

(No Model.)

2 Sheets—Sheet 1.

G. COOPER.
WIRE BENDING MACHINE.

No. 468,301,

Patented Feb. 2, 1892.

Fig 1

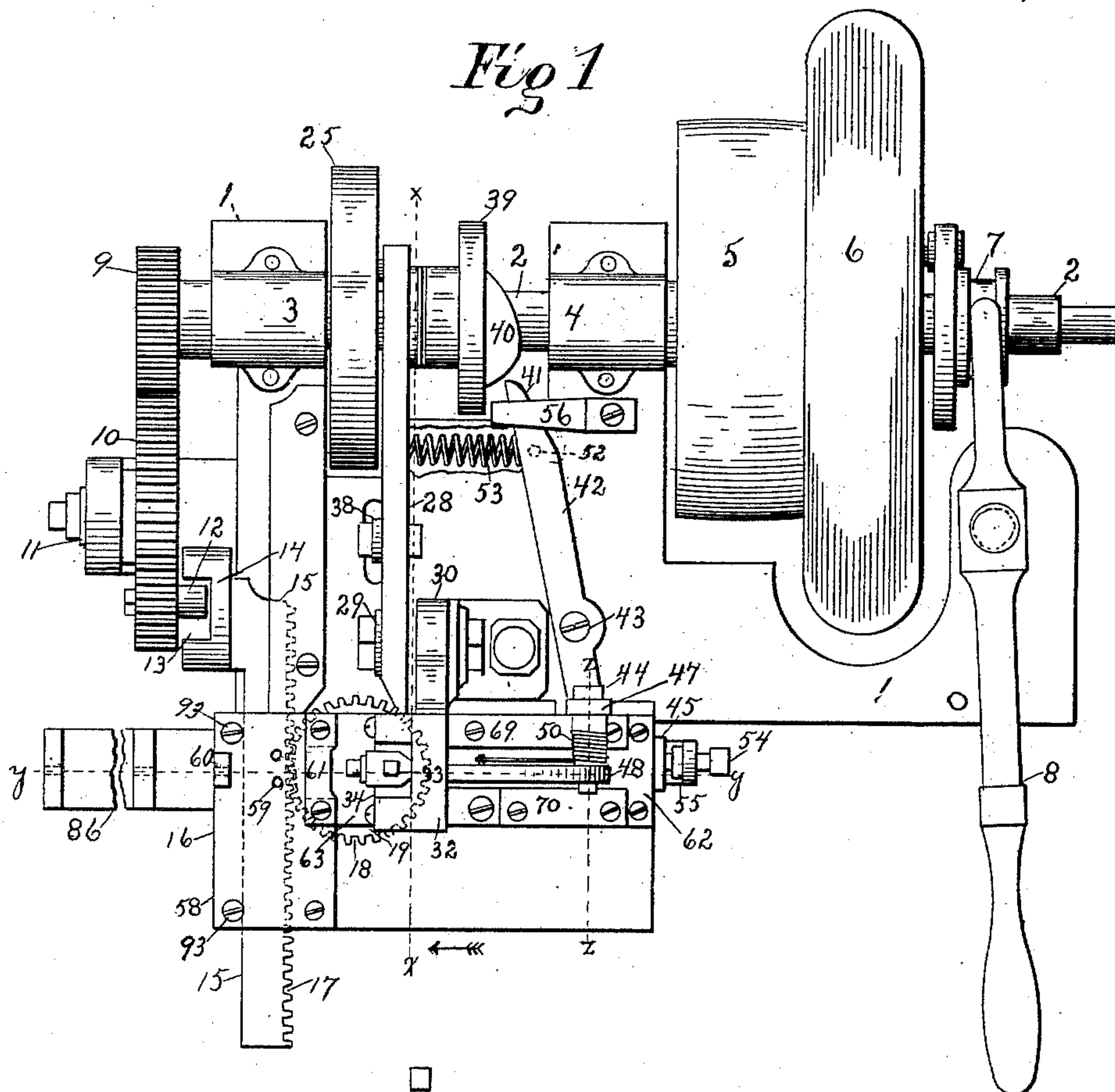
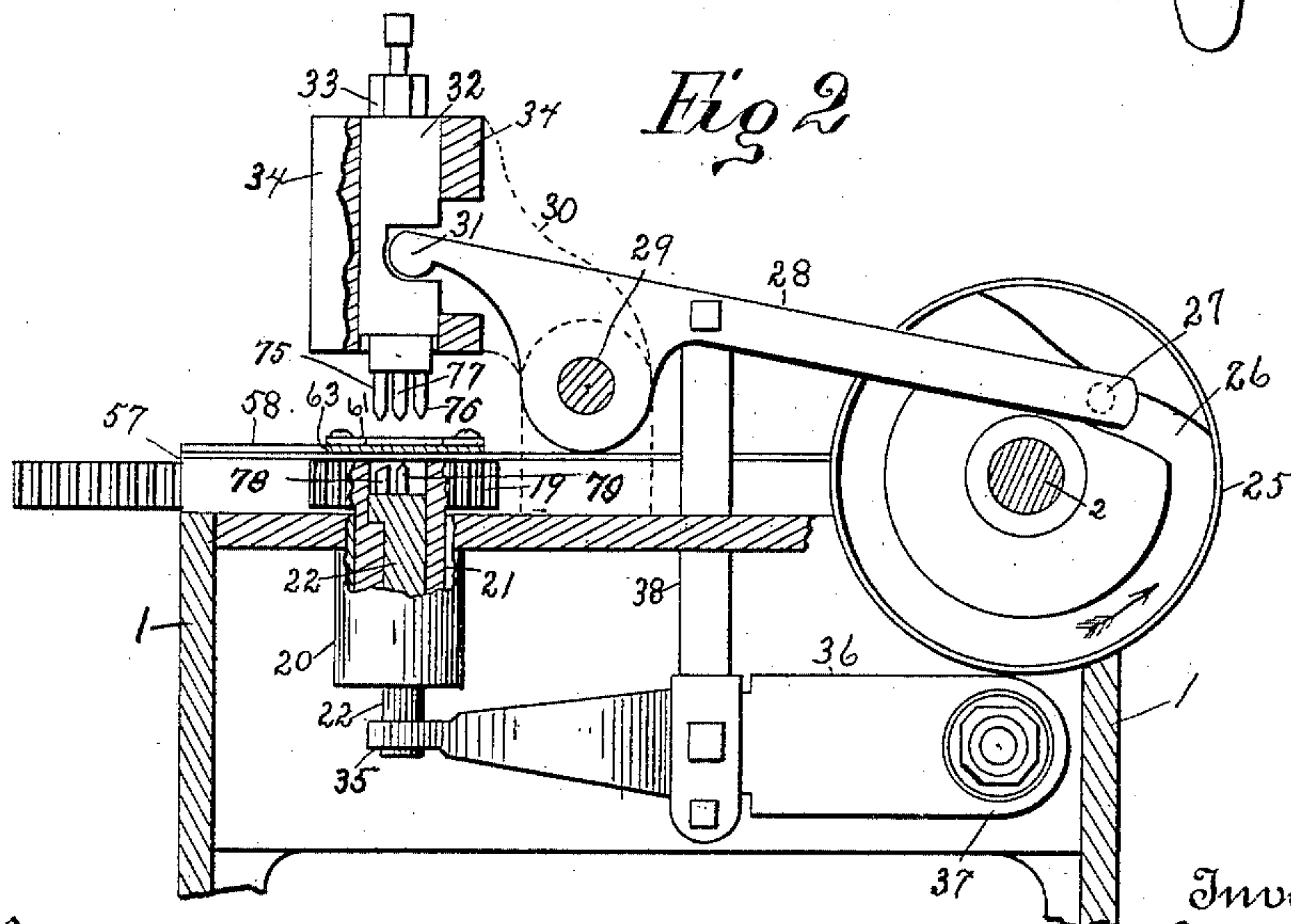


Fig 2



Witnesses

H. P. Wilson
S. V. Bowells

Inventor

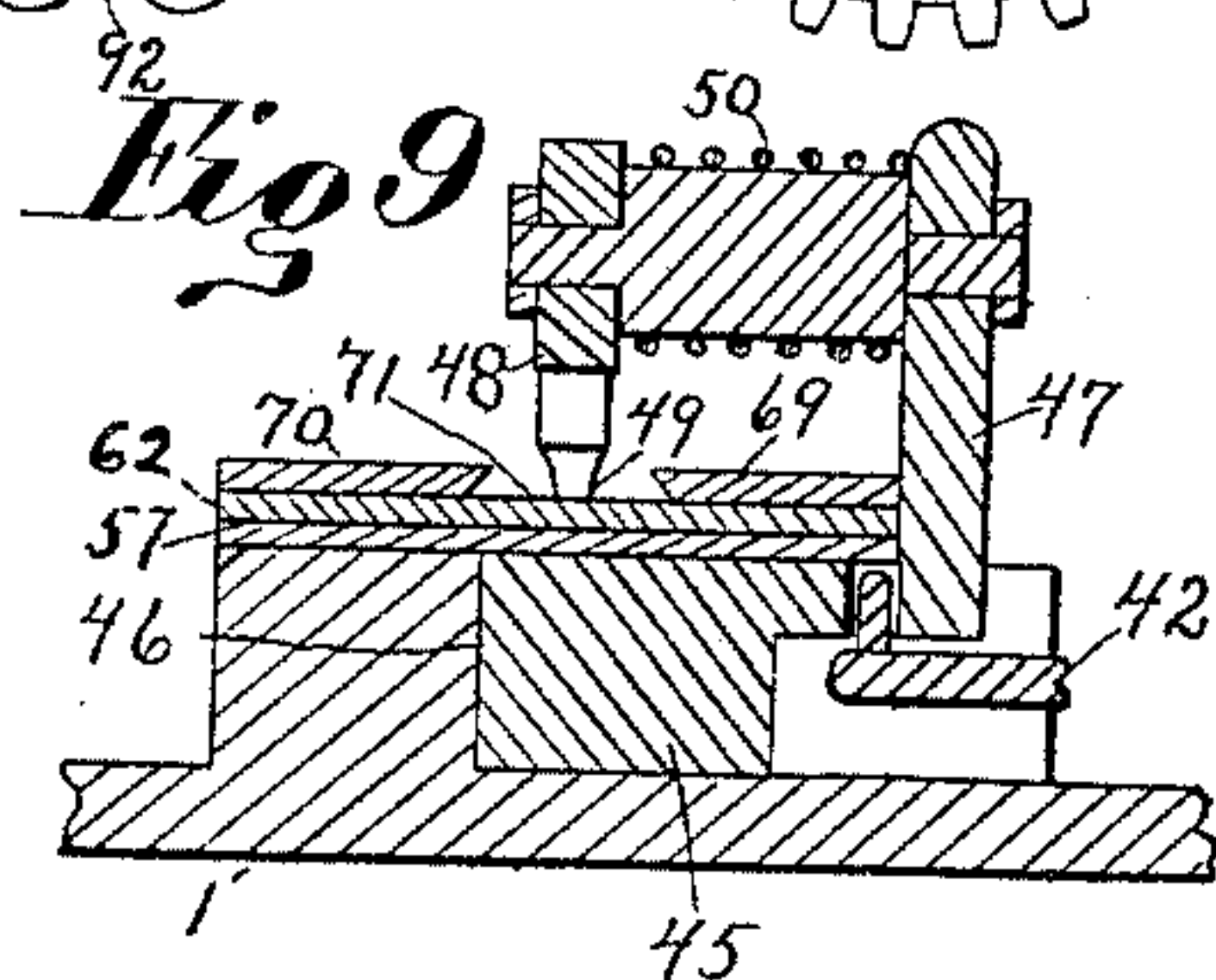
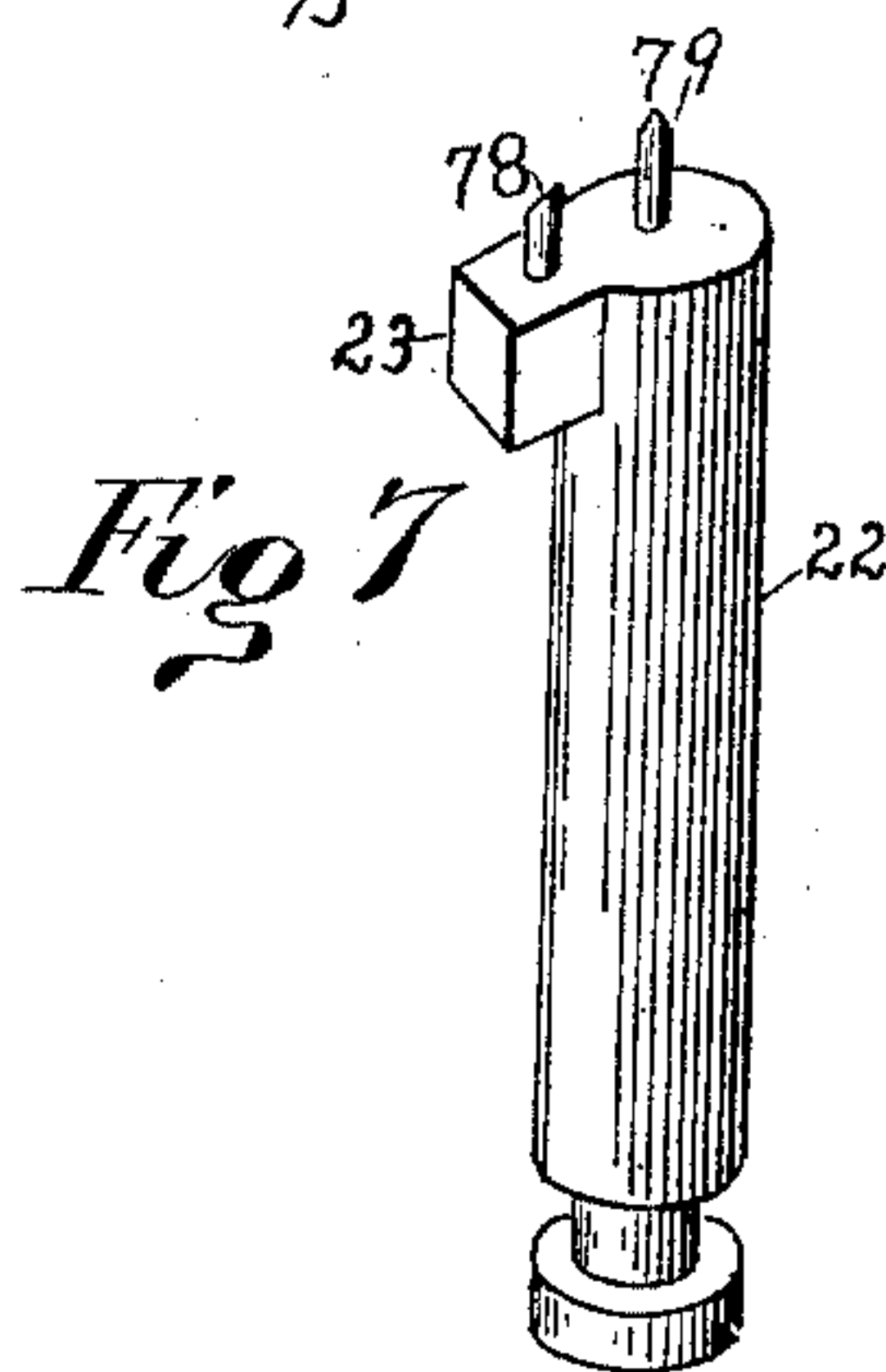
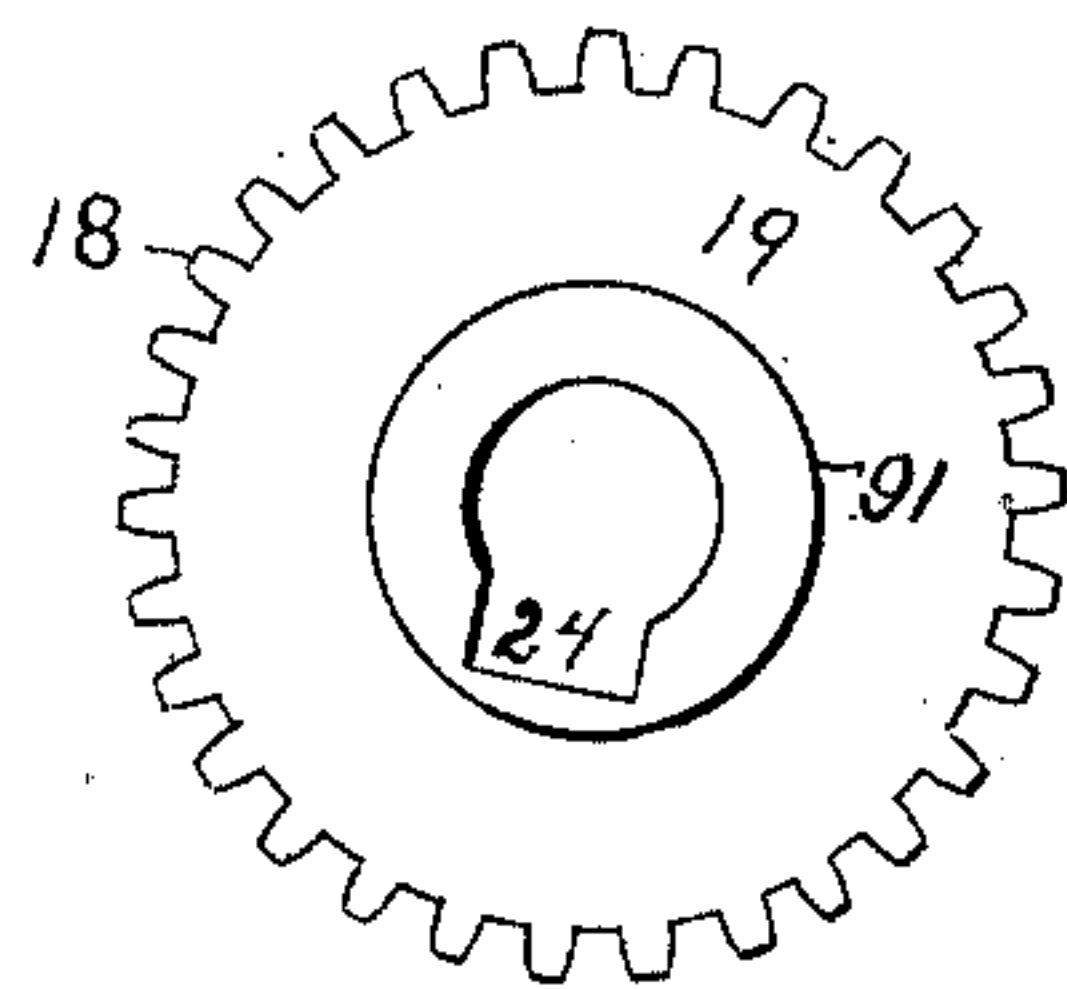
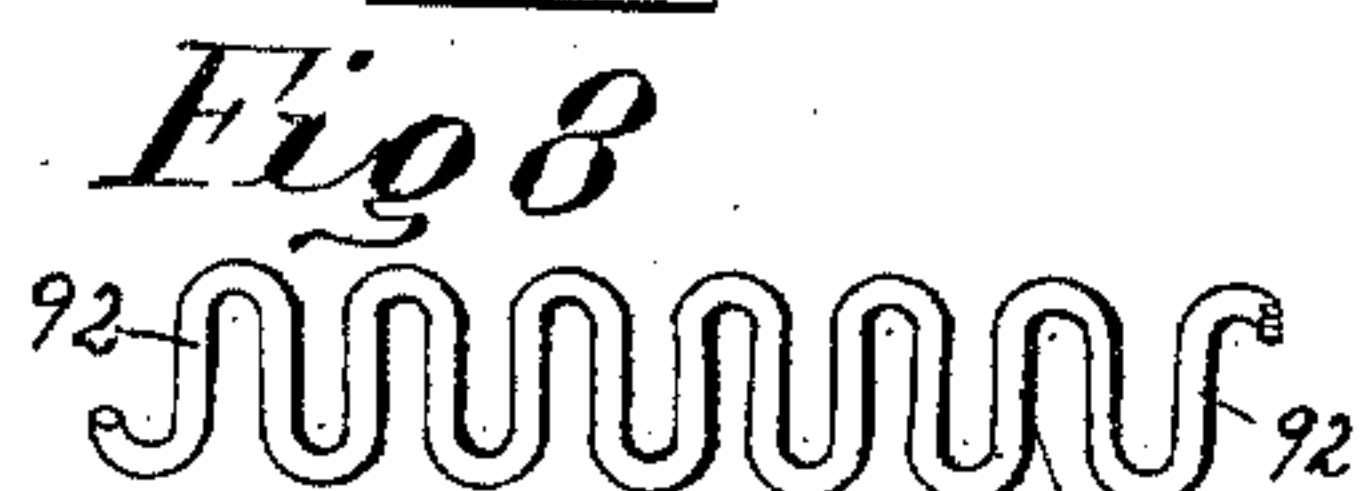
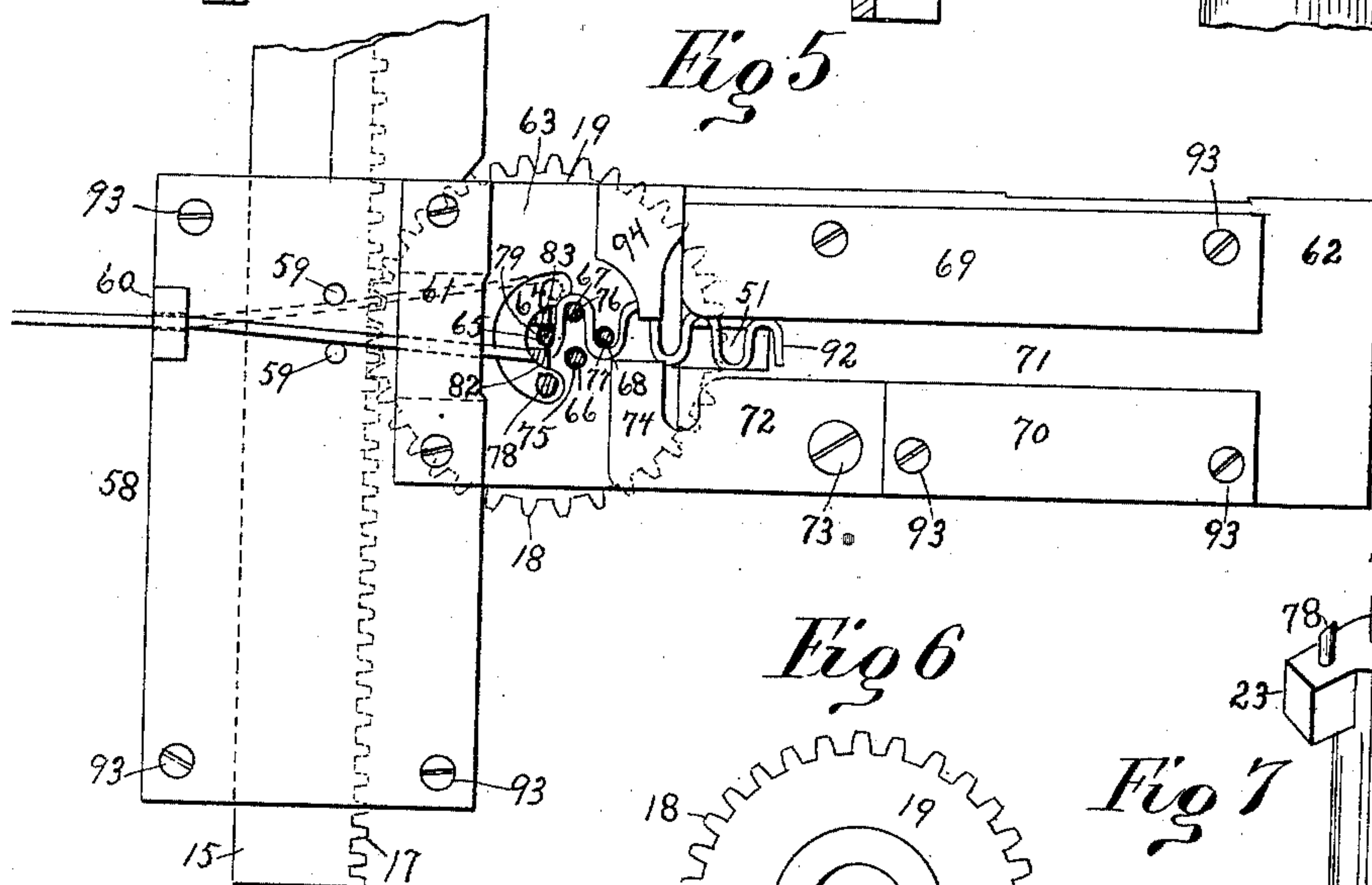
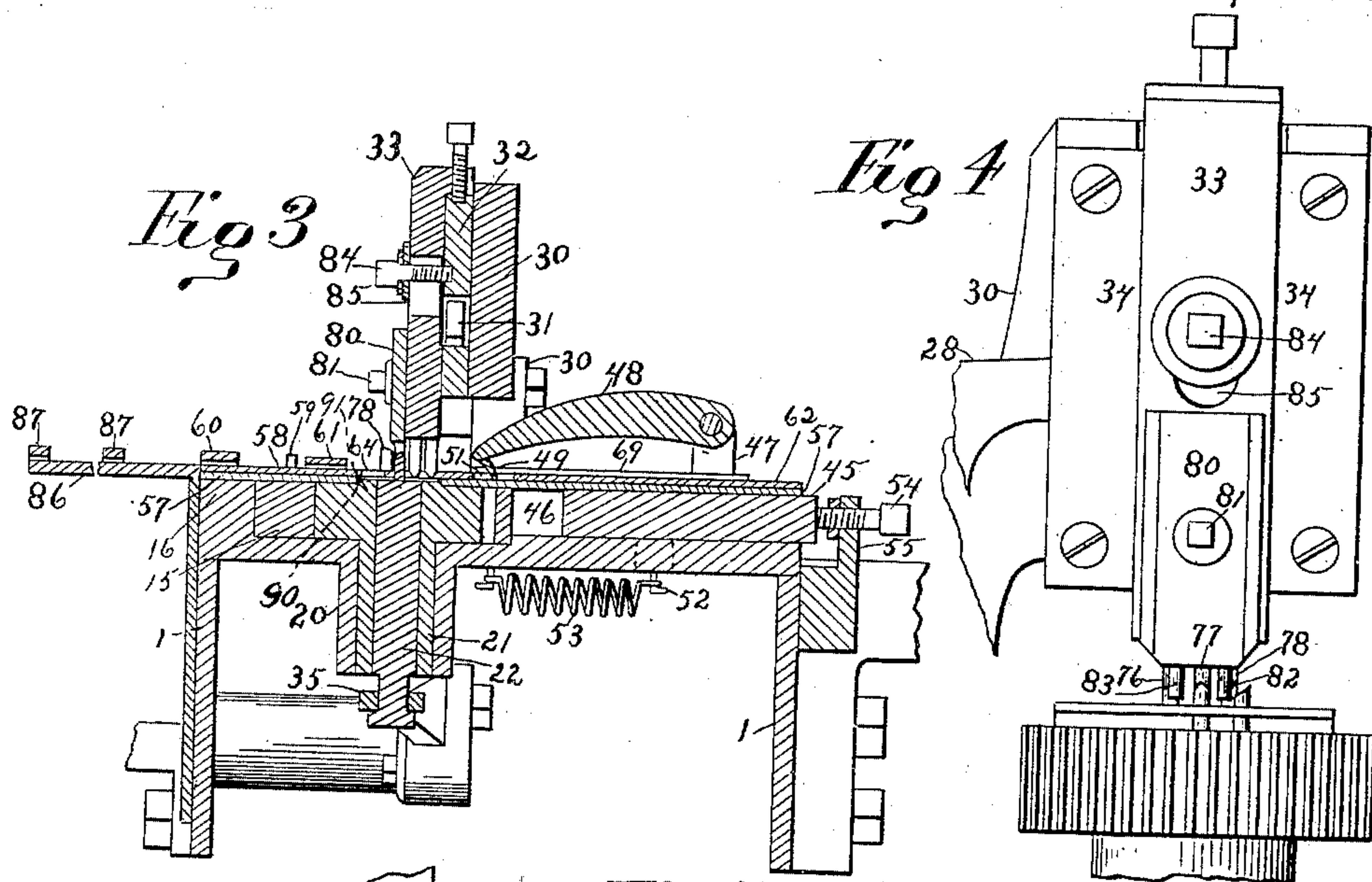
George Cooper

by
M. W. Peck

his Attorney

No. 468,301.

Patented Feb. 2, 1892.



Witnesses

Witnesses
H. P. Wilson.
G. V. Howells.

Inventor

Inventor
George Cooper
by
M. W. Peck
his Attorney

UNITED STATES PATENT OFFICE.

GEORGE COOPER, OF BENNINGTON, VERMONT.

WIRE-BENDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 468,301, dated February 2, 1892.

Application filed September 16, 1891. Serial No. 405,902. (No model.)

To all whom it may concern:

Be it known that I, GEORGE COOPER, a citizen of the United States, residing at Bennington, in the county of Bennington and State of Vermont, have invented certain new and useful Improvements in Wire-Bending Machines; 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, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to machines for bending or looping steel wire, the manufactured article being more particularly for use as corset-stiffeners, and has for its object to provide a mechanism that will make such short and decisive turns in the wire as to fix it in the position in which it is bent and prevent it from springing back.

My invention consists of two vertically-reciprocating plungers adapted to have simultaneous movement toward and away from each other, one of said plungers being also given a to-and-fro rotary movement, suitable pins carried by the two plungers, which hold and bend the wire, a supporting-plate provided with suitable openings for the passage of the pins, a device to automatically move the looped wire through and out of the machine as it is formed, and suitable means to give the several parts their respective movements, all as hereinafter described, and more particularly pointed out in the claims.

Referring to the drawings, Figure 1 is a plan view of the machine, partly broken away. Fig. 2 is a vertical section on the line $x x$ of Fig. 1. Fig. 3 is a vertical section on the line $y y$ of Fig. 1. Fig. 4 is a side elevation of the plunger detached. Fig. 5 is a plan view, partly in section, of the wire-bending mechanism, showing the wire in position. Figs. 6 and 7 show portions of the loop-forming devices detached. Fig. 8 is an illustration of the product of the machine, and Fig. 9 is a vertical section on the line $z z$ of Fig. 1.

Similar numerals of reference indicate corresponding parts in the respective figures.

The main frame of the machine is designated by 1, and 2 is the main driving-shaft, mounted in suitable bearings 3 and 4 on the

frame and carrying loosely thereon the belt-pulley 5 and fly-wheel 6. A suitable clutch 7 is also mounted on the shaft 2 and operated by the lever 8 to engage or disengage the belt-pulley, and thereby control the operation of the machine. The clutch mechanism is not particularly illustrated or described, as it forms no part of the invention, and may be of any suitable and well-known character.

The shaft 2 projects beyond the bearing 3 and carries a spur-gear 9, meshing with the larger gear-wheel 10, mounted in a suitable bearing 11, secured to the side of the main frame. The wheel 10 is provided on its inner face with a pin carrying a roller 12, which enters the straight-sided slot or groove 13 in the block 14, attached to the rack-bar 15, the latter having a longitudinal sliding movement in suitable ways 16 on the main frame. The teeth 17 of the rack-bar engage the teeth 18 of the spur-gear 19, which revolves in a horizontal plane, having its bearing in a sleeve 20, cast integral with the main frame, as shown in Figs. 2 and 3.

The spur-gear 19 is provided with a sleeve 21, which fits within the sleeve 20 and revolves therein. The reciprocating movement of the rack-bar 15 will cause the spur-gear 19 to rotate intermittently first in one direction and then in the opposite direction, as will be more fully explained hereinafter.

Within the sleeve 21 a plunger 22 is fitted, adapted to have vertical movement therein and also to revolve with the spur-gear 19, the plunger being provided with a lug 23, which enters the recess 24 in the sleeve 21, as shown in Figs. 2, 6, and 7.

On the shaft 2 is also mounted the wheel 25, having on one of its faces a cam-groove 26, into which a roller 27, carried by a pin on the end of the lever 28, enters. The lever 28 is pivoted at 29 on a standard 30, extending upward from the main frame. The other end 31 of the lever forms a part of a ball-joint and engages a block 32, to which is attached the plunger 33. The block 32 is adapted to have a vertical movement in suitable ways in the standard 30. To the lower part of the main frame one end of another lever 36 is pivoted at 37, while the other end 35 of this lever engages the lower end of the plunger 22 by means of a strap connection. The levers

28 and 36 are connected by the bar 38 in such manner that when the machine is in operation the plungers 22 and 33 will have a vertical reciprocating movement toward and away from each other, as will be more fully explained hereinafter. It will be observed that the wheel 25 will only impart movement to the lever 28 when the roller 27 is in the cam portion of the groove 26.

Mounted on the shaft 2 is a wheel 39, which is provided on one of its faces with the eccentric 40, adapted to engage the end 41 of a lever 42, pivoted at 43 to the main frame. The other end 44 of the lever is connected to the bar 45 by means of a vertical pin, as seen in Fig. 9, said bar being adapted to slide in a suitable way 46 on the main frame. The bar 45 carries a short standard 47, to which is pivoted a dog 48, the free end of which is provided with a hook 49, for a purpose hereinafter explained. A spring 50 tends to hold the free end of the dog 48 down in the slot 51. The lever 42 is provided with a pin 52 near its end 41, which passes down through a slot in the frame of the machine, and is attached to one end of a coiled spring 53. The other end of this spring is attached to any suitable part of the main frame. The normal tendency of this spring is to cause the lever 42 to force the sliding bar 45 outward against the end of a set-screw 54, which is adjustable in a bearing 55, secured to the main frame. When the eccentric 40 engages the end 41 of the lever 42, it will cause the lever to move the sliding bar 45 away from the set-screw 54, and thereby give the dog 48 a forward movement. As soon, however, as the eccentric 40 passes out of engagement with the lever 42 the spring 53 will cause the lever to move the sliding bar 45 back to the set-screw, and thereby give the dog 48 a backward movement. The end of the lever 42 which comes in contact with the eccentric 40 is prevented from having vertical movement by means of the guide-bar 56, which is secured at one end to the main frame and bears at its other end against the upper surface of the lever 42.

A bridge-plate 57 extends across the front part of the machine, being supported on the upper surface of the lugs projecting up from the main frame, and which forms the ways in which the rack-bar 15 and the sliding bar 45 move. This plate 57 serves to prevent the rack-bar 15, the sliding bar 45, and the spur-gear 19 from having vertical play. It is provided with a suitable opening over the spur-gear 19 to permit the movement of the plunger 22. A recess 90 is also formed in the under side of the plate 57, into which the cylindrical projection 91 on the upper face of the spur-gear 19 enters, thereby forming an additional bearing for the said spur-gear, as shown in Figs. 3 and 6. On that portion of the plate 57 that covers the rack-bar 15 and its ways another plate 58 is placed. This plate is provided with stationary pins 59 and with the guides 60 and 61. The guide 60 is provided

with a passage for the wire sufficiently large to give it a slight lateral movement at this point, and the guide 61 is provided with a passage sufficiently wide to enable the wire to have free lateral play between the pins 59.

On that portion of the bridge-plate 57 that covers the slide-bar 45 and its ways a plate 62 is placed, extending from the end of the plate 57 to a point just beyond the hook 49 on the dog 48. The plate 62 is provided with a slot 51, in which the hook 49 plays, the hook resting on the plate 57. From the plate 62 to the plate 58 another plate 63 of finely-tempered steel extends, which is provided with a semi-circular slot 64 and with the holes 65, 66, 67, and 68. Above the plates 62 two narrow plates 69 and 70 are placed, a space being left between them, forming a groove 71 for guiding the bent or formed wire out of the machine. The plate 70 is shorter than the plate 69, and a plate 72, pivoted at 73, forms an extension thereof. This plate 72 extends beyond the plate 69, and is provided with a hook 74, the hook portion extending inwardly a little beyond the inner line of the plate 70. Directly opposite the hook 74 is another short plate 94, forming a continuation of the plate 69. This plate is cut away, as shown, to enable the operator to manipulate the wire when the machine is first started, and it projects inwardly slightly beyond the plate 69. The object of pivoting the plate 72 is to enable it to be moved out of the way to permit the operator to have easy access to the wire when the operation of bending it begins and the object of projecting the hook part inwardly is to enable it to engage the wire at all times to keep it in position on the plates 62 and 63, as will be explained hereinafter. The inner edges of the plates 69 and 70 and 72 are undercut, as shown in Fig. 9, in order to permit them to slightly overlap the finished product as it passes along the groove 71 and hold it therein. All the aforementioned plates, except that marked 72, are held securely in place by the screws 93.

Referring again to the plungers 33 and 22, the former is provided at its lower end with three pins 75, 76, and 77, adapted to enter the holes 66, 67, and 68, respectively, when the plunger 33 is depressed. For the sake of clearness these pins will be called the "holding-pins." The plunger 22 is provided at its upper end with two pins 78 and 79. The pin 78 is what may be termed the "bending-pin" and the pin 79 the "forming-pin," as the first moves to and fro in the slot 64 and carries the wire with it and the latter is the pin around which the wire is always bent. On the outer face of the plunger 33 a bar 80 is secured by the set-screw 81, and is provided at its lower end with two pins 82 and 83, which may be designated "presser-pins," as their object is to press on the upper surface of the wire during the operation of bending to prevent it from riding up the forming-pin 79. The pins 82 and 83 are flat at their ends and have two flat inner sides and a rounded outer

side, as clearly shown in Fig. 5. There is just sufficient space to enable the forming-pin 79 to pass up between them. The pins 75, 76, and 77 are longer than the pins 82 and 83, the former being adapted to enter the holes 66, 67, and 68 in the plate 63 and the latter to be a distance above the plate 63 equal to the thickness of the wire operated upon when the plunger 33 is at its lowest point.

In practice the pins 82 and 76 co-operate to press and hold the wire during the movement of the bending-pin 78 in one direction, and the pins 83 and 75 co-operate for the same purposes when the bending-pin is moved in the opposite direction. The pins 82 and 76 and 83 and 75 therefore form, respectively, two sets of pressing and holding pins, which alternately engage the looped wire, and the holding-pin 77 co-operates with both sets.

In order to adapt the machine to wires of different thicknesses, the plunger 33 is vertically adjustable in the standard 30 by means of the set-screw 84, which passes through the slot 85 into the block 32, with which the lever 28 engages. A bracket 86 is attached to the feeding-in end of the machine, which is provided with guides 87, having openings through which the wire passes from any suitable point.

In the operation of the machine the wire is passed through the guides 87, 60, and 61 over the plate 63 and to one side or the other of the holes 65 and 68, according to the position of the machine, it being understood of course that the plunger 33 is at its highest and the plunger 22 at its lowest point. In this position the roller 27 will be just midway of the cam portion of the groove 26 on the wheel 25 and the roller 12 will be about to disengage itself from one side of the groove 13 in the block 14, for it will be observed that this groove 13 is wider than the roller 12, and consequently at two periods in the revolution of the wheel 10 it will not engage the block 14, and therefore the rack-bar 15 will be at rest.

The gear-wheel 10 has twice as many teeth as the gear-wheel 9. Consequently the wheels 9, 25, and 39 on one common shaft will have two revolutions to one revolution of the wheel 10, while in the position above named the end of the lever 42 will have just become disengaged from the cam 40 on the wheel 39. The shaft 2 being now rotated so as to turn the wheel 25 in the direction of the arrow on Fig. 2, the end 31 of the lever 28 will be depressed, and at the same time the free end of the lever 36 will be raised. This will have the effect of lowering the plunger 33 and cause the pins 75, 76, and 77 to enter the holes 66, 67, and 68, and either the presser-pin 82 or 83 to bear on the wire. It will also elevate the plunger 22 and cause the pins 78 and 79 to pass up through the slot 64 and hole 65, respectively. By this time the roller 12 will have again engaged one side of the groove 13, and the block 14 will then be moved, carrying with it the rack-bar 15. This will cause the gear-wheel 19 to rotate, and with it the

plunger 22. The bending-pin 78 will thereby be caused to move from one end to the other of the slot 64, carrying the wire with it and bending it around the pin 79. By the time the bending-pin 78 has traversed the length of the slot 64 the concentric portion of the groove 26 will have passed over the roller 27, and the cam portion of the groove will then engage it. This will have the effect of elevating the end 31 of the lever 28 and depressing the other end thereof and cause the plunger 33 to be elevated and the plunger 22 to be depressed, thereby withdrawing all the pins from engagement with the wire and permitting it to be moved forward a certain distance for the next bending operation.

In making the first three or four bends the wire will have to be shifted by hand; but as soon as the operation has sufficiently advanced the hook 49 on the end of the dog 48 will engage the loops successively and automatically move the wire along. The reciprocating movement of the dog 48 is caused by the action of the eccentric 40 and the lever 42, as has been previously explained, and the eccentric is so arranged as to operate on the lever just as the plunger 33 reaches its highest point, which is when the roller 27 is midway of the cam position of the groove 26. As the dog advances, its hook 49 will lift and ride over one of the straight sides 92 of the loops against the force of the spring 50, which latter will force the hook back into the slot 51 as soon as the hook has passed over the wire and so cause a positive engagement between the hook and wire when the dog is retracted. The dog moves the finished product through the machine the space of one loop at each backward movement. The machine and wire being in the position shown in Fig. 5, it will be observed that the holding-pins 76 and 77 engage two of the finished loops and that the presser-pin 82 bears on the unbent wire, which latter is also in contact with one of the corresponding stationary guide-pins 59. As the bending-pin 78 traverses the slot 64, the wire will be carried with it and form another loop, the unbent wire by the operation being carried over to the other pin 59, as indicated in dotted lines in Fig. 5. This will cause the wire to be slightly bent around the side of the pin 59, and thus create a tendency in the wire to spring, which, as soon as the pins are disengaged from the loops, will cause it to have a slight lateral movement just previous to its longitudinal movement caused by the action of the dog 48. These two movements will bring the wire into such position that on the next movement of the plungers the loop just formed will be engaged by the pin 75 and the loop previously engaged by the pin 76 will be engaged by the pin 77. The unbent wire will be on the opposite side of the bending and forming pins 78 and 79 and be engaged by the presser-pin 83. The hook portion 74 of the plate 72 and the plate 94 are sufficiently near together as to be always in

engagement with the top surface of the wire irrespective of its lateral movements. The operation will thus continue, the bending-pin 78 traversing the slot first in one direction and then in the other, this movement being imparted to it by the reciprocating movement of the rack-bar 15, caused by the alternate engagement by the roller 12 of the opposite sides of the slot 13 during the revolution of the wheel 10.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a machine for looping and bending wire, two reciprocating plungers provided with wire-holding and loop-forming devices, combined with a supporting-plate between said plungers on which the wire rests, substantially as specified.

2. In a machine for looping wire, two reciprocating plungers, one provided with holding and pressing pins and the other with bending and forming pins, and suitable means to operate the plungers, substantially as set forth.

3. The combination, in a wire-looping machine, of a bearing-plate having a series of holes and a semicircular slot, two reciprocating plungers, one plunger having holding pins adapted to enter some of the holes in said plate and the other having a bending-pin adapted to traverse the slot in the plate and a forming-pin to enter one of the holes in the plate, and suitable means to operate the plungers, substantially as set forth.

4. In a machine for looping wire, two reciprocating plungers provided with suitable devices to form the loops, combined with a dog engaging the looped wire, a pivoted lever connected at one end to said dog, and suitable means to intermittently operate the lever to give the dog a reciprocating movement, substantially as set forth.

5. In a machine for looping wire, the combination, with loop-forming devices, of a dog pivoted at one end to a reciprocating bearing, a pivoted lever connected at one end to said bearing, a spring connecting the other end of the lever to a fixed part of the machine, and an eccentric adapted to intermittently engage the lever and move it against the force of the spring, substantially as set forth.

6. In a machine for looping wire, a wire-supporting plate, combined with two plungers carrying loop-forming devices and having a vertical reciprocating movement toward and away from each other on opposite sides of the plate, suitable mechanism to give the plungers simultaneous vertical movement, and suitable mechanism to impart a rotary movement to one of said plungers, substantially as and for the purpose specified.

7. In a machine for looping wire, a plunger adapted to have vertical movement, a pivoted lever connected at one end to said plunger, and a device to intermittently operate the lever, combined with another plunger,

suitable connections between the two plungers to give them simultaneous vertical movement toward or away from each other, means to rotate one of said plungers, and loop-forming devices carried by said plungers, substantially as set forth.

8. In a machine for looping wire, the combination, with vertically-reciprocating plungers, loop-forming devices carried thereby, and mechanism to impart the vertical movement thereto, of a spur-gear connected to one of said plungers, a rack-bar engaging said spur-gear, and means to reciprocate the rack-bar, as and for the purpose set forth.

9. In a machine for looping wire, the combination, with vertically-reciprocating plungers and the loop-forming devices carried thereby, of a spur-gear connected to one of said plungers, a rack-bar engaging the spur-gear, a slotted block attached to the rack-bar, a wheel carrying a roller which enters said slot, and suitable means to rotate the wheel, as set forth.

10. In a machine for looping wire, the combination, with a main driving-shaft and a wheel provided with an eccentric mounted thereon, of loop-forming mechanism, a dog pivoted on a sliding bar and adapted to engage the looped wire, a lever pivoted on the main frame and connected at one end to the said sliding bar and at its other end to a spring attached to the main frame, said lever being so located as to be intermittently operated by the eccentric on the wheel when the main shaft is revolved, for the purpose set forth.

11. In a machine for looping wire, the combination, with a main driving-shaft and a wheel having a cam-groove carried by said shaft, of two vertically-reciprocating plungers connected therewith, having simultaneous vertical movement, a lever pivoted on the main frame and connected at one end to one of said plungers, a roller on the other end of the lever, which enters the cam-groove, and loop-forming devices carried by the plungers, as set forth.

12. In a machine for looping wire, the combination, with main driving-plungers, two vertically-reciprocating shafts carrying loop-forming devices, suitable connections between the two plungers to give them simultaneous vertical movement toward and away from each other, and a dog adapted to engage the looped wire, of suitable connections between the main shaft, the plungers, and the dog, whereby both plungers are given vertical movement, one plunger rotary movement, and the dog a sliding movement, all of said movements being intermittent, as and for the purpose set forth.

13. In a machine for looping wire, a supporting-plate, two reciprocating plungers, bending and forming pins on one of said plungers, and two sets of pressing and holding pins on the other plunger adapted to alternately engage the looped wire, combined with

two stationary pins on the supporting-plate, between which the wire passes before it is looped by the plungers, the said stationary pins being so located with reference to the direct line of feed that the unbent wire will be carried against them alternately by the bending-pin, the result being that the resistance offered by said pins to the lateral movement of the wire will create a tendency in said wire to spring into position to be engaged by one set of pressing and holding pins immediately on its release by the other set, substantially as described.

14. In a machine for looping wire, the combination, with a supporting-plate and the loop-forming devices, of narrow plates secured to the upper face of the supporting-plate, said plates having their inner edges under-cut and a space between them forming a groove for the passage of the looped wire, and a reciprocating dog adapted to engage the wire in said groove and move it longitudinally therein, as set forth.

15. In a machine for looping wire, a rack-bar, suitable means for operating the same, a spur-gear engaging said rack-bar and provided with a sleeve, said spur-gear having also a recess therein, a plunger supported in said sleeve and having a lug which fits in the recess, and wire bending and forming pins carried by the plunger, combined with a second plunger adapted to have a reciprocal movement toward and away from the other plunger, holding and pressing pins carried by the second plunger and adapted to co-operate with the bending and forming pins on the other plunger, and suitable means to give simultaneous movement to both plungers toward or away from each other, substantially as described.

16. In a machine for looping wire, the combination, with the main frame and a standard thereon, of a block sliding vertically in said standard, a plunger adjustably secured to said

block, a pivoted lever connected at one end to the sliding block and at its other end to a device adapted to intermittently rock it on its pivot, a second plunger supported by the main frame, a second lever pivoted at one end to the main frame and connected at its other end to the second plunger, a rod connecting the two levers, whereby the two plungers have simultaneous movement toward or away from each other, and suitable wire-holding and loop-forming devices carried by said plungers, substantially as described.

17. The combination, in a machine for looping wire, of an upper plunger provided at its lower end with holding-pins, a bar removably secured to the plunger and provided at its lower end with presser-pins, a lower plunger carrying at its upper end a bending-pin and a forming-pin, and a plate interposed between the said plungers, provided with a semicircular slot for the passage of the bending-pin and with suitable holes for the passage of the forming and holding pins, substantially as set forth.

18. In a machine for looping wire, the combination, with a supporting-plate and suitable loop-forming devices, of the narrow plates 69, 70, and 94, rigidly secured to the supporting-plate, the hooked plate 72, pivoted at one end to the supporting-plate, the said plates being so constructed and arranged that a groove 71 is formed between them, into which the looped wire passes from the loop-forming devices, and a pivoted reciprocating dog whose free end projects into the groove to engage the looped wire, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

GEORGE COOPER.

Witnesses:

EDWARD L. BATES,
ORION M. BARBER.