Feb. 3, 1959 N. G. LITZ 2,872,231

LOOP-FORMING MACHINE

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FIG. 1.

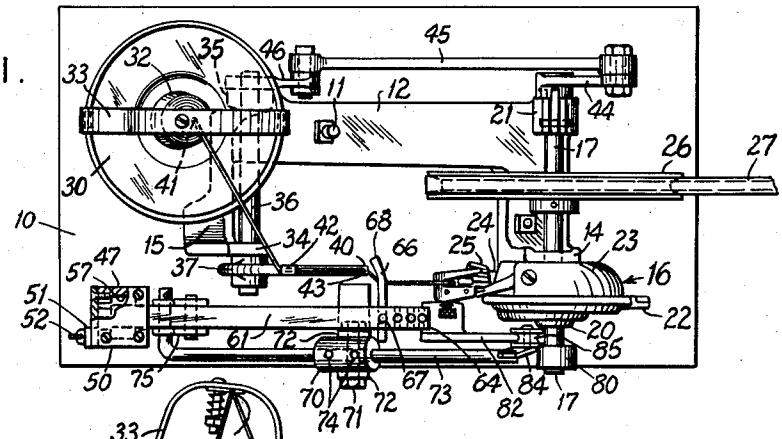


FIG. 2.

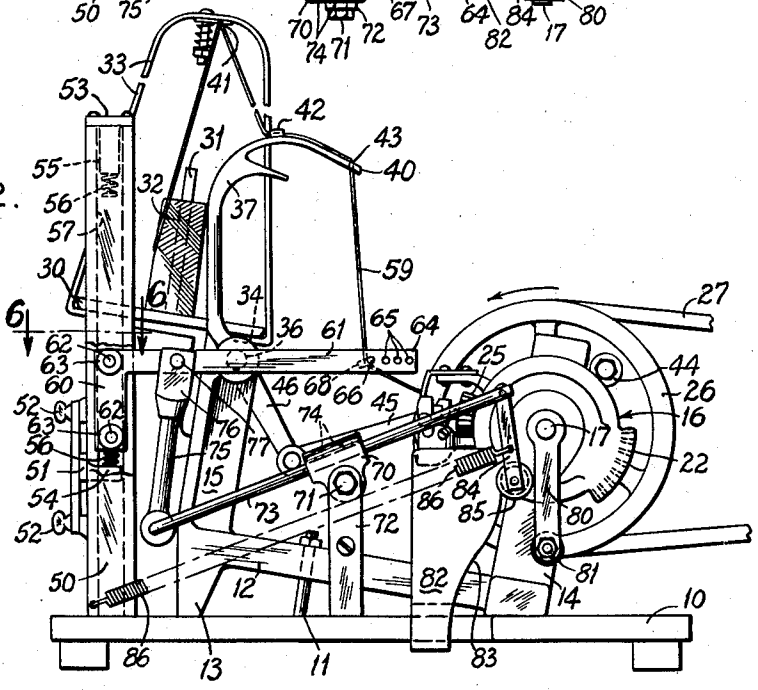
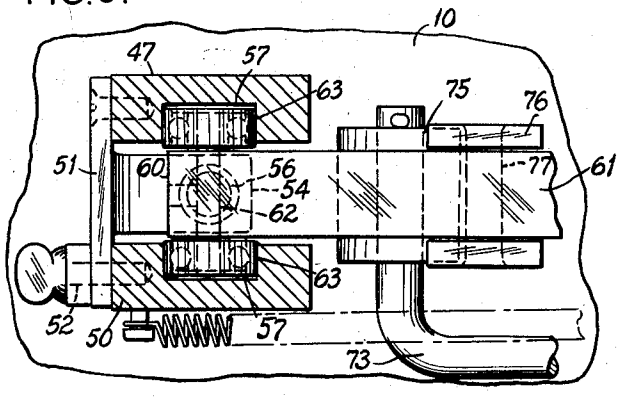


FIG. 6.



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LOOP-FORMING MACHINE

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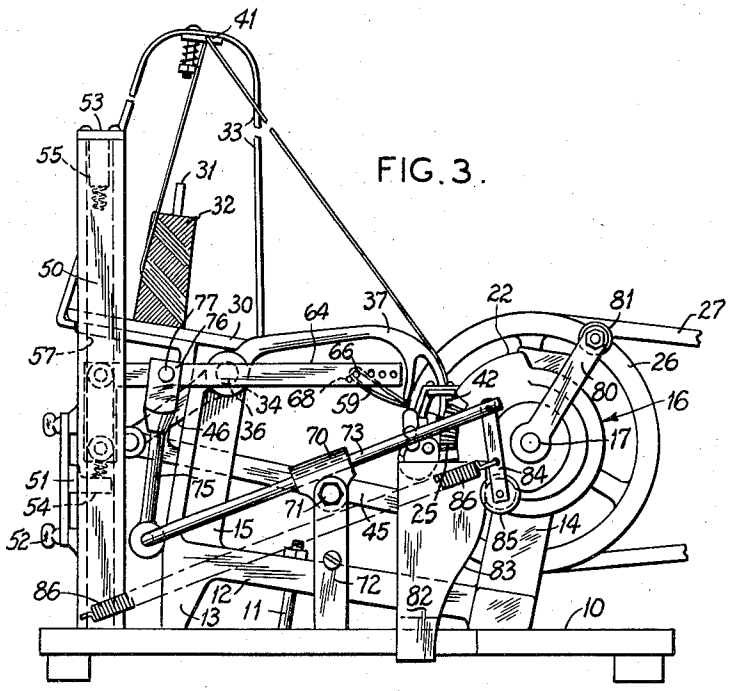


FIG. 3.

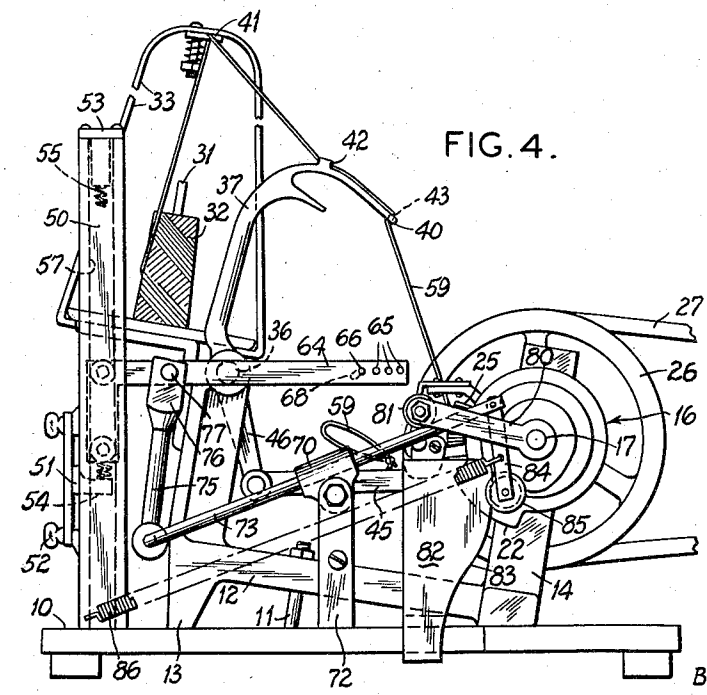


FIG. 4.

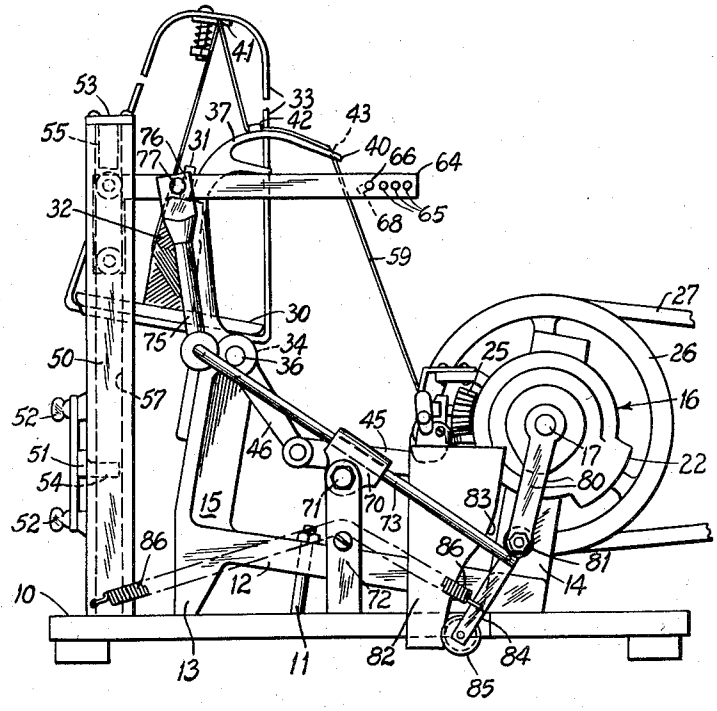
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LOOP-FORMING MACHINE

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FIG. 5.



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2,872,231

LOOP-FORMING MACHINE

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14 Claims. (Cl. 289—1)

This invention relates to improvements in a loop-forming machine.

It is an important objective of the present improvement to realize a machine that will form, knot and cut a loop of strand material, the pre-formed loops being particularly adapted for attachment to wearing apparel such as women's dresses, blouses and the like.

This invention incorporates a bundle-tying device manufactured by National Bundle Tyer Company, of Blissfield, Michigan, and sold under the trademark Saxmayer. The basic tying-and-cutting mechanism of this bundle tying device is disclosed in U. S. Patent No. 1,105,703, issued August 4, 1914, to A. H. Saxton, et al.

An important object is achieved by providing mechanism that cooperates with this known bundle tyer to form closed strand loops.

Another important object is to provide a loop-forming finger that engages the strand at a particular point in the cycle of operation of the above-mentioned tying device to form the loop, and to provide an improved mechanism for conditioning the finger automatically for subsequent loop-forming operation after each loop is formed and cut free.

Other important advantages are realized in providing an intermittent drive connection between the main drive shaft of the tying device and the finger mechanism for performing the above mentioned functional results.

Still another important object is achieved by providing an adjustable connection for the loop-forming finger which has the effect of predetermining different sizes of loops.

Yet another important object is provided by improved means for raising the loop-forming finger to an overlying position relative to the strand length leading from the tying device, and for lowering the finger to its operative position relative to the strand length and to the said device.

Another advantage is realized by the provision of improved means for dampening or slowing the descent of the means supporting the finger, whereby to minimize impact vibration and noise.

The foregoing and numerous other objects and advantages of the invention will more clearly appear from the following detailed description of a preferred embodiment, particularly when considered in connection with the accompanying drawings, in which:

Fig. 1 is a top plan view of the loop-forming machine;

Fig. 2 is a side elevational view of the machine shown in Fig. 1;

Fig. 3 is a side elevational view of the loop-forming machine showing the relation of the component parts after approximately 150° rotation of the main drive shaft from the position shown in Fig. 2;

Fig. 4 is a side elevational view of the machine showing the relative position of the component parts after approximately 270° rotation of the main drive shaft from the position shown in Fig. 2;

Fig. 5 is a side elevational view of the machine showing the relative position of the component parts after approximately 350° rotation of the main drive shaft from the position shown in Fig. 2; and

Fig. 6 is a fragmentary, enlarged view of the vertical track and supporting bar mounted thereon, as seen along line 6—6 of Fig. 2.

Referring now by characters of reference to the drawings, the loop-forming machine includes a frame structure having a flat base **10** on which an L-shaped frame element **12** is mounted by bolts **11**. A leg **13** is provided at one end of frame element **12** and seats on base **10** to hold the frame element **12** in an inclined position as is best shown in Fig. 2. At each end of frame element **12** is an upstanding frame portion **14** and **15**.

Mounted on upstanding frame portion **14** is a conventional tying-and-cutting head **16** that is part of a well known device manufactured by National Bundle Tyer Company, of Blissfield, Michigan, and sold under the trademark Saxmayer.

Briefly this well known tying-and-cutting head **16** includes a main drive shaft **17** rotatively mounted in spaced bearings **20** and **21** provided on frame element **12**. Drivingly attached to main drive shaft **17** is a mutilated drive gear **22**. A housing structure **23** is located about the mutilated gear **22**, and is fixed to the upstanding frame portion **14**.

Further, the tying-and-cutting head **16** includes a stub shaft **24** rotatively mounted in housing **23**, on which is secured a driven gear **25** adapted to be engaged intermittently by mutilated drive gear **22**. Operatively connected ot the stub shaft **24** is a conventional shuttle, knot-tier and cutter mechanism that is operated upon rotation of shaft **24** by gears **22** and **25**.

Although the machine can be operated manually, it is preferred to power the machine by the use of an electric motor unit (not shown). The drive connection of this power unit is illustrated by the showing of a pulley **26** fixed to main drive shaft **17**, and by a V-belt **27** engaging the pulley **26**. The belt **27** is preferably connected to another pulley (not shown) drivingly connected to the drive shaft of the electric motor. Of course, any suitable control means such as a clutch may be utilized for starting and stopping the power unit.

Attached to the upstanding frame portion **15** is a platform **30** on which is mounted a central spindle **31** adapted to hold a spool of strand material **32** utilized in forming the strand loops. A strap **33** is attached to a platform **30** and extends upwardly and diametrically across the platform **30** in overlying relation to the spindle **31** and strand spool **32**.

The frame arm **15** is provided with a pair of spaced bearings **34** and **35**, adapted to mount a shaft **36**. Fixedly attached to one end of shaft **36**, adjacent bearing **34**, is a needle arm **37**. The needle arm **37** includes a curved hook end **40** that is adapted to engage operatively the tying-and-cutting mechanism of head **16** when the arm **37** is oscillatingly moved to the position shown in Fig. 3 upon rotation of shaft **36**.

The supply of strand material is first threaded through a holder **41** on strap **33** (Fig. 1), thence threadedly connected to the needle arm **37** through socket portion **42** and through an opening **43** formed in arm end **40**, and thence threadedly connected to the tying-and-cutting mechanism of operating head **16** in the usual manner.

A linkage mechanism operatively interconnects the main drive shaft **17** and the cross shaft **36** to oscillate the needle arm **37** from the raised position shown in Fig. 2, down to the lowered loop-forming position shown in Fig. 3, and back to the raised position shown in Fig. 2 upon a complete revolution of main drive shaft **17**. This linkage mechanism includes a link arm **44** fixed to one end of main drive shaft **17**, the link arm **44** being pivot-

ally connected to a crank arm 45 that is in turn pivotally connected to a link arm 46 attached to one end of cross shaft 36.

A vertical track structure is fixed to base 10 and includes a pair of spaced plates 47 and 50, best shown in Fig. 6, closed at one side by plate 51 to provide a U-shaped channel, the plate 51 being secured by screws 52. The top of the track is closed by a lid 53 (Fig. 2). Located within the channel of the track structure is a lowermost stop element 54 and an uppermost stop element 55, such stops 54 and 55 determining the range of movement along the track structure. Secured to the stop elements 54 and 55 are springs 56 adapted to cushion a track follower that is described later, then moved along the track structure to each of the predetermined limits. The spaced plates 47 and 50 are provided with longitudinal internal grooves 57 arranged in vertical alignment, as best shown in Fig. 6.

The previously mentioned track follower consists of an L-shaped bar having angularly related bar sections 60 and 61. The bar section 60 is provided with a pair of axle shafts 62, that extend outwardly on each side of the bar. On each axle 62 at each end is mounted a roller 63 adapted to engage the opposite margins of grooves 57. Obviously, the rollers 63 operate in track grooves 57 to move the bar upwardly and downwardly in the track structure between predetermined limits.

The other bar section 61 extends laterally outwardly of the channel track so that its forwardmost end 64 is located closely adjacent the tying-and-cutting mechanism of the operating head 16, and is located immediately to one side of the strand length 59 leading from such mechanism to the needle arm 37.

The bar section end 64 is provided with a plurality of spaced apertures 65. A finger 66 is selectively located in one of apertures 65 and retained therein by a set screw 67. The finger 66 extends laterally outwardly of bar section 61, and extends in overlying relation to the strand length 59 between the needle arm 37 and the loop-tying mechanism. The finger 66 is provided with a downturned hook end 68, to facilitate gripping action of the strand length 59 when the bar is moved to its lowermost position, as shown in Fig. 2, and as will be seen later to facilitate movement of the hook over the strand length 59 as the bar is moved to its upwardmost position shown in Fig. 5, after the completed strand loop is formed and cut.

The actuating means operatively connecting the bar 61 with the main drive shaft 17 includes a socket sleeve 70 pivotally connected by bolt 71 to a pair of spaced frame arms 72 secured to the frame base 10. A lever arm 73 is received in sleeve 70 and is retained by set screws 74. One end of lever arm 73 is pivotally connected to a link element 75. The link element 75 is provided with a yoke 76 that embraces opposite sides of bar section 61, the yoke 76 being pivoted to bar section 61 by pin 77.

Fixed to one end of main drive shaft 17 is a cam arm 80 that has a roller 81 rotatively mounted on one end. The lever arm 73 and cam arm 80 are structurally related and arranged so that the roller 81 engages the top of one end of lever arm 73, as is shown in Fig. 4, during a predetermined portion of the cycle of operation of the machine, the cam arm 80 acting through lever arm 73 to move the bar 61 upwardly along the track structure to its uppermost position, as shown in Fig. 5. At another point in the cycle of operation upon continued rotation of main shaft 17 and cam arm 80, the roller 81 disengages from the lever arm 73 to permit the bar section 61 to drop by gravity to the lowermost position shown in Fig. 2.

Means is provided to slow the descent of bar section 61 from its uppermost position of Fig. 5 to its lowermost position of Fig. 2, after operative disengagement of cam roller 81 from the lever arm 73, in order to minimize noise and impact vibration. For this purpose, a plate 82 is fixed to the frame base 10 and is located adjacent one side of the lever arm 73. The plate 82 is provided with a curved cam margin 83. Pivotally secured to the end of lever arm 73 is a link arm 84 that carries a roller 85 adapted to engage and ride the cam margin 83. A compression spring 86 is attached at one end to the track plate 50, and attached at the other end to the link arm 84. The spring 86 tends to urge the roller 85 against the cam margin 83.

It is thought that the operation of the loop-forming machine has become fully apparent from the foregoing detailed description of parts, but for completeness of disclosure the operation is briefly set forth.

First, the strand material is threaded through the needle arm 37, located below the finger 66 and threadedly attached to the tying-and-cutting mechanism of the operating head 16, as described previously. For purposes of explanation, it will be assumed that the initial starting position of the machine is shown in Fig. 2. Then the main drive shaft 17 is rotated by belt 27 and pulley 26 upon actuation of the power means.

As the main drive shaft 17 rotates counterclockwise, as seen in Fig. 2, the link arms 44 and 46 and crank arm 45 rotate the cross shaft 36 to move the needle arm 37 downwardly to the position shown in Fig. 3, in which the needle arm 37 operatively connects the opposite end of the strand length 59 to the tying-and-cutting mechanism and loops the strand length 59 over finger 66.

Continued and further counterclockwise rotation of main drive shaft 17 operates to bring the mutilated gear 22 into operative meshing engagement with the gear 25, and hence actuates the tying-and-cutting mechanism of the operating head 16. As the strand loop is being formed by operating head 16, the main drive shaft 17 operates through link arms and crank arms 44—46 to raise the needle arm 37 upwardly, as is best shown in Fig. 4.

After the strand loop is formed, tied and cut, the loop falls off of finger 66, as illustrated in Fig. 4. At this point in the cycle of operation, the cam roller 81 engages the end of lever arm 73. As the main drive shaft 17 continues to rotate counterclockwise, the cam roller 81, acting through cam arm 80, pivots the lever arm 73 about its hinge connection 71 so that yoke 75 acts to raise the bar 61 from its lowermost position, shown in Fig. 4, to its uppermost position shown in Fig. 5. It will be noted that the finger 66 is located below the strand length 59 when bar 61 is located in its lowermost position (Fig. 4), and is moved above the strand length 59 when the bar 61 is moved to its uppermost position (Fig. 5).

After the bar 61 is raised so that finger 66 is located in overlapping position above the strand length 59, as shown in Fig. 5, the cam roller 81 disengages from the lever arm 73 upon continued rotation of main drive shaft 17. When the cam roller 81 disengages, the bar 61 drops under gravity to its lowermost position in which the finger 66 engages the strand length 59, as illustrated in Fig. 2. The cycle of operation is then repeated upon continued rotation of main drive shaft 17.

If smaller loop sizes are desired, the finger 66 is relocated in one of the apertures 65 to bring the finger 66 closer to the tying-and-cutting mechanism of the operating head 16, and conversely if larger loops are desired the finger 66 is located further away from such mechanism.

It is seen that as the bar 61 is moved upwardly to its uppermost position upon tilting of lever arm 73 by cam roller 81, as illustrated in Fig. 5, the roller 85 is moved downwardly along the curved cam margin 83 of plate 82 under the loading of compression spring 86. As the bar 61 drops under gravity from the position shown in

Fig. 5 to the position shown in Fig. 2, the roller **85** engages the curved cam margin **83** of plate **82**, slowing the gravitational descent of bar **61**, and hence minimizing noise of operation and impact vibration.

Although the invention has been described by making detailed reference to a single preferred embodiment, such detail is to be understood as in an instructive, rather than in any restrictive sense, many variants being possible within the scope of the claims hereunder appended.

I claim as my invention:

1. In a loop-forming machine, a frame, a knot-tying-and-cutting mechanism mounted on said frame, a shaft operatively connected to said mechanism for operating same, a supply of strand material having one end threadedly connected to said mechanism, a strand-engaging finger operatively disposed over the strand length leading from such mechanism, a needle arm pivotally mounted on said frame and threadedly holding the strand length at the other side of said finger, means connecting said needle arm to said shaft for operating said arm to loop the strand length over said finger and to connect the formed loop to said mechanism, and means operatively interconnecting said finger with said shaft to raise the finger in overlying relation to the strand length between the arm and mechanism after the loop is tied and cut by said mechanism.

2. The combination and arrangement of elements as recited in claim 1, but further characterized in that the finger includes a downwardly turned hook portion enabling the strand length to slip over the finger when the finger is raised, and normally engaging the strand length in overlying relation.

3. In a loop-forming machine, a frame, a knot-tying-and-cutting mechanism mounted on said frame, a shaft operatively connected to said mechanism for operating same, a supply of strand material having one end threadedly connected to said mechanism, a strand-engaging finger operatively disposed over the strand length leading from said mechanism, a needle arm pivotally mounted on said frame and threadedly holding the strand length at the other side of said finger, means connecting said arm to said shaft for oscillating said arm to loop the strand length over said finger and to connect the formed loop to said mechanism, a track element on said frame, a bar supporting said finger and mounted on said track element, and means operatively interconnecting the bar with said shaft for moving the shaft along said track element to raise the finger in overlying relation to the strand length between the arm and mechanism after the loop is tied and cut by said mechanism.

4. The combination and arrangement of elements as recited above in claim 3, but further characterized in that said interconnecting means between the bar and shaft includes an intermittent drive connection selectively moving the bar along said track to raise the finger in overlying relation to the strand length between the needle arm and mechanism after the loop is tied and cut by said mechanism, and selectively enabling the finger to move downwardly to engage the strand length in overlying relation.

5. The combination and arrangement of elements as recited above in claim 3, but further characterized in that the bar is provided with an adjustable connection with said finger to vary selectively the distance of said finger from said mechanism, whereby to determine different loop sizes.

6. In a loop-forming machine, a frame, a knot-tying-and-cutting mechanism mounted on said frame, a shaft operatively connected to said mechanism for operating the same, a supply of strand material having one end threadedly connected to said mechanism, a strand-engaging finger operatively disposed over the strand length leading from the said mechanism, a needle arm pivotally mounted on said frame and threadedly holding the strand length at the other side of said finger, means connecting said needle arm to said shaft for oscillating said arm to loop the strand length over said finger and to connect the formed loop to said mechanism, a track element on said frame, a bar supporting said finger and mounted on said track element, a lever arm pivotally mounted on said frame, the lever arm having one end operatively connected to said bar, a lever-engaging member secured to said shaft and intermittently engaging the other end of said lever arm for raising said bar along said track element to raise the finger in overlying relation to the strand length between the needle arm and mechanism after the loop is tied and cut by said mechanism.

7. In a loop forming machine, a frame, a knot-tying-and-cutting mechanism mounted on said frame, a shaft operatively connected to said mechanism for operating the same, a supply of strand material having one end threadedly connected to said mechanism, a strand-engaging finger operatively disposed over the strand length leading from said mechanism, a needle arm pivotally mounted on said frame and threadedly holding the strand length at the other side of said finger, means connecting said arm to said shaft for operating said arm to loop the strand length over said finger and to connect the formed loop to said mechanism, a track element on said frame, a bar supporting said finger and mounted on said track element, a lever arm pivotally mounted on said frame, a link element pivotally connecting said bar with one end of said lever arm, a cam attached to said shaft and rotatable therewith, the cam engaging the other end of said lever arm after the loop is tied and cut by said mechanism, raising the bar long said track element to raise the finger in overlying relation to the strand length between the needle arm and mechanism, and disengaging from the lever arm to permit the bar and finger to drop to the normal operative position relative to said strand length and mechanism.

8. The combination and arrangement of elements as set forth in claim 7, but further characterized in that the finger includes a downwardly turned hook portion enabling the strand length to slip over the finger when the finger is raised and engaging normally the strand length in overlying relation, and further characterized in that the bar is provided with an adjustable connection with said finger to vary selectively the distance of said finger from said mechanism, whereby to determine different loop sizes.

9. The combination and arrangement of elements as recited above in claim 7, but further characterized in that the track element is disposed vertically, and characterized by the provision of resilient means between the track element and bar for cushioning the drop of said bar after disengagement of the cam from the lever arm.

10. In a loop-forming machine, a frame, a knot-tying-and-cutting mechanism mounted on said frame, a shaft operatively connected to said mechanism for operating the same, a supply of strand material having one end threadedly connected to said mechanism, a strand-engaging finger operatively disposed over the strand length leading from said mechanism, a needle arm pivotally mounted on said frame and threadedly holding the strand length at the other side of said finger, means connecting said arm to said shaft for operating said arm to loop the strand length over said finger and to connect the formed loop to said mechanism, a vertical track element on said frame, a bar supporting said finger and mounted on said track element, a lever arm pivotally mounted on said frame, the lever arm having one end operatively connected to said bar, a cam attached to said shaft and rotatable therewith, the cam engaging the other end of said lever arm after the loop is tied and cut by said mechanism for moving the bar along said track element to raise the finger in overlying relation to the strand length between the said needle arm and mechanism, and the cam disengaging from the lever arm to permit the bar and

finger to drop to normal operative position relative to said strand length and said mechanism, a plate on said frame having a cam track, a cam track follower attached to said bar, and means urging said follower against said cam track to slow the descent of said bar.

11. The combination and arrangement of elements recited above in claim 10, but further characterized in that the finger includes a downwardly turned hook portion enabling the strand length to slip over the finger when the finger is raised, and normally engaging the strand length in overlying relation.

12. The combination and arrangement of elements as set forth above in claim 10, but further characterized in that the bar is provided with an adjustable connection with said finger to vary selectively the distance of said finger from said mechanism, whereby to determine different size loops.

13. The combination and arrangement of elements as recited above in claim 10, but further characterized in that the said plate on said frame includes a curved, offset cam track, characterized in that the said cam track follower is pivotally connected to said lever arm, and characterized by the provision of a spring connected to said follower tending to urge said follower against the said cam track to slow the descent of said bar.

14. In a loop-forming machine, a frame, a knot-tying-and-cutting mechanism mounted on said frame, a shaft operatively connected to said mechanism for operating same, a needle arm pivotally mounted on said frame, means connecting said arm to said frame for oscillating said arm toward and away from said mechanism upon shaft rotation, a supply of strand material threadedly attached to said arm and to said mechanism, a track element on said frame, a bar reciprocably mounted on said track element, a strand-engaging finger on the bar projecting in normal overlapping relation to the strand length between the arm and said mechanism, the said strand length being in the path of said finger, and an actuating means operatively connecting said bar to said shaft for moving the bar along the track element in one direction to move the finger to one side of the said strand length and for causing movement in the other direction to engage the finger with said strand length.

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