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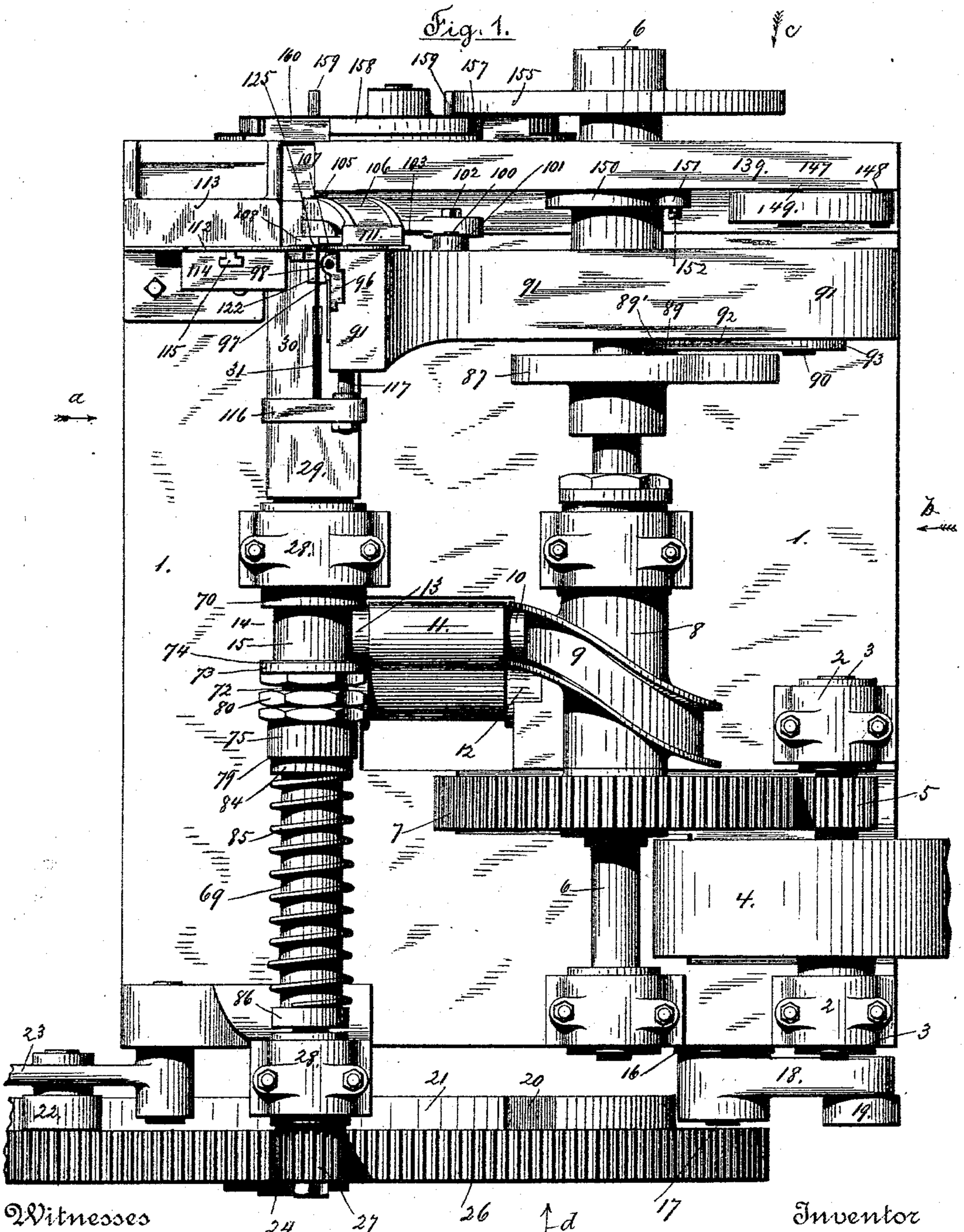
J. E. MORSE.

BALE TIE MACHINE.

No. 414,430. Patented Nov. 5, 1889.

Fig. 1.



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By his Attorney
John C. Dewey.

(No Model.) 9 Sheets—Sheet 2.

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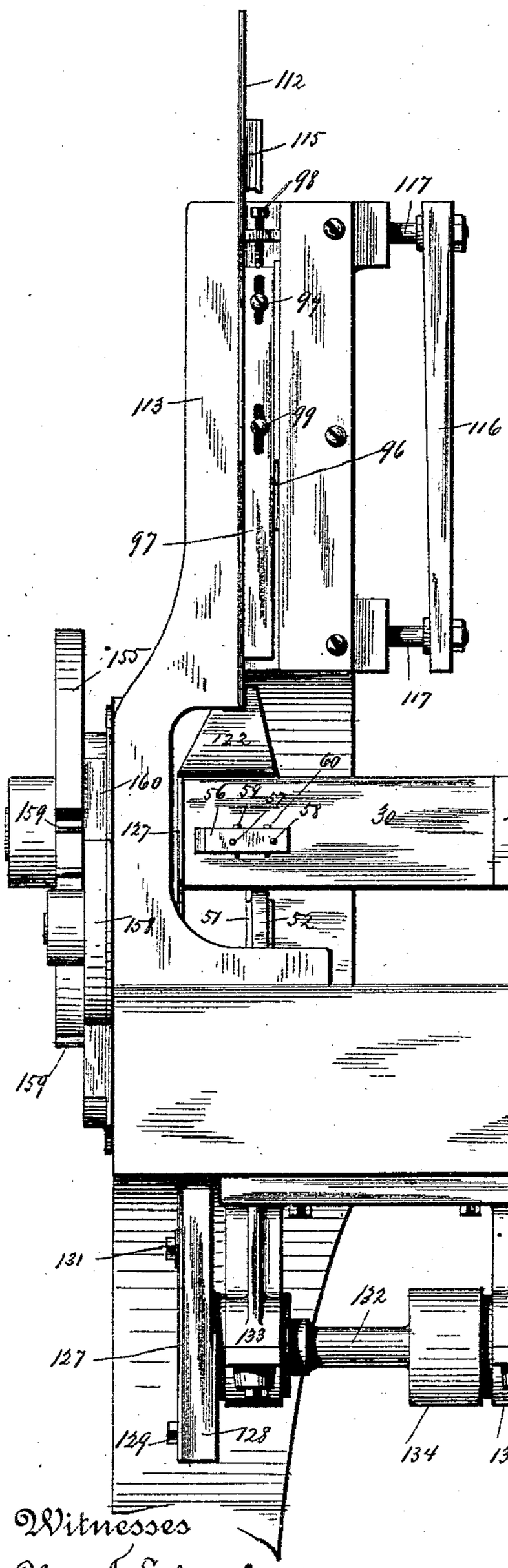

Fig. 2.

Witnesses
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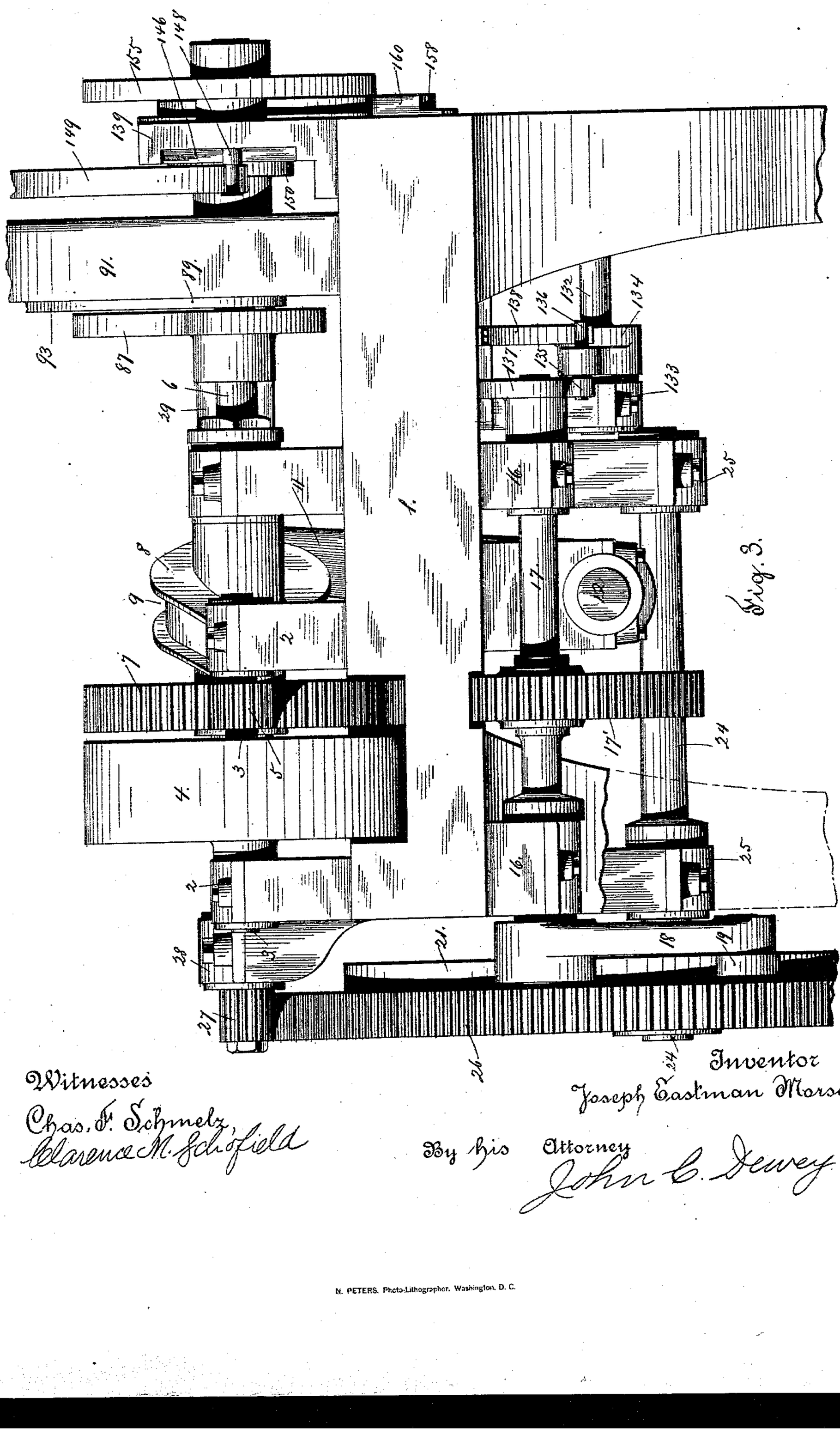

Fig. 3.

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Fig. 4.

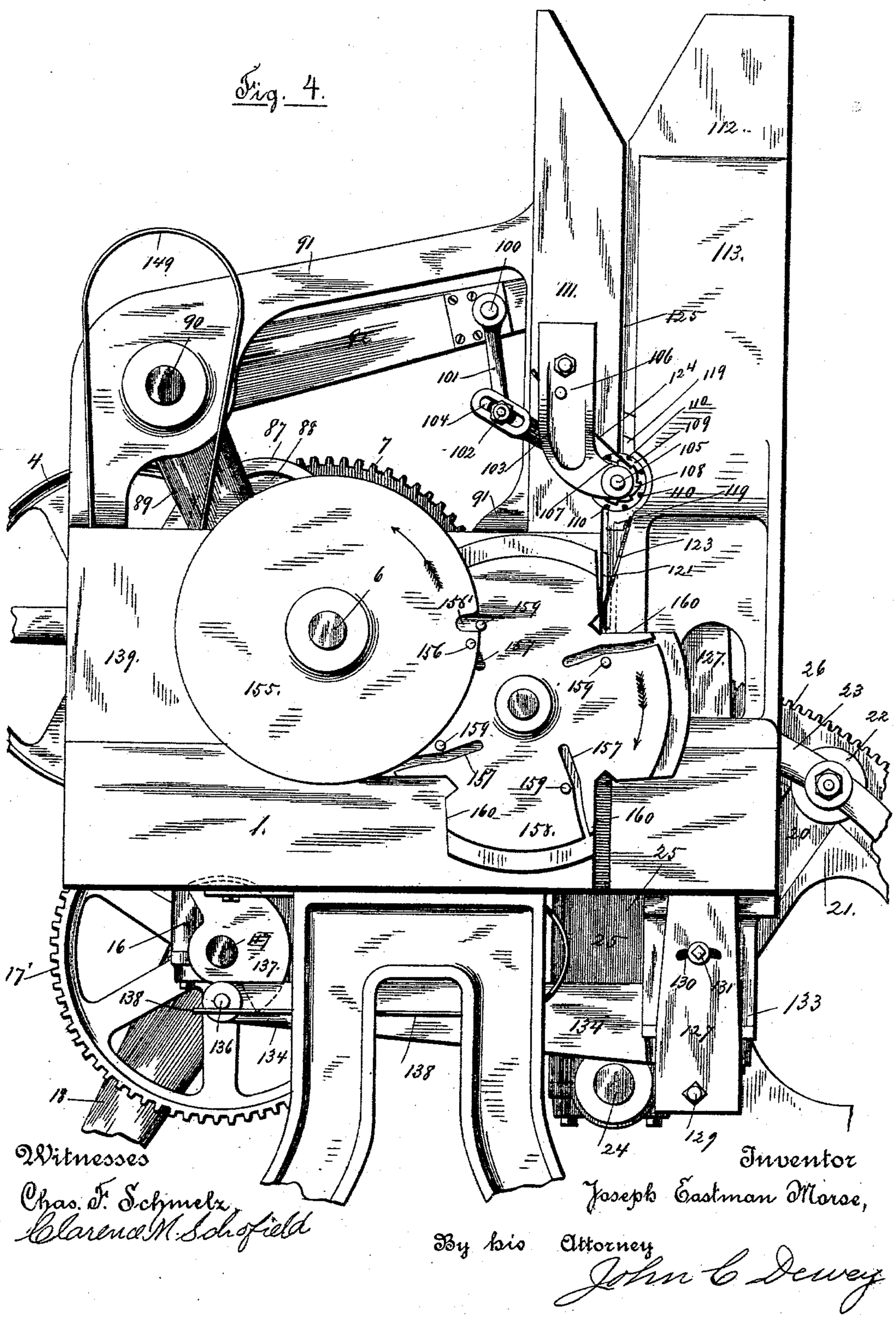

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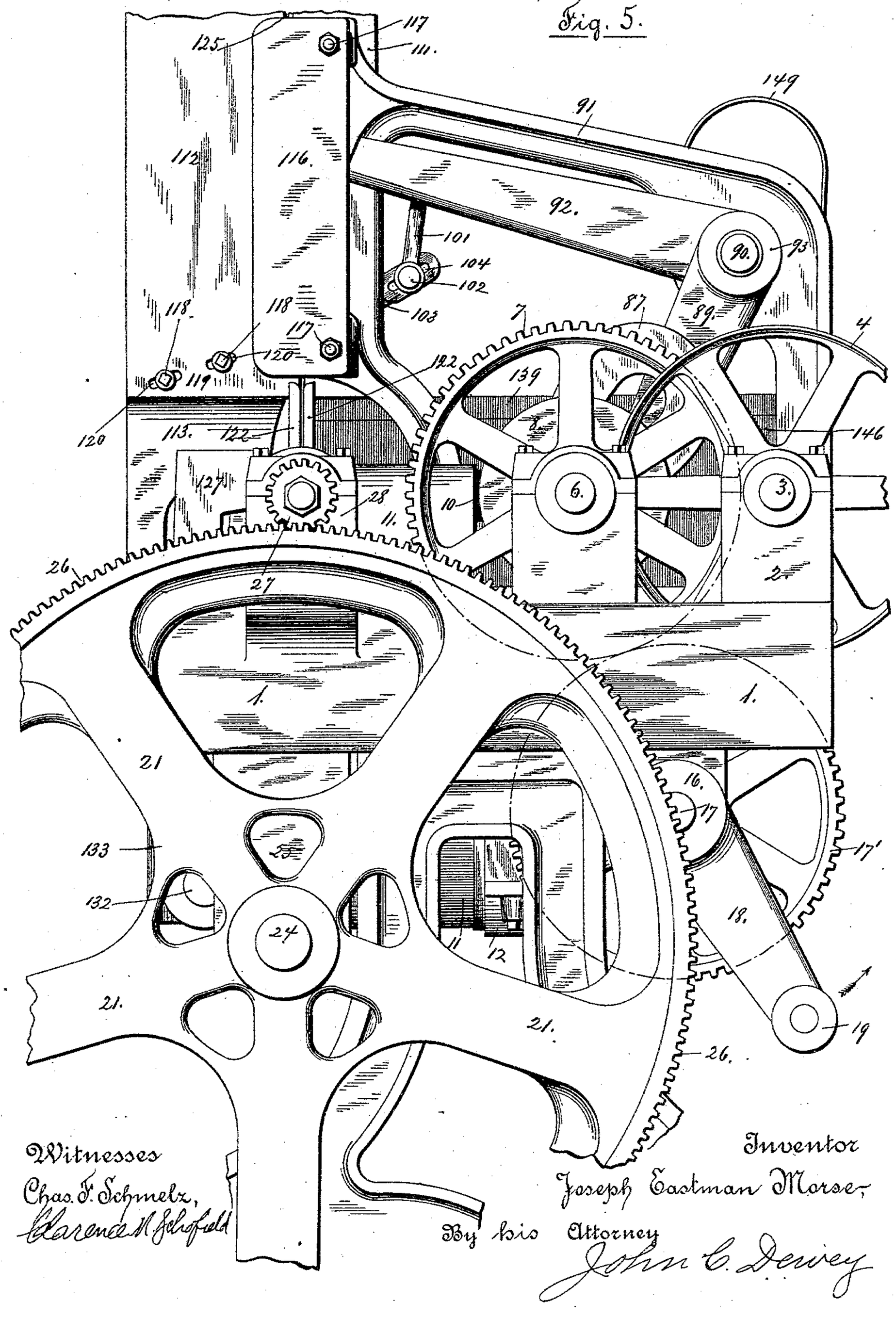
Fig. 5.



Witnesses
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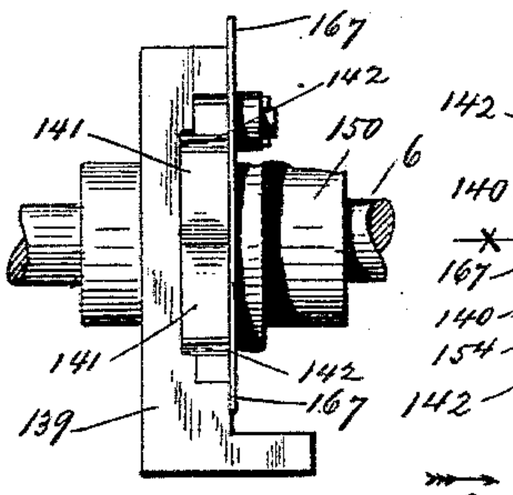

Fig. 7.

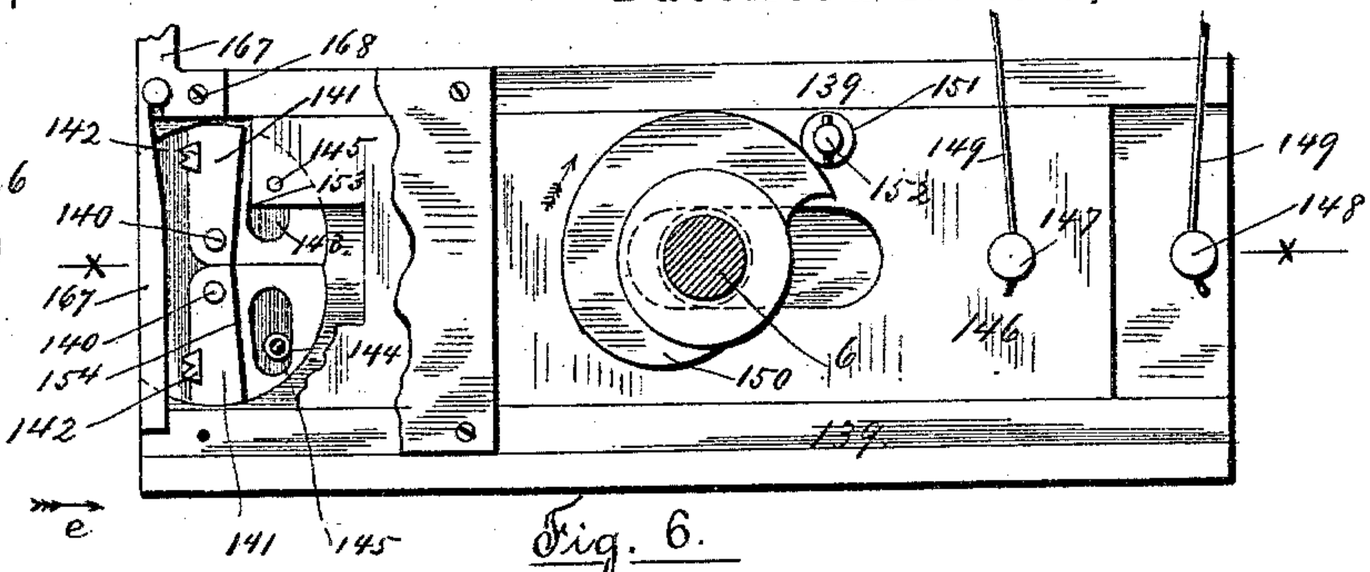

Fig. 6.

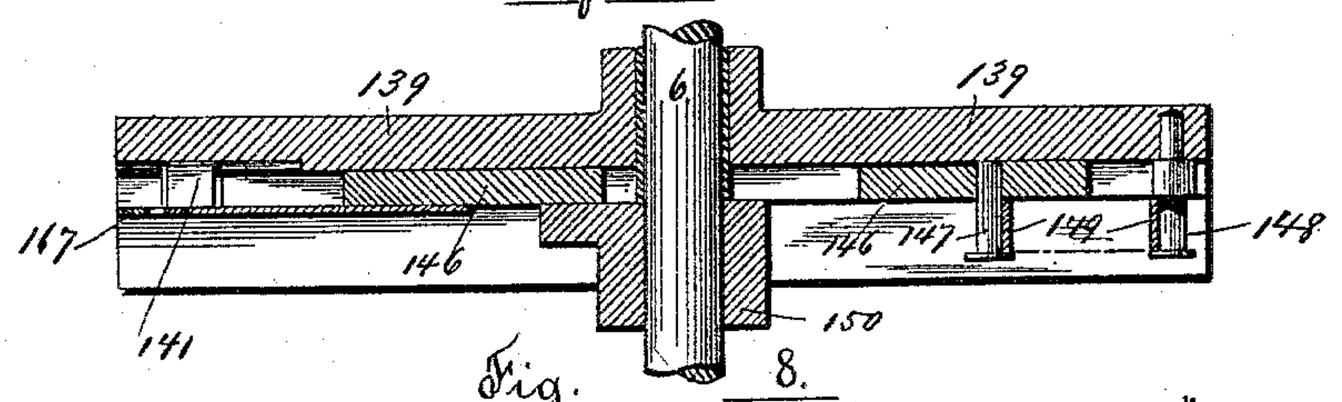

Fig. 8.

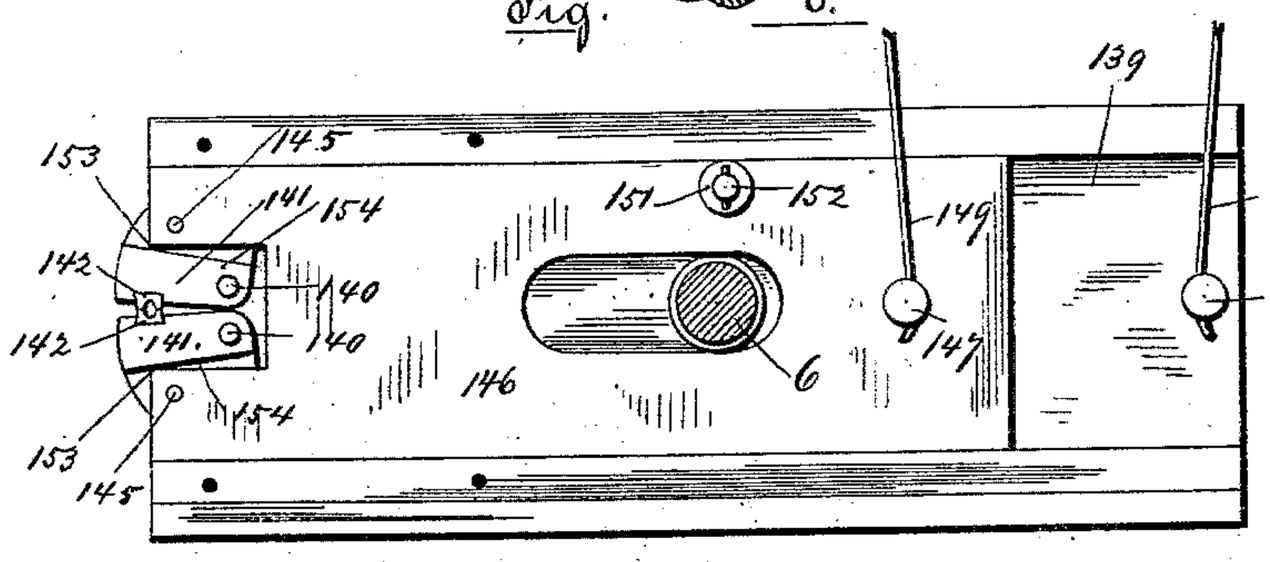

Fig. 9.

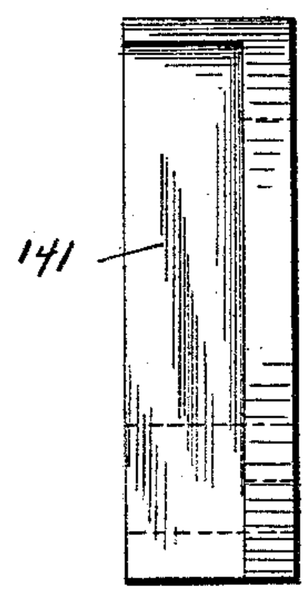

Fig. 11.

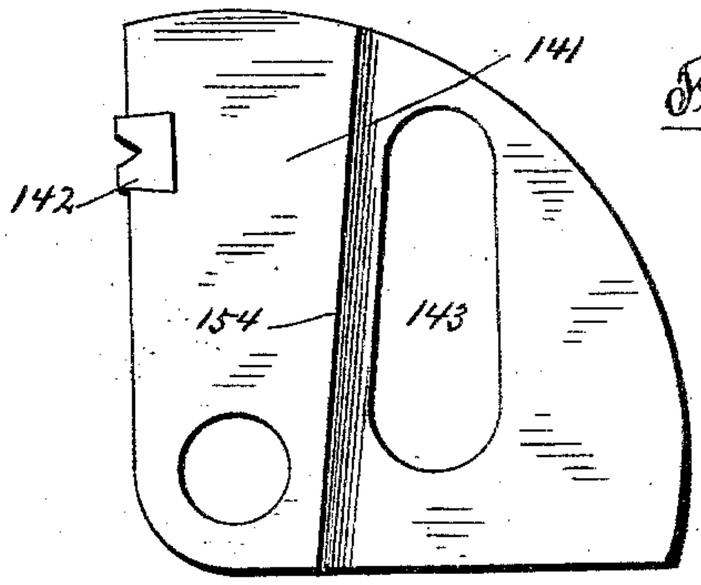

Fig. 10.

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BALE TIE MACHINE.

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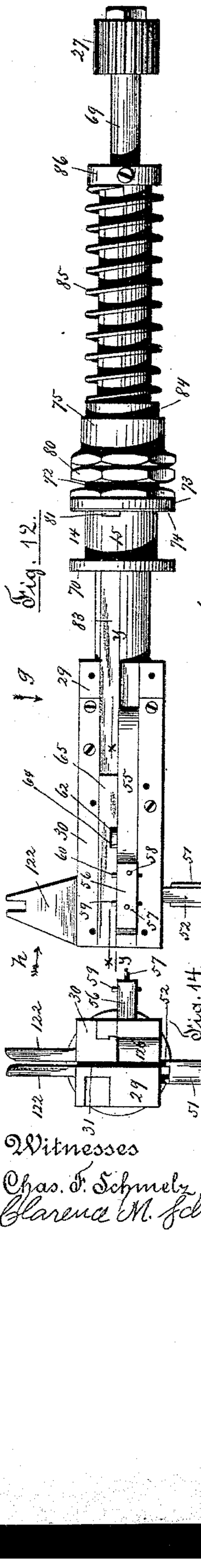

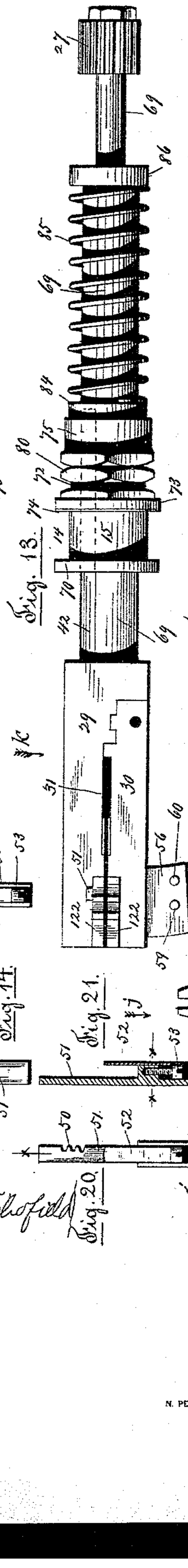

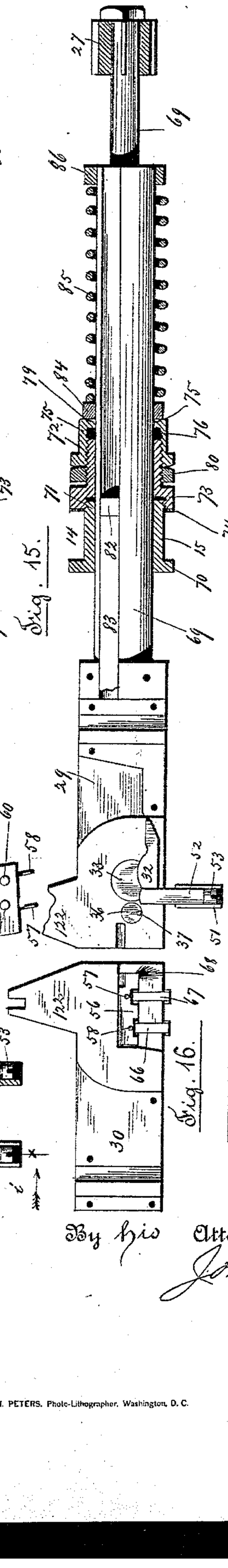

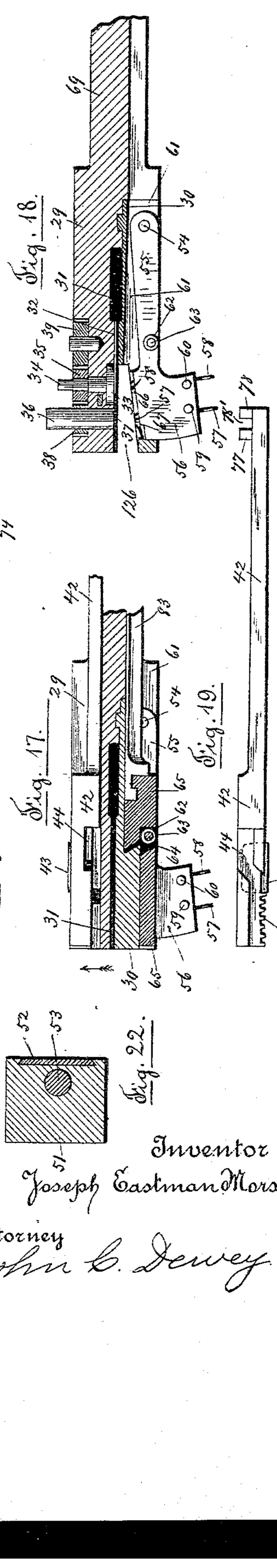

Witnesses

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BALE TIE MACHINE.

No. 414,430. Patented Nov. 5, 1889.

Fig. 24.

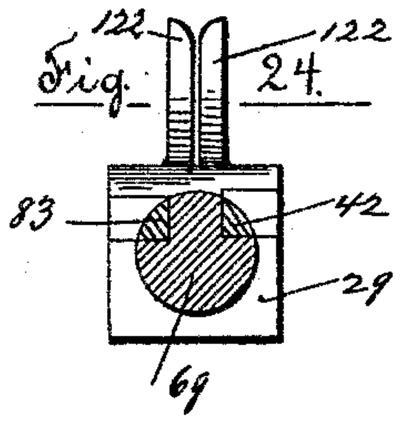


Fig. 23

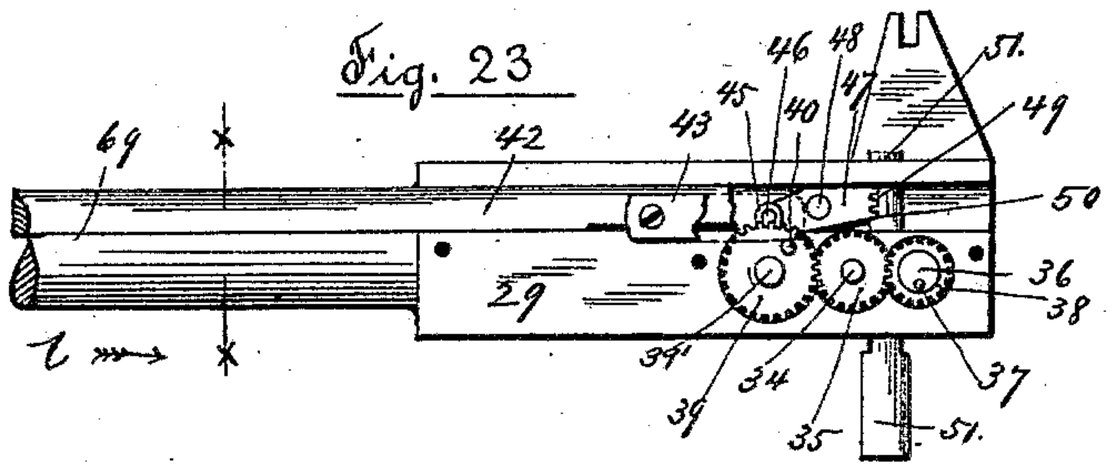


Fig. 25.

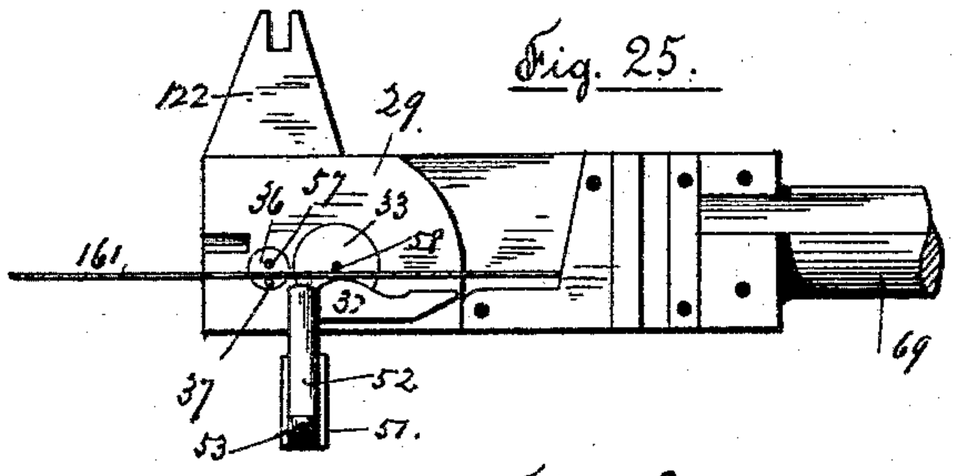


Fig. 26.

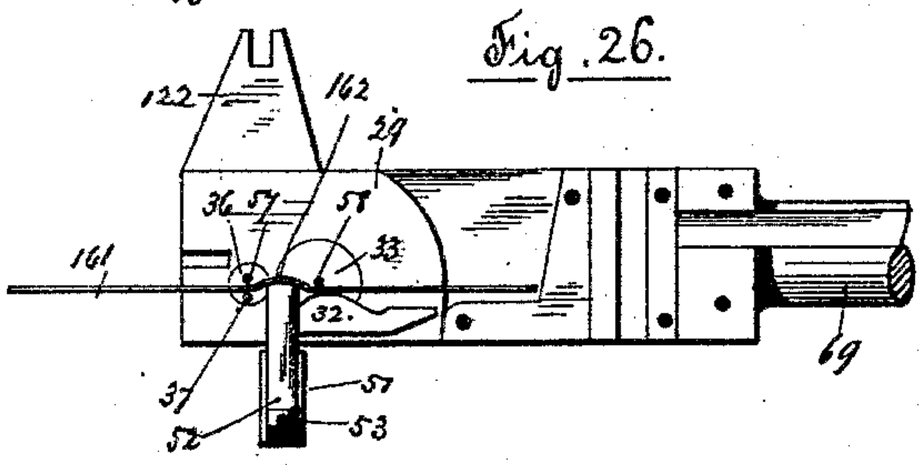


Fig. 27.

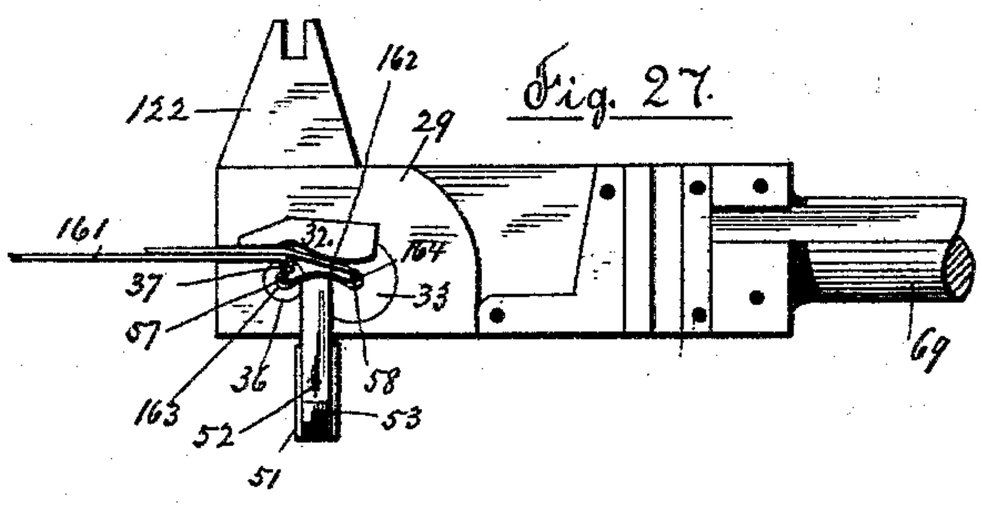


Fig. 28.

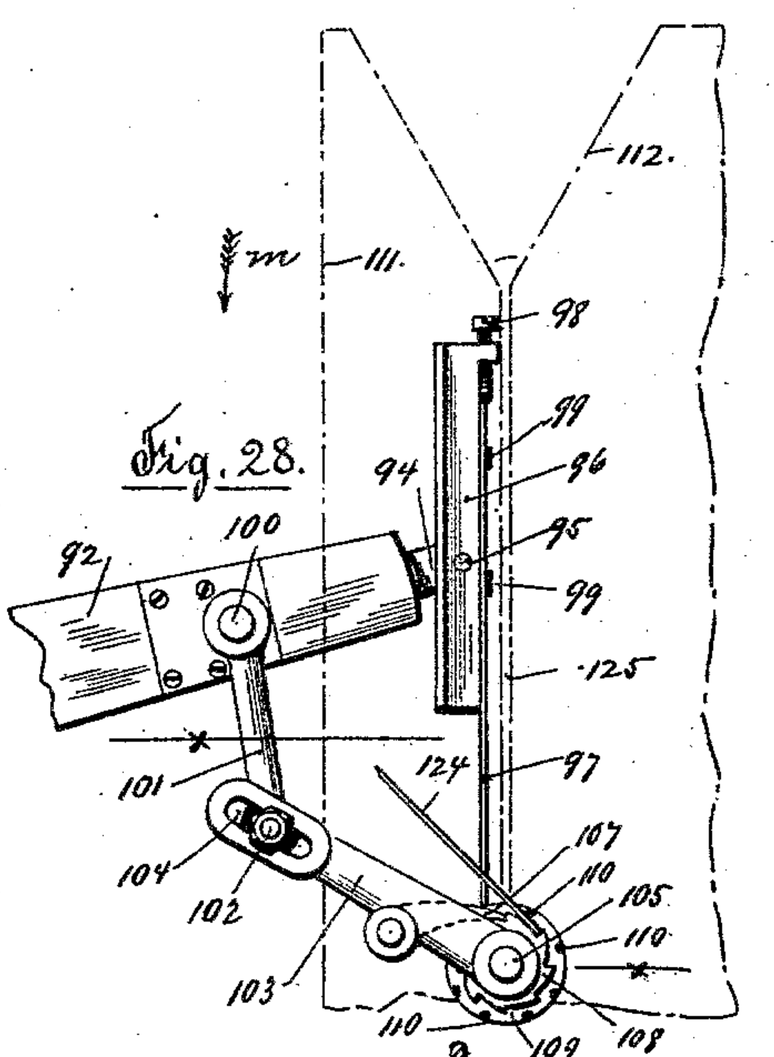


Fig. 29

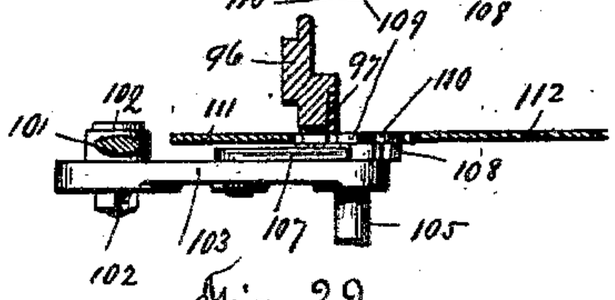
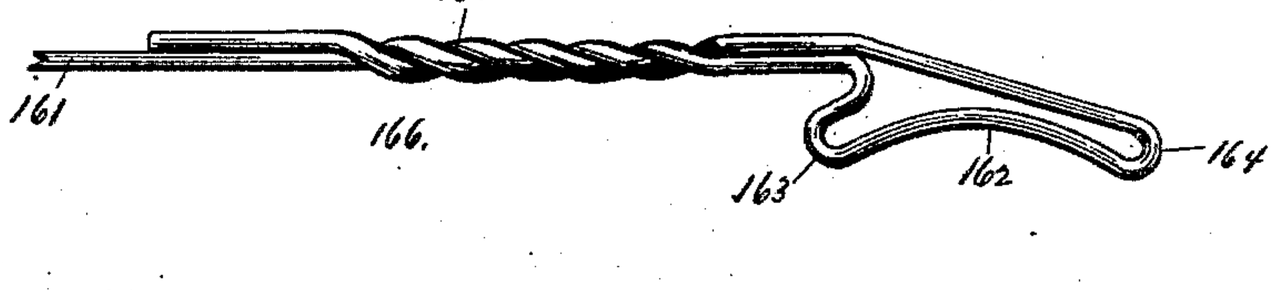


Fig. 30.



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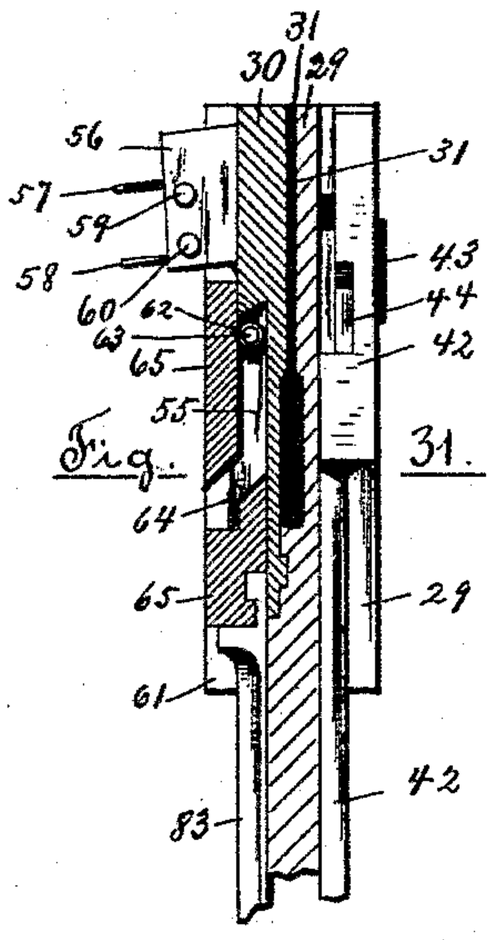

Fig. 31.

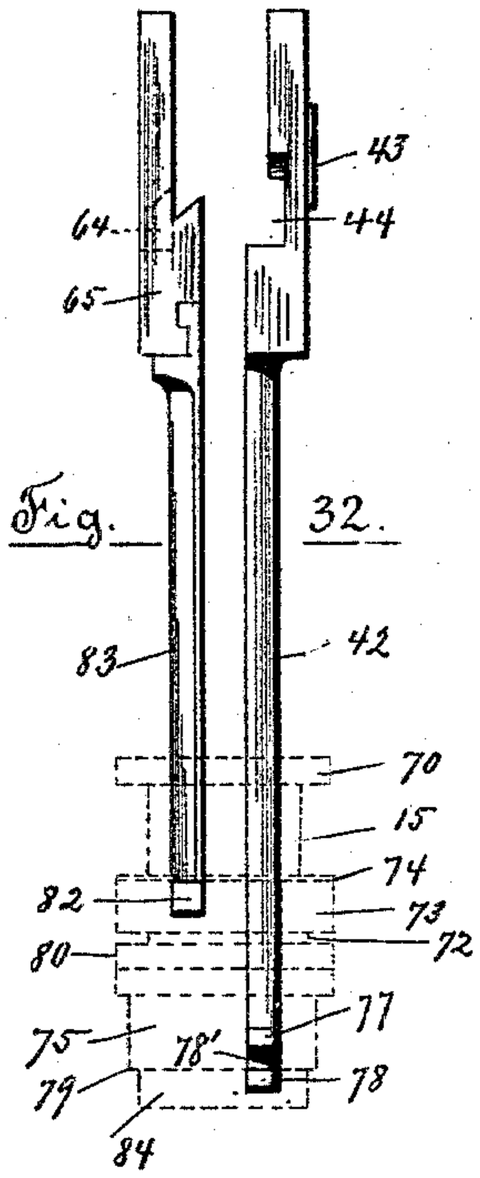

Fig. 32.

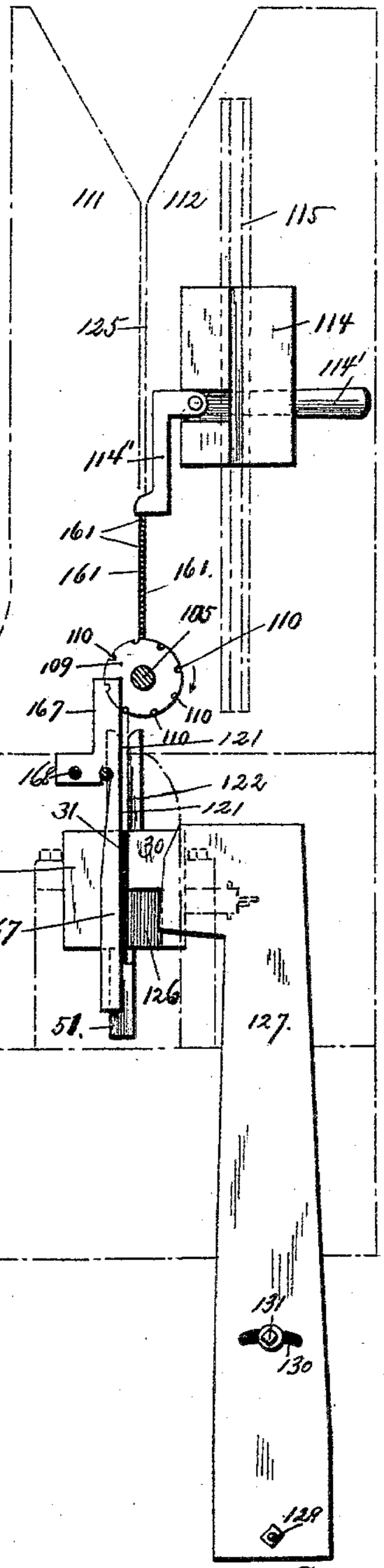

Fig. 33.

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UNITED STATES PATENT OFFICE.

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BALE-TIE MACHINE.

SPECIFICATION forming part of Letters Patent No. 414,430, dated November 5, 1889.

Application filed December 31, 1888. Serial No. 295,030. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH EASTMAN MORSE, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Bale-Tie Machines; and I do hereby declare that the following is a full, clear, and exact description thereof, which, in connection with the drawings, making a part of this specification, will enable others skilled in the art to which my invention belongs to make and use the same.

My invention relates to automatic machines for making wire bale-ties, more particularly of the description shown in Fig. 30 of the drawings—to wit, with a hook on one end, which is adapted to engage a loop on the other end.

Only the hook end of the tie is made on the machine shown in the drawings and to be hereinafter described.

The object of my invention is to provide an automatic bale-tie machine to feed in the strands of wire to be operated upon at regular intervals, to bend the wire and form the hook, to grip the two wires during the twisting operation, and to discharge the finished hook, all in regular order; and my invention consists in certain novel features of construction and operation of mechanisms for carrying out the several steps above mentioned in the manufacture of wire bale-ties, as will be hereinafter fully described, and the nature thereof indicated by the claims.

Referring to the drawings, Figure 1 is a plan view of a bale-tie machine embodying my improvements. Fig. 2 is a partial side view of the machine shown in Fig. 1, looking in the direction of arrow *a*, same figure. Fig. 3 is a view of the opposite side, looking in the direction of arrow *b*, Fig. 1. Fig. 4 is a front end view looking in the direction of arrow *c*, Fig. 1. Fig. 5 is a rear end view looking in the direction of arrow *d*, Fig. 1. Figs. 6 to 11, inclusive, are detail views of the vise mechanism for gripping and holding the wires during the twisting operation, to wit: Fig. 6 is a rear view of the vise mechanism with a portion of the protecting-plate broken away to show the interior parts, the gripping-jaws being shown open. Fig. 7 is an end view of the same looking in the direction of arrow *e*, Fig. 6. Fig. 8 is a horizontal section on line *x x*, Fig. 6. Fig. 9 is a rear view similar to Fig. 6, the gripping-jaws being shown closed. Fig. 10 represents on an enlarged scale one of the gripping-jaws detached; and Fig. 11 is an edge view of the jaw shown in Fig. 10, looking in the direction of arrow *f*, same figure. Figs. 12 to 24, inclusive, are detail views of the flier and parts connected therewith, which receive the end of the wire to be operated upon, bend it to form the hook, and twist the wires together, to wit: Fig. 12 is a front view of the flier, looking in the direction of arrow *a*, Fig. 1, as it appears when removed from its bearings on the bed of the machine and with the protecting-plate at the head removed. Fig. 13 is a top view looking in the direction of arrow *g*, Fig. 12. Fig. 14 is an end view looking in the direction of arrow *h*, Fig. 12. Fig. 15 is a central longitudial vertical section of the spindle portion of the flier shown in Fig. 12, while the two parts constituting the head of the flier are taken apart, showing the main part thereof. Fig. 16 is a view of the second part of the head to be applied and secured to the part shown in Fig. 15. Fig. 17 is a horizontal section of the head portion of the flier, taken on line *x x*, Fig. 12, looking in the direction of arrow *g*, same figure. Fig. 18 is a similar section taken on line *y y*, Fig. 12. Fig. 19 is a side view of the sliding rack employed for operating the presser and the hook-forming spindles. Fig. 20 is a front view of the presser as it appears when removed from the head. Fig. 21 is a vertical section on line *x x*, Fig. 20, looking in the direction of arrow *i*, same figure. Fig. 22 represents on an enlarged scale a horizontal section on line *x x*, Fig. 21, looking in the direction of arrow *j*, same figure. Fig. 23 is a rear view of the head of the flier, looking in the direction of arrow *k*, Fig. 13, with the protecting-plate removed; and Fig. 24 is a section on line *x x*, Fig. 23, looking in the direction of arrow *l*, same figure. Figs. 25 to 27, inclusive, are diagrams showing the head of the flier as shown in Fig. 15, with the secondary portion removed to illustrate the manner of bending the wire and forming the hook, to wit: Fig. 25 shows the wire in

place ready to be operated upon. Fig. 26 shows the wire bent by the presser, and Fig. 27 shows the free end of the wire bent over and the hook formed. Fig. 28 is a detail view of the mechanism by which the ends of the wires to be operated upon are fed into the flier. Fig. 29 is a cross-section on line *x x*, Fig. 28, looking in the direction of arrow *m*, same figure. Fig. 30 represents, full size, the finished hook end of the bale-tie made by my machine. Fig. 31 is a horizontal section of the head portion of the flier corresponding to the view shown in Fig. 17, except that some of the parts are shown in a different position. Fig. 32 is a top view of the slides detached, for operating the mechanisms on the flier-head, and shows the connections of the slides with the collars and sleeves (shown in dotted lines) on the flier-spindle; and Fig. 33 is a diagram of the front end of the flier-head, the spring-guide and guiding-plate for directing the wire into its proper position in the flier-head, the carrier-wheel for feeding in the wires, the reservoir, and the weight for forcing the wires down, all as will be hereinafter fully described.

In the accompanying drawings, 1 is the bed of the machine mounted on legs and supporting in bearings 2 the main shaft 3, which carries the driving-pulley 4 fast thereon. On the main shaft 3 is secured the pinion 5, by which is driven, through the gear 7, the cam-shaft 6, having a cam 8 thereon, the groove 9 of which receives a roll 10 on the upper end of the rocker-arm 11, which is pivoted at 12 on the under side of the bed of the machine (see Figs. 2, 3, and 5) and obtains a rocking motion as the cam 8 is rotated. Opposite the roll 10 on the rocker 11 is a similar roll 13, which travels in the groove 14 of the adjustable sleeve 15 on the flier-spindle 69, and it will be readily understood that the rocking motion of the arm 11 through roll 13 will cause a reciprocating motion of the sleeve 15 on the flier-spindle. On the under side of the bed 1, in bearings 16, is supported the crank-shaft 17, to which rotary motion is imparted through the gear 17′ fast on said shaft, meshing into the gear 7 on cam-shaft 6. (See Figs. 3 and 5.) At the outer end of said crank-shaft 17 is secured the crank arm 18, provided at its free end with a roll 19, adapted to enter grooves 20 in star-wheel 21, (see Figs. 1, 3, and 5,) thereby causing the latter to partly rotate at regular intervals, the roll 22 on the arm 23 (see Figs. 1 and 4) entering the groove 20, which at the time is brought opposite it, serves to hold the star-wheel 21 stationary, when it is not revolved by crank-arm 18. The star-wheel 21 is supported on shaft 24, hung in bearings 25 on the under side of the bed of the machine, and attached to the star-wheel 21, or made integral therewith, is the spur-gear 26, the teeth of which mesh into the pinion 27, secured on the rear end of the flier-spindle 69, which is supported in bearings 28 on the bed 1.

I will now proceed to describe the construction and operation of the flier, which receives the end of the bale-tie wire to be operated upon, bends the wire and forms the hook by a series of operations, as shown in the diagrams, Figs. 25 to 27, inclusive.

In Figs. 12 to 24, inclusive, and also in Fig. 31, is illustrated the construction of the flier, the protecting-plates being left off in order to show the interior parts.

The flier consists, essentially, of two parts—viz., the head and the spindle—the former containing all the mechanisms for bending the wire and forming the hook, while the latter in a great measure carries the means for operating the different devices contained in the former.

The head of the flier is composed of two sections 29 and 30, the main section 29 being made in this instance integral with the spindle 69, while the other section 30 is adapted to be removed (see Fig. 16) from the main body 29 of the flier, in order to facilitate the building and fitting of the interior mechanisms. When both sections are properly secured together, a slot 31 (see Fig. 13) is left for the end of the bale-tie wire to enter and rest on top of the folder-blade 32, Figs. 15 and 25, which is of the same thickness as the diameter of the wire and which is attached to the disk 33, secured on the spindle 34, which extends through the main section and carries at its rear end the pinion 35. (See Fig. 23.) Close to the spindle 34 is the heel-forming spindle 36, carrying the pin 37 and having at its rear end the pinion 38, meshing into the pinion 35. (See Figs. 18 and 23.) Into the pinion 35 also meshes the pinion 39 on a stud 39′, and having a pin 40, which serves to hold the train of pinions 35, 38, and 39 in proper position ready to operate, as follows: The pinion 39 is engaged by the rack-teeth 41 (see Figs. 19 and 23) on the sliding rack 42, which is adapted to slide in a groove in the flier spindle and head and which is provided with a plate 43 at its forward end, adapted to ride over the pin 40 after the necessary amount of rotation on the part of the pinion 39 is accomplished, and hold the pinion 39 and pinions 35 and 38 in position. As the number of rack-teeth 41 is limited, and the rack 42, after rotating the pinion 39, still continues its forward movement, it is necessary to retain the gear 39 in such a position that the rack-teeth 41 on the return movement of the rack 42 will strike the same tooth on the pinion 39 which it left when going forward, and furthermore to counteract the amount of spring resistance which will be the natural result of bending the wire, and it is particularly for the purposes above mentioned that the plate 43 and pin 40 are provided. The sliding rack 42 also has a groove 44 (see Fig. 19) to receive a roll 45, (see Fig. 23,) which turns on a stud 46, secured at one end of the lever 47, pivoted at 48 on the main section 39 of the flier, and

provided with teeth 49 at its other end opposite from the roll 45, which teeth 49 mesh into teeth 50, cut in the edge of the presser-slide 51. It will thus be seen that the reciprocating motion of the rack 42 by means of the groove 44 and roll 45 will cause the lever 47 to rock, and thereby raise or lower the presser-slide 51, in addition to operating the pinion 39 by the teeth 41, as above described.

The construction of the presser-slide 51, which acts to bend the wire, (see Fig. 26,) may be seen in Figs. 20, 21, and 22, in which 52 is the presser-blade proper, resting with its lower edge on the shoulder of the screw-head 53. The screw itself is screwed into the lower part of the slide 51, so that by slightly turning said screw the presser-blade 52 may be raised or lowered, as desired, and a close adjustment of the same obtained.

The parts of the flier so far described are contained in the main section 29, and I will now describe the mechanisms contained in the other section 30 of the flier-head. (See Figs. 12, 14, 16, 17, and 18.)

Pivoted in a recess 61 and on a pin 54 is a bar 55, having its outer end 56 enlarged (see Fig. 18) to receive the pins 57 and 58, which extend through the head 56 and are held therein by the wedge-pins 59 and 60. The free end of the wire tie is bent around the inner ends of the pins 57 and 58. (See Fig. 27.) The bar 55 is provided on its top surface with a roll 62, loosely running on a stud 63 and adapted to enter into the cam-shaped groove 64 of the slide 65. (See Figs. 17 and 31.) It will be seen that a reciprocating motion on the part of slide 65 will cause the bar 55 to swing horizontally on its pivot-pin 54, thus bringing the inner projecting ends of the pins 57 and 58 closely against the inner surface of the main section 29 of the flier-head. (See Fig. 31.) Secured in the secondary section 30 and arranged beneath the head 56 of the swinging bar 55, and beneath the inner ends of the pins 57 and 58, are two stationary clearing-plates 66 and 67, (see Fig. 16,) for the purpose of clearing the hook after it is formed in the head of the flier from the pins 57 and 58 in case said hook clings to said pins, which would cause the wire to be drawn into the recess 61, when the head 56 is swung outwardly after the wire is bent around the pins 57 and 58 and twisted. And, furthermore, the secondary section 30 is chipped away at 68, (see Fig. 16,) so as to remove any possibility of the hook-toe 163 catching to prevent the discharge of the finished bale-tie from the flier.

I will now proceed to describe the construction of the flier-spindle. Sliding on the spindle 69 is a sleeve 15, having at its front end a flange 70 and having its rear end screw into the sleeve 72, which has a flange 73, against which a washer on the sleeve 15 bears. (See Fig. 15.) The groove 14, between the flange 70 and washer 74 on the sleeve 15, receives the roll 13 on the rocker-arm 11, as before described. The rear end of the sleeve 72 is also screw-threaded externally to screw into the nut 75, which is recessed at 76 to receive the projection 77 on the slide 42, (see Fig. 19,) while a similar projection 78, in conjunction with the projection 77, forms an opening 78′ to receive shoulder 79 on the nut 75. It will be understood from the drawings that by turning the nut 75 on the sleeve 72 the distance from the groove 14 in the sleeve 15 to the shoulder 79 on the nut 75 will be varied, and after the proper adjustment has been made a check-nut 80 may be employed to firmly hold the parts in their proper relative positions. The sleeve 15 is cut away at 81 to receive the projection 82 on the sliding rack 83, which operates the cam-slide 65, (see Figs. 12, 15, and 17,) so that by the rotation of the main cam 8 through the rocker-arm 11 a reciprocating motion is imparted to both of the sliding racks 42 and 83 and the cam-slide 65. Against the rear end of the nut 75 is placed a wearing-washer 84, forming a surface for one end of the spiral spring 85, encircling the spindle 69, to bear against, while the other end of said spring bears against the collar 86, secured on the rear end of the spindle 69.

I will now proceed to describe the mechanism by which the ends of the wires to be operated upon by the flier are fed into the flier at regular intervals by a positive feed device.

On the cam-shaft 6 is secured a cam 87, (see Figs. 1, 3, 4, and 5,) having a groove 88, Fig. 4, to receive a roll 89′, Figs. 1 and 3, secured to the lower end of the arm 89, which is pivoted at 90, Figs. 4 and 5, to the framework 91, arranged on top of the bed 1. A second arm 92, also pivoted at 90, forms, with arm 89, a bell-crank lever 93. The arm 92 of the bell-crank lever 93 carries at its forward end a slide 94, (see Fig. 28,) to which is attached by means of a pin 95 the vertical sliding plunger 96, moving in ways provided in the upper part of the frame 91. (See Fig. 1.) To the front face of the vertical sliding plunger 96 is secured the forcer-blade 97, with its upper end bearing against the lower end of the adjusting-screw 98, and being firmly held against the face of said plunger 96 by the screws 99. (See Figs. 1, 2, and 28.) Near the forward end of the arm 92 of the bell-crank lever 93, at 100, is attached the pitman-rod 101, (see Figs. 4, 5, and 28,) the lower end of which is provided with a bolt 102, adapted to be clamped to the outer end of the lever 103, which has a slot 104 therein to allow adjustment of the bolt 102. The inner end of the lever 103 is pivoted on the stud 105, which is firmly held in the casting 106, secured to the frame 91. (See Figs. 1 and 4.) On the inner side of the lever 103 is pivoted the pawl 107, which is adapted to engage the ratchet-teeth 108 on the carrier-wheel 109, having notches 110 in its periphery, each notch adapted to receive one of the wires to be operated upon as they drop down

the upper slot 125, which is formed by the edges of the guiding-plates 111 and 112, the former of which is secured on the frame 91, while the other is attached to the supporting-frame 113.

The ends of the wires to be operated upon are placed in the slot 125 and are evened against the gage-plate 116, secured on the frame 91 by bolts 117. (See Figs. 1, 2, 3, and 5.) In order to insure the ends of the wires to be operated upon dropping down the slot 125, which serves as a reservoir to hold the wires, and into the notches 110 on the carrier-wheel 109, I may employ a weight 114, sliding on a way 115, (see Figs. 1 and 33,) said weight 114 having a handle 114′, by which it is raised or lowered by the operator, and a hinged latch 114″, secured to the inner end of said handle, which may be turned so that the latch 114″, which is adapted to extend over and rest on the wires 161, may be moved out of the way to allow the ends of the wires 161 to be placed in the reservoir 125.

Any other suitable weight device may be employed in lieu of the one shown and described, or the weight may be dispensed with and the wires drop by their own gravity.

To the supporting-frame 113 by means of screws 118, (see Fig. 5,) is secured the wearing-plate 119, (see Figs. 4 and 5,) which fits closely around a portion of the periphery of the carrier-wheel 109 to retain the ends of the wires to be fed into the flier in the notches 110. By means of slots 120, through which the retaining-screws 118 extend, the wearing-plate 119 may be adjusted to the required fit.

The cam 87, for operating the bell-crank lever 93, is so constructed that the arm 92 in its upward travel will cause the carrier-wheel 109 to come to a momentary stop when the uppermost notch 110 is opposite or in line with the slot 125 to allow a wire to drop into said notch 110 in said wheel, and then the wheel 109 to continue its rotation until the lower notch is brought into line with the lower guide-slot 121 to allow the wire to drop out of the notch 110 and leave the carrier-wheel 109 to be forced down between the guides 122, Fig. 5, into the flier-head by the plunger 96 and its attached blade 97, (see Figs. 2 and 28,) which action will cause the wire to pass below the spring 123, (see Fig. 4,) which spring will then resume its normal position and hold the wire in the flier-head while it is being operated upon. The free end of a spring 124, secured to the casting 106, extends into the ratchet-teeth 108 and prevents said ratchet-teeth and carrier-wheel 109 from having a backward or retrograde movement.

By referring to Fig. 18 and also to Fig. 33 it will be seen that the secondary section 30 of the flier-head is cut away at 126 to provide a free passage for the finished bale-tie hook out of the flier, and, as it is of great importance that the end of the wire to be operated upon should be placed properly within the flier-head and held there, I have provided a guiding blade or plate 127, (see Figs. 2, 4, 5, and 33,) which is secured to the arm 128 by the bolt 129, and which is provided with a slot 130, through which the bolt 131 passes, so that a close adjustment of the upper end of the guiding-plate 127 may be obtained. The guiding-plate 127 is a thin plate of metal, and is so arranged in connection with the flier-head that its upper end extends up in a vertical position directly in front of the front end of the flier-head (see Figs. 2 and 33) with its front edge or face extending at right angles to the slot or opening 126 in the flier-head, (see Figs. 17, 18, and 33,) so as to act in connection with the guide-spring 167, to be hereinafter described, as a guide to direct the wires entering the slot 126 directly onto the folder-blade 32 and to hold them there during the bending operation. The arm 128, carrying the guiding-plate 127, is secured on the shaft 132, (see Fig. 2,) which has bearings 133 on the under side of the bed 1 and carries an arm 134, (see Fig. 4,) to the free end of which is secured a roll 135, loosely running on a stud 136 and which travels on a cam 137 on the crank-shaft 117. The stud 136, carrying the roll 135, extends through the arm 134 and rests upon the free end of the U-shaped spring 138, the other end of which is fastened to the under side of the bed 1. Said spring 138 serves to hold the roll 135 against the cam 137, thereby causing the free end of the arm 134 to move up and down as the cam 137 revolves, causing the shaft 132 and arm 128 secured thereon to have a rocking motion, and the guiding-plate 127 to move in toward the flier-head at the proper time when the end of the wire to be operated upon is forced down by the plunger-blade 97 into the flier-head, and said guiding-plate 127 to move out away from the flier-head at the proper time when the hook on the end is finished.

I will now proceed to describe the vise mechanism for gripping and holding the wire strand and the loose end (after the bending operation) together, one on top of the other, during the revolution of the flier and the twisting of the wires together.

The vise mechanism is fully illustrated in Figs. 6 to 11, inclusive. At the front end of the machine, (see Fig. 4,) and at right angles to the axis of revolution of the flier on the bed 1, is secured a stand 139, the inner face of which has grooves or ways in which the slide 146 is adapted to move back and forth. At the forward end of the stand 139, next to the head of the flier, are pivoted on studs 140 two jaws 141, moving in a vertical plane on their pivot-points. Said jaws 141 carry the grippers 142, of hardened metal, secured in the contiguous edges thereof, between which the wires to be gripped extend. Slots 143 extend through the jaws 141, adapted to receive rolls 144, which are held on studs 145 on the slide 146. (See Fig. 6.) At the rear end of the slide 146 is secured a stud 147,

and a similar stud 148 is secured in the rear part of the stand 139. Said studs 147 and 148 are slotted and adapted to receive the ends of the U-shaped spring 149, by means of which the slide 146 is moved forward and the pivoted-jaws 141 closed. The backward movement of the slide 146 (against the action of the spring 149) and the opening of the jaws 141 are caused by the cam 150, secured on the cam-shaft 6 and operating against the roll 151, which turns on the stud 152 on the slide 146. (See Figs. 1 and 6.) As the cam 150 rotates, the spring 149 will cause the slide 146 to move toward the flier-head, and by means of the rolls 144 on the slide, which extend into the slots 143 in the jaws 141, will cause the jaws 141 to close loosely, and upon a continued further movement of the slide 146 the corners 153 thereof will act against the inclined surfaces 154 of the jaws 141, (see Fig. 9,) closing the same tightly and in such a way that each of the grippers 142 partly incloses one wire, and the two wires are held one on top of the other.

For the purpose of guiding the wires into the proper place for the grippers 142 to act on and into the proper position in the slot in the flier-head, I employ a spring 167, which is secured by the screw 168 to the forward end of the vise-stand 139. (See Fig. 6.) Said spring 167 acts in connection with the guiding-plate 127, before described, (see Fig. 33,) to guide the wires onto the folder-blade 32, and to hold them there during the bending operation. When the cam 150 commences to act against the roll 151, the movement of the slide 146 will be rapid in order to quickly release the wires from between the gripping-jaws after the twisting operation and allow the finishing-hook to be discharged from the flier-head by the discharging mechanism, which I will now proceed to describe.

On the front end of the cam-shaft 6 is secured the disk 155, having a pin 156, adapted to enter into the slots 157, four in number, in the discharging-wheel 158, thereby turning the same one-quarter of a revolution for each complete revolution of the disk 155. Check-pins 159 are provided on the discharging-wheel 158, which extend into a notch 156′ in the periphery of the disk 155, in order to retain the discharging-wheel 158 in proper position, so that as the wire to be operated upon is fed into the flier-head and below the retaining-spring 123 it may come to a point of rest within the notches 160 of the discharging-wheel, which, after the finishing-hook is made, rotates one-quarter of a revolution, thereby carrying the wire resting in the notch 160 along with it out of the flier and discharging it from the machine by a regular and positive motion.

I will now briefly describe the operation of my bale-tie machine to manufacture the finished hook 166. (Shown in Fig. 30 of the drawings.)

A number of wires are placed in the slot 125, between the guide-plates 111 and 112, which acts as a supply-reservoir, with the ends to be operated upon butting against the gage-plate 116, and their other ends extending out from the front of the machine and supported on a bench or table. (Not shown.) The latch 114″ of the weight 114, sliding in the ways 115, is placed on top of the wires to insure their dropping down into the notches 110 of the carrier-wheel 109. The machine is now put into operation, and through the cam 87 on cam-shaft 6 and bell-crank lever 93 the carrier-wheel 109 is revolved, and as the notches 110 therein pass under the slot 125 the ends of wires drop into said notches and are carried around into line with the lower guide-slot 121. The plunger 96, with its blade 97, is, by the cam 87 acting on the bell-crank lever 93 through slide 94, brought into its highest position, so that the lower end of the plunger-blade 97 reaches a point above the wire in the carrier-wheel 109. The plunger-blade 97, by the continued revolution of the cam 87, descends at the proper time, forcing the wire which has dropped from the lowest notch 110 in the carrier-wheel 109 into the slot 121, down said slot beneath the retaining-spring 123 and into the recess 126 in the flier-head, and by means of the guiding-plate 127, which is moved toward the flier-head at the proper time by the mechanism hereinbefore described, in connection with the guide-springs 167, (see Fig. 33,) the wire is guided directly on to the top of the folder-blade 32, and spur 37 on the disk 36 in the flier-head. The rack 42 and slide 83 on the flier-spindle are now moved backward toward the end of the flier by means of the sleeve 15, actuated through rocker-arm 11 by cam 8 on cam-shaft 6. The backward movement of the slide 83, through the cam-slide 65 and roll 62 on the bar 55, moves said bar 55 inward and holds it there, (see Fig. 31,) thus bringing the pins 57 and 58 over the wire 161. (See Fig. 25.) The backward movement of the sliding rack 42 rocks the lever 47 through the intervention of the groove 44 in said rack 42 and the roll 45 on the lever 47, (see Fig. 23,) causing the presser-plate 52 to be raised to form the bend 162 in the wire. (See Fig. 27.) The continued backward movement of the sliding rack 42 causes the disk 33, carrying the folder 32, and the disk 36, carrying the pin 37, to revolve through the intervention of the teeth 41 on rack 42, engaging the pinion 39′, which drives the pinions 35 and 36 (see Fig. 23) and bend the end of the wire around the pins 57 and 58. (See Fig. 27.) The pin 37 draws in the wire and forms the heel portion of the hook 166. The end of the wire bent over by the folder 32 rests on the wire 161, and is held by the guiding-plate 127 in combination with the guiding-spring 167. (See Figs. 6 and 33.)

The gripping-jaws 141 of the vise mechanism, operated by the slide 146, in connection with the spring 149, now close on the wires just in front of the flier-head and hold them firmly during the revolution of the flier, which

twists the wires together at 165, back of the vise mechanism. The flier is revolved by means of the crank-arm on shaft 17, turning the star-wheel 21 and its gear 26 one-fifth of a revolution, which, through pinion 27 on the flier-spindle, causes a very rapid revolution of the flier-head containing the hook to twist the wires together, as above stated. During the twisting operation the guide-plate 127 moves back away from the guiding-spring 167 (see Fig. 33) and leaves room for the finished hook 166, when the flier stops revolving, the jaws 141 being opened, to be carried around and dropped out of the machine by the discharging-wheel 158, operated by the disk 155 on the cam-shaft 6, (see Fig. 4,) the pivoted bar 55, carrying the pins 57 and 58, having moved outward to leave a clear space, as above described. The operation is then repeated, and for each revolution of the driving-shaft 3 one finished hook 166 is made.

It will be understood that the details of construction of the several parts of the different mechanisms shown in the drawings and hereinbefore described may be varied somewhat, if desired, without departing from the principle of my invention.

Having thus described my improvements in machines for making wire bale-ties, what I claim as my invention, and desire to secure by Letters Patent, is—

1. In a bale-tie machine, a supply-reservoir for holding the wires to be operated upon, and a carrier provided with a groove capable of receiving but one wire at a time preparatory to the movement thereof toward the flier, and mechanism for causing said groove to be presented to the lower end of the reservoir at regular intervals, in combination with a flier adapted to revolve to twist the wires together, and carrying thereon mechanism for bending the wire, and means for operating said mechanism, consisting of a sliding rack and a pinion carried on the flier, substantially as set forth.

2. In a bale-tie machine, the positive intermittent feeding mechanism consisting of a notched carrier-wheel adapted to carry the wires to be operated upon into position to enter the flier-head, in combination with a vertical reciprocating plunger to force the wire after it has left the carrier-wheel down into the machine to be operated upon, and means for operating said carrier-wheel and plunger, substantially as shown and described.

3. In a bale-tie-machine feeding mechanism, the combination, with the carrier-wheel 109, provided with notches 110 and ratchet-teeth 108, operated by a pawl on a hinged lever connected with and operated by a bell-crank lever, of a vertical reciprocating plunger 96, carrying a plunger-blade adapted to engage and force down the wire after it leaves the carrier-wheel into the machine to be operated upon, and a slide connecting said plunger with the bell-crank lever which operates the carrier-wheel and said bell-crank lever, and means for operating the same, substantially as shown and described.

4. In a bale-tie machine, the combination, with the flier carrying thereon mechanism for bending the wire, of mechanism for operating the same, consisting of a sliding rack and a pinion carried on said flier, substantially as set forth.

5. In a bale-tie machine, a flier adapted to revolve, consisting of a head portion made in two parts, and a spindle portion connected with the head portion, said head portion having an opening to receive the wire and carrying mechanism for folding over the end of the wire, and mechanism for bending the wire to form the heel and toe part of the hook, and the spindle portion, carrying the means for operating the mechanisms in the head portion, in the manner substantially as shown and described.

6. The flier consisting of the head portion made in two parts 29 and 30, adapted to be detached from each other, and the spindle portion 69, integral with one of the head portions, the main part 29 carrying the mechanism for folding over the end of the wire and bending it into the form of a hook, consisting of a disk 33, carrying the folder-blade 32, a disk 36, carrying the pin 37, said disks driven by a system of pinions operated by a rack 42, and a presser-blade 52, operated by a toothed lever on said rack, and the secondary part carrying the forming-pins 57 and 58, around which the wire is bent, supported in a pivoted bar 55, which carries the forming-pins toward and away from the folder-blade 32, said pivoted bar being operated by a slide 83, all combined together and operated substantially as shown and described.

7. The combination, with flier-spindle 69, carrying the rack 42 and slide 83 for operating the hook-forming mechanisms in the flier-head, of a sleeve 15, for operating the slide 83, and the nut 75, for operating the rack 42, said nut being connected with said sleeve 15, and the position of said sleeve and nut being adjustable on the spindle 69 relatively to each other, substantially as shown and described.

8. In a bale-tie machine, the flier consisting of a head portion and a spindle portion, the head portion having a slot to receive the wire, and carrying mechanisms for folding over the end of the wire around forming-pins for bending the wire into the form of a hook and for releasing the wire from the forming-pins, and the spindle portion carrying a rack, and a slide for operating the hook-forming mechanisms, and sleeves for operating said rack and slide having a reciprocating motion and adjustable relatively to each other, substantially as shown and described.

9. The vise mechanism consisting of the stand 139, having two jaws 141, pivoted at its forward end, and provided with slots 143, and adapted to move toward each other to grip the wires and away from each other to release them, and a reciprocating slide 146,

moving in ways on said stand, and having rolls at its forward end to engage the slots 143 in the jaws, and moved in one direction by a spring and in the other direction by a cam engaging a roll on said slide, substantially as shown and described.

10. In a vise mechanism, the combination, with the stand 139, having jaws 141 with slots 143 therein, and inclined surfaces 154, pivoted on said stand and adapted to move toward and away from each other, of a reciprocating slide 143, having rolls 144 to engage the slots 143, and shoulders 153, to engage the inclined surfaces 154, and means for operating said slide to close the jaws to grip the wires and to open them to release the wires, substantially as shown and described.

11. In a bale-tie machine, the combination, with the flier adapted to revolve and having a slot into which the wire enters to be operated upon, of a spring-guide and a movable guiding-plate for directing the wire into the proper position in the flier and holding it there during the bending operation, substantially as shown and described.

12. In a bale-tie machine, the combination, with the flier-head having a slot therein into which the wire enters, and carrying a disk with the folder-blade for bending the wire, of a guiding-plate 127, adapted to be moved in to guide the wire to be operated upon onto the folder-blade, and to be moved out to release the wire, and means for operating said guiding-plate 127 at regular intervals, substantially as shown and described.

13. In a bale-tie machine, the combination, with the flier adapted to revolve and carrying mechanism for bending and forming the end of the tie, of mechanism operating intermittently for discharging the finished bale-tie from the flier, consisting of a disk or wheel having notches in its periphery in which the wire rests during the operation of the flier and having slots for engagement with a pin on a revolving disk or wheel, and said revolving disk or wheel, substantially as set forth.

14. In mechanism for discharging the finished bale-ties from the machine, the combination, with the wheel 158, having notches 160 in its periphery in which the main wire rests during the operation of the flier, and slots 157 therein, and stop-pins 159, of a disk 155, carrying a pin to engage the slot 157 in said wheel to operate the same intermittently, and a notch to engage the stop-pins 159, and means for operating said disk, substantially as shown and described.

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