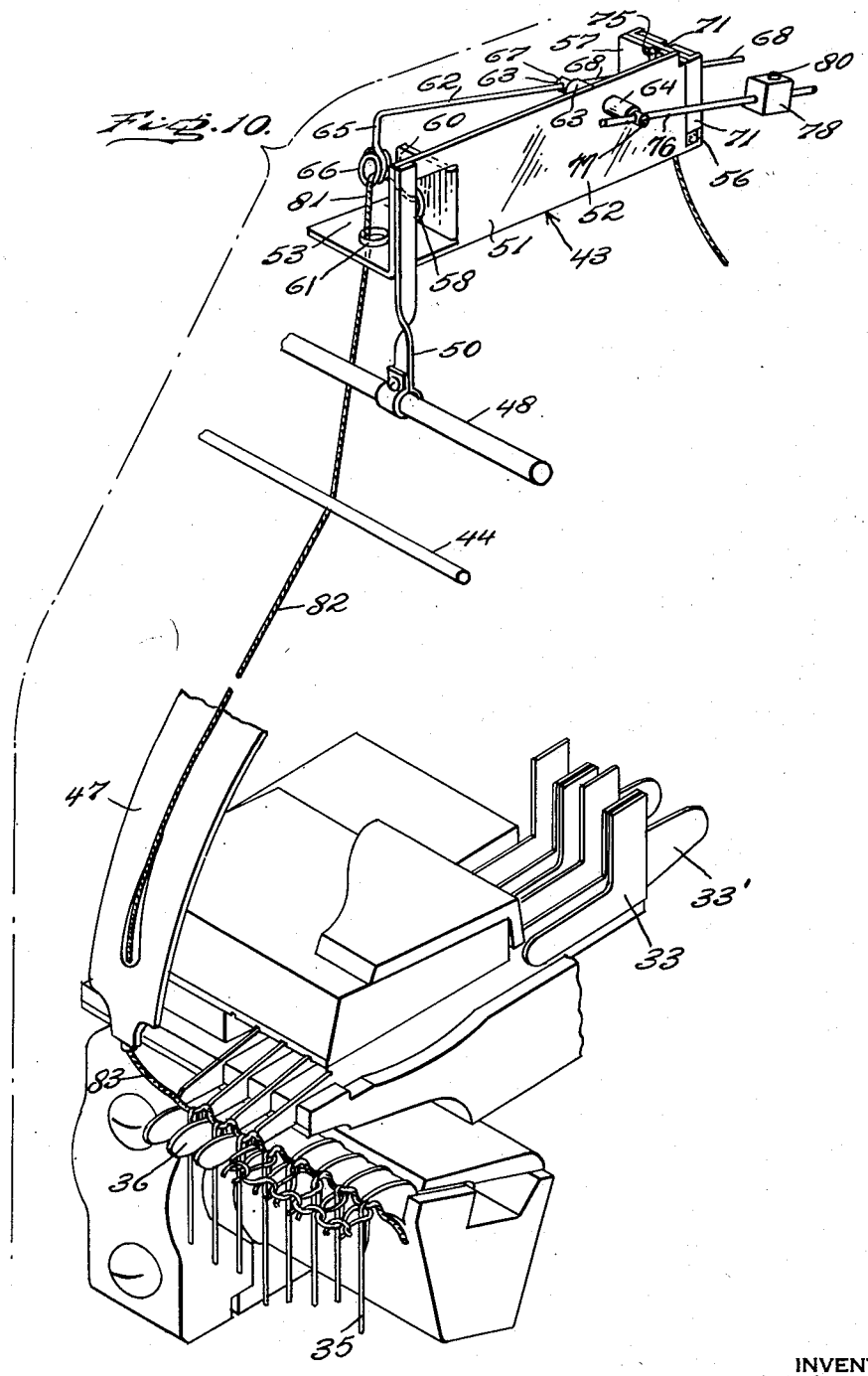
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YARN TENSIONING

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Fig. 10.



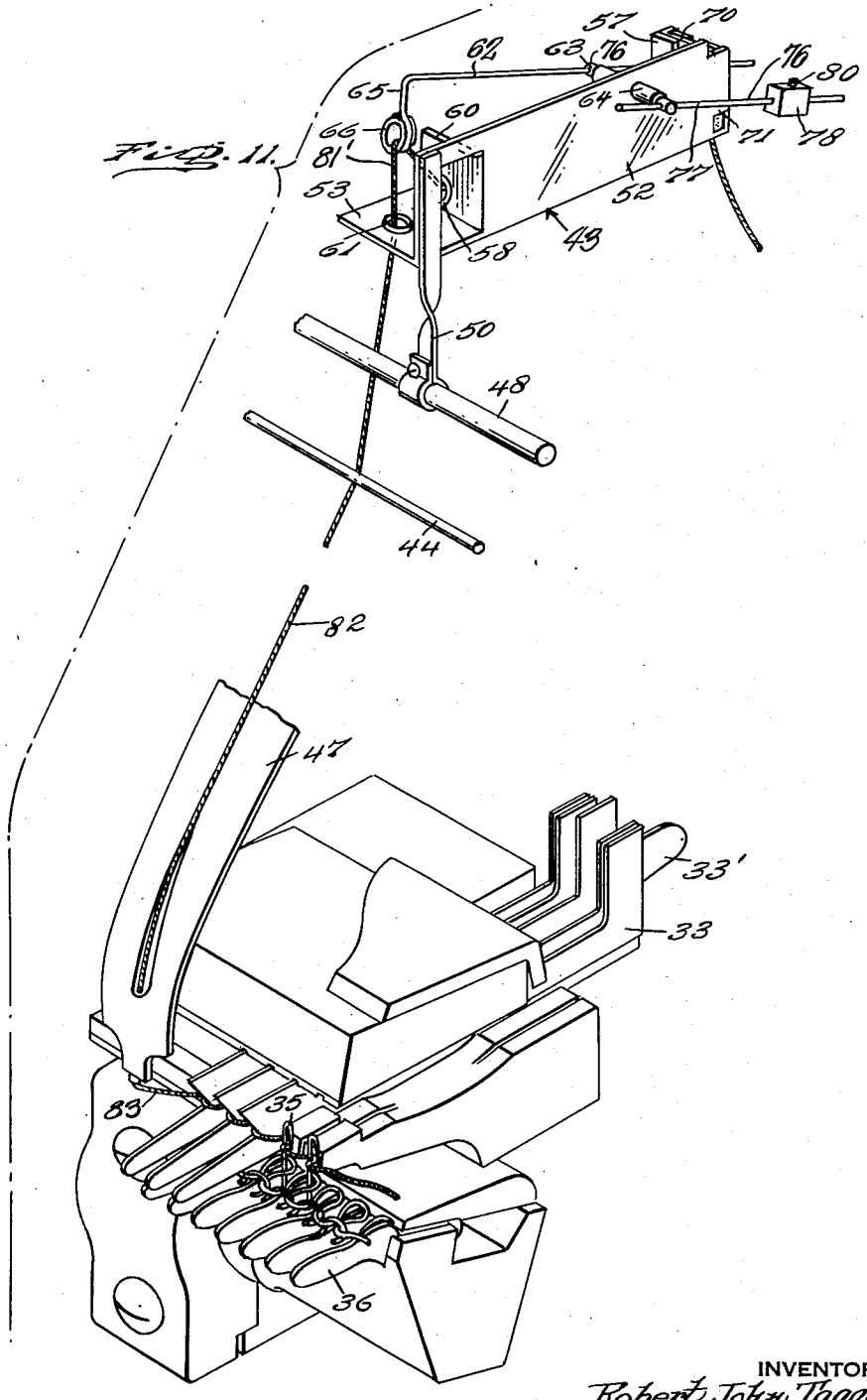
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Fig. 11.



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YARN TENSIONING

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Fig. 14.
PRIOR ART

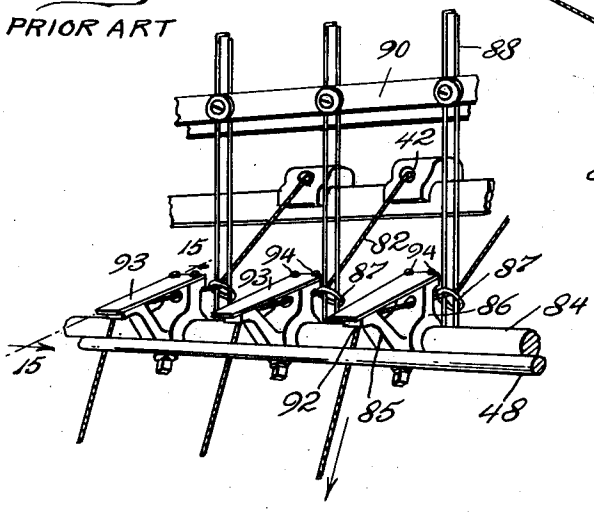


Fig. 15.
PRIOR ART

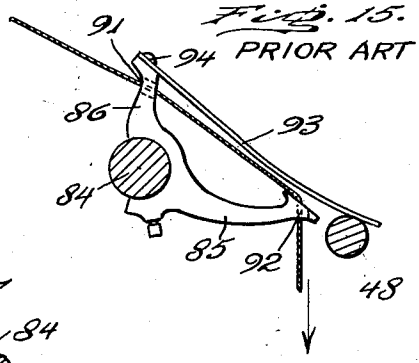


Fig. 17.
PRIOR ART

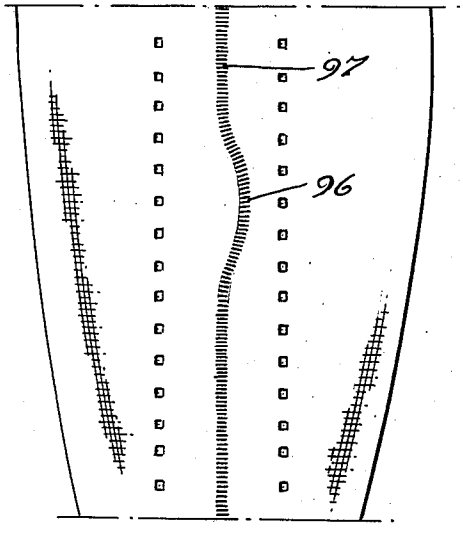
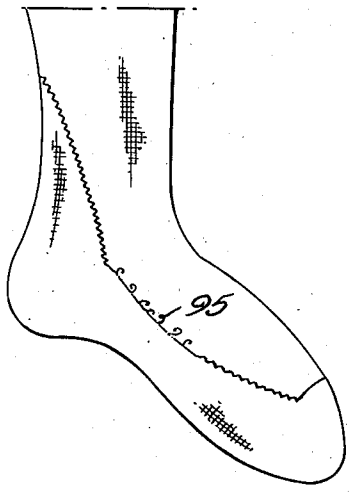


Fig. 16.
PRIOR ART



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Patented Nov. 18, 1952

2,618,444

UNITED STATES PATENT OFFICE

2,618,444

YARN TENSIONING

Robert John Taggart, Philadelphia, Pa., Charlotte C. Taggart administratrix of said Robert John Taggart, deceased

Application July 28, 1950, Serial No. 176,284

6 Claims. (Cl. 242—149)

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The present invention relates to a yarn tensioning device especially suited for full fashioned hosiery knitting machines.

A purpose of the invention is to regulate the yarn tensioning to avoid the creation of defective knitted goods, especially hosiery, and particularly to avoid excessive tightness of knitting, on the one hand, and looseness which may create excessively large loops at the selvage, loops at the splicing line which stand out from the stocking, cuts at the selvage or unevenness of the selvage seam.

A further purpose is to apply and remove tension on yarn in response to the drag of the yarn on a movable yarn guide between two fixed yarn guides mounted on a take-up rocker.

A further purpose is to bias the take-up rocker in a direction to move the relatively movable yarn guide away from the line of shortest distance between the fixed yarn guides.

A further purpose is to control the application of drag by a binder against a cushion by the motion of the take-up rocker under the action of the movable yarn guide.

A further purpose is to manipulate the binder by the rear end of a take-up rocker which is biased to place the binder in engaging position and which is urged to release the binder by motion of the movable yarn guide with respect to the fixed yarn guides at the forward end.

A further purpose is to provide an elongated slot on the binder which engages the rear end of the rocker and permits the binder to apply drag to the yarn while the movable yarn guide is permitted additional motion away from the fixed yarn guides under the action of the bias.

Further purposes appear in the specification and in the claims.

In the drawings I have chosen to illustrate one only of the numerous embodiments in which my invention may appear, selecting the forms shown from the standpoints of convenience in illustration, satisfactory operation and clear demonstration of the principles involved.

Figure 1 is an end elevation partially in phantom, showing a full fashioned hosiery machine to which the invention has been applied.

Figure 2 is a detail sectional perspective of the yarn tensioning device of the present invention, the section being taken transverse to the rod 48 in Figure 1. The take-up rocker is in normal drag position.

Figure 2ª is a fragmentary section transverse to the axis through one of the eyelets showing a variation.

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Figure 2ᵇ is a side elevation of the gripping spring shown in Figure 2ª.

Figure 2ᶜ is a section of Figure 2ª on the line 2ᶜ—2ᶜ.

Figure 3 is a fragmentary perspective of two yarn tensioning devices, in accordance with the invention side by side acting on adjoining yarn ends and illustrating the manner of mounting a large number of similar yarn tensioning devices running the full width of the knitting machine.

Figure 4 is a fragmentary perspective of the rear end of the yarn tensioning device of the invention.

Figure 5 is a detail perspective of the binder.

Figure 6 is a longitudinal section on the line 6—6 of Figure 2 through the yarn tensioning device, showing the take-up rocker in yarn release position, whereas Figure 2 shows the take-up rocker in normal drag position.

Figure 7 is a view similar to Figure 6 showing the take-up rocker in the abnormal drag position encountered at the selvage in narrowing.

Figures 8 to 10 inclusive are fragmentary perspectives showing the essential elements of the yarn take-up device and knitting machine in the positions they assume at the various stages of normal knitting on a full fashioned hosiery machine.

Figure 8ª is a fragmentary perspective of a modification of the tension structure shown in Figure 8.

Figure 11 is a fragmentary perspective showing the essential element of the yarn take-up device and the knitting machine in the position assumed at the selvage in narrowing.

Figure 12 is a fragmentary rear elevation of a stocking which has been knitted using the mechanism of the present invention.

Figure 13 is a side elevation of the foot of a stocking which has been knitted using the mechanism of the present invention.

Figures 14 to 17 are showings of the prior art.

Figure 14 is a fragmentary perspective of prior art snappers.

Figure 15 is an enlarged section of the line 15—15 through one of the snappers of Figure 14.

Figure 16 is a view similar to Figure 13, but showing the defects which have been encountered using the prior art tensioning devices.

Figure 17 is a view similar to Figure 12 showing the defects created at the selvage using the prior art tensioning devices.

In the drawings like numerals refer to like parts throughout.

In the prior art practice on full fashioned

hosiery machines it has been common to tension yarn by cam actuated snappers which depend on direct spring engagement with the yarn. These devices have proved to be subject to wide variations in tension and this has been noticed particularly in knitting nylon hosiery, due to the fact that slight variations in condition make tremendous differences in the frictional characteristics of nylon yarn.

As later explained more in detail, there has been a tendency either to knit too tight, in which case the hosiery is likely to be unduly short, or more particularly to allow undue looseness at the selvage or end of a knitting course. During the time between the end of one course and the beginning of the next course, when the machine is inactive as far as yarn motion is concerned, there has been a tendency to permit excessively large loops to form which result in the creation of bulging loops which themselves stick out at the selvage or at the splicing line and cause defects, or which become caught in the sinker head slots creating defects by cutting of the yarn at the selvage.

In accordance with the present invention, all direct connection between the yarn tensioning and the cycle of machine operation by cams or otherwise is avoided and instead the tendency of the yarn to travel forward and the drag under which the yarn travels forward are themselves employed to create the tensioning. Thus the operation is rendered automatic and the possibility of forming excessive loops at the selvage is prevented.

The control in the present invention is achieved by the existence or extent of an upbend in the yarn between two stationary yarn guides and a movable yarn guide. When the movable yarn guide is close to the straight line connecting the stationary yarn guides, the tension is reduced to a minimum, but as the movable yarn guide moves away from the stationary yarn guides as permitted by reduction in the drag due to slowing down or stopping of forward motion of the yarn, drag is then positively applied by a gate-like binder. The movable yarn guide is urged away from the stationary yarn guides and in a direction to increase the up-ended bend and apply the drag, by biasing the take-up rocker supporting the movable yarn guide under a counterweight or the like.

The binder is desirably actuated by the opposite end of the yarn take-up rocker from that which supports the movable yarn guide. The binder desirably has lost motion connection with the rocker as by an elongated slot in the binder so that the rocker can continue to enlarge the up-ended loop while the drag applied by the binder remains constant.

As seen in Figure 1, the machine is a standard full fashioned hosiery knitting machine, having a leg 30, a bed 31, and a sinker head support 32 supporting sinker heads 33 and dividers 33'. The sinker heads cooperate with needles bar 34 carrying needles 35. A knocking-over bar is shown at 36.

The yarn is withdrawn from one of the cones 37 through an opening 37' in a damp box 38 over a fixed guide 40 mounted on a galley 41 extending up above the machine. The yarn passes through a moistener 42, then through the yarn control 43 of the present invention, finally being taken down over a fixed yarn guide 44 through the space between carrier rods 45 on a carrier rod bracket 46, and thence through a carrier 47 to the needles.

The yarn control 43 of the invention is suitably supported on a longitudinally extending rod 48 of the machine by a clamp bracket 50 which is secured to an L-shaped frame 51 of the control device.

The frame 51 has a back portion 52 which is suitably upstanding and a base portion 53 which is desirably horizontal.

The yarn passes through the control from stationary back eyelets 54 and 55 which are supported in separated end walls 56 and 57 connected to the frame, to a stationary front eyelet 58 in a transverse front wall 60 which is suitably formed by lancing and bending from the back wall 52, and thence through a stationary eyelet 61 in the bottom wall 53 of the control device.

The eyelets are desirably of steel, lava, porcelain or china, in order to obtain very smooth guiding surfaces. A take-up rocker 62 is pivoted at 63 on the back wall 52. The pivot is accomplished by the pivot shaft 63 passing through a stationary tube 64 in the back wall. The take-up rocker 62 at its forward end has an L-shaped downward extension 65 which mounts an eyelet 66 extending forwardly and positioned forward of the eyelet 58 and behind the downwardly extending eyelet 61.

The position of the forward movable eyelet 66 is rendered adjustable by mounting the rocker 62 in the pivot shaft 63 by extending the rocker through a transverse hole in the shaft and holding the rocker by a set screw 67, so that adjustment of the position of the eyelet 66 is readily accomplished.

At the rearward end of the take-up rocker 62, an extension 68 passes through a vertical slot 70 in a gate-like binder 71 which has a smooth lower pressure edge 72 which goes down on the yarn between the eyes 54 and 55 against a cushion 73 desirably of felt, although permissibly of metal. The binder 71 is positioned between the transverse walls 56 and 57 and desirably has ears 71' at the ends riding on the outer edges of walls 54, which is conveniently bent up from the bottom 53.

In order to provide adequate freedom of motion of the extension 68 of the take-up rocker, slots 74 and 75 extend downwardly in the rear end walls 56 and 57 to a position near the upper edges of the eyelets 54 and 55.

The take-up rocker is counterweighted at the rear end to overbalance the weight of the forward end and give the desired tension on the yarn by extending a counter-weighting arm 76 through a transverse hole in shaft 63, holding it in adjusted position by set screw 77 and mounting a weight 78 on the arm which is adjusted by set screw 80, or by a spring 79 as in Figure 8a.

It will be understood that while the bracket 50 from the rod 48 is a desirable means of support, any other desirable means of support can be used.

In operation, prior to the start of a course as shown in Figure 8, the machine is momentarily stopped as far as drag on the yarn is concerned, and the overbalancing of counter-weight 78 causes the forward movable eyelet 66 to raise forming an upbend 81 of the yarn as shown in Figure 2 between the stationary eyelets 58 and 61. At the rear of the control device, the gate-like binder 71 is in its engaging position as shown

in Figure 7, applying a slight amount of drag to the yarn.

As the course begins in Figure 8, the needles **35** are up as well known, the sinkers **33** and dividers **33'** are back and beginning to come forward and the knock-overs **36** are down. The yarn carrier **47** is starting across to the left to make a course as shown, and the pull on yarn **82** causes the forward movable eye **66** on the take-up rocker to move down, as shown in Figure 8, reducing the upbend **81** to a minimum. The upbend **81** is formed by the preferably horizontally axised moveable yarn guide **66** between the preferably horizontally axised fixed yarn guide **58** and the preferably vertically axised fixed yarn guide **61**. At the back of the yarn control, the gate-like binder **71** is in its raised position relieving the yarn from tension, and the yarn is passing through the control device without encountering any appreciable drag except the very minimum drag imparted by the cushion **73**.

Figure 9 shows the operation of the control device during the intermediate progress on a course, the control device position being the same as that of Figure 8 notwithstanding that the needles **35** are up, the sinkers **33** and dividers **33'** are forward and the knock-overs **36** are down.

As knitting of a course is completed, as shown in Figure 10, yarn carrier **47** has completed its travel to the left, and the machine is momentarily stopped as far as yarn motion is concerned, leaving a stretch of yarn **83** which will form the loop at the selvage. In this position the needles **35** are down, sinkers **33** and dividers **33'** are starting to move back and the knock-overs are up knocking over the stitch as well known in the art. At this point the tension control device starts to rise as the needles come up, ready to start the new course, raising bend **81** to its elevated position, and at the same time lowering the gate-like binder **71** against the cushion **73** to provide full or maximum drag as in Figure 2 for the normal leg knitting procedure. This prevents the stretch of yarn at **83** from whipping or forming an excessive length which would cause a big loop and produce a defect at the selvage and also prevents the possibility that the stretch of yarn at **83** could become caught and pulled into the slot of the sinker head as the sinkers move back.

The operation as shown in Figures 8 to 10 inclusive applies except when the machine is narrowing. When the machine is narrowing, the operation is as shown in Figures 7 and 11. During the narrowing operation, the needles **35** are rocking (coming up and then immediately coming down again), and the sinkers **33** and dividers **33'** are back. The carrier **47** is stationary. Extra freedom is allowed the yarn by the rocking motion at the time of narrowing and the device of the present invention responds by the take-up rocker **62** raising the movable eye **66** to its uppermost position forming a large up bend **81'**, at which it is stopped by engagement of the extension **68** with the bottom of slot **74**. Sufficient freedom is provided in slot **72** in the gate-like binder **71** so that the binder will engage under its weight against the yarn notwithstanding that the take-up rocker may vary its angular position as long as it is raised sufficiently at the front to allow the binder to engage the yarn.

It will be evident that in accordance with the invention, the control device has three different phases of operation:

1. It may apply no drag whatever to the yarn except the slight drag from the cushion **73**.

2. It may apply the drag from the weight of the binder pressing down against the yarn and the slight additional drag due to the comparatively small up bend formed between the movable eyelet **66** and the stationary eyelets **58** and **61** (Figure 2).

3. It may provide the drag due to the weight of the binder and also the considerably increased drag due to the larger bent up portion **81'** (Figures 7 and 11) at the time of narrowing.

It will be evident that by the application of these increments of drag it is possible to prevent the damage to the loop at the selvage by forming an excessively large loop which itself will constitute a defect in the stocking, or which will produce a defect by allowing the yarn to be engaged in the slot of the sinker bar and cut or otherwise damaged.

The device of the invention greatly simplifies the construction of the yarn tensioning device and greatly improves uniformity. Figures 14 and 15 illustrate a prior art tensioning device of the common snapper variety. In this form a snapper rocker **84** operated by the usual cam and linkage mechanism from the knitting machine, carries a forward snapper arm **85** and a rearward snapper arm **86** at each yarn position. The yarn **82** enters through a moistener **42** and then passes through a tension ring **87** on a hairpin **88** mounted on a bar **90** running longitudinally of the machine, and then passes through a rear eyelet **91** on snapper arm **86** and then through a front eyelet **92** from the front of snapper arm **85**.

A snapper spring **93** is mounted on snapper arm **85** by screw **94** and extends forwardly beyond the forward end of snapper arm **85**. In one position of rocker **84** the snapper spring **93** engages the yarn (Figure 14), whereas in the rocked position (Figure 15) the snapper springs encounter fixed bar **48** and are raised away from the yarn.

Unfortunately the drag response of any two yarn ends varies and this is especially so in nylon, where there is a very different response in different ends. Furthermore, the snapper springs do not always exert the same pressure and the snapper spring pressure variation causes a variation in the tension. A further objectionable feature of this mechanism is that slight variation in the position of the snapper arms on the rocker will cause an error. The cam linkage and rocker mechanism is also complicated and it is very desirable to avoid it if possible.

Accordingly it will be seen that by the present invention the mechanism of Figures 14 and 15 is wholly eliminated. Where in the prior art the snapper spring tension has been too great, the machine has knitted too tight and the stocking is not of the proper length. Where in the prior art the snapper spring has been too loose the defects mentioned above have been caused and in particular a big loop has been formed standing out at the selvage. This may make itself evident by excessive loops at the seam on the leg, or in the narrowing it may produce excessive loops **95** along the splicing line where the conventional knitted portion joins the reenforced or ornamented portion (Figure 16). Another variation in the defect which may be produced by excessively loose tension on the snapper spring is that the extra large loop may be drawn into the slots of the sinker head and cut, causing unravelling

and formation of an unevenness or curving 96 in the selvage as shown at the seam line 97 of Figure 17 along the back of a stocking. The invention also saves the loss of production due to press-offs which occur from the defects in the loops at the selvage.

Figures 12 and 13 show the results achieved by the invention in which the stockings are free from the defects of Figures 16 and 17. In Figure 12 the seam line 97 at the back of the stocking is straight, free from the curved defect 96 shown in Figure 17.

In Figure 13 the splicing line 98 is contoured as planned without the excessively large loops 95 as shown in Figure 16.

In most of the drawings I have illustrated eyelets which are cemented or otherwise secured in place. Figures 2^a to 2^c inclusive show a variation in which the eyelets are spring held. In this case an eyelet 58 is shown which has a circular interior 100 and a circular exterior provided with an enlargement of flange 101 at one end and a reduced generally cylindrical shank 102 having an exterior annular groove 103 extending for a distance longitudinally from the flange sufficient to be located beyond the supporting element 104, which will suitably be a metallic sheet provided with a hole for the eyelet. The hole desirably is slightly larger than the shank 102 but smaller than the flange 101.

The eyelet is held in place by a U-shaped quick acting spring retainer 105 of wire or the like having a generally circular contour 106 with flares at the ends 107. The retainer 105 is conveniently snapped into the groove 103 from the side and can readily be pulled out by the fingers or by a tool. The retainer is desirably wide enough to jam or engage against the supporting element 104 to prevent the eyelet from being free longitudinally.

I find that this manner of supporting the eyelet has the advantage that it can be rotated for example a quarter turn by hand when it wears and then be used for another period. Thus four independent wear periods can be obtained before the eyelet is worn out and has to be replaced. Replacement is made very easily, as the retainer can simply be pulled off to the side and the eyelet be slipped out from the flange end.

It will be evident that the invention can be used on yarn other than nylon although it finds its widest application in nylon knitting. With less advantage it can also be used on silk, rayon, and wool knitting.

In view of my invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of my invention without copying the structure shown, and I, therefore, claim all such insofar as they fall within the reasonable spirit and scope of my claims.

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

1. In a yarn tensioning device, a cushion over which yarn is guided, a binder movable toward and away from the cushion and adapted to press against the yarn moving over the cushion, a pivoted arm extending over the pivot at one end and operatively engaging the binder to move the binder toward and away from the cushion, a pair of fixed yarn guides located on the opposite side of the pivot of the arm from the cushion and binder, a movable yarn guide between the fixed yarn guides in one position and mounted on the arm at the opposite side of the pivot from the binder and means for urging the arm in the direction to move the binder toward the cushion and to move the movable yarn guide away from the line of shortest distance between the fixed yarn guides.

2. In a yarn tensioning device, a cushion over which yarn moves, a pair of relatively spaced fixed yarn guides located forwardly in the direction of yarn motion of the cushion, a binder movable toward and away from the cushion on the opposite side of the yarn from the cushion and adapted to contact the yarn moving over the cushion, a relatively movable yarn guide located in one position between the fixed yarn guides, a take-up rocker pivoted between its ends, toward one end operatively interconnecting with the binder to move the binder and toward the other end mounting the relatively movable yarn guide, and means overbalancing the rocker in the direction to move the binder into binding position and move the relatively movable yarn guide away from the line of shortest distance between the fixed yarn guides.

3. In a yarn tensioning device, a cushion, a pair of fixed yarn guides spaced from one another and located forwardly in the direction of yarn travel from the cushion, a binder guided for motion toward and away from the cushion on the opposite side of the yarn passing over the cushion and having an elongated slot in the direction toward and away from the cushion, a relatively movable yarn guide positioned between the fixed yarn guides and movable toward and away from the line of shortest distance between the fixed yarn guides, a take-up rocker pivoted between its ends and at one end extending through and operatively engaging the elongated slot of the binder to raise the binder in one position of the rocker and to bring the binder against the yarn on the cushion in the other position of the rocker and on the opposite end mounting the relatively movable yarn guide, and means continuously urging the rocker into position to bring the binder into binding position and to bring the movable yarn guide to a position remote from the fixed yarn guides.

4. In a yarn tensioning device, a cushion, a pair of fixed yarn guides spaced from one another and located forwardly in the direction of yarn travel from the cushion, a binder guided for motion toward and away from the cushion on the opposite side of the yarn passing over the cushion and having an elongated slot in the direction toward and away from the cushion, a relatively movable yarn guide positioned between the fixed yarn guides and movable toward and away from the line of shortest distance between the fixed yarn guides, a take-up rocker pivoted between its ends and at one end extending through and operatively engaging the elongated slot of the binder to raise the binder in one position of the rocker and to bring the binder against the yarn on the cushion in the other position of the rocker and on the opposite end mounting the relatively movable yarn guide, and a counterweight acting on the rocker and continuously urging the rocker in the direction to bring the binder into binding position against the cushion and to bring the movable yarn guide to a position remote from the fixed yarn guides.

5. In a yarn tensioning device, a cushion over which yarn is carried, a pair of relatively spaced fixed yarn guides receiving the yarn at a posi-

tion displaced along the length of the yarn with respect to the cushion, guides above the cushion, a binder mounted in the guides above the cushion and having a slot, a relatively movable yarn guide in one position between the relatively fixed yarn guides and movable away from and toward the line of shortest distance between the fixed yarn guides, a rocker pivoted intermediate its ends, toward one end passing through the slot in the binder and toward the other end supporting the relatively movable yarn guide, the slot being elongated so that as the relatively movable yarn guide moves away from the line of shortest distance between the fixed yarn guides the binder is first brought into contact with the yarn against the cushion and then as the relatively movable yarn guide moves further away from the line of shortest distance the rocker end extending through the binder moves in overtravel in the elongated binder slot, and a counterweight acting on the rocker and urging it into position to release the binder against the yarn on the cushion and to raise the relatively movable yarn guide to the position remote from the line of shortest distance between the fixed yarn guides.

6. In a yarn tensioning device, a cushion over which yarn is carried, a pair of relatively spaced fixed yarn guides receiving the yarn at a position displaced along the length of the yarn with respect to the cushion in the forward direction of yarn travel, guides above the cushion, a binder mounted in the guides above the cushion and having a slot, a relatively movable yarn guide in one position between the relatively fixed yarn guides and movable away from and toward the line of shortest distance between the fixed yarn guides, a rocker pivoted intermediate its ends,

toward one end passing through the slot in the binder and toward the other end supporting the relatively movable yarn guide, the slot being elongated so that as the relatively movable yarn guide moves away from the line of shortest distance between the fixed yarn guides the binder is first brought into contact with the yarn against the cushion and then as the relatively movable yarn guide moves further away from the line of shortest distance the rocker end extending through the binder moves in overtravel in the elongated binder slot, and a counterweight acting on the rocker and urging it into position to release the binder against the yarn on the cushion and to raise the relatively movable yarn guide to the position remote from the line of shortest distance between the fixed yarn guides.

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