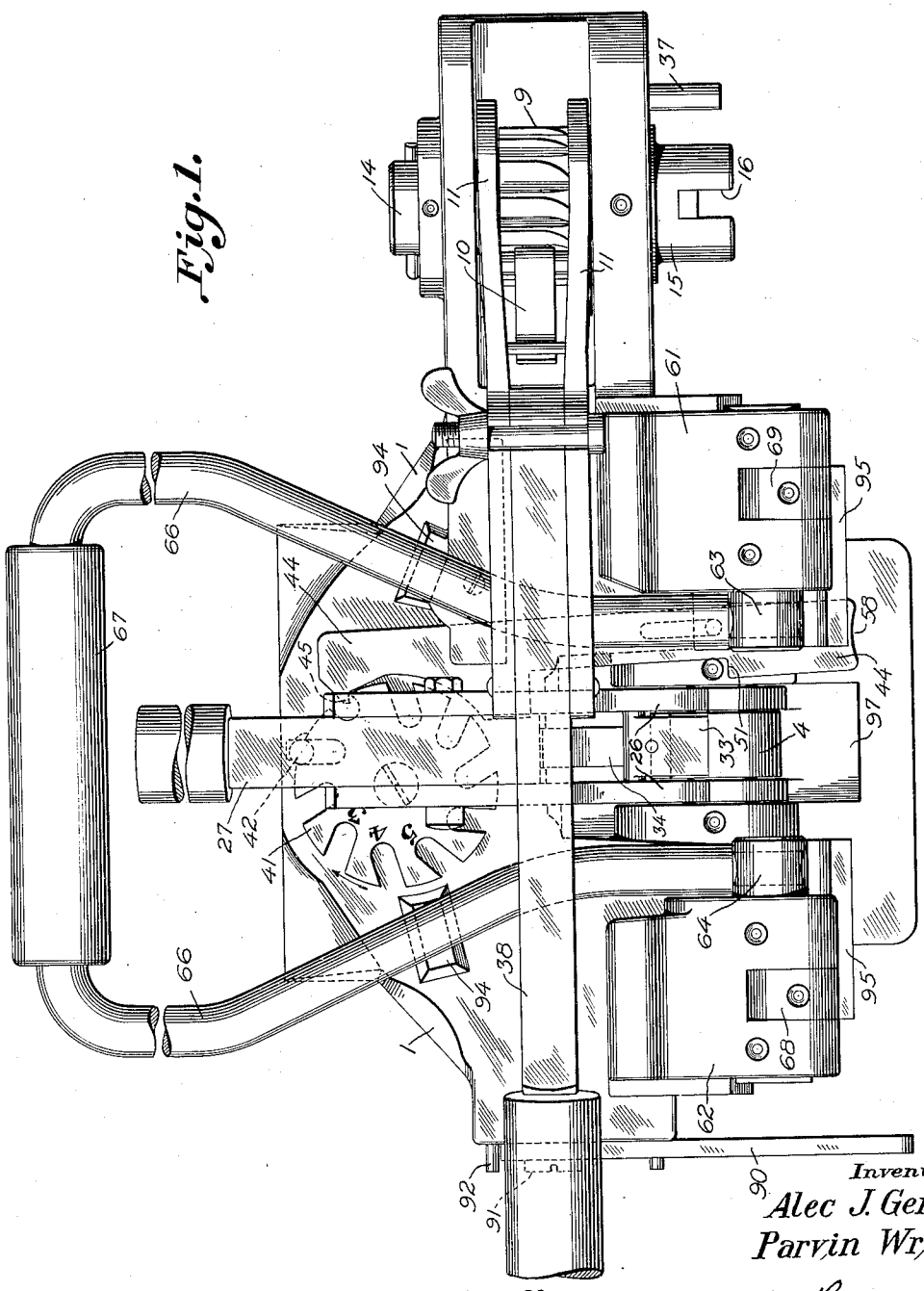
Dec. 20, 1927. 1,653,165

A. J. GERRARD ET AL

WIRE TYING MACHINE

Filed March 29, 1923 7 Sheets-Sheet 1

Fig. 1.



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WIRE TYING MACHINE

Filed March 29, 1923 7 Sheets-Sheet 2

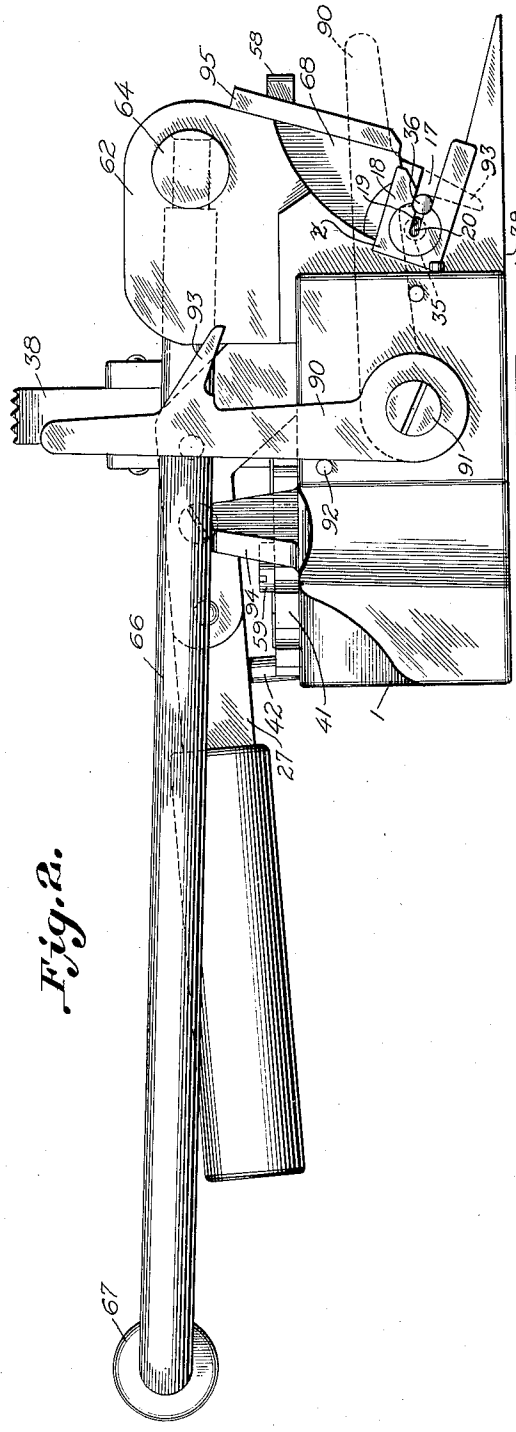


Fig. 2.

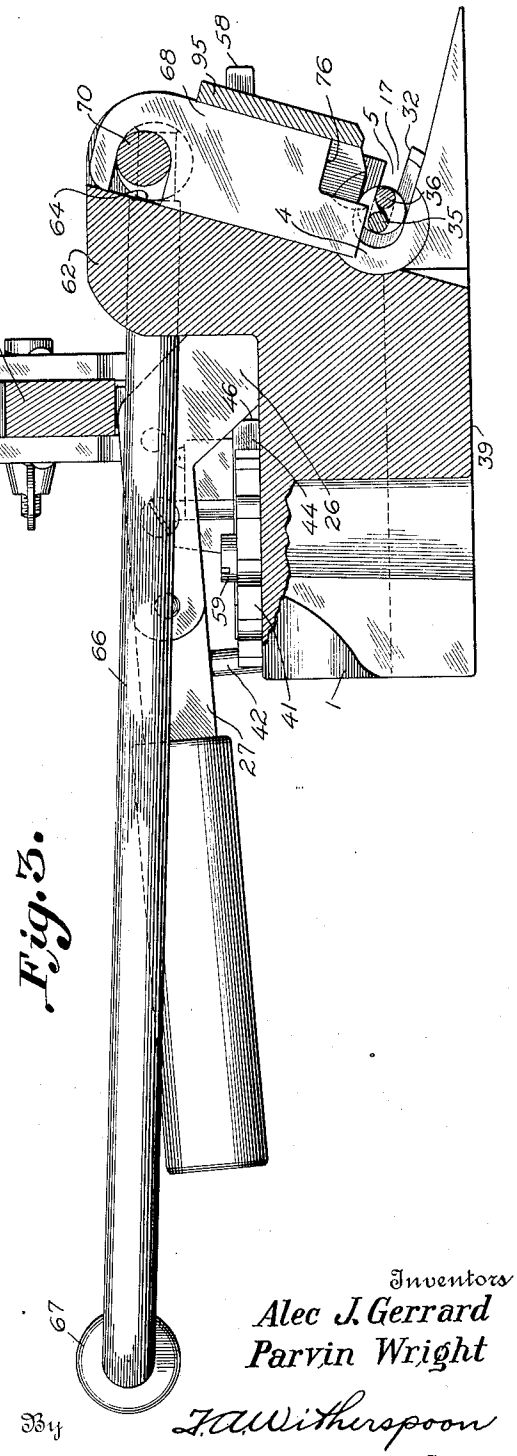


Fig. 3.

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WIRE TYING MACHINE

Filed March 29, 1923 7 Sheets-Sheet 3

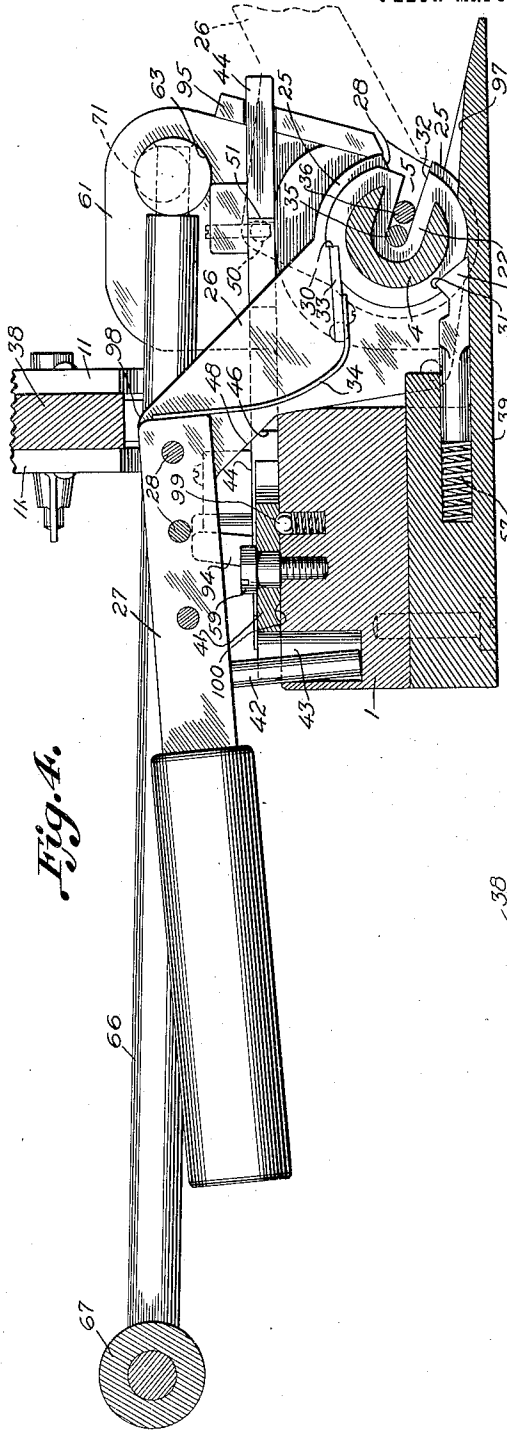


Fig. 4.

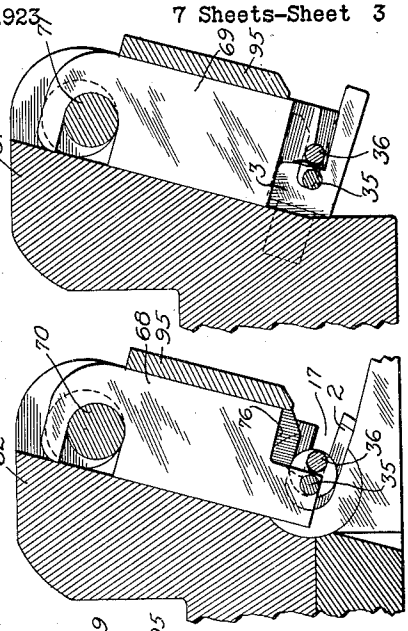


Fig. 7.

Fig. 6.

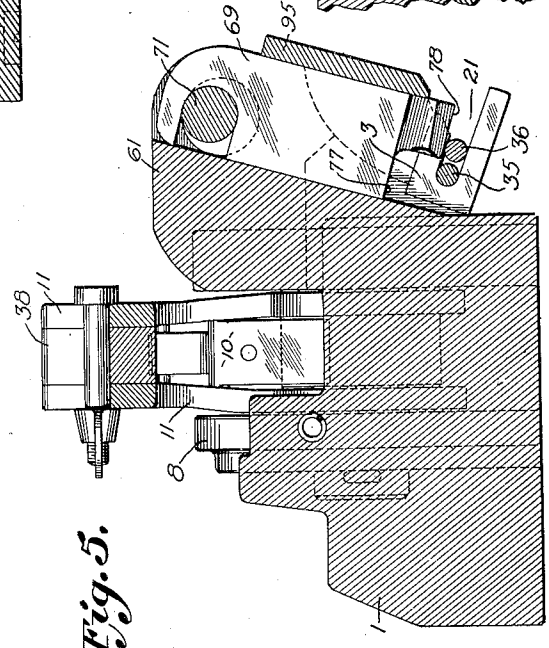


Fig. 5.

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WIRE TYING MACHINE

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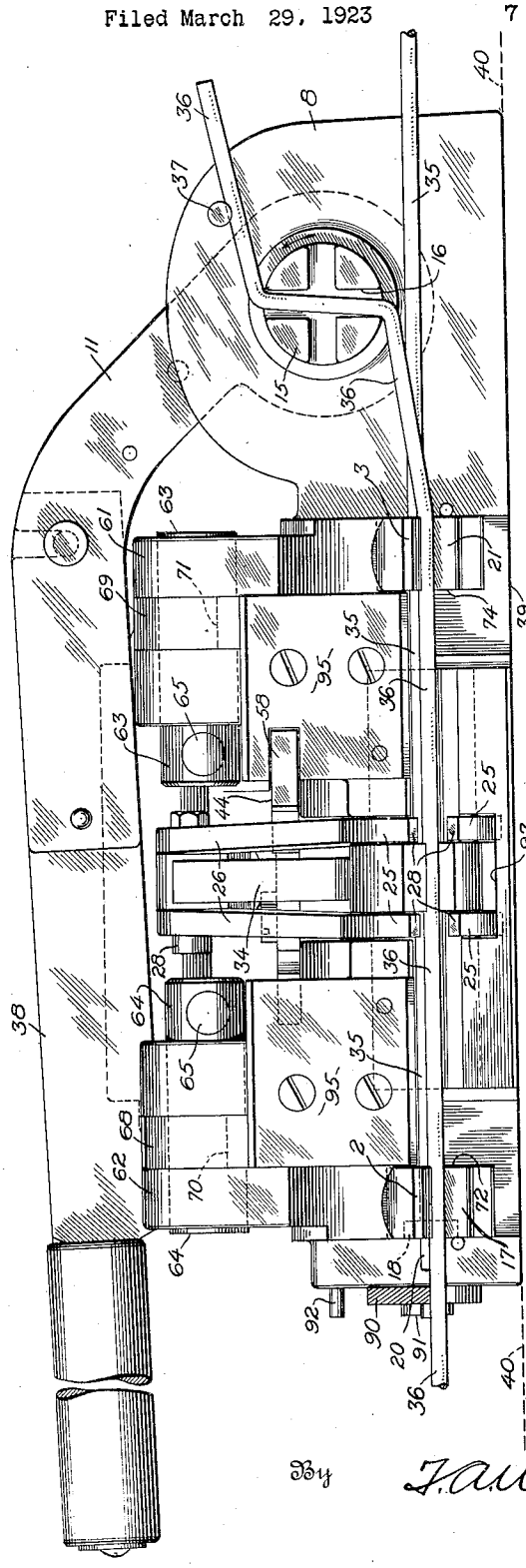


Fig. 8.

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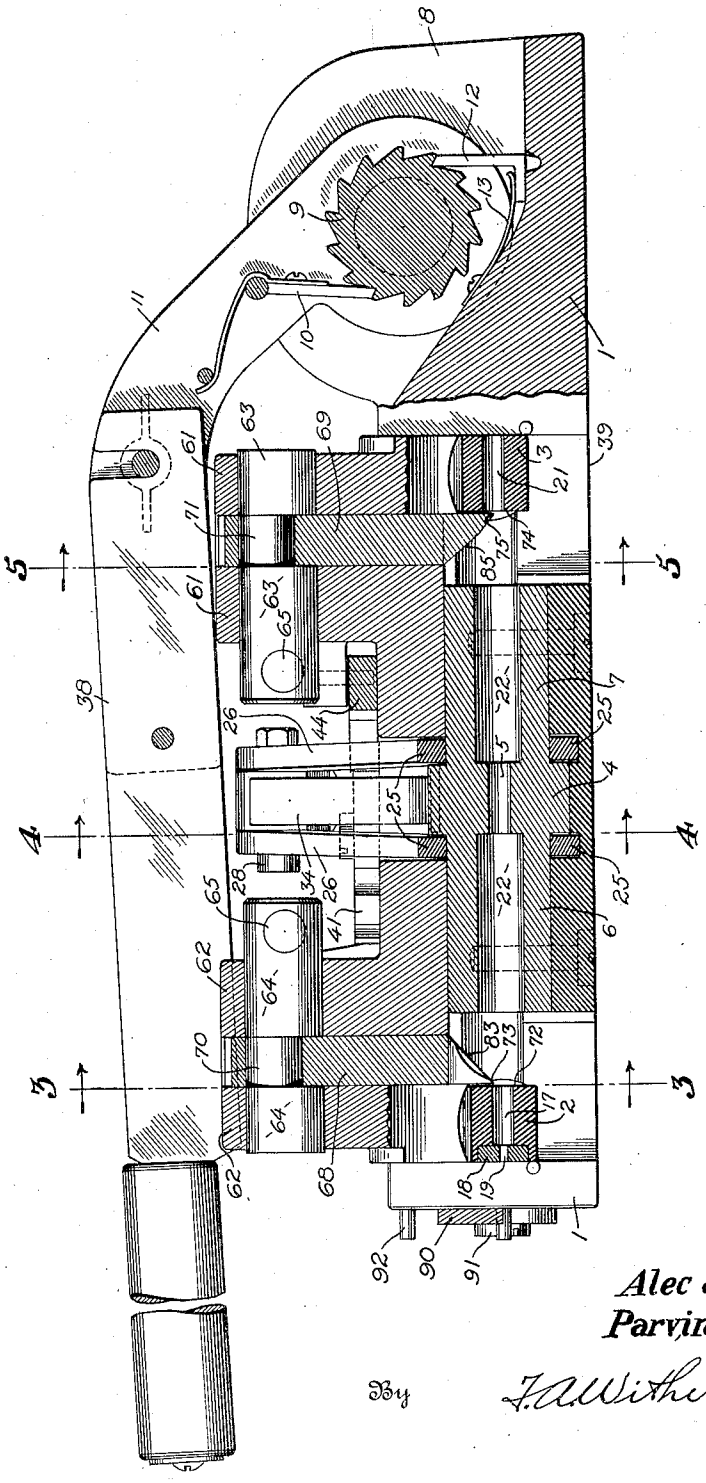
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WIRE TYING MACHINE

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Fig. 9.



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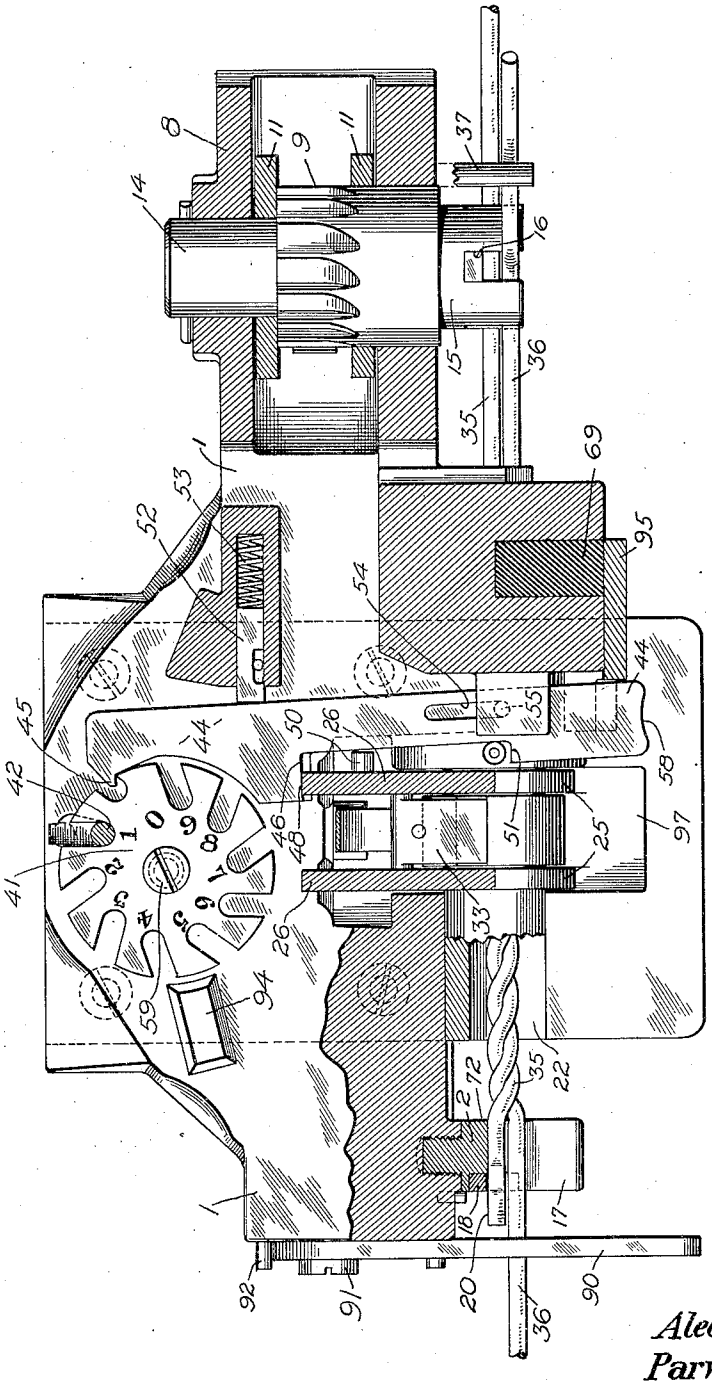
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WIRE TYING MACHINE

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Fig. 10.



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WIRE TYING MACHINE

Filed March 29, 1923 7 Sheets-Sheet 7

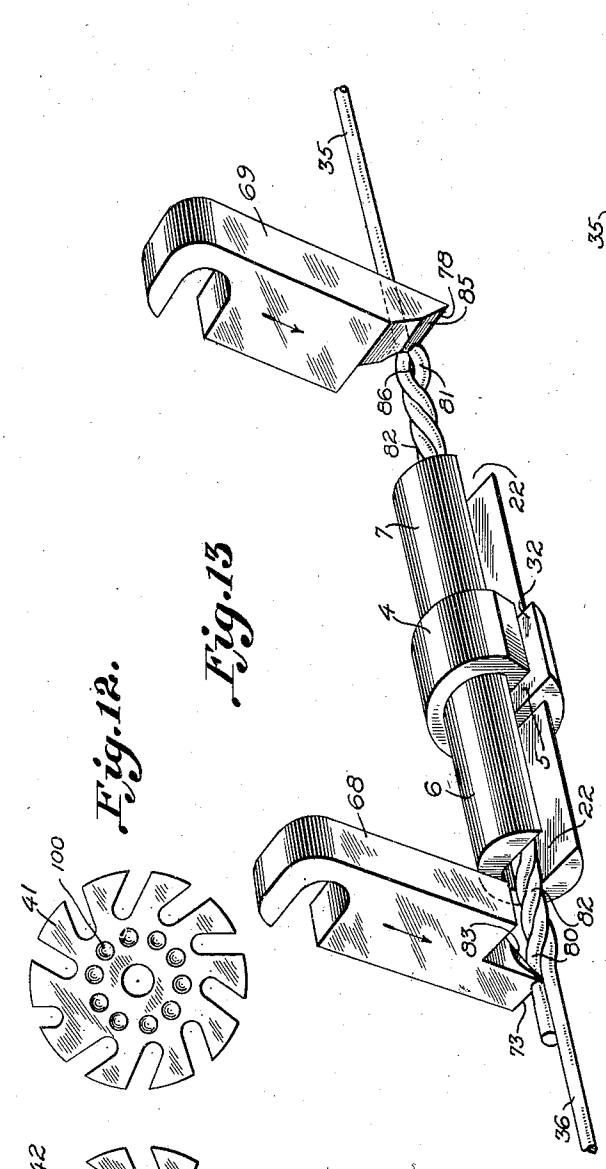


Fig. 13

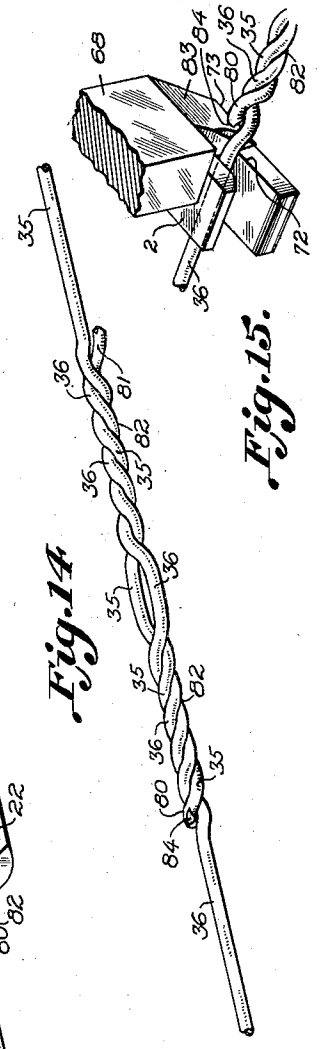


Fig. 14

Fig. 15.

Fig. 12.

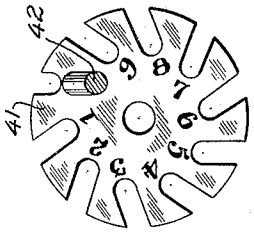


Fig. 11.

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Patented Dec. 20, 1927. 1,653,165

UNITED STATES PATENT OFFICE.

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WIRE-TYING MACHINE.

Application filed March 29, 1923. Serial No. 628,591.

This invention relates to wire tying machines, and has for its object to provide a relatively light machine which will tie under tension relatively very heavy wire, as well as one that will be certain in action and comparatively inexpensive to manufacture, while the mechanism is so arranged that the ends of the tied knot will be tucked down alongside of the tensioned bights of wire, so as to not tear packages that are moved thereover.

With these and other objects in view, the invention consists in the novel details of construction and combinations of parts more fully hereinafter disclosed and particularly pointed out in the claims.

Referring to the accompanying drawings forming a part of this specification in which like numerals designate like parts in all the views:

Figure 1 is a plan view of a machine made in accordance with this invention;

Figure 2 is an end elevational view of the parts shown in Figure 1;

Figure 3 is a cross sectional view taken on the line 3—3 of Figure 9, looking in the direction of the arrows;

Figure 4 is a cross sectional view taken on the line 4—4 of Figure 9, looking in the direction of the arrows;

Figure 5 is a cross sectional view taken on the line 5—5 of Figure 9, looking in the direction of the arrows;

Figure 6 is a detailed view showing the position of one of the cutters after the wire has been completely severed;

Figure 7 is a view similar to Figure 6 showing another cutter after another portion of the wire has been severed;

Figure 8 is a front elevational view of the parts shown in Figure 1;

Figure 9 is a cross sectional view of the parts shown in Figure 8;

Figure 10 is a partially sectional, partly plan view, of the parts shown in Figures 1 and 8;

Figure 11 is a top plan view of a timing disk controlling the operation of the machine;

Figure 12 is a bottom plan view of the parts shown in Figure 11;

Figure 13 is a perspective view showing a portion of the twisting and cutting mechanism associated with the tied knot;

Figure 14 is a perspective view of the tied knot; and

Figure 15 is a detailed perspective view illustrating the action of the tied knot of one of the cutters and the anvil associated therewith.

1 indicates any suitable framework, on which is mounted wire holding posts 2 and 3, see Figures 8 and 9, and 10, while 4 represents a twisting pinion or ratchet having the twisting slot 5 and the elongated bearings 6 and 7 mounted for rotation in the frame, as best shown in Figures 9 and 13. Also mounted in an extension 8 of the frame is the ratchet 9 operated by the pawl 10 carried by the lever 11 and provided with the stop pawl 12 controlled by the spring 13. This said ratchet 9 is provided with the extended bearings 14, see Figure 10, and also with the wire tensioning extension 15 provided with a plurality of slots 16, see Figures 8 and 10. The wire holding post 2 is provided with an open ended slot 17, see Figures 2, 9 and 10, and with an open ended slotted member 18 provided with a restricted slot 19 registering with said open ended slot 17. The said restricted slot 19 is of a size sufficient to receive the deformed end 20 of the wire and to thus hold said end firmly in place during the tensioning and twisting operation, while the open ended larger slot 17 is of sufficient size to receive the full diameter of the wire, but is of a size too small to permit two bights of the wire to twist around each other. In the same way, the holding post 3 is provided with an open ended slot 21, which is of substantially the same diameter of the wire being used, and is therefore of a size too small to permit two bights of the wire to be twisted around each other. Likewise, the slot 5 in the twisting ratchet 4 can receive two parallel bights of the wire, and said slot is too small to permit the bights to be twisted around each other. On the other hand, the slots or bores 22 in the twisting ratchet 4 are of a size sufficient to permit the bights of the wire to be freely twisted around each other, all as will be clear from Figures 9 and 10.

Surrounding the extensions 6 and 7 of the twisting ratchet 4, and straddling each side of said ratchet are a pair of collars 25, Figures 4, 8, 9 and 10, which are rigid with the hand operated lever 26 provided with the handle 27, secured to the member 26, as by the bolts 28. Said lever 26 is thus bifurcated or made in two parts, as shown, while

the handle member 27 is secured between said parts, and the extension of said members 26 constituting the collars 25 are slotted as at 28 to permit the wire to freely pass into the slot 5 of the twisting ratchet 4, all as will be clear from the drawings. The outer circumference of the ratchet 4 is provided with a pair of notches or ratchet teeth 30 and 31, while one of the lips 32 of the slot 5 constitutes a third ratchet tooth. A pawl 33 controlled by the spring 34 is mounted between the members 26 of the lever and takes against said ratchet teeth 30, 31 and 32, when the handle 27 is operated, so that the said ratchet twisting pinion may be readily turned to twist the two bights of the wire together.

In other words, from the mechanism so far disclosed, it will be readily understood that the deformed end 20 of the wire is slipped into the restricted slot 19 on the left hand portion of the machine, as seen in Figures 9 and 10, whereupon the bight 35 of the wire is passed through the slots 22, 5 and 21 toward the right, down around the right hand side of the package, not shown, (to be wired) across the bottom and up on the left hand side thereof whereupon the bight 36 of the wire is passed into the larger open ended slot 17 of the post 2, through the slots 22, the slot 5, of the twisting pinion, through the slot 21 of the holding post 3, and up through one or more of the slots 16 in the tensioning device 15, and under the steadying pin 37 with which the extension 8 of the frame is provided. The wire being thus trained around the box and through the machine, the handle 38 of the tensioning lever 11 is now reciprocated a sufficient number of times to put the desired tension upon the wire.

It should be observed that this machine is intended for, and is capable of handling or tying relatively very large and stiff wires, so that it being portable, it may be readily carried from one large heavy package to another, and there used to band boxes, which heretofore have been usually banded by extraordinarily large and expensive machines. Therefore, as the wire is unusually stiff and heavy, it is very desirable indeed that the slack shall be taken up on both sides of the box during the tensioning operation.

To this end, the bottom 39 of the machine is made smooth, so that during the tensioning operation the end 20 of the wire being held stationary in the machine and the bight 36 of the wire being pulled on, the machine readily crawls over the top 40 of the package toward the right, as seen in Figure 8, and thus takes up the slack on the right hand side of said figure, while the tensioning device 15 takes up the slack on the left hand side of said figure.

The desired tension being thus placed in the wire, the two bights 35 and 36 of the wire are twisted together as follows: The handle 27 of the bifurcated lever 26 is reciprocated a predetermined number of times, depending upon the amount of twist it is desired to place in the bights 35 and 36. The twisting ratchet 4 being thus rotated on its bearings 6 and 7, the said bights 35 and 36 are twisted together to form the knot shown in Figure 4. The wire being unusually stiff and heavy, it is very important indeed that the twisting operation shall cease when the slot 5 is in registry with the slots 28 of the collars 25 forming a part of the lever 26, for otherwise it would be difficult to get the twisted knot out of the machine, and the parts would jam. Further, it is important that the operator should be assured that the proper number of twists had been put into the wire to provide the necessary strength in the knot.

In order to accomplish this purpose, there is provided on the frame 1 the timing disk 41 pivoted as at 59, to said frame. This disk is provided with a predetermined number of notches numbered from zero (0) to 9. These notches, except the one marked zero (0) are all of a depth sufficient to permit the pin 42 carried by the handle 27 to pass therethrough and down into the hole 43, with which the frame 1 is provided, all as will be clear from Figures 4, 10, 11 and 12. In other words, so long as any of the notches, except the one marked zero (0) is in the path of movement of said pin 42, the ratchet disk 4 can be turned by the pawl 33, but when the notch marked zero (0) is in the path of movement of said pin, 42, a complete stroke of the lever 26 or handle 27 cannot be made, and therefore the ratchet disk 4 cannot be turned. That is to say, this machine is provided with slidable pawl member 44, provided with the hook or toe 45, which engages each of the notches marked from zero (0) to 9, in the timing disk 41, and this pawl 44 is provided with the shoulder 46, adapted to be struck by the lever 26 at the point 48, see Figures 4 and 10, and thus is the said pawl 44 moved in a direction toward the top of Figure 10, and toward the left of Figure 4, when said lever 26 is correspondingly moved. On the other hand, attached to said lever 26 is a pin 50 which when the reverse movement of the lever 26 is had, contacts with the shoulder 51 of the pawl 44, and thus moves said pawl in an opposite direction or in such a direction as will turn the timing disk 41. That is to say, when the lever 26 is turned in such a direction as to cause it to occupy its full line position, in Figure 4, the hook 45 of the pawl will move from one notch of the disk 41 around the circumference of said disk into engagement with another notch, while when the lever 26 is moved in a direc-

tion to make it occupy its dotted line position shown in Figure 4, the pawl 44 through the action of the pin 50 contacting with the shoulder 51 will move said pawl 44 in an opposite direction, or in such a direction as will turn the timing disk 41 one notch. The engagement and disengagement of the notches in the disk 41 by the hook 45 is effected through the spring pressed pawl 52 controlled by the spring 53, as best shown in Figure 10, and the said pawl is provided with a slot 54 and pin 55 to hold it in position.

It thus results that in beginning the twisting operation, the extreme end 58 of the pawl 44 is pushed by hand so that it engages the notch number 9 on the disk 41. When the parts are in the position stated, the pin 42 of the lever 27 is on the blank space numbered zero (0), of the disk 41, and the said lever occupies its position toward the left, as seen in Figure 4. However, its pawl 33 is not engaged with the notch 30 on the twisting ratchet for the pin 42 not occupying the hole 43, said pawl 33 can not engage said notch. Therefore, the first stroke over toward the right as seen in Figure 4 of the lever 27 only serves to cause the pin 50 of the member 26 to engage the extension or shoulder 51 on the pawl 44, and to force said pawl 44 over toward the right as seen in Figure 4.

No twisting is accomplished by this first stroke at all, but the blank or shallow notch zero (0) in Figure 10 has been moved by the pawl tooth 45 around to the position shown in Figure 10, whereupon the succeeding notches from 1 to 9 will be of a sufficient depth to enable 9 complete strokes of the levers 27 and 26 to be made, and thus will three complete turns or twists be placed in the bights 35 and 36 of the wire.

It will be understood, of course, that during this operation, the pawl 33 takes against the lip 32 as if it were a notch. In the meantime, the pawl 56 controlled by the spring 57 takes in the notches 30 and 31 or against the lip 32 to hold the twisting ratchet into whatever position it may have been brought by the actuation of the levers 26 and 27. A very considerable mechanical advantage is had by the disposition and arrangement of parts just described, for such disposition enables one to make the machine exceedingly compact and strong, thus enabling it to be made unusually light for the heavy work required.

It is well known that heavy wires are very stiff and hard, to work when twisting pinions are geared up in the usual way, and that it is therefore very difficult indeed to sufficiently gear down a twisting pinion to do the heavy work of this machine, without causing great difficulty in the operation of the machine. On the other hand, by operating the twisting slot 5 as if it were a slotted ratchet wheel, a maximum of power in a minimum of space can be readily applied thereto. Further, by providing only two notches on the periphery of the twisting ratchet 4 and a lip 32 to cooperate with the ratchet pawl 33, one is enabled to avoid any notch coinciding with the axis of the slot 5 which would thus greatly weaken the twisting pinion or ratchet. In other words, a maximum of strength is needed in the prolongation of the axis of the slot 5 and this strength is provided in the construction shown by placing the notches 30 and 31 on opposite sides of said axis. The result is an unusually light mechanism, an unusually strong one, thus enabling the operator to employ an unusually heavy and stiff wire.

In addition to the above, owing to the timing disk 41 and its associated parts being perfectly automatic, in their action, the operator need pay no attention to the number of twists he is placing in the wire, nor to the causing of the slot 5 to register with the slot 28 in the twisting lever. The disk 41, the pin 42, and the slidable pawl 44, so controls the twisting action that the operator cannot overtwist nor can he undertwist, so long as he continues to move his lever. These are important factors in this invention, as will appear more fully hereinafter.

The two bights 35 and 36 of the wire having thus been tensioned, and twisted to a predetermined degree, it is of course very necessary to cut the same, and it is also very desirable to cut said bights close up to the termination of the twisted portions of the knot, so as to leave no upstanding ends to act as chisel points or a tearing means for boxes and packages that may be slid over the particular package being wired.

Accordingly, the following cutting mechanism is provided. In extensions 61 and 62 of the frame 1, there are mounted a pair of journals 63 and 64 respectively. These journals are connected as at 65 to the looped lever 66 provided with the operating handle 67. The extensions 61 and 62 are slotted as shown, and in the slot of the extension 62 is placed the reciprocating cutter member 68, while in the slot of the extension 61 is placed the reciprocating cutter member 69. A cam 70 rigid with the journal 64 operates the cutter 68, while a cam 71 rigid with the journal 63 operates the cutter 69. The post 2 not only serves as a holding member for the wire bights, as above disclosed, but the lower inside vertical edge of said post 2 likewise acts as an anvil or as a cutter complemental to the cutter 68. That is to say, referring more particularly to Figures 8, 9 10, and 15, the edge 72 of the post 2 constitutes a cutting edge of one portion of the complete cutter, while the edge 73 of the cutter 68 con-

stitutes the other cutting member. The holding post 3 likewise is provided with the lower edge 74 constituting one of the cutting members, while the extreme edge 75 of the cutter 69 constitutes the other cutting member.

After the twisting operation has been completed, a throw of the handle 67 in a clockwise direction as seen in Figures 2 and 3 causes the cams 70 and 71 to depress their respective cutters 68 and 69 to sever their appropriate bights of wire. That is to say, the cam 70 and cutter 68 will sever the bight 35, while the bight 36 will escape the severing action owing to the fact that the cutter 68 is provided with a blank or cut away space 76. On the other hand, the cutter 69, see Figure 5 is provided with a blank space 77 which permits the bight 35 to escape the severing action while its cutting edge 78 severs the bight 36.

As above intimated, it is very important indeed that the extreme ends 80 and 81 of the finished knots shall be cut off as close as possible to the twisted portion 82 of the knot, and it is furthermore of extreme importance that said ends 80 and 81 be not permitted to extend up above the horizontal plane in which the top surfaces of the bights 35 and 36 are located, for since said extreme ends 80 and 81 are made of steel, if they should extend up above the surfaces of the bights 35 and 36, they not only would act as veritable chisel points to tear the hands of the operator, but they would also act to rip open any other packages that may be moved over the top surfaces of said knots.

In this invention, said extreme ends of the knot are cut off short at the termination of the twisted portion of the knot by locating the cutting edges 72 and 73 on the inner sides of the slots 17 and 21, which mark the termination of the twisted portion of the knot. Said extreme ends are not only in this invention prevented from extending up above the top surfaces of the bights 36 and 35, but they are actually turned down below said top surface, and even below the horizontal diameters of said bights 36 and 35, by the disposition and operation of parts now to be disclosed.

Turning to Figures 2, 3, 4, 5, 13, and 15, it will be seen that the cutters 68 and 69 are inclined to the vertical, so that as the cutting edge 73 of the cutter 68 acts upon the extreme end 80 of the bight 35, it tends to increase the twist and thus to force the said end 80 down below the horizontal diameter of the bight 36. This action is enhanced by the relatively long slope 83, Figures 13 and 15, of the extreme end 73 of the cutter 68, which after the bight 35 has been severed to form the end 80, continues its downward movement, and thus forcibly bends downwardly below the diameter of the bight 36 the severed end 80. In fact, the friction is so great on the extreme end 80 after the bight 35 has been severed that the metal of said bight 80 is torn off or rubbed off, as indicated at the point 84, and the twist is increased in pitch so that the said end 80 is locked, so to speak, or bent down well below the horizontal diameter of the bight 36, and thus forms an exceedingly smooth and desirable knot. In the same way, coming to the cutter 69, its cutting edge 78 has a considerable slope 85, which acts upon the extreme end 81 after the bight 36 has been severed, and tends to untwist said extreme end 81, so that this said end is also bent down well below the horizontal diameter of the bight 35. In the case of the bight 80, the normal twist of the knot is slightly increased due to the action of the cutter, 68, while in the case of the end 81, the twist is slightly decreased, so that in some cases daylight may be seen at the point 86 between the severed end 81 and the bight 35. In every case, however, due to the inclination of the cutters 68 and 69, and to the extra wide beveled surfaces 83 and 85 the ends of the knot are tucked down below their corresponding bights of the wire, and one may pass the hands carelessly and freely over the knot without being in any danger at all of having them injured. This feature, coupled with the feature of the ends 80 and 81 being cut off so close to the twisted portion absolutely prevents any end from sticking up above the surface of the bights 36 and 35, and thus injuring other packages or the persons handling the freight.

During the tensioning operation, since the wires are so very stiff and since the amount of tension is very great, the machine being relatively light, during its crawl over the package, it is liable to slue around and thus carry the held end 20 of the wire away from the bight 36. This action is liable to destroy the parallelism of the two bights 35 and 36, so that should the twisting operation be carried on when in this position a faulty knot and an unsatisfactory operation of the machine is liable to occur. To prevent this, the hook lever 90 is provided, and is conveniently pivoted as at 91 to the frame 1. Said lever when not in use occupies its vertical position against the pin 92 shown in full lines in Figure 2. When, however, the lever is in its operative position, its hook member 93 comes down just outside the bight 36 as indicated in dotted lines in Figure 2, and firmly holds the two bights 35 and 36 in parallelism ready for the twisting operation. Although this hook lever 90 is very useful when the machine does slue around during the tensioning of the wire, yet in many cases there is little or no tendency to slue around, and therefore the hook lever is not brought into use. In fact, the holding means for the wire which is constituted by

the post 2, the slot 5 of the twisting ratchet and by the post 3, when coupled with the slot 16 of the tensioning mechanism is found sufficient to keep the wire in parallelism in many cases.

94 represents stops for the lever 66, when in one extreme position, and 95 represents stops for said lever when in the other extreme position. The bottom of the hole 43 constitutes a stop for the combined lever 27, 26, when in one extreme position, while the cut away portion 97, Figure 4, constitutes a stop for the portion 98 of said lever 27, when in its other extreme position. In other words, in reciprocating the lever 27 all the operator has to do is to throw it in a counterclockwise direction as seen in Figure 4 until the pin 42 reaches the bottom of the hole 43, when the pawl 33 will snugly engage its corresponding notch 30, 31 or 32. On the other hand, the operator when he throws said lever 27 in a clockwise direction as seen in Figure 4 until its point 98 touches the cut away portion 97, then the pawl 33 has turned the twisting ratchet 4 through an arc of 120°, and has brought the succeeding notch such as 31 into the proper position to be engaged by the pawl 33 when the lever 27 has made a complete stroke in the opposite direction. In other words, unless the operator carries the lever 27 to its extreme positions in both directions, he will not be enabled to turn the ratchet 4 and therefore again the construction is such as to compel the operator to put the proper number of twists into the knot, and also to bring the twisting slot 5 into registry with the slot 28 in the jaws 25 of the lever 27.

The disk 41 is held in its adjusted position by means of the spring controlled ball 99 taking in the notches 100, see Figures 4 and 12.

The operation of this device will be clear from the foregoing, but may be briefly summarized as follows: The operator passes the deformed end 20 of the wire through the open ended slot 17 and into the restricted slot 19 of the holding post 2 whereupon he trains the wire around the package to be banded having passed the same through the slots 22, 5 and 21, and brings the bight 36 of the wire back through the open ended slot 17, passes said bight 36 through the enlarged slot 22, and the restricted slot 5 of the twisting ratchet, through the open ended slot 21 of the post 3, and through one or more of the tensioning slots 16 in the tensioning mechanism, whereupon any desired tension is placed upon the wire by the lever 38. He next, while the wire is under tension, reciprocates the twisting lever 27 backwards and forwards making complete strokes each time, in order to cause the pawl 33 to engage one of the notches 30, 31, or the lip 32 of the twisting ratchet 4. Should he fail to cause the pin 42 to reach the bottom of the hole 43, or should he fail to cause the point 98 to contact with the cut away portion 97 of the frame, the ratchet notches would not be left in the proper positions to be subsequently engaged by the pawl 33, and therefore he would not be able to turn the ratchet 4. On the other hand, when complete strokes are made, the pawl 33 will properly engage the notches of the ratchet 4, and a predetermined number of twists will be placed in the two bights 35 and 36 of the wire determined by the timing disk 41. If said timing disk has ten notches, as indicated in Figure 10, one notch will be utilized in bringing the deeper notches in registry with the pin 42, while the other nine notches will be utilized in permitting the pin 42 to make a complete stroke. Therefore, there being three notches, including the lip 32 in the twisting ratchet 4, there will be three complete turns placed in each end of the twisted knot. Should a greater number of notches be placed in the disk 41, a correspondingly different number of turns will be placed in the knot. The timing disk 41 thus governs the rotations of the ratchet twister 4. The cutters 68 and 69 are inclined to a vertical plane as indicated in the drawings, and they have the effect at one end of the twisted knot to increase the twist thereof, and thus to tuck down the severed end of the bight of the wire below the horizontal diameter of the unsevered bight, while at the other end of the knot slightly untwists the severed end, of the knot, and thus again tucks down said severed end below the corresponding unsevered bight. The actions in each case are greatly enhanced by the fact that each cutter is provided with the prolonged beveled portions such as 83 and 85, which have the effect of frictionally engaging the extreme severed ends of the knot such as 80 and 81, respectively, and thus still further tuck down said ends beneath their corresponding bights after the severing action is completed. So great, in fact, is this frictional action on the severed ends that portions of the metal are wiped or torn off of the severed ends as indicated at 84 in Figures 14 and 15. It thus results that an exceedingly strong and valuable knot is produced, because its ends 80 and 81 being severed close to the twisted portion 82 and also being tucked down below the upper surfaces of the bights 36 and 35, there are no projecting points above the twisted portion which can tear the hands of the freight handlers or will rip open other packages which are moved thereover.

It is obvious that those skilled in the art may vary the details of construction as well as the arrangement of parts without departing from the spirit of the invention, and therefore we do not wish to be limited to

the above disclosure except as may be required by the claims.

What we claim is:

1. In a wire tying machine, the combination of means to hold portions of a pair of bights of a wire against twisting; a slotted twisting ratchet member for twisting together other portions of the held bights; slotted means comprising a lever for operating said ratchet member; and a cutter coacting with a surface of said first named means next to the twisted bights to sever one of said bights.

2. In a wire tying machine, the combination of a rotatable ratchet twister provided with a slot and with bearing members; a lever provided with a slot and with means partially surrounding said bearing members; a pawl carried by said lever to rotate said ratchet member; and automatic means to limit the rotations of said twister.

3. In a wire tying machine the combination of means for disposing parallel bights of a wire in positions to be twisted together; a slotted rotatable twisting means provided with a ratchet for twisting said bights; operating means comprising a lever and pawl for engaging said ratchet to rotate said twisting means; and a timing means to govern the rotations of said twisting means.

4. In a wire tying machine the combination of means for receiving oppositely disposed parallel bights of a wire preparatory to being twisted together; means for tensioning one of said bights; a rotatable slotted twisting means provided with a ratchet and adapted to receive said bights; a pawl and lever for rotating said twisting means; and a timing means to limit the rotations of said twisting means.

5. In a wire tying machine, the combination of means to hold portions of a pair of bights of a wire against twisting; a slotted twisting ratchet member for twisting together other portions of the held bights; slotted means comprising a lever for operating said ratchet member; and automatic means for limiting the twisting action of said ratchet member.

6. In a wire tying machine the combination of a twister means having a slot and provided with a ratchet; a lever provided with a slot normally adapted to register with said first named slot; operating connections between said lever and said ratchet; and a timing means governing the operation of said twister means.

7. In a wire tying machine, the combination of a rotatable twister having a slot; a lever associated with said twister having a slot adapted to normally register with said first named slot; operative connections between said lever and said twister; and a timing mechanism for automatically limiting the rotations of said twister.

8. In a wire tying machine, the combination of a rotatable ratchet twister provided with a slot and with bearing members; a lever provided with a slot and with means partially surrounding said bearing members; a pawl carried by said lever to rotate said ratchet member; and means to automatically govern the rotations of said twister.

9. In a wire tying machine, the combination of means for holding two separated portions of a pair of bights of a wire against rotation around each other; a rotatable slotted ratchet member disposed between said holding means and provided with means to prevent a third portion of said bights from rotating around each other; a slotted lever connection for operating said ratchet member and twisting other portions of said bights together; and means to limit the rotations of said ratchet member and to cause said slots to register.

10. In a wire tying machine, the combination of means for holding two separated portions of a pair of bights of a wire against rotation around each other; a rotatable slotted ratchet member disposed between said holding means and provided with means to prevent a third portion of said bights from rotating around each other; a slotted lever connection for operating said ratchet member and twisting other portions of said bights together; means to limit the rotation of said ratchet member and to cause said slots to register; means to tension said bights before the twisting operation; and means to sever one of said bights after the twisting operation.

11. In a wire tying machine, the combination of a rotatable twisting ratchet provided with a slot; an oscillating operating lever for said ratchet also provided with a slot; connections between said lever and said ratchet; and means associated with said lever for causing said first and second named slots to register after a predetermined number of oscillations of said lever have been had.

12. In a wire tying machine, the combination of a rotatable twisting ratchet provided with a slot; an oscillating operating lever for said ratchet also provided with a slot; connections between said lever and said ratchet; and automatic means comprising a timing disk associated with said lever for causing said first and second named slots to register after a predetermined number of oscillations of said lever have been had.

13. In a wire tying machine, the combination of means for holding two bights of a wire to be twisted together; means for twisting said bights together comprising a rotatable slotted ratchet having side extensions forming journal supports; a slotted operating lever for said ratchet; a tensioning

means for one of said bights only; and a cutting means for one of said bights.

14. In a wire tying machine, the combination of a wire holding means for one end of the wire only; a wire tensioning means; a wire twisting means having a slot; an operating means for said twisting means having a slot adapted to register with said first named slot; and a cutter for severing the wire at the end of the twisting operation.

15. In a wire tying machine, the combination of a wire holding means; a wire tensioning means; a wire twisting means having a slot; an operating means for said twisting means having a slot adapted to register with said first named slot; and a means for severing said wire after the twisting operation.

16. In a wire tying machine, the combination of means for twisting two bights of a wire together; and a cutter arranged to sever one of said bights close to one end of the twisted knot, said cutter having a sloping surface removed from its cutting edge and operating, by the continued movement of the cutter after completing its severing action, to engage the severed end of the bight and permanently depress and set the same below the top surface of the adjacent bight.

17. In a wire tying machine, the combination of means for tensioning a wire; means for twisting two bights of said wire together; means to hold portions of said bights from twisting; and means coacting next to the twisted portions and with said last named means to sever one of said bights close to one end of the twisted knot and in the same operation permanently setting the severed end below the top surface of its adjacent bight.

18. In a wire tying machine, the combination of a rotatable twister having a slot; a lever associated with said twister having a slot adapted to normally register with said first named slot; operative connections between said lever and said twister; and an inclined cutter adapted to sever a wire being twisted and in the same operation to permanently set the severed end below the top surface of its associated bight.

19. In a wire tying machine, the combination of means to twist two bights of a wire into a knot; slotted means to prevent portions of said bights from being twisted; and a pair of inclined cutters coacting with said slotted means adapted to sever said bights and to increase the twist at one end of the knot and to decrease the twist at the other end of said knot.

20. In a wire tying machine, the combination of means to tension a wire; means to twist two bights of said wire into a knot; slotted means to prevent portions of said bights from being twisted; and a pair of inclined cutters coacting with said slotted means adapted to sever said bights close to the ends of said knot and to increase the twist at one end of the knot and to decrease the twist at the other end of said knot.

21. In a wire tying machine, the combination of means to twist two bights of a wire together; slotted means to prevent portions of said bights from being twisted; and a pair of cutters coacting with said slotted means having friction surfaces beyond their cutting edges adapted to force down the severed ends of the wire and permanently set them below the top surfaces of their adjacent bights.

22. In a wire tying machine, the combination of means to twist two bights of a wire together; slotted means to prevent portions of said bights from being twisted; and a pair of inclined cutters coacting with said slotted means having extended friction surfaces beyond their cutting edges adapted to force down the severed ends of the wire and permanently set them below the top surfaces of their adjacent bights.

23. In a wire tying machine, the combination of means to twist two bights of a wire together under tension; slotted means to prevent portions of said bights from being twisted; and means comprising a pair of cutters coacting with said slotted means adapted to sever the wire close to each end of the twisted knot, said cutters having friction surfaces beyond their cutting edges adapted to force down the severed ends of the wire and permanently set them below the top surfaces of their adjacent bights.

24. In a wire tying machine, the combination of a pair of slotted means to prevent two bights of a wire from being twisted together; a twisting means disposed between said pair of slotted means; and a pair of cutters coacting with said pair of slotted means and on the sides thereof next to said twisting means adapted to sever said bights at the ends of the twisted knot, and in the same operation permanently set the severed end of each bight below the top surface of its adjacent bight.

25. In a wire tying machine the combination of means for holding parallel disposed bights of wire in position to be twisted together; a rotatable twisting pinion provided with a radially disposed slot and having ratchet notches on each side of the axis of said slot with an unnotched space between them; oscillating means for engaging said notches to rotate said pinion; and a plurality of stops for said oscillating means to stop said slot in a predetermined position when the twisting action is completed.

26. In a wire tying machine the combination of means for holding parallel dis-

posed bights of wire in position to be twisted together; a rotatable twisting pinion provided with a radially disposed slot and having ratchet notches on each side of the axis of said slot with an unnotched space between them; oscillating means for engaging said notches to rotate said pinion; and means for stopping said slot in a predetermined angular position after more than three complete oscillations of said second named means have been had.

27. In a wire tying machine the combination of means comprising fixed members provided with slots for holding parallel disposed bights of wire in position to be twisted together; a rotatable twisting pinion provided with a radially disposed slot and having ratchet notches on each side of the axis of said slot with an unnotched space between them; oscillating means for engaging said notches to rotate said pinion; and means for stopping said pinion slot in register with said first named slots after more than three complete oscillations have been had.

28. In a wire tying machine the combination of a twisting means having a slot and provided with a ratchet; a rotatable slotted wire tensioning means; an oscillating lever; connections between said lever and said ratchet; and means for compelling a plurality of complete oscillations of said lever to cause one turn of said twisting means.

29. In a wire tying machine, the combination of a rotatable twister having a slot; a lever associated with said twister having a slot adapted to normally register with said first named slot; operative connections between said lever and said twister; a plurality of stops to limit the movements of said lever; and means to sever the ends of the wires after the twisting operation.

30. In a wire tying machine, the combination of a rotatable slotted twisting ratchet member adapted to receive two bights of wire to be twisted; means comprising an oscillating lever to rotate said member; means to prevent the twisting of said bights; means to tension one of said bights before the twisting operation; means to sever one of said bights at the end of the twisted portion after the twisting operation; and means to limit the oscillations of said lever.

31. In a wire tying machine the combination of fixed means provided with slots for receiving oppositely disposed parallel bights of a wire preparatory to being twisted together; means for tensioning one of said bights; a rotatable twisting pinion provided with a slot to receive said bights and to twist them together; an oscillating lever adapted to partially rotate said pinion at each complete oscillation; and means compelling said pinion slot to register with said first named slots after the twisting operation is completed.

32. In a wire tying machine the combination of fixed means provided with slots for receiving oppositely disposed parallel bights of a wire preparatory to being twisted together; means for tensioning one of said bights; a rotatable twisting pinion provided with a slot to receive said bights and to twist them together; an oscillating lever adapted to partially rotate said pinion at each complete oscillation; and means including a timing disk for compelling said pinion slot to register with said first named slots after the twisting operation is completed.

33. In a wire tying machine the combination of fixed means provided with slots for receiving oppositely disposed parallel bights of a wire preparatory to being twisted together; means for tensioning one of said bights; a rotatable twisting pinion provided with a slot to receive said bights and to twist them together; an oscillating lever adapted to partially rotate said pinion at each complete oscillation; and means including a rotatable, spring pressed timing disk for compelling said pinion slot to register with said first named slots after the twisting operation is completed.

34. In a wire tying machine the combination of fixed means provided with slots for receiving oppositely disposed parallel bights of a wire preparatory to being twisted together; means for tensioning one of said bights; a rotatable twisting pinion provided with a slot to receive said bights and to twist them together; an oscillating lever adapted to partially rotate said pinion at each complete oscillation; and means including a rotatable, spring pressed timing disk provided with a plurality of notches for compelling said pinion slot to register with said first named slots after the twisting operation is completed.

35. In a wire tying machine the combination of fixed means provided with slots for receiving oppositely disposed parallel bights of a wire preparatory to being twisted together; means for tensioning one of said bights; a rotatable twisting pinion provided with a slot to receive said bights and to twist them together; an oscillating lever adapted to partially rotate said pinion at each complete oscillation; and means including a rotatable, spring pressed timing disk provided with a plurality of notches one of which is shorter than the others for compelling said pinion slot to register with said first named slots after the twisting operation is completed.

In testimony whereof we affix our signatures.

ALEC J. GERRARD.
PARVIN WRIGHT.