R. M. WARWICK.

MACHINE FOR TYING OBJECTS WITH WIRE.

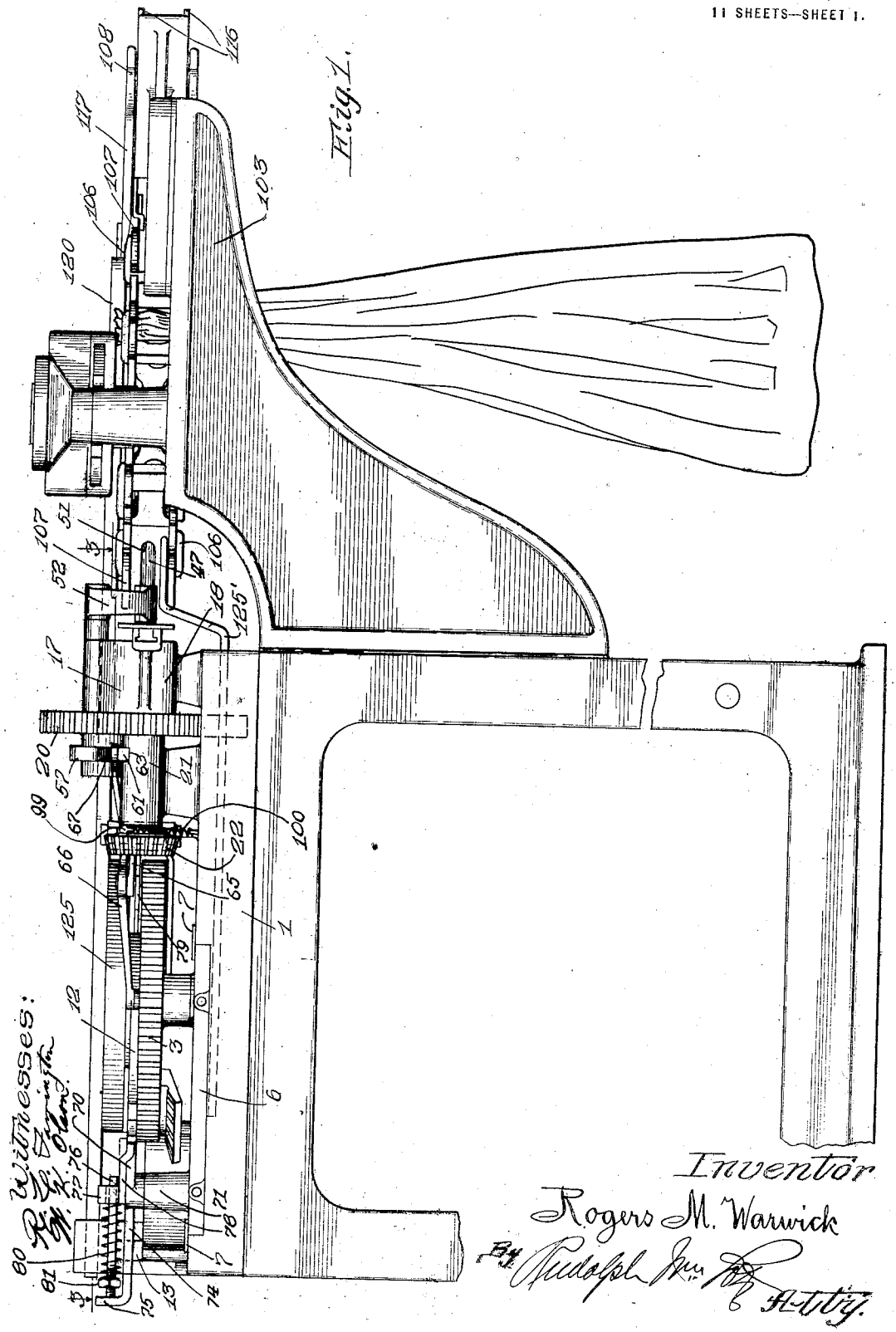
APPLICATION FILED FEB. 23, 1915.

1,293,267.

Patented Feb. 4, 1919.

11 SHEETS—SHEET 1.

Fig. 1.



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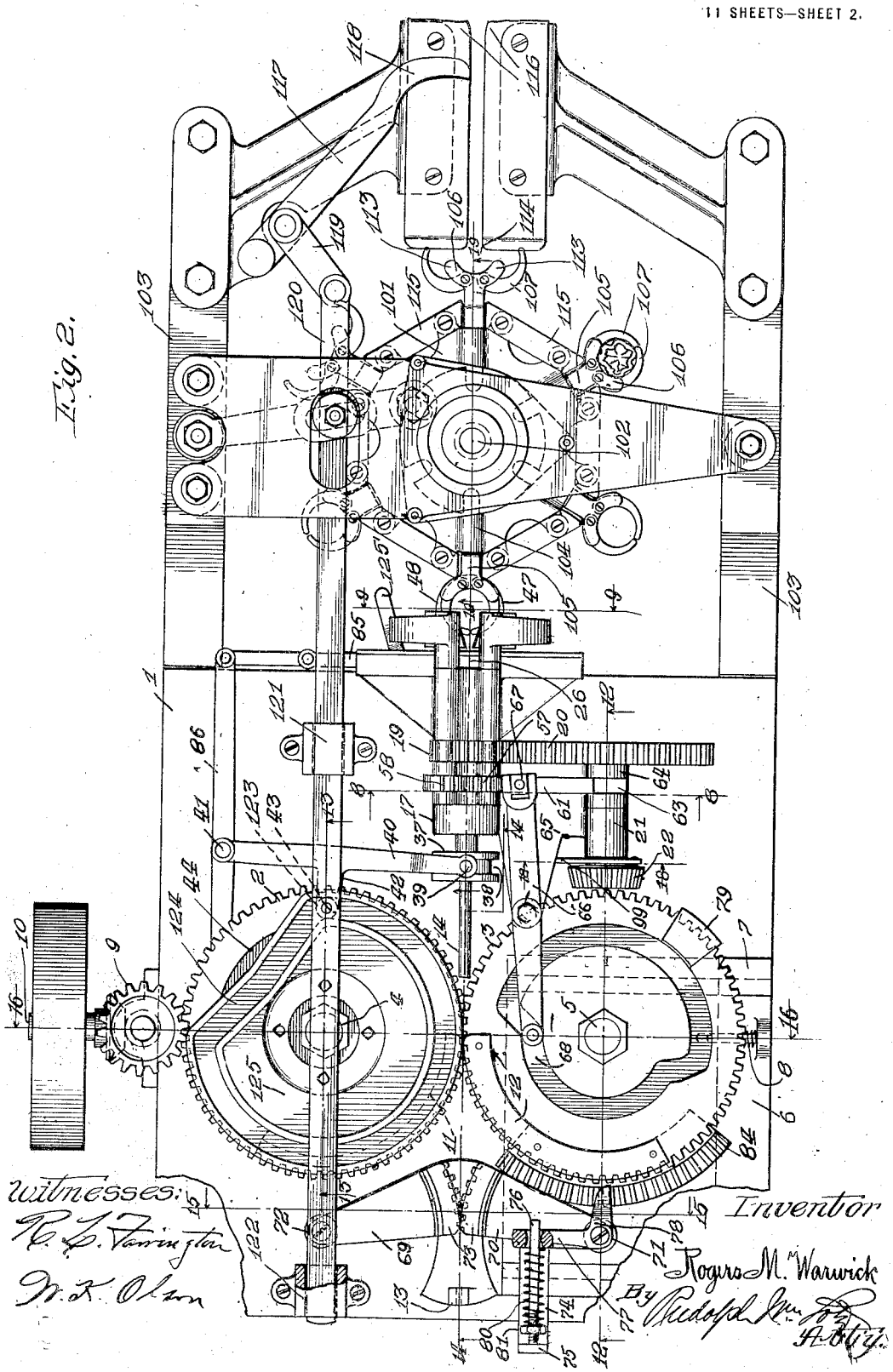
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Patented Feb. 4, 1919.

11 SHEETS—SHEET 2.

Fig. 2.



Witnesses:
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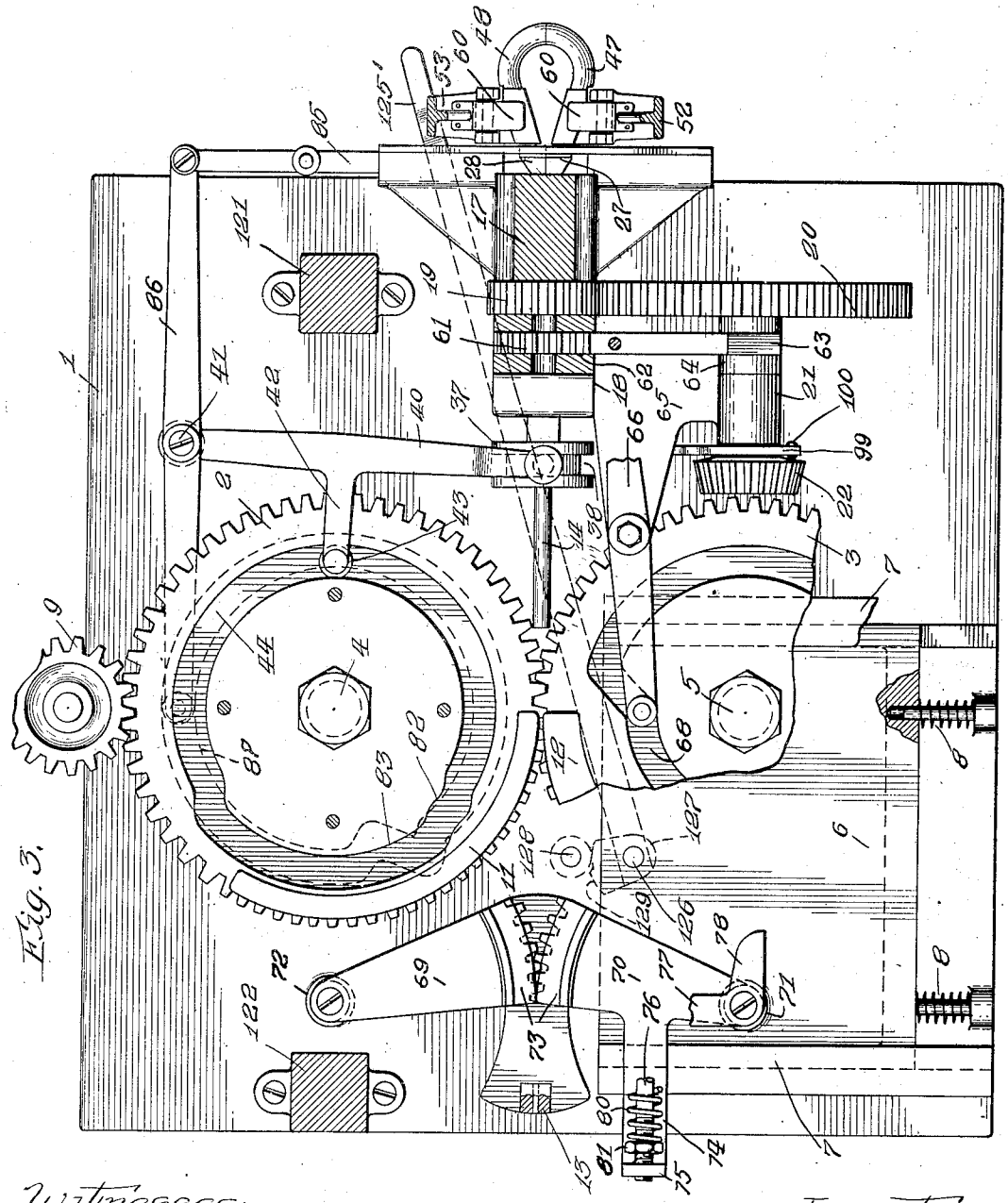


Fig. 3.

Witnesses:

R. L. Farrington

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1,293,267.

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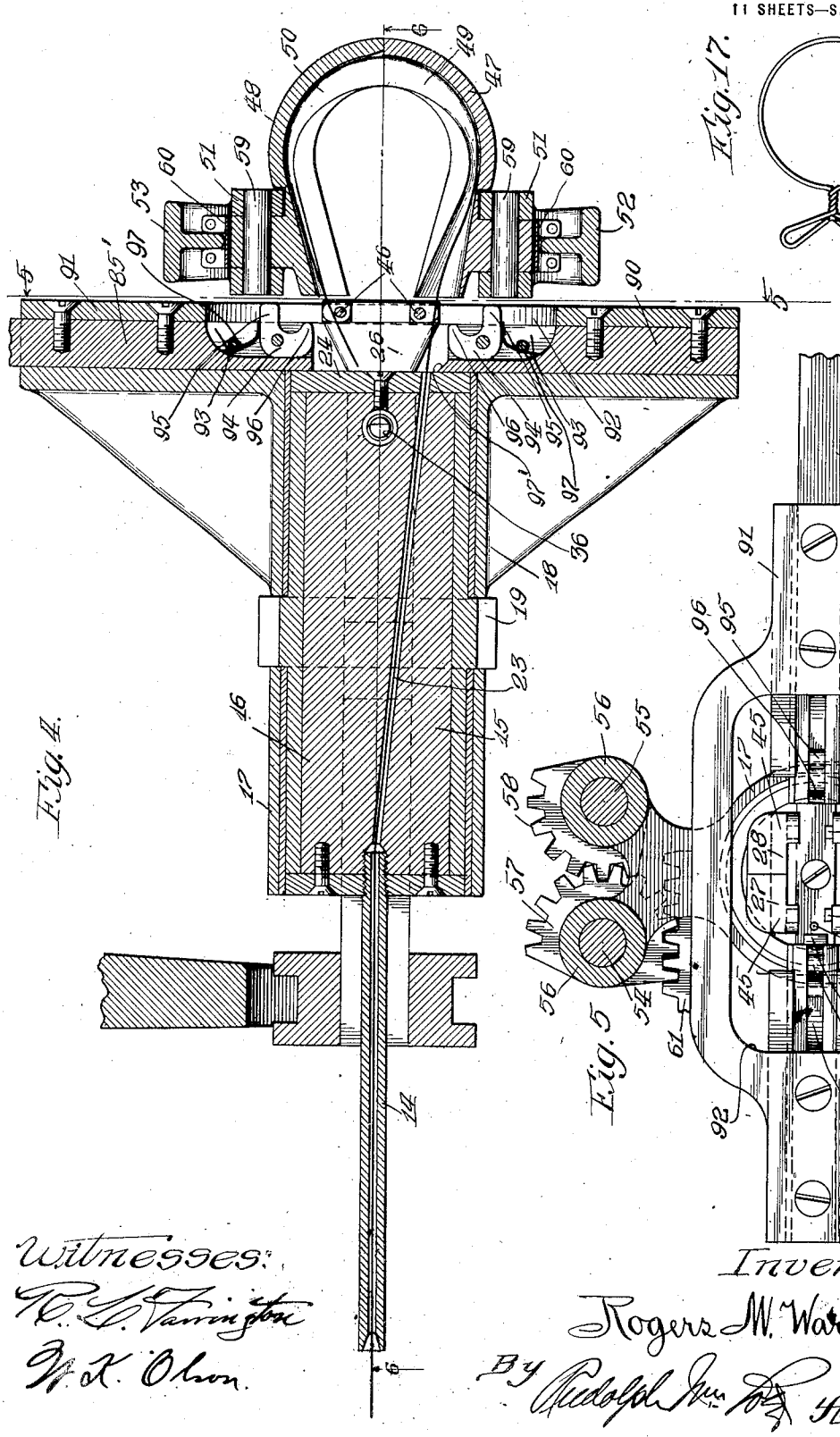


Fig. 4.

Fig. 17.

Fig. 5

Witnesses:

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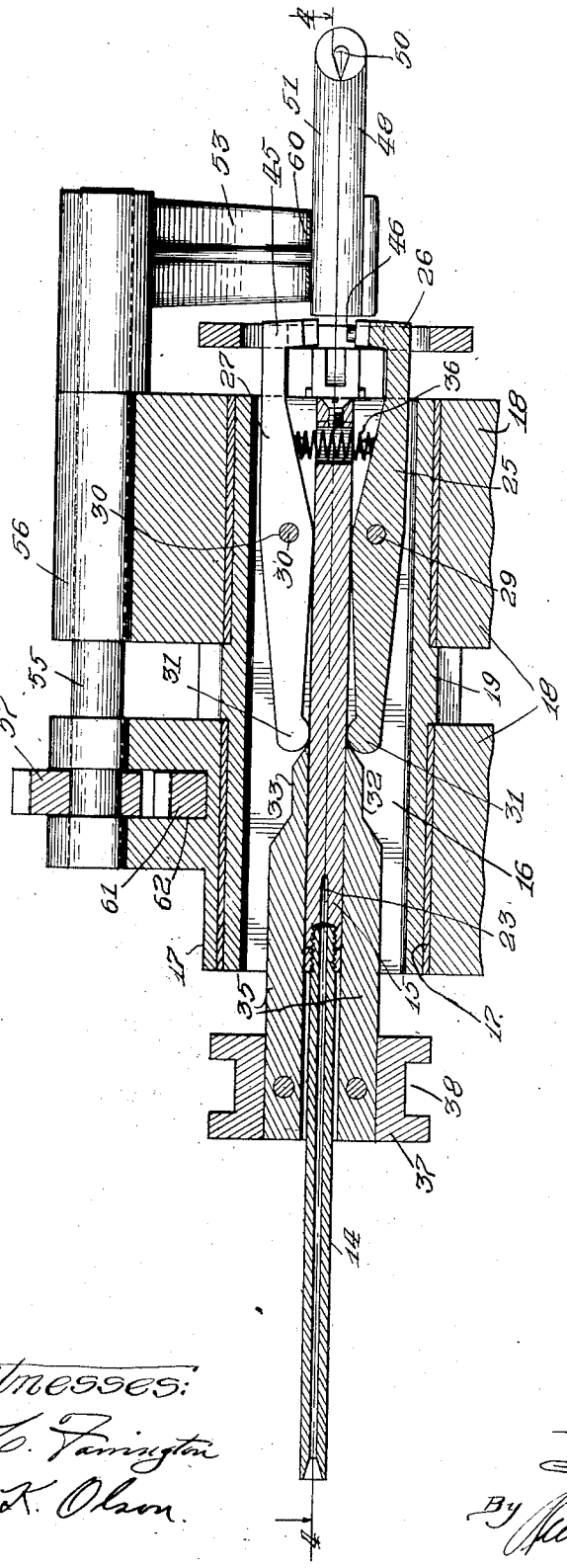


Fig. 6.

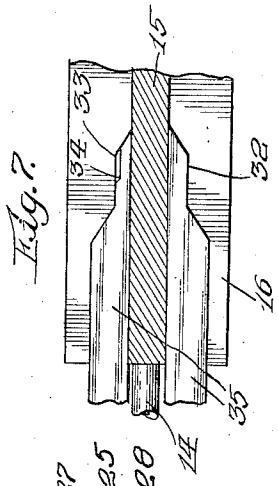


Fig. 7.

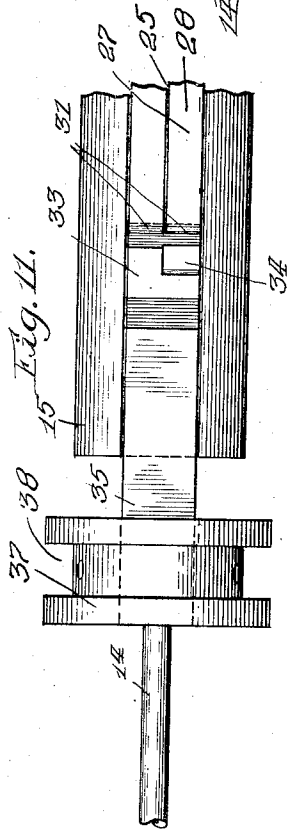


Fig. 11.

Witnesses:
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MACHINE FOR TYING OBJECTS WITH WIRE.

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1,293,267.

Patented Feb. 4, 1919.

11 SHEETS—SHEET 6.

Fig. 8.

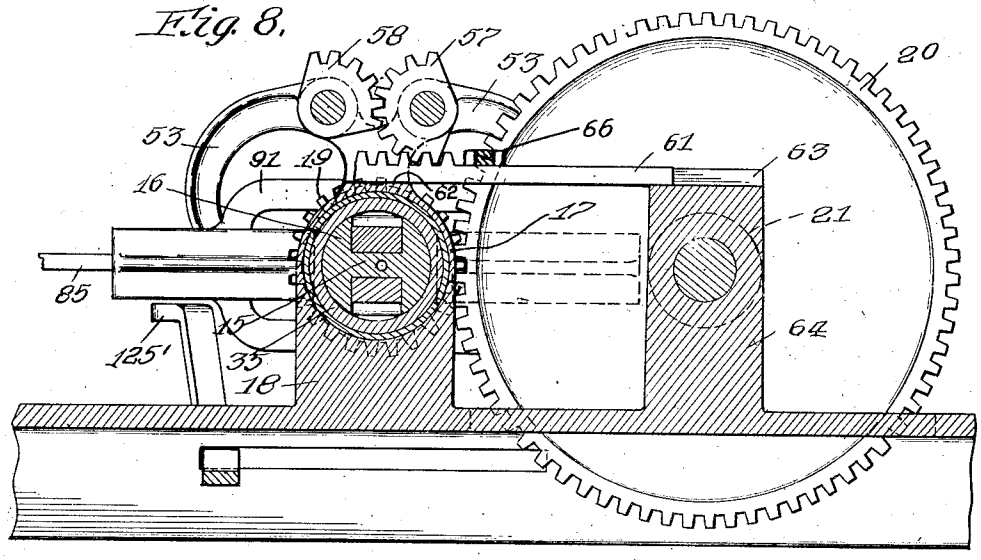
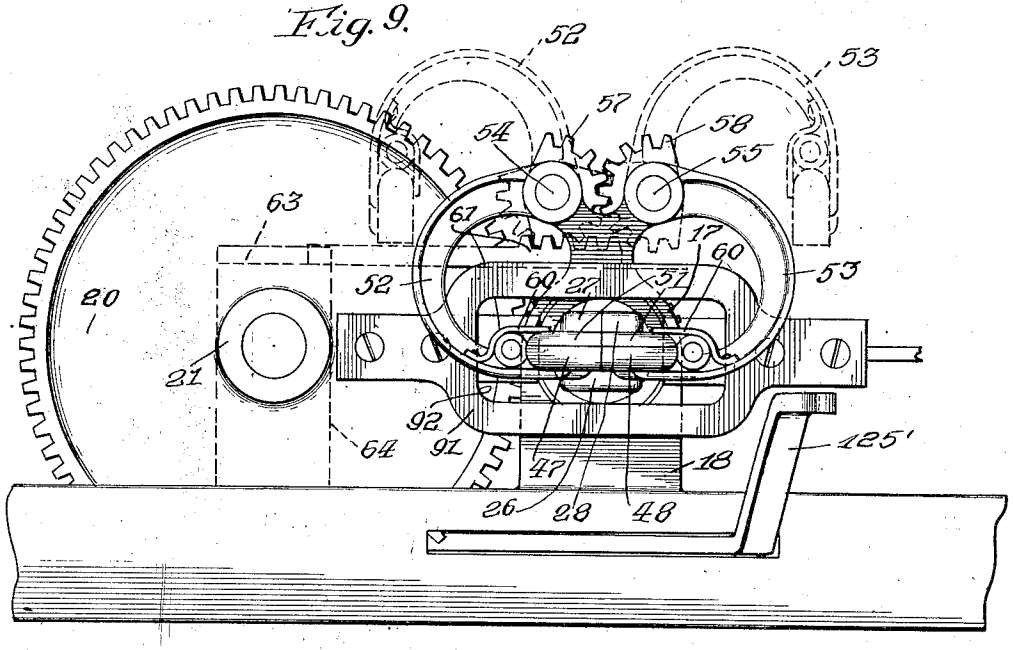


Fig. 9.



Witnesses:

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MACHINE FOR TYING OBJECTS WITH WIRE.

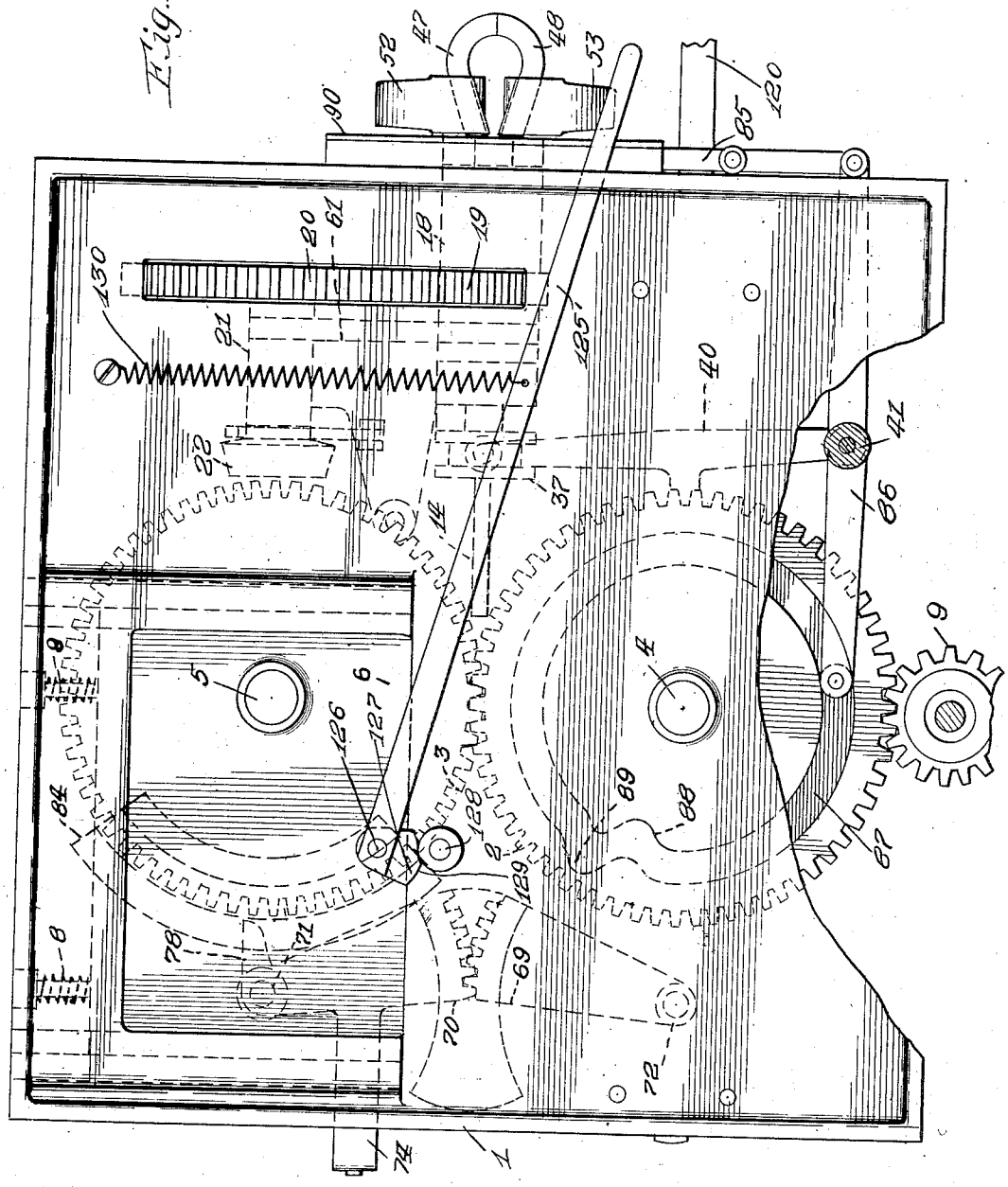
APPLICATION FILED FEB. 23, 1915.

1,293,267.

Patented Feb. 4, 1919.

11 SHEETS—SHEET 7.

Fig. 10.



Witnesses:

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MACHINE FOR TYING OBJECTS WITH WIRE.

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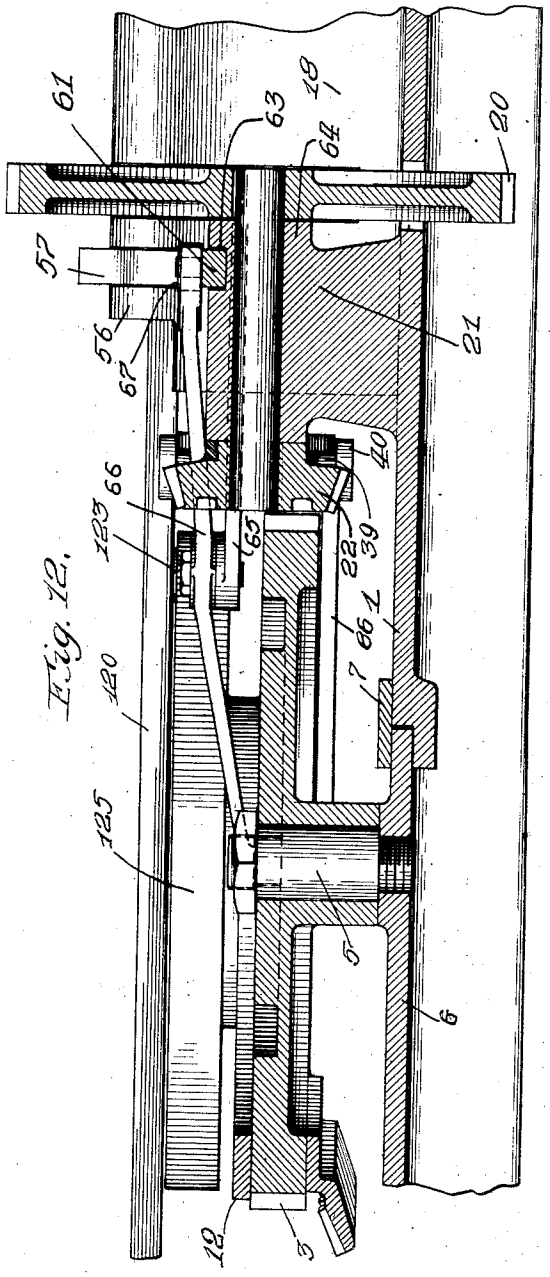


Fig. 12.

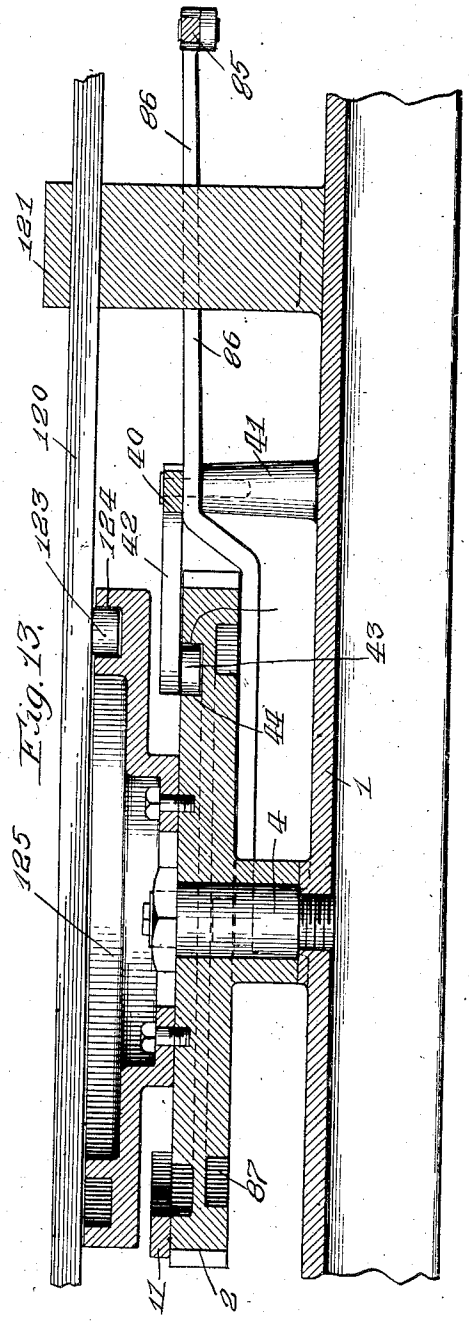


Fig. 13.

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MACHINE FOR TYING OBJECTS WITH WIRE.

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1,293,267.

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11 SHEETS—SHEET 9.

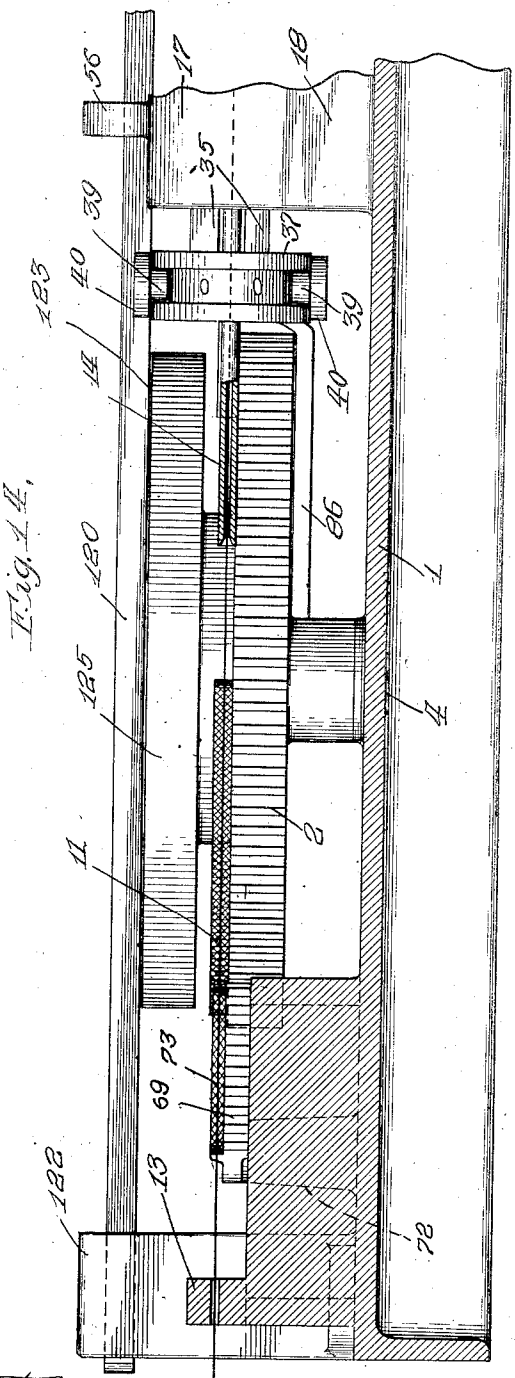


Fig. 14.

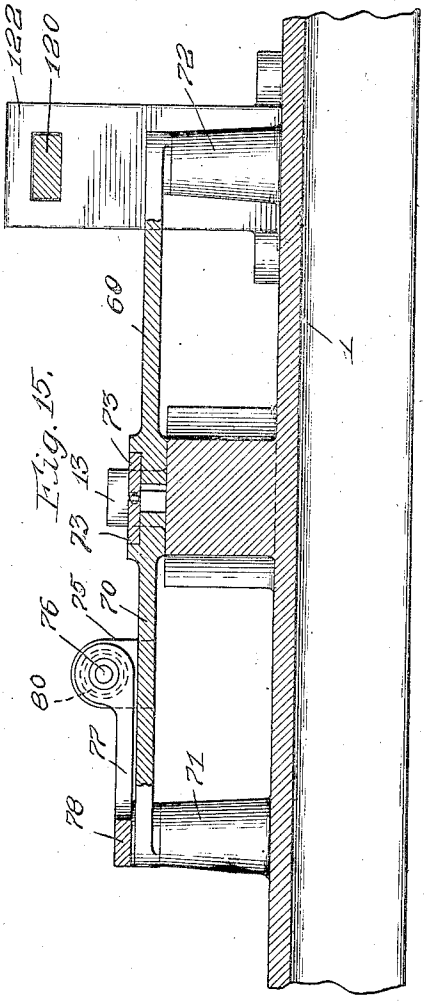


Fig. 15.

Witnesses:
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1,293,267.

Patented Feb. 4, 1919.

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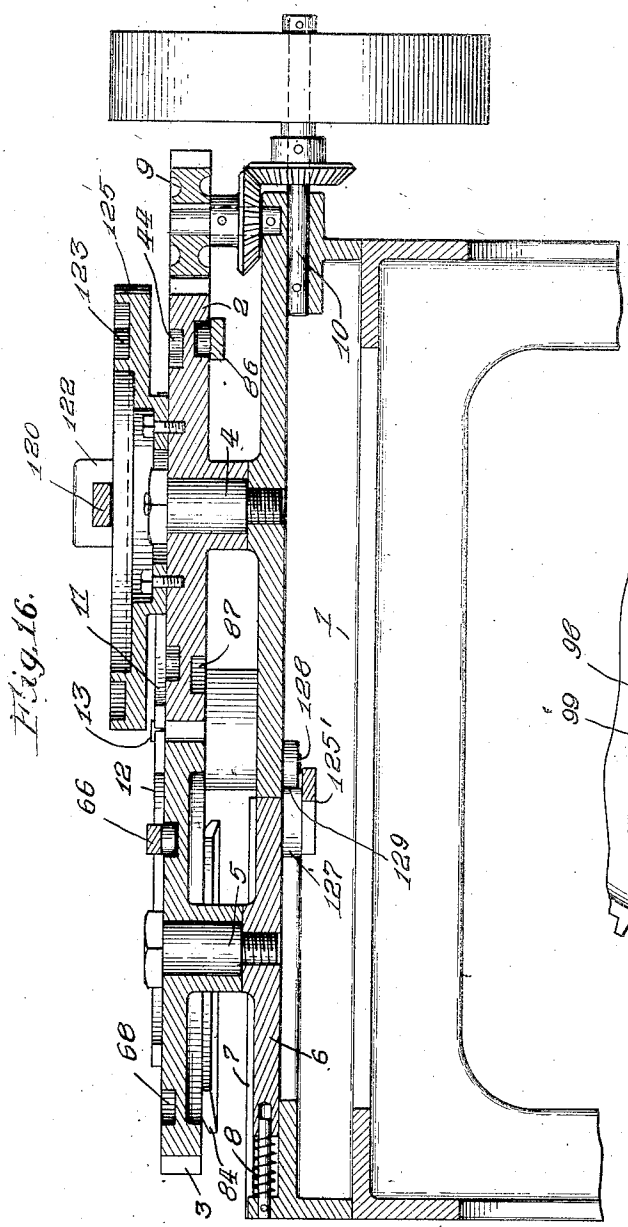


Fig. 16.

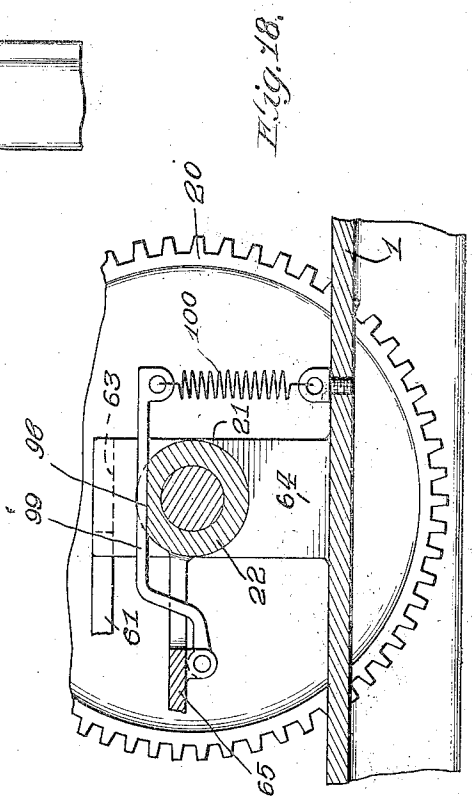


Fig. 18.

Witnesses:

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MACHINE FOR TYING OBJECTS WITH WIRE.

APPLICATION FILED FEB. 23, 1915.

1.293,267.

Patented Feb. 4, 1919

11 SHEETS—SHEET 11.

Fig. 19.

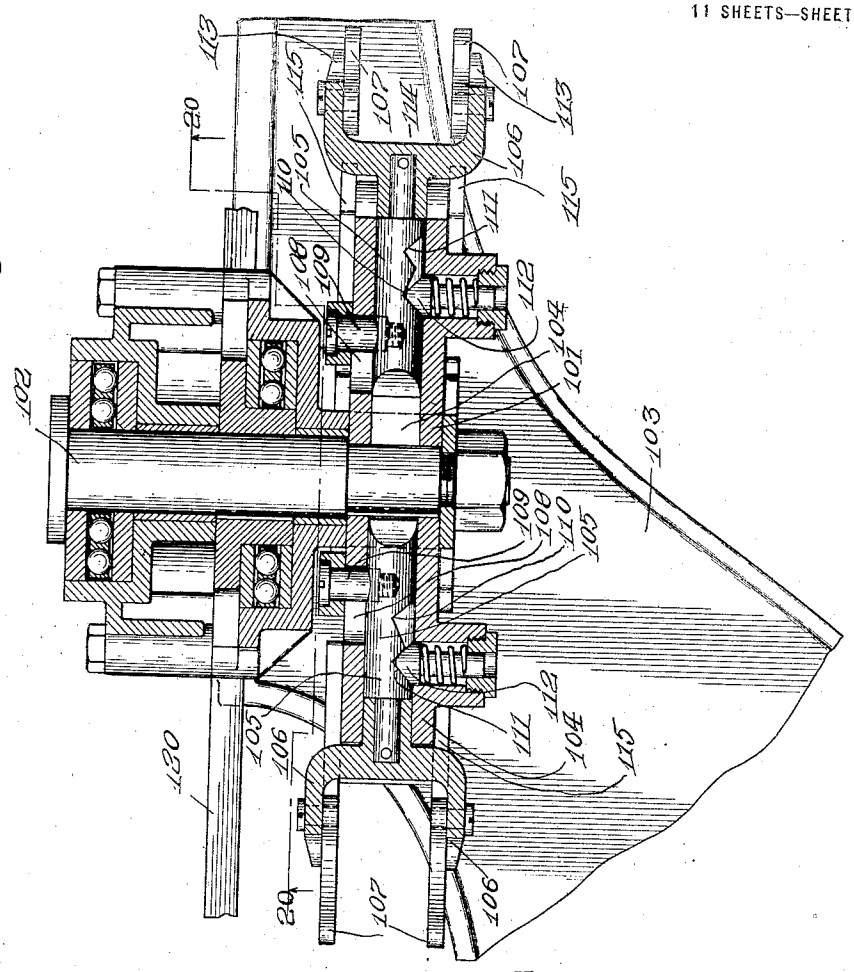
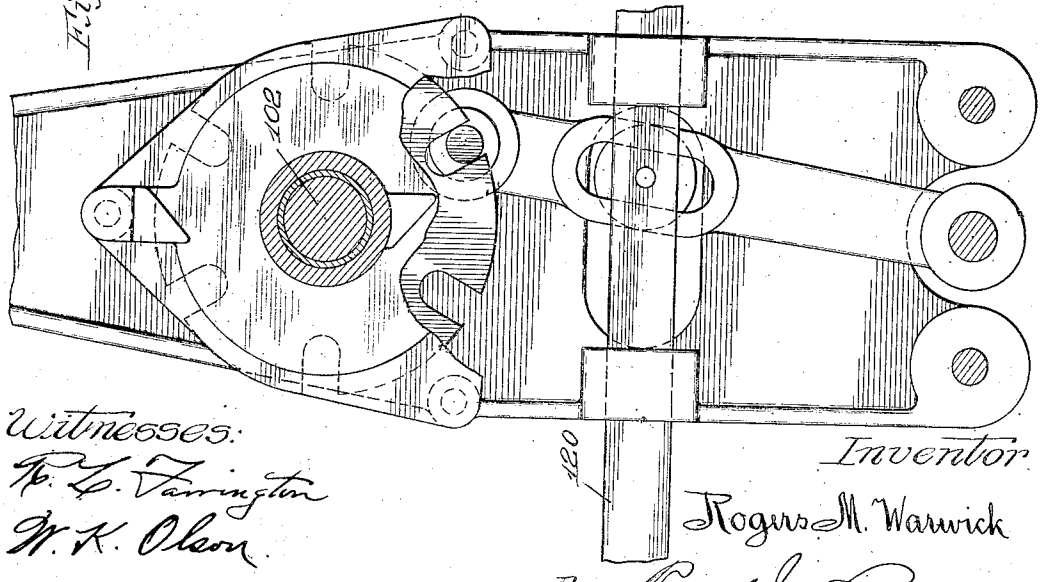


Fig. 20.



Witnesses:

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UNITED STATES PATENT OFFICE.

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MACHINE FOR TYING OBJECTS WITH WIRE.

1,293,267. Specification of Letters Patent. Patented Feb. 4, 1919.

Application filed February 23, 1915. Serial No. 9,962.

To all whom it may concern:

Be it known that I, ROGERS M. WARWICK, citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Machines for Tying Objects with Wire; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in machines for tying objects such as the puckered mouths of bags, bundles of fiber, sticks or the like, and, in fact, any other object, with wire.

The principal objects of the invention are, first to produce a wire tie for objects which will be of uniform tension on all objects regardless of variations in sizes; second, to produce a tie which may be easily removed from the object; third, to produce a tie which will not scratch and tear the skin of the person removing the tie.

These several main objects are attained by the machine embodying the invention which is illustrated in the accompanying drawings forming a part hereof.

Other objects of the invention are:—First, to provide a machine attaining the aforesaid main objects which will automatically loop wire from a coil around the object to be tied, and draw the same tautly about the object, and will, while maintaining the said loop taut, tie the ends thereof to each other, sever the same from the coil, and will finally form what I term a key for digitally opening the loop or tie. Second, to provide means for engaging and holding the objects in position to be tied; third, to provide means of which the last aforesaid means constitute a part; for synchronously carrying objects successively in position to be tied and subsequently releasing the same.

The machine embodying my invention illustrated in the accompanying drawings is particularly intended and adapted to tie the puckered mouths of bags and particularly the so-called "valve bags" used extensively for Portland cement, flour, and similar products; and, therefore, includes means for first puckering the mouths of bags, and thereafter carrying the same to the tying mechanism while maintaining them puckered. Where other objects are to be tied such mechanism as is adapted to the proper handling thereof may be substituted for the bag puckering mechanism without departing from the invention, and where the object is a rigid entity in itself, as for example a bottle, jar, box or similar object which does not permit of crowding, suitable mechanism for feeding the same to the carrier at regular intervals may be provided and the object-engaging elements of the carrier modified in construction to adapt the same to the characteristics of the objects.

Another important object of the invention is to provide means whereby the tension of the tie about the object may be nicely adjusted to suit the characteristics of the object so that the latter may not be injured by too high tension on the tie and the latter not broken by the strain imparted thereto, but at the same time insuring sufficient tension of the tie to accomplish the desired purpose thereof with relation to the object.

The invention resides in the several combinations and associations of elements or groups of elements and mechanisms whereby the aforesaid several objects and other objects which will appear from the following specifications, are attained.

While the several functions of the machines are performed and the objects attained to the best advantage by the particular embodiment illustrated in the accompanying drawings particularly in carrying out such objects and performing such functions in the tying of the puckered mouths of bags, such embodiment is merely exemplary, the same being capable of being variously modified to satisfactorily carry out said objects, and all such modifications are included in the invention as defined in the appended claims.

Thus, in said drawings I have illustrated a very simple embodiment of the invention which adapts the same to the greatest variety of purpose without material alteration or modification in the matter of the relative arrangement and location of the several parts, but in particular objects, some parts or mechanisms will require alteration in the component elements and in the matter of relative position, but these may be easily accomplished by persons skilled in the art without the exercise of invention.

In the accompanying drawings illustrating a suitable embodiment of the invention:

Figure 1 is a view in side elevation of a machine constructed in accordance with my invention.

Fig. 2 is a top plan view of the machine partly in section.

Fig. 3 is a plan view partly in section on the line 3—3 of Fig. 1 the carrier for objects being omitted and certain parts broken away to disclose others.

Fig. 4 is a detail horizontal section on an enlarged scale on the line 4—4 of Fig. 6, showing the guide and loop-forming mechanism and the wire cutting member and associated parts.

Fig. 5 is a detail view in front elevation of a part of the tying mechanism and the cutting means, and partly in vertical section on the line 5—5 of Fig. 4.

Fig. 6 is a fragmentary detail vertical longitudinal section on the line 6—6 of Fig. 4.

Fig. 7 is a fragmentary detail vertical longitudinal section of the clamp or vise closing plunger employed.

Fig. 8 is a fragmentary detail vertical transverse section on the line 8—8 of Fig. 2.

Fig. 9 is a fragmentary detail front elevation of the tying mechanism looking from the plane of the line 9—9 of Fig. 2, the parts of the carrier intersected by said plane being omitted.

Fig. 10 is a bottom plan view of the machine partly broken away and partly in section.

Fig. 11 is a detail fragmentary view in elevation of the twisting head employed.

Fig. 12 is a detail vertical longitudinal section on the line 12—12 of Fig. 2.

Fig. 13 is a detail vertical longitudinal section on the line 13—13 of Fig. 2.

Fig. 14 is a detail central vertical longitudinal section on the line 14—14 of Fig. 2.

Fig. 15 is a detail vertical transverse section on the line 15—15 of Fig. 2.

Fig. 16 is a transverse section on the line 16—16 of Fig. 2.

Fig. 17 is a detail transverse section on the line 17—17 of Fig. 2.

Fig. 18 is a view in elevation of the completed tie formed by the machine about an object.

Fig. 19 is a fragmentary detail central vertical section of the object carrier on the line 19—19 of Fig. 2.

Fig. 20 is a detail plan section on the line 20—20 of Fig. 19.

The machine comprises a suitable supporting table 1 for the wire feeding and tying mechanism. The coil or reel of wire is suitably mounted rearwardly of the machine so that the wire may be drawn therefrom as required by the machine, such support being omitted from illustration.

The tying mechanism includes means for feeding a predetermined length of wire forward at predetermined intervals, means associated with the feeding mechanism to form the wire fed by the latter into a loop of a given size and shape, means for clamping the extreme end of the fed portion of the wire to maintain the loop in position after release of the same by the loop-forming means, means for retracting an indeterminate portion of the wire fed to contract the loop about the object and engage the latter with a predetermined and adjustable pressure, means for twisting the looped portion of the wire and the body portion thereof about each other to complete the tie, and means for severing the completed tie from the body of wire, and finally forming the key on the completed and severed tie for digitally opening the latter to release the object.

The feeding mechanism comprises a pair of intermeshing spur gears 2 and 3 rotatable on vertical axes, one of the latter being a shaft 4 rigid with the frame of the machine, and on which the gear 2 rotates, and the other being a stud 5 carried by a plunger 6 horizontally movable in suitable guides 7 on the frame of the machine, toward and from the shaft 4. Said plunger is held at the inner limit of its movement by means of springs 8 in a well-known manner whereby to maintain the gears 2 and 3 in mesh with each other. The said gear 2 also meshes with a spur-pinion 9 geared by means of miter gears with the drive shaft 10 of the machine.

Secured to the upper faces of said gears 2 and 3 are two segmental wire engaging members 11 and 12, the wire-engaging surfaces of which are nurled and are disposed substantially in the pitch-lines of said gears. The arcs through which said segments extend will be controlled by the length of wire to be fed forward during each revolution of the gears 2 and 3, the latter being of the same pitch-diameter and adapted to rotate in unison in respectively opposite directions, and said segments being disposed to become opposed to each other from end to end at a given point in the revolution of said gears to engage and feed the wire.

The wire passes into the machine through the guide 13 and, after passing through the vertical plane of the meeting point of the pitch-lines of said gears 2 and 3 it passes into a guide tube 14 mounted in the rear end of the middle portion 15 of a rotatable head 16, said tube being concentric with the latter. The said head 16 is journaled in a bearing 17 supported upon a standard 18 integral with the table of the machine or suitably rigidly mounted thereon. The said bearing comprises two parts separated from each other by a space which is occupied by

the spur gear 19 rigid with said head 16 and which meshes with the larger spur gear 20, the shaft of which is journaled in the bearing 21 and carries the bevel gear 22 at its other end.

Said head 16 is shown in detail in Figs. 4 and 6 and as will be seen in Fig. 4, the bore of the tube 14 registers with the inner end of an opening 23 in the said middle portion 15 of said head, said opening 23 extending laterally at an angle to the axis of the head and having its discharge end or mouth in the front face of the head at one side of the center thereof. The front end of the head 16 is equipped with a steel plate 24 which may be renewed from time to time. The head 16 is provided with two channels separated by said middle portion or web 15.

Within the said head 16 there is mounted in the channel on one side of the middle portion or web 15, a jaw member 25 of a clamp or vise, the head 26 of which projects from the front end of said head, and in the other channel two coacting jaw members 27 and 28 are pivotally mounted, the said members 27 and 28 together being of the same shape and size as the member 25. The pivot pins 29 and 30 of the said jaw members pass through the latter substantially midway between the ends thereof and span the channels containing said members. The inner ends of the latter are tapered and terminate in rounded projections 31 which are adapted to be engaged by the cam faces 32, 33 and 34, of a plunger 35, the latter being composed of two parts or arms adapted to receive the web 15 of said head 16 therebetween, the said arms thereof entering the respective channels. Each of said arms has a beveled end which is adapted to be forced between said web and the opposed projections 31 of the jaw members to turn the latter in a direction to cause the heads thereof to meet against the action of the spring 36. The said plunger 35 is longitudinally movable but non-rotatable relatively to said head 16, the outer ends of its arms being rigidly secured within the bore of a collar 37 having an annular groove 38 therein. In said groove anti-friction rollers 39 at the end of a forked lever 40 engage, said lever being pivotally secured at its other end to a stud 41 on the table of the machine, and being provided between its ends with a projection or arm 42 carrying an anti-friction roller 43 which engage in the cam groove 44 in the upper face of the gear 2.

The heads 45 of the jaw members 27 and 28 are provided with openings in the faces opposing the head 26 of the member 25 to receive the pins 46 in the said head 26 whereby the said opposing faces are enabled to approach each other to an extent sufficient to permit wire passing therebetween to be securely gripped, the said pins performing a function hereinafter fully described.

In front of the said heads of the several jaw members is a horseshoe-shaped wire guide consisting of two equal members 47 and 48 having channels therein, the mouth of the channel 49 in the member 47 being disposed opposite the mouth of the opening 23 in the head 16 so that the wire projected from the latter will pass between the opposed gripping surfaces of the heads of the jaw members 25 and 28 lying in the path of the wire and outwardly of the pins 46, and said wire will then pass into the mouth of the channel 49 through the latter, and through the registering channel 50 between the gripping surfaces of the heads of the jaw members 27 and 25. When this position (as shown in Fig. 4) has been attained, the wire feeding segments will have passed out of engagement with the wire.

As shown in Fig. 4 and 6 each of said members 47 and 48 of the wire guide consists of two separable members, the guide channels 49 and 50 being in the lower members indicated by said numerals 47 and 48, and the upper members 51 being merely covers for said channels. The lower members 47 and 48 are rigidly mounted upon the lower ends of U-shaped arms 52 and 53 respectively, which are rigidly mounted at their other ends on the shafts 54 and 55 journaled in bearings 56 above the bearing 17 for the head 16. At their other ends said shafts 54 and 55 carry segmental spur gears 57 and 58 respectively, meshing with each other and adapted to rotate simultaneously in opposite directions to separate the members 47 and 48. Contiguous to their juncture with the latter, the U-shaped arms carry pivot pins 59 axially parallel with the head 16, and on which the cover-members 51 are hinged. The latter are maintained normally pressed upon the members 47 and 48 by means of springs 60.

The channels 49 and 50 each have a concave outer wall and beveled inner walls and the cover members 51 have companion beveled surfaces coacting with the beveled walls of said channels to provide a V-shaped inner portion for the guide. These permit the escape of the wire loop from the guide channels as the members 47 and 48 separate, the springs 60 being adapted to resist separation of the members 47 and 48 and their cover members 51.

It will be observed that the plunger 35 is provided on its upper face with what may be termed the cam faces 33 and 34, the portion 34 being merely a recess in the face 33. The latter engages the projection 31 of the inner end of the jaw member 27 while the recess 34 receives the projection 31 of the inner end of the jaw member 28. Hence, it will be obvious that as the plun-

ger 35 moves forward it will primarily move the jaw member 27 to a greater extent than the member 28. The cam groove 44 is arranged to impart successive forward movements to said plunger 35, the initial movement terminating before the projection 31 of the member 28 has passed out of the recess 34. Hence, the wire disposed between the gripping surfaces of the heads of the jaw-members 25 and 27 will be firmly engaged therebetween before the body portion of the wire is gripped between the heads of the plungers 25 and 28. This relative position is maintained during a very short interval during which two operations occur substantially simultaneously one being the separation of the guide members 47 and 48, and the other being the retraction of a portion of the wire fed forward to form the loop through said guide members 47 and 48.

The first of these operations is performed by the segmental gears 57 and 58. It will be noted that the arc described by the gear 57 is longer than that described by the gear 58. The former meshes with a reciprocable rack-bar 61 mounted in a suitable guide 62 below the said gears in the bearing 17 and a similar guide 63 in the upper face of the standard 64 for the bearing 21. The latter is provided with an arm 65 in the end of which a lever 66 is pivotally supported between its ends. The forked end of said lever 66 engages a rectangular head 67 pivotally mounted on the upper face of the rack bar 61, and at its other end said lever 66 carries an anti-friction roller engaging in a cam groove 68 in the upper face of the gear 3. Just as the plunger 35 has completed its initial forward movement so as to cause the end of the looped portion of the wire to be gripped by the vise jaws, the said cam groove actuates the lever 66 to move the rack 61 outwardly thereby turning the gears 57 and 58 and their associated parts whereby the separation of the guide members 47 and 48 is accomplished, these parts becoming disposed at a relatively high elevation and there maintained while the contraction, tying and severance of the loop are being successively accomplished, the retraction being accomplished substantially simultaneously with the separation of the wire guides 47 and 48.

The mechanism for retracting the wire is very similar to the feeding mechanism. It comprises two segmental gears 69 and 70, the stud 71 on which the latter is pivoted being carried by the plunger 6 and the stud 72 on which the gear 69 is pivoted being rigidly mounted on the machine table. Said gears are provided on their upper faces with segmental opposed wire-engaging members 73 having nurled faces disposed substantially in the pitch-line of the said gears. When the latter are positioned as shown in Fig. 2 the wire is free to pass between the nurled surfaces, but when said gears are turned toward the rear end of the machine the said opposed surfaces will grip and retract the wire, the latter being at this time disengaged from the feeding segments 11 and 12.

The gear 70 is provided with an arm 74 at its rear edge having a projection 75 in which the pin 76 is mounted. The latter projects over said gear 70 and through an opening in one arm 77 of a bell-crank lever 78 pivotally mounted at its elbow portion on the stud 71. The other arm of said lever 78 is disposed in the path of a projection 79 on the gear 3 and is adapted to be forced out of the path of the same and in so doing to turn the said lever 78 on its pivot. This movement effects compression of the spring 80 on the pin 76 between the projection 75 and the arm 77 of said bell-crank lever. The force of the compression of said spring 80 exerted on the projection 75 causes the gears 70 and 71 to be turned to effect retraction of the wire. The force exerted by the spring 80 constitutes the maximum tension which may be imparted to the wire in the retraction thereof, and this may be adjusted by the use of springs of various strengths, which may be substituted for one another, or may be fixed by adjusting the said spring 80 by means of the nut 81 on the pin 76 or by any other suitable means.

The relative positions of the portion of the cam groove 68 of least radius and of the projection 79 in Fig. 2 show that the separation of the guide members 47 and 48 takes place slightly before the retraction mechanism is actuated, but this is not essential as the two operations might be simultaneous except that the resistance to opening of the loop guides offered by the springs 60 might then put an extra strain on the retracting mechanism. Hence, it is preferable to let them occur in such rapid sequence as to be almost simultaneous.

Following retraction of the wire, as above described, and the separation of the wire loop-forming guides, the next step consists in clamping the body of the wire between the head 26 of the plunger 25 and the opposing head 45 of the vise member 28. This consists in effecting a further forward movement of the plunger 35 so as to cause the recess 34 to pass forward beyond the inner end 31 of said vise or jaw member 28. This is accomplished by the lever 40, the projection 42 of which carries the anti-friction roller 43 engaged in the cam groove 44 in the spur gear 2. It will be noted that the said cam groove 44 has a portion 82 which is very short and is radially farther removed from the axis of rotation than the main portion 83 still farther removed from the axis of rotation of said gear 2 than said

portion 82. The primary forward movement of said plunger 35 is effected as the portion 82 causes the anti-friction roller 43 to move said lever 40. During the period that said portion 82 is required to rotate past said anti-friction roller 43 the retracton of the wire and the opening or separation of the wire looping guide takes place. As the portion 83 causes the lever 40 to move still farther in the same direction, the said recess 34 in the plunger 35 passes the inner end of the jaw or vise member 28 and causes the same to rest upon the flat surface flush with or constituting a part of the surface 33 thereby causing the wire to be clamped between the head 45 of said member 28 and the opposing portion of the head 26 of the jaw or vise member 25. It will be seen from the arc described by the portion 83 of said cam groove 44 that the wire is maintained clamped for a considerable period, and during this period the head 16 is rotated to effect a tying of the wire by twisting the end portions of the loop surrounding the object which was contained within the wire guide during the operation of feeding the wire forward as will be hereinafter more fully explained.

It will be noted upon reference to Fig. 5 particularly, that the portions of the vise in which the end and body portion of the wire are maintained clamped are disposed equidistantly from and upon opposite sides of the axis of rotation of said head 16, and that the wire passes outwardly of the said pins 46 so that in twisting the wires upon each other to tie the loop, the pitch of the torsion of said wires will be at a relatively sharp angle transversely of the axis on which the twisting occurs, which is substantially coincident with the axis of rotation of said head 16.

The rotation of the head 16 is accomplished as follows:

As previously described the gear 19, rigid with said head 16, meshes with the gear 20, the shaft of which is journaled in the bearing 21, and carries the bevel gear 22 at its other end. The said bevel gear 22 is adapted to mesh with a segmental bevel gear 84 carried by the gear 3, as shown in Figs. 2 and 12. The position of said segmental gear 84 relatively to the projection 79 and the step portion of the cam groove 68, which effects the movement of the rack-bar 61 to effect separation of the guides 47 and 48, is such that said segmental gear 84 will mesh with said gear 22 slightly following the aforesaid movement of said plunger 61, and also very slightly after the body of the wire has been clamped as last above described. The length of the arc described by the segmental gear 84 relative to the pitch-diameter of the bevel gear is such that said gear 22 will be given a complete revolution by said segment 84. The relative pitch diameters of the gears 19 and 20 is such that the gear 19 will be given three full revolutions for each revolution of said gear 20, it being obvious, however, that this ratio may be varied if desired. Accordingly, as the segment 84 rotates said gear 22 the head 16 will be given three complete revolutions and will thereupon resume its normal position, as shown in Fig. 5, and the vise jaws contained in said head will thereafter be opened to release the wire.

Before said wire is released, however, a severance of the body of the wire from the tied portion thereof is effected by means of the severing plunger 85 and the ends of the wire bent to form divergent loops by means of the dogs carried by said severing plunger 85 as will be now more particularly described.

The said severing plunger 85 is reciprocated by means of the lever 86 pivotally mounted between its ends upon the stud 41 and at its other end carrying an anti-friction roller which engages in the cam groove 87 in the lower face of the gear 2. The said lever 86 is rocked by means of the said cam groove 87, the latter being shown in detail in Fig. 10, and as will be seen from said figure, said cam is provided with two contiguous off-set portions 88 and 89 respectively, the first of which causes the inner end of said lever 86 to move radially nearer the axis of rotation of said gear 2 while the portion 89 causes the same to move farther radially outwardly therefrom than the main portion of said groove 87. This causes the said lever 86 to make two quick succeeding reciprocal movements. The first one being toward the left and the second toward the right. The plunger 85 comprises the rectangular rod 85′ and a similar rectangular rod 90. Said rods 85′ and 90 are connected together by means of a cross-head 91, the middle portion of which is enlarged and is provided with a longitudinal slot 92 through which the wire passes in forming the loop and through which the twisting or tying of the wire is effected. The opposing end portions of said rods 85′ and 90 are provided with recesses 93 in each of which a dog 94 is pivotally mounted. Each of said dogs comprises a bell-crank lever having one arm 95 extending outwardly parallel with the axis of rotation of the head 16 while the opposing ends of the other arms of said dogs 94 are provided with projections 96 which are adapted to engage the wire and bend the same substantially over the said pins 46. The inner edge of the last-named arm of each of said dogs 94 normally abuts against the bottom of the recess 93 containing the same, and is thus held in the position shown in Fig. 4 by means of a spring 97. The arms 95 of said

dogs project into the slot 92 in the crosshead 91 and the vise jaw heads surrounding the pins 46 are disposed in the path thereof when the vise or clamp is closed. As the plunger 85 moves to the left the dog 94 at the right-hand side which is carried by the rod 85′ engages the end portion of the wire and bends the same over the vise-jaw heads at the right-hand side, and as the arm 95 of said dog contacts with the wire the said projection 96 will be caused to move into the open space between the vise-jaw head carrying the pins 46 thereby bending the wire inwardly toward the twisted portion thereof. This having been accomplished the plunger 85 and associated parts immediately move to the left a distance greater than the initial movement to the right. The inner end of the rod or member 90 carries a wire cutting edge 97 which cuts the wire at the mouth of the opening 23 before the projection 96 of the dog 94 at the left hand side engages this portion of the wire. During the further movement to the right the said dog 94 carried by the rod 90 performs the same operation as the dog 94 has theretofore performed, thereby completing the tie. As the plunger moves back to the right the dog 94 is returned to the position shown in Fig. 4 and after the movement to the left has been completed the plunger is returned to the normal position shown in Fig. 4, the dog 94 carried by the rod or member 90 is returned to its normal position and retains the same until the operation is repeated on the next tie. The complete tie is shown in detail in Fig. 16.

As the tie is completed the vise or clamping member opens to the position shown in Fig. 5, thus throwing the pins 46 below the plane of operation of the dogs 94 and out of the loops formed by said dogs, thus permitting the tie to move out of the machine without hindrance.

In order to prevent the head 16 from moving out of its normal position, as shown in Fig. 5, after each twisting operation, I provide means associated with the bevel gear 22 to hold the latter and associated parts against movement between the intervals of the meshing of the segmental bevel gear 84 with the bevel gear 22. This comprises a flat portion 98 on the hub of said bevel gear 22 and a lever 99 pivotally secured at one end to the table 1 and is engage at its other end by a spring 100 which causes it to normally bear between its ends upon said hub of said gear, thereby yieldingly holding the latter against rotation when said rod engages the flat portion of said hub, the position of the latter being such that when said rod engages the same the gears 19 and 20 are held in the position whereby the head 16 is in the position shown in Fig. 5.

It will be obvious that in order to effect the tying of an object the latter must project through the closed loop forming guide 47—48 during the time that the wire is fed forward therethrough and must be held in such position until the tie has been completed. The object may be so supported manually but it is preferable to provide a carrier therefor and such a carrier is associated with the machine hereinbefore described. The said carrier in its specific construction illustrated in the drawings is the joint invention of myself and Edward Nessling of Chicago, and constitutes the subject-matter of a copending application filed the 19th day of April, 1915, Ser. No. 22,374, but I desire it to be understood that the broad idea of providing a carrier for the objects to be tied to be associated with and move in synchronism with the tying mechanism constitutes a part of my conception of the invention.

The carrier herein illustrated, and which I will now proceed to describe, consists of a member 101 carried by a shaft 102 mounted to rotate in a suitable supporting frame 103. The said member 101 is provided with a plurality of radial guides 104 in which plungers 105 are reciprocably movable. Each of said plungers is equipped with a forked head 106 carrying object-engaging means 107 which are adapted to be closed by suitable mechanism as said plungers are moved radially inwardly in said guides 104. Each guide is provided in its upper wall with a longitudinal slot 108 through which the projection 109 carried by the plunger passes for holding said plungers against rotation in said guides and for limiting the reciprocal movements thereof. Each plunger is provided in its lower face with beveled recesses 110 and 111 in which the spring-actuated latch member 112 engages, the latter being adapted to hold the plunger with sufficient force against outward radial movement to enable the object held by the parts 107 and the head 106 to be securely retained and supported thereby during the tying operation. In the drawings the machine is particularly illustrated in that embodiment which adapts it for carrying bags, the mouths of which must be puckered and subjected while so puckered to the tying operation, hence, the head 106 and the parts 107 associated therewith are constructed and arranged in combination with other mechanism to engage the puckered mouth of the bag. This engaging mechanism may, however, obviously be changed and varied in construction to adapt it to engage other objects to be tied without departing from the invention. The said arms of the heads 106 are forked to provide oppositely extending projections 113 bordering a segmental recess 114. The levers 107 are pivotally secured to the inner ends of said projections 113 and are so formed as to co-

operate with the latter to provide a clamp which, when closed, presents a circular orifice in which the puckered mouth of the bag is contained. Members 115 are rigidly mounted upon the rotatable member 101 and at their ends are disposed in the path of said arms 107 so that as each plunger 105 is moved radially inwardly to cause the member 112 to engage in the recess 111 said arms 107 will be swung into closed position as shown in Fig. 2, and will be so held until its release and outward movement is again accomplished. The said plungers are arranged to be brought consecutively into axial alinement with the head 16 while at the inner limits of their movement so that the arms 107 will be closed. The puckered mouths of the bags are received by said engaging means at the diametrically opposite side of said member 101 from the head disposed in position to enable the bag carried thereby to be tied and at this point the particular engaging means referred to are open to receive the object or bag. At this point I provide pairs of opposed plates 116 having an open space therebetween in which the mouth of the bag is adapted to be received flatwise. Associated with said plates 116 is a pair of levers 117 having bent free end portions 118, said levers being pivotally mounted at their other ends upon the frame of the machine. Contiguous to their pivots said levers are pivotally connected with a link 119 connecting the same with a reciprocable plunger 120 mounted in guides 121 and 122, and which carries an anti-friction roller 123 engaging in the groove 124 of a cam 125 rigidly mounted upon the gear 2, said plunger 120 being adapted to be reciprocated at proper intervals by said cam to cause the end portions 118 of said levers to move toward the rotatable member 101. The bag is disposed flatwise in that part of the open space separating the plates 116 inwardly of said ends 118 of said levers and in the path of the latter as said levers are swung inwardly by the plunger 120. During this movement of said plunger the mouth of the bag is puckered by reason of the fact that the inner edge thereof is prevented from moving beyond the opposing wall of the recess 114 and said puckered mouth is thus crowded into said recess by said lever. The latter moves so far toward the axis of rotation of the member 101 as to exert such a pressure upon the puckered mouth of the bag in said recess 114 as to move the plunger 105 radially inwardly to an extent sufficient to enable the latch member 112 to engage in the recess 111. The pressure of the said latch member upon the tapered inner wall of the recess 111 will obviously exert a force tending to draw said plunger 105 farther radially inwardly. During this movement the arms 107 will engage the ends of the members 115 thereby closing said arms around the puckered mouth of the bag. The latch member now holds the plunger 105 in this position while the rotatable member 101 moves intermittently until the bag held by said particular plunger is disposed in position to be tied. The tying mechanism operates in synchronism with said member 101, that is to say, as the particular head last referred to approaches its final position relative to the tying mechanism the guides 47—48 are separated and disposed out of the path of the bag carried thereby. As soon as the latter has moved into position said guides 47 and 48 close, the wire is fed forward through said wire guides to form the loop, and the tie is then completed. Said wire guides then separate and the member 101 makes a further rotation through the given arc and after the second following movement the bag mouth-engaging mechanism is opened by effecting a radial outward movement of the particular plunger referred to, whereupon the tied bag is dropped and the said head thereafter again moved into position to receive another bag.

Further detail description of said bag carrier is deemed unnecessary in this specification inasmuch as it constitutes no part of my sole invention in its specific embodiment as shown.

In the drawings I have also illustrated a mechanism actuated by the object-carrier for automatically causing wire to be fed forward to tie the object as the latter moves into position, but which throws the wire feeding mechanism out of actuating relation to the wire if the object is not carried into such position, but I disclaim this mechanism as my invention, the same having been invented by Edward Nessling of Chicago, Ill., and is described and claimed in a copending application filed the 19th day of April, 1915, Ser. No. 22,395.

This mechanism comprises a lever 125 projecting outwardly from the front end of the machine below the plane in which the wire loop is formed, and into the path of the object carried by the carrier, that is to say, the same projects just above the path of the lower set of arms 107 of the bag carrier. Said lever is pivotally mounted at its inner end on a pin 126 carried by the plunger 6 and rigid with said arm is a cam 107 having a stepped segmental face projecting beyond the inner end of said plunger 6. On that portion of the frame of the table 1 of the machine opposing the plunger 6 there is mounted a pin 128 carrying an anti-friction roller disposed in the path of the portion 129 of said cam 127 which is of greater radius and which, when the lever 125 is turned to the position shown in dotted lines in Fig. 3, causes the plunger 6 and the parts carried thereby to be moved against the action of

the springs 8. This effects a separation of the wire-engaging segments carried by the gears 2 and 3, and similarly the wire-engaging segments carried by the segmental gears 69 and 70 so that wire cannot be fed forward or retracted respectively by said respective segments. The said lever 125 is normally maintained in the position shown in dotted lines by means of a spring 130 and is adapted to be moved against the action of said spring by the object carried by the carrier as the latter moves into position to be tied. Said lever springs back to normal position as each of the tied objects passes the same in an obvious manner.

Thus the formation of a tie and waste of wire is automatically prevented in the event that the object is not fed or brought into position to be tied.

I also disclaim as my invention the specific construction and arrangement whereby the wire guides 47 and 48 are raised out of the path of the object to be tied as they are separated to release the loop formed thereby during their closed position. This specific arrangement being also the invention of Edward Nessling of Chicago, and being particularly described and claimed in the aforesaid copending application Ser. No. 22,395.

It will be obvious, of course, that the retracting and tying mechanisms can operate only in combination with means for holding the object in a predetermined position within the loop and which will prevent movement of the object in the direction of retraction of the wire and will prevent rotation thereof as the head 16 rotates to twist the wire to close and tie the loop. The outer ends of the arms 107 of the carrier perform the first-named function as they are interposed between the object and said head 16, and the middle portions of said arms disposed on either side of the object prevent rotation of the latter. My original conception included similar means rigidly attached to the frame carrying the wire manipulating mechanism but this is now omitted as the carrier not only supplies the equivalent thereof, but possesses superior advantages in that it obviates the necessity on the part of the operator to place his hands in dangerous proximity to the looping and tying mechanism.

While the preferred embodiment of my invention contemplates a retraction of the wire for the purpose of imparting a primary tension thereto about the object and increasing said tension during the tying operation, I desire it to be understood that I do not limit my invention to this succession of steps but that the same includes any means or mechanism, broadly, which will place the wire under tension around the object and hold the same under tension while tying the same regardless of whether the tying operation increases such tension.

Nor do I limit my invention to necessarily include feeding wire from a coil or in greater than the minimum lengths required to form the tie but I desire it to be particularly understood that the invention includes any mechanism falling within the definitions of the several appended claims.

I claim as my invention:

1. In a machine of the kind specified, means for feeding wire longitudinally, means disposed to resist the feed of said wire for causing the same to form an open loop to receive the object to be tied, and mechanism for closing the loop.

2. In a machine of the kind specified, means for feeding wire longitudinally, means associated therewith for causing the wire to form an open loop to receive the object to be tied, and mechanism including a portion of the feeding means for closing the loop.

3. In a machine of the kind specified, means for feeding wire longitudinally, means associated therewith for causing the wire to form an open loop to receive the object to be tied, and mechanism rotatable on an axis intersecting the open portion of the loop for closing the latter.

4. In a machine of the kind specified, means for feeding wire longitudinally, means associated therewith for causing the wire to form an open loop to receive the object to be tied, mechanism engaging the end of the wire after the loop is formed, said last-named mechanism and a portion of the feed mechanism rotatable to cause the end portion of the wire to overlap the body portion to close the loop.

5. In a machine of the kind specified, means for feeding wire longitudinally, means associated therewith for causing the wire to form an open loop to receive the object to be tied, mechanism engaging the end of the wire after the loop is formed, said last-named mechanism and a portion of the feed mechanism rotatable to cause the end portion of the wire to overlap the body portion to close the loop, and means for severing the closed loop from the body of the wire.

6. In a machine of the kind specified, means for feeding wire longitudinally, means associated therewith for causing the wire to form an open loop to receive the object to be tied, mechanism engaging the end of the wire after the loop is formed, said last-named mechanism and a portion of the feed mechanism rotatable to cause the end portion of the wire to overlap and be twisted about the body portion to close and contract the loop about the object.

7. In a machine of the kind specified, means for feeding wire longitudinally, means associated therewith for causing the wire to form an open loop to receive the ob-

ject to be tied, mechanism engaging the end of the wire after the loop is formed, said last-named mechanism and a portion of the feed mechanism rotatable to cause the end portion of the wire to overlap and be twisted about the body portion to close and contract the loop about the object, and means for severing the closed loop from the body of the wire.

8. In a machine of the kind specified, mechanism for manipulating a piece of wire to form an open loop in which the object to be tied is adapted to be received, means for clamping the portions of the wire bordering the mouth of the loop, and means for rotating said clamping means to hook said portions of said wires over each other to close and tie the loop.

9. In a machine of the kind specified, mechanism for manipulating a piece of wire to form an open loop in which the object to be tied is adapted to be received, means for clamping the portions of the wire bordering the mouth of the loop, and means for rotating said clamping means to twist said portions of said wire about each other to close, contract and tie the loop.

10. A machine of the kind specified including mechanism for manipulating a piece of wire to project an open loop thereof from the body of the machine and support said loop in position to receive the object to be tied, and mechanism for subsequently closing said loop.

11. In a machine of the kind specified, mechanism for manipulating a piece of wire to form a loop of predetermined shape and size and to support said loop in position to receive the object to be tied, and mechanism controlled by the object for contracting the loop to fit the latter.

12. Tying mechanism including means controlled by the object to be tied for contracting the tie to fit the same.

13. Tying mechanism including tension mechanism for contracting the tie about the object to be tied.

14. Tying mechanism including yielding take-up mechanism for automatically contracting the tie to fit objects of varying peripheral dimensions.

15. Tying mechanism including a part against which the object inclosed in the tie is adapted to bear, take-up mechanism engaged with the tie for drawing the latter toward said part under predetermined tension, and means acting while said tie is maintained under the tension aforesaid for forming a ring around said object.

16. Tying mechanism including means engaging a tie disposed about the object to be tied, a member projecting into a tie and against which the object to be tied is adapted to bear, and means for imparting relative movement to said member and said tie-engaging means for contracting the tie about the object.

17. Tying mechanism including means engaging a tie having a portion thereof partially surrounding the object to be tied, a member surrounding that portion of the object not surrounded by said tie, take-up mechanism associated with said tie-engaging means and said member for imparting a relative movement thereto to contract that portion of the tie which contacts with the object.

18. Tying mechanism including mechanism for manipulating a piece of wire to form a loop of predetermined size adapted to receive an object to be tied, means engaging one end of the loop to hold the same rigidly in a given position, a take-up mechanism engaging another portion of the wire for contracting the loop about the object, means for maintaining the loop contracted, and mechanism associated with the loop engaging means for completing the tie.

19. Tying mechanism including mechanism for feeding a predetermined length of wire, means associated therewith to cause the end portion of said wire to form a loop of predetermined size adapted to receive the object to be tied, means engaging the extreme end portion of the wire against retraction, and take-up mechanism for retracting a portion of said wire to contract said loop about the object under predetermined tension, and mechanism for closing the contracted loop.

20. Tying mechanism including mechanism for feeding a predetermined length of wire, means associated therewith to cause the end portion of said wire to form a loop of predetermined size adapted to receive the object to be tied, means engaging the extreme end portion of the wire against retraction, and mechanism for retracting a variable length of the wire fed to contract said loop about the object, and mechanism for closing the cantracted loop.

21. Tying mechanism including mechanism for feeding a predetermined length of wire, means associated therewith to cause the end portion of said wire to form an open loop of predetermined size adapted to receive the object to be tied, a member disposed relatively to the loop forming mechanism to coact with the loop to provide means completely encircling the object under predetermined tension, and means for effecting closure of said contracted loop.

22. In a machine of the kind specified, mechanism controlled in part by the object to be tied for encircling said object with wire under a predetermined tension, and means adapted to act while said wire is maintained under the aforesaid tension for forming a permanent ring of said wire about said object.

23. In a machine of the kind specified,

mechanism controlled in part by the object to be tied for encircling said object with one end portion of a piece of wire under a predetermined tension, and means adapted to act while said wire is maintained under the aforesaid tension for forming a permanent ring of said portion of said wire encircling said object, means for severing said ring from the body of the wire, and mechanism for manipulating the end portions of the wire composing said ring to form a key for digitally opening the same.

24. In a machine of the kind specified, means for feeding a predetermined length of wire from a coil, means associated therewith to cause the fed end portion of the wire to form a loop adapted to receive the object to be tied, clamping means disposed to receive the extreme end of the wire forming said loop to hold the same against retraction, means for retracting a portion of the fed wire for contracting the loop about the object, clamping means interposed between the looping means and the retracting means and adapted to engage the body of the wire after retraction to hold same against longitudinal movement, and mechanism for rotating the respective clamping about an intermediate axis for twisting the extreme end portion of the looped wire and the body thereof about each other to complete the tie.

25. In a machine of the kind specified, means for feeding a predetermined length of wire from a coil, means associated therewith to cause the fed end portion of the wire to form a loop adapted to receive the object to be tied, clamping means disposed to receive the extreme end of the wire forming said loop to hold the same against retraction, means for retracting an indeterminate portion of the fed wire for contracting the loop about the object, clamping means interposed between the looping means and the retracting means and adapted to engage the body of the wire after retraction to hold same against longitudinal movement, mechanism for rotating the respective clamping about an intermediate axis for twisting the extreme end portion of the looped wire and the body thereof about each other to complete the tie, and means disposed between the means for clamping the body of the wire and the wire looping means for severing the tie from the body of the wire.

26. In a machine of the kind specified, a wire guide, means for feeding wire therethrough, means associated with said guide for causing the wire to form a loop adapted to receive the object to be tied, wire-clamping means associated with said guide and said loop-forming means for maintaining the loop, and means for effecting relative movement between the body of the loop and the wire-clamping means for tying the loop.

27. In a machine of the kind specified, a wire guide, means for feeding wire therethrough, means associated with said guide for causing the wire to form a loop adapted to receive the object to be tied, wire-clamping means associated with said guide and said loop-forming means and engaging the extreme end portion and body portion of the wire at one side of the loop for maintaining the latter, and means for effecting relative movement between the body of the loop and the wire-clamping means for tying the loop, and means for severing the tied loop from the body of the wire.

28. In a machine of the kind specified, a wire guide, means for feeding wire therethrough, means associated with said guide for causing the wire to form an open loop adapted to receive the object to be tied, wire-clamping means associated with said guide and said loop-forming means for maintaining the loop, and means for effecting relative movement between the body of the loop and the wire-clamping means for closing and tying the loop.

29. In a machine of the kind specified, a wire guide, means for feeding a predetermined length of wire therethrough to project therefrom at one end, means associated with said guide to form a loop of the projecting portion of said wire, means for engaging the extreme end of the looped wire to hold the same against retraction, and means for retracting a portion of the fed wire to contract said loop, the latter adapted to receive an object and said object partially controlling the extent of retraction of said wire, and means including said wire-engaging means coacting with the object to close and tie said loop.

30. In a machine of the kind specified, a wire guide, means for feeding a predetermined length of wire therethrough to project therefrom at one end, means associated with said guide to form a loop of the projecting portion of said wire, means for engaging the extreme end of the looped wire to hold the same against retraction, means for retracting a portion of the fed wire to contract said loop, the latter adapted to receive an object and said object partially controlling the extent of retraction of said wire, means engaging the body of the wire after retraction for preventing expansion of said loop, and means including said wire-engaging means coacting with the object to close and tie said loop.

31. In a machine of the kind specified, a wire guide, means for feeding a predetermined length of wire therethrough to project therefrom at one end, means associated with said guide to form a loop of the projecting portion of said wire, means for engaging the extreme end of the looped wire to hold the same against retraction, means for retracting a portion of the fed wire to con-

tract said loop, the latter adapted to receive an object and said object partially controlling the extent of retraction of said wire, means engaging the body of the wire after retraction for preventing expansion of said loop, and means including said wire engaging means coacting with the object to close and tie said loop, means for severing the tied loop from the body of the wire, and means associated with said severing means for looping the severed end portions of the wire in the tie.

32. In a machine of the kind specified, a rotatable head having a longitudinal guide opening therethrough having its inlet end concentric therewith and its discharge end eccentric thereto and through which wire from a coil is adapted to be fed, means associated with said head for feeding predetermined lengths of wire therethrough to project at one end therefrom, means associated with said head for bending said projecting portion of the wire to form a loop, means carried by the said head for engaging the extreme end of the looped wire against movement relatively to said head, means carried by said head for similarly engaging the body of wire, and means for rotating said head to cause the last-named end of said wire and the adjacent body portion of the latter to become twisted about each other to tie said loop.

33. In a machine of the kind specified, a rotatable head having a longitudinal guide opening therethrough having its inlet end concentric therewith and its discharge end eccentric thereto and through which wire from a coil is adapted to be fed, means associated with said head for feeding predetermined lengths of wire therethrough to project at one end therefrom, means associated with said head for bending said projecting portion of the wire to form a loop, means carried by the said head for engaging the extreme end of the looped wire against movement relatively to said head, means carried by said head for similarly engaging the body of wire, and means for rotating said head to cause the last-named end of said wire and the adjacent body portion of the latter to become twisted about each other to tie said loop, and means for severing the tied loop from the body of the wire.

34. In a machine of the kind specified, a rotatable head having a longitudinal guide opening therethrough having its inlet end concentric therewith and its discharge end eccentric thereto and through which wire from a coil is adapted to be fed, means associated with said head for feeding predetermined lengths of wire therethrough to project at one end therefrom, means associated with said head for bending said projecting portion of the wire to form a loop, means carried by the said head for engaging the extreme end of the looped wire against movement relatively to said head, means associated with said head for retracting the wire to contract said loop, means carried by said head for similarly engaging the body of wire, means for rotating said head to cause the last-named end of said wire and the adjacent body portion of the latter to become twisted about each other to tie said loop, and means for severing the tied loop from the body of the wire.

35. In a machine of the kind specified, a rotatable head having a longitudinal guide opening therethrough having its inlet end concentric therewith and its discharge end eccentric thereto and through which wire from a coil is adapted to be fed, means associated with said head for feeding predetermined lengths of wire therethrough to project at one end therefrom, means associated with said head for bending said projecting portion of the wire to form a loop, a vise carried by said head having two independently operable vise members, a cam for closing the same at different intervals, one of said members interposed between the mouth of said guide opening and the said bending means, and the other thereof disposed in the path of and adapted to receive the extreme end of the looped wire and engage the same against retraction, means associated with said head for retracting the wire to contract said loop, and means for rotating said head to cause the last-named end of said wire and the adjacent body portion of the latter to become twisted about each other to tie said loop.

36. Apparatus for tying the puckered mouth of a bag, comprising feed mechanism for propelling wire, guide means disposed near the said mouth of the bag and coacting with the said feed mechanism to dispose the end portion of the wire in a loop about the mouth of the bag; clamping means for gripping the end of the wire when thus disposed, mechanism for partially retracting the wire to contract the said loop about the mouth of the bag, mechanism for relatively twisting the wire portions forming the ends of the said contracted loop, and cutting means for severing the body of wire from the said relatively twisted portions thereof.

37. Wire tie forming apparatus including, in combination feed mechanism and guide means for disposing the end portion of the wire in loop formation, mechanism for relatively twisting the portions of the wire forming the ends of the said loop, cutting means for severing the supply of wire from the portion connecting the same to the said twisted loop, and mechanism for forming the ends of the said relatively twisted portions of the wire into auxiliary loops.

38. Apparatus for making a tie of wire, including mechanism for propelling the

wire, guide means coöperating with the said feed mechanism to dispose the end portion of the wire in the form of a loop, mechanism for retracting the main portion of the wire to effect a contraction of the said loop, and spring means for limiting the extent of the said retraction of the wire.

39. Apparatus for tying the puckered mouth of a bag, comprising in combination feed mechanism for propelling the end portion of the wire, guide means disposed near the said mouth of the bag and coacting with the said feed mechanism to dispose the said end portion of the wire in a loop about the mouth of the bag, clamping means for gripping the end of the wire when thus disposed, mechanism for partially retracting the wire to contract the said loop about the mouth of the bag, and into engagement with the latter, means associated with the said means effecting engagement of the loop with the mouth portion of the bag for limiting the extent of the said retraction of the wire, and means for relatively twisting the end portions of the said contracted loop.

40. Wire tie forming apparatus, including in combination feed mechanism and guide means for disposing the free end of the wire in loop formation, mechanism for relatively twisting the portions of the wire forming the ends of the said loop, cutting means for severing the supply of wire from the portion connecting the same to the said twisted loop, and means for locking the said twisting mechanism against movement during the actuation of the said feed and cutting mechanisms.

41. Wire tie-forming apparatus including, in combination a support for the object, a thrust member adapted to engage the object, mechanism for feeding the wire from the said supply thereof, guide means for guiding the wire in loop formation about a portion of the said object adjacent to the thrust member, tension means for retracting the wire to draw the said loop into forcible engagement with the said portion of the object, and twisting means for twisting the ends of the said loop, the said thrust member so disposed with respect to the loop and object supporting means as to maintain the object in a predetermined position during the said retracting of the wire.

42. In a wire loop forming machine, the combination with means for feeding wire and means for disposing an end portion of the same in loop formation, of means for gripping the free end of the wire, means for retracting the main portion of the wire to afford a loop of the desired size, means for holding the said main portion of the wire under tension, and means for relatively twisting wire portions constituting ends of the said loop while maintained under said tension.

43. In a machine of the kind specified, wire retracting means comprising two opposed segmental wire engaging surfaces adapted to be simultaneously rotated in respectively opposite directions, means for moving the same toward and from each other to alternately engage and release the wire disposed therebetween, mechanism for rotating said members at predetermined intervals, and a spring interposed between said mechanism and said members for effecting a yielding engagement therebetween.

44. In a machine of the kind specified, a pair of wire engaging members, means for alternately moving the same toward and from each other to alternately engage and release a wire disposed therebetween, means for simultaneously moving the same in a direction to move the wire, and cushioning means effecting a yielding engagement between last-named means and said members.

45. In a machine of the kind specified, the combination with means for resisting retraction of wire, of means for effecting retraction of the slack portion of the wire comprising wire-clamping means, mechanism for opening and closing the same at intervals, and mechanism for moving the same while closed to effect retraction of the wire, a spring interposed between said mechanism and said clamping means for regulating the tension of said wire, and means for adjusting the force exerted by said spring.

46. In a machine of the kind specified, the combination with wire-feeding means, and means associated therewith for bending the end portion of the wire to form a loop adapted to receive an object to be tied, of a rotatable member interposed between the feeding means and the looping means rotatable on an axis substantially transverse to the axis of the loop and through which the wire is adapted to pass axially thereof at one end and eccentrically thereto at its other end, clamping means carried by said head for engaging the end and body portions of the wire against movement relatively thereto, and means for rotating said head to tie the loop, the latter adapted to be held against rotation by said object.

47. In a machine of the kind specified, a rotatable head having an opening extending therethrough, wire feeding means disposed contiguous to the inlet end of said head for forcing wire through the opening therein, wire looping means disposed contiguous to the other end of the head and adapted to bend the end of the wire to form a loop, means carried by head for clamping the end and body portions of the wire, and means for rotating said head.

48. In a machine of the kind specified, a rotatable head having a wire guide opening having its discharge end disposed laterally of the axis of rotation thereof and hav-

ing its other end disposed in the axis of rotation thereof, wire feeding means disposed contiguous to the last-named end of said head for forcing wire through the opening therein, wire looping means disposed contiguous to the other end of the head and adapted to effect bending of the end of the wire into a loop, means carried by the head for clamping the end and body portions of the wire, means operable from the exterior of said head for actuating said clamping means, and means for rotating said head a predetermined number of revolutions while said clamping means are engaged with the wire.

49. In a machine of the kind specified, rotatable head having a wire guide opening having its discharge end disposed laterally of the axis of rotation thereof and having its other end disposed in the axis of rotation thereof, wire feeding means disposed contiguous to the last-named end of said head for forcing wire through the opening therein, wire looping means disposed contiguous to the other end of the head and adapted to effect bending of the end of the wire into a loop, means carried by the head for clamping the end and body portions of the wire, means operable from the exterior of said head for actuating said clamping means at respectively different intervals, wire retracting mechanism including means for regulating the tension of the wire associated with the clamping means for contracting the loop after engagement of the end of the wire and before engagement of the body thereof by said clamping means, and means for rotating said head while said clamping means are engaged with the wire.

50. In a machine of the kind specified, the combination with means for feeding wire longitudinally, of means for bending the fed wire to form a loop, a guide member provided with a channel of the shape to be imparted to the loop, said guide member separable to disengage the loop when the latter has been formed.

51. In a machine of the kind specified, the combination with means for feeding wire longitudinally, of a guide through which said wire is adapted to be forced to bend the same to loop formation, said guide comprising a plurality of members adapted to be separated to release the loop formed thereby.

52. In a machine of the kind specified, the combination with mechanism for effecting forced feed of wire longitudinally, of a guide through which said wire is adapted to be forced to bend the same to form a loop thereof, said guide comprising a channeled member and a companion cover member for preventing escape of the wire from said channeled member, said members hinged together and separable to release the loop formed thereby.

53. In a machine of the kind specified, the combination with mechanism for effecting forced feed of wire longitudinally, of a guide through which said wire is adapted to be forced to bend the same to form a loop thereof, said guide comprising a pair of coacting channeled members, and a pair of cover members therefor for preventing escape of the wire from said channeled members, the latter separable from each other and from said cover members for releasing the loop formed thereby, and springs arranged to maintain said cover members in closed position on said channeled members.

54. In a machine of the kind specified, the combination with mechanism for effecting forced feed of wire longitudinally, of a separable guide through which the wire is adapted to be forced for bending the same to a loop, and mechanism for effecting separation of said guide to release said loop.

55. In a machine of the kind specified, the combination with mechanism for effecting forced feed of wire longitudinally, of a guide through which the wire is adapted to be forced for bending the same to a loop, said guide comprising a channeled member and a cover member separable to permit the escape of the loop therefrom, springs for maintaining said cover members on said channeled members, and mechanism for effecting separation of said parts against the action of said springs to release the loop.

56. In a machine of the kind specified, the combination with means for supporting an object in a given position, of a separable wire guide adapted to surround the object, mechaninism for effecting closure of said guide, mechanism for effecting forced feed of wire through said guide, mechanism for engaging said wire to retain the same in position around said object, mechanism for effecting opening of said guide to release the loop, and mechanism coacting with the object supporting means for trying said loop upon the object.

57. In a machine of the kind specified, the combination with mechanism for bending wire into loop formation, mechanism for maintaining said loop formation, and mechanism for tying said loop, of means for supporting the object to be tied within the space comprised within the loop and coacting with said tying mechanism for securing said loop upon said object.

58. A machine of the kind specified, including wire clamping means, and mechanism coacting therewith for bending the end portions of said wire about said clamping means to form loops adapted to be digitally engaged for opening the tie formed by said machine.

59. In a machine of the kind specified, means for effecting forced encircling of an object with a piece of wire under a predeter-

mined tension, and means for simultaneously increasing said tension and fixing said wire upon the object to retain the same under the increased tension.

60. In a machine of the kind specified, means for feeding wire longitudinally, means associated therewith for bending the wire during its longitudinal movement to form an open loop to receive the object to be tied, and mechanism for closing the loop.

61. In a machine of the kind specified, mechanism for simultaneously effecting a longitudinal movement of wire and forming an open loop adapted to receive the object to be tied, mechanism for contracting the loop about the object, and mechanism for tying said loop.

In testimony whereof I have signed my name in presence of two subscribing witnesses.

ROGERS M. WARWICK.

Witnesses:
M. M. BOYLE,
RUDOLPH WM. LOTZ.