Dec. 10, 1935. F. CHATFIELD 2,023,515

THREAD FEEDING MECHANISM

Filed Oct. 24, 1932 6 Sheets-Sheet 1

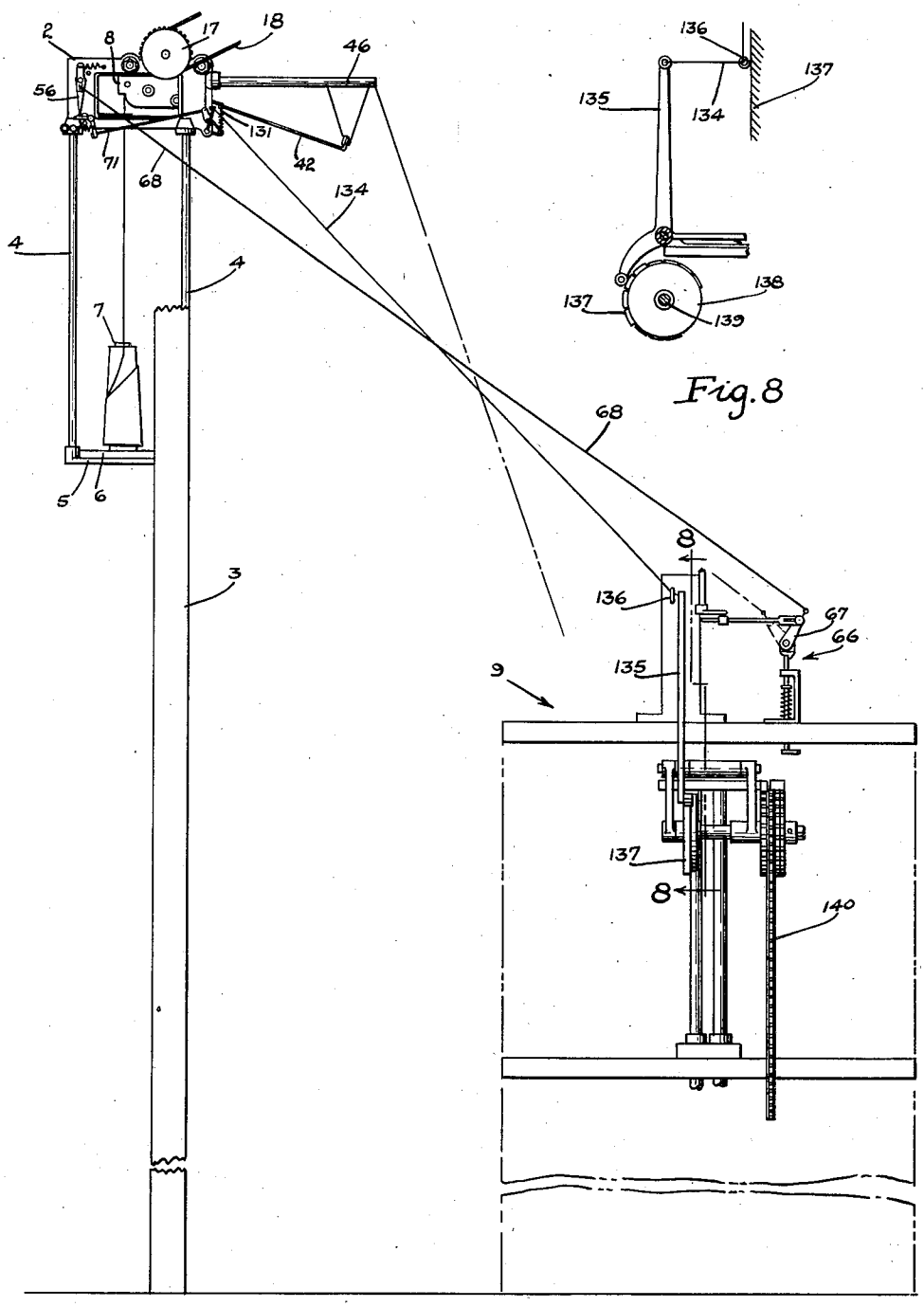


Fig. 1

Fig. 8

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THREAD FEEDING MECHANISM

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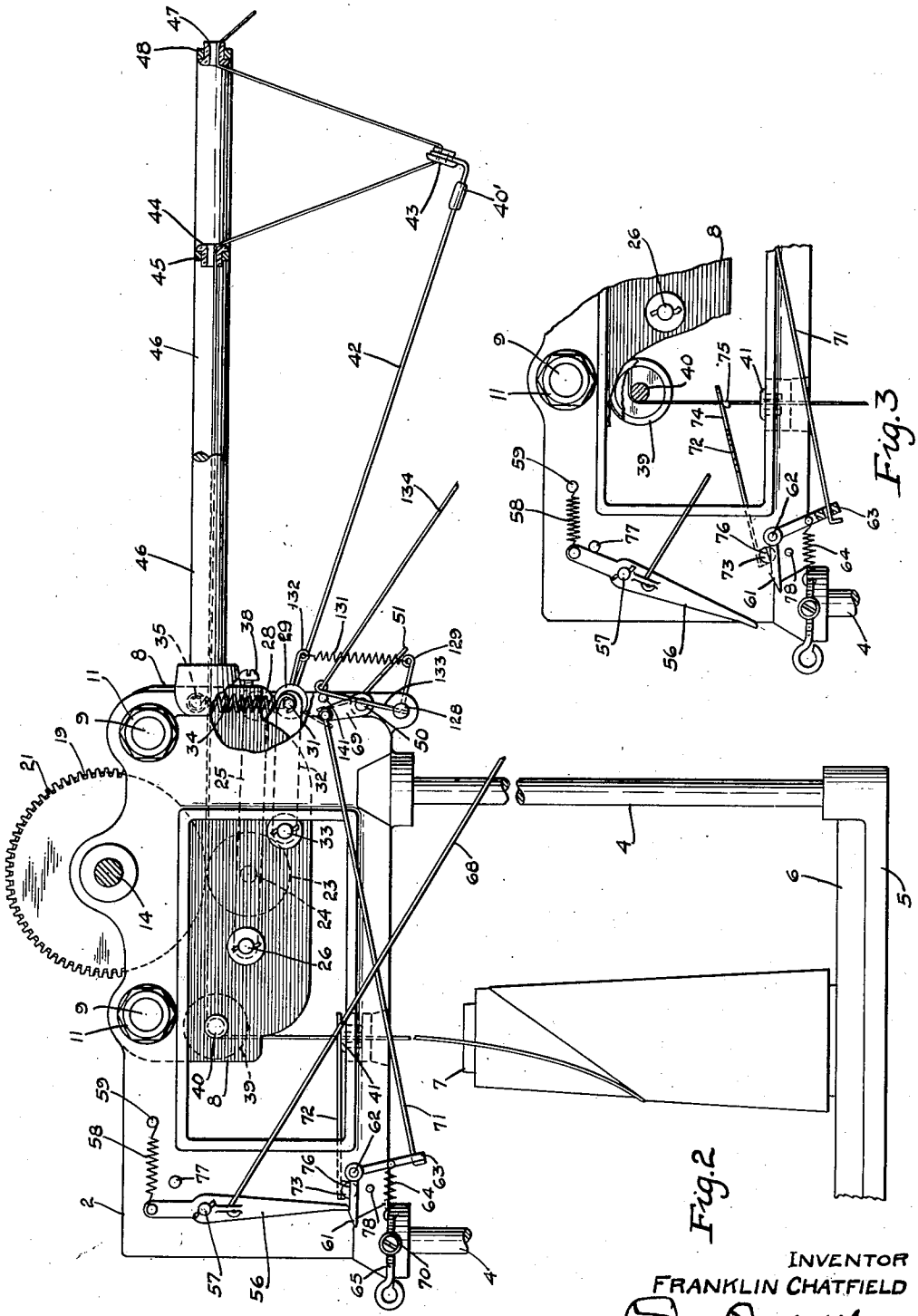


Fig. 2

Fig. 3

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THREAD FEEDING MECHANISM

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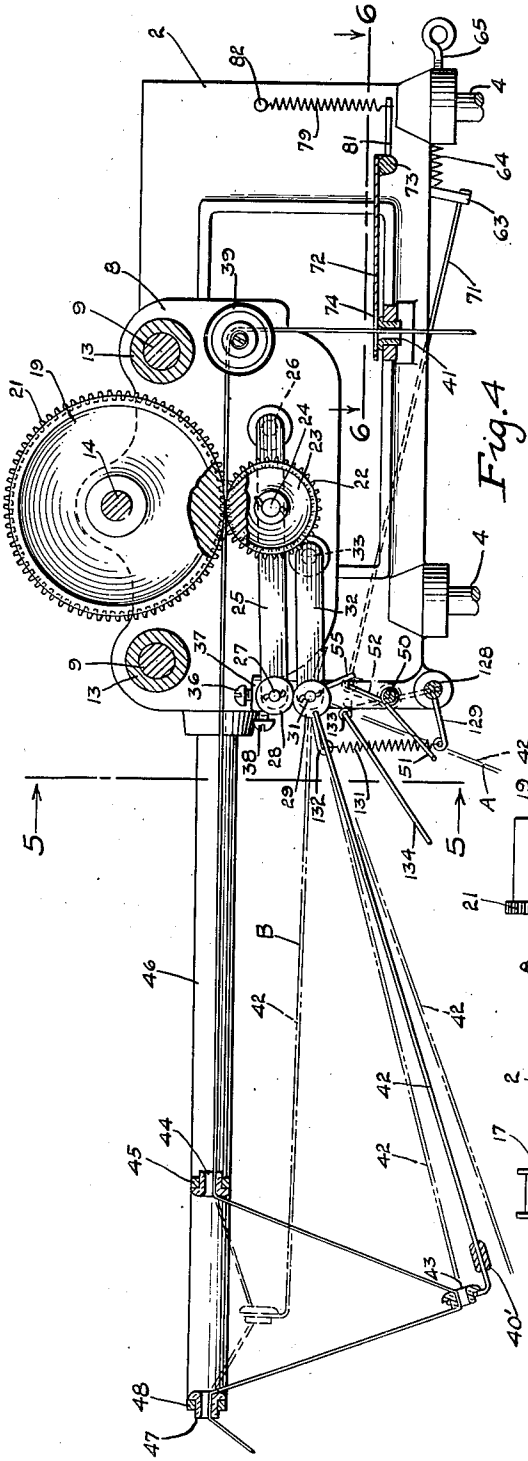


Fig. 4

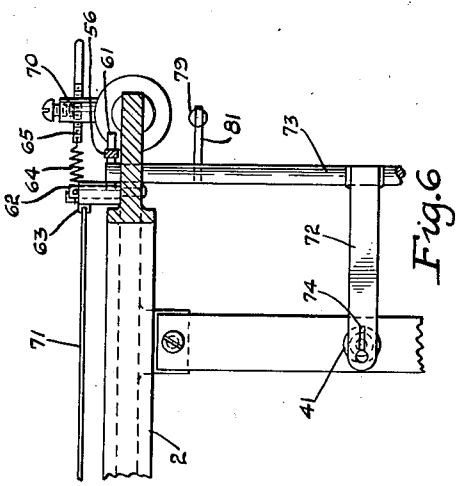


Fig. 6

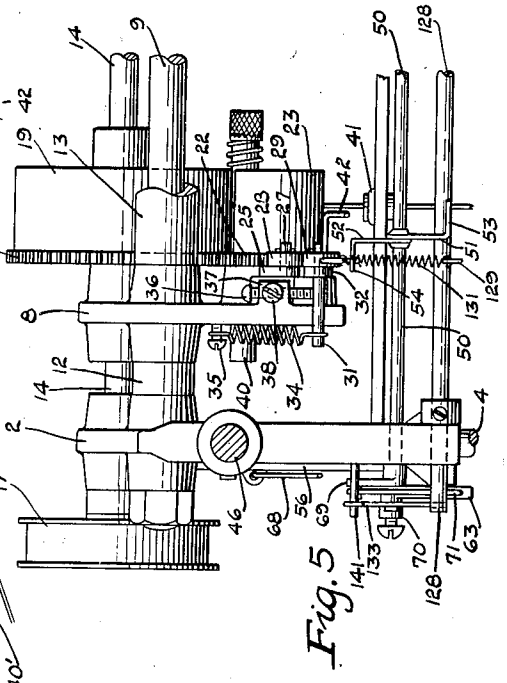


Fig. 5

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THREAD FEEDING MECHANISM

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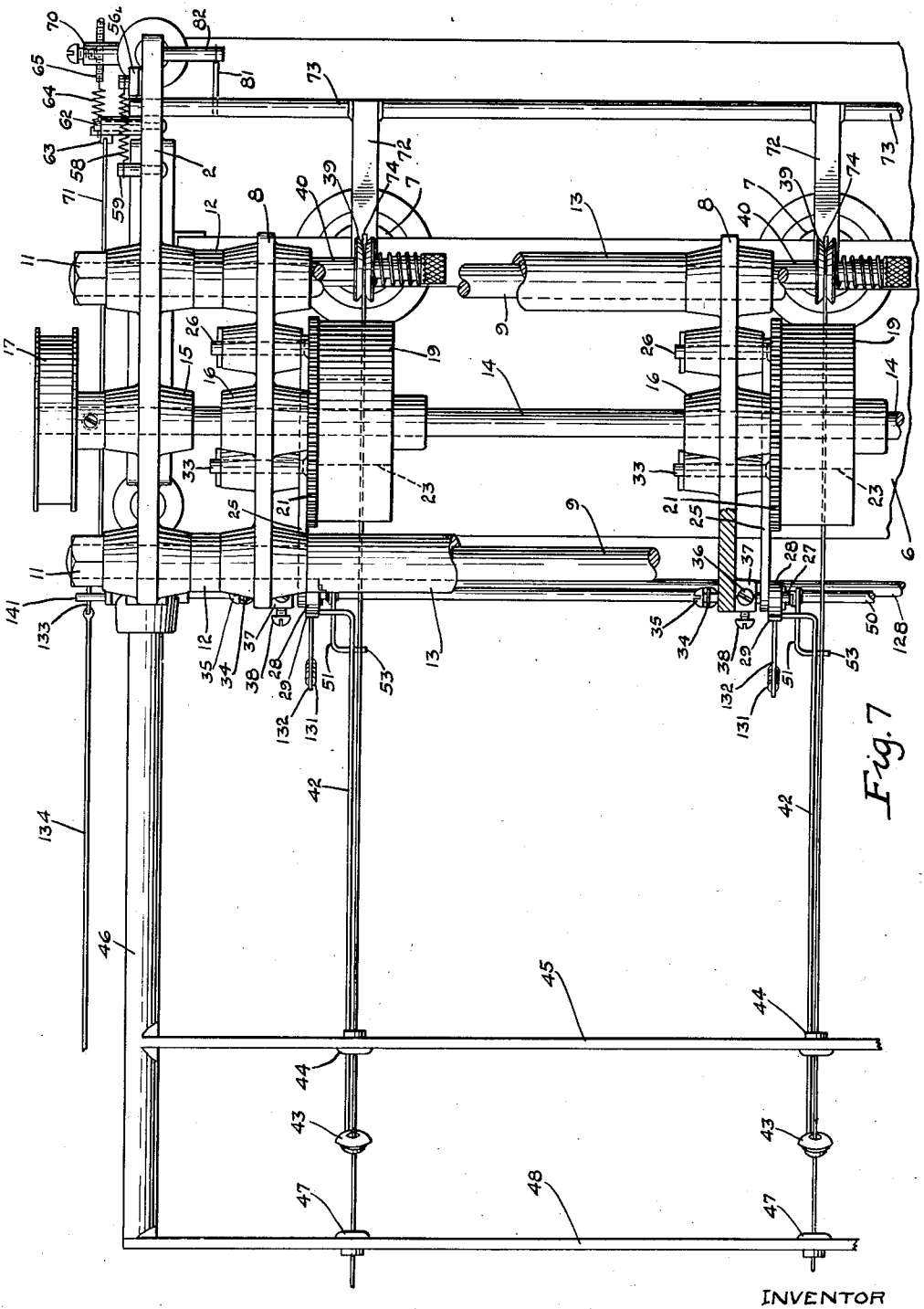


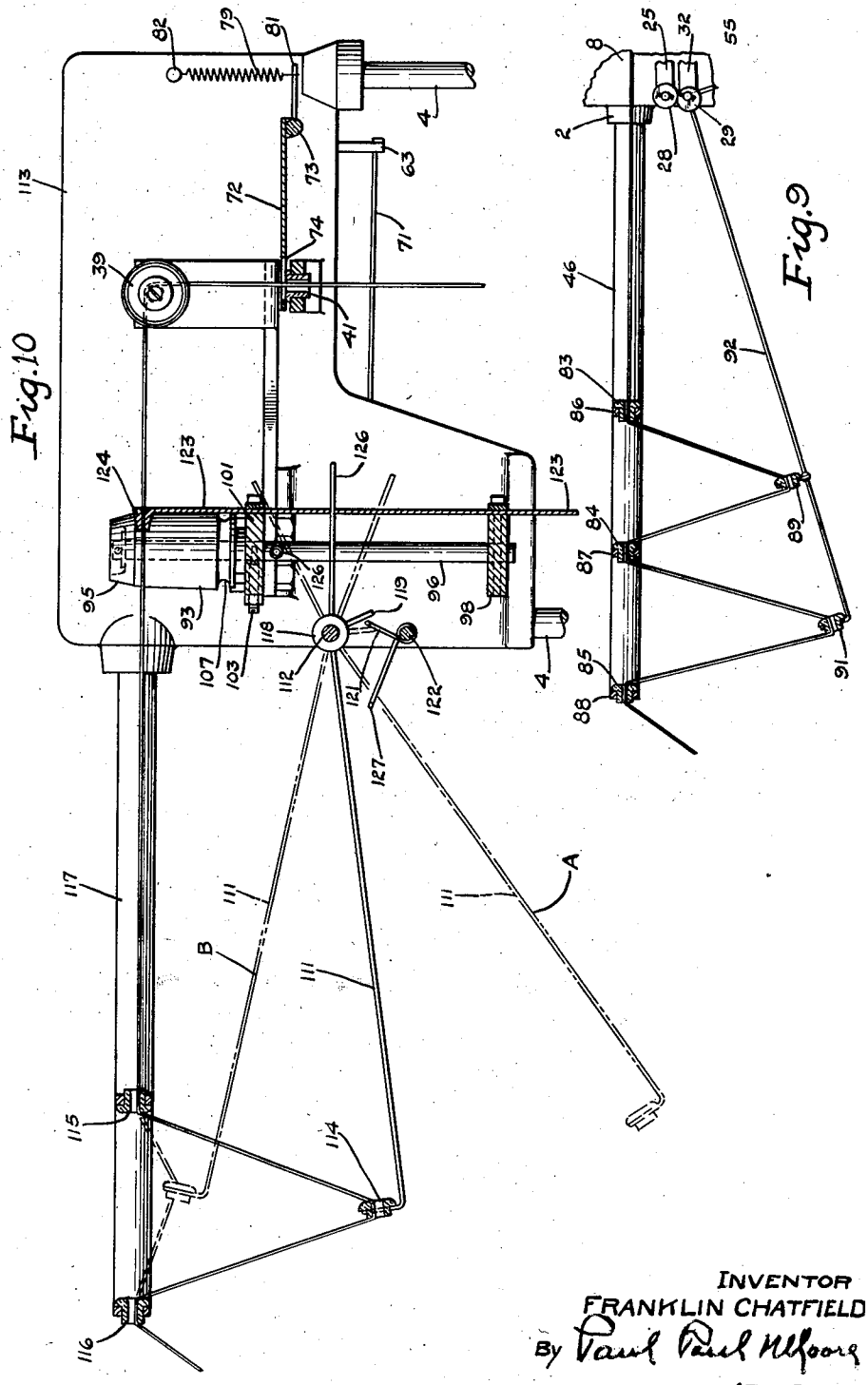
Fig. 7

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THREAD FEEDING MECHANISM

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THREAD FEEDING MECHANISM

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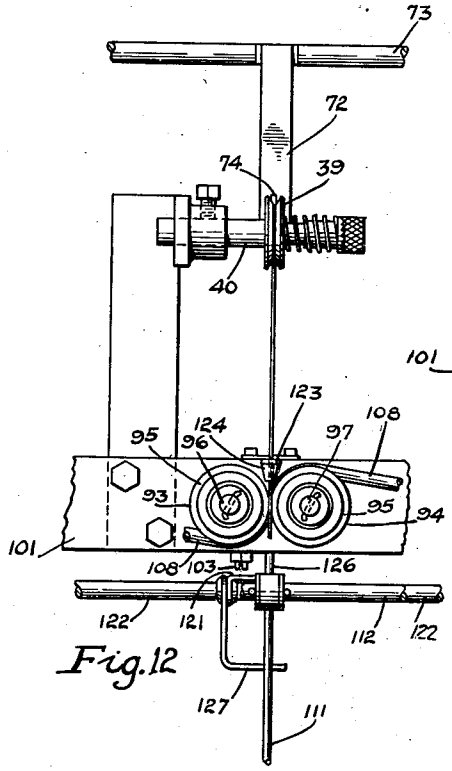


Fig. 12

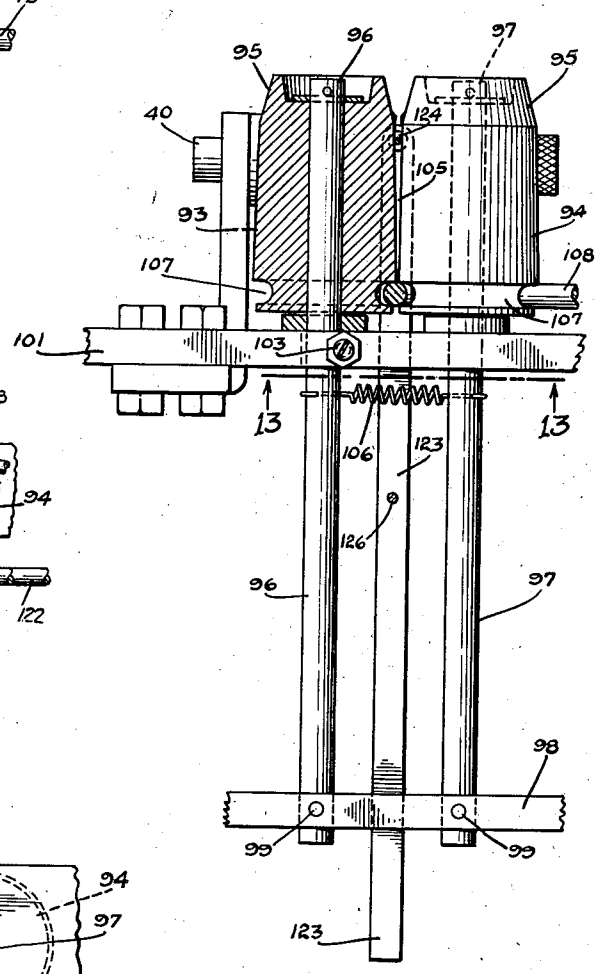


Fig. 11

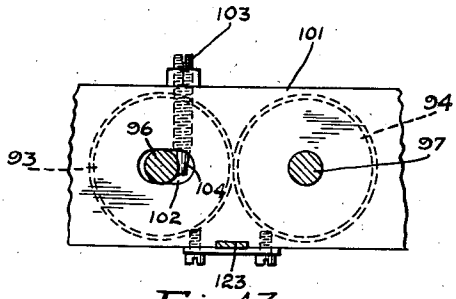


Fig. 13

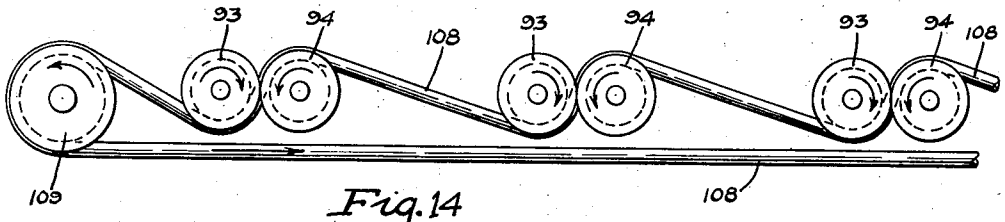


Fig. 14

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Patented Dec. 10, 1935 2,023,515

UNITED STATES PATENT OFFICE

2,023,515

THREAD FEEDING MECHANISM

Franklin Chatfield, Minneapolis, Minn., assignor to The Munsingwear Corporation, Minneapolis, Minn., a corporation of Minnesota

Application October 24, 1932, Serial No. 639,248

14 Claims. (Cl. 66—132)

This invention relates to new and useful improvements in thread feeding mechanisms.

To produce an even fabric made of elastic threads or material, and particularly when a plurality of threads are being simultaneously knitted into the fabric, it is essential that some method be used that will deliver all of the threads to the fabric-making machine at an even tension. In the mechanism herein disclosed, a separate tension device is provided for each thread, and each such tension device comprises two or more relatively fixed guides through which the threads are fed, and suitable weighted members of uniform weight, have running connections with the threads between said fixed guides and are floatingly supported thereon whereby the tension in said threads will be equalized, and whereby said tension may well be termed a floating tension.

An object of the invention is to provide a thread feeding mechanism adapted for use to feed a thread from a holder and delivering it to a suitable receiving means at a predetermined tension.

A further object is to provide a mechanism for feeding a plurality of threads, yarns, and like materials from a holder and delivering them to a suitable receiving means, such as a knitting machine, at a predetermined tension.

A further object is to provide a thread feeding and tensioning mechanism comprising means for feeding threads from a plurality of holders to a suitable receiving means at a predetermined tension, and whereby the tension in the various threads will be equalized.

A further object is to provide a mechanism adapted for use in connection with a fabric-making machine to feed a plurality of threads thereto at a predetermined tension, and whereby the tension in the various threads will be equalized, and said mechanism having an operative connection with the clutch operating mechanism of the machine whereby, when a portion of thread in abnormal condition passes through said feeding mechanism, the latter will be actuated to cause said clutch operating mechanism to automatically interrupt the operation of the fabric-making machine.

A further object is to provide a threaded feeding and tensioning mechanism adapted for automatically feeding a plurality of threads to a knitting machine at a predetermined and equalized tension, and said mechanism comprising a stop device having an operative connection with the knitting machine, and including a plurality of pivoted members through which the threads pass from the usual thread holders, and said pivoted members being adapted to be actuated by knots, snarls, or other defects in the threads, whereby said stop device will be actuated and thereby automatically cause interruption of the knitting machine.

A further object is to provide a mechanism of the class described comprising a plurality of pairs of feed rolls adapted to feed threads or yarns to a knitting machine, and a pivoted thread tension member being operatively associated with each pair of rollers and having a running connection with the thread fed therefrom, whereby said members will be actuated and thereby control the thread-feeding action of said rollers, and said thread tension member also being operatively connected with a stop device which, in turn, is connected with the usual clutch control mechanism of the knitting machine, whereby when an abnormal movement is imparted to said tension member in either direction, said stop device will be actuated to cause operation of said clutch control mechanism whereby the knitting machine and said feeding and tensioning mechanism will automatically come to rest.

A further object is to provide a mechanism of the class described comprising a plurality of feed rollers arranged in pairs, and each pair being adapted to feed a thread from a suitable holder to a knitting machine, and one roller of each pair of rollers being mounted for movement towards and away from its complemental roller to control the feeding of the thread therefrom, and a plurality of cams being provided for relatively moving said movable rollers, and each cam having a member connected therewith which has running connections with the threads fed from said rollers, whereby said members may be actuated by the threads and thereby control the thread-feeding action of said feed rollers, and a stop device being operatively connected with the usual clutch control mechanisms of the knitting machine and comprising an arm having a dog normally retaining it in inoperative position, and said dog being adapted to be actuated by an abnormal movement of any one of said members, whereby said arm will be released and cause actuation of said clutch control mechanism with the resultant interruption of the knitting machine and said feeding and tensioning mechanism.

A further object is to provide a thread feeding and tensioning mechanism comprising a plurality of feed rollers, and each pair of said rollers being adapted to feed a thread from a suitable holder towards a suitable receiving means such as a knitting machine, and a pivoted thread tension

member being provided for each thread and adapted to be actuated by variations in the tension in said threads to cause the threads to be delivered to the knitting machine at a predetermined tension, and means also being provided in connection with said tension members for automatically increasing the tension in the threads at intervals.

A further object is to provide a thread feeding and tensioning mechanism comprising a plurality of thread feeding units having a common drive, and said units being adapted to independently control the feeding of the threads from suitable holders and delivering them at a predetermined tension to a suitable receiving means, and whereby the tensions in the various threads will be substantially equalized.

A further object is to provide a feeding and tensioning mechanism for feeding elastic threads from a holder and delivering them to a suitable receiving means at a predetermined tension, and having means for substantially equalizing the stretch of said threads when delivered to the receiving means.

A further object is to provide a thread feeding and tensioning mechanism comprising a pair of feed rollers having means associated therewith for automatically separating them when a knot, snarl, or other defect in the thread passes through the feeding mechanism, whereby the thread will not be cut as it passes between said rollers, and means also being provided for actuating said rollers to automatically control the feeding of the thread therefrom to the knitting machine.

Other objects of the invention will appear from the following description and accompanying drawings and will be pointed out in the annexed claims.

In the accompanying drawings, there has been disclosed a structure designed to carry out the various objects of the invention, but it is to be understood that the invention is not confined to the exact features shown as various changes may be made within the scope of the claims which follow.

In the drawings:

Figure 1 is a diagrammatic view showing the thread feeding and tensioning mechanism operatively connected with a knitting machine of conventional form;

Figure 2 is an enlarged detail view, partially in section, showing the pivoted thread tension member and the stop mechanism provided for automatically interrupting operation of the knitting machine, in the event of abnormal feeding of the thread through the mechanism, and also showing the arm of the stop device in its normal position in engagement with the locking dog thereof;

Figure 3 is a detail view showing the member or arm of the stop device released, whereupon the connection between said arm and the clutch control mechanism of the knitting machine has been actuated to automatically render the knitting machine and the feeding mechanism inoperative, and also showing one of the pivoted members being actuated by a knot or slug in the thread to thereby cause the dog to be actuated to release the stop arm;

Figure 4 is a vertical sectional view, partially in elevation, showing the parts in their normal operative positions;

Figure 5 is a vertical sectional view on the line 5—5 of Figure 5, showing only a portion of the mechanism;

Figure 6 is a sectional plan view substantially on the line 6—6 of Figure 4, showing one of the pivoted members through which the threads pass from the holder to the feed rollers of the thread feeding mechanism;

Figure 7 is a plan view of Figure 4, showing only a portion of the mechanism;

Figure 8 is a detail sectional view on the line 8—8 of Figure 1, showing the arm adapted to be actuated by the usual cam wheel of the knitting machine to cause the automatic operation of an auxiliary tensioning means provided in connection with the thread tensioning mechanism;

Figure 9 is a detail view showing a tension arm particularly applicable for light, fine threads;

Figure 10 is a vertical sectional view showing a modified construction;

Figure 11 is a detail elevational view partially in section showing the arrangement of the feed rollers illustrated in Figure 10;

Figure 12 is a plan view of Figure 10 on a smaller scale;

Figure 13 is a horizontal sectional view on the line 13—13 of Figure 11, showing a means for relatively adjusting one of the feed rollers with respect to its complemental roller; and

Figure 14 is a diagrammatic view illustrating a means for driving the feed rollers of the construction illustrated in Figure 10.

The novel thread feeding and tensioning mechanism herein disclosed is shown comprising a pair of end frames 2 which may be supported upon suitable uprights 3, as indicated in Figure 1. Suitable rods 4 are shown having their upper ends secured to the end frames 2 and have their lower ends secured to cross members 5 adapted to support a suitable plate 6, upon which the usual thread holders 7 are mounted in the usual manner.

When this novel thread feeding and tensioning mechanism is used in connection with a circular knitting machine, a separate mechanism is provided for each thread whereby each thread delivered to the knitting machine will be provided with an independent feeding and tensioning mechanism. These mechanisms preferably have a common drive, but their thread-feeding actions are independently controlled by the travel of the threads therethrough, so that they may operate independently of one another whereby all of the threads may be delivered to the knitting machine at a predetermined tension and also whereby the tension in all of the threads fed to the knitting machine may be substantially equalized. As the thread feeding and tensioning mechanism for each thread is assembled as a unit, and because of the several units being alike in construction, but one such unit will be described in detail.

Each unit comprises a bracket 8, shown secured to a pair of rods 9 having their ends suitably secured in the end frame members 2 by such means as nuts 11, received in threaded engagement with the ends of the rods, as shown in Figure 7. Suitable spacing sleeves 12 and 13 may be provided upon the rods 9 between the end frame members 2 and the adjacent brackets 8, and also between adjacent brackets, whereby the entire apparatus may be secured together as a unitary structure.

A shaft 14 is mounted in suitable bearings 15 provided in the end frames 2, and also passes through alined bearings 16 provided in the brackets 8 of said units. A suitable pulley 17 is shown

secured to one end of the shaft 14 whereby the shaft may be driven by means of a belt 18 connected with a suitable source of power, not shown.

Each unit has a feed roller 19 secured to the shaft 14 for rotation therewith. The roller 19 is shown provided at one end with a gear 21 which meshes with a pinion 22 provided at one end of a relatively smaller feed roller 23, rotatably mounted upon a stud 24 secured to an arm 25 supported at one end upon a pivot 26 secured to the bracket 8. A pin 27 is secured to the opposite end of the arm 25 and has a small antifriction wheel 28 mounted thereon which peripherally engages a cam wheel 29 secured to a pin 31 provided upon one end of an arm 32, the opposite end of which is pivotally supported upon the bracket 8 by means of a pivot 33. The opposite end of the pin 31 projects laterally from the arm 32 and has one end of a spring 34 connected therewith. The opposite end of the spring 34 is connected to a screw or pin 35 secured to the bracket 8, whereby a force will constantly be exerted upon the arm 32 to move the roller 23 into peripheral engagement with the roller 19. An adjusting screw 36 is received in threaded engagement with a lug 37 provided upon th bracket 8, and has its lower end positioned to be engaged by the pin 31 to thereby limit the upward movement of the roller 23. A suitable lock screw 38 provides means for locking the adjusting screw 36 in adjusted position. By means of the adjusting screw 36, the gap between the peripheries of the feed rollers 19 and 23 may be varied to adapt the apparatus for feeding threads of different diameters or sizes.

A pair of thread tensioning disks 39, of ordinary construction, are shown supported upon a stud 40 directly back of the feed rollers 19 and 23, and between these tension disks the thread is fed from the thread holder 7, shown in Figure 1. A suitable guide 41 is shown positioned between the tension disks 39 and the thread holder 7, as will be noted by reference to Figure 4.

Means is provided for automatically moving the feed roller 23 towards and away from the feed roller 19 to automatically control the feeding of the thread from said rollers. Such means is shown consisting of a tension arm 42 having one end secured to the cam 29 and having its opposite end provided with an eye or guide 43 through which the thread passes from a similar guide 44 provided upon a supporting member 45 having its ends supported by suitable means such as rods 46, secured to the end frame members 2, as will readily be understood by reference to Figures 2, 4, and 7. A similar guide 47 is secured in a similar supporting member 48 which also is supported by the rods 46, as shown in Figure 7. The guides 44 and 47 are substantially horizontally alined with the gap between the feed rollers 19 and 23, and the movable guide 43 carried by the tension arm 42 is arranged as shown in Figure 4, so that the thread feeds from the feed rollers through the guide 44, thence downwardly through the guide 43 of the tension arm 42, and then through the guide 47, from which it leads to the usual knitting machine, generally indicated by the numeral 49 in Figure 1.

Small weights 40' may be suitably mounted upon the arms 42, as shown in Figure 4, whereby the effective weights of said arms may be varied according to the tension desired.

Means is provided for automatically interrupting the operation of the knitting machine in the event that the thread is in abnormal condition when it passes through the thread feeding and tensioning mechanism as, for example, if it contains a defect such as a knot or snarl. In other words, should the thread accidentally break, or should it become entangled with a portion of the mechanism as a result of having a knot or snarl therein, then the thread feeding mechanism will be actuated to automatically cause interruption of the knitting machine, which will remain inoperative until an attendant has removed the trouble and restored the thread to its normal condition. The means provided for thus interrupting the operation of the knitting machine is shown comprising a shaft 50 mounted in the end frame members 2 and having a member secured thereto provided with oppositely extending arms 51 and 52, the former having an off-set end portion 53 positioned in the path of the tension arm 42 so that, in the event that the latter drops to the dotted line position A in Figure 4, it will engage and actuate the arm 51 and thereby relatively rotate the shaft 50 in its bearings. The opposite arm portion 52 has an off-set end portion 54 adapted to be engaged by a pin 55 secured to the cam 29, when the tension arm 42 is raised to the dotted line position B in Figure 4. It will thus be seen that when the tension arm moves to either of its extreme positions A or B, as indicated in Figure 4, the shaft 50 will be rocked in its bearings to thereby cause actuation of a stop device which is next to be described. It is to be understood that when the mechanism is operating normally, the tension arm 42 usually has a relatively short movement at a point substantially midway between the extreme positions A and B, and does not reach said extreme positions unless an abnormal condition occurs in the feeding of the thread through the mechanism.

The stop device is best shown in Figures 2 and 3 and comprises an arm 56 mounted for pivotal movement upon a stud 57 secured to one of the end frame members 2. A spring 58 is shown having one end connected to the upper end of the arm 57 and has its opposite end connected to a pin 59 secured to the frame 2, whereby the spring constantly tends to swing the lower portion of the arm 56 from the position shown in Figure 2 to that shown in Figure 3. A dog 61 is supported upon a pivot 62 and has an arm 63 extending downwardly from the pin 62 to which one end of a spring 64 is connected, the opposite end of which is secured to an adjusting screw 65, mounted in a stud 70 secured to the end frame 2. The spring 64 constantly tends to move the dog 61 into locking engagement with the lower end of the arm 56 and normally retains it in the position shown in Figure 2.

The arm 56 is operatively connected with the usual clutch control mechanism of the knitting machine, generally indicated by the numeral 66 in Figure 1. This clutch control mechanism is shown provided with a pivoted arm 67 which, when moved to the dotted line position indicated, will cause the clutch operating mechanism of the knitting machine to become inoperative, whereupon the knitting machine will come to rest. The clutch control mechanism is well-known in the knitting machine art and it is therefore thought unnecessary to herein show and describe the same in detail. In order that the arm 67 of the clutch control mechanism may be actuated when the arm 56 of the stop device is operated, these two arms are shown operatively connected together by a suitable connection 68 which may be in the

form of a light cord or thread, as very little effort is required to actuate the arm 67 of the clutch control mechanism.

To cause actuation of the arm 56 of the stop device, the dog 61 is operatively connected with the shaft 50 by means of an arm 69 having a connection 71 connecting it with the depending arm 63 of the dog 61. By thus connecting the dog 61 with the shaft 50, when the latter is rotated as a result of the tension arm 42 engaging one or the other of the off-set arm portions 53 or 54, said dog will be moved out of engagement with the lower end of the arm 56, whereupon the spring 58 will cause the arm to be moved to the position shown in Figure 3, with the result that the arm 67 of the clutch control mechanism will be actuated to cause interruption of the knitting machine. In practice, the thread feeding and tensioning mechanism is preferably driven from a suitable pulley provided upon the knitting machine so that when the latter is interrupted, the thread feeding and tensioning mechanism will also come to rest.

By thus operatively connecting the shaft 50 with the dog 61, it will be noted that whenever the tension arm 42 moves to the position indicated at A in Figure 4, which might result if the thread should accidentally break, or the end of the thread pass through the feed rollers 19 and 23, then the arm 56 will be released, whereupon the clutch control mechanism of the knitting machine will be actuated to interrupt the latter. In like manner, if the tension arm 42 is moved to the dotted line position B, which might occur if the thread should become entangled so as to cause an abnormal pull to be exerted thereon, then the arm 56 will again be released to cause interruption of the entire apparatus. It will thus be seen that if the thread breaks, or an abnormal pull is exerted thereon, the tension arm 42 will be actuated to cause the release of the arm 56, whereupon the clutch control mechanism of the knitting machine will be operated to automatically interrupt operation of the knitting machine.

Means is also provided for interrupting the knitting machine and the thread feeding and tensioning mechanism in the event that the thread becomes snarled or kinked between the thread holder 7 and the tension disks 39. Such means is best shown in Figures 2, 3, and 4 and comprises a pivoted member 72 secured to a shaft 73 having its end portions supported in suitable bearings provided in the end frame members 2. The member 72 has a key slot 74 at its outer end, through which the thread passes from the guide 41, as clearly illustrated in Figures 3, 4, and 6. The reduced portion of the key slot 74 is normally positioned directly over the opening in the guide 41 so that the thread normally passes therethrough. Should the thread contain a knot, or a snarl, or a kink, as indicated at 75 in Figure 3, then the pivoted member 72 may be elevated because of said knot, snarl, or kink being unable to pass freely through the slot 74 provided in the member 72. Such actuation of the member 72 will cause the shaft 73 to be rocked in its bearings which, in turn, will depress the dog 61 and cause the release of the arm 56, as shown in Figure 3. By reference to this figure, it will be noted that one end of the shaft 73 is cut away to provide a cam face 76 which will engage and actuate the dog 61 when the shaft is rocked in its bearings, as will be clearly understood by reference to Figure 3.

To permit free movement of the dog 61, when actuated by the shaft 73, the connection 71 between the lower end of the arm 63 of the dog and the arm 69 secured to the shaft 50, has a sliding connection with the arm 63, whereby the dog may be readily actuated by the cam face 76 of the shaft 73, when a knot in the thread engages the pivoted member 72. Suitable stops 77 and 78 may be provided to limit the swinging movements of the arm 56 and dog 61, respectively, as shown in Figure 2.

The shaft 50 extends the full width of the mechanism and supports all of the arms 51 and 52 of the thread feeding and tensioning units, so that regardless of which thread breaks or becomes unnecessarily taut, the knitting machine will be automatically interrupted. In like manner, all of the pivoted members 72 are supported upon the shaft 73 so that regardless of which one is actuated, the arm 56 will be released to cause the actuation of the clutch control mechanism and the resultant interruption of the knitting machine and the thread feeding and tensioning mechanism. A suitable spring 79 is shown having one end connected to a pin 81 secured to the shaft 73, and having its opposite end connected with a pin 82, which may be secured to one of the end frames 2. The spring 79 acts to constantly hold the members 72 in engagement with their respective guides 41, as shown in Figure 4.

The novel thread feeding and tensioning mechanism herein disclosed has been found very useful in connection with knitting machines to control the feeding of the thread or yarn thereto, as it provides means for positively controlling the tension of the thread or yarn so that it will be delivered to the knitting machine at a predetermined tension. It has also been found particularly applicable for handling elastic threads or yarns such as are now commonly used in the manufacture of various kinds of knit fabrics. Such elastic threads or yarns are more or less difficult to feed to the knitting machine so that they will be delivered thereto at a predetermined tension, because of the inherent characteristic of the thread to stretch. The construction of the thread feeding and tensioning mechanism herein set forth is such that the mechanism readily lends itself for use to feed such threads to a knitting machine, or other receiving means, at a predetermined tension, and also whereby the tension in all of the various threads delivered to the receiving means may be equalized. The mechanism is very sensitive in operation and is controlled entirely by the traveling movement of the thread therethrough.

When handling very light and delicate threads or yarns, it is sometimes desirable that additional means may be added in connection with the mechanism hereinbefore described, whereby any excess slack or looseness which may appear in the thread as a result of kinks or loops, and which may accidentally pass through the machine, may be taken up automatically, so that the thread may be delivered to the knitting machine or other receiving means at a predetermined tension.

In Figure 9 I have shown a device capable of taking up excess slack or looseness in the thread after it leaves the feed rollers 19 and 23. Such means consists of providing a plurality of guides or eyes 83, 84, and 85 upon suitable supporting members 86, 87, and 88 and have their ends suitably secured to the supporting rods 46 in the manner shown and described with reference to the members 45 and 48, shown in Figure 7. The

guides 83, 84, and 85 are spaced apart as shown, and a plurality of similar guides 89 and 91 are secured to a tension arm 92 which is secured to the cam 29 in the same manner as the tension arm 42 shown in Figure 4. The thread or yarn is threaded through the guides 83, 84, 85, 89, and 91 in the manner shown in Figure 9, whereby the amount of slack taken up by the oscillatory movement of the arm 92 will be substantially equal to twice that taken up by the movement of the tension arm 42, shown in Figure 4.

Figures 10 to 14, inclusive, illustrate a modified construction wherein the horizontally disposed feed rollers 19 and 23 have been eliminated and, in lieu thereof, a pair of vertically disposed feed rollers 93 and 94 have been provided. The feed rollers 93 and 94 preferably have their peripheries slightly tapered, as clearly illustrated in Figure 11, and have their upper corners beveled off, as indicated at 95. The rollers 93 and 94 are shown rotatably mounted upon the upper ends of rods 96 and 97, the lower ends of which are received in suitable apertures provided in a supporting bar 98, and in which apertures the rods are secured by suitable pins 99. The upper ends of the rods are supported in a suitable bar 101 which, like the bar 98, has its ends suitably secured to a pair of end frame members 113. The rod 97 is preferably immovably supported in the bars 98 and 101, and the rod 96 has its upper end guidingly supported in a slot 102 provided in the supporting bar 101, whereby the rod 96 may be relatively moved in a direction towards or away from the fixed rod 97. A suitable set screw 103 is received in a threaded socket provided in one edge of the supporting bar 101 and has a tapered terminal 104 engaging the rod 96 to thereby limit the movement thereof in a direction towards the fixed rod 97, as shown in Figure 13. By relatively rotating the adjusting screw 103, the gap 105 provided between the rollers 93 and 94 may be varied to accommodate the feeding mechanism for different sizes of threads. A suitable spring 106 is interposed between the upright rods 96 and 97 and normally holds the rod or shaft 96 in engagement with the terminal 104 of the adjusting screw 103. In the present instance, the rollers 93 and 94 are shown provided with annular grooves 107 adjacent their lower ends adapted to receive a belt 108 which may be driven by a pulley 109 provided with a suitable driving means, not shown. If desired, the rollers 93 and 94 may be driven by other suitable means, such as gearing, in lieu of the belt 108.

A tension arm 111 is secured to a shaft 112 having its ends supported in the end frame members 113, and this tension arm has a guide 114 at its outer end adapted to receive the thread from a guide 115. From the movable guide 114, the thread passes through a guide 116, from whence it leads to the knitting machine. The guides 115 and 116 are supported between horizontal rods 117 in a manner similar to the guides 45 and 47, shown in Figure 4.

In the form shown in Figures 10 and 11, the tension arm 111 has its inner end secured to a suitable hub 118 which is bored to receive the shaft 112. A pin 119 is also secured to the hub 118 and is adapted to engage an offset arm 121 secured to a shaft 122. The offset arm 121 may be made from a suitable wire coiled about the shaft 122 and has an opposite end portion 127 projecting outwardly and normally positioned to be engaged by the tension arm 111, when the latter moves to the dotted line position A in Figure 3. The shaft 122 is connected to a stop device similar to that shown and described with reference to the previous figures.

The means for guiding the thread into the gap between the vertical feed rollers 93 and 94 is clearly shown in Figure 10, and comprises a vertically disposed member 123 having a head 124 apertured to receive the thread. The member 123 is adapted for up-and-down movement, which movement is controlled entirely by the oscillations of the tension arm 111. To thus control the operation of the member 123, the latter is provided with a suitable aperture adapted to receive one end of a pin 126 having its opposite end secured to the periphery of the hub 118 secured to the shaft 112. Because of the pin 126 being secured to the hub 118, each time the latter is relatively moved by the action of the tension arm 111, a vertical movement will be imparted to the member 123 which will cause the thread to be relatively moved up or down as it is guided between the feed rollers 93 and 94, whereby the feeding action of the thread through the mechanism is controlled. The thread, before reaching the head 124, passes through the guide 41, pivoted member 72, and tension disks 39, as shown in Figure 10. The member 72, as hereinbefore stated, is provided with a key slot 74, and the thread normally passes through the restricted portion of said slot, so that when a portion of thread contains a knot, snarl, or other defect, said knot or snarl will engage the pivoted member 72 and swing it upwardly to the position shown in Figure 3, whereupon the clutch control mechanism of the knitting machine will be automatically actuated by the release of the arm 56, as hereinbefore described.

The result obtained by the operation of the mechanism shown in Figures 10 to 14, inclusive, is substantially the same as that obtained by the use of the mechanism disclosed in the previous figures. In the construction shown in Figures 10 to 14, the feed rolls 93 and 94 are not adapted for relative movement towards and away from one another during the normal operation of the machine. In the construction here shown, to obtain the desired feeding action of the thread, the latter is moved in a vertical plane between the peripheries of the two feed rollers by the oscillatory movement of the tension arm 111. Thus, when the thread feeding from the feed rolls becomes a little taut, the tension arm 111 may be moved upwardly to the dotted line position B whereupon the head 124 of the member 123 will be moved downwardly and cause the thread to become frictionally engaged with the peripheries of the constantly rotating feed rollers 93 and 94, as a result of the peripheries thereof being tapered.

When the thread is thus moved into frictional engagement with the rollers 93 and 94, it will be positively fed in a direction towards the guides 115 and 116, whereby the thread may be automatically delivered to the knitting machine or other receiving means, at a predetermined tension. Should the thread accidentally become broken in passing through the feeding and tensioning mechanism, then the tension arm 111 will drop to the dotted line position A and engage the arm 127 secured to the shaft 122, thereby causing the stop device to be actuated in the manner shown and described with reference to the previous figures. In like manner, when the tension

arm 111 is moved upwardly to the dotted line position B, the pin 119 will engage the arm 121 which also will cause the shaft 122 to be rocked in its bearing, with the result that it will cause the dog 61 to move out of engagement with the arm 56 and cause the clutch control mechanism of the knitting machine to be actuated to render said machine inoperative.

In the manufacture of knit fabrics, it is desirable at times to vary the tension in the threads, and in the mechanism herein disclosed, I have provided means whereby the tension may be automatically varied periodically during the operation of the knitting machine. To thus automatically increase the tension in the thread, there is shown in Figures 1, 2, and 4, a device adapted to exert a slight downward force upon the tension arm 42 to thereby increase the tension in the thread as it passes through the guide 43 at the outer end of said arm.

The device above referred to, is shown comprising a shaft 128 mounted in suitable bearings provided in the end frame members 2. A small arm 129 is secured to the shaft 128 and has a spring 131 connecting it with an arm 132, shown secured to the cam 29 to which the tension arm 42 is secured. A small rod or arm 133 is secured to one end of the shaft 128 and has a connection 134, which may be in the form of a small cord or thread, connecting it with an arm 135 provided upon the knitting machine 49. The connection 134 is shown passing through an eye 136 provided upon the frame 137 of the knitting macine, diagrammatically indicated in Figure 8.

The arm 135 is adapted to be actuated by a series of cams 137 provided upon a cam wheel 138 secured to a shaft 139 adapted to be intermittently actuated by the usual well-known ratchet mechanism of the knitting machine. The arm 135 is yieldingly maintained in engagement with the cam wheel 138 by a suitable spring, not shown. The spring for holding the arm 135 in a position to cause the cam wheel on the lower end of the arm 135 to ride on the periphery of the cam wheel 138, is a part of the knitting machine and is well-known and it is therefore thought unnecessary to herein show and describe the same. The operation of the shaft 139 is controlled by movement of the usual pattern chain 140, and by means of the cams 137, the arm 135 may be caused to operate at intervals to exert a slight downward force upon the tension arm 132, whereby the tension in the thread is increased. The arm 135, cams 137, cam wheel 138, shaft 139, and pattern chain 140, are well-known in the knitting machine art, and it is therefore thought unnecessary to herein show and describe the same in detail.

The mechanism above described for automatically increasing the tension in the thread periodically, readily lends itself for use in connection with the novel thread feeding and tensioning mechanism herein disclosed, and cooperates therewith to provide a mechanism which is capable of positively delivering the thread to the knitting machine at a predetermined tension, and whereby the tension of the various threads delivered to the knitting machine may be substantially equalized, and also whereby the tension in the threads may be automatically increased from time to time, depending upon the arrangement of the cams 137 upon the cam wheel 138.

I claim as my invention:

1. A thread feeding mechanism adapted to feed a thread from a holder to a suitable receiving means at a predetermined tension, said mechanism comprising a pair of cylindrical feed rollers, a pivoted arm supporting one of said rollers, a cam element for actuating said arm to control the feeding action of the rollers upon the thread, and a tension member secured to said cam element and having a running connection with the thread, whereby variation in the tension of the thread will oscillate said arm and thereby control the feeding action of the rollers.

2. A thread feeding mechanism adapted to feed a thread from a holder to a suitable receiving means at a predetermined tension, said mechanism comprising a pair of cylindrical feed rollers, an arm pivotally supported at one end and supporting one of said rollers, a cam element engaging the opposite end of said arm, and a tension member having one end secured to the element and its opposite end engaged with the thread, whereby the tension in the thread will oscillate said tension member and thereby actuate the arm to control the feeding action of the feed rollers.

3. A thread feeding mechanism adapted to feed a thread from a holder to a suitable receiving means at a predetermined tension, said mechanism comprising a frame, a pair of cylindrical feed rollers, an arm having one end pivotally supported on the frame and having its opposite end adapted for limited swinging movement, one of said feed rollers being carried by said arm intermediate its ends, a second arm having one end pivoted to the frame and disposed in substantially parallel relation to said first mentioned arm and having a cam element at its opposite end engaging the first mentioned arm, tension means yieldably holding said cam element in engagement with the upper arm, and a tension member secured to the cam element and having a running connection with the thread, whereby variations in the tension of the thread will cause actuation of the upper arm and thereby control the feeding action of the feed rollers.

4. A thread feeding mechanism adapted to feed a thread from a holder and delivering it to a suitable receiving means at a predetermined tension, said mechanism comprising a pair of cylindrical feed rollers, a movable tension member having a running connection with the thread and adapted to be actuated thereby to control the frictional feeding engagement of the rollers therewith, and yieldable means connected with said tension member and adapted to exert a pull thereon at intervals to thereby periodically vary the tension in the thread.

5. A thread feeding mechanism adapted to feed thread from a holder to a suitable receiving means at a predetermined tension, said mechanism comprising a pair of feed rollers between which the thread travels, a pivoted arm for supporting one of said feed rollers, a pivoted tension member having a running connection with the thread whereby variations in the tension or elasticity of the thread may oscillate said member, and eccentric means operatively connecting said tension member with said supporting arm, whereby oscillation of said tension member will cause the feed roller associated therewith to be moved into or out of feeding engagement with the thread, whereby the thread is delivered to the receiving means at a constant tension, regardless of inherent variation in the stretch or elongation of the thread.

6. The combination with a knitting machine

having a clutch control mechanism for controlling the operation thereof, of a thread feeding mechanism operatively connected with said knitting machine and comprising means for feeding a plurality of threads from holders and delivering them to said knitting machine at a predetermined tension, a stop device having an operative connection with said clutch control mechanism, a tension member for each thread, a shaft having an operative connection with said stop device, a plurality of elements secured to said shaft and each positioned to be engaged by one of said tension members, said tension members having running connections with said threads whereby variations in the tension of said threads will oscillate said tension members, independently of one another, said tension members being adapted to engage their respective elements, upon abnormal travel thereof in either direction, whereby said shaft will be operated to release said stop device and cause actuation of said clutch control mechanism and interruption of the knitting machine, and a second shaft having an operative connection with said stop device and provided with a plurality of arms each having a running connection with a thread, each of said arms being adapted to be actuated by a defect in the thread and thereby cause said shaft to rotate and operate said stop device with the resultant actuation of said clutch control mechanism and the subsequent interruption of the knitting machine.

7. In a thread feeding mechanism, a plurality of thread feeding units each comprising a pair of vertically disposed tapered rollers, shafts supporting said rollers, means whereby the spacing between the peripheries of said rollers may be varied, a guide for directing the thread between said rollers, a pivoted tension member for each unit having one end engaged with its respective thread and supported thereon, means connecting said tension members with their respective guide members, whereby the latter are moved with respect to the feed rollers, when said tension members are oscillated, thereby to vary the feeding action of the rollers upon the thread, and a drive for said units comprising a flexible element having running connections with the rollers of each unit, and whereby the rollers of each unit will rotate in opposite directions.

8. In a thread feeding mechanism, a plurality of substantially horizontally alined thread guides, a pair of tapered rollers interposed between certain of said guides, one of said guides being movable to relatively change the position of the thread in a direction lengthwise of said rollers, to thereby vary the feeding action of the rollers thereon, a pivoted tension member having one end floatingly engaged with the thread between others of said guides to thereby maintain the thread at a constant tension, means operatively connecting the tension member to said movable thread guide whereby movement of the tension member by the thread will cause movement of said movable guide, and a single flexible element for driving said rollers, in opposite directions.

9. The combination with a knitting machine having a clutch control mechanism for controlling the operation thereof, of a thread feeding mechanism operatively connected with said knitting machine and comprising a pair of vertically disposed tapered rollers between which and whereby a thread is fed from a suitable holder to the knitting machine, a guide for directing the thread between said rollers, a pivoted tension member having its swinging end engaged with and supported on the thread at a point between said rollers and the knitting machine, to thereby take up slack in the thread and maintain it at a constant tension, means operatively connecting said guide member with the tension member whereby said guide member is moved with respect to said rollers upon relative movement of the tension member in either direction, to thereby vary the feeding action of the rollers upon the thread, and a stop mechanism for actuating said clutch mechanism to interrupt operation of the knitting machine, upon an abnormal condition of the thread, said stop mechanism comprising a movable element having a slot therein through which the thread travels, and whereby a knot or other defect in the thread will cause actuation of said element, whereby said stop mechanism is actuated to automatically render the clutch control mechanism inoperative.

10. In a thread feeding mechanism for knitting machines, a pair of co-acting feed rolls between which the thread is fed, a pivoted arm for supporting one of said feed rolls, means for guiding the thread between said rolls, spaced guides for receiving the thread from said feed rolls, a tension member having a running connection with the thread between said spaced guides and floatingly supported thereon, said tension member having its opposite end suitably secured to an eccentric element having an operative connection with said supporting arm, whereby when the tension member is oscillated by variations in the tension of the thread, said eccentric element will actuate said arm to thereby vary the feeding action of said rolls upon the thread.

11. In a thread feeding mechanism for knitting machines, a pair of feed rolls operatively connected together for simultaneous operation, a pivoted arm for supporting one of said rolls and whereby the spacing between the peripheries of said rolls may be varied, means for guiding the thread between said rolls, spaced guides for receiving the thread from the rolls, a pivoted tension member having a running connection with the thread between said spaced guides, means at the pivotal support of said tension member adapted to oscillate said supporting arm when the tension member is oscillated by variations in the tension of the thread, relative movement of said supporting arm varying the spacing between said rolls, whereby the feeding action thereof on the thread is correspondingly varied, a stop mechanism on the knitting machine, and a trip for said stop mechanism comprising a pivoted arm having an aperture therein, through which the thread travels before being delivered to said feed rolls, said aperture being such that a defect in the thread will actuate said trip arm and thereby automatically release the trip and cause interruption of the knitting machine.

12. The combination with a knitting machine having a clutch control mechanism for controlling the operation thereof, of a thread feeding mechanism operatively connected with the knitting machine and comprising a pair of co-acting feed rollers for feeding the thread from a holder thereto at a predetermined tension, a pivoted arm having an operative connection with the clutch control mechanism, means for retaining said arm in a position to hold the clutch control mechanism in clutch operating position, a tension member operatively associated with the feed rollers and having a running connection with the thread, whereby variations in the tension of the thread will control the feed-

ing action of the feed rollers, and means connected to said arm retaining means and positioned to be engaged by the tension member, upon abnormal travel thereof in either direction, caused by an abnormal condition in the feeding action of the thread, whereby a defect or break in the thread may cause the tension member to operate said retaining means and release said arm, whereby the clutch control mechanism of the knitting machine is released to cause interruption of the knitting machine.

13. The combination with a knitting machine having a clutch control mechanism for controlling the operation thereof, of a thread feeding mechanism operatively connected with the knitting machine and comprising a pair of co-acting feed, rollers for feeding the thread from a holder thereto at a predetermined tension, a pivoted arm having an operative connection with the clutch control mechanism, a dog for retaining said arm in a position to hold the clutch control mechanism in clutch operating position, a tension member operatively associated with the feed rollers and having a running connection with the thread, whereby variations in the tension of the thread will control the feeding action of the feed rollers, a rock shaft having an operative connection with said dog, and oppositely disposed arms on the rock shaft positioned to be engaged by the tension member, upon abnormal travel thereof in either direction, caused by an abnormal condition in the feeding action of the thread, whereby a defect or break in the thread will cause the tension member to operate said retaining means and release said arm, whereby the clutch control mechanism of the knitting machine may operate to interrupt the knitting machine.

14. In a thread feeding mechanism, a pair of tapered feed rollers for feeding the thread from a holder to a suitable receiving means, a longitudinally movable member for guiding the thread between said rollers, and a tension member operatively connected to said guide member and having a running connection with the thread at a point between the feed rollers and said receiving means, said guide member being actuated by oscillatory movement of the tension member, caused by variations in the tension of the thread, whereby the guide member is relatively moved in an axial direction with respect to the rollers, to thereby increase or decrease the feeding action of the rollers upon the thread.

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