(No Model.) 5 Sheets—Sheet 1.

F. B. GRISWOLD.

MACHINE FOR FORMING EYES ON WIRE BANDS.

No. 418,456. Patented Dec. 31, 1889.

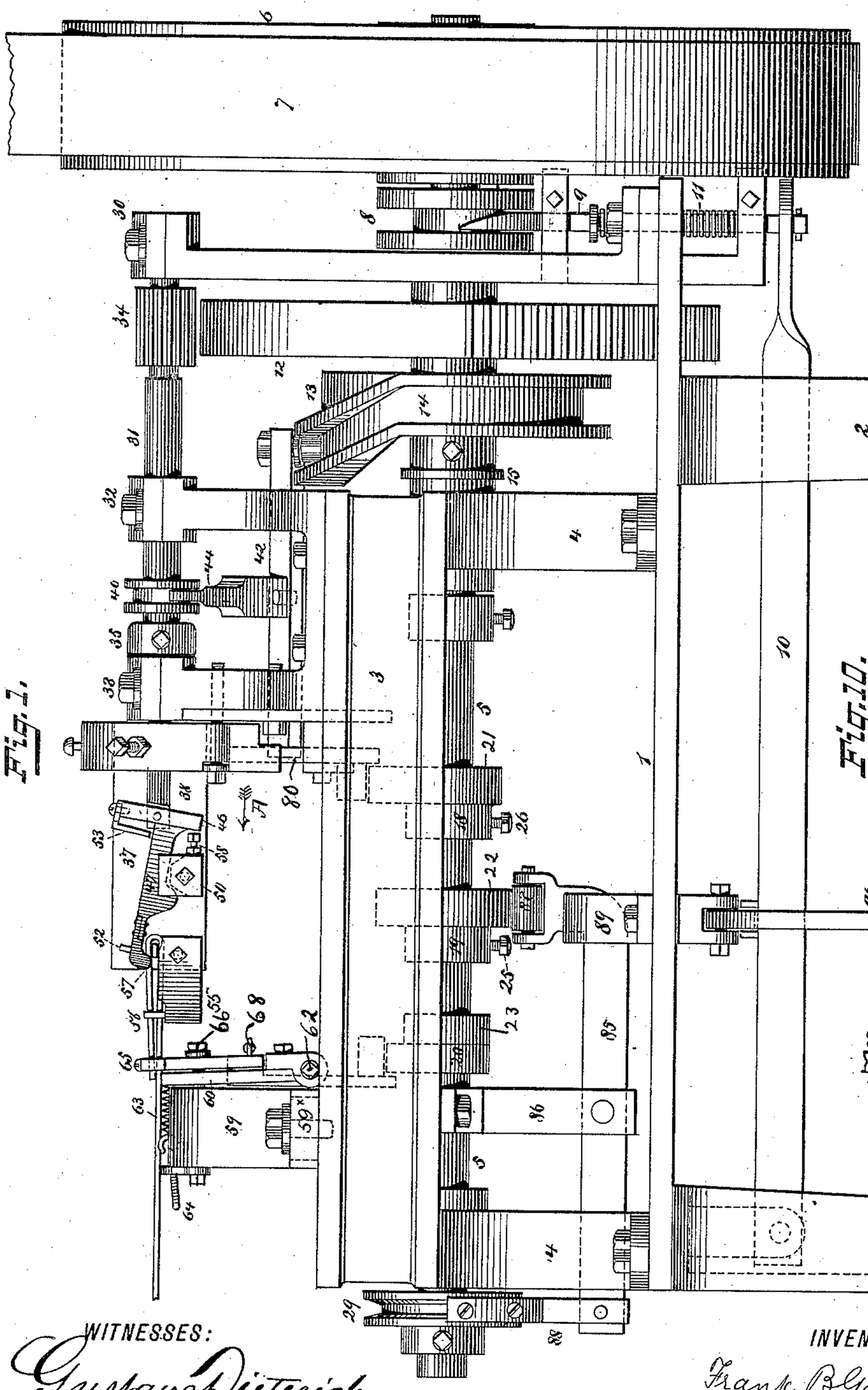


Fig. 1.

Fig. 10.

Fig. 11.

WITNESSES:
Gustave Dieterich.
William Goebel.

INVENTOR
Frank B. Griswold
BY
Parker, Benjamin
his ATTORNEY

(No Model.)

5 Sheets—Sheet 2.

F. B. GRISWOLD.

MACHINE FOR FORMING EYES ON WIRE BANDS.

No. 418,456. Patented Dec. 31, 1889.

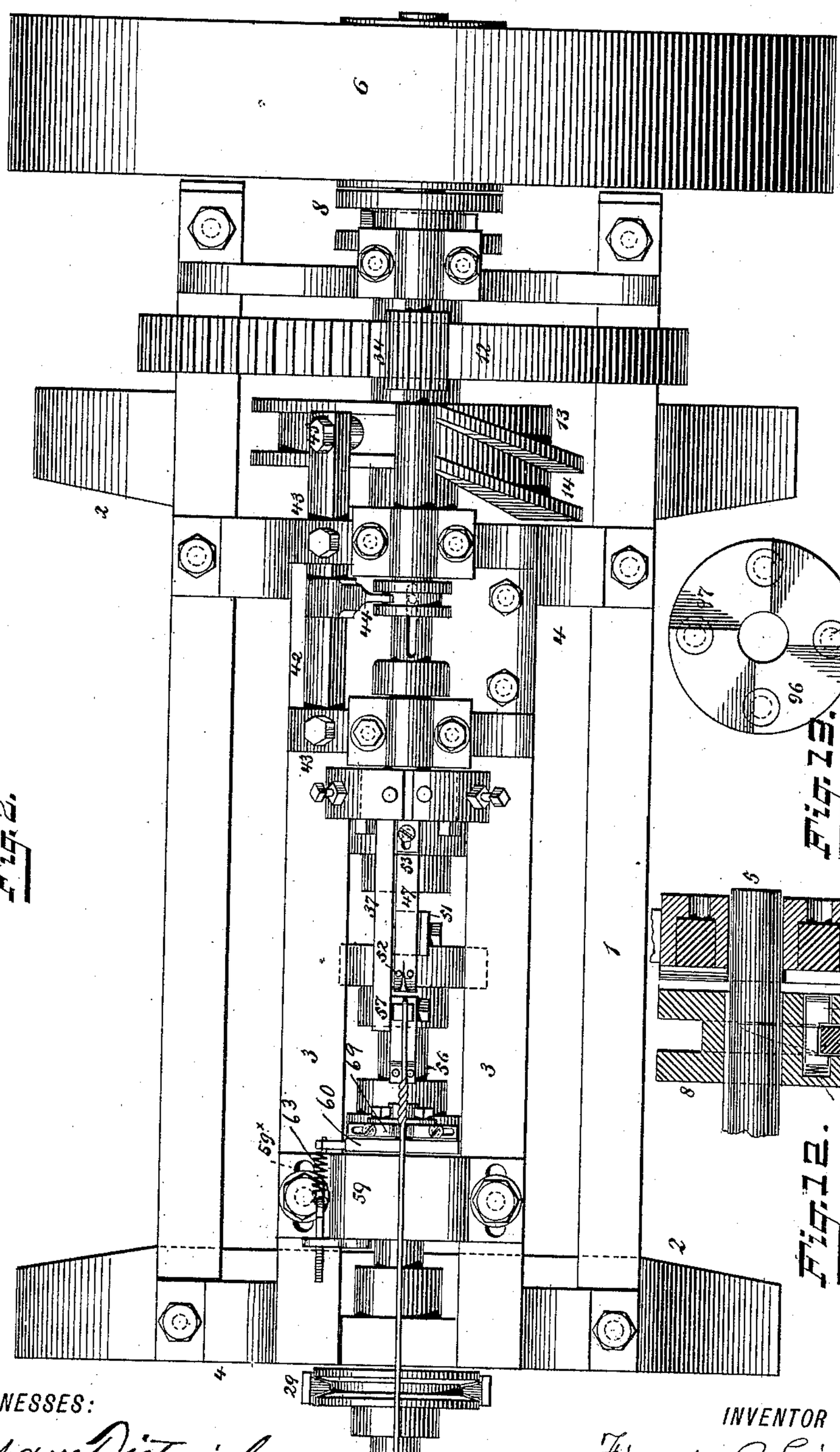


Fig. 2.

Fig. 3.

Fig. 4.

WITNESSES:

Gustave Dieterich.

William Goebel.

INVENTOR

Frank B. Griswold

BY

Parker Benjamin

His ATTORNEY

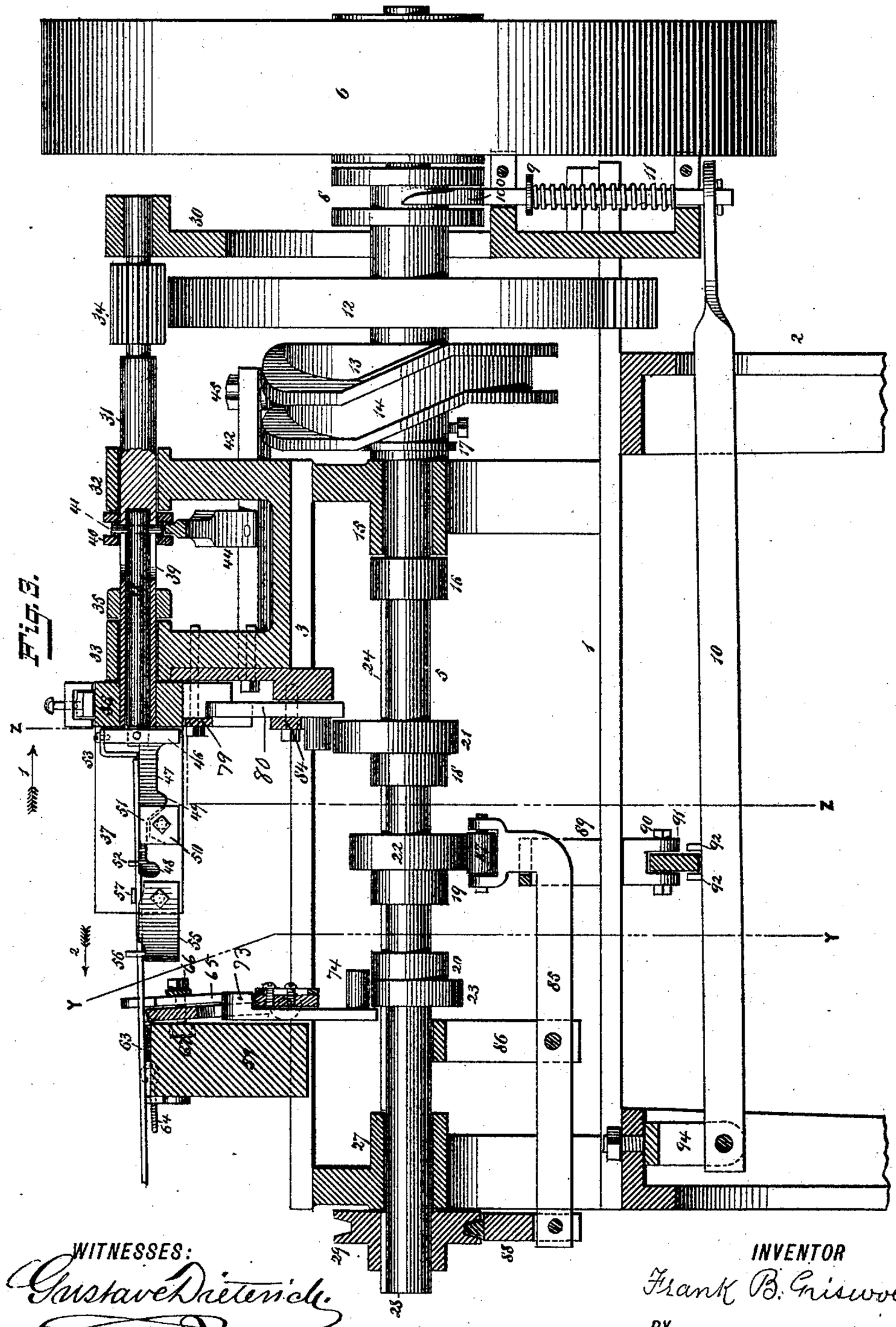
(No Model.) 5 Sheets—Sheet 3.

F. B. GRISWOLD.

MACHINE FOR FORMING EYES ON WIRE BANDS.

No. 418,456. Patented Dec. 31, 1889.

Fig. 3.



WITNESSES:
Gustave Dieterich.
William Goebel.

INVENTOR
Frank B. Griswold
BY
Paul Benjamin.
his ATTORNEY

(No Model.) 5 Sheets—Sheet 4.

F. B. GRISWOLD.

MACHINE FOR FORMING EYES ON WIRE BANDS.

No. 418,456. Patented Dec. 31, 1889.

Fig. 5.

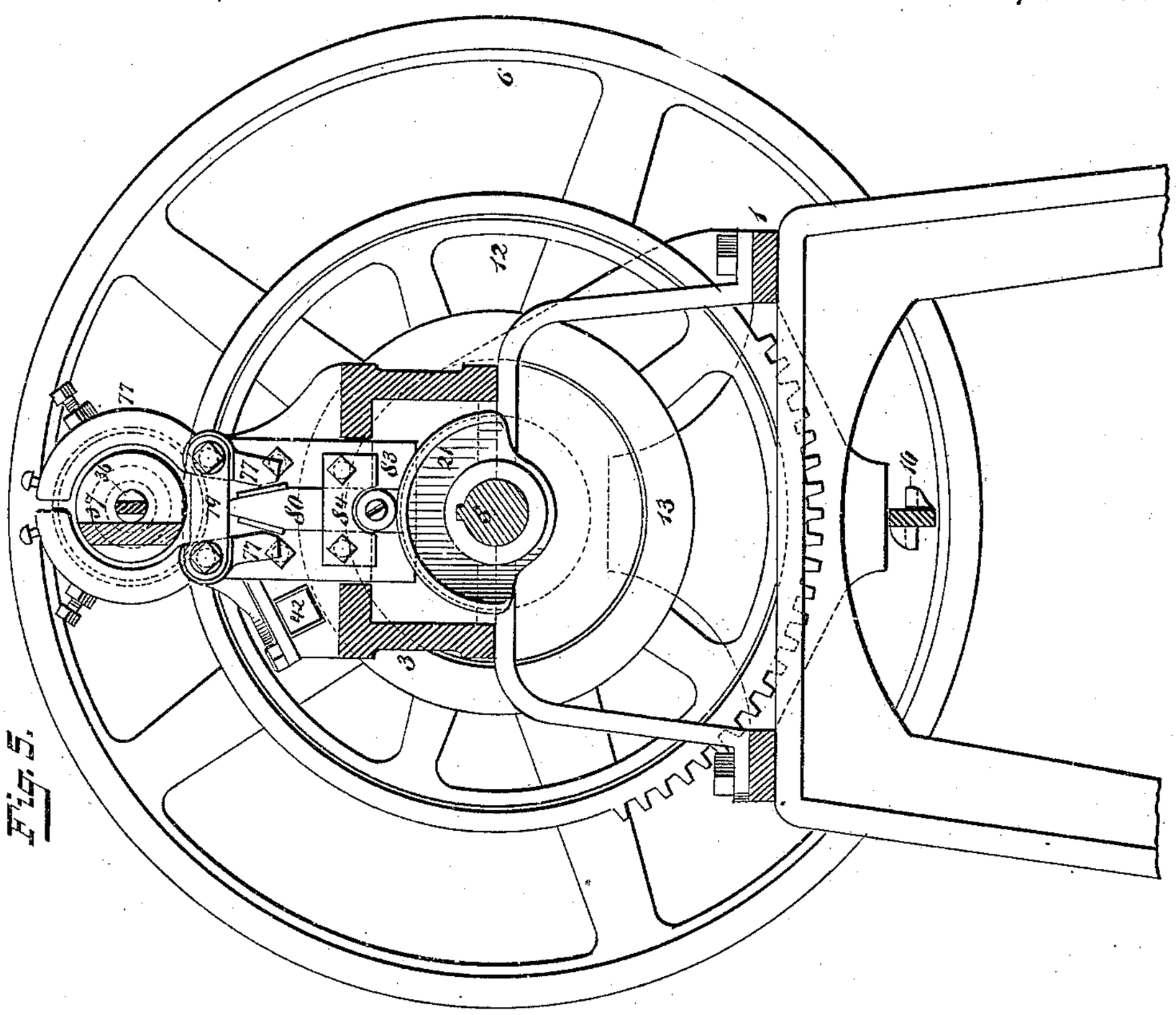
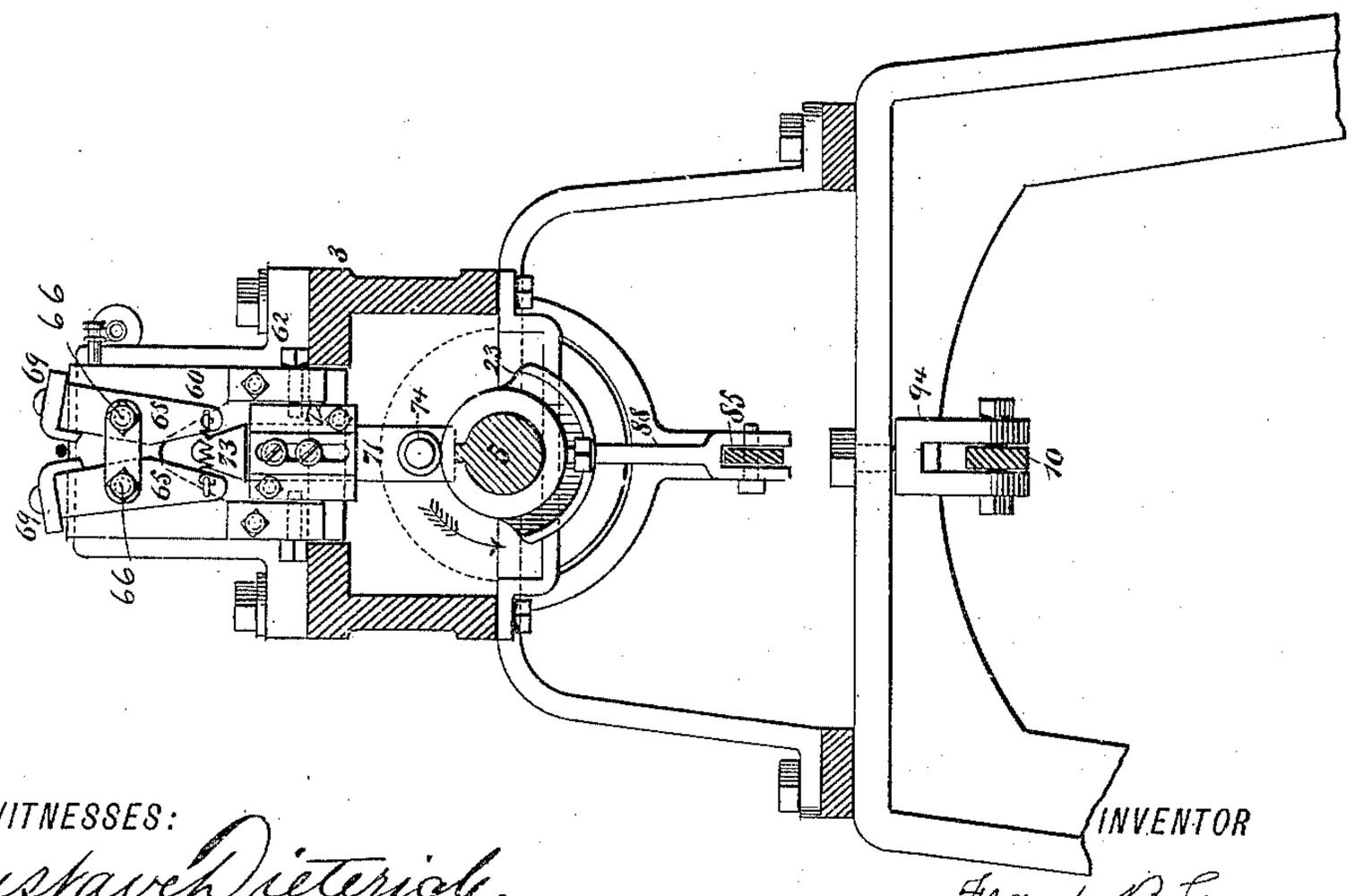


Fig. 4.



WITNESSES:
Gustave Dieterich.
William Goebel.

INVENTOR
Frank B. Griswold
BY
Paul Benjamin
his ATTORNEY

(No Model.) 5 Sheets—Sheet 5.

F. B. GRISWOLD.

MACHINE FOR FORMING EYES ON WIRE BANDS.

No. 418,456. Patented Dec. 31, 1889.

Fig. 4.

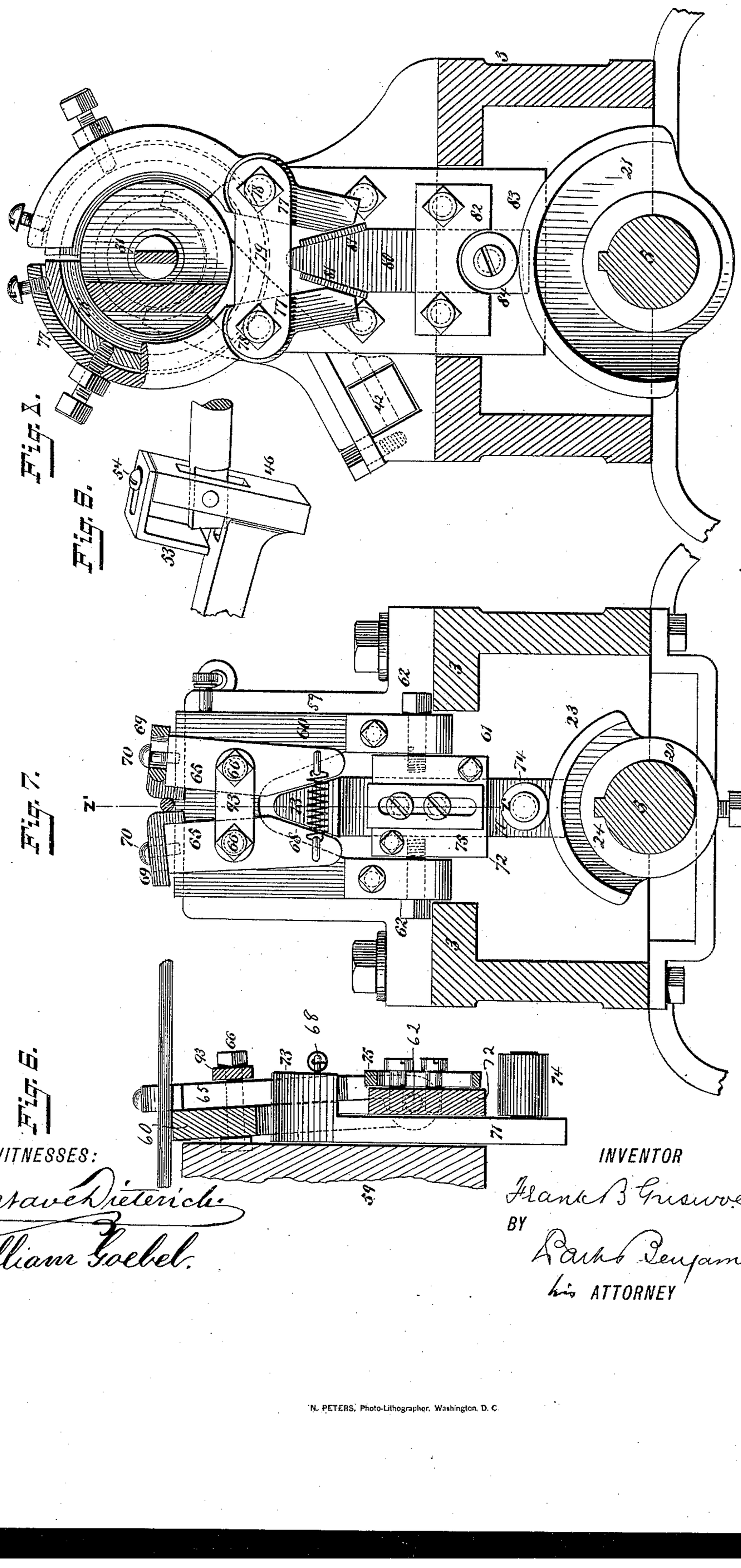


Fig. 7.

Fig. 5.

WITNESSES:

Gustave Dieterich

William Goebel.

INVENTOR

Frank B Griswold.

BY

Louis Benjamin

his ATTORNEY

UNITED STATES PATENT OFFICE.

FRANK B. GRISWOLD, OF TROY, NEW YORK.

MACHINE FOR FORMING EYES ON WIRE BANDS.

SPECIFICATION forming part of Letters Patent No. 418,456, dated December 31, 1889.

Application filed July 26, 1889. Serial No. 318,782. (No model.)

To all whom it may concern:

Be it known that I, FRANK B. GRISWOLD, of Troy, Rensselaer county, New York, have invented a new and useful Improvement in Machines for Forming Eyes on Wire Bands, of which the following is a specification.

My invention relates to a machine for producing upon the end of a piece of wire an eye by bending over the extremity of said wire and twisting the said parts together.

My invention consists in the novel construction of the machine, hereinafter described, and in the various combinations therein embodied, whereby the apparatus is caused to bend over the wire, to twist it, to hold it while being twisted, and to check the motion of the moving parts at the proper times.

In the accompanying drawings, Figure 1 is a side elevation. Fig. 2 is a plan view. Fig. 3 is a vertical longitudinal section. Fig. 4 is a vertical transverse section on the line Y Y of Fig. 3. Fig. 5 is a similar section on the line Z Z of Fig. 3, looking in the direction of the arrow 1. Fig. 6 is a vertical section on the line Z′ Z′ of Fig. 7. Fig. 7 is a vertical transverse section showing the construction of the wire-holding vise. Fig. 8 is a similar section showing the construction of the friction-brake for checking the revolution of the spindle. Fig. 9 is an enlarged perspective view of the connection between the bending-dog and its spindle and the stop on said dog. Fig. 10 shows the eye of twisted wire produced by the machine. Fig. 11 is a sectional view enlarged, showing the arrangement of the pin 57 in the head 37. Fig. 12 is a vertical section of the clutch mechanism. Fig. 13 is a face view of the notched clutch-disk in the hub of the driving-pulley 6.

Similar numbers of reference indicate like parts.

1 is the supporting-table of the machine, carried on legs 2, shown broken away.

3 is the bed of the machine proper, supported on standards 4, which are bolted to the table 1.

5 is the main driving-shaft, which carries at one extremity the loose driving-pulley 6. This pulley is actuated by the belt 7.

For throwing the shaft 5 in gear with the driving-pulley a simple clutch mechanism is provided, controlled by the vertical rod 9, which is connected at its lower end to the lever 10. When the lever 10 is depressed, the clutch is thrown into operation against the action of the spiral spring 11, and the shaft 5 is then rotated by its driving-pulley. When the lever 10 is released, the spring 11 raises the rod 9, and so throws the clutch out of operation. Said clutch mechanism is described in detail farther on.

Upon the shaft 5 is a mutilated gear-wheel 12, and also upon said shaft 5, in the following order from right to left of Figs. 1 and 3, are the following parts: first, a pulley 13, having upon its periphery a cam-groove 14. The shaft then passes through the journal-bearing 15 in the bed 3. On each side of said bearing are fixed collars 16 and 17, which prevent lateral motion of the shaft. Upon the shaft 5 then follow three cams 21 22 23, having hubs 18 19 20. The portion of the shaft 5 which passes through the cams is feathered, as shown at 24, Fig. 3. Said cams are clamped in position by set-screws, two of which are shown passing through the hubs 18 and 19 at 25 and 26 in Fig. 1. The shaft 5 then passes through a journal-bearing 27 in the bed 3, and on the outside of said bearing said shaft is feathered at 28 and receives the grooved friction-wheel 29.

Supported upon the table 1 is an end bearing 30 for the rotary spindle 31. This spindle also passes through bearings 32 33, which are supported on the bed 3. Upon the spindle 31 is a pinion 34, with which the toothed portion of the mutilated gear 12 engages. Fast upon the spindle 31 and on opposite sides of the bearing 33 is a collar 35 and a friction-disk 36. Supported upon the friction-disk and cast in one piece therewith is a flat projecting head 37. The spindle 31 is hollow for a portion of its length, and entering said hollow portion is a rod 38. Between the collar 35 and the bearing 32 the spindle 31 is slotted above and below, as shown at 39, Figs. 2 and 3. Upon the spindle 31 on said slotted portion is a grooved collar 40. A pin passes down through said collar, through the slots 39, and through the rod 38.

42 is a bar which has sliding motion in its

bearings 43, Fig. 2. Fast upon said bar and between said bearings is a dog 44. The end of this dog enters the groove or channel in the collar 40. At the extremity of the bar 42 is a pin or roller 45, which enters the cam-groove 14 of the pulley 13.

From what has been explained it will now be understood that when the shaft 5 is rotated motion therefrom is communicated from the toothed portion of the gear 12 to the pinion 34, and thence to the spindle 31, so that intermittent rotary motion is imparted to said spindle and likewise to the head 37, carried thereby. The pin or roller 45, following the cam-groove 14 in the pulley 13, imparts a longitudinal motion in its bearings to the bar 42, and this bar, by the dog 44, gives longitudinal motion to the spindle-ring 40 upon the spindle 31. The collar carries with it the rod 38, which is thus alternately projected from and thrown into the spindle. Inasmuch as the throw or working portion of cam 14 is opposite the blank part of the mutilated gear 12, and the straight part of the cam 14 is opposite the toothed portion of said gear, it follows that said rod 38 is operated in the manner described before the rotation of spindle 31. When said spindle 31 is rotated, the groove in the periphery of collar 40 travels freely over the projecting end of the dog 44. The end of the rod 38 enters and is pivoted in a mortise in a vertical bar 46, Fig. 9, upon which bar below the pivot is secured or formed integral therewith the bending-dog 47. This dog has a rounded downward projection at its extremity 48, and also upon said dog on its under side is the cam projection 49. Bolted to the plate 37 is a fixed cam 50. When the parts are in the position shown in Fig. 3, the dog 47 rests upon said cam 50 and is retained between the plate 37 and a similar plate 51 outside of said cam. In the upper front portion of the dog 47 there is an inclined longitudinal score, as shown in Fig. 2, and on opposite sides of this score project upward pins 52. Supported upon the upper portion of the bar 46 is a downwardly-bent plate 53, which, as shown in Fig. 9, is slotted and secured by a set-screw 54, passing through the slot, so that the vertical portion of said bar may be adjusted nearer to or farther from the extremity of the bending-dog 47. Also supported upon the head 37 is a guide-plate 55, which on its upper side is grooved or scored and is provided with two guide-pins 56. Projecting from the head 37, above the guide-plate 55, is a forming-pin 57.

The parts just described constitute the devices for bending back upon itself the end of the wire upon which the loop is to be formed, and the said parts operate in the following manner: The wire is introduced between the guide-pins 56 and under the forming-pin 57, and then between the pins 52 on the dog 47, until its end reaches the stop 53. The wire then lies in the grooves on the upper sides of the guide-plate 55 and the dog 47, and the distance to which it extends over the dog is limited by the position of the stop 53, which is adjusted in the manner already described. It has already been explained that when the pulley 13 is rotated the collar 40 is slid on the spindle 31, and in this way the rod 38 is caused to move within the spindle 31, or, in other words, to the left of the drawings, Figs. 1, 2, and 3, and in the direction of the arrow A, Fig. 1. As the rod 38 moves outwardly, the cam 49 on the under side of the dog 47 meets the incline of the fixed cam 50, supported on the head 37, and rises over said cam. As it rises, it carries up with it the end of the wire which is beyond the forming-pin 57, so that this end of the wire assumes first a vertical position, and then is bent backward over the pin 57, the end 48 of the dog finally riding over the loop and the parts assuming the position as shown in Fig. 1. In order now to make a close bend as the rod 38 continues to move outward, the lower end of the bar 46 meets an adjustable stop 58 on the side of the fixed cam 50; and as the bar 46 continues to be pressed against this stop the extremity 48 of the dog is forced downward, so as to bring the bent-over part of the wire into proximity to the standing part. Of course when this operation takes place the spindle 31 is at rest and the head 37 stands vertically in the position shown in Figs. 1 and 2.

I will now describe the device which holds the wire after it is bent and during the process of twisting, and this is best shown in Figs. 3, 6, and 7. 59 is a vise-stock rising from bed 3 and adjustable thereon by means of the slotted bolt $59^{\times}$. (Shown in Fig. 2.) 60 is a recessed plate, which is arranged above an opening 61, Fig. 7, in the bed 3. Entering eyes in the lower part of this plate are bolts 62. The ends of these bolts rest on the edges of the bed, Fig. 7, and form trunnions on which the plate 60 may rock. Normally the plate 60 is drawn against the support 59 by means of a spiral spring 63, Fig. 3, which is secured to the upper part of said plate, and also of a hook 64, which is threaded, and which enters a nut in a projection on the support 59. By suitably adjusting the hook-bolt in the nut the spring 63 can be given more or less tension. Upon the front side of the plate 60 are arranged the jaws 65 the pivot-bolts 66 of these jaws passing through the plate 60. The rear ends of these pivots are threaded, and the nuts enter depressions in the support 59, as best shown in Fig. 3. A bar 93 connects said pivot-bolts 66. Between the lower ends of the jaws 65, extends a spiral spring 68, Fig. 7. On the upper ends of said jaws are slotted face-pieces 69, which are secured to the jaws by the bolts 70, passing through the slots. The downwardly-bent portions of the face-pieces 69 can therefore be adjusted nearer together or farther apart, as desired. The effect of the spring 68 is normally to hold

the upper or clamping ends of the jaws 65 apart. 71 is a bar, which has vertical sliding motion between the vise-stock 59 and a guide-plate 72, which receives the ends of the bolts 62. Said guide-plate 72 is bolted to the vise-stock 59. On the upper end of the bar 71 is a wedge-shaped head 73, which projects over the guide-plate 72. This wedge-shaped head enters between the lower inclined ends of the jaws 65. Near the lower end of the bar 71 is a laterally-projecting pin, which carries a roller 74, and this roller 74, as is shown in Fig. 3, is located so as to be acted upon by the cam 23.

The operation of the device is as follows: The jaws being opened, and the wire being placed as shown in Fig. 3, the end of the wire is bent over, as already explained, so as to form a loop, as shown in Fig. 1, the extremity of which will also fall between the jaws 65 of the vise. When the cam 23 meets the roller 74, the bar 71 is raised and the wedge-shaped end 73 is forced between the lower ends of the jaws 65, so that the upper ends of said jaws are carried together, when the two parts of the wire become tightly clamped between them, and when the cam 23 runs from under the roller 74 the bar 71 is free to descend and the jaws open again. The object of giving the vise a rocking motion on the pin 62 will be explained farther on. Upon the plate 72 is a slotted stop-plate 75, secured in place by set-screws, as shown in Fig. 7, so that it may be adjusted up and down on the plate 72. The projection of the head 73 meets the upper edge of the plate 75, so that said plate acts as a stop to limit the downward motion of the bar 71.

Referring to Figs. 1, 3, and 8, I will now describe the friction device for stopping the rotation of the spindle 31 at the proper time. 76 is a divided leather-faced spring ring, which encircles the friction-disk 36 and is contained in the hollow semicircular pivoted jaws 77. These jaws are pivoted to a support rising from the bed, as shown at 78, the pivots being connected by bar 79. Between the lower ends of the jaws 77 enters the wedge-shaped end of a bar 80, the inclined faces of the wedge-shaped end of said bar being provided with wearing-plates 81. The bar 80 has longitudinal motion between the guide-plates 82 83, and at its lower portion it is provided with a roller 84, which is acted upon by the cam 21. When the cam 21 acts upon the roller 84, the bar 80 is lifted, and the jaws 77, being forced together, compress said ring around the friction-disk 36, so that the ends of said ring are brought nearer together, causing the ring to act as a brake. The set-screws passing through the jaws 77 and bearing against the ring 76 serve to adjust the pressure. When the cam 21 runs from under the roller 84, the bar 80 descends and the jaws 77 open.

I will now describe the device for checking the rotation of the main driving-shaft 5. 85, Figs. 1 and 3, is a lever pivoted to a support 86. One end of said lever is forked, and is provided with a roller 87, against which bears the cam 22. To the other end of the lever is pivoted a friction-yoke 88, which enters the groove in the friction-wheel 29. When the cam 22 acts upon the roller 87, the brake-yoke 88 is forced into the groove of the wheel 29, and the rotation of the shaft 5 is thus checked. 89 is a strap which is secured to the table 1, and which passes over the lever 85 and serves to limit the upward motion of said lever. Its upper horizontal portion is slotted to receive the upwardly-bent portion of said lever, as indicated in dotted lines, Fig. 3. Depending from the table 1 is a bracket 90, in which is pivoted a transverse bar 91, which is received between pins 92 in the lever 10. To this bar is connected a downward rod 93, Fig. 1, which communicates with a treadle, (not shown,) and this treadle when depressed causes the lever 91 to act upon the lever 10, so as to depress said lever. The lever 10 is pivoted at one end in the bracket 94.

The various parts of the machine having been described and their several functions indicated, I will now describe the operation of the apparatus as a whole. The wire to be bent, as already described, is introduced between the jaws 65 of the vise and placed in the scores on the upper sides of the guide 55 and the dog 47. The clutch is then thrown into operation by depressing the bar 10. Inasmuch as the smooth portion of the pulley 12 is now opposite the pinion 34, no motion from that pulley can be transmitted to the spindle 31, and hence that spindle will remain stationary. The cam 14, however, will cause the bar 42 to move longitudinally, and in the manner already described will so cause the rod 38 to move out of the spindle 31, and so cause the dog 47 to bend the wire in the form of a loop over the fixed projection 57 on the plate 37, and finally to carry the bent-over end of the wire in between the jaws 65 of the vise. By the time this is done the cam 23 acts on the vise-jaws and closes them, so that both the standing part and the bent-over part of the wire are tightly gripped. Then, still by the action of the cam-pulley 13, the rod 38 is retracted and the bending-dog brought back to its normal position. By this time the toothed part of the pulley 12 engages with the pinion 34 and the spindle 31 begins to rotate, of course carrying with it the plate 37. The wire being then tightly clamped in the vise-jaws 65 is of course twisted, and as it twists it tends to shorten in length, and to compensate for this shortening the vise, riding on its pivot 62, is allowed by the yielding of the spring 63 to move slightly toward the revolving portion of the apparatus. As soon as the twist is completed the cam 21 operates on the roller 84 to raise the bar 80 and so close the friction-clamp upon the disk 36, thus checking the rotation of the spindle 31, while the cam

22 acts on the lever 85 to force the yoke 88 into the groove or friction wheel 29, thus stopping the rotation of the main shaft after the toothed portion of the pulley 12 has gone clear of the pinion 34. The completed eye being then made, it simply remains to remove the wire from the apparatus, substitute a new wire, and repeat the preceding operation.

The eye produced in accordance with the foregoing description is that represented in Fig. 10, and it will be understood that the tightness of the twist will depend upon the distance between the jaws 65 and the pins 56. In making a shorter eye, however, I may remove the block 55, and then the tightness of the twist will be regulated by the distance between the jaws 65 and the pin 57. The flat pin 57 is provided with a cylindrical end, which passes through a hole in the head 37, (see Fig. 11,) and is secured to the rear side by a nut, between which nut and the head a spiral spring 57* is interposed. This allows the pin to turn when the wire is removed, so that the latter may be conveniently moved out of the score in the block 56.

The clutch mechanism here shown is as follows, Figs. 12 and 13: The inner face of the hub of the pulley 6 is notched, as shown at 96. The bottoms of the notches are formed in removable steel pins 97, so that wear may be provided for. Arranged transversely of the pulley 8 is a sliding key or pin 98, which is normally pushed outwardly by a spring 99. The pin, when it projects from the pulley 8, enters and engages with one of the notches 96.

100 is a yoke on the end of rod 9, which enters the groove or channel on the periphery of pulley 8 and is received in a notch in the key or pin 98. The effect of pulling down the rod 9 is to allow the pin 98 to be pushed out by its spring and to engage with the driving-pulley 6.

I claim—

1. The combination, in a wire-bending machine, of a fixed pin around which the wire is bent, a dog swinging in a vertical plane and also having at its center of oscillation a reciprocating motion toward and from said pin, and a fixed cam placed beneath said dog and regulating its upward throw, the aforesaid parts being arranged and operating so that when a wire is introduced under said pin and over said dog the forward motion of said dog over said cam shall cause said dog to rise and to carry and bend said wire over said pin.

2. The combination, in a wire bending and twisting machine, of a plate or head rotary on a longitudinal axis, a rod having a longitudinal reciprocating motion in front of the surface of said plate, a bending-dog pivoted to the end of said rod, and a fixed cam on said head, said cam regulating the throw of said dog as said dog is moved by said rod in contact with said cam, substantially as described.

3. The combination, in a wire-bending machine, of a fixed projecting pin around which the wire is bent, a dog swinging in a vertical plane and also having at its center of oscillation a reciprocating motion toward and from said pin, a fixed cam acting upon said dog and regulating its throw, a fixed stop, and an arm or projection on said dog, the aforesaid parts being arranged and operating so that when a wire is inserted under said pin and over said dog the forward movement of said dog shall first bend said wire over said pin, and then the arm or projection on said dog, meeting said fixed stop, shall cause the end of said dog to move downwardly after said end shall have passed over said pin to complete the shape of the loop or eye in said wire, substantially as described.

4. The combination, in a wire bending and twisting machine, of a plate or head rotary on a longitudinal axis, a rod having a longitudinal reciprocating motion in front of the surface of said plate, a bending-dog pivoted to the end of said rod, a fixed cam on said plate wherewith said dog makes contact and whereby the throw of said dog is regulated, mechanism for rotating said plate or head, a pin on said head over which the wire is bent by said dog, and mechanism for reciprocating said rod, the said mechanisms being timed so that one operates while the other is at rest.

5. The combination of a flat plate or head rotary on a longitudinal axis, a rod having a longitudinal reciprocating motion in front of the surface of said plate, a bending-dog pivoted at its extremity to the end of said rod, and having the other end curved or rounded and on its under side a curved or cam projection, a fixed cam on said plate beneath said dog, and a bending-pin, also carried by said plate, the aforesaid parts being combined and operating so that when the said rod is moved forward the cam on said dog shall rise over the cam on said plate, and the end of said dog shall thus be caused to rise over said bending-pin, substantially as described.

6. The combination, with the head 37 and forming-pin 57 and fixed cam 50 thereon, of the rotary spindle 31, carrying said head 37, the rod 38, longitudinally movable in said spindle, and the bending-dog 47, pivoted at the extremity of said rod 38, substantially as described.

7. The combination, with the head 37 and forming-pin 57, cam 50, and block 55, supported on said head, of the rotary spindle 31, carrying said head 57, the rod 38, longitudinally movable in said spindle, and the bending-dog 47, pivoted at the extremity of said rod 38, substantially as described.

8. The combination, with the head 37, the forming-pin 57, cam 50, and block 55, having guide-pins 56, said pin, cam, and block being supported on said head, of the rotary spindle 31, carrying said head 37, the rod 38, longitudinally movable in said spindle, and the bend-

ing-dog 47, having guide-pins 52, pivoted at the extremity of said rod 38, substantially as described.

9. The combination, with the head 37 and forming-pin 57 and fixed cam 50 thereon, of the rotary spindle 31, carrying said head 37, the rod 38, longitudinally movable in said spindle, and the bending-dog 47, pivoted at the extremity of said rod 38 and provided with a stop 53, substantially as described.

10. The combination, with the head 37 and forming-pin 57 and fixed cam 50 thereon, of the rotary slotted spindle 31, carrying said head 37, the rod 38, longitudinally movable in said spindle, the bending-dog 47, pivoted at the extremity of said rod 38, the movable collar 40, secured to said rod 38, and means for reciprocating said collar on said spindle, substantially as described.

11. The combination, with the head 37 and forming-pin 57 and fixed cam 50 thereon, of the rotary slotted spindle 31, carrying said head 37, the rod 38, longitudinally movable in said spindle, the bending-dog 47, pivoted at the extremity of said rod 38, the movable grooved collar 40, secured to said rod 38, the dog 44, entering the groove of said collar, the movable bar 42, carrying said dog 44, and the rotary cam 13, communicating motion to said bar, substantially as described.

12. The combination, with the head 37 and forming-pin 57 and fixed cam 50 thereon, of the spindle 31, carrying head 37 and pinion 34, the rod 38 and means for longitudinally reciprocating said rod in said spindle, the bending-dog 47, pivoted at the end of said rod 38, and the mutilated gear 12, engaging with and intermittently imparting motion to said pinion 34.

13. The combination of the slotted spindle 31, carrying the head 37 and pinion 34, the cam 50 and bending-pin 57 on said head, the rod 38, entering said spindle, the dog 47, pivoted on the end of said rod, and the collar 40, surrounding said spindle and connected to said rod 38, with the driving-shaft 5, the cam 13 and mutilated gear 12 on said shaft, and the sliding bar 42 and dog 44 on said bar, the said bar 42 engaging with the cam 13, and the dog 44 with the collar 40, and the gear 12 engaging with the pinion 34, substantially as described.

14. The combination of the spindle 31, the bending-dog 47, supported on said spindle, rotary shaft 5, a means of intermittently communicating motion from said shaft to said spindle, a friction-brake mechanism applied to spindle 31, and a cam governing said brake mechanism on said shaft 5, the said parts being so arranged and operating that when motion is no longer transmitted from the shaft 5 to the spindle 31 the said brake mechanism shall be put into operation by the throw of said cam, substantially as described.

15. The combination of the spindle 31, carrying the friction-disk 36 and pinion 34, the rotary shaft 5, carrying cam 21, and the mutilated gear 12, engaging with pinion 34, the brake-jaws 77, acting upon said friction-disk, and wedge-bar 80, movable between the lower ends of said jaws, the said spindle 31 being intermittently rotated by said gear 12, and the said cam 21 operating to raise said bar 80 and to cause said jaws 77 to act upon said friction-disk 36, and so to arrest the motion of said spindle at the end of its rotary period, substantially as described.

16. In a wire-bending machine, a flat projecting pin around which the wire is bent and a fixed support for said pin, the said pin being free to rotate axially in its support, substantially as described.

17. In a wire-bending machine, a flat projecting pin around which the wire is bent, the said pin having axial play in its support, substantially as described.

18. The combination, with the head 37 and vibrating bending-dog 47, of the bending-pin 57, extending through said head 37, and provided with the spring 57*, substantially as described.

19. The combination of the spindle 31, carrying the head 37 and pinion 34, bending mechanism, substantially as set forth, shaft 5, carrying cam 23, and mutilated gear 12, engaging with said pinion 34, the vise-jaws 65 and support therefor, and the vertically-movable wedge-bar 71, the said cam operating to raise said bar and close said jaws during the period of rotation of the head 37, substantially as described.

20. The combination of the head 37 and forming-pin 57 and fixed cam 50 thereon, the rod 38, longitudinally movable in face of said plate, the bending-dog 47, pivoted to the end of said rod, the driving-shaft 5 and mechanism for actuating said rod 38 from said driving-shaft, the vise-jaws 65 and support therefor, and mechanism transmitting motion from said driving-shaft to said jaws to cause intermittent closing of said jaws, the aforesaid parts being so arranged and timed that when a wire is inserted in said jaws and under said pin and over said dog the said dog shall first double said wire over said pin to bring its free end between said jaws, and thereupon said jaws shall close upon both parts of said wire, substantially as described.

21. The combination of the head 37, forming-pin 57, and fixed cam 50 on said head, the spindle 31, carrying said head, the driving-shaft 5 and transmitting mechanism between said shaft 5 and spindle 31 for causing intermittent rotary motion of said spindle, the reciprocating rod 38 and dog 47, pivoted to the end thereof, transmitting mechanism between said shaft 5 and rod 38 for causing intermittent reciprocating motion of said rod, the vise-jaws 65 and support therefor, and transmitting mechanism between said shaft 5 and said jaws 65 for causing intermittent closing of said jaws, the aforesaid parts being arranged and timed so that when a wire is inserted in said jaws 65, under said pin 57

and over said dog 47, the said dog shall first operate to bend or double said wire over said pin to bring its free end between said jaws, the said jaws shall then close upon both parts of said wire, and the said head shall then rotate and cause said parts held as aforesaid to be twisted together, substantially as described.

22. The combination of the head 37, pin 57, stop 58, and cam 50 thereon, the reciprocating rod 38, the dog 47, pivoted on the end of said rod and having a projection 46, adapted to meet said stop 58, and a second projection on its under side adapted to meet the cam 50, substantially as described.

FRANK B. GRISWOLD.

Witnesses:
O. E. VAN ZILE,
CHARLES R. HILL.