May 7, 1940. V. F. ZAREMBA ET AL 2,200,234

WIRE TYING MACHINE

Filed May 6, 1939 3 Sheets-Sheet 1

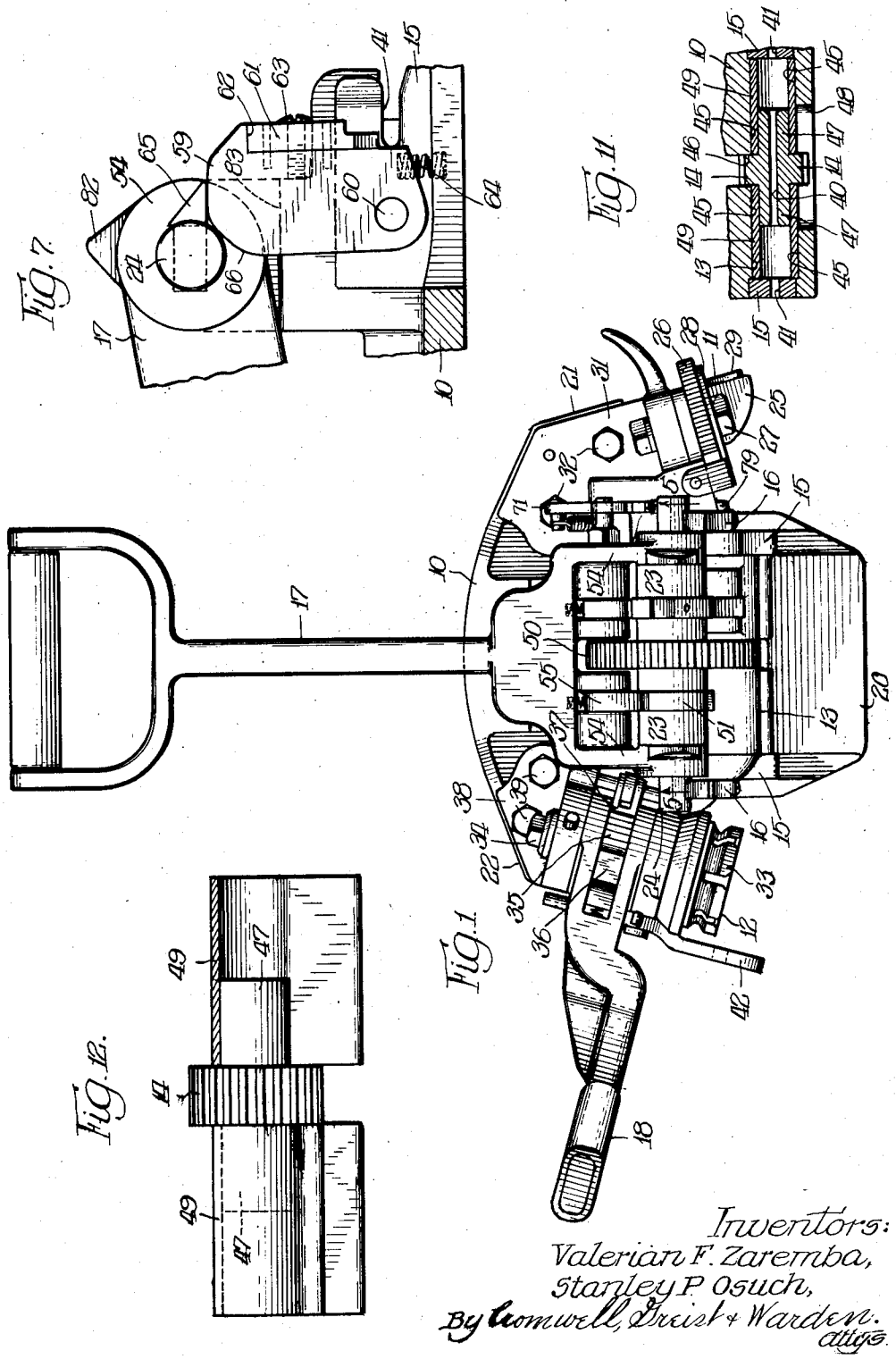


Fig. 1.

Fig. 7.

Fig. 11.

Fig. 12.

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Filed May 6, 1939 3 Sheets-Sheet 2

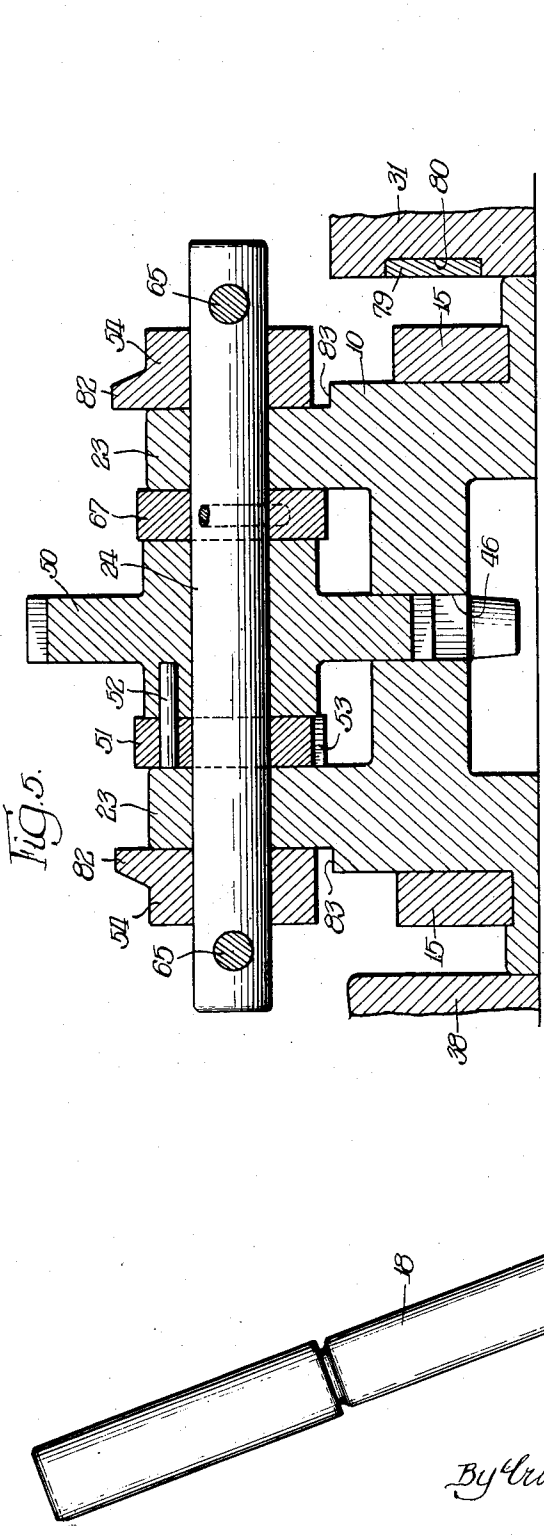


Fig. 5.



Fig. 3.

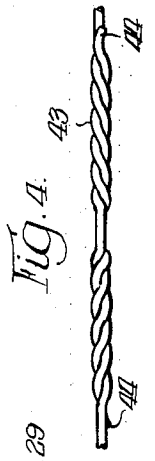


Fig. 4.

Fig. 2.

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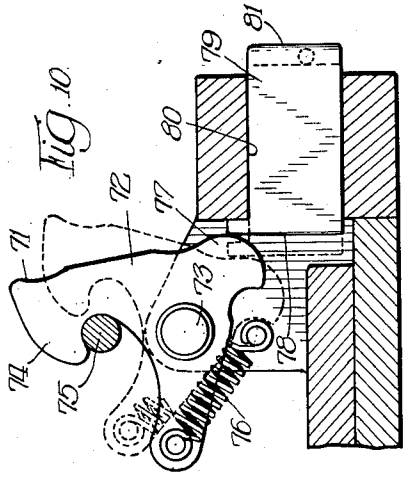


Fig. 10

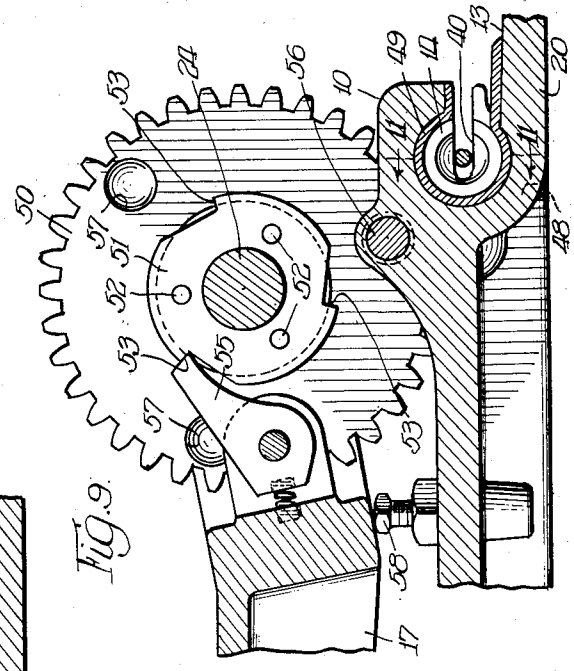


Fig. 9

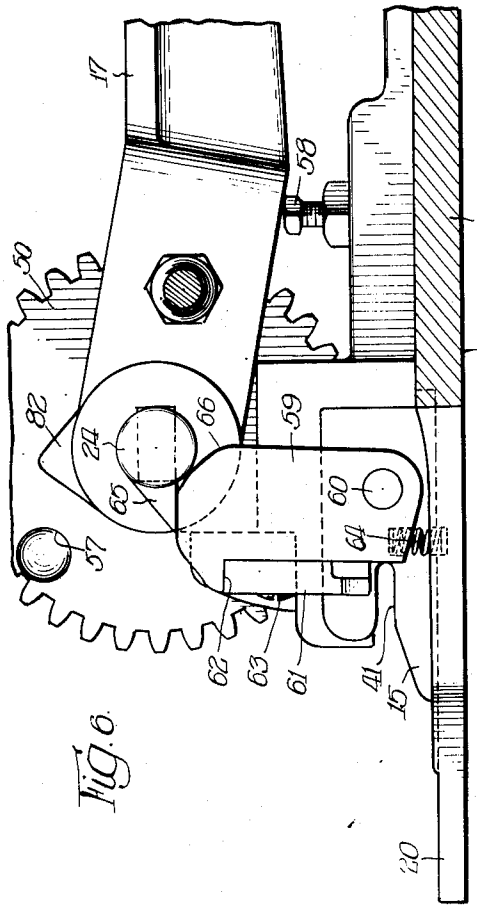


Fig. 6

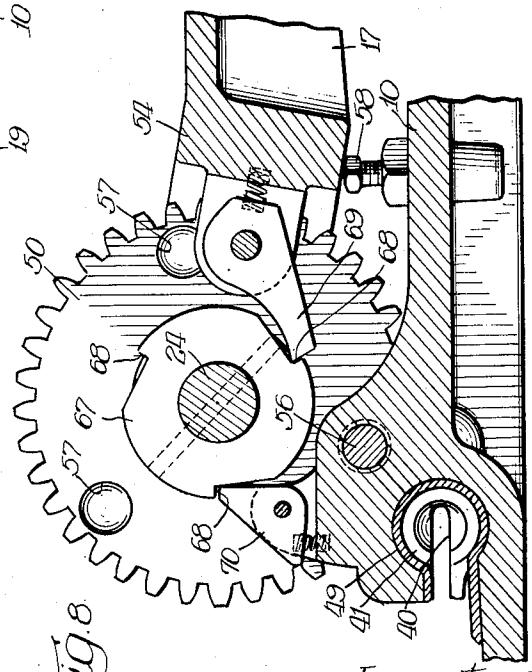


Fig. 8

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UNITED STATES PATENT OFFICE

2,200,234

WIRE TYING MACHINE

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Application May 6, 1939, Serial No. 272,251

11 Claims. (Cl. 140—93)

This invention relates to wire tying machines of the type having means for tensioning a wire about an object, twisting overlapped portions of the wire into a flat knot, and cutting off the excess wire at the ends of the knot.

One of the objects of the invention is to provide, in such a machine, improved means for transmitting the necessary power from an operating handle to the twisting means and cutting means.

Another object is to provide improved means for maintaining the slot in the twisting pinion in proper position to receive the overlapped portions of the wire.

Another object is to provide improved means for rotatably supporting the twisting pinion, whereby to facilitate renewal of the bearings when worn.

While the foregoing statements are indicative in a general way of the nature of the invention, other more specific objects and advantages will be apparent to those skilled in the art upon a full understanding of the construction, arrangement and operation of the improvements incorporated in the machine.

A preferred embodiment of the invention is presented herein for the purpose of exemplification, but it will of course be appreciated that the invention is susceptible of embodiment in other structurally modified forms coming equally within the scope of the appended claims.

In the accompanying drawings:

Fig. 1 is a plan view of a machine constructed in accordance with the invention;

Fig. 2 is a front view of the machine;

Fig. 3 is a plan view of the knot tied by the machine;

Fig. 4 is a front view of the knot;

Fig. 5 is a vertical section through the machine, taken on the line 5—5 of Fig. 1;

Figs. 6, 7, 8, 9 and 10 are vertical sections through the machine, taken respectively on the lines 6—6, 7—7, 8—8, 9—9 and 10—10 of Fig. 2;

Fig. 11 is a fragmentary vertical section, taken on the line 11—11 of Fig. 9; and

Fig. 12 is a plan view of the twisting pinion and interchangeable bearings for the same, removed from the machine.

The machine shown in the drawings includes a base 10, a stationary wire gripper 11 at one side of the base, a movable wire gripper 12 at the other side of the base, a horizontally arranged forwardly opening throat 13 in the base between the grippers 11 and 12, a slotted twisting pinion 14 journaled in the base in the rear part of the throat 13, slotted holding yokes 15 at opposite sides of the pinion 14 between the latter and the grippers, cutters 16 associated with the yokes 15 for severing the excess wire at the ends of the knot, a hand lever 17 for operating both the twisting pinion 14 and the cutters 16, and another hand lever 18 for operating the movable gripper 12.

The base 10 is provided with a flat bottom 19 which enables it to rest stably on the object, a forwardly projecting lip 20 which forms a continuation of the lower part of the throat 13, and side extensions 21 and 22 which support respectively the stationary gripper 11 and the movable gripper 12. The base is also provided, at substantially its center, with a pair of upwardly projecting lugs 23 in which a shaft 24 is journaled.

The stationary wire gripper 11 consists of a forwardly projecting bottom plate 25 and a downwardly spring-pressed disk 26 which is peripherally serrated in order to frictionally grip a wire portion resting on the plate 25. The disk 26 is eccentrically pivoted on a bolt 27 and is secured to a small sheet metal bracket 28, which bracket moves with the disk. The bracket 28 is provided with a forwardly projecting ear 29 above one edge of the plate 25, which ear has a cam-shaped lower edge 30 which causes the gripper to open automatically when a wire portion is pushed rearwardly in engagement with such edge. This gripper assembly is set back at a slight angle to the axis of the twisting pinion 14 and is secured to a bracket 31 which is rigidly but detachably fastened to the extension 21 of the base by machine screws 32.

The movable wire gripper 12 consists of a radially slotted winding head 33, a bolt 34 on which the head is journaled, a ratchet wheel 35 associated with the head, a dog 36 pivotally carried by the handle 18 for turning the wheel 35 and head 33 in a clockwise direction, and a second dog 37 for preventing movement of the same in the opposite direction. This gripper assembly is likewise set back at a slight angle to the axis of the twisting pinion 14 and is secured to a bracket 38 which is rigidly but detachably fastened to the extension 22 of the base by machine screws 39.

In proceeding to tie a wire about an object, the machine is placed on the object, one end of the wire is hooked into the radially slotted winding head 33 at the left side of the machine, and the head 33 is then turned by means of the handle 18 far enough to prevent any likelihood of the

wire becoming accidentally disengaged from the head. The wire portion leading from the thusly engaged end is then pushed back within the throat 13 of the base into the narrow slot 40 in the twisting pinion 14 and the equally narrow slots 41 in the holding yokes 15. After this has been done the wire is passed about the object and again pushed back into the slot 40 in the twisting pinion and the slots 41 in the holding yokes, thereby lodging portions of the wire side-by-side in such slots. The far end of the wire leading back to the coil or other source of supply is then pushed under the ear 29 on the gripper 11 at the right side of the machine, allowing the disk 26 of the gripper to be pressed into frictional engagement with the wire.

During the application of the wire to the machine, the portion of the wire leading off toward the left about the object is adapted to be engaged by a downwardly opening hook 42 which is pivoted to the base at the left side of the machine. This hook assists in keeping the machine in proper position with respect to the loop of wire about the object during the subsequently performed tensioning, twisting and cutting operations.

As soon as the machine has been threaded with the wire in the manner described, the operating handle 18 for the movable gripper 12 is given a few strokes in order to tension the wire about the object to the extent desired. After this has been done the handle 17 is given three strokes forward and backward. The forward strokes of this handle cause the twisting pinion 14 to rotate and twist the overlapped portions of the wire together into the flat knot 43 shown in Figs. 3 and 4, while the last one of the three rearward strokes of the same handle causes the cutters 16 to sever the excess wire at the points 44 just beyond the ends of the twist.

The forwardly opening throat 13 contains two axially aligned cylindrical bores 45 which are separated from each other by a transverse slot 46. The twisting pinion 14 is positioned in the slot 46 and is provided with axially extending cylindrical studs 47 which are disposed within the adjacent ends only of the bores 45. The portion of the base 10 immediately below the slot 46 and below the adjacent ends of the bores 45 is provided with an opening 48, which opening underlies the pinion 14 from one end of one stud 47 to the other end of the other stud, thereby permitting insertion and removal of the pinion through such opening upon endwise withdrawal of two interposed bearing sleeves 49. The sleeves 49, which are preferably made of bronze but may be made of any other suitable bearing material, line the bores 45 in the throat 13. These sleeves are open at the front and conform to the upper and lower surfaces of the portions of the throat 13 in front of the bores. The sleeves 49 extend the full length of the bores 45 but only the ends of the sleeves adjacent the pinion 14 serve as bearings for the studs 47 on the pinion. This permits the two sleeves 49 to be interchanged, one for the other, in the bores 45 upon becoming worn, thereby in effect permitting renewal of the bearings for the pinion without the necessity of having to actually replace the sleeves.

The twisting pinion 14 meshes upwardly and rearwardly with a relatively large gear 50, which gear is journaled on the previously mentioned shaft 24. The gear 50 is secured to a collar 51 on the shaft by means of several locking pins 52, and the collar 51 is provided about its periphery with three equally spaced ratcheting notches 53. The operating handle 17 for the twisting and cutting mechanisms is provided at the location of the shaft 24 with two laterally spaced arms 54 which are freely pivoted on the shaft 24 at opposite sides of the lugs 23. One of the arms 54 carries a pivotally mounted spring-pressed dog 55 which engages within one of the notches 53 in the collar 51 upon each forward stroke of the handle 17, turning the gear 50 one-third of a revolution during each stroke. At the end of each stroke the gear 50 is yieldingly held against inadvertent movement by two oppositely disposed spring-pressed plungers 56, carried by the base, which plungers project into shallow recesses 57 in the opposite faces of the gear. The gear 50 makes a complete revolution for each three strokes of the handle 17 and during this complete revolution of the gear 50 the twisting pinion 14 makes three complete turns to twist the wire held therein into the desired knot formation. The rearmost position of the handle 17 at the commencement of each forward stroke, is determined by an adjustable set screw 58 in the base, which screw is so disposed as to cause the slot 40 in the twisting pinion 14 to be directed toward the front of the machine while the wire is being connected up with the machine preparatory to the tensioning, twisting and cutting operations.

The holding yokes 15—which keep the overlapped wire portions from turning at the locations of such yokes during the twisting operation—fit against the otherwise open ends of the bores 45, between the latter and the cutters 16. The cutters 16 consist of blocks 59 which are pivoted at their lower ends on pins 60, and cutting blades 61 which are detachably secured to the front edges of the blocks 59, beneath overhanging shoulders 62 on the blocks, by means of screws 63. The blades 61 shearingly coact with the side faces of the yokes 15 at the locations of the slots 41 therein and are notched in such a way that the blade 61 at the left side of the machine will cut only the rear wire while the blade 61 at the right side will miss the rear wire and cut only the front wire. The blocks 59 are normally held in their raised inoperative positions by springs 64 which are located beneath the lower edges of the blocks. The blocks are swung forwardly and downwardly to cut the wire at the end of the third and last rearward stroke of the handle 17. This is accomplished by cams 65 on the ends of the shaft 24, which cams revolve with the shaft one-third of a revolution during each rearward stroke of the handle 17. The shaft 24 and the cams 65 turn in the opposite direction from the gear 50 on the same shaft, the shaft and cams making a complete revolution in one direction while the gear is making a complete revolution in the opposite direction. At the end of the third rearward stroke of the handle 17 the cams 65 will engage with the blocks 59 at 66, causing the blocks 59 to swing forwardly and cut the wire. The shaft 24 and the cams 65 are rotated by a collar 67 which is fastened to the shaft between the gear 50 and one of the lugs 23. This collar, like the previously described collar 51, is provided with three equally spaced ratcheting notches 68 which are engaged, one after the other, by a pivotally mounted spring-pressed dog 69 on the other arm 54 of the handle 17. The notches 68 and the dog 59 are so positioned, however, as to turn the shaft 24 during the rearward strokes only of the handle. A small spring-

pressed pivotally mounted locking dog 70 is carried by the base in engagement with the notches 68, one after another, for preventing the shaft 24 from turning in the same direction as the gear 50.

To prevent any inadvertent movement of the handle 17 relative to the base 10 before the wire is connected up with and threaded into the machine, and thereby insure the slot 40 in the twisting pinion 14 opening toward the front of the machine to receive the wire, a special locking device 71 is provided, which locking device will not permit the handle 17 to be moved from its starting position until after the wire has been connected up with the grippers 11 and 12 and placed under at least some tension. The locking device 71 consists of a plate 72 which is pivotally mounted on a pin 73. The plate is characterized by a hook portion 74 which is adapted to engage with a stud 75 on one of the arms 54 of the handle 17. When the machine is not in use the hook 74 is held in engagement with the stud 75 by a spring 76. This locked engagement of the parts prevents the then rearwardly disposed handle 17 from being moved. The plate 72 is provided with a cam 77 which engages with the rear edge 78 of a slide 79. The slide 79 is movable forwardly and rearwardly in a passage 80 provided for that purpose. The front edge 81 of the slide projects into the position occupied by portions of the wire when the latter is under tension. Accordingly, as soon as the wire is tensioned and drawn into the dotted line position shown in Fig. 10, the slide 79 will be forced rearwardly by the wire, camming the plate 72 into the released position shown in dotted lines in that view. Later, when the wire portion leading to the gripper 11 is cut, the slide 79 will be released from the pressure of the wire and the spring 76 will cause the hook 74 to again lock with the stud 75 on the handle.

In completing the formation of the knot 43, the overlapped wire portions held by the yokes 15 are given a slight over-twist by the pinion 14, the latter turning a little beyond its final position so that the knot will receive a set in which the ends thereof are in substantially the same horizontal plane when they come to rest. In accomplishing this over-twist, the previously mentioned indexing plungers 56, after riding into the recesses 57 at the end of the last forward stroke of the handle 17, will ride somewhat past the centers of the recesses 57 under resiliently yielding resistance while the handle is moved forwardly to a position wherein bosses 82 on the handle come into engagement with abutments 83 on the base. As soon as all forward pressure on the handle 17 is relieved the indexing action of the plungers 56 will come into play, springing the twisting pinion 14 back into a position wherein the slot 40 therein opens toward the front in a perfectly horizontal position in readiness to permit removal of the knot as soon as the cutters 16 have cut away the excess wire. Since the cutters 16 cannot act upon the wire until after the handle 17 has been moved all of the way from its foremost position into its rearmost position, the knot formation is always given an opportunity to come to rest in its final position before any cutting thereon takes place. As a result of this, the wire portions adjacent the ends are disposed side by side in the same horizontal plane and the extremities of the wire where the cutting takes place are depressed by the action of the cutting blades into positions a little below such plane.

Briefly reviewing the operation of the improved machine, the base of the machine is placed against the object about which the wire is to be looped and tied, one end of the wire is engaged with the winding head 33, moved back into the slots 40 and 41 in the twisting pinion and holding yokes, passed about the object, moved again into the slots 40 and 41 in overlapping relation to the portion of the wire already occupying such slots, and then secured beneath the disk 26. After the wire has been connected with the machine and looped about the object in this manner, tension is placed on the wire by operating the handle 18. As the wire becomes taut, the slide 79 is forced rearwardly by the wire in engagement with the front edge of the slide, releasing the hook 74 from the stud 75 on the handle 17. The handle 17 is then given three forward strokes and three rearward strokes. The three forward strokes act through the gear 50 to rotate the twisting pinion the number of turns necessary to produce the knot 43, while the three rearward strokes act through the shaft 24 to bring the cams 65 at the end of the last rearward stroke into engagement with the blocks 59 of the cutters 16, causing the latter to sever the excess wire from the ends of the knot. At the completion of this cutting operation the handle 17 will become automatically locked in its rearmost position.

We claim:

1. In a wire tying machine, tensioning and twisting mechanisms, separate independently movable hand levers for operating said mechanisms, and means for locking the hand lever for the twisting mechanism against movement prior to the operation of the tensioning mechanism irrespective of the position of the hand lever for the tensioning mechanism.

2. In a wire tying machine, tensioning and twisting mechanisms, separate independently movable hand levers for operating said mechanisms, and means for preventing the operation of the twisting mechanism prior to the operation of the tensioning mechanism, said means being operative in all positions of the machine, whereby to permit the machine to be moved about in any position without rendering said means inoperative.

3. In a wire tying machine, tensioning and twisting mechanisms, separate independently movable hand levers for operating said mechanisms, means for normally locking the hand lever for the twisting mechanism against movement, and means operable by the pressure of the wire thereagainst when drawn taut by the tensioning mechanism for releasing the locking means to thereafter permit movement of the hand lever for the twisting mechanism.

4. In a wire tying machine, twisting and cutting mechanisms, means rotatable in one direction a predetermined amount to operate the twisting mechanism, other means rotatable in the opposite direction a predetermined amount to operate the cutting mechanism, and a single hand lever movable in one direction to turn only the first mentioned means and movable in the opposite direction to turn only the second mentioned means.

5. In a wire tying machine, twisting and cutting mechanisms, a gear rotatable in one direction a complete revolution to operate the twisting mechanism, a cam shaft rotatable in the opposite direction a complete revolution to operate

the cutting mechanism, and a single hand lever movable in one direction to turn the gear and movable in the opposite direction to turn the cam shaft.

6. In a wire tying machine, twisting and cutting mechanisms, a gear rotatable in one direction a complete revolution to operate the twisting mechanism, a cam shaft rotatable in the opposite direction a complete revolution to operate the cutting mechanism, a single hand lever for turning both the gear and the cam shaft, a one-way ratchet connection between the hand lever and the gear for turning the gear only when the hand lever is moved in one direction, and a second oppositely working one-way ratchet connection between the hand lever and the cam shaft for turning the shaft only when the hand lever is moved in the other direction.

7. In a wire tying machine, twisting and cutting mechanisms, a gear rotatable in one direction a complete revolution to operate the twisting mechanism, a cam shaft rotatable in the opposite direction a complete revolution to operate the cutting mechanism, a single hand lever for turning both the gear and the cam shaft, a one-way ratchet connection between the hand lever and the gear for turning the gear only when the hand lever is moved in one direction, and a second oppositely working one-way ratchet connection between the hand lever and the shaft for turning the cam shaft only when the hand lever is moved in the other direction, the gear being rotatably mounted on the cam shaft, and the hand lever being pivotally mounted on the cam shaft.

8. In a wire tying machine, a base containing two axially aligned bores, a slot between the bores, and an opening underlying the slot and the adjacent ends of the bores, a radially slotted twisting pinion positioned in the slot and provided at its sides with axially extending journaling studs which are located in said bores directly above said opening, and bearing sleeves surrounding and supporting the journaling studs in said bores, said sleeves being withdrawable endwise from the bores to permit removal of the pinion with its studs downwardly through said opening.

9. In a wire tying machine, a base containing two axially aligned bores, a slot between the bores, and an opening underlying the slot and the adjacent ends of the bores, a radially slotted twisting pinion positioned in the slot and provided at its sides with axially extending journaling studs which are located in said bores directly above said opening, and bearing sleeves surrounding and supporting the journaling studs in said bores, said sleeves being withdrawable endwise from the bores to permit removal of the pinion with its studs downwardly through said opening, and said sleeves being substantially longer than the studs to permit the sleeves to be interchanged in the bores to effect renewal of the bearing surfaces for the studs.

10. In a wire tying machine, twisting and cutting mechanisms, and a single hand lever for operating both of said mechanisms, the completion of the twisting operation taking place when the hand lever reaches the end of its movement in one direction, and the entire cutting operation taking place when the hand lever reaches the end of its movement in the opposite direction, whereby to allow the twisted knot formation to come to rest before the excess wire is cut from the ends of such formation.

11. In a wire tying machine, tensioning and twisting mechanisms, separate independently moving hand levers for operating said mechanisms, and means for locking the hand lever for the twisting mechanism against movement prior to the operation of the tensioning mechanism, said locking means being operative in all positions of the machine, whereby to enable the machine to be carried about by either lever as a handle without releasing said locking means.

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