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5 Sheets—Sheet 1.

P. M. BEERS.

NEEDLE GROOVING MACHINE.

No. 378,489. Patented Feb. 28, 1888.

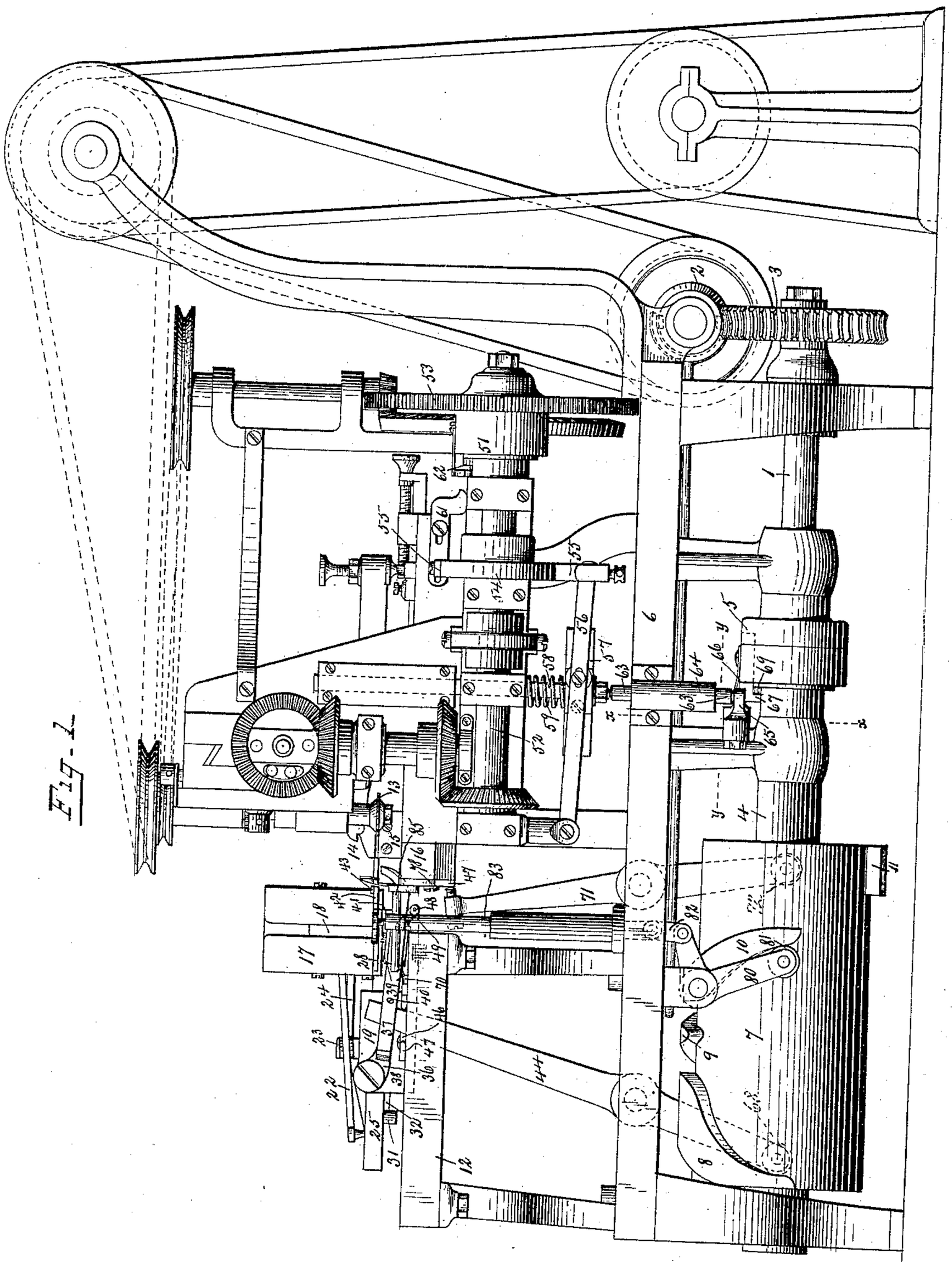

Fig. 1.

Witnesses.
E. D. Smith.
B. E. Lee.

Inventor.
Philo M. Beers.
By A. M. Wooster
Atty.

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P. M. BEERS.

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Fig. 3.

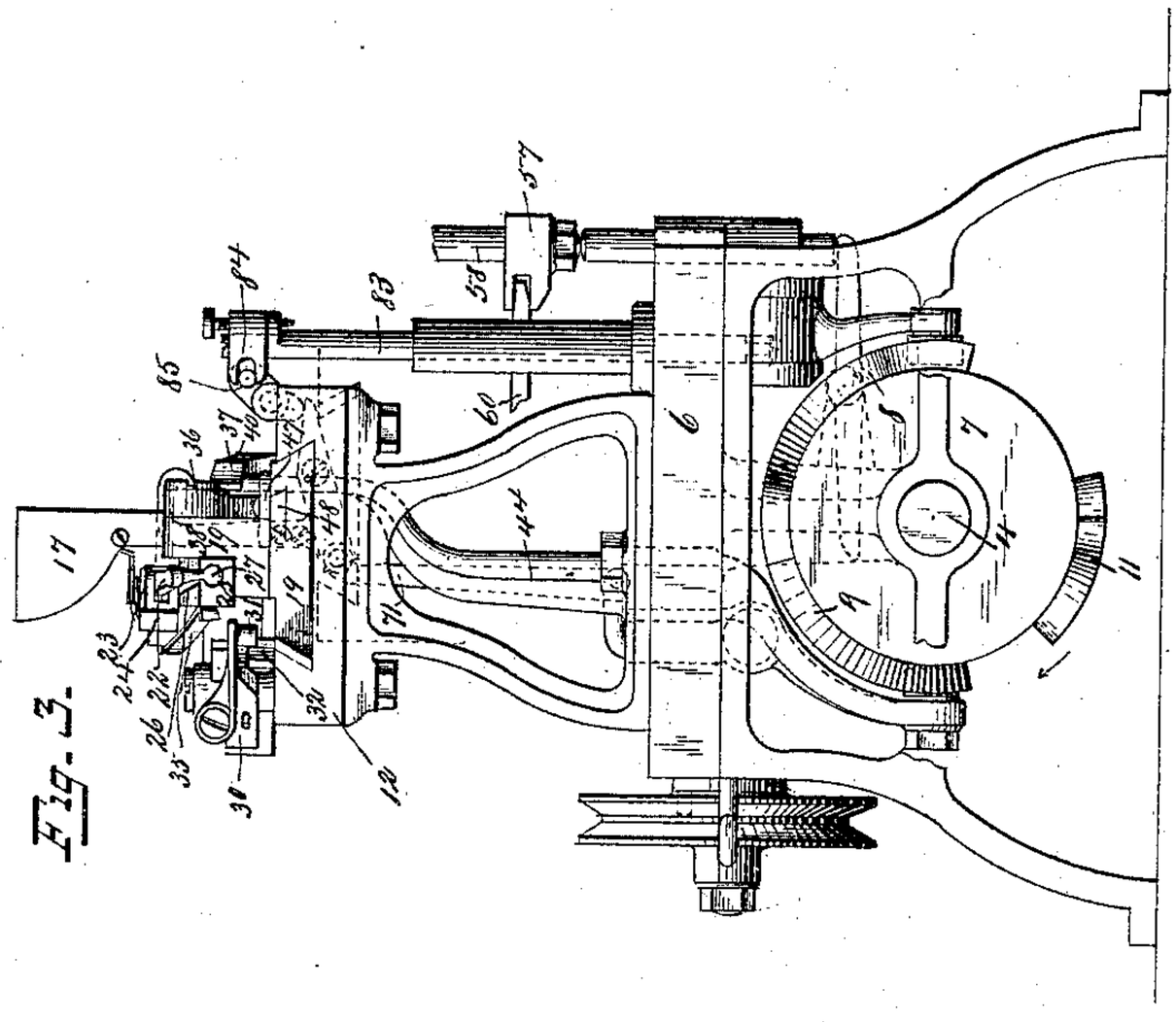
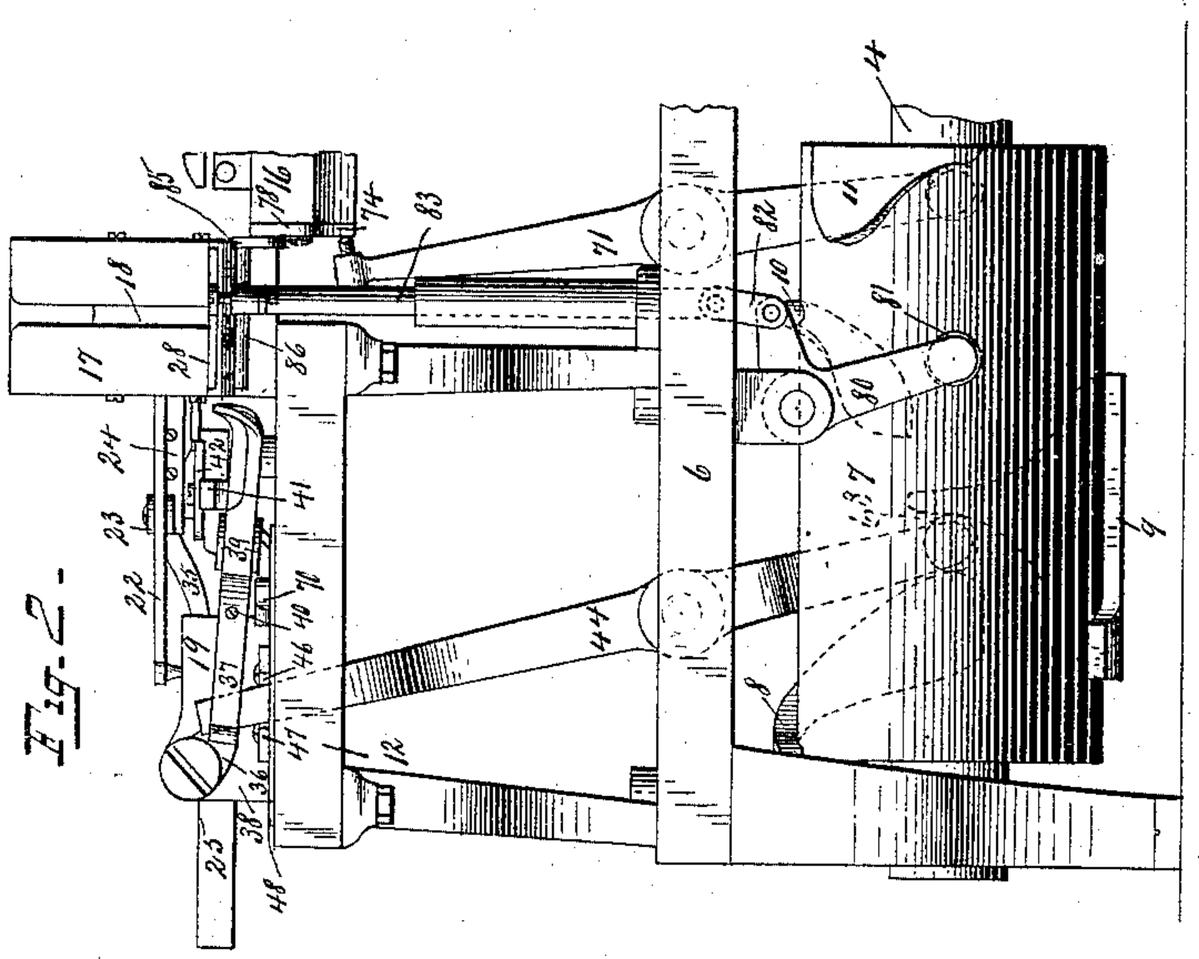


Fig. 2.



Witnesses—
E. D. Smith,
B. E. Lee.

Inventor—
Philo M. Beers.
By A. M. Wooster
Atty.

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P. M. BEERS.

NEEDLE GROOVING MACHINE.

No. 378,489. Patented Feb. 28, 1888.

Fig. 6.

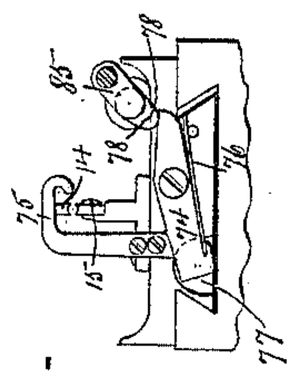


Fig. 7.

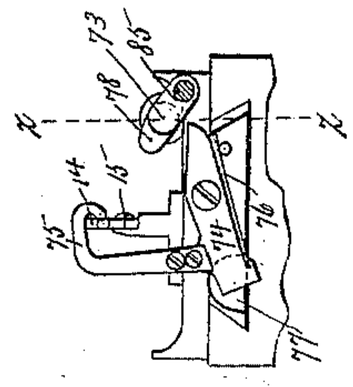


Fig. 8.

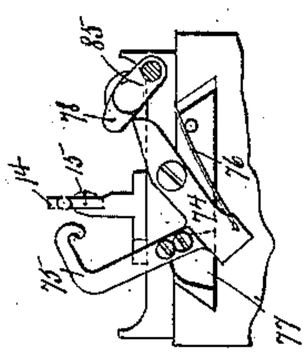


Fig. 4.

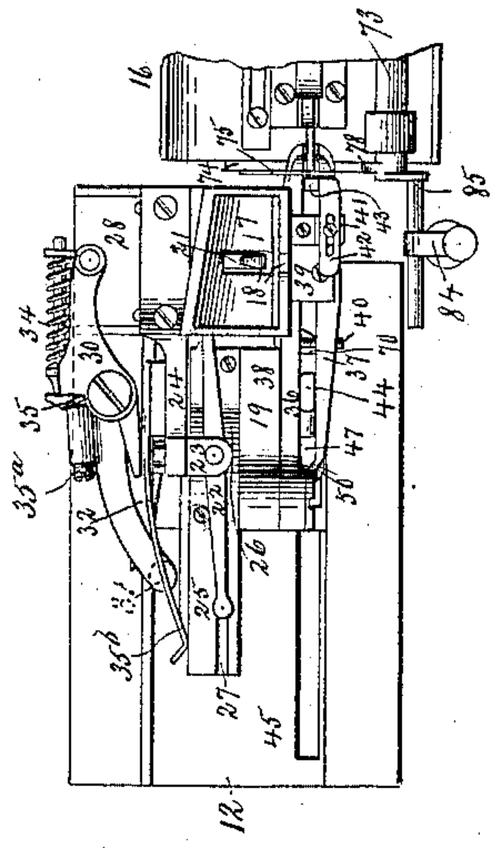
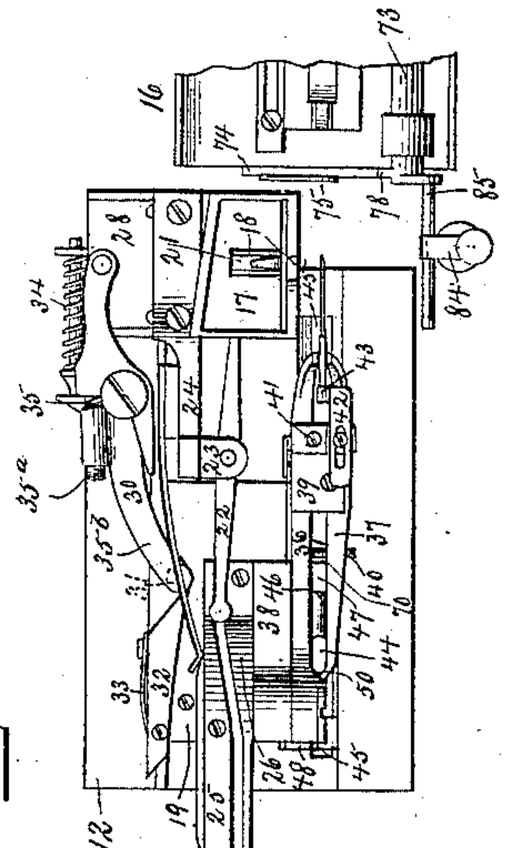


Fig. 5.



Witnesses.
E. D. Smith.
B. E. Lee.

Inventor.
Philo M. Beers
By A. M. Wooster.
Atty.

(No Model.) 5 Sheets—Sheet 4.

P. M. BEERS.

NEEDLE GROOVING MACHINE.

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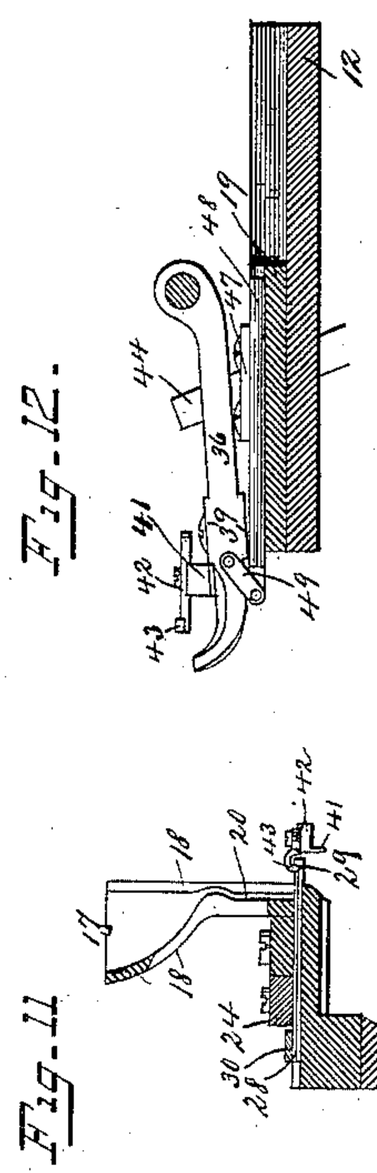

Fig. 12.

Fig. 11.

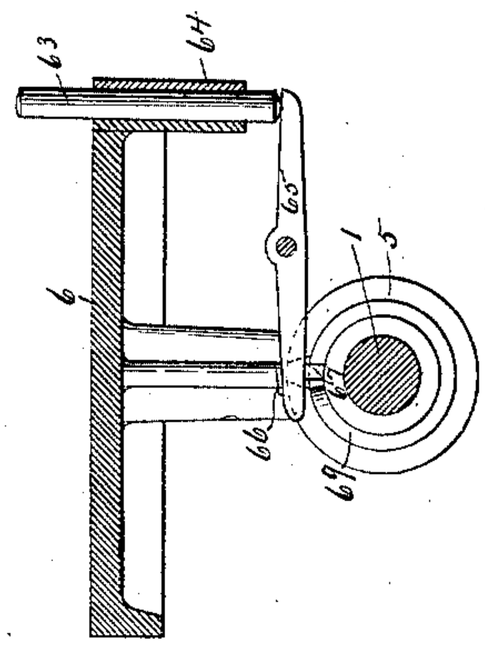

Fig. 9.

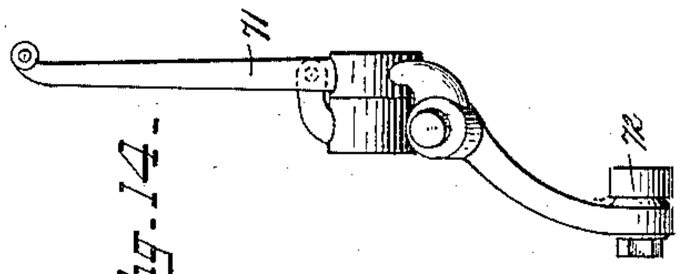

Fig. 14.

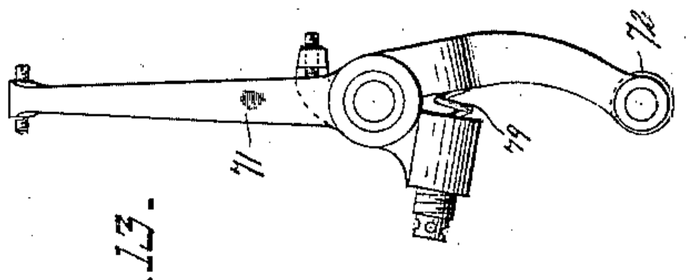

Fig. 13.

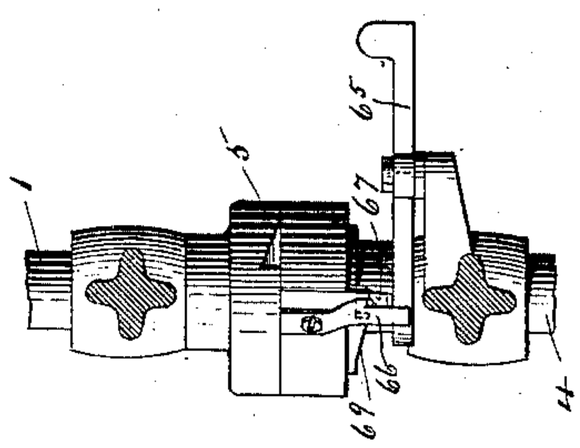

Fig. 10.

Witnesses
E. D. Smith
B. E. Lee.

Inventor—
Philo M. Beers.
By A. M. Wooster
Atty.

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P. M. BEERS.

NEEDLE GROOVING MACHINE.

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Fig. 17.

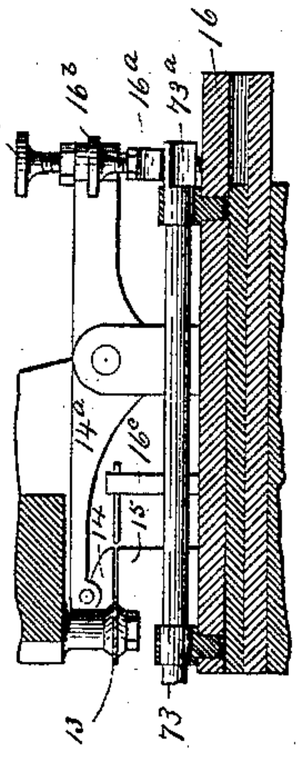


Fig. 18.

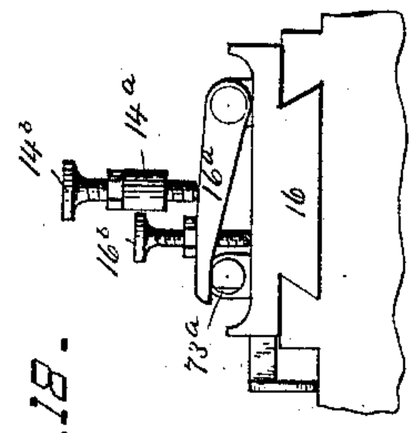


Fig. 15.

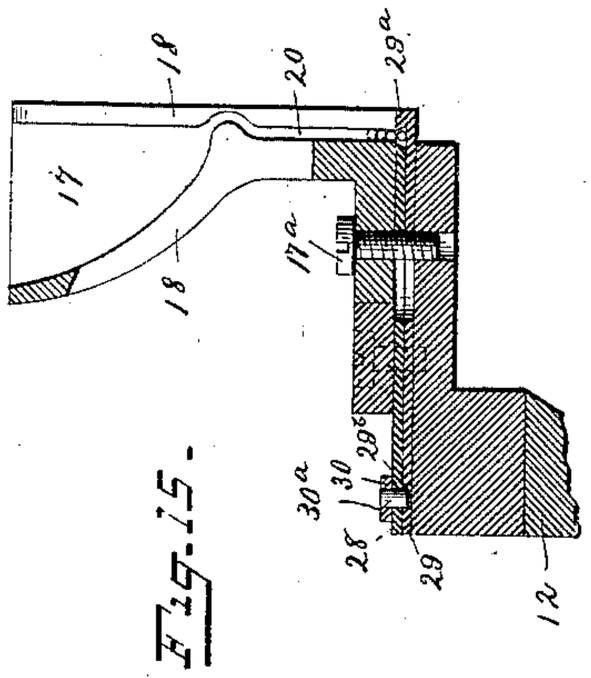
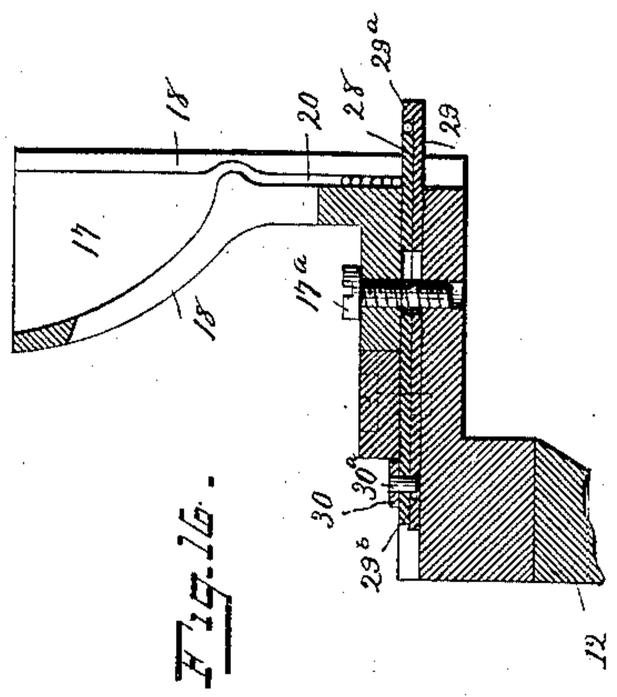


Fig. 16.



Witnesses.
E. D. Smith.
B. E. Lee.

Inventor.
Philo M. Beers.
By A. Wooster
Atty.

UNITED STATES PATENT OFFICE.

PHILO M. BEERS, OF BRIDGEPORT, CONNECTICUT.

NEEDLE-GROOVING MACHINE.

SPECIFICATION forming part of Letters Patent No. 378,489, dated February 28, 1888.

Application filed November 2, 1887. Serial No. 254,035. (No model.)

To all whom it may concern:

Be it known that I, PHILO M. BEERS, a citizen of the United States, residing at Bridgeport, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Needle-Grooving Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention has for its object to simplify and improve the construction of this class of machines, the special object being to facilitate the adjustment for different sizes and styles of needles and to greatly increase the capacity of the machine. With these ends in view I have devised a novel feeding mechanism, a novel device for stopping the machine should the supply of needles become exhausted, or should the jaws fail for any reason to grasp a needle, and have so organized the machine that but one mechanism requires adjustment in changing from one class of needles to another.

I will now proceed to describe my novel machine, referring by numbers to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a side elevation of the entire machine, a needle having just been placed in the dies; Fig. 2, a partial side elevation illustrating the feeding mechanism in the retracted position, the needle just acted upon having been dropped; Fig. 3, an end elevation of the feeding mechanism, the position of the parts corresponding with Fig. 1; Fig. 4, a plan view of the feeding mechanism, the position of the parts corresponding with Fig. 1; Fig. 5, a similar plan view, the position of the parts corresponding with Fig. 2, except that the completed needle has not been dropped; Fig. 6, a detail view illustrating the construction of the automatic stop mechanism, the parts being in position to receive a needle; Fig. 7, a similar view, a needle having been grasped by the dies; Fig. 8, a similar view illustrating the action of the stop mechanism when no needle has passed into the dies; Fig. 9, a detail sectional view on the line *x x* in Fig. 1, illustrating the mechanism which releases the clutch-dog that connects the shaft for actuating the feeding mechanism with the driven shaft; Fig. 10, a detail sectional view on the line *y y* in Fig. 1, illustrating the mechanism for connecting the shafts; Fig. 11, a detail sectional view illustrating a portion of the feeding mechanism; Fig. 12, a detail sectional view illustrating the construction of the gripping-jaws; Figs. 13 and 14, detail views illustrating the preferred construction of the lever for returning the carriage; Fig. 15, a cross-section of the hopper, table, &c., showing the cross-slides in position to receive a needle; Fig. 16, a similar view showing the cross-slides at their forward position; Fig. 17, a detail section on the line *z z* in Fig. 7, showing the mechanism for closing the dies; and Fig. 18 is a detail rear elevation of the die-carriage.

Similar numbers denote the same parts in all the figures.

1 denotes a shaft driven in any suitable manner—for example, a worm, 2, engaging a worm-wheel, 3, as shown in Fig. 1.

4 is an independent shaft placed in line with shaft 1, to which it is intermittently connected by a clutch, 5. These shafts are journaled in suitable bearings under the bed of the machine, which I have designated by 6.

7 is a cylinder or barrel on shaft 4, which is provided with cam projections, indicated, respectively, by 8, 9, 10, and 11.

12 is a table at the front end of the machine, the left, as seen in Fig. 1, upon which is placed the hopper and the feeding and extracting mechanism. The dies by which each needle is held during the operation of grooving, the movements of the die-carriage, and the cutters by which the operation is performed are the same as in my former patents, No. 217,921, dated July 29, 1879, and No. 258,695, dated May 30, 1882, and will therefore not be described in detail. One of the cutters appears in Fig. 1, and is designated by 13. The upper and lower dies are designated, respectively, by 14 and 15, and the sliding die-carriage by 16.

17 denotes the hopper which is attached to table 12, and is provided with slots 18 in opposite sides thereof.

19 denotes a carriage sliding in ways in the table.

The hopper is made widest at the end toward the front of the machine and the needles

are placed therein with the shanks at that end of the hopper. The hopper narrows down toward the bottom and leads into curved passage 20, just wide enough to receive a single needle. The needles are agitated in the hopper and caused to feed down freely by means of a curved spring, 21, secured to the inner end of a lever, 22. This lever is pivoted in a yoke, 23, swiveled in a bracket, 24, upon the table.

25 is a block secured to the sliding carriage and having an incline, 26, and an undercut circular groove, 27. A ball depending from the outer end of lever 22 engages this groove, so that as the carriage moves backward and forward, upward, downward, and lateral motions are imparted to spring 21, causing it to enter the groove at one side of the hopper and lift the needles therein at each reciprocation of the carriage, substantially as in my former patent, No. 339,361, dated April 6, 1886.

28 and 29 denote, respectively, upper and lower cross-slides which are caused to reciprocate under the hopper. The forward end of the lower cross-slide extends outward beyond the upper cross-slide, and is provided with a projection or thickened portion, 29ª, the upper surface of which is level with the surface of the upper slide. The rear edge of this projection and the forward edge of the upper cross-slide are both undercut, as clearly shown in Figs. 15 and 16, an undercut groove or recess being thus formed between said slides, the lower slide forming the bottom of the recess, which is adapted to receive one needle at a time from passage 20 and carry it out from the hopper, ready to be moved forward to be acted upon by the grooving mechanism, as will presently be fully explained.

The reciprocatory movements of the cross-slides may be imparted in any suitable manner, preferably, as shown in the drawings, by a lever, 30, pivoted to the table. One end of this lever is provided with a roller, 31, adapted to engage a switch-cam, 32, and the other end is connected to the cross-slides, as shown in Figs. 15 and 16.

30ª denotes the pivot-pin which connects lever 30 with the cross-slides. This pin is fixed in the upper cross-slide and extends downward and engages a slot, 29ᵇ, in the lower cross-slide. The switch-cam is pivoted to the sliding carriage, and is shown in its normal position in Fig. 5, in which position it is held by a spring, 33. As the carriage moves forward from the position shown in Fig. 5, roller 31 engages the outer wall of the switch-cam, first presses it inward against block 25, the spring yielding, and then travels along the outer wall of the switch-cam, the effect of which movement is to force the cross-slides inward and carry the needle-groove out from under the hopper. As soon as roller 31 has reached the rear end of the switch-cam, spring 34, one end of which bears against a projection on lever 30, acts to force the rear end of said lever inward, as shown in Fig. 4, and returns the cross-slides to their former position—that is, under the hopper—ready to receive another needle. During the return-movement roller 31 travels along the inner wall of the switch-cam.

In practice I preferably make lever 30 in two parts, as indicated in Figs. 4 and 5, both parts being journaled on the same pivot and provided with projections between which a strong spring, 35, is placed. This spring is strong enough, so that in ordinary use it yields but slightly, so that with each reciprocation of the carriage a corresponding reciprocation of the cross-slides takes place. Should the cross-slides become wedged, however, as by an imperfect needle or from any cause whatever, spring 35 will yield and prevent any breakage of the parts when the forward movement of the carriage takes place. This spring is adjusted by a set-screw, 35ª. It will of course be understood that while the parts of the feeding mechanism are moving from the position shown in Fig. 4 to that in Fig. 5 the cross-slides remain stationary. The instant the cross-slides have reached the position shown in Fig. 4 the needle-groove will be directly below passage 20, so that a single needle will drop from the passage down into the groove. The operation of the cross-slides will be clearly understood from Figs. 15 and 16. When the return movement takes place, the upper slide of course moves first, which separates the undercut edges of the two slides, opening the needle-groove slightly. As soon as pin 30ª engages the outer end of slot 29ᵇ in the lower cross-slide, the latter begins to move backward also, which movement continues until the needle-groove is under the hopper, when a needle drops into the groove, as clearly shown in Fig. 15. When the parts have reached the position shown in Figs. 5 and 15, they are ready for the next forward movement of the cross-slides. At the proper time the upper slide moves first and the forward edge thereof is closed against the needle in the groove, the needle being thus held firmly between the undercut edges of the two slides. As soon as pin 30ª engages the inner end of slot 29ᵇ, the lower cross-slide begins to move forward also, and the parts move to the position shown in Figs. 11 and 16, the needle-groove having passed out from under the hopper, carrying the needle with it, as will presently be more fully explained. In the drawings I have shown the hopper as held in place by screws 17ª, which pass through slots in the cross-slides.

35ᵇ denotes a friction-spring secured to the table and bearing against block 25, to insure steady movement of the carriage. The extracting mechanism consists of two gripping-jaws, 36 and 37. The rear end of the shank of jaw 36 is pivoted to a block, 38, upon the carriage, this jaw being stationary relatively to the other jaw. Jaw 37 is pivoted about midway its length between ears 39 on the shank of jaw 36, and swings toward or from said jaw, as will be more fully explained.

40 is a set-screw which passes through the

shank of jaw 37 and engages the shank of jaw 36, acting as a stop to limit the movement of the jaws in opening.

41 is a bracket secured to jaw 36, and 42 a plate adjustably secured to this bracket, which is provided with a finger, 43, curved in suitable form to engage the needle in the groove between the cross-slides. (See Fig. 11.) This finger acts to force the needle forward between the dies ready to be operated upon by the grooving-cutters when the forward movement of carriage 19 takes place.

As already stated, the movements of the die-carriage and the grooving-cutters, not being part of my present invention, will not be described in detail.

The forward and backward movements of carriage 19 and the cross-slides, the carrying forward of the needle into the dies, and the movements of the gripping-jaws in taking the needle from the dies and dropping it are all accomplished through the instrumentality of a lever, 44, pivoted in the present instance in the bed of the machine. The upper end of this lever passes through a slot, 45, in table 12, and a corresponding slot through the carriage, and rests in a recess, 46, in adjustable plate 47, secured to slide 48, which is adapted to reciprocate longitudinally in undercut ways in carriage 19, plate 47 projecting over the slots, as clearly shown in Figs. 4 and 5. Turning now to Fig. 12, which is a reverse view of jaw 36, it will be seen that said jaw is connected to the forward end of slide 48 by a link, 49, Figs. 4 and 12. Both show the position of the parts at the instant the grooving action of the cutters has ceased and the needle is ready to be extracted from the dies. As lever 44 begins to move backward, carrying slide 48 with it, the first action is to raise the jaws by means of the link. This movement places the jaws on opposite sides of the needle. An instant later, as the lever continues to move backward, it engages inclines 50 at the rear ends of the inner sides of the shanks of the jaws, forcing the shanks outward and causing the jaws to grip the needle firmly. The continued backward movement of the lever carries the jaws, the carriage, and all of the parts carried thereby back to the position shown in Fig. 5. The instant the forward movement of the lever begins it leaves inclines 50, thus allowing the shanks to close together and the jaws to open, which releases the needle and allows it to drop out into a suitable receptacle below. As already stated, shaft 1 is continuously in rotation, but the operations of the grooving mechanism and of the extracting and feeding mechanism are alternate—that is to say, suppose the grooving of the needle to have been completed, the grooving mechanism ceases to act instantly and the movement of the other mechanisms begins, the finished needle being removed from the dies and a new one inserted, ready to be clamped in position and operated upon by the cutters. The instant the forward movement of carriage 19, carrying the feeding and extracting mechanism, is completed, shaft 4, carrying the cams by which the parts are operated, is disconnected from shaft 1 through the automatic action of clutch 5, and the grooving mechanism is again placed in operation through the automatic action of another clutch, which I have designated by 51. (Seen at the right in Fig. 1.) When the operation of grooving a needle is completed, the forward movement of die-carriage 16 is stopped automatically through the action of mechanism fully described in my former patent, No. 217,921.

In order to make clear the operation of my present invention, I shall refer briefly to certain parts fully illustrated and described in my said former patent.

52 is a shaft having at its inner end a beveled gear, which, by means of gear-connections and cams, (not shown in this case,) imparts the necessary forward and backward movements to the cutters. Clutch 51 connects this shaft with a gear-wheel, 53, which is continuously in rotation.

54 is a cam on shaft 52, and 55 an L-shaped arm upon a lever, 56. The inner end of this lever is pivoted to a fixed point, and at or about the center thereof it is pivoted to a vertically-movable block, 57, carried by rod 58, and pressed downward—that is, to its normal position—by a spring, 59.

60 (see Fig. 3) is a lever the outer end of which engages block 57 and the inner end engages the feeding mechanism (not shown) for die-carriage 16. When the die-carriage is carried inward—that is, toward the right—the operation of which will presently be fully explained, plate 61 at the rear end thereof engages clutch 51 and connects shaft 52 with the hub of gear-wheel 53.

It should be understood that the cutters are continuously in rotation, but are only moved inward to their operative position by the action of shaft 52.

The operation of grooving the needle is completed during a single rotation of shaft 52. As soon as the grooving operation is completed, arm 55 drops into a notch (not shown) in cam 54, causing block 57 to drop from the position shown, and causing lever 60 to disconnect the feeding mechanism (not shown) which actuates the die-carriage. An instant later cam 62 on the hub of gear-wheel 53 acts to disconnect shaft 52. These parts all operate as in my said former machine. In my present machine I extend rod 58 downward, or provide an additional rod, 63, as shown in the drawings, in line with said rod, and support it in a sleeve, 64, upon the bed of the machine. This rod rests against the end of a lever, 65, and acts, when pressed down, to tilt said lever, which lifts a spring-latch, 66, and releases the spring-actuated dog 67 of clutch 5, thereby connecting the independent shaft 4 with shaft 1. This imparts rotation to cylinder 7, having the cam projections 8, 9, 10, and 11, which actuate the feeding and extracting mechanism,

the stop device, which I shall presently describe, and the lever, which causes the return movement of die-carriage 16. In Fig. 1 the position of the parts is shown at the instant a needle is about to be acted upon by the grooving-cutters, and in Fig. 2 the position of the parts at the instant a finished needle has been dropped by the clamping-jaws, carriage 19 having just commenced the forward movement. The forward and backward movements of this carriage, and incidental to said movements all the movements of the feeding and extracting mechanism, are caused by the engagement of roller 68 at the lower end of lever 44 with cam projections 8 and 9 upon the surface of cylinder 7. Turning now to Fig. 1, as soon as the needle has been carried forward between the dies, and before it has been clamped there, the operation of which will presently be explained, dog 67 of clutch 5 is engaged by a stationary cam, 69, carried ordinarily by the shaft-bracket, and retracted, thereby disconnecting the independent shaft from shaft 1. The cams upon cylinder 7 and the parts actuated thereby will consequently remain in the position shown in Fig. 1. As soon as lever 65 is tilted at the completion of the grooving operation, in the manner already explained, dog 67 is released again, thereby connecting shafts 4 and 1, and imparting rotation again to cylinder 7, the movement of said cylinder being over from back to front, as indicated by the arrow in Fig. 3. As the rotation of the cylinder proceeds, the outer end of the inner wall of cam projection 8 first comes in contact with roller 68, and moves lever 44 from the position shown in Fig. 1 to the position shown in Fig. 2. As said roller travels along this cam-wall, the first action of lever 44 is to move slide 48 backward, which, by means of link 49, lifts the clamping-jaws on opposite sides of the needle. As the backward movement of the lever continues, it engages inclines 50 at the rear ends of the jaw-shanks, causing the jaws to grip the needle firmly. The continued movement of the lever moves the carriage to the position shown in Fig. 2. At the instant the backward movement of the carriage is completed roller 68 will have reached the end of the inner wall of projection 8, and will be engaged by the outer wall of projection 9. (See Figs. 1 and 2.) As the roller travels along this wall, lever 44 is caused to swing backward again to the position shown in Fig. 1. The first action of this lever in the return movement is to release the jaws so that the needle drops out. The lever then, by engagement with the recess in plate 47, moves slide 48 forward, which lowers the jaws again, in which position they are carried forward. By this time plate 47 will have engaged a plate, 70, on the carriage, so that the continued movement of the lever forces the carriage forward through the engagement of the plates. Finger 43 now passes into groove 29 in the cross-slide and forces the needle forward into the dies. The forward movement of the needle will be completed at the instant roller 68 has reached the end of the outer wall of cam projection 9 on the cylinder, the parts being now in the position shown in Fig. 1, in which position they remain until the grooving of the needle is completed, as already stated.

It will of course be understood by those familiar with the art that in this class of machines the operation of grooving is performed while the die-carriage, denoted in this instance by 16, is moving toward the left—that is, toward the table carrying the feeding and extracting mechanism. When the parts have reached the position shown in Fig. 1, and the needle has passed into the dies, the first operation is to close the dies upon the needle, locking it in place, as will presently be explained, and the second to move the die-carriage forward—that is, toward the right sufficient distance, so that the grooving-cutters, when moved forward into operative position, will begin to act at the desired portion of the needle. This "return movement," as I term it, of the die-carriage is effected by means of a lever, 71, pivoted to the bed of the machine. The upper end of this lever is provided with a set-screw, forming an adjustable point of contact with the die-carriage, and the lower end is provided with a roller, 72, which is engaged by cam projection 11 on the cylinder, which acts to swing the upper end of the lever inward and move the die-carriage to the desired position. As has already been explained, when this carriage has reached the extreme of its movement toward the right, plate 61, at the rear end thereof, actuates clutch 51 and again moves the grooving-cutters into operative position. In order to insure, however, that the grooving mechanism shall not act unless a needle has been placed in the dies, I have provided a stop device, which prevents the return of the die-carriage should the needles have become exhausted, or should the gripping-jaws for any reason fail to operate perfectly. I thus insure that the grooving-cutters shall under no circumstances come in contact with the dies.

73 denotes a rock-shaft journaled in suitable bearings on the die-carriage, which serves the double purpose of actuating mechanism for closing the dies upon the needle and unclosing them again, and also mechanism for controlling the stop device. The mechanism for closing and unclosing the dies is clearly illustrated in Figs. 17 and 18.

14^a denotes a lever fulcrumed in a suitable bracket upon the die-carriage. The forward end of this lever is pivoted to the upper die, as is clearly shown.

16^a denotes a lever pivoted to a suitable stump at the outer edge of the die-carriage. This lever extends inward, and its inner end engages a cam, 73^a, at the rear end of rock-shaft 73. The movement of the rock-shaft and cam being oscillatory, the action is of course to raise and lower lever 16^a at each oscillation. At the rear end of lever 14^a is a set-screw, 14^b, the end of which bears against le-

ver 16ª, so that the upward movement of lever 16ª tilts the rear end of lever 14ª, causing the forward end to clamp the upper die down firmly upon the needle, the backward movement of cam 73ª of course acting to relieve the pressure of said die upon the needle. In practice the rear end of lever 14ª is made heavy enough to drop by gravity and lift the die the instant lever 16ª is allowed to drop by the backward movement of cam 73ª.

16ᵇ denotes a set-screw in lever 16ª, the point of which engages the die-carriage. By means of these two set-screws I am enabled to adjust the upper die so as to clamp the different sizes and styles of needles.

16ᶜ denotes a stop, in practice made adjustable, which limits the forward movement of the needle—that is, it stops the needle at the exact place necessary in order to cut the grooves accurately. The stop device is clearly illustrated in Figs. 6, 7, and 8, and consists, essentially, of a plate, 74, pivoted to the forward end of the die-carriage. A curved finger, 75, projects upward from this plate. This finger is so shaped that in use its end rests against the needle, as shown in Fig. 7, the needle being represented as held between the dies.

76 denotes a spring on the under side of the plate, which bears against a pin or suitable projection. The action of this spring is to hold the point of the finger against the needle, as in Fig. 7; or, should it happen from any cause that no needle is received by the dies, the spring will throw the finger over to the position shown in Fig. 8, dropping the plate down, so as to leave opening 77 in the die-carriage uncovered. This opening is made amply large to receive the upper end of lever 71.

78 is a cam on shaft 73, which, as soon as the dies are unclosed by cam 73ª and levers 14ª and 16ª, engages the outer end of plate 74 and moves said plate and the finger from the position shown in Fig. 7 to that shown in Fig. 6, and holds it there while the extracting and feeding mechanism are operating—that is, until the new needle has been placed between the dies. As soon as the new needle has been placed in the dies, the cam 73ª acts to close the dies and lock them upon the needle. As soon as the locking of the dies has been effected, cam 78 moves upward again to the position shown in Figs. 7 and 8, releasing plate 74. If a needle has been properly grasped by the dies, the end of the finger now rests against the needle, as clearly shown in Fig. 7. Should it happen, however, that a needle has not been received by the dies, the finger swings by, and the plate drops down to the position shown in Fig. 8, leaving opening 77 in the die-carriage uncovered. After the movements just described the next movement is the movement of lever 71 to return the die-carriage. If the needle has been received by the dies, plate 74 must be in the position shown in Fig. 7, and is engaged by the upper end of said lever, and the carriage moved backward. In the absence of a needle from the dies, however, the downward movement of the plate, as in Fig. 8, uncovers the opening so that the upper end of the lever passes into it, moving by the plate, but not coming in contact with the carriage at all, so that the latter is not moved, and the grooving-cutters are consequently not thrown into operative position. In practice I preferably make lever 71 in two parts, substantially as shown in Figs. 13 and 14, both of said parts being journaled on the same pivot, a set-screw being provided to adjust their position relatively to each other, and a strong spring, 79, also adjusted by a set-screw placed between the parts. This spring is of course strong enough to carry the die-carriage backward in the ordinary working of the machine; but should it happen from any cause, however, that the die-carriage should become "set," spring 79 would yield, and thus avoid the danger of breakage of any portion of the machine. Rock-shaft 73 is actuated by means of a bell-crank lever, 80, pivoted under the bed of the machine, and having upon one arm a roller, 81, which is adapted to engage the left wall of projection 10 on the cylinder and the right wall of projection 9. The other arm of the bell-crank lever is connected, by means of a link, 82, with a rod, 83, which reciprocates in a suitable sleeve secured to the bed of the machine. At the upper end of this rod is a yoke, 84, which is engaged by the rod 86 of crank 85 on rock-shaft 73. The crank-rod is of course made sufficiently long to allow for the reciprocation of the die-carriage, as clearly shown in Figs. 1 and 2. In Fig. 6 the position of the parts corresponds with Figs. 1 and 3. As roller 81 rides along the wall of cam projection 10, the upper arm of the bell-crank lever is swung downward. This moves cam 78 from the position shown in Fig. 6 to that shown in Figs. 7 and 8, and permits finger 75 to rest against the needle or else to swing past, and the plate to drop down out of the way, uncovering opening 77 in the die-carriage. After roller 81 has reached the end of the wall of cam-projection 10, it passes off onto the inner—that is, the right—wall of cam projection 9. The position of parts shown in either Figs. 7 or 8 is that at which the rotation of cylinder 7 ceases, as has already been explained. As soon as the forward movement of the cylinder commences again, roller 81 travels in the opposite direction down the inner or right wall of cam projection 9, the action of which is to move cam 78 back to the position shown in Fig. 6, carrying the point of finger 75 away from the needle, so that there shall be no obstruction to the ready withdrawal of the needle by the gripping-jaws and the placing of the new needle between the dies by the feeding mechanism. When the parts have reached the position shown in Fig. 6, roller 81 will have passed off from the wall of cam projection 9, and the parts will remain in the position shown until said roller is again engaged by the left wall of projection 10, as shown in

Fig. 1, the action of which is to cause the locking of the dies again, and also at the proper time to throw the end of finger 75 against the needle or else to prevent the return movement of the die-carriage, as has been fully explained. As the operation of each mechanism and its connection with the other mechanisms has been already fully explained in this specification, further description of the operation of the machine would be superfluous.

Having thus described my invention, I claim—

1. The combination, with a hopper for needles and an agitating-spring, of upper and lower cross-slides adapted to pass under the hopper and having formed between them a groove of sufficient size to receive a single needle.

2. The hopper terminating in a curved passage, 20, and an intermittently-acting agitating-spring, in combination with cross-slides 28 and 29, having undercut edges to form a needle-groove.

3. The combination, with the hopper, of an upper cross-slide undercut at its forward edge, and a lower cross-slide having at its forward end a projection, 29^a, undercut at its rear edge, a needle-groove being formed between said edges, having for its bottom the lower cross-slide.

4. The combination, with the hopper and the reciprocating cross-slides having a groove adapted to receive a needle from the hopper, of a curved finger adapted to engage the groove and move longitudinally therein to carry the needle forward.

5. The combination, with the table and hopper, of carriage 19, the cross-slides having a groove adapted to receive a needle, and finger 43.

6. The combination, with the table and hopper, of carriage 19, carrying a switch-cam, and a lever, 30, pivoted to the table, one end of said lever being connected to the cross-slides and the other adapted to engage the switch-cam.

7. The hopper and lever 30, in combination with the upper and lower cross-slides, the latter having a slot, 29^b, and pin 30^a, which connects the lever with the upper cross-slide and engages the slot in the lower cross-slide, whereby the movement of the upper cross-slide in both directions is caused to begin first.

8. The combination, with lever 30, of the upper cross-slide undercut at its forward edge, the lower cross-slide having slot 29^b and projection 29^a, undercut at its rear edge, and pin 30^a, connecting the lever with the upper cross-slide and engaging the slot in the under cross-slide.

9. The combination, with the hopper and lever 30, of the upper cross-slide having slot 29^b and projection 29^a, said projection and upper slide forming between them a needle-groove having the under slide for its bottom, and pin 30^a, connecting the lever with the upper slide and engaging the slot in the lower slide, whereby the upper slide is caused to start backward first to widen the groove and to start forward first to clamp the needle between the slides.

10. The combination, with the table and hopper, of carriage 19, carrying a switch-cam, the cross-slides, a two-part lever pivoted to the table, which engages the switch-cam and reciprocates the cross-slide, a spring, 34, to hold the hopper in operative position, and a spring, 35, between the parts of said lever, which yields to prevent breakage should the cross-slides become wedged.

11. The combination, with the table, the carriage, and the cross-slides, of lever 30, made in two parts, both of which are pivoted to the table, spring 34, which holds the lever in operative position, and a spring, 35, between the parts of said lever, as and for the purpose set forth.

12. The combination, with the table, carriage, and cross-slides, of two-part lever 30, springs 34 and 35, and adjusting-screw 35^a.

13. The combination, with the table, carriage, and cross-slides, of lever 30, switch-cam 32, and springs 33 and 34.

14. The combination, with the carriage and cross-slides, of the gripping-jaws, and lever 44, whereby said jaws are operated and the carriage is reciprocated.

15. The combination, with the carriage and the cross-slides having a needle-groove, of the gripping-jaws upon the carriage, slide 48, and a link connecting said slide with the gripping-jaws, substantially as described.

16. The combination, with the carriage and lever 44, of jaw 36, whose shank is pivoted to the carriage to permit movement in the vertical plane, and jaw 37, pivoted to jaw 36 and adapted to swing in the horizontal plane, the shanks of said jaws having inclines 50 at their rear ends, which are engaged by lever 44 to close the jaws.

17. The combination, with lever 44 and jaw 36, pivoted to swing in the vertical plane, of jaw 37, pivoted to jaw 36 midway its length, to swing in the horizontal plane, the shanks of said jaws having inclines 50, as and for the purpose set forth.

18. The carriage, jaw 36, pivoted thereto, and jaw 37, pivoted to jaw 36, in combination with slide 48, and a link connected to said slide and to jaw 36, whereby the reciprocation of the slide is caused to impart an upward and downward movement to the jaws.

19. The carriage, the jaws having shanks provided with inclines 50, and the slide having recessed plate 47, in combination with a link connecting the slide to the jaws, and lever 44, which engages the inclines to close the jaws and engages plate 47 to raise and lower the jaws, substantially as described.

20. The carriage having plate 70, the jaws having shanks with inclines 50, and the slide having recessed plate 47, in combination with link 49, pivoted to the slide and to one of the jaws, and lever 44, which engages plate 47 to reciprocate the slide, carries said plate against plate 70 to move the carriage forward, and en-

gages the inclines to close the jaws and return the carriage to its retracted position.

21. Jaw 36, whose shank is pivoted to the carriage, and jaw 37, pivoted to said jaw midway its length, the shanks of both jaws having inclines 50, in combination with lever 44, which engages the inclines to open the shanks, thereby closing the jaws, and a set-screw, 40, in one jaw, which engages the other to limit the movement of the shanks toward each other in opening the jaws.

22. The combination, with the cross slides having a needle-groove, of the carriage, jaws 36 and 37, and a finger carried by jaw 36, which, as the carriage moves forward, engages said groove and carries the needle to the operating mechanism.

23. The combination, with the carriage and the cross-slides having a needle-groove, of jaws 36 and 37, pivoted to the carriage, and a finger carried by jaw 36 and adapted to engage the needle-groove, as and for the purpose set forth.

24. The combination, with the cross-slides having a needle-groove, of the jaws and an adjustable slide carried by one of said jaws, and having a finger adapted to engage the needle-groove, as and for the purpose set forth.

25. The combination, with the carriage, jaws, and cross-slides, of lever 44 and a cylinder, 7, having cam projections adapted to oscillate said lever.

26. The combination, with the carriage, jaws, cross-slides, and connecting mechanism, substantially as described, of an oscillating lever for actuating said parts, and a friction-spring, 35^b, bearing against a portion of the carriage to insure steady movement of the parts.

27. The combination, with the hopper, carriage, jaws, and the cross-slides having a needle-groove, of slide 48, a link connecting the slide with the jaws, a finger carried by one of said jaws and engaging the needle-groove, and oscillating lever 44, whereby the needles are taken from the hopper, carried to the operating mechanism, extracted therefrom, and dropped, substantially as described.

28. The combination, with the dies and reciprocating die-carriage, of the cross-slides and carriage 19, carrying the jaws, and finger 43, whereby the needles are fed to the dies singly and removed therefrom after being acted upon.

29. In a needle-grooving machine, the die-carriage having an opening, 77, and a swinging plate adapted to cover said opening or to drop down out of the way, in combination with an oscillating lever, 71, adapted to engage said plate to return the carriage to its normal position or to pass into said opening without moving the carriage when the plate has dropped down.

30. The combination, with the die-carriage having opening 77, of plate 74, adapted to cover said opening, and a spring, 76, adapted to throw said plate downward, leaving the opening uncovered, substantially as described.

31. The combination, with the die-carriage having opening 77, the dies, and lever 71, of a plate adapted to cover said opening, and having a finger, 75, a spring acting to throw said plate downward to uncover the opening, and an intermittently-acting cam, which alternately engages the plate to hold the finger away from the needle and releases it, permitting the finger to drop against a needle in the dies or to swing past the dies, permitting the plate to drop down if no needle has been received.

32. The combination, with the cross-slides having a needle-groove, the jaws, and finger 43, of the die-carriage having an opening, 77, the dies, a plate adapted to cover said opening or to drop down out of the way, and having finger 75, a cam adapted to alternately engage and release said plate, and an oscillating lever, 71, which engages the plate to retract the die-carriage when said plate is held up by a needle in the dies, and passes into said opening when the plate drops down.

33. The combination, with the jaws, the die-carriage having opening 77, the dies, and a plate pivoted to the die-carriage which is adapted to cover said opening or to drop down out of the way, of oscillating lever 71, which engages the plate to retract the die-carriage when a needle has been received by the dies, and passes into the opening without moving the die-carriage when no needle is received by the dies and the plate drops down.

34. The combination, with the jaws, the die-carriage having opening 77, the dies, and a plate pivoted to the die-carriage which is adapted to cover said opening or to drop down out of the way and is provided with a finger, 75, adapted to engage the needle held by the dies, of oscillating lever 71, which engages the plate to retract the die-carriage when a needle has been received by the dies, and passes into the opening without moving the die-carriage when the plate is not held up by engagement of the finger with a needle in the dies.

35. In a needle-grooving machine, the combination, with the die-carriage having an opening, 77, of a plate pivoted to the carriage and adapted to cover said opening, and oscillating lever 71, substantially as described.

36. The combination, with the die-carriage having opening 77, and a swinging plate, 74, adapted to cover said opening, of lever 71, and cylinder 7, having a cam projection which is engaged by said lever, as and for the purpose set forth.

37. The combination, with the die-carriage having opening 77, plate 74, adapted to cover said opening, and oscillating lever 71, of rock-shaft 73, having a cam adapted to engage said plate, as and for the purpose set forth.

38. In a needle-grooving machine, the combination, with plate 74 and rock-shaft 73, having a cam adapted to engage said plate, and a crank, of rod 83, having a yoke engaging the crank-rod, a bell-crank lever engaging cam projections on cylinder 7, and a link connecting said rod with the bell-crank lever.

39. The combination, with the hopper, the

cross-slides having a needle-groove, and finger 43, of rock-shaft 73, having cam 73ª, the upper and lower dies, and intermediate mechanism, substantially as described, whereby the oscillation of the rock-shaft causes the automatic opening and closing of the dies.

40. The combination, with the feeding mechanism, the dies, and the cutters, of rock-shaft 73, and intermediate connections, substantially as described, for opening and closing the dies.

41. The combination, with the upper and lower dies, and rock-shaft 73, having cams 73ª, of lever 14ª, pivoted to the upper die, and lever 16ª, which engages the cam and is engaged by lever 14ª, whereby the latter is tilted to close the dies upon the needle.

42. The upper and lower dies, and a lever, 14ª, pivoted to the upper die, in combination with a rock-shaft having a cam, and a lever, 16ª, which engages the cam and is engaged by lever 14ª.

43. The combination, with the dies, the die-carriage having opening 77, a plate adapted to cover said opening, and lever 71, for moving the carriage backward, of a lever for closing the upper die, and a rock-shaft having cams 73ª and 78, one of which engages said plate and the other actuates the lever which closes the die.

44. The combination, with the dies and the rock-shaft having cam 73ª, of levers 14ª and 16ª, having set-screws 14ᵇ and 16ᵇ, as and for the purpose set forth.

45. In a needle-grooving machine, the combination, with the die-carriage and a cylinder having cam projection 11, of the two-part lever 71, spring 79 between the parts of said lever, and a set-screw for adjusting said parts, whereby, should the die-carriage become set, the spring would yield and prevent breakage of the parts.

46. The combination, with the die-carriage and an intermittently-rotating cylinder having a cam projection, 11, of two-part lever 71, one of said parts having a set-screw engaging the die-carriage and the other a roller engaging the cam projection, and a spring, 79, between the parts of said lever, which is adapted to yield should the die-carriage become set.

47. The combination, with the jaws, oscillating lever 44, the grooving-cutters, the die-carriage having a plate, 61, and an oscillating lever for retracting the die carriage, of a shaft, 52, clutch 51, actuated by said plate, through which motion is imparted to said shaft to move the cutters into operative position when the die-carriage is retracted, a cylinder having cam projections which actuate the levers, and a clutch, 5, through which motion is imparted to said cylinder when the grooving operation is completed.

48. The combination, with the jaws, the cutters, the die-carriage, and oscillating levers 44 and 71, of a cylinder having cam projections which actuate said levers, shaft 52, through which the cutters are moved into operative position, clutch 51, through which motion is imparted to said shaft when the die-carriage is retracted, and clutch 5, through which motion is imparted to the cylinder when the grooving operation is completed.

49. The combination, with power-shaft 1, shaft 4, having a cylinder with cam projections, and clutch 5, having a clutch-dog, 67, adapted to connect said shafts, of a stationary cam, 69, for withdrawing the dog, a spring-latch, 66, to hold it withdrawn, and a lever, 65, whereby the spring-latch is tripped, substantially as described.

50. The clutch, cross-slide, jaws, die-carriage having plate 74, and rock-shaft 73, in combination with levers 44, 71, and 80, and an intermittently-rotating cylinder having cam projections engaged by said levers, whereby the needles are fed forward to be acted upon and extracted and dropped at the completion of the operation.

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

PHILO M. BEERS.

Witnesses:
A. M. WOOSTER,
B. E. LEE.