No. 627,286.

Patented June 20, 1899.

B. F. WINDSOR.

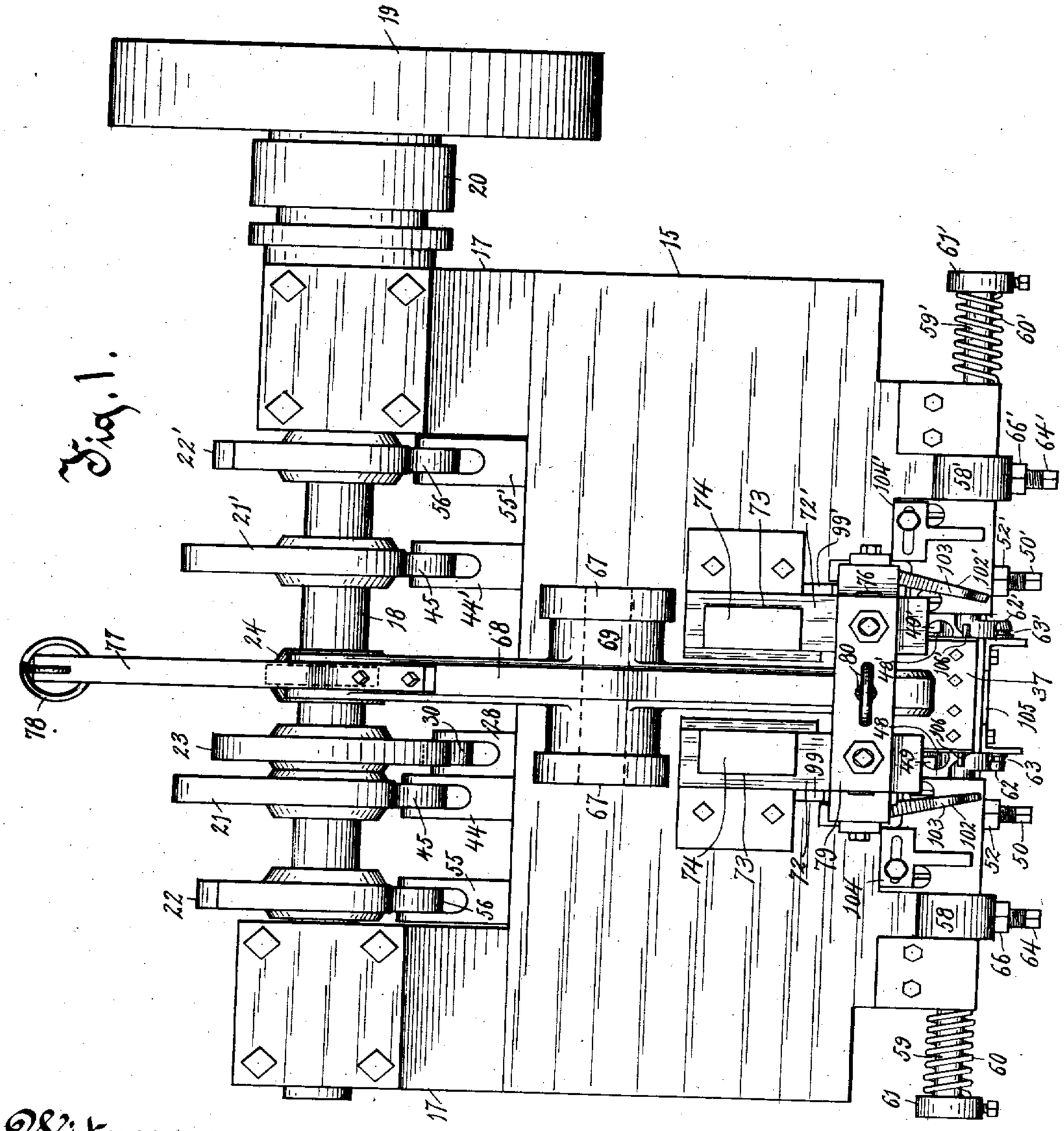
MACHINE FOR BENDING ENDS OF WIRE FOR BED BOTTOM SPRINGS.

(Application filed Dec. 20, 1898.)

(No Model.)

7 Sheets—Sheet 1.

Fig. 1.



Witnesses.

Inventor.

Benjamin F. Windsor.

By Benedict and Morsell.

Attorneys.

No. 627,286. Patented June 20, 1899.

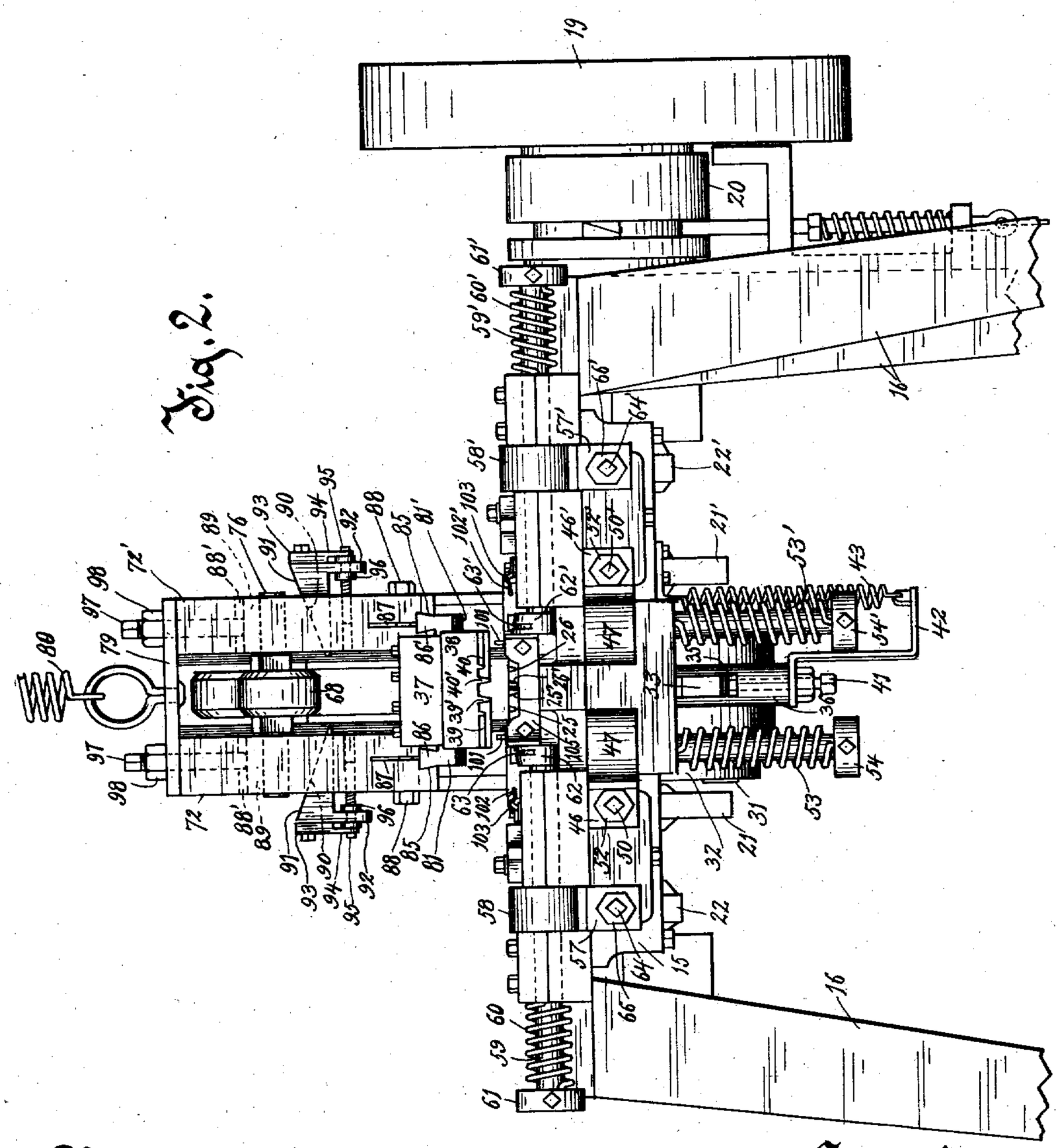
B. F. WINDSOR.

MACHINE FOR BENDING ENDS OF WIRE FOR BED BOTTOM SPRINGS.

(Application filed Dec. 20, 1898.)

(No Model.) 7 Sheets—Sheet 2.

Fig. 2.



Witnesses.

A. N. Keeney.

Geo. C. Faust.

Inventor.

Benjamin F. Windsor.

By Benedict and Morsell

Attorneys.

No. 627,286. Patented June 20, 1899.

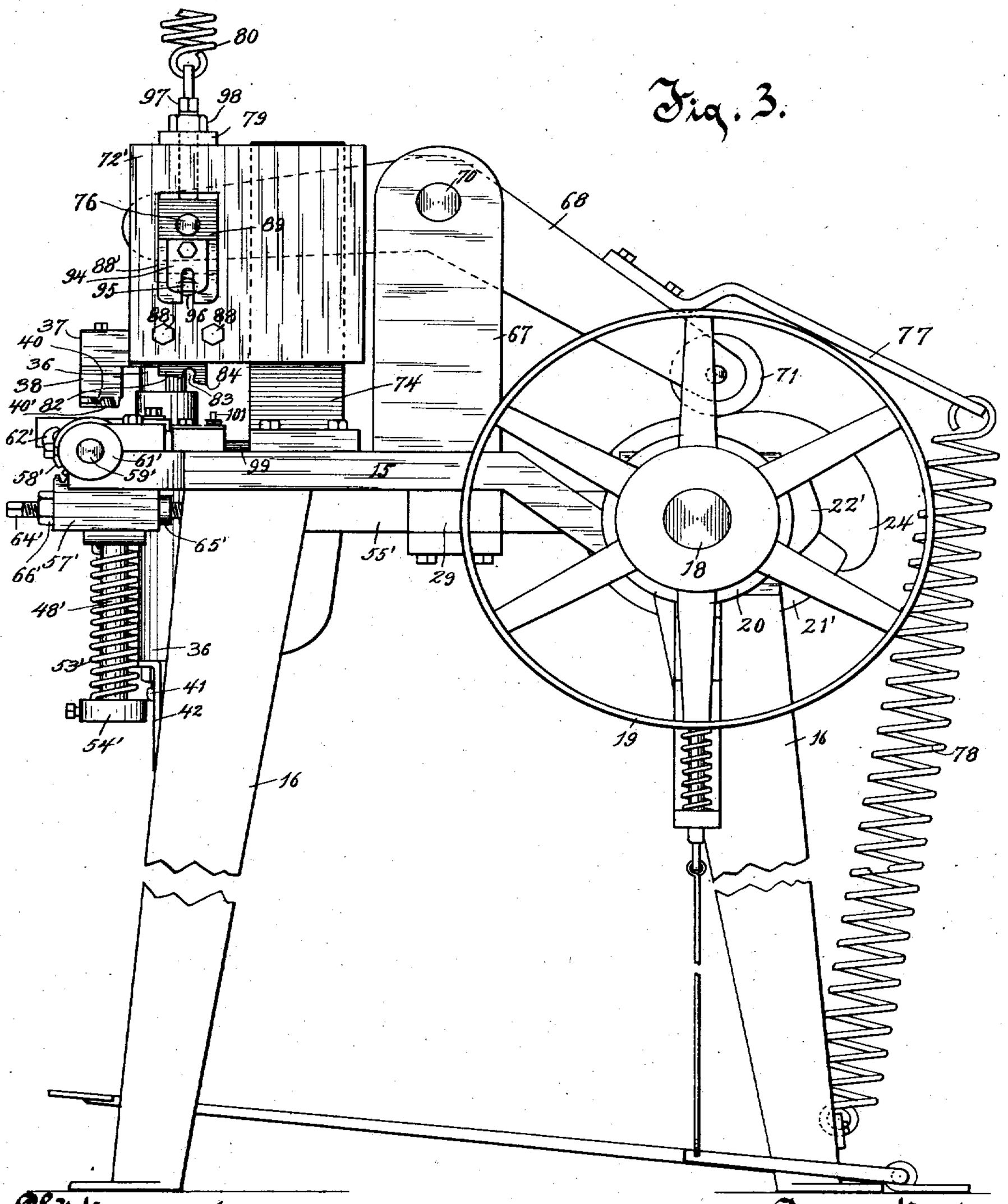
B. F. WINDSOR.

MACHINE FOR BENDING ENDS OF WIRE FOR BED BOTTOM SPRINGS.

(Application filed Dec. 20, 1898.)

(No Model.) 7 Sheets—Sheet 3.

Fig. 3.



Witnesses.
C. F. Burgess.
Geo. C. Sweet.

Inventor.
Benjamin F. Windsor.
By Benedict & Morsell.
Attorneys.

No. 627,286. Patented June 20, 1899.

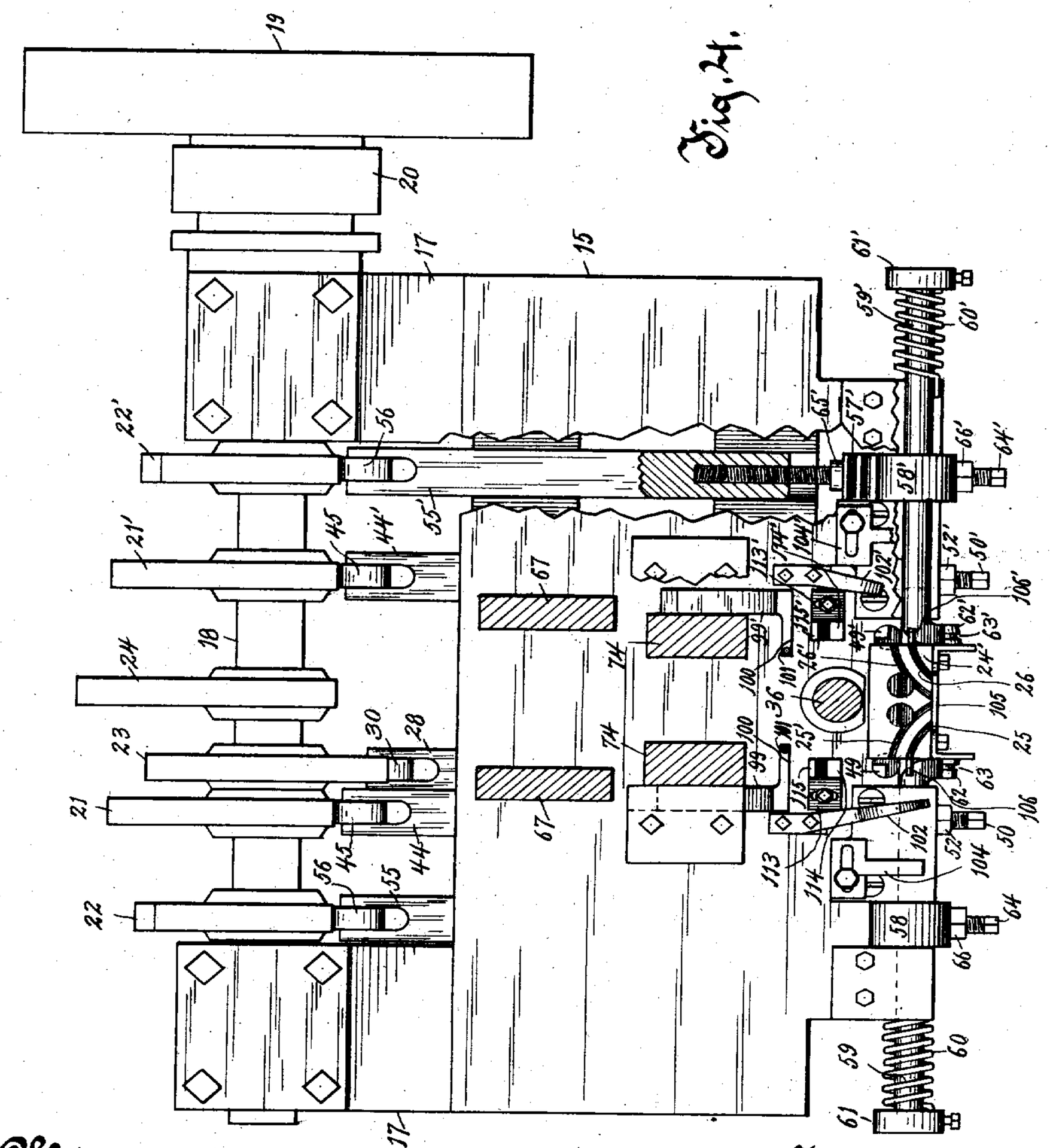
B. F. WINDSOR.

MACHINE FOR BENDING ENDS OF WIRE FOR BED BOTTOM SPRINGS.

(Application filed Dec. 20, 1898.)

(No Model.) 7 Sheets—Sheet 4.

Fig. 24.



Witnesses:
C. A. Keeney
Henry C. Fawcett

Inventor.
Benjamin F. Windsor
By Benedict and Morsell
Attorneys.

No. 627,286. Patented June 20, 1899.

B. F. WINDSOR.

MACHINE FOR BENDING ENDS OF WIRE FOR BED BOTTOM SPRINGS.

(Application filed Dec. 20, 1898.)

(No Model.) 7 Sheets—Sheet 5.

Fig. 5.

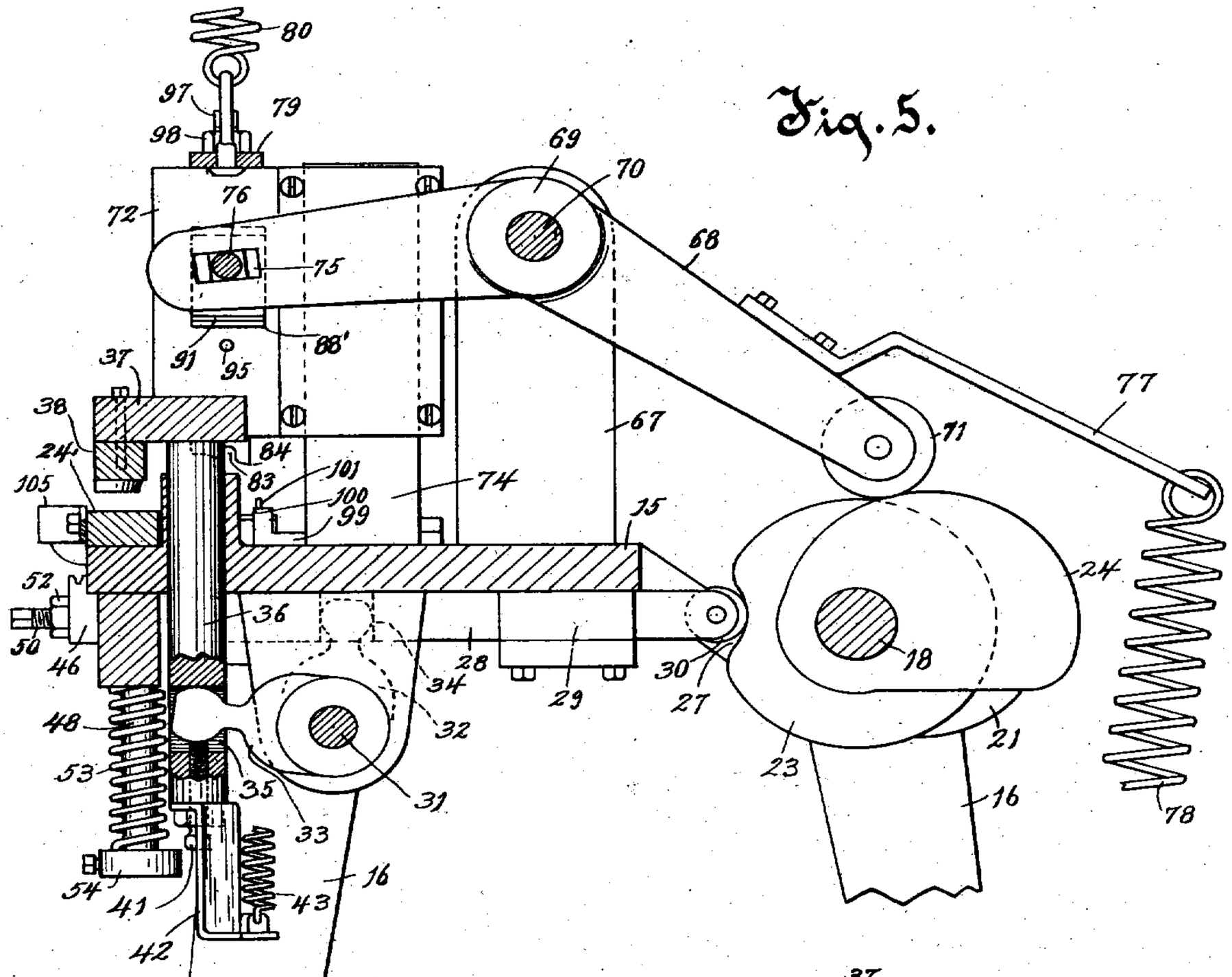
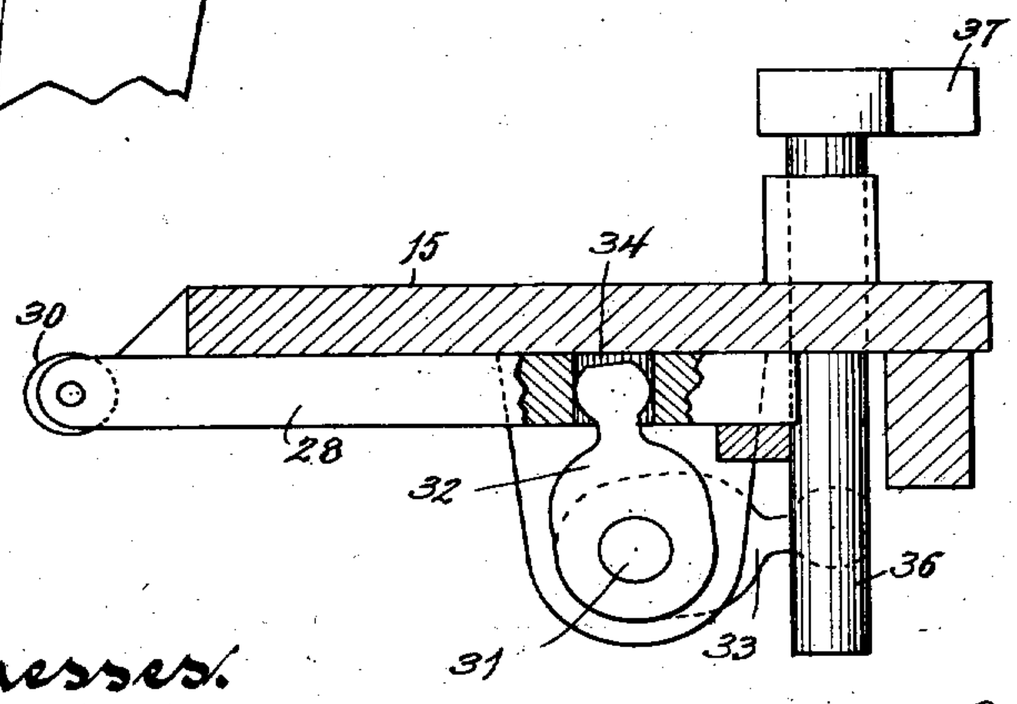


Fig. 6.



Witnesses.
C. N. Keeney.
Anna V. Faust.

Inventor.
Benjamin F. Windsor.
By Benedict & Morsell
Attorneys.

No. 627,286. Patented June 20, 1899.

B. F. WINDSOR.

MACHINE FOR BENDING ENDS OF WIRE FOR BED BOTTOM SPRINGS.

(Application filed Dec. 20, 1898.)

(No Model.) 7 Sheets—Sheet 6.

Fig. 7.

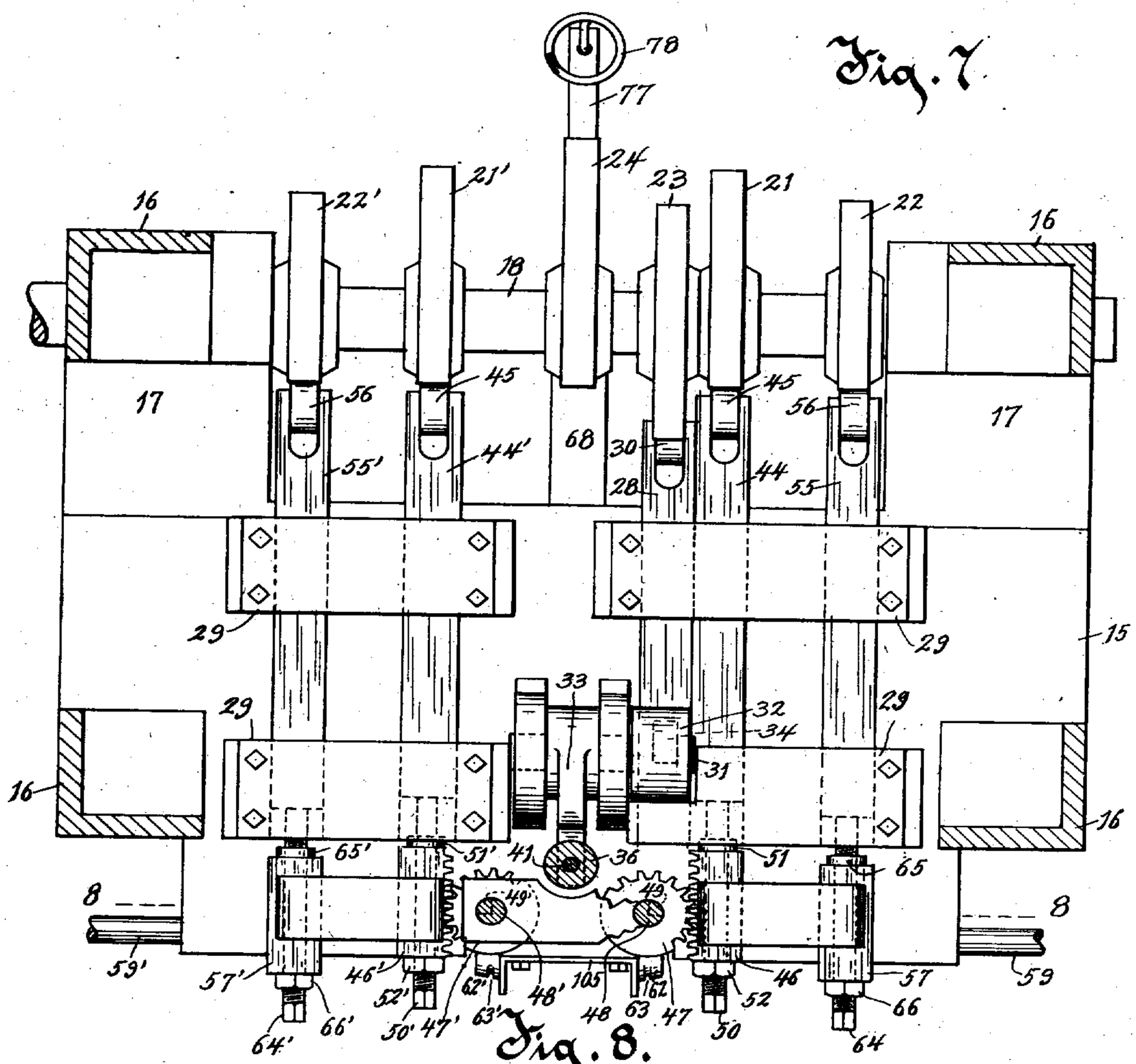
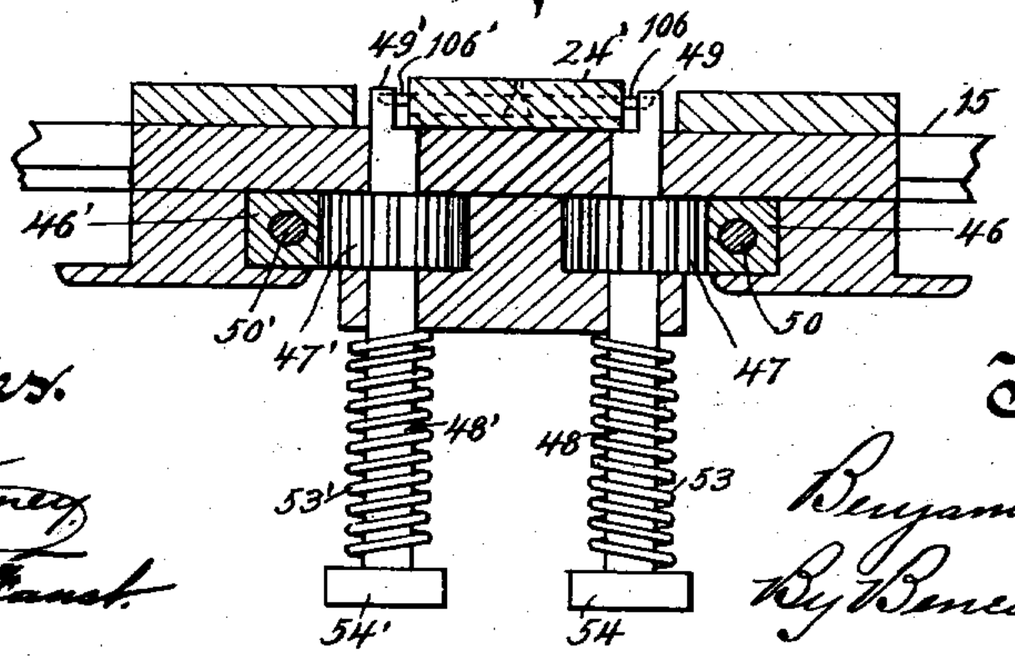


Fig. 8.



Witnesses.

C. A. Keeney

Anna V. Faust

Inventor.

Benjamin F. Windsor

By Benedict & Morsell

Attorneys.

No. 627,286. Patented June 20, 1899.

B. F. WINDSOR.

MACHINE FOR BENDING ENDS OF WIRE FOR BED BOTTOM SPRINGS.

(Application filed Dec. 20, 1898.)

(No Model.) 7 Sheets—Sheet 7.

Fig. 9.

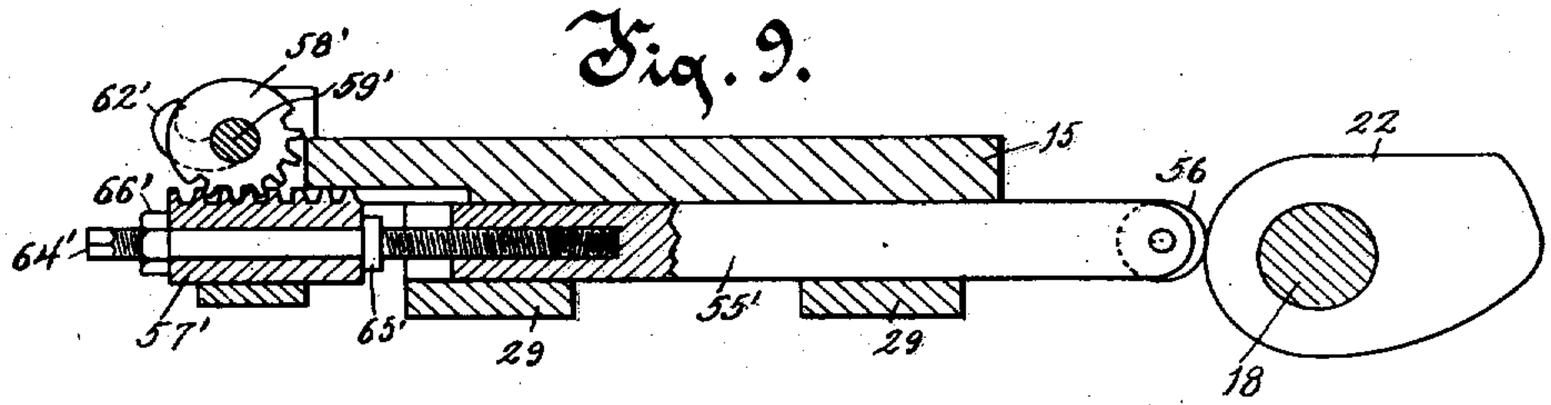


Fig. 10.

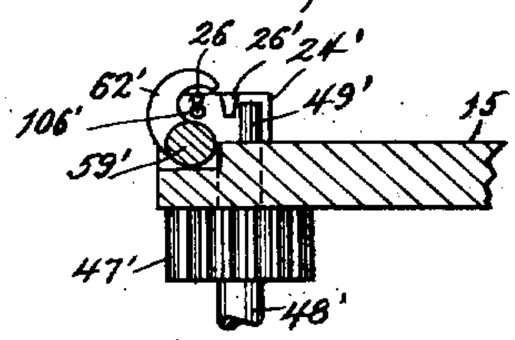


Fig. 11.

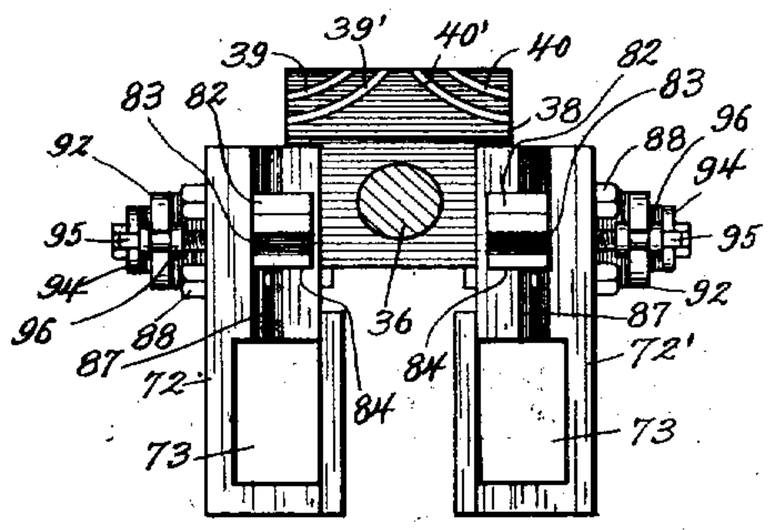


Fig. 12.

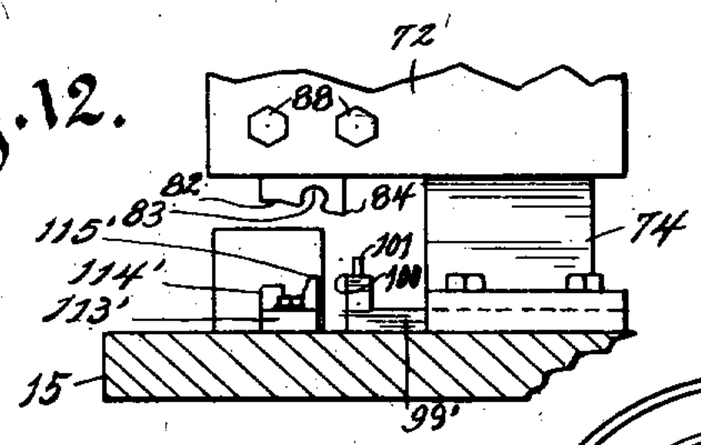


Fig. 13.

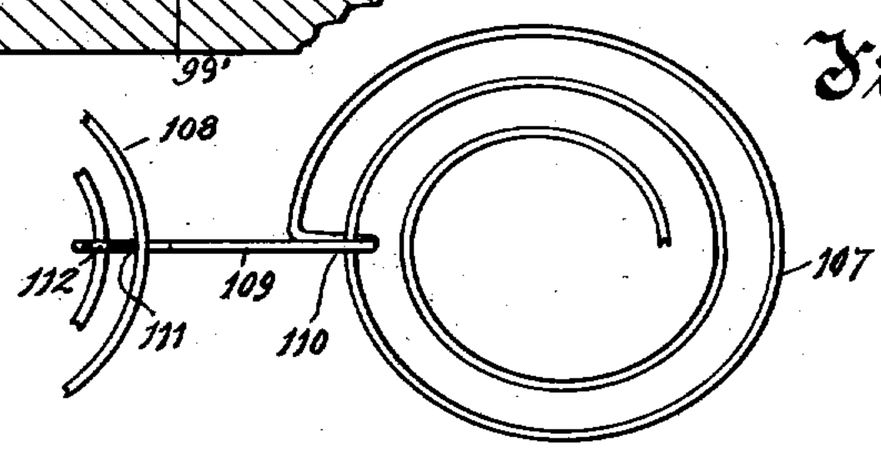
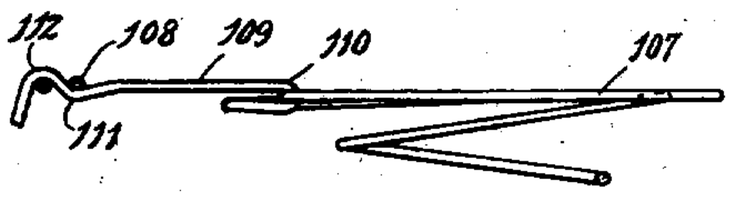


Fig. 14.



Witnesses.
C. A. Keeney
Anna C. Faust.

Inventor.
Benjamin F. Windsor
By Benedict & Morsell
Attorneys.

UNITED STATES PATENT OFFICE.

BENJAMIN F. WINDSOR, OF KENOSHA, WISCONSIN.

MACHINE FOR BENDING ENDS OF WIRE FOR BED-BOTTOM SPRINGS.

SPECIFICATION forming part of Letters Patent No. 627,286, dated June 20, 1899.

Application filed December 20, 1898. Serial No. 699,813. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN F. WINDSOR, of Kenosha, in the county of Kenosha and State of Wisconsin, have invented a new and useful Improvement in Machines for Bending the Ends of the Wire of a Bed-Bottom Spring, of which the following is a description, reference being had to the accompanying drawings, which are a part of this specification.

My invention has relation to improvements in machines for bending the end of the wire of a bed-bottom spring to form a projecting hook adapted to engage the corresponding coil or convolution of an adjacent spring. The machine is adapted for so operating upon any form of bed-bottom spring whether said spring be merely a simple coiled spring, a conical spiral spring, or a double conical spiral spring. In case of the latter class of springs the ends of both end convolutions are operated upon in the manner indicated.

It is the primary object of my invention to provide a machine of such construction that the operation of bending and forming the hook is accomplished in the most efficient, accurate, and rapid manner.

A further object resides in providing a machine of the class described in which provision is made for adjusting different parts, so that most accurate working is insured.

With the above and other incidental objects in view the invention consists of the devices and parts or their equivalents, as hereinafter more fully set forth.

In the accompanying drawings, Figure 1 is a plan view of the entire machine. Fig. 2 is a front view of the upper portion of the machine. Fig. 3 is a side elevation of the complete machine. Fig. 4 is a plan view with the upper part removed and parts broken away and in section. Fig. 5 is a section taken on a plane through the machine near the center of said machine. Fig. 6 is a detail of a portion of the wire-holding device with parts in section and parts broken away. Fig. 7 is an under view of the machine with parts broken away and in section. Fig. 8 is a section on the line 8 8 of Fig. 7. Fig. 9 is a detail cross-section of one of the cam-actuated bars and related mechanism, parts being broken away and in section. Fig. 10 is a detail plan view of Fig. 9, parts in section. Fig. 11 is an inverted plan view of the head-piece of the holding mechanism. Fig. 12 is a detail of the hook forming and cutting mechanism. Fig. 13 is a plan view of one spring after having been operated upon by the machine, showing the upper convolution of this spring as having been formed into a hook, said hook being shown as properly engaging another spring; and Fig. 14 is a side view of one of the springs shown in Fig. 13 and a section of the other spring.

Referring to the drawings, the numeral 15 indicates the bed of the machine, which is supported on suitable legs 16. Extending rearwardly from the bed are extensions 17 17, which are formed or provided with bearings for a shaft 18. Upon one end of this shaft is mounted a belt-wheel 19, to which rotation is imparted by means of a belt (not shown) or other equivalent mechanism. This wheel is mounted loosely on the shaft, but is adapted to be made fast thereto by means of suitable clutch mechanism 20 of any ordinary and well-known form of construction.

The machine is shown as capable of acting upon two double conical springs at the same time, but upon opposite ends of said springs, and for this purpose many of the parts on opposite sides of a line drawn through the center of the bed of the machine are duplicated and perform similar functions. For instance, on the shaft 18 are mounted a series of cam-wheels, and two of these cam-wheels (designated by the numerals 21 21′, respectively,) are adapted, in conjunction with other mechanism, for performing the same function on opposite sides of said central line of the machine, and two other of said cam-wheels (designated, respectively, by the numerals 22 22′) are also adapted, in conjunction with other mechanism, for performing similar functions on opposite sides of the machine. On the left-hand side of the center line of the machine, Figs. 1 and 4, however, another cam-wheel 23 is mounted on the shaft 18. This wheel serves to act in conjunction with other mechanism for performing a function on both sides of the machine, while on the center or approximately the center of the shaft is another cam-wheel 24, which, in conjunction with other mechanism, acts to effect the bending of the ends of the wires of the springs into

hook form and also for cutting off the ends of the wire, if necessary.

On the upper side of the bed of the machine and at the front edge thereof is a plate 24′, forming the lower member of holding mechanism. This plate has two sets of concentric grooves, one set being indicated by the numerals 25 25′ and the other set by the numerals 26 26′. The grooves 25′ and 26′ of the respective sets are deeper than the grooves 25 26, as shown clearly in Fig. 10. The cam-wheel 23 is formed at one point of its periphery with a depression 27.

Beneath the bed of the machine is a longitudinal bar 28, which is adapted to work in suitable guideways 29 on the under side of the bed. The rear end of this bar carries an antifriction-roller 30, which is adapted normally to rest in the depression 27 of the cam-wheel 23; but when the machine is started and the cam-wheel 23 thereby rotated said antifriction-roller is adapted to pass out of said depression and to ride on the non-depressed portion of the periphery of the cam-wheel, whereby the bar is forced toward the front of the machine. A short shaft 31 is journaled in suitable bearings depending from the under side of the bed of the machine, and this shaft has fixed thereon two levers 32 and 33, respectively extending from the shaft at angles to each other and forming practically a bell-crank lever. The ends of both of these levers are preferably rounded, and the rounded end of the upwardly-extending lever 32 engages a slot 34, formed in the longitudinal bar 28, while the rounded end of lever 33 engages a slot 35 in a vertical rod 36. This rod passes freely through an opening therefor in the bed of the plate, and the upper end of said rod is formed or provided with a head-piece 37. To the under side of this head-piece and at the forward edge thereof is secured a depending block 38. The block 38 of course, if desired, may be made in one piece with the head-piece. The under side of this block is formed with two sets of projecting concentric curved beads, one set being indicated by the numerals 39 39′ and the other set by the numerals 40 40′. The inner beads 39′ and 40′ of the respective sets extend downwardly a greater distance than the outer beads 39 and 40. These sets of depending beads are in a line directly above the concentric grooves 25 25′ and 26 26′ of plate 24′, so that when the block 38 is carried downwardly by the downward movement of the rod 36 the longest ribs 39′ and 40′ will fit in the deepest grooves 25′ and 26′ of the plate 24′ and the shortest ribs 39 and 40 will fit in the less deep grooves 25 and 26 of said plate. The rounded end of lever 33 is adjustable in the slot 35 of the vertical rod 36 by means of a set-screw 41, said set-screw extending upwardly through the lower end of the rod and entering the slot, its end within the slot adapted to be turned against the lever. The rod 36 has secured to its lower end a bracket 42, to which bracket one end of a coiled spring 43 is connected, the opposite upper end of said spring being secured to the framework. This spring effects the function of normally holding the rod in the position shown in Fig. 5, so that the head-piece 37 and its depending block 38 will be above the plate 24′. Beneath the bed of the machine and working in the guideways 29 are other bars 44 44′. These bars carry at their rear ends antifriction-rollers 45. These rollers are adapted to bear against the peripheries of the cam-wheels 21 21′. The forward ends of the bars 44 44′ are provided with a series of teeth, forming racks 46 46′. These racks engage with toothed segments 47 47′, carried near the upper ends of the upright shafts 48 48′. The upper extremities of these shafts are formed with upwardly-extending fingers 49 49′, respectively, the inner edges of said fingers being in the form of right angles and said fingers forming one-quarter of the upper ends of the shafts. The racks 46 46′ are preferably not formed integral with the bars 44 44′, but are advisably formed of separate blocks, as clearly shown in Fig. 7. Through these blocks pass screw-bolts 50 50′, which screw-bolts enter threaded sockets in the ends of the bars 44 44′. These screw-bolts are formed or provided with collars 51 51′, which bear against the inner ends of the rack-bars 44 44′. Jam-nuts 52 52′ are adapted to turn on the outer ends of the bolts 50 50′ against the outer ends of said rack-bars. By loosening these jam-nuts and turning the bolts the bars 44 44′ may be made to be adjusted longitudinally toward either the rear or front of the machine in accordance with the direction in which the bolts are turned. By this means the rack-bars are so positioned with relation to the toothed segments 47 47′ that the shafts 48 48′ are so turned as to regulate the points from which the fingers 49 49′ start and stop. The shafts 48 48′ are surrounded by coiled springs 53 53′. The lower ends of these springs are secured to the shafts, preferably to set-collars 54 54′, mounted on the lower ends of said shafts, and the upper ends of the springs are secured to the framework. When the bars 44 44′ are caused to travel toward the front of the machine by the action of the cam-wheels 21 21′ and the shafts 48 48′ are thus caused to rotate by the engagement of the racks 46 46′ with the toothed segments 47 47′ of the shafts, the coiled springs 53 53′ are wound up on said shafts, and thereby serve to hold rollers 45 of the bars 44 44′ in firm engagement with the cam-surfaces of the wheels 21 21′. The numerals 55 55′ indicate two other bars arranged beneath the bed and on opposite sides, respectively, of the center of the machine. These bars also pass through the guideways 29 and carry at their rear ends antifriction-rollers 56, which bear against the respective cam-wheels 22 22′. The forward ends of these bars 55 55′ are provided with rack-bars 57 57′, the teeth of said respective rack-bars engaging the toothed segments 58

58′, carried by horizontal shafts 59 59′. These shafts are also spring-retrieved the same as the shafts 53 53′ by means of coiled springs 60 60′, respectively, surrounding said shafts, and said coiled springs secured at their outer ends to set-collars 61 61′, mounted on the shafts, while the inner ends of the springs are secured to the framework. These springs are wound up on the shafts 59 59′ as the bars 55 55′ are caused to travel forwardly, and hence the rollers 56 are kept in firm contact with the cam-wheels 22 22′. The shafts 59 59′ are also formed or provided with curved projecting fingers 62 62′, located, respectively, on opposite sides of the center line of the machine and adjacent, respectively, to opposite side edges of the plate 24′. These fingers are provided, respectively, with grooves or recesses 63 63′. The rack-bars 57 57′ are preferably separate from the bars 55 55′, and through these rack-bars pass adjusting screw-bolts 64 64′, said screw-bolts entering threaded sockets in the ends of the bars 55 55′. (See Figs. 7 and 9.) These screw-bolts are formed or provided, respectively, medially with collars 65 65′. The outer ends of the screw-bolts carry jam-nuts 66 66′, which are adapted to be turned up against the outer ends of the rack-bars. By loosening these jam-nuts and turning the screw-bolts the bars 55 55′ may be adjusted either rearwardly or forwardly in accordance with the direction in which the screw-bolts are turned. By this means the points at which the curved fingers 62 62′ start and stop may be regulated.

Projecting upwardly from the rear portion of the bed of the machine are standards or uprights 67 67. The numeral 68 indicates a bell-crank lever, the hub 69 of which is arranged between the standards 67. A pivot-pin 70 passes through said hub and is journaled in the upper ends of the standards. The rear end of this bell-crank lever carries an antifriction-roller 71, which bears against the cam-wheel 24. The forward end of the bell-crank lever passes between two blocks 72 72′, which carry the hook bending and cutting mechanism. Toward their rear portions these blocks are formed on their inner faces with angular grooves 73 73, (see particularly Fig. 1,) and these grooves are fitted to upright posts 74 74, on which the blocks are adapted to move vertically. The forward end of the bell-crank lever, between the blocks 72 72′, is provided with an elongated rectangular slot 75. In this slot fits the squared portion of a pin 76. The slot 75 is somewhat longer than the squared portion of the pin 76, so that said squared portion may have a slight play in the slot as the bell-crank lever is rocked and the blocks moved vertically. The rear member of the bell-crank lever has secured thereto a rearwardly-projecting arm 77. To the extremity of this arm is secured the upper end of a coiled spring 78, the lower end of said coiled spring being secured to a fixed portion of the frame. The upper edges of the blocks 72 72′ are connected by means of a cross-piece 79, and to this cross-piece is connected the lower end of a coiled spring 80, the upper end of said coiled spring being secured to a fixed portion (not shown) located above the machine. Each block carries on its under edge, near the front, a depending hook forming and cutting mechanism, the hook forming and cutting mechanism of block 72 being indicated by the numeral 81 and the hook forming and cutting mechanism of block 72′ by the numeral 81′. The under surface of each hook forming and cutting mechanism is formed with a slightly-concaved portion 82, extending from the front edge rearwardly for a desired distance, and at the rear terminal point of the portion 82 is formed a rounded recess 83. From the lower edge of the rear wall of this recess the surface is continued rearwardly at a slight bevel or decline, the rear angle or corner forming a cutting edge 84. The lower ends of both the blocks 72 72′ are formed with dovetail grooves 85 85, and in these dovetail grooves are fitted upwardly-extending dovetail feathers 86 86′ from the hook forming and cutting mechanisms 81 81′. Slits 87 87 are provided in the blocks 72 72′, and said slits extend from the dovetail grooves 85 upwardly for a desired distance, and screw-bolts 88 88 extend inwardly through the side edges of the blocks and across these slits. By loosening the screw-bolts the hook forming and cutting mechanisms may be adjusted either forwardly or rearwardly, as desired, by sliding the dovetail feathers in the dovetail grooves, and when the required adjustment is obtained the bolts are again tightened. A means is also provided for adjusting the degree of bending of the hook. For this purpose the blocks 72 72′ are each formed with side slots 88′ 88′, in which are disposed blocks 89 89, said blocks forming the bearings for the ends of the pin 76, which passes through the forward member of the bell-crank lever 68. These blocks do not fill quite the entire length of the slots 88′, so that there is room left for the vertical adjustment of said blocks. The lower edges of the blocks are beveled or inclined, as indicated by the numerals 90 90, and adapted to work against these beveled or inclined edges are the upper beveled or inclined edges of wedges 91 91. The outer ends of these wedges are formed with downwardly-projecting bifurcated extensions 92 92. Plates 93 93 are adapted to be bolted to the outer ends of the wedges, and these plates are also provided with downwardly-extending bifurcated portions 94 94. Screw-bolts 95 95 pass through bifurcated portions 94 and 92 of the plates and wedges, respectively, and enter the solid portions of the blocks 72 72′ below the slots 88′ of said blocks. These bolts carry rigid collars 96 96 thereon, said collars adapted to bear against opposite sides of the bifurcated portions 92 of the respective wedges 91. Screw-bolts 97 97 also extend downwardly through the upper ends of the blocks

72 72′ and enter the slots 88′ and are adapted to bear against the blocks 89 89. Jam-nuts 98 98 turn on the upper ends of the screw-bolts 97 against the cross-piece 79. In order to adjust the blocks 89 89, the jam-nuts 98 are loosened, the vertical screw-bolts 97 properly turned, the plates 93 of the wedges removed, and the screw-bolts 95 turned in the proper direction. This will cause the blocks 89 to be moved either upwardly or downwardly in accordance with the direction of the turning of said screw-bolts 95, whereby the lower bordering edges of the slots 88′ 88′ are brought closer to or farther away from the lower edges of the blocks 89 and the extent of the movement of the blocks 72 72′ thereby regulated, and consequently the degree of the bending of the hooks adjusted.

Secured to the base of the machine below the hook forming and bending mechanisms 81 81′ are angle-plates 99 99′. The outer forward angles of these plates form cutting edges 100, which coöperate with the cutting edges 84 of the hook forming and cutting mechanisms. The cutting edges of these angle-plates therefore form the stationary members of the cutting mechanisms. Each of these angle-plates is provided with an upwardly-extending finger 101. These fingers form guards to prevent the wire of the hooks which extend across the angle-plates from being forced sidewise off said plates by the action of the cutting mechanism when operated.

Secured to the bed of the machine, on each side of the center line of said machine, are spring-fingers 102 102′. These fingers project forwardly and are inclined toward the side edges of the plate 24′ of the holding mechanism. Each of these fingers is provided with a slight upward bulge 103, as shown most clearly in Fig. 2. Adjustable gage-plates 104 104′ are also secured to the bed of the machine on opposite sides of the center line of said bed, and these plates are so adjusted as to adapt the ends of the wires of the springs which are formed into hooks to contact thereagainst on the first application of said ends of the wires of the springs to the machine.

To the front of the machine, directly in front of the plate 24′ of the holding mechanism, is secured an angle-bracket 105, the forwardly-projecting side members of which are adapted to act as guards to prevent the ends of the wires of the springs from being bent toward each other.

Projecting laterally from opposite side edges of the lower member 25′ of the holding mechanism are pins 106 106′, the function of which will be hereinafter described.

In Figs. 13 and 14 are shown two double conical spiral springs, one of said springs being indicated by the numeral 107 and the other by the numeral 108, the end of said spring 107 being shown as having been bent into hook form by the operation of my improved machine, the hook 109 so formed being shown as engaging the other spring 108.

The lower stationary members of the hook-forming mechanism are indicated by the numerals 113 113′. These are formed at their outer ends with upwardly-extending lugs 114 114′, respectively, and at their rear ends with upwardly-extending lugs 115 115′.

The operation of my machine is as follows: The first step is to adjust by hand the end of one spring to the lower member 24′ of the holding mechanism, so that the end of the wire of the terminal coil or convolution will fit in the inner deep groove 25′. The curve of the wire of course corresponds to the curvature of the groove, and said wire extends out of said groove in front of the front wall of the quartered finger 49 and under the spring-finger 102, seating itself in the upward bulge 103 of said finger. The extremity of the wire will then bear against the adjustable gage 104. A portion of the next lower convolution of the spring fits in the shallow of the groove 25. The opposite end of another spring—that is to say, the end thereof which is opposite to the end of the spring which is adjusted to the grooves 25 25′—is adjusted to the grooves 26 26′ in exactly the same manner. It is necessary that there should be the two sets of grooves 25 25′ and 26 26′ for opposite ends of double conical spiral springs, inasmuch as, as is well known, the ends of the wires of said springs at opposite ends of the springs project out therefrom in opposite lateral directions. After the springs are thus adjusted the machine is started, and owing to the relative arrangement between the different cam-wheels on the shaft 18 the antifriction-roller 30 of the bar 28 is first caused to ride out of the depression 27 of cam-wheel 23, and this through the mechanism already described causes the head-piece 37 to descend and the upper member 38 of the holding mechanism to be forced downwardly, whereby the ridges 39 39′ and 40 40′ of said part 38 are made to enter the grooves 25 25′ and 26 26′ of the lower member 24′ of the holding mechanism, the springs being thereby firmly clamped and held. After this operation the two cam-wheels 21 21′ will have forced the bars 44 44′ outwardly a sufficient distance for the rack-bars 46 46′ to turn the segments 47 47′, and consequently shafts 48 48′ and quartered fingers 49 49′, carried at the upper ends of said shafts, each quartered finger bending the end of the wire of each spring around at right angles and forwardly and beneath the next inner coil of the spring, this being permitted by reason of the fact that the inner grooves of the sets are deeper than the outer grooves, and consequently the ends of the wires in said deeper grooves are held on a plane below the plane of the wire of the next inner coil of the spring. The spring-fingers 102 102′ prevent the wires from jumping up over the upper ends and out of engagement with the quartered fingers during this operation; but said ends of the wire are gradually worked from beneath said spring-fingers

upon the completion of this bending. The forwardly-projecting side members of the bracket 105 when the wires are bent around in the manner just described act as guards to prevent said wires from being forced inwardly toward each other. After the completion of the last-referred-to operation the cams 22 22′ will have been rotated sufficiently far to cause the bars 55 55′ to be thrust forwardly a sufficient distance to cause, through the engagement of the rack-bars 57 thereof with the segments 58 58′, a turning of the shafts 59 59′ and a consequent inward turning of the fingers 62 62′. It will be understood that when the ends of the springs are bent outwardly in the manner before described said ends rest in the grooves 63 63′ of the fingers 62 62′. When, therefore, these fingers are turned inwardly in the manner just explained, the wires are bent inwardly over the next inner coils of the springs, forming the loops 110, the wires extending inwardly for a desired distance. (See Figs. 13 and 14.) The under portions of these loops rest on the pins 106 106′ during this bending operation, said pins thereby affording a support and preventing downward give of the springs during said operation. Immediately following this last-referred-to bending the shaft 18 will have been rotated sufficiently to cause the cam-wheel 24 to have operated on the bell-crank lever 68 to the full extent and said bell-crank to cause the full down movement of the blocks 72 72′ in order to bring the hook bending and cutting mechanism into play. In the operation of this hook bending and cutting mechanism the centers of the slightly-concaved surfaces 82 of said mechanisms act on the wire to force said wire against the inner corners of the upwardly-extending lugs 114 114′ of the lower members of the hook-forming mechanism to form the slight downward bends 111, while the grooves 83, in connection with the lugs 115 115′ of said lower members of the hook-forming mechanisms, which lugs fit in the grooves 83, form the hook extremities 112. If the wires are too long, the cutting edges 84, acting in conjunction with the stationary cutting edges 100 of the angle-plates 99 99′, serve to cut off the ends of the wires. This completes the operation of bending, &c., and with the continued rotation of the shaft the holding mechanism is first released, so as to permit of the removal of the springs, and the other mechanisms are successively brought out of working position.

It is obvious that my machine is not necessarily restricted to the double form herein shown and described, inasmuch as the machine could be constructed for operating only on one end of single conical spiral springs or simple spiral springs, as it is necessary that the hooks should be formed only at one end of such springs. In that case it would only be necessary to employ a single holding mechanism, a single quartered finger, and a single finger, such as 63 or 63′, as also a single hook forming and cutting mechanism, and where these several mechanisms are operated by the specific means herein shown and described it will only be necessary to employ the cam-wheel 24 and allied mechanism, together with the other cam-wheels shown on the left of Fig. 1. In case of this single form of machine, however, where it is desired to operate upon simple coiled springs (not conical) the front edge of the machine should be constructed so as to permit the end of the upper coil and the next inner coil to be adjusted to the grooves of the lower member of the holding device, which could be accomplished by beveling inward the front edge of the machine, so as to allow of the spring being properly adjusted to the front of the bed of the machine, which otherwise could not be well done, owing to the fact that the convolutions of such springs are of equal diameter.

While I have shown and described herein certain specific details of construction, I wish it to be understood that I do not thereby intend to restrict myself to such details, inasmuch as various modifications and variations thereof can be made without departing from the broad spirit and scope of my invention.

What I claim as my invention is—

1. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism consisting of two members, one of said members provided with curved grooves to receive the wire of two terminal coils of the spring, and the other member provided with ridges adapted to fit said grooves and thereby clamp the wire, means for moving one of said members toward and from the other, and bending mechanism.

2. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism consisting of two members, one of said members provided with curved grooves to receive the terminal coils of the spring, the inner groove being deeper than the outer groove, and the other member provided with ridges, the inner ridge being wider than the outer ridge, said ridges adapted to fit the grooves of the other member of the holding mechanism and thereby clamp the wire, means for moving one of said members toward and from the other, and bending mechanism.

3. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism consisting of two members, one of said members provided with two sets of curved grooves adapted to receive the wires of the two terminal coils at the opposite ends of coiled springs, and the other member provided with two sets of ridges adapted to fit said grooves and thereby clamp the wires, means for moving one of said members toward and from the other, and bending mechanism.

4. In a machine for bending the end of the wire of a coiled spring, the combination, of a plate forming one member of holding mech-

anism, a rod carrying at one end the other member of the holding mechanism, means for giving said rod longitudinal movement, and bending mechanism.

5. In a machine for bending the end of the wire of a coiled spring, the combination, of a plate forming one member of holding mechanism, a rod carrying at one end the other member of the holding mechanism, means for giving said rod longitudinal movement, a spring acting on the rod to hold said rod at a normal position with its holding member out of engagement with the plate forming the other holding member, and bending mechanism.

6. In a machine for bending the end of the wire of a coiled spring, the combination, of a plate forming one member of holding mechanism, a rod carrying at one end the other member of the holding mechanism, a longitudinally-actuated bar, a rock-shaft, levers fixed on said shaft, one of said levers engaging the bar, and the other lever engaging the rod, and bending mechanism.

7. In a machine for bending the end of the wire of a coiled spring, the combination, of a plate forming one member of holding mechanism, a rod, carrying at one end the other member of the holding mechanism, and said rod also provided with a slot, a longitudinally-actuated bar, a rock-shaft, levers fixed on said shaft, one of said levers engaging the bar, and the other lever engaging the slot of the rod, a set-bolt passing through the end of the rod and engaging the end of the lever within the slot of said rod, and bending mechanism.

8. In a machine for bending the end of the wire of a coiled spring, the combination, of a plate forming one member of holding mechanism, a rod carrying at one end the other member of the holding mechanism, a bar, a rock-shaft, levers fixed on said shaft, one of said levers engaging the bar, and the other lever engaging the rod, a cam acting on the bar to longitudinally actuate the same, and bending mechanism.

9. In a machine for bending the end of the wire of a coiled spring, the combination of holding mechanism for the terminal coil of the spring, a quartered shaft adapted to engage the end of the wire of the terminal coil, a segment mounted on said shaft, and a longitudinally-actuated rack for engaging said segment.

10. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coil of the spring, a spring-retrieved quartered shaft adapted to engage the end of the wire of the terminal coil, and means for rocking said shaft.

11. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coil of the spring, a spring-retrieved quartered shaft adapted to engage the end of the wire of the terminal coil, means for adjusting the tension of the retrieving-spring, and means for rocking said shaft.

12. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coil of the spring, a quartered shaft adapted to engage the end of the wire of the terminal coil, a segment mounted on said shaft, a bar provided with teeth forming a rack to engage the segment, and a cam for longitudinally actuating said bar.

13. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coil of the spring, a quartered shaft adapted to engage the end of the wire of the terminal coil, a spring-finger engaging over the end of the wire, and means for rocking the quartered shaft, whereby the terminal end of the wire of the coil is bent at an angle.

14. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coil of a spring, a gage for the extremity of the wire of the terminal coil, a quartered shaft adapted to engage the end of the wire of the terminal coil, and means for rocking said shaft, whereby the terminal end of the wire of the coil is bent at an angle.

15. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coil of a spring, an adjustable gage for the extremity of the wire of said terminal coil, a quartered shaft adapted to engage the end of the wire of the terminal coil, and means for rocking said shaft, whereby the terminal end of the wire of the coil is bent at an angle.

16. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coil of a spring, means for bending the wire of the terminal coil forwardly at an angle, and a guard to limit the extent of said turning.

17. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coil of the spring, a quartered shaft adapted to engage the end of the wire of the terminal coil, a segment mounted on said shaft, a bar, means for actuating said bar, a rack-bar engaging the segment, a bolt passing through said rack-bar and provided medially with a collar bearing against one end of the rack-bar, and said bolt having a threaded end entering a socket of the longitudinally-actuated bar, and a jam-nut on the bolt and adapted to be turned against the opposite end of the rack-bar.

18. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coils of a spring, means for bending the end of the wire of the terminal coil at an angle and under the next coil, and means for looping the

wire over said coil next to the terminal coil, and bending said wire in a reverse direction to the first bending.

19. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coils of a coiled spring, means for bending the end of the wire of the terminal coil at an angle and under the coil next to the terminal coil, a shaft, means for rocking said shaft, and a finger carried by said shaft, and adapted to engage the end of the wire and loop it over the coil next to the terminal coil and bend said wire inwardly in a reverse direction to the first bending.

20. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coils of a coiled spring, means for bending the end of the wire of the terminal coil at an angle and under the coil next to the terminal coil, a spring-retrieved shaft, means for rocking said shaft, and a finger carried by the shaft and adapted to engage the end of the wire and loop it over the coil next to the terminal coil and bend said wire inwardly in a reverse direction to the first bending.

21. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coils of a coiled spring, means for bending the end of the wire of the terminal coil at an angle and under the coil next to said terminal coil, a shaft, a segment mounted thereon, a rack-bar engaging the segment, means for actuating the rack-bar, and a finger carried by the shaft and adapted to engage the end of the wire and loop it over the coil next to the terminal coil and bend said wire inwardly in a reverse direction to the first bending.

22. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coils of a coiled spring, means for bending the end of the wire of the terminal coil at an angle and under the coil next to the terminal coil, a shaft, a segment mounted thereon, a bar formed or provided with a rack-bar engaging the segment, a cam for actuating the first-referred-to bar, and a finger carried by the shaft, and adapted to engage the end of the wire and loop it over the coil next to the terminal coil, and bend said wire inwardly in a reverse direction to the first bending.

23. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coils of a coiled spring, means for bending the end of the wire of the terminal coil at an angle and under the coil next to the terminal coil, a shaft, a segment mounted thereon, a longitudinally-actuated bar, a rack-bar engaging the segment, a screw-bolt passing through the rack-bar and having its inner threaded end engaging a threaded socket of the longitudinally-actuated bar, and also provided medially with a collar bearing against one end of the rack-bar, a jam-nut engaging the screw-bolt and adapted to be turned against the opposite end of the rack-bar, and a finger carried by the shaft, and adapted to engage the end of the wire and loop it over the coil next to the terminal coil, and bend said wire inwardly in a reverse direction to the first bending.

24. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanisms for the terminal coils at opposite ends of coiled springs, means for bending the ends of the wires of the terminal coils at angles, and under the coils next to the terminal coils, and means engaging the ends of the wires and adapted to loop said ends of the wires over the coils next to the terminal coils, and bend said wires inwardly in a reverse direction to the first bending.

25. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanisms for the terminal coils at opposite ends of coiled springs, means for bending the ends of the wires of the terminal coils at angles and under the coils next to the terminal coils, fingers adapted to engage the ends of the wires and loop said wires over the coils next to the terminal coils, and bend said wires inwardly in a reverse direction to the first bending, and means for actuating said fingers.

26. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coils of a coiled spring, means for bending the end of the wire of the terminal coil at an angle and under the coil next to said terminal coil, means for looping the end of the wire over the coil next to the terminal coil, and bending said wire inwardly in a reverse direction to the first bending, and a projecting pin adapted to support the wire of the spring in the process of forming the loop.

27. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coils of a coiled spring, means for bending the end of the wire of the terminal coil at an angle and under the wire of the coil next to the terminal coil and looping it over the last-referred-to coil and bending said wire inwardly in a reverse direction to the first bending, and hook-forming mechanism adapted to act against said inwardly-bent portion of the wire and to form the same into a hook.

28. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coil of a coiled spring, of hook forming and cutting mechanism adapted to act on the end of the wire of the terminal coil and form the same into a hook, and sever surplus wire.

29. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coil of a coiled spring, a block, hook-forming mechanism carried by said block, and means for reciprocating the block, whereby on one recip-

rocation thereof the hook-forming mechanism is caused to act on the end of the wire of the terminal coil and form a hook.

30. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanisms for the terminal coils at opposite ends of coiled springs, a block, hook-forming mechanisms carried by said block, and means for reciprocating said block, whereby on one reciprocation thereof the hook-forming mechanisms are adapted to engage the ends of the wires of the terminal coils of the springs and form said ends of the wires into hooks.

31. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coil of a coiled spring, a reciprocating device, a hook-forming mechanism carried by said reciprocating device, said hook-forming mechanism formed on its face with an inward projection adapted to form a bend in the wire of the terminal coil of the spring, and also provided in its face with a recess adapted to form the hook portion of the end of the wire, and a coacting stationary hook-forming mechanism, provided with two projecting lugs.

32. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coil of a coiled spring, a reciprocating device, a hook forming and cutting mechanism carried by the reciprocating device, said hook forming and cutting mechanism having one face provided with a projection to form a bend in the projecting wire of the terminal coil of the spring, and also having a recess to form the hook of the terminal wire, and also provided with a cutting edge, a stationary cutting edge adapted to act in conjunction with the first-referred-to cutting edge, and a coacting stationary hook-forming mechanism, provided with two projecting lugs.

33. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coil of a coiled spring, a block, a hook-forming mechanism carried by said block, and adapted to engage the projecting wire of the terminal coil of the spring, a bell-crank lever engaging the block, and means for actuating said bell-crank lever.

34. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coil of a coiled spring, a block, hook-forming mechanism carried by said block, means for reciprocating the block, and means for normally holding the block so as to hold the hook-forming mechanism out of engagement with the projecting wire of the terminal coil of the spring.

35. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coil of a coiled spring, a block, hook-bending mechanism carried by said block, a bell-crank lever engaging the block, and a cam-wheel engaging the bell-crank lever.

36. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coil of a coiled spring, a block, hook-forming mechanism carried by the block, a bell-crank lever engaging the block, means for rocking the bell-crank lever, and a spring or springs for normally holding the block raised out of operative position.

37. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coil of a coiled spring, a block, means for reciprocating said block, hook-forming mechanism carried by the block, and means for adjusting said hook-forming mechanism rearwardly or forwardly.

38. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coil of a coiled spring, a block, provided with a dovetail recess having a slit extending therefrom, a hook-forming mechanism provided with a dovetail feather fitting in the dovetail recess, a bolt passing into the block and extending across the slit, and means for reciprocating the block.

39. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coil of a coiled spring, a block, a hook-forming member carried by said block, means for reciprocating said block, a complementary hook-forming member, and means for regulating the extent of the movement of the block which carries one of the hook-forming members toward the complementary hook-forming member, in order to adjust the degree of bending of the hook.

40. In a machine for bending the end of the wire of a coiled spring, the combination, of holding mechanism for the terminal coil of a coiled spring, a block having a slot therein, a block fitting in said slot and provided with an inclined wedge, a wedge entering the slot and formed with an inclined edge engaging the inclined edge of the block within the slot, a bolt extending longitudinally into the slot and adapted to engage the block therein, a bell-crank lever, a pin passing through the end of the forward member of said bell-crank lever and engaging the block in the slot, means for actuating said bell-crank lever, and hook-forming mechanism carried by the block.

41. In a machine for bending the end of the wire of a coiled spring, the combination, of a shaft, a series of cams mounted thereon, a plate forming one member of a holding mechanism, a rod carrying at one end the other member of said holding mechanism, a bar, a rock-shaft, levers mounted on said rock-shaft, one of the levers engaging the bar, and the other lever engaging the upright rod, and one end of the bar engaged by one of the cams of

the shaft, a quartered shaft having a segment mounted thereon, a bar formed or provided with a rack-bar adapted to engage the segment, and said bar actuated by another cam on the shaft, another shaft carrying a curved finger, and having a segment mounted thereon, a bar formed or provided with a rack-bar engaging the segment, and said bar being actuated by another cam on the shaft, hook-forming mechanism, and a bell-crank lever for actuating the hook-forming mechanism, said bell-crank lever being actuated by another cam on the shaft.

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

BENJAMIN F. WINDSOR.

Witnesses:
A. L. MORSELL,
F. P. CHESLEY.

Correction in Letters Patent No. 627,286.

It is hereby certified that in Letters Patent No. 627,286, granted June 20, 1899, upon the application of Benjamin F. Windsor, of Kenosha, Wisconsin, for an improvement in "Machines for Bending Ends of Wire for Bed-Bottom Springs," an error appears in the printed specification requiring correction, as follows: In line 114, page 8, the word "wedge" should read *edge;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 4th day of July, A. D., 1899.

[SEAL.]

WEBSTER DAVIS,
Assistant Secretary of the Interior.

Countersigned:
C. H. DUELL,
Commissioner of Patents.

Correction in Letters Patent No. 627,286.

It is hereby certified that in Letters Patent No. 627,286, granted June 20, 1899, upon the application of Benjamin F. Windsor, of Kenosha, Wisconsin, for an improvement in "Machines for Bending Ends of Wire for Bed-Bottom Springs," an error appears in the printed specification requiring correction, as follows: In line 114, page 8, the word "wedge" should read *edge;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 4th day of July, A. D., 1899.

[SEAL.]

WEBSTER DAVIS,
Assistant Secretary of the Interior.

Countersigned:

C. H. DUELL,
Commissioner of Patents.