July 3, 1934. E. J. ABBOTT ET AL 1,965,023

KNOT TYING

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Fig. 2

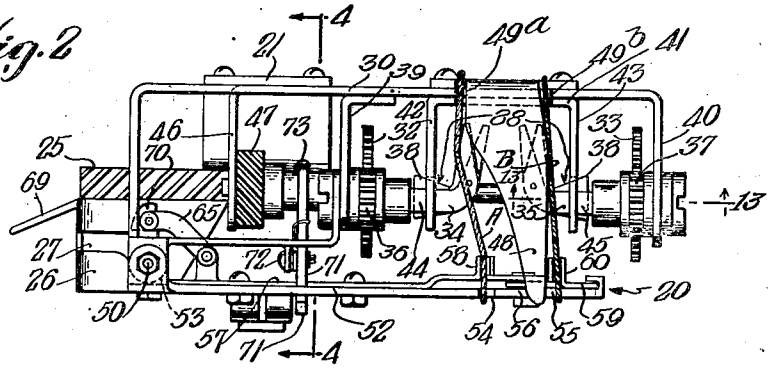


Fig. 1

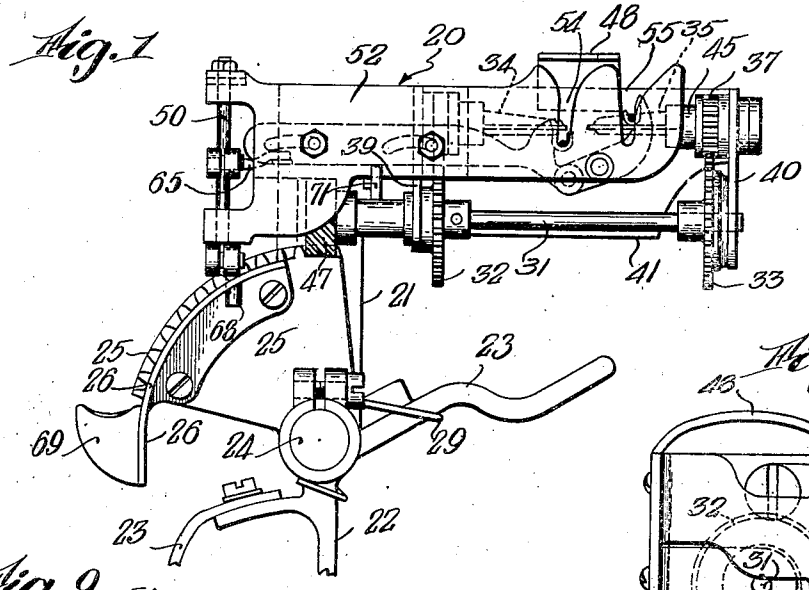


Fig. 3

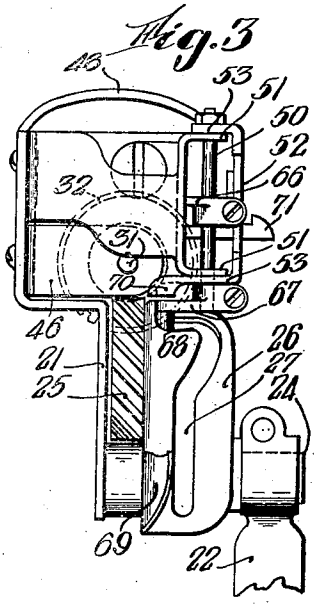


Fig. 9

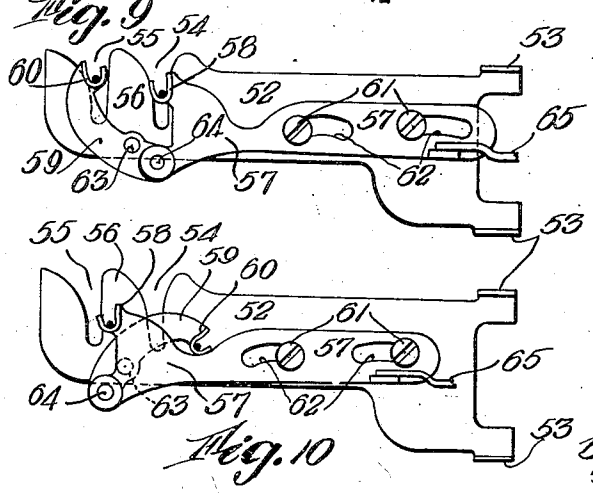


Fig. 10

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KNOT TYING

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Fig. 4

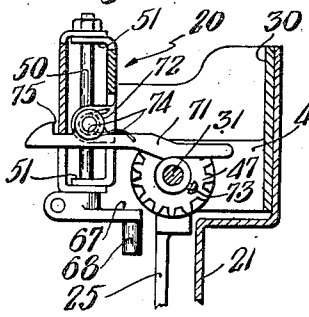


Fig. 5

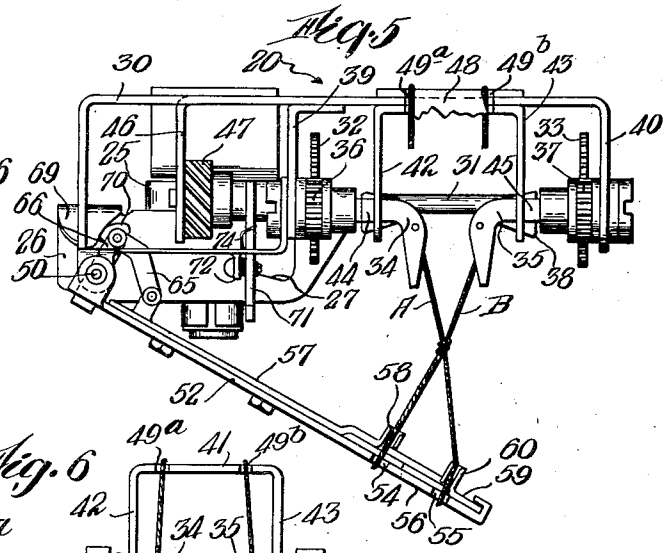


Fig. 6

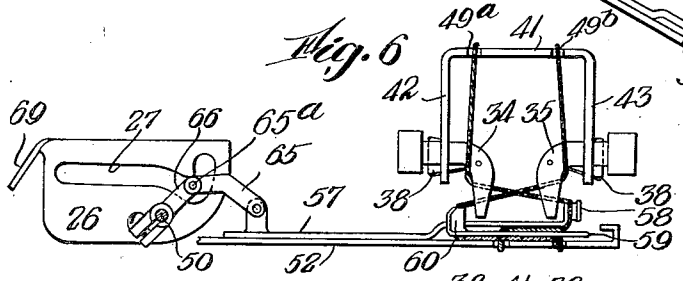


Fig. 7

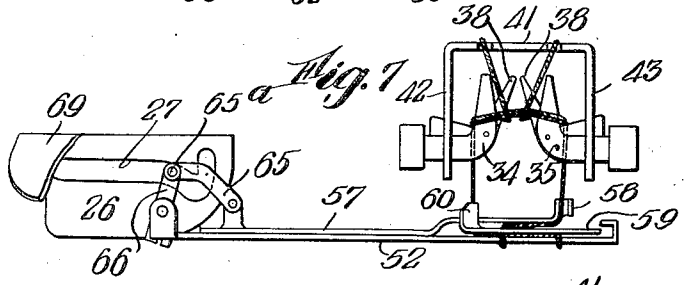
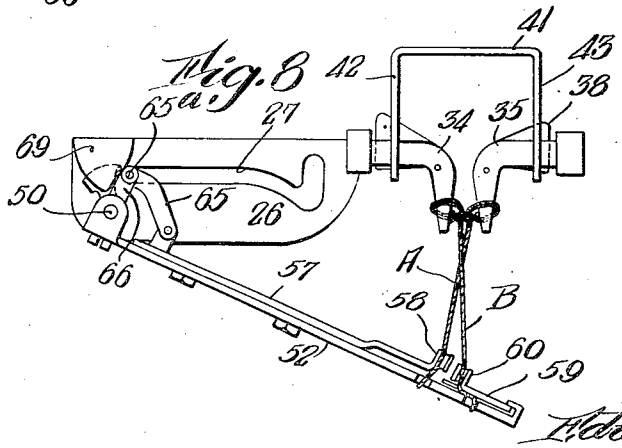


Fig. 8



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Fig. 8a

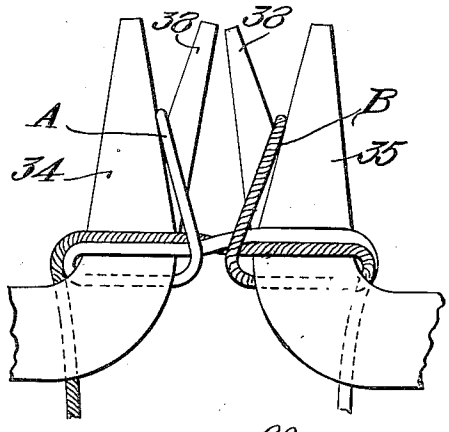
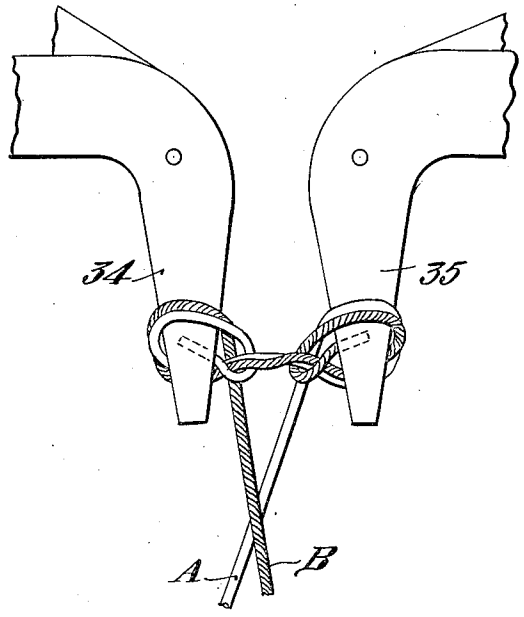


Fig. 8a



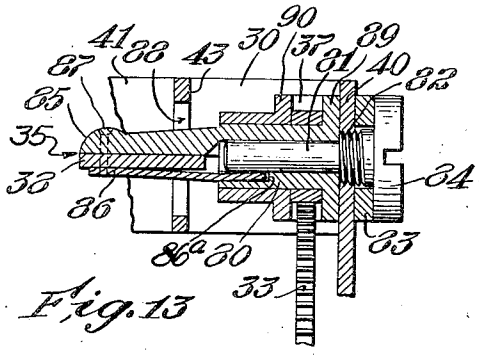


Fig. 13

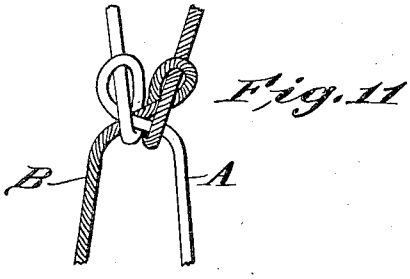


Fig. 11

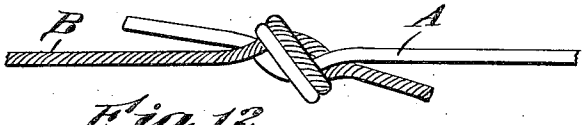


Fig. 12

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UNITED STATES PATENT OFFICE

1,965,023

KNOT TYING

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Application September 1, 1933, Serial No. 687,788

31 Claims. (Cl. 289—2)

This invention relates to an improvement in a knot tyer and has for its object to provide a knot tyer adapted to join two strands by knotting each strand about a single thickness of the other strand in such a way that the two knots, when drawn together, reinforce each other against displacement of the knot by tension in the united strand.

When joining strands of certain material as, for instance, mohair, it has been difficult to prevent slippage of the strands and to maintain a firm joinder when the united strand was put under tension in subsequent operations. A knot tyer embodying this invention prevents such slippage since the knots are so formed and are brought into such close relationship that tension on the united strand resists displacement of either of the cooperating and mutually reinforcing knots.

Knot tyers are particularly used to join the ends of strands or filaments in textile mills and this invention will be shown and described as applicable to that use, it being understood, however, that it is not limited to such use and may be employed wherever it is desired to join two strands.

Other objects of invention and features of novelty and utility will be apparent from this specification and its drawings, wherein the invention is explained by way of example only.

In the drawings:

Fig. 1 is a side elevation of a knot tyer embodying this invention;

Fig. 2 is a plan view thereof showing the strands in position ready to be tied;

Fig. 3 is an end elevation viewed from the left in Fig. 1;

Fig. 4 is a sectional view taken along the line 4—4 in Fig. 2;

Fig. 5 is a plan view similar to Fig. 2 showing the united strands;

Figs. 6, 7 and 8 are partial plan views illustrating successive positions of the knot tying elements between the position shown in Fig. 2 and the position shown in Fig. 5;

Fig. 7ª illustrates the tying elements on an enlarged scale, midway between the positions of Fig. 7 and Fig. 8;

Fig. 8ª shows the tying elements in the position of Fig. 8, on an enlarged scale;

Figs. 9 and 10 illustrate the stripper gate element of the knot tyer in the two extreme positions;

Fig. 11 illustrates on an enlarged scale an arrangement of the strands before the knots have been tightened;

Fig. 12 illustrates the resulting knot; and

Fig. 13 is a vertical sectional view on the line 13—13 of Fig. 2, showing in detail the construction of a knot-tying bill of the device.

Referring to Fig. 11 wherein the knot is shown in an untightened condition, it will be observed that a single thickness of strand A passes through a knot formed of strand B and itself forms a knot surrounding a single thickness of strand B; further that this single thickness of strand B itself forms the knot surrounding the single thickness of strand A. This relation of the strands involves oppositely disposed portions of two strands, each of which comes out of a knot formed thereof, and passes directly through the knots formed of its companion strand; these oppositely disposed portions continue from either side of the completed knot, one being the old strand and the other the new one united thereto. Tension on the united strand, considering for example only strand A, tightens the knot of strand A about strand B and simultaneously pulls the knot of strand A into interfitting relation to the knot of strand B so that neither knot can further change its configuration or position in the united strand. This result may be attributed at least in part to the fact that the long ends of each knotted strand pass in opposite direction through the knots formed from the respective other strand of the pair to be united.

A tying device according to the present invention is preferably constructed so as to include means for tying the two knots involved, and means for pulling the knots tight so that they draw into contact.

By way of example, the invention is illustrated in its preferred form in which the means for tying the two knots each about the other strand comprises separate (though cooperating) means, each adapted to tie one of the two knots and to include in such knot the strand of which the other knot is formed. Simultaneous action of these two tying means is preferable and is employed in the illustrated device. As these two cooperating means, the illustrated device utilizes tying bills 34, 35 (Fig. 2) rotatably mounted on a common axis. The two tying bills may, if desired, be of any appropriate conventional construction but preferably are constructed in the improved manner now to be described.

Fig. 13 illustrates the interior construction of bill 35 and its mode of attachment to the extension 40 of frame 30; the other bill 34 being

similar but reversed in form and arrangement, and similarly attached to a transverse bracket 39 on frame 30. According to the illustrated preferred construction, the bill such as bill 35, includes an integral hub 80 rotatably mounted on a stationary pin 81 which is screw threaded at 82 to the extension 40 of the frame. A washer 83 may, if desired, be interposed between the head 84 of the screw and this extension 40 and can serve to adjust the location of the outer end of the bill. Integral with the hub 80 is the thicker leading fixed blade 85 of the bill. The hub 80 is slotted at 86[a] to receive the inner end of the other thinner, following fixed blade 86, and the intermediate shear and clamping blade 38 is pivotally secured between the leading and following fixed blades 85 and 86 by means of a pin 87. Referring to Fig. 2, a U-shaped plate 41, fastened to frame 30, is provided with parallel flanges 42, 43 having holes 88 through which the tails of the pivoted blades 38 of the bills extend. These holes 88 are eccentric to the axis of hubs 44 and 45 of the bills, and accordingly act on the tails of the blades 38 in the manner of cams, to cause these blades to clamp, sever and release the strands as the bills rotate. As shown in Fig. 13, the pin 81 on which the bill turns extends close to the cam member 43 and eccentric hole 88. This feature improves the ease of operation of the bill since the thrust of the cam member on the tail of the bill is much more nearly in line with the bearing of the bill than is the case with bills mounted on the usual shafts of which the bearings are some distance from the cam member. For rotating the bills 34 and 35 their hubs are provided with the gears 36 and 37, respectively meshing with gears 32 and 33 on a shaft 31, such as shown in Fig. 1. Referring to Fig. 13, the gear 37 is mounted on the hub 80 of the bill and with a tight fit, and lies between the flange 89 of the hub and a separate sleeve 90. The use of the pin 81 as a bearing for the hub and the location of the gear 37 where the hub is supported by the pin is highly advantageous in that the driving gear 33 is thus aligned with the bearing for the bill instead of an overhung end of a shaft.

The mechanism for driving the shaft 31 may, for example, comprise a spur gear 47 meshing with a segment gear 25 pivotally mounted at 24 on a post 21 extending down from frame 30. In case the knotter is to be hand operated, this post 21 may, for example, carry a handle 22 and strap 23 adapted to encircle the left hand of the operator, whose thumb presses down the conventional lever 28 against the spring 29, thus to rotate the segment gear 25 and actuate the tying bills.

The timing of the tying bills may, for example, be such that in the position of Fig. 8, the strands engaged by the pivoted shear blades 38 are clamped and severed during the casting-off of a loop of strand over the clamped and severed end, while in the preceding opposite position of Fig. 7 the blades 38 are open to receive the ends to be clamped and severed.

Referring now to Fig. 2, appropriate means for causing a single thickness of the respective strands to be included within the knot formed of the other strand will now be described by way of example. It will be understood that the loop-forming, casting-off and strand-severing instrumentalities herewith represented by the two tying bills 34, 35, can tie separate knots; it will now be explained how the strands are preferably guided and arranged in position, firstly, so that for each operation of a rotary tying bill, each strand is in position to be appropriately made into a loop, severed, and cast off over the severed end to form a knot, and secondly, so that each knot thus formed in a respective strand shall each include within itself a single thickness of the other strand.

The illustrated device is particularly adapted to receive the two strands in position for manipulation without any effort on the part of the operator other than carrying the two strands up in front of the device, over the top thereof and down behind (which can be done practically with a single motion of the right hand) and then grasping and holding the strands below the device, as is usual with hand-operated knotters. The front pivotally mounted plate 52, of which the functions are explained later, is therefore provided with notches 54 and 55 adapted to receive the strands A and B separately, the frame member 30 and associated parts are provided with notches 49[a] and 49[b] likewise adapted to receive the strands A and B separately, and a guide horn 48 attached to frame member 30 is shaped and adapted to guide the two strands into the notches 49[a] and 49[b], to lie outside the two bills 34, 35. The strands A and B are guided by notches 54 and 55 into pockets 58 and 60 respectively of two plate members 57 and 59 (shown in detail in Figs. 9 and 10). Plate 59 is pivotally mounted to gate 52 at 63 and the two plates 57 and 59 are pivotally connected at 64, plate 57 further being guided by screws 61 which extend through arcuate slots 62 therein. Movement of the two plates 57 and 59 and their strand-carrying pockets 58 and 60, as more fully described in connection with the tying operation, is preferably caused as follows: The segment gear 25 is provided with an arcuate member 26 having a closed cam-follower path 27 (Fig. 2) within which a cam follower 68 is engaged. This cam follower 68 is carried by an arm 67 fastened to a rotatable post 50 (Fig. 3) and carrying an upper arm 66. A link 65 is pivotally connected to this upper arm 66 and to the reciprocating plate 57. Thus the strand pockets 58 and 60 are moved from the position of Fig. 9 to that of Fig. 10 in timed relation to the rotation of the tying bills 34, 35.

The shape of the cam path 27 is such that during the first 180° of rotation of the bills 34, 35, the pockets 58, 60 will move approximately to the position of Fig. 6, thus performing the joint functions of (1) carrying each strand into position to be engaged by one of the fixed blades of its initially adjacent bill, and (2) carrying each strand into position to be engaged by the initially opposite bill outside of the partial loop or bight formed by the other strand thereon. Further rotation of the bills permits the tail portions of the strands (placed in notches 49[a] and 49[b]) to slide over the rounded shoulders of the bills, until they are detained by and overlie the two strands connecting the bills. Approximately at the position of Fig. 7, the pivoted shear blades 38 of the two bills engage these tail portions; at approximately the position of Fig. 7[a] (90° from Fig. 7) the shear blades begin to clamp and cut the tail portions. In this position it will be observed that around bill 34 there is a loop of strand A grasped by the blades of the bill and having a run of strand B within it; further that around bill 35 there is a loop of strand B grasped by the blades of the bill and having a run of strand A within it. This formation is thus prepared for each bill to

cast off its principal loop over the severed end thereof (thus forming a knot) and for the inclusion within the thus formed knot of the opposite strand which is detained by the aforesaid loop and grasped end.

As a preferred means for stripping the thus prepared loops from the bills, the illustrated device utilizes the previously mentioned gate member 52, which, as shown in Figs. 1, 2 and 3, is pivotally mounted coaxially with the post 50. Initial actuation of the sliding plate 57 by the link 65 tends to swing the gate 52 outwardly, but this swinging movement is checked by a latch 71 which is pivotally mounted on an ear 72 on the frame of the device. At approximately the end of the operative rotation of the shaft 31, a pin 73 on this shaft trips the latch 71, releasing the gate 52. Thereupon a tongue 69 (Fig. 1) on the arcuate plate 26 engages an arm 70 (Fig. 3) on the gate 52, positively swinging the gate outwardly to the position of Fig. 6. It has previously been mentioned that the strands when laid in the knotter are grasped beneath the knotter by the operator's hand. In an automatic device, other suitable means can be used to hold the strands. Since the strands A and B are held at a suitable location below the gate 52, outward swinging of the gate pulls the formed loops of strand off each bill over the ends of strand severed and held by the pivoted blades 38 thereof.

During the swinging of gate 52 to its outward position, the plate 57 is held by the link 65 of which one end is pivoted to the arm 66 at a point offset from the vertical axis of rotation of the gate 52 as a whole. At this time the follower 68 controlling this arm 66 is held in a straight portion of the cam slot 27; the arm 66, thus being held immovable, constrains the link 65 to pivotal movement about the point 65^a, offset from the axis 50 about which the gate rotates. The plate 57, engaged by link 65, is thus moved relative to the gate 52 approximately to its original relative position with respect thereto, returning the pockets 58 and 60 to the relative positions of Fig. 9 during the outward movement of the gate 52.

By a comparison of Fig. 7^a (where the bills are vertical) and Fig. 8^a (at 90° therefrom) it will be observed that the strands A and B extending from the bills have each been moved toward the opposite bill by the return of pockets 58 and 60 from the relative position of Fig. 10 to a relative position like that of Fig. 9, with the result that a secondary loop of each strand about a bill extends inwardly of the primary knot-forming loop thereon and the end of the secondary loop extending from the bill underlies the portions of strands extending between the two bills.

These two portions of strands extending between and connecting the two bills are particularly adapted to pull the formed knots off the bills, and any suitable means for forcing these two connecting portions of strands off the tips of the bills may be employed to remove the formed knots from the bills. In the illustrated device such mode of operation is attained by the motions of the guides 58 and 60 on the gate 52 which bring the ends of the secondary loops into contact with these connecting portions of the strands, and then, as the gate 52 swings outwardly, pull the formation of strands of Fig. 8^a outwardly until the loops slide off the bills. The secondary loop of strand about each bill thus is adapted, when pulled by the gate 52, to pull the primary loop of strand off the bill, allowing the secondary loop to dissolve, leaving the end of the primary loop held by the blades, and leaving the strand formerly constituting the secondary loop now embraced or surrounded by the said primary loop which forms a knot. Further pull by the gate 52 draws the two knots together, as diagrammatically illustrated in Fig. 11, and still further together until they tightly abut. A slight further rotation of the bills releases the severed ends which constitute the tails of the knot. Fig. 12 illustrates the appearance of the preferred form of knot when the strands A and B are stretched out straight as in normal use of the united strand. It will readily be observed that the knot thus formed has the desirable characteristics of minimum thickness, by virtue of inclusion of only one thickness of either strand in any loop constituted of the other strand, and tightness by virtue of the two loops being mutually braced against each other so that tightening of either by pull on the main united strand can result only in more tightly grasping the portion of the united strand included therein.

From the foregoing description it will readily be apparent that many specific forms of knot-tying apparatus can be adapted to the principles of this invention. Thus, for example, the invention in its broader aspects is not dependent upon the specific form of the loop-forming means, nor upon the preferred arrangement whereby two separate instrumentalities are employed to form the loops simultaneously, nor upon the preferred form of means for including a single thickness of one strand within the loop formed of the opposite strand, nor upon the specific form of illustrated means for accomplishing such inclusion in respect to two simultaneously-forming loops. Further, although it is desirable, as in the illustrated device, to utilize some parts for the dual functions of guiding the strands to form loops and for guiding the strands into position to be included within such loops such double use of the same parts, as for example the pockets 58 and 60, is not an indispensable feature of the invention. It will moreover readily appear that the invention is not dependent, in certain respects, upon the use of a secondary loop in position to facilitate the stripping of the primary or knot-forming loop provided the corresponding strand be included within the knot-forming loop, the exact mode of stripping the knot-forming loop and its included strand being of secondary consideration.

Reference to the knot of Fig. 12 and to the course of the strands laid in the knotter with respect to the loop-forming mechanism operating thereon will show that the illustrated device is adapted to provide in the united strand two knots of similar pitch, that is, both right-handed or both left-handed, depending on the direction from which the completed knot is viewed. Obviously with a reversal of direction of one of the loop-forming operations a similar joining of the two strands will result, lacking, however, the preferred feature of identical pitch of the two knots, a feature which permits them to occupy the close relation shown in Fig. 12.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

We claim:

1. A knot tyer for joining two strands com-

prising means for forming each strand into a knot inclusive of only one thickness of the other strand, and means for drawing the thus-formed knots together.

2. A knot tyer for joining two strands comprising means for simultaneously forming each strand into a knot inclusive of only one thickness of the other strand, and means for drawing the thus-formed knots together.

3. A knot tyer for joining two strands comprising means for forming a knot in the first strand about a single thickness of the second strand, and means for forming a knot in the second strand about a single thickness of the first strand.

4. A knot tyer for joining two strands comprising means for forming a knot in the first strand about a single thickness of the second strand, means for forming a knot in the second strand about a single thickness of the first strand, and means for drawing the thus-formed knots together.

5. A knot tyer for joining two strands comprising means for forming each strand into a knot, and means for including within the knot of each strand a single thickness only of the other strand.

6. A knot tyer for joining two strands including two rotary knot-tying bills, and means for including within the knot formed by each bill a single thickness of the strand knotted by the opposite bill.

7. A knot tyer for joining two strands including two rotary tying bills, means for positioning two strands for the formation of loops in each by both bills while retaining the strands for separate engagement by the severing blades of the bills, and means for stripping the bills, whereby to cast off from each bill a single knot inclusive of the other strand of the pair.

8. A knot tyer for joining two strands including two rotary tying bills, means for holding two strands in position to be severed and formed into knots by the respective bills, means for positioning each strand for inclusion in the knot of the other strand, and means for stripping the two knots from the bills.

9. A knot tyer for joining two strands including two rotary tying bills, means for holding two strands in position to be severed and formed into knots by the respective bills, means for positioning each strand to be formed by rotation of a bill into a secondary loop extending through the knot-forming loop of the other strand, and means for pulling the secondary loops to strip the knot-forming loops from the bills.

10. A knot tyer for joining two strands including two tying bills, means for positioning the two strands for loop-formation by both bills and for positioning each strand for operative engagement by the clamping and severing blade of a respective one of the bills following such loop-formation, and means for stripping the loops from the bills over the severed and clamped ends.

11. A knot tyer for joining two strands including two rotary tying bills, means for guiding the two strands into positions crossing the shanks of the respective bills, means for carrying a portion of each strand into the path of rotation of the bill whose shank it crosses and thence into the path of rotation of the other bill whereby to form loops of both strands on both bills, means for causing each of the two bills to sever and clamp a respective single one of the strands so as to confine to the bill the loop of the opposite strand formed thereon, and means for pulling the strands to cause said loops to be cast off over the clamped and severed ends.

12. A knot tyer including two rotary tying bills, means for causing two strands to lie oppositely directed in the paths of rotation of both bills, guide means for positioning portions of the two strands for clamping and severing by respective bills, and means for stripping the bills.

13. A knot tyer including two rotary tying bills having clamping and shearing blades, means for causing two strands to lie oppositely directed in the paths of rotation of both bills, including guides adapted to position the strands for clamping and severing by respective bills after association of both strands with both rotating bills, and means for stripping the bills.

14. A knot tyer including two rotary tying bills having clamping and shearing blades, means for causing two strands to lie oppositely directed in the paths of rotation of both bills prior to action of the clamping and shearing blades, guides for the ends to be sheared locating said ends for shearing and clamping by the respective bills and for formation into loops about said respective bills prior to shearing and while the other strand is associated with the same bill, means for rotating the bills to form said loops and thereafter sever and clamp the two ends, and means for stripping the bills to cast off from each a knot formed from said loop and surrounding the other strand of the pair.

15. A knot tyer including two rotary tying bills having clamping and shearing blades, means for associating two strands with the respective bills for formation about each bill of a knot-forming loop of a respective strand having its end sheared and clamped by the said bill, means functioning before clamping of said ends to dispose each strand in position to be included between the looped, clamped and sheared end of the other strand and the bill carrying said end, and means for stripping the knot-forming loops off the bills over the severed ends thereby to convert said loops into single knots each surrounding the opposite strand of the pair.

16. A knot tyer including two rotary tying bills having clamping and shearing blades, means for associating two strands with the respective bills for formation about each bill of a knot-forming loop of a respective strand having its end sheared and clamped by said bill, means functioning before clamping of said ends to dispose each strand in position to be included between the looped, clamped and sheared end of the other strand and the bill carrying said end, means for completing about the respective bills secondary loops of the strands thus disposed, and means for pulling said strands so that the secondary loops strip the knot-forming loops from their bills and dissolve, leaving each strand surrounded by a knot constituted of the other strand.

17. A knot tyer for joining two strands including two rotary knot-tying bills, and guide means for positioning strands in relation to the bills to form in each strand a knot surrounding a single thickness of the other strand, said guide means including guides adapted to position tail portions of the strands to be engaged by the clamping and shear blades of respective bills after formation of knot-forming loops by said bills, and guides adapted to position the main portions of the strands, said latter guides having an initial motion adapted to position both strands in opposite directions in the paths of rotation of the two tying bills, and having a subsequent motion adapt-

ed substantially to complete the formation around each bill of a secondary loop capable of dissolving upon stripping.

18. A knot tyer for joining two strands including two rotary knot-tying bills, movable guide means adapted to move to position the main portions of two strands in the paths of rotation of both bills, guide means for the tail portions of the strands adapted to position said tail portions for engagement by the clamping and shearing blades of respective bills after formation of knot-forming loops by the bills, said movable guide means for the portions of the strands having a second motion adapted substantially to complete the formation around each bill of a secondary loop capable of dissolving, and means for moving the last-named guide means away from the bills to pull the loops from the bills.

19. In a knot tyer, a rotary knot-tying bill comprising a hub and blades thereon, a pin on which the hub is adapted to turn, a gear located on the hub in the region of said pin, and means for driving said gear to turn the bill, whereby the pin acts as a bearing for the bill adjacent to the point of receipt of drawing stress.

20. In a knot tyer, a rotary knot-tying bill comprising a hub and blades thereon, one of said blades being pivotally mounted, a cam acting on said pivotally mounted blade, a gear located on said hub, a pin extending through the hub and rotatably supporting the hub adjacent the cam, and means for driving said gear to turn the hub and move the pivoted blade in relation to the cam.

21. In a knot tyer, a rotary knot-tying bill comprising a hub and blades thereon, one of said blades being pivotally mounted, a cam surrounding a portion of said pivoted blade, means for rotating the bill so as to operate said pivoted blade during rotation, and a support for the bill comprising a pin extending through the hub to a point near the cam.

22. A knot tyer including two rotary tying bills facing each other, each bill including a hub, and pins located on a common axis and extending into said hubs for rotatably supporting said bills.

23. A knot tyer including two rotary tying bills, means for operating said bills, and means for holding two strands in a crossed relation in the paths of said bills.

24. A knot tyer for joining two strands including two rotary tying bills, means for operating said bills, and means for positioning two strands for engagement by both bills.

25. A knot tyer including two rotary tying bills adjacent and facing each other and mounted for rotation on a common axis, means for operating said bills, and means for positioning two strands for engagement by both bills.

26. A knot tyer including two rotary tying bills adjacent to and facing each other and mounted for rotation on a common axis, said bills including clamping and severing blades, means for operating said bills, means for holding two strands for engagement by said bills, and means for pulling the strands, said pulling means being timed in relation to operation of the clamping and severing blades of the bills to draw together and tighten loops formed by the respective bills.

27. A knot tyer including two rotary tying bills adjacent to and facing each other on a common axis and adapted to cast off knot-forming loops, each bill including a blade adapted to sever, clamp, and subsequently release a strand, means for operating said bills, means for holding two strands for engagement by said bills, and means for pulling the strands, the operation of the clamping and severing blades being timed so that said blades retain the strands during pulling of the strands, whereby to draw together and tighten the loops formed by the two bills.

28. A knot tyer including two rotary knot-tying bills each adapted to make a knot-forming loop and to sever and clamp an end thereof, guide means for presenting two strands to the bills with portions of both strands extending between the bills, means for operating the bills, and means for forcing off from the tips of the bills the two portions of strands extending between the bills, thereby to pull the knot-forming loops over their clamped and severed ends.

29. A knot tyer including two rotary knot-tying bills each adapted to make a knot-forming loop in a strand and to sever and clamp an end of the loop, means for operating the bills, guide means for causing each strand to extend from the respective bill by which it is clamped to the opposite bill, whereby to provide two portions of strands extending between the bills and having knot-forming loops about respective bills, and means for forcing off from the tips of the bills the two portions of strands extending between the bills.

30. A knot tyer including two rotary knot-tying bills each adapted to make a knot-forming loop in a strand and to sever and clamp an end of the loop, means for operating the bills, guide means for presenting two strands for knot-formation by the respective bills and for inclusion of each strand within the knot-forming loop of the other strand on the respectively opposite bill, whereby two portions of strands extend between the bills, and means for forcing these portions off from the tips of the bills away from the clamped and severed ends to remove the knot-forming loops from the bills and tighten the resulting knots.

31. A knot tyer including two rotary knot-tying bills each adapted to make a knot-forming loop in a strand and to sever and clamp an end of the knot-forming loop, means for operating the bills, guide means for two strands to be united for presenting said strands for knot-formation by the respective bills and for inclusion within the knot-forming loop on the respectively opposite bill whereby two connecting portions of strands extend between the two bills, and means for pulling the strands to be united against the said connecting portions of strands to remove the knots from the bills.

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JOSEPH E. RING.

CERTIFICATE OF CORRECTION.

Patent No. 1,965,023. July 3, 1934.

EDWARD J. ABBOTT, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, line 13, claim 18, before "portions" insert the word main; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 11th day of September, A. D. 1934.

(Seal)

Leslie Frazer
Acting Commissioner of Patents.