April 12, 1966 E. G. COLLINS ETAL 3,245,434

WIRE LOOPING AND TYING APPARATUS

Filed May 16, 1963 2 Sheets-Sheet 1

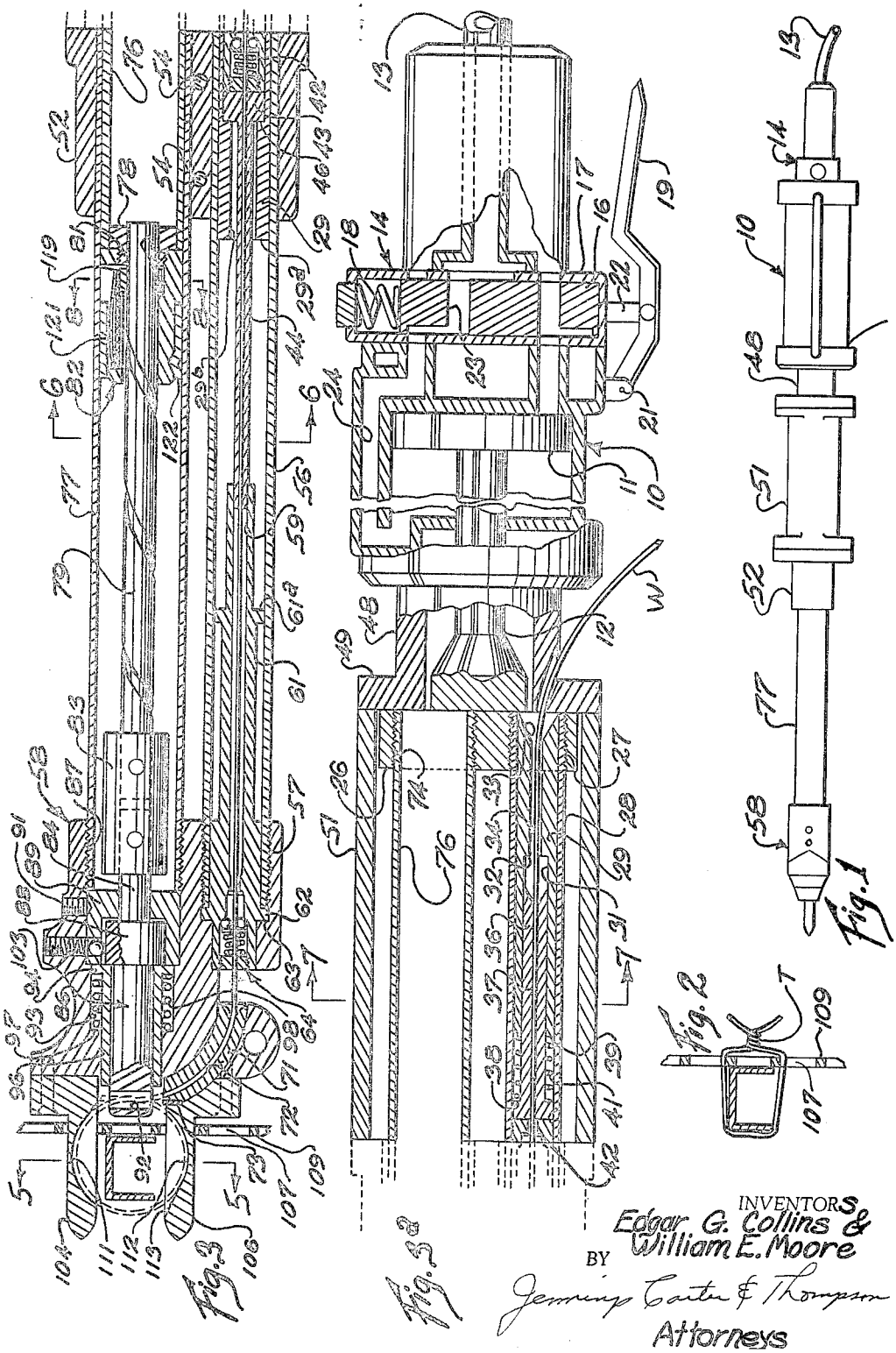


Fig. 1

Fig. 2

Fig. 3

Fig. 3a

INVENTORS
Edgar G. Collins &
William E. Moore

BY
Jennings Carter & Thompson
Attorneys

April 12, 1966 E. G. COLLINS ETAL 3,245,434

WIRE LOOPING AND TYING APPARATUS

Filed May 16, 1963 2 Sheets-Sheet 2

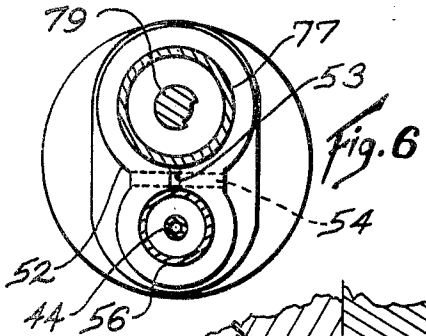


Fig. 6

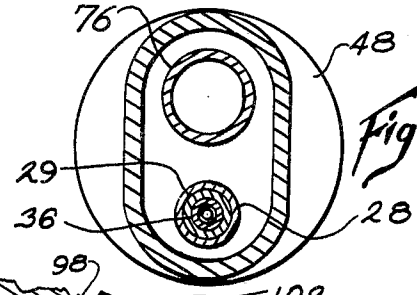


Fig. 7

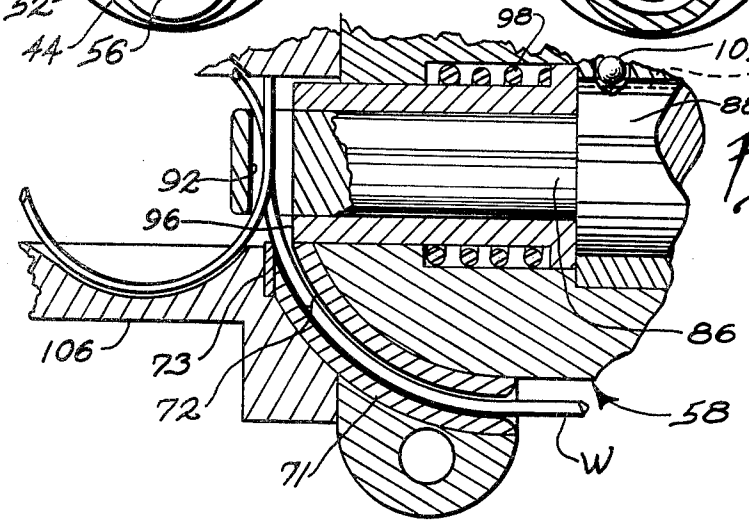


Fig. 4

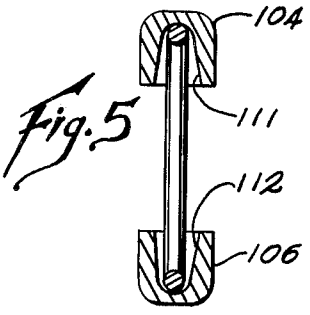


Fig. 5

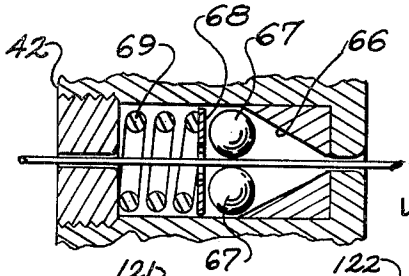


Fig. 10

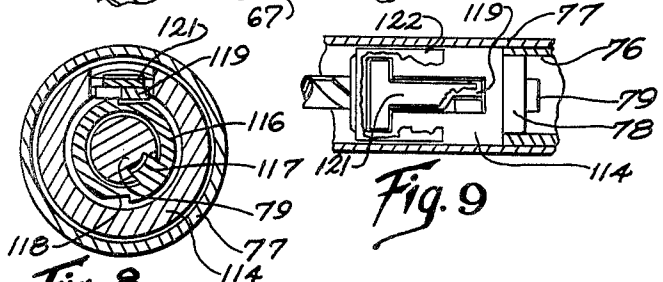


Fig. 8

Fig. 9

INVENTORS
Edgar G. Collins &
BY William E. Moore

Jamming Carter & Thompson
Attorneys

United States Patent Office 3,245,434 Patented Apr. 12, 1966

3,245,434

WIRE LOOPING AND TYING APPARATUS

Edgar G. Collins, Rte. 13, Box 214, and William E. Moore, 1024 5th St. W., both of Birmingham, Ala.

Filed May 16, 1963, Ser. No. 280,881
8 Claims. (Cl. 140—93.6)

Our invention relates to apparatus for looping a length of wire about a member or members and then twisting the wire upon itself, whereby the loop is secured about the member or members.

An object of our invention is to provide a portable, light-weight, but highly efficient machine which may be used for securing members together with wire, such for instance in tying metal lathing to the supporting members therefore in buildings and the like.

Another object of our invention is to provide a wire loop forming and tying apparatus in which the loops may be quickly and accurately formed from a length of wire drawn from a roll, spool or or like, and in which the length of wire necessary to form the loop is automatically cut from the supply thereof, the wire twisted, and the tool is ready again, all automatically, for a subsequent cycle.

Another object is to provide apparatus of the character designated in which the actual loop-forming members may be a pair of spaced apart, finger-like members, having wire channeling grooves in opposite faces thereof, together with means to feed the wire first into the bottom of one of said grooves in one of said members, in an arcuate or curved path, whereby the wire crosses over and enters the second of said wire channeling grooves in the second of said members then, in response to further feeding of the wire, the end first fed crosses over the loop at the lower or bottom end thereof, together with means to sever this length of wire from the longer length, and then to twist the loop, and to draw it tight about members around which the loop may be formed.

Another object is to provide apparatus of the character designated in which the several parts all are operated from a common source of power, which conveniently may be a double-acting fluid pressure cylinder, and so arranged that the timing sequence of the operation is positively maintained, whereby the wire is first fed, looped, severed, and then twisted.

A further object of our invention is to provide means for feeding the wire outwardly of the apparatus to form the loop which may conveniently be in the form of a pair of chucks, one of which is mounted for longitudinal movement in the apparatus and which when moving forwardly, that is, to feed the wire, tightly engages the wire, but releases upon the return stroke, and the second of which chucks is fixed in the housing of the apparatus and is constructed and arranged to prevent the wire from feeding back into the apparatus while the movable chuck is making its return stroke and while the wire is being cut.

Briefly, our improved apparatus comprises essentially five portions. First, there is a wire feeding mechanism; second, a loop forming mechanism; third, a wire severing mechanism; fourth, means to twist the wire ends after the length of wire is severed; and fifth, power means for driving the movable ones of the aforesaid mechanisms. Thus, we propose to use a pair of chucks, one of which seizes the wire for forward pushing of the same and releases upon return movement, and the other of which prevents the wire from being withdrawn back into the apparatus as the first chuck returns. The loop forming means may be a pair of finger-like members, as stated, which are small enough to enter between the interstices of metal lathing or the like. The wire severing means may be a stationary anvil and a movable part. The twisting mechanism may be in the form of a coarsely

threaded rod with a ratchet nut thereon which rotates the rod when the nut moves in one direction, but permits it to remain stationary when the nut moves in the opposite direction. As a matter of convenience and practical construction, we prefer to use a double-acting air cylinder, the piston and rod thereof being controlled by means of a manually operated four-way valve.

Apparatus illustrating features of our invention is shown in the accompanying drawings, forming a part of this application, in which:

FIG. 1 is a plan view drawn to a small scale and showing our complete apparatus;

FIG. 2 is a typical example of the kind of wire loop and twist thereon which our apparatus accomplishes, and showing a piece of metal lathing attached to a small channel-shaped member which may be in the ceiling or wall of a building;

FIG. 3 is a transverse detail sectional view of the forward or wire tying end and mid-portion of our apparatus, drawn to an enlarged scale as compared to FIG. 1;

FIG. 3A is a view taken generally along the same plane as FIG. 3 and showing the rear and adjoining central portion of our apparatus, certain of the parts being broken away and in section, and drawn to the same scale as FIG. 3;

FIG. 4 is an enlarged detail sectional view of the wire severing mechanism and a portion of the wire twisting means;

FIG. 5 is a detail sectional view taken generally along line 5—5 of FIG. 3 and drawn to an enlarged scale;

FIG. 6 is a detail sectional view taken generally along line 6—6 of FIG. 3;

FIG. 7 is a detail sectional view taken generally along line 7—7 of FIG. 3A;

FIG. 8 is a detail sectional view through the ratchet nut and taken along line 8—8 of FIG. 3, drawn to a slightly enlarged scale;

FIG. 9 is a plan view of the ratchet nut, certain parts being broken away and in section; and,

FIG. 10 is an enlarged sectional view of one of the ball-type chucks for feeding the wire.

Referring now to the drawings for a better understanding of our invention, and particularly to FIG. 1, it will be seen that our improved apparatus embodies at its rear end a double-acting fluid pressure cylinder **10** having a piston **11** therein carrying a piston rod **12**. Fluid under pressure, for instance air, may be admitted from a source of supply, not shown, by means of a flexible conduit **13** to the housing of a four-way valve indicated generally at **14**. The four-way valve may embody a spool **16** mounted in a ported housing **17**, and may be returned to posiiton by means of a spring **18**. A manually operated lever **19**, pivoted at **21**, may be connected through a stem **22** to the spool **16**. As shown in FIG. 3A it will be apparent that with the ports in the position shown fluid under pressure is being supplied from the conduit **13**, through the valve port **23**, a passage **24** that leads to the forward end of the cylinder whereby the piston **11** is urged to the right as shown in FIG. 3A. Thus, by raising upwardly on the lever **19** fluid may be admitted to the right-hand end of the cylinder as viewed in FIG. 3A, it being understood that the exhaust ports for the cylinder are automatically provided by the porting of the valve.

The piston rod **12** carries a cross head **26** which may be in the form of a disc. Secured to the disc, as by the threaded section **27**, is a length of tube **28** which we will refer to hereafter as the wire feed tube. Secured to the inside of the tube **28** as by soldering or the like is a sleeve **29**. The sleeve **29** has an axial bore **31** therein terminating in a shoulder indicated at **32**. Also, at its rear end the sleeve **29** has a flared conical opening **33**,

and a wire passage 34 connects the bore 31 with the flared conical opening 33.

Slidably mounted in the bore 31 of sleeve 29 is a tube 36 having an axial wire receiving opening 37 extending therethrough. The tube 36 is shouldered at 38 and this shoulder is spaced forwardly of the end 39 of the sleeve 29. Interposed between the shoulder 38 and the end 39 is a compression spring 41, the purpose and function of which will later appear.

Secured inside the tube 28, and with its rear housing portion abutting the forward end of member 36 is a movable wire feeding chuck 42, the details of which are shown more clearly in FIG. 10 and which will be described fully later on.

Forwardly of the housing of the wire feeding chuck 42 is the rear end 43 of a wire guide tube 44. It will be noted that the end 43 of the wire guide tube is fitted against a shoulder 46 provided near the outer end of the wire feed tube 29.

Forwardly of the cylinder 10 is a connecting frame portion 48 having an enlarged shoulder portion 49 formed integrally thereon. Projecting forwardly of the shoulder or flange 49 is a tubular housing portion 51. Mounted adjacent the forward end of the tubular housing 51 is a figure 8 shaped clamp 52 which is split as indicated at 53, FIG. 6, and which may be drawn together at its center by means of a pair of bolts or the like 54.

Disposed to be clamped in the lower portion of the figure 8 clamp 52 is the rear end of a tube 56. The tube 56 extends forwardly and is threaded as indicated at 57 into a fitting or head indicated generally by the numeral 58.

It will be seen that the wire guide tube 44 projects slidably into the bore 59 of a tube 61 having a shoulder 62 on its forward end. The shoulder 62 fits against a shoulder 63 at the forward end of the opening which is threaded at 57 to receive the forward end of the tube 56. Mounted in a suitable opening in fixed manner in the forward end of the tube 56 is the stationary one 64 of the wire chucks which is shown more fully in FIG. 10.

From what has been so far described it will be seen that when the piston rod 12 moves to the left from the position shown in FIG. 3A, the cross head 26 moves to the left, carrying with it the tube 28, member 29, chuck 42, and the wire guide feed tube 44. It will further be noted that the leftward movement imparted to the wire feed tube, by movement of the cross head and tube 28 is through the medium of the compression spring 41, and the purpose and function of this will be later described. Thus, since the chuck 42 will engage the wire W threaded through the apparatus as shown, upon leftward movement as viewed in FIGS. 3 and 3A of the chuck, the wire will be fed to the left, or forwardly of the apparatus.

Referring now to FIG. 10 it will be seen that the chucks 42 and 64 may embody a conical seat member 66 which converges to the right as viewed in the drawings, in both instances. Mounted for rolling engagement with the tapered seat are balls 67. Forwardly of the balls is a washer 68. A spring 69 urges the washer and hence the balls to the right as viewed in FIG. 10. Thus, when the wire is threaded through the chuck as shown, leftward movement of the chuck 42 will cause the balls to seize upon the wire, pushing the wire along. However upon rightward movement of the chuck 42 the balls will slightly compress the spring through the washer 68, and roll freely along the wire W. Chuck 64, constructed identically with the one already described, serves to hold the wire against withdrawing into the apparatus while the chuck 42 is returning for a new grip, for a subsequent feeding operation, as will appear.

The fitting 58 is provided with a hardened insert 71 which has a curved wire passage 72 therein as shown.

Mounted adjacent the exit end of the opening 72 is a hardened stationary wire shear blade 73.

Screwed into the cross head 26 as at 74 is the rear end of what we will hereafter refer to as a ratchet nut tube 76. This tube extends slidably into a ratchet nut tube housing 77, also into the form of a tube, and which is clamped at its rear end by the figure 8 clamp 52. Mounted in the outer end of tube 76 is a bushing 78. The bushing 78 is mounted slidably about a coarsely threaded rod 79. Carried by a threaded forward extension 81 of bushing 78 is a ratchet nut indicated generally by the numeral 82.

At the forward end of the rod is a coupling 83 which rotatably connects the rod 79 to the projecting stem 84 of a wire twist pin indicated generally by the numeral 86.

It will now be noted that the forward end of tube 77 is threaded into the fitting 58 as at 87. Further, the stem 84 of the twist pin carries an enlarged portion 88 which fits in a housing 89 secured by a set screw 91 in the fitting 58. The forward end of the twist pin 86 has a cross opening 92 therein which is located, when the parts are in loop forming position, in alignment with the exit of the opening 72 in the wire guide member 71.

Mounted in an annular recess 93 in the fitting 58 is the rear, flanged end 94 of a cutter sleeve 96. Interposed between the flange 94 of the cutter sleeve and the shoulder 97 of the annular recess 93 is a spring 98.

The enlarged portion 88 of the twist pin is provided with a longitudinally extending slot 101. Adapted to seat in this slot is a ball 102. The ball 102 is pressed downwardly by a spring 103, FIG. 3.

Mounted on the forward end of the fitting 58 is a pair of finger-like wire loop forming members 104 and 106. The cross sectional shape of these members is indicated in FIG. 5. Thus, they are small enough to be inserted between the interstices 107 of the usual metal lathing 109. Further, the finger 104 has an arcuate groove 111 therein while the member 106 has an arcuate groove 112 therein but at its outer end has a tangential portion 113. It will be noted that these grooves are outwardly flaring as illustrated in FIG. 5 and that they are provided on the facing surfaces of the members 104 and 106.

While various forms of ratchet nuts may be employed, we show by way of illustration one form that is operative in FIGS. 8 and 9. Thus, the nut may embody a housing 114 which as stated may be threaded or otherwise secured to the forward end of the bushing 78. Mounted rotatably in the housing 114 is the tubular nut proper 116 which has threaded engagement as at 117 with the threads of the rod 79. The outer surface of the nut is provided with shouldered, sloping depressions 118. Adapted to fit in either of the depressions 118 is a floating detent 129 which is pressed downwardly by means of a flat leaf spring 121, the spring being held over the detent 119 by means of a sleeve 122. Thus, due to the action of the detent and spring, when the nut moves to the left as viewed in FIG. 3 the twister rod 79 remains stationary, due to the ball detent 102, but when the nut moves from the left-hand position on the rod 79 back to the position shown in FIG. 3, the rod is rotated, consequently rotating the twister pin.

From the foregoing the method of constructing and using our invention and the many advantages thereof may now be more fully explained and understood.

With the parts in the position shown in FIGS. 3 and 3A of the drawings, and with the wire W threaded through and stopping where it has previously been cut off adjacent the stationary anvil member 73, the action is as follows: upon opening the valve through the handle 19 to let fluid into the rear of the cylinder 10, the piston and rod moves to the left. This moves the movable chuck to the left, feeding the wire outwardly, causing the end adja-

cent the member **73** to travel through the opening **92** of the twister pin, into the bottom of the groove **111** of the finger **104**, across the member such as a furring strip F, to which the lathing **108** has been applied, into the tangential portion **113** of the curved groove **112** in the member **106**, back through the opening **92** and finally the end of the wire comes to rest by abutting at **123** against against the side of the inner part of finger **104**. It will be seen that the ball **102**, held resiliently in the slot **101**, serves to hold the opening **92** in position to receive the wire.

During this same time it will be of course understood that the ratchet nut has moved to the left and that the left-hand end of its housing has come into abutment with the right-hand end of the coupling **83**. Further, at this same time the end **29A** of the tube **29** will have come into abutment with the shoulders **61a** of the tube **61**, it being noted that the tube **29** is drilled out at **29b** to slide over the right-hand end of the tube **61**. Therefore, with the nut housing abutting the coupling **83** and with **29a** and **61a** in contact, slight further leftward movement in response to still further leftward movement of the piston rod is permitted by the compression of the spring **41** without overfeeding the wire. Therefore, slight leftward movement moves the rod **79**, coupling **83**, and of course the twister pin and the cutter sleeve **96**. The outer sleeve thus moves into shearing relation with the shear blade **73** and the wire thus is sheared, with its ends still remaining through the opening **92**, with the members to be comprised inside the loop. Upon releasing the handle **19** the spring **18** pushes the spool valve back to the position shown, whereupon fluid is admitted to the left-hand end of the cylinder, moving all the mechanism previously mentioned back to the right. During this movement the detent of the ratchet nut engages, rotating rod **79**, in turn rotating the twister pin, thereby twisting the wire as indicated at T, FIG. 2.

It will be seen that our improved apparatus is fully effective to feed, on each stroke, a predetermined length of wire from a roll, spool or the like, loop it about members to be tied, sever the wire, and then twist it. It will further be seen that the actual twisting takes place in that part of the overlapped ends of the severed wire between the lowermost member to be tied and the end of the twister pin outwardly of the opening **92**. In other words, the wire is twisted by a member which, in the beginning, lies inside the loop, but when finished lies outside the loop. Therefore, the ends of the wire outwardly of the twist simply pull out of the opening **92** when the tool is withdrawn.

In actual operation our invention has proved to be extremely satisfactory. With a tool weighing altogether 5 pounds, and roughly 30 inches in overall length, and using air pressure of about 75 pounds per square inch, we have consistently tied as many as 1200 ties per hour, using 18 gauge wire. This was accomplished in applying metal lathing to the usual channel-shaped furring members.

While we have particularly described our invention as useful for tying metal lathing and the like to furring, it will be apparent that it may have other uses. Furthermore, the principles disclosed herein, in our opinion, lend themselves to incorporation in machines for tying heavy wire as well as light or smaller wire.

While we have shown our invention in but one form, it will be obvious to those skilled in the art that it is not so limited but is susceptible of various changes and modifications without departing from the spirit thereof, and we desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What we claim is:

1. In wire loop forming and tying apparatus,

(a) a body,

(b) wire feed means carried by the body and effective upon actuation to feed a predetermined length of wire from a longer length thereof outwardly of the body,

(c) loop forming means on the body having spaced apart portions disposed to straddle a member to be tied and positioned to be engaged by the length of wire as it is fed from the body and form it into a loop with the free end of said length of wire laying alongside the loop,

(d) means effective to sever the said loop forming length of wire from the longer length thereof, and

(e) means to twist the ends of the severed length of wire, thus to tie the loop.

2. In wire loop forming and tying apparatus,

(a) an elongated body,

(b) spaced apart jaw-like members adjacent one end of the body adapted to straddle a member about which the loop is to be formed,

(c) means to feed a predetermined length of wire from a longer length thereof outwardly of the body and into contact with said jaw-like members thereby to form a loop from said predetermined length of wire,

(d) means to cut said predetermined length of wire from the longer length, and

(e) means carried by the body to twist the ends of the severed length upon each other thus to tie the loop.

3. In apparatus for looping a length of wire about a member and twisting together the ends thereof,

(a) a loop former embodying oppositely disposed curved surfaces spaced apart a distance greater than the diameter of the loop to be formed,

(b) means to feed one end of the wire to be looped into contact with one of said curved surfaces whereby said end follows a curved path, moves across the space between said surfaces and into engagement with the other of said curved surfaces, and eventually completes the loop with the entrance end portion of the wire lying across another portion of the length thereof, and

(c) mechanism effective to engage the loop in the area thereof where the wire is crossed and to twist the wire upon itself in said area.

4. Apparatus as defined in claim **3** in which the said curved surfaces are substantially in the shape of arcs of a circle, and in which the second one thereof has a tangentially disposed section on the end thereof first to be contacted by the end of the wire coming from the said first surface.

5. Apparatus as defined in claim **3** in which said curved surfaces are located at and form the bottoms of wire feeding grooves.

6. In apparatus for looping a length of wire about a member and then twisting the ends of said length of wire upon each other,

(a) a pair of loop forming members spaced apart a distance to receive between them the member to be looped,

(b) there being a pair of arcuately concave wire threading grooves in facing surfaces of the loop forming members,

(c) means to feed an end of the length of wire into one end of said grooves whereby the said end of the wire follows the path of the bottom of said groove, and, upon continued movement crosses over the member to be looped and into the second groove and thereafter crosses the portion of the said length of wire adjacent the wire entrance point of the first of said grooves,

(d) rotatable wire twisting means having portions lying on the inside and outside of the loop just formed and in the area thereof where the wire is crossed, and

(e) means to rotate the twisting means whereby the crossed wires are twisted in an area thereof between the member to be looped and the portion of the wire twisting means initially located on the inside of the loop.

7. In apparatus for looping a length of wire about a member and twisting the ends of said length of wire upon itself to form a loop,

(a) an axially elongated body member of a size to be held in the hands of an operator,

(b) means in the body positively to feed axially thereof said length of wire to be looped,

(c) a curved guide carried by the end of the body from which the wire emerges and through which the wire is fed in its path of movement from the end of the body,

(d) a pair of spaced apart finger-like members on said end of the body from which the wire emerges,

(e) there being arcuate grooves in the facing surfaces of said finger-like members, one of said grooves in one of said members being located to receive the wire as it is fed from said curved guide,

(f) the second of said grooves being located in position for the wire coming from the first of said grooves to enter thereinto thereby to be forced to continue its circular movement whereby the end of the wire eventually overlaps the wire at the bottom of the loop,

(g) twisting mechanism having portions between which are located the ends of the wire thus looped, and

(h) means to actuate the twisting mechanism thus to twist the wire upon itself and to draw the loop tight about a member located between the finger-like members.

8. In apparatus for drawing off from a longer length of wire a shorter length thereof, forming the shorter length into a loop and then twisting it upon itself,

(a) an elongated body of a size to be held in the hands of an operator,

(b) wire feeding, looping, severing and twisting mechanisms in the body, and

(c) a double acting fluid pressure cylinder carried by the body for operating said mechanisms in the following sequence: first, to feed outwardly of the body a predetermined length of wire, second, to form said predetermined length of wire into a loop, third, to sever said looped length of wire from the longer length thereof, and fourth, to twist the ends of the looped wire upon itself, and means operatively connecting said cylinder to said mechanisms to return them to initial positions, thus readying them for a subsequent cycle.

References Cited by the Examiner

UNITED STATES PATENTS

1,087,787	2/1914	Langley	140—93
1,305,422	6/1919	Warwick	140—93
1,357,883	11/1920	McChesney	140—93

FOREIGN PATENTS

589,464	2/1925	France.

CHARLES W. LANHAM, *Primary Examiner.*