2 Sheets--Sheet 1.

C. P. S. WARDWELL.

Making Knitting Machine Needles.

No. 50,188. Patented Sept. 26, 1865.

Fig. 1.

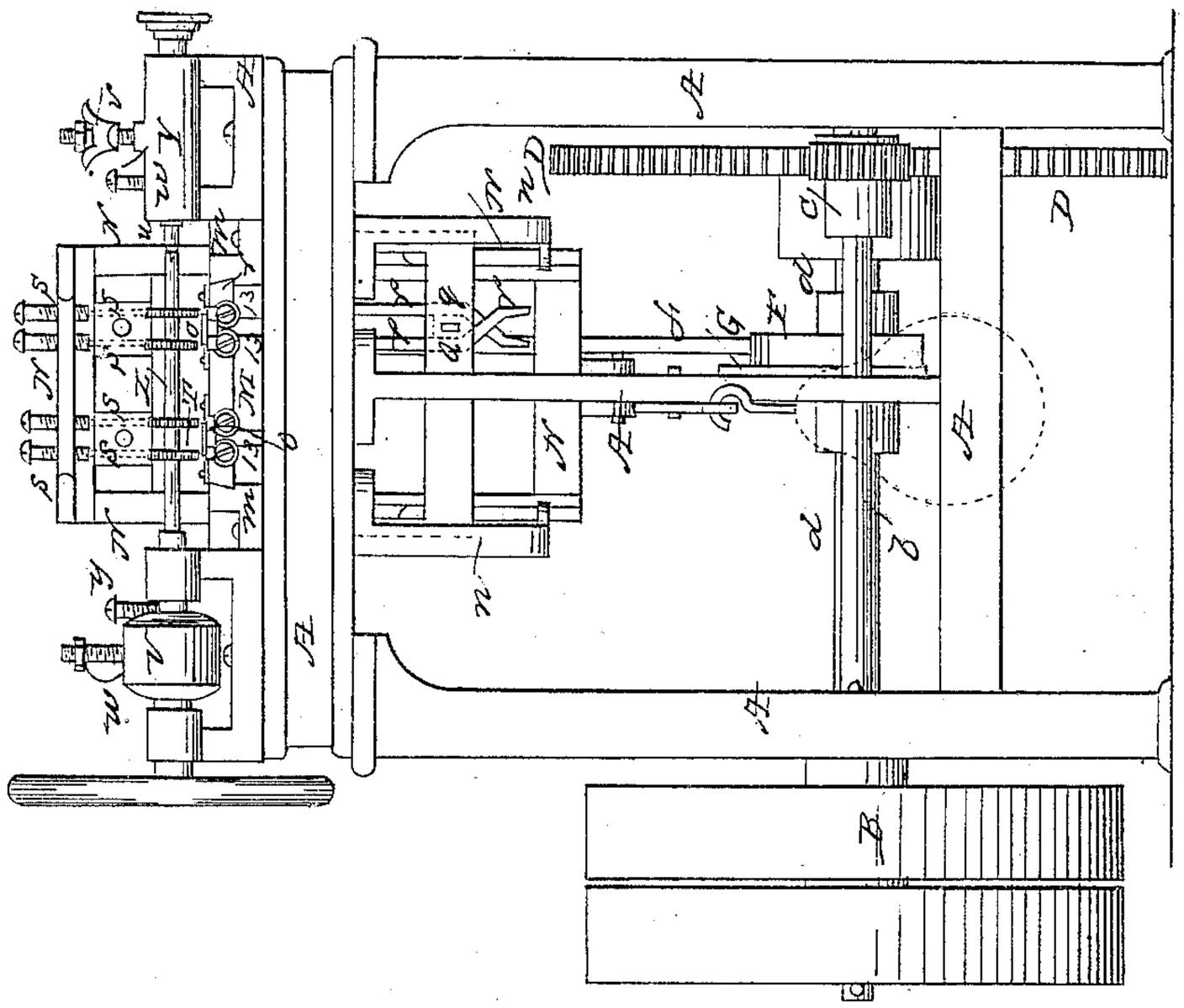
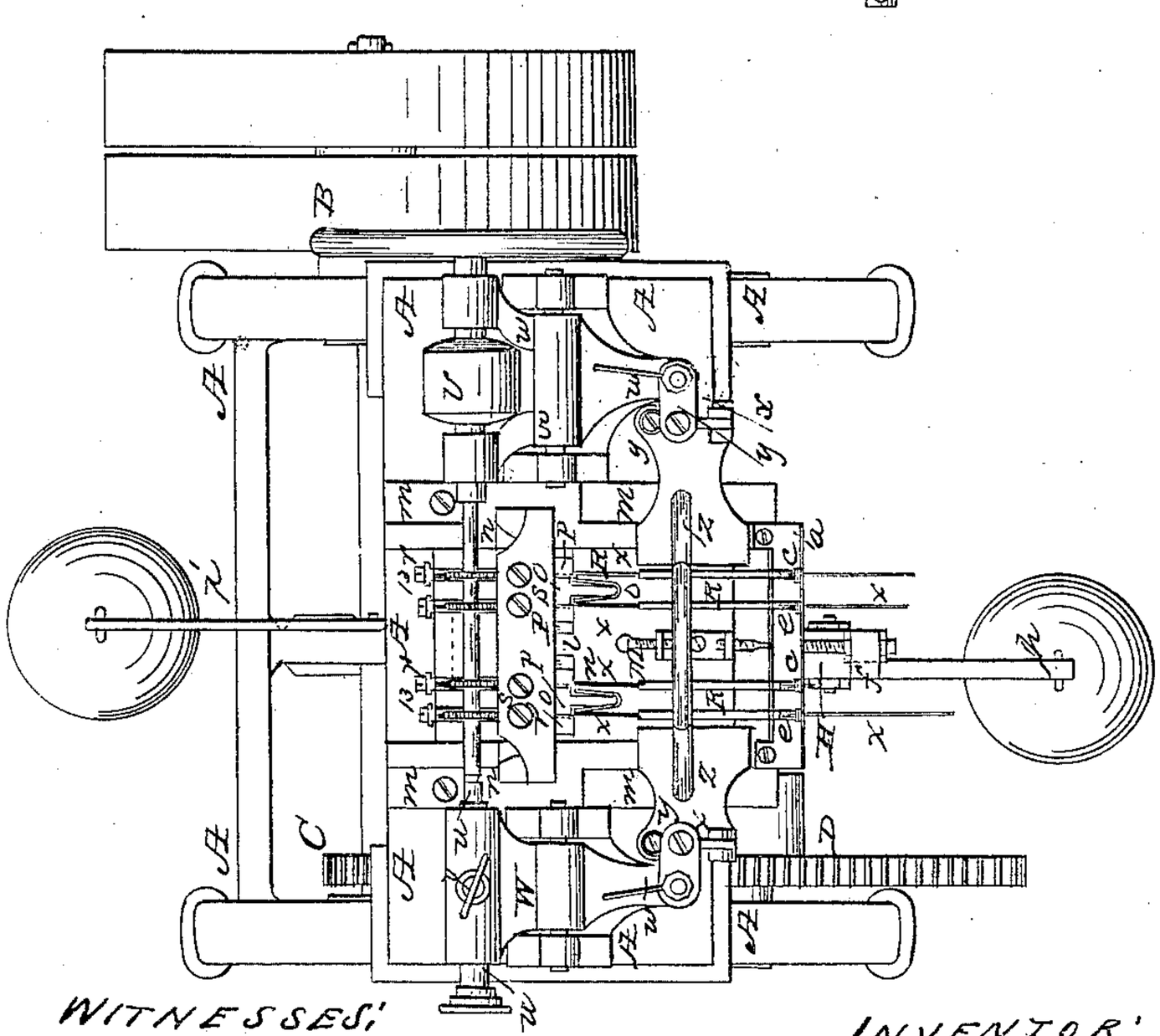


Fig. 2.



WITNESSES:

M. B. Wardwell
J. L. Browne

INVENTOR:

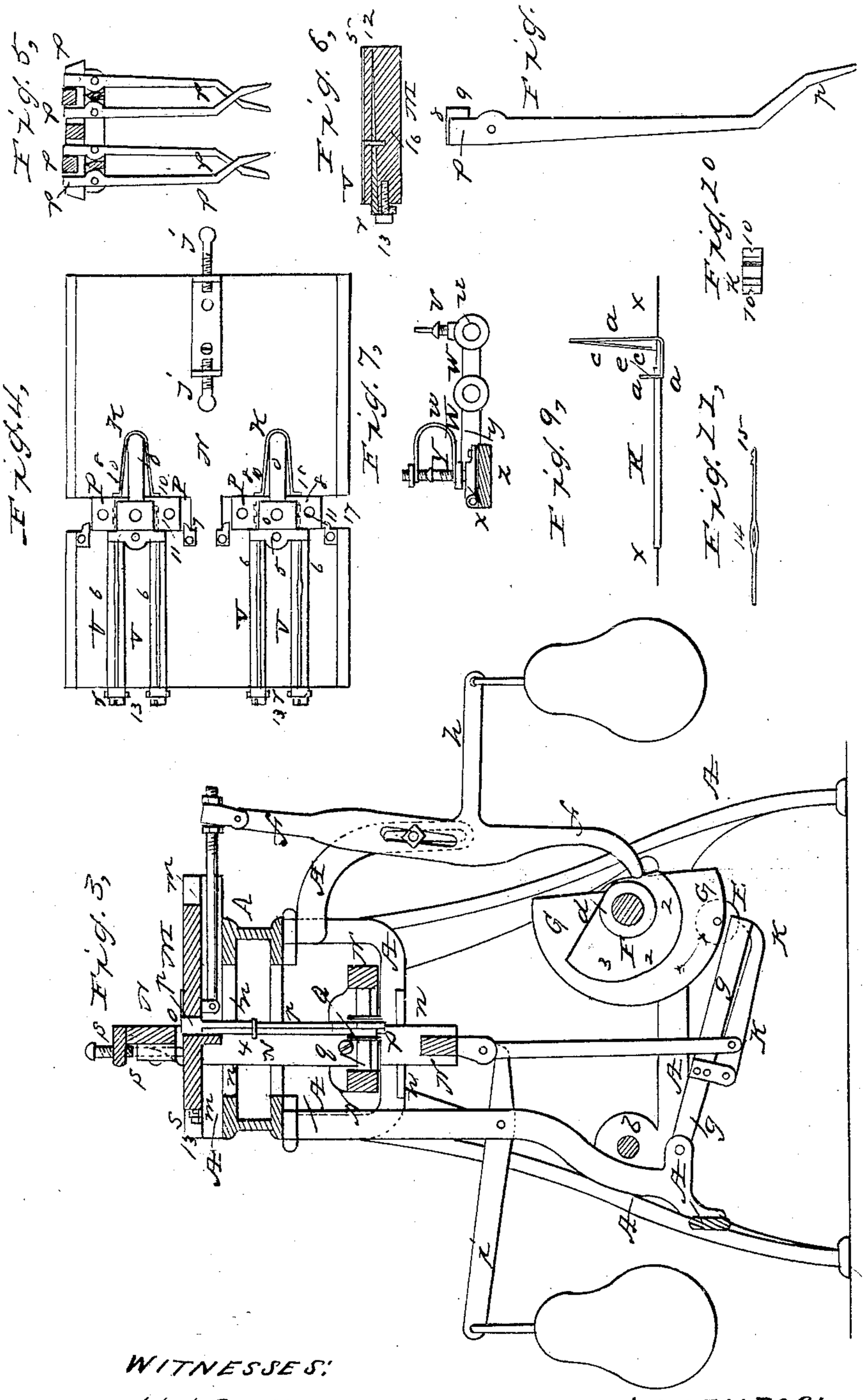
C. P. S. Wardwell

2 Sheets--Sheet 2.

C. P. S. WARDWELL.

Making Knitting Machine Needles.

No. 50,188. Patented Sept. 26, 1865.



WITNESSES:

M. S. Wardwell
J. L. Brown

INVENTOR:

C. P. S. Wardwell.

UNITED STATES PATENT OFFICE.

C. P. S. WARDWELL, OF LAKE VILLAGE, NEW HAMPSHIRE.

MACHINE FOR MAKING KNITTING-NEEDLES.

Specification forming part of Letters Patent No. **50,188**, dated September 26, 1865.

To all whom it may concern:

Be it known that I, C. P. S. WARDWELL, of Lake Village, in the county of Belknap and State of New Hampshire, have invented a new and Improved Machine for Making Knitting-Needles Used in Knitting-Machines; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making part of this specification—

Figure 1 being a plan of the machine; Fig. 2, a front elevation thereof; Fig. 3, a transverse vertical section showing the principal working parts together, the less important parts being omitted, in order not to obstruct the view; Fig. 4, an enlarged top view of the sliding bed or table on which the needles are formed; Fig. 5, a vertical cross-section of the same in its middle or narrow part, looking forward; Fig. 6, a longitudinal vertical section of the front portion of the bed through the center of one of its bed-blocks; Figs. 7, 8, 9, and 10, views of parts detached; Fig. 11, top view of one of the needles as it is formed by the machine.

Like letters designate corresponding parts in all of the figures.

The frame A may be made of cast-iron, and of such form and parts as may be most convenient for mounting the working parts upon. The drawings exhibit about the form that I have adopted, but it may be varied at will.

All the operations of the machine are produced by the movements of three fundamental parts, namely—by the horizontal reciprocating motion of a bed or table, M, by the vertical reciprocating motion of a sliding frame or gate, N, and by the revolution of the "slabbing" mills or cutters T T.

The functions of the horizontally-reciprocating bed or table M are to draw or feed the wire of which the needles are made into the machine; to hold the needles while punching their eyes, and slabbing them; to actuate the patterns which shape their points or barbs, and to discharge them from the machine.

The active functions of the vertically-reciprocating frame N are to actuate the movable jaws by which the needle-blanks are cut off and "spotted," and retained fixedly on the table M during the succeeding operations, and to punch the eyes in the needles. The single function of the mills T T is to "slab" or dress down to the proper thickness the points or barbs of the needles.

The forward or positive motion of the table M is produced by a revolving cam, F, operating on a vibratory lever, *f*, which is connected with the table by a connecting-rod, H, and its return motion is effected by a counter-weight suspended from an arm, *h*, of the lever. The lever *f* has the requisite adjustment of its pivot to vary the extent of movement produced by it to make needles of different lengths, or for any other reason, and an adjustable connection with the connecting-rod H to regulate the beginning and ending of the table's movement.

The downward or positive motions of the frame N are produced by a cam, G, and a cam wheel or projection, E, on the periphery thereof, operating respectively on levers *g* and *k*, which are both connected with the frame by a single connecting-rod, J, and its return motion is likewise best effected by a counter-weight suspended from a lever, *i*, the short arm of which bears up under the frame, or by the equivalent thereof.

Both the cams F and G are secured to a horizontal revolving shaft, *d*, on which is a gear-wheel, D, of the proper size in relation to that of a driving-pinion, C, which gears into it and is secured to the shaft *b* of the main driving-pulley B. The direction of the motion of the cams is indicated by an arrow in Fig. 3.

The mills or cutters T T receive their revolving motion by a small driving-pulley, U, on a separate mandrel-shaft, to which their own shaft *t* is coupled, so as to be removable and replaceable at pleasure. The opposite end of their shaft *t* is centered on the point of a "tail-stock" pivot, *u*, which is made movable or fast by a set-screw, *v*. These mills turn in a direction to cut with the feed of the table M. The motion may be transferred to the pulley U from the main driving-shaft *b*, or from any other on the machine, or not.

These general parts require no multiplication nor duplication to make any convenient number of needles at once, and thus multiply the capacity of the machine. In the drawings the machine is represented as making four needles at once.

The wires *x x x x*, from which the needles are made, are straightened and wound on reels of suitable size, and pass therefrom first through

a holding-plate, *a*, Figs. 1 and 9, attached to the back side of the machine. To this plate (or to the bed, if preferred) are secured tubes R R R R, one for each wire, reaching forward as far as the motions of the table M will allow, and having their apertures just large enough to permit the wires to pass freely through. The office of these tubes is to guide the wires forward to the jaws or dies which next receive them, and to prevent the wires from doubling up or bending when the table M makes its backward movement, in which operation the wires are pushed forward each time between the said jaws or dies preparatory to cutting off the needle-blanks. For this feeding forward the wires are held from sliding back by means of spring-plates *c c c c*, arranged as shown in Fig. 9. They are attached at the top to the plate *a* and reach forward somewhat from a vertical line, as well as downward, and their lower ends or edges touch the wires, the upper halves of the tubes R R R R being cut away, as seen at *e*, to allow the contact. The effect of this arrangement is, when the wires are drawn forward, to move the lower ends of the plates forward, rising at the same time in the circle, and thereby releasing the contact, so as to allow a free movement of the wires; but when the wires begin to move backward the effect is to draw the lower ends of the plates backward, and consequently downward, in the circle by a toggle-arm action, and thus securely to lock the wires and prevent further backward motion before the plates come to a vertical position. The lower edges of the plates *c c c c* are sharpened, as shown, to cause them to hold against the wires more surely, and they are sufficiently flexible to allow all the vibratory motion at their lower ends which may be necessary. Each wire passes from its directing-tube R first through a hole, 9, Fig. 8, in a shear-projection, 8, on the inner rear edge of a movable jaw or die, P, and thence forward between this and a stationary jaw or die, O. The jaw or die P is at or on the upper end of a lever, *p*, which has a transverse vibrating movement on its fulcrum sufficient to open and close the jaws, as desired. The closing of this movable jaw or die against the stationary jaw or die is effected by a wedge or separator, Q, Figs. 2 and 3, which is secured in the vertically-reciprocating frame N and moves up and down therewith, while it is allowed a horizontal movement parellel or corresponding with that of the reciprocating table M by sliding on a rod, *q*, of the frame N. This rod is angular, oblong in cross-section, or of some other suitable form which will prevent the wedge Q from turning on it, while allowing the wedge to slide freely forward and backward. The wedge as it descends with the frame N between each pair of die-levers *p p* first acts against portions thereof, which are bent or inclined inward, as shown in Figs. 2 and 5, and thus forces the lower ends of the levers outward apart, and consequently the jaws or dies P P, at their upper ends, inward toward the double stationary jaw or die O between them. There is a wedge, Q, for each pair of die-levers *p p*.

The shutting of the jaws or dies first cuts off the wires into blanks of the proper length for the needles by the shearing action of the perforated shear-projections 8 8 of the movable jaws or dies acting against the rear edges of the stationary jaws or dies O. The shear-hole 9 of each shear-plate, through which the wire passes, is situated about one diameter of the wire farther in than the face of the jaw or die itself, as seen in Fig. 8, so as to insure the cutting off before the jaws close against the wire. The next action, which immediately succeeds the cutting off of the blanks, and which is only a continuation of the same motion of the dies, is to "spot" the shanks of the needles. For this purpose the inner faces of the movable jaws or dies P P have the requisite projections, as seen at 11, Fig. 4, to impress the desired form on the needles, as indicated at 15, Fig. 11. The indentations, however, are such as to leave the rear ends of the needles round or of the full size of the wire, so that there may be no failure of the wires behind hitting them when it is required to push the needles out of the machine in the backward movement of the table M. Any equivalent of the spotting of the shanks may be employed, the dies being so varied in form or motion as to produce it.

The jaws or dies are kept closed to hold the needles in the same position as when the act of spotting is finished till all the forward movements of the machine are completed; and this is simply effected by means of parallel portions or faces of the lower ends of the die-levers *p p*, so that the wedge Q sliding between them merely holds them in a fixed position while the frame H completes its farther descent. The cam G, which draws the frame N for its first movement, thence continues concentric for a time, and does not move the frame at all. The next succeeding movement is required of the cam F to move the table N forward, so as to bring the needles into the right position for punching their eyes 14, Fig. 11. The amount of this movement is but small, and is produced by the first small rise from the lowest or innermost part of the cam. Thence the cam is concentric for a distance at 1, Fig. 3, in order to hold the table M stationary while punching the eyes of the needle. The punches S S S S for this purpose are mounted in the upper end of the frame N, and are adjustable up and down therein by means of set-screws *s s s s*. This operation requires much more power and less motion than the other movements produced by the cam G. These requisites are well provided for by not employing the immediate action of the cam on its lever *g*, but by using a cam wheel or projection, E, turning in and projecting from its periphery, so as to extend down in an opening of or by the lever *g* and act upon an auxiliary lever, *k*, pivoted

both to the connecting-rod J and to the main lever *g* in a manner to give a much greater leverage and less motion to the frame N, as shown in Fig. 3. As the connecting-rod J is not pivoted to the main lever *g*, the further movement of the lever *k* is not impeded thereby, and the lever *g* acts upon the connecting-rod J by bearing against the lever *k*.

The needles while receiving the punching and other operations rest in bed pieces or blocks V V, having respectively longitudinal grooves in their upper surfaces just wide enough to receive the wires and deep enough to take in about half the diameter thereof. These bed-pieces lie in grooves of the table M, and are adjustable up and down in their grooves by means of wedge-strips *r r r r*, which are driven in to a greater or less distance under them by set-screws 13 13 13 13 or their equivalents, substantially as shown in Fig. 6. A pin, 16, extends down through each bed-piece into the table below, so as to prevent it from sliding in its groove lengthwise, the wedge being slotted so as to pass by the pin, as seen in the same figure. Thus the needles are adjusted to exactly the height required. The grooves in the bed-pieces are widened somewhat, as at 6, Fig. 4, beneath where the eye-punches S S act upon the needles, in order to allow the lateral widening of the needles by the punching of the eyes, as at 14, Fig. 11.

The rear ends of the grooves in the bed-pieces are made slightly flaring or funnel-shaped, to guide the ends of the needles therein with certainty; but the greatest width should not be quite equal to twice the diameter of the needle-wire, otherwise the wires behind, which push the needles out of the grooves when finished, might slip by their rear ends, and thus fail to effect the purpose. The sides of the stationary dies O at the front edge are slightly chamfered off, as shown in Fig. 4, to allow the taper in spotting to be on both sides of the needles.

Just over the rear ends of the bed-pieces V V is a spring, 5, pressing down upon the needles to keep them in place while feeding forward into the grooves, and, more essential still, to hold the blanks in the grooves during the moment after cutting them off from the wires before the jaws or dies close, and hold them firmly. The principal danger to avoid here is the snapping forward of the blanks by the action of the shears of the dies at the moment of severing the wires. The spring need not be of much force for the purpose. They may be grooved underneath and flared behind correspondently with the shape of the grooves below for the same purpose.

After the punching of the needles they are moved forward a short distance before the milling of their points or barbs commences, and this, requiring little power, may be done quickly. Therefore, the shape of the cam F at that part of its action is considerably abrupt; but the moment the milling commences the feeding should be slow, and the cam, therefore, is very gradual in its rise there, as at 2, Fig. 3; but the rate of movement is gradually increased, because the beard or barb as it nears the shank thickens, allowing less metal to be taken off in slabbing, and hence requiring less power to cut it away. In this manner the motions of the machine are very nicely graduated to correspond with the weight of the work to be done.

The depth of the cut in slabbing is gaged by the simultaneous raising or lowering of the mills or cutters T T T T on their common shaft *t*, and this is effected by the vibration of their head and tail stocks W W on pivots, the vibrations being automatically regulated by moving patterns X X, all substantially as shown in Figs. 1, 2, and 7. These patterns are mounted on a carriage, Z, which slides on the ways *m m* (or otherwise) of the table M, and is moved forward and backward by the movement of the said table. The extent of its movement and times of commencing and closing the same are regulated by adjustable stops *j j* on the table M, acting against the cross-yoke or connecting-bar *z* of the carriage Z, as represented, the stops serving as the means by which the table moves the carriage first one way and then the other way. As the table moves forward at the proper moment one stop strikes this cross-yoke and moves the carriage forward till the beard of the needle is formed, and a little farther, so as to completely raise the mills or cutters from the needles, and thereby insure against their touching the needles in the return movement of the table. Then, as the table returns, the other stop *j*, after moving a short distance, strikes the yoke of the carriage and moves it back again to the proper starting-point for the next forward movement. The patterns X X are thus moved by their carriage Z under adjustable projections Y Y on the end of the vibratory head and tail stocks W W opposite to that in which the mill-shaft *t* is mounted, so that the raising of the ends Y Y lowers the cutters, making them cut deeper, and vice versa. Counter-springs *w w* keep the projections Y Y constantly pressed down upon the patterns X X. The patterns are also adjustable in height by set-screws *y y*, and may be varied in form or replaced by others of different form. The mills or cutters T T T T are grooved, so as to round the surface of the needle-beards, or plain, as may be preferred. While the table M is moving forward to perform all these operations on the needles the wires *x x x x* are also brought forward, ready for the next set of blanks to be cut therefrom. This is effected by means of spring jaws or holders K K, acting in conjunction with the shear-projections 8 8 of the movable jaws or dies P P. The outwardly-projecting ends of these springs are notched, as seen at 10 10, Fig. 10, and sharpened, so that by pressing the wires against the opposite sides of the apertures 9 9, Fig. 8, of the shear-projections

8 they hold the wires clamped with sufficient force to draw them forward with the table when the said jaws are closed in toward the springs. Then, as the table returns, the wires are held from sliding back by the spring-plates *c c c c*, as before described, and are consequently fed forward over the table into the proper position for cutting the blanks from them when the table commences the next forward movement, the jaws being opened then away from the springs, so that the wires pass them freely. This act of feeding the wires forward also expels the milled needles from the machine. In the return motions of the table M and frame N, as the levers *p p* are relieved from the action of the wedge Q, the lower ends of each pair are brought back closer together again by a spring-band, 4, Fig. 3, or its equivalent, thus separating the jaws or dies P P from the stationary ones O O. They are prevented from separating too far by stops 7 7 on the table N. These movable jaws or dies P P are worked in pairs, and a single stationary jaw or die, O, serves (as two) for each movable pair. The springs K K are also generally paired, or made two in one. So are the springs 5 5. This arrangement simplifies the construction as well as the operation of the parts.

The shear-projections 8 8 of the movable dies P P are generally made removable and replaceable. The same is true of the stationary jaws or dies O O upon the blocks *o o*, as represented.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The arrangement and combination of the horizontally-reciprocating table M, the vertically-reciprocating frame N, and the revolving mill or mills T, respectively performing the several functions, and in relation to one another substantially as and for the purposes herein specified.

2. The auxiliary cam wheel or projection E on the main cam G, in combination with the additional lever *k*, pivoted to the cam-lever *g* and to the connecting-rod J, so as to produce increased leverage, substantially as and for the purpose herein set forth.

3. The perforated shear-projections 8 8 on the movable jaws or dies P P, by which the wires are guided and held in place, as well as cut off, in connection with the stationary dies O O, as herein specified.

4. The notched springs K K, in combination with the shear-projections of the movable dies or jaws P P, for clamping the wires and drawing them forward with the table M, substantially as herein set forth.

5. Spotting the needles and holding them in the same position and by the same means as when spotted till all the operations upon them are completed, substantially as herein specified.

6. The mechanism, or the equivalent thereof, substantially as described, whereby the needles are spotted and then continually held in like manner and by the same means till all the operations of the machine upon the needles are completed.

7. So spotting the needles as to leave the rear ends thereof round or of the full size, when arranged in combination with the wire behind so that the latter shall strike the needles and expel them from the machine, substantially as herein set forth.

8. Expelling the milled needles from and feeding the wires forward upon the table M by the return motion of said table, the wires remaining stationary for the purpose.

9. The levers *p p*, for operating the movable jaws or dies P P, arranged and operating substantially as described.

10. The wedges Q Q on the frame N, traveling with the table M, in combination with the levers *p p*, as set forth.

11. The adjustable bed-pieces V V, arranged substantially as and for the purposes herein specified.

12. Gaging the milling of the beards through patterns X X, actuated by the movements of the table M, so as to raise or lower the mill or cutter shaft, as required, substantially as specified.

The above specification signed by me this 15th day of August, 1864.

C. P. S. WARDWELL.

Witnesses:
J. S. BROWN,
M. B. WARDWELL.