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A. A. CUMING & E. J. PEIRCE, Jr.

WAX THREAD SEWING MACHINE.

No. 417,002. Patented Dec. 10, 1889.

Fig. 1.

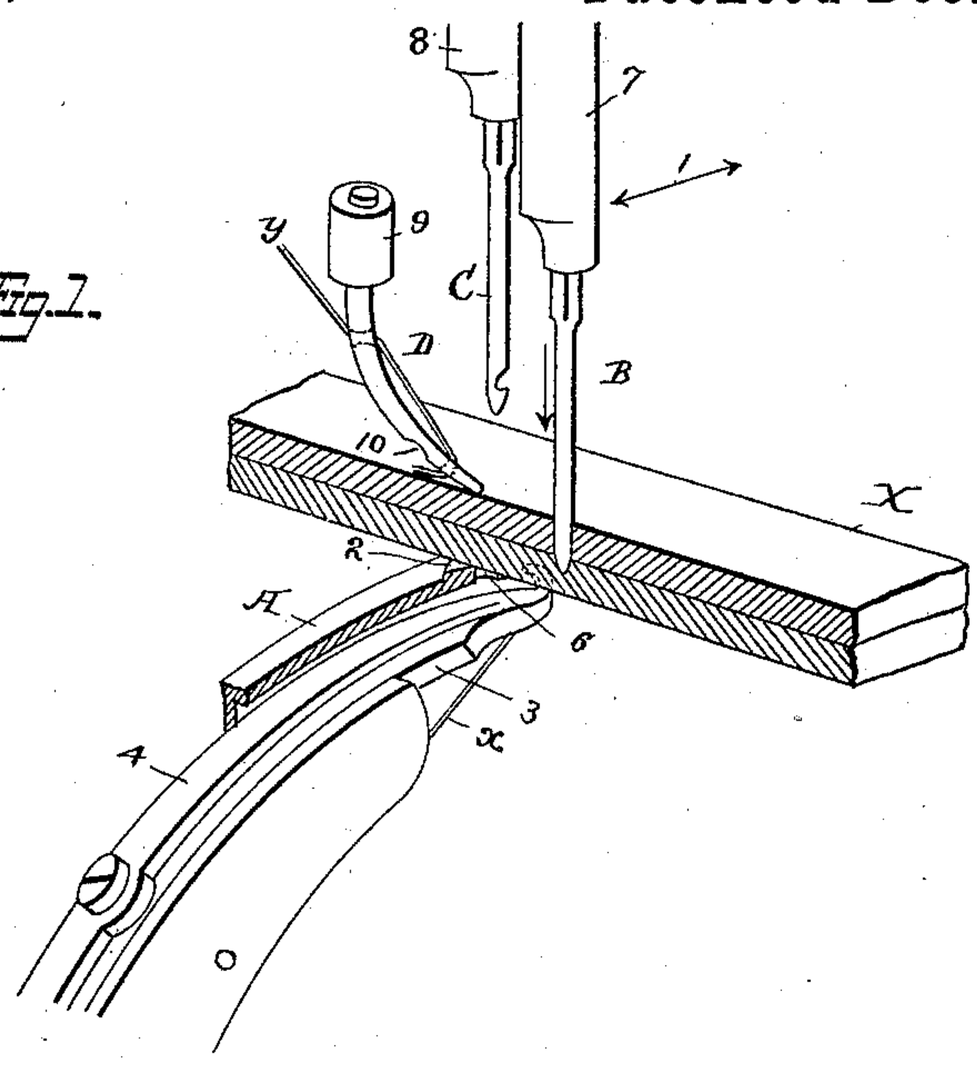

Fig. 2.

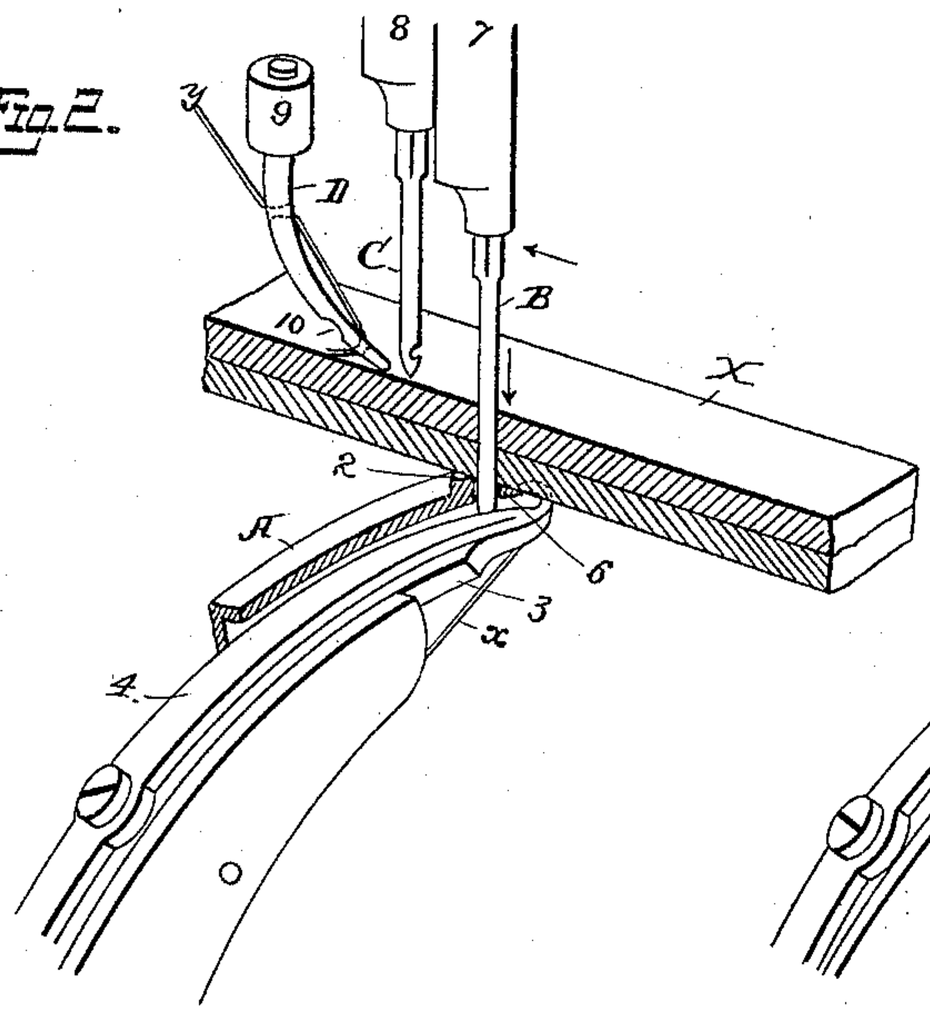

Fig. 3.

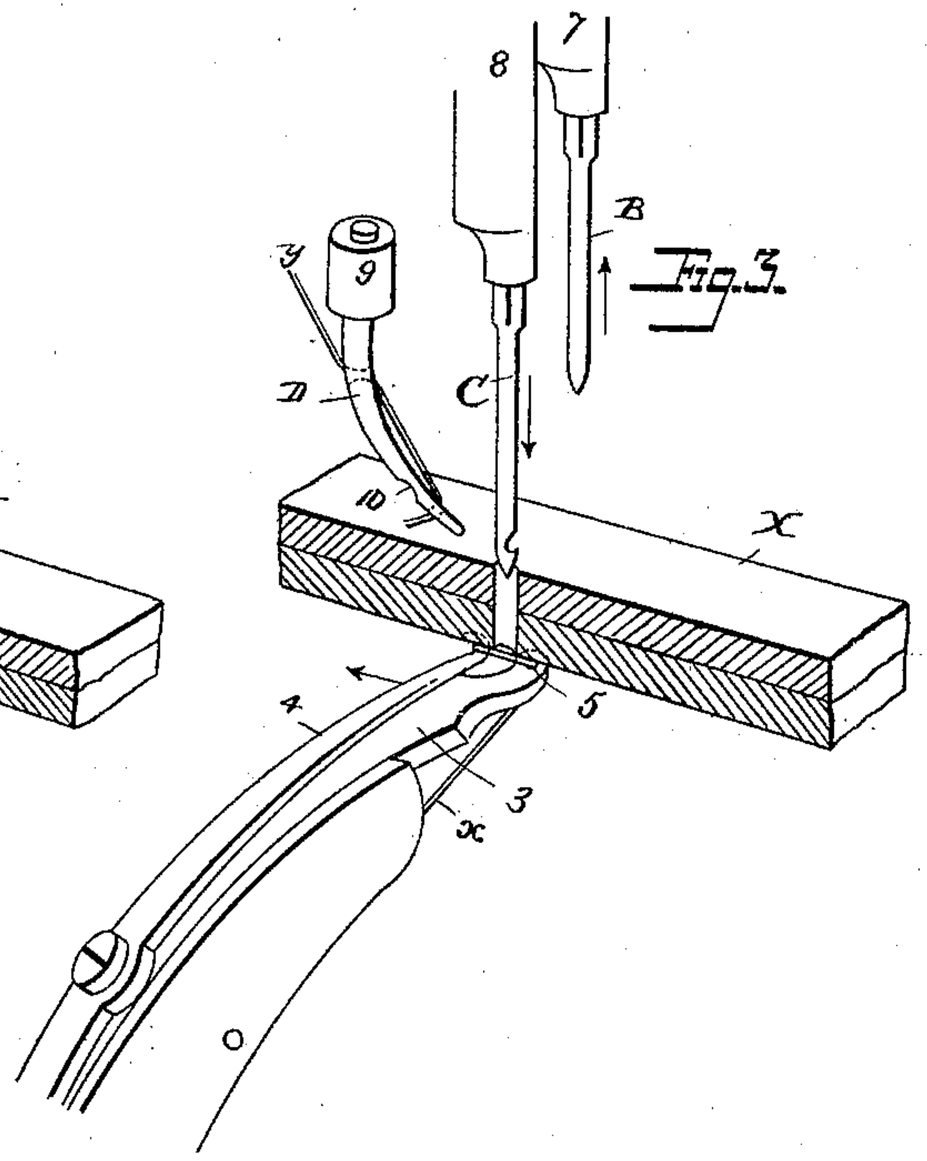

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Fig. 4.

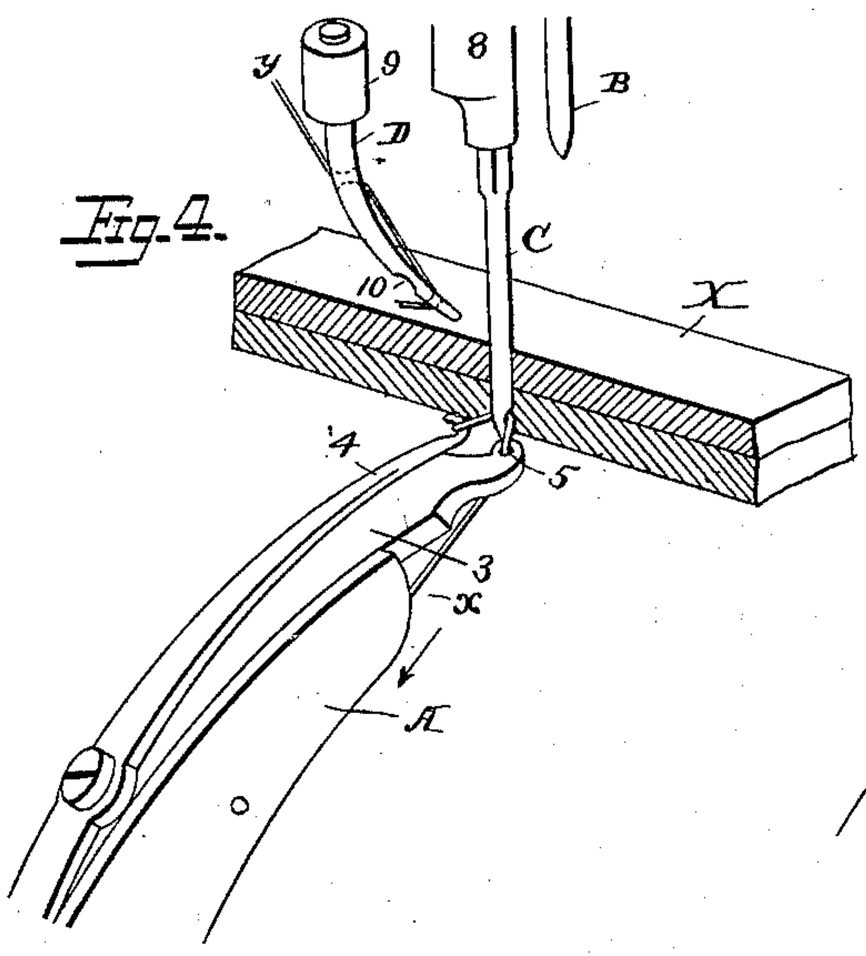

Fig. 5.

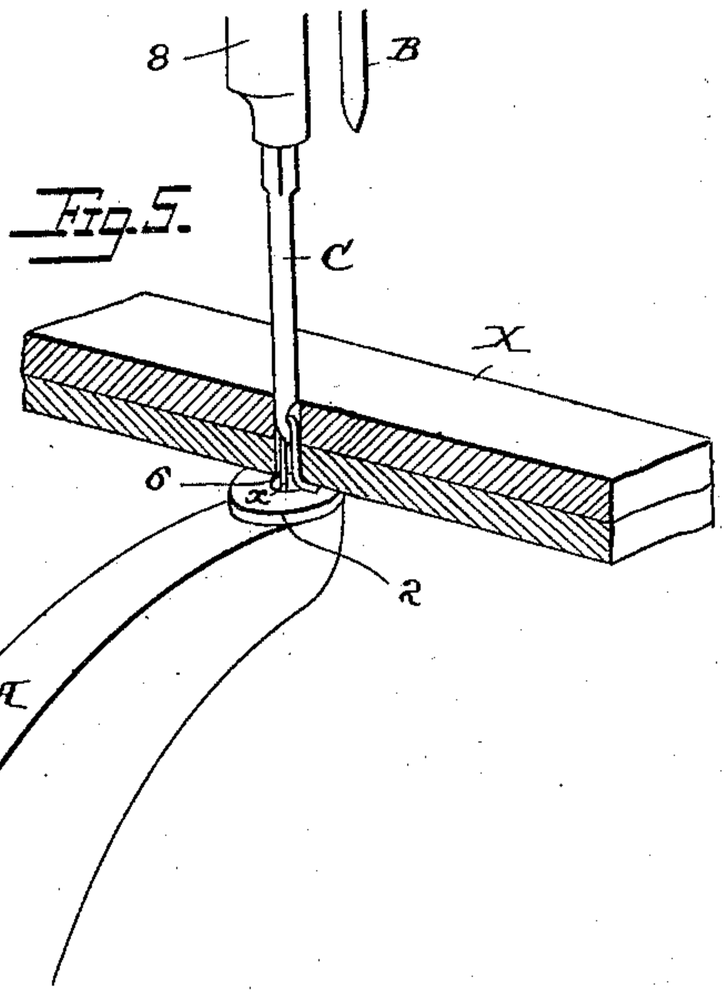

Fig. 6.

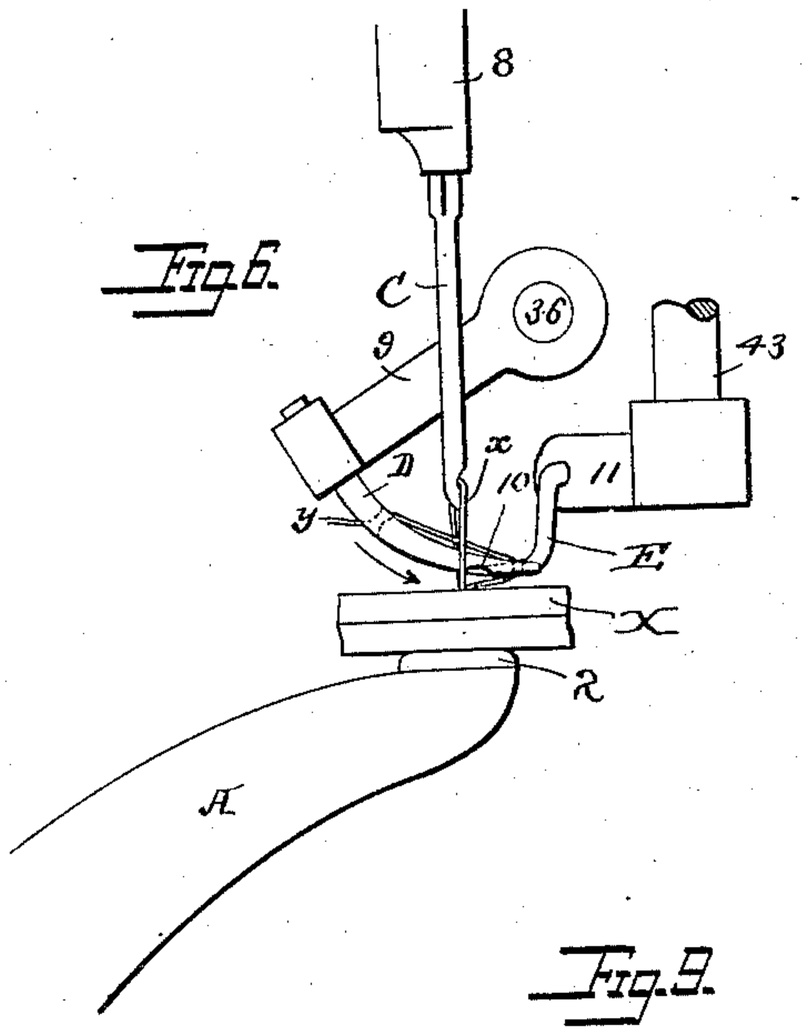

Fig. 7.

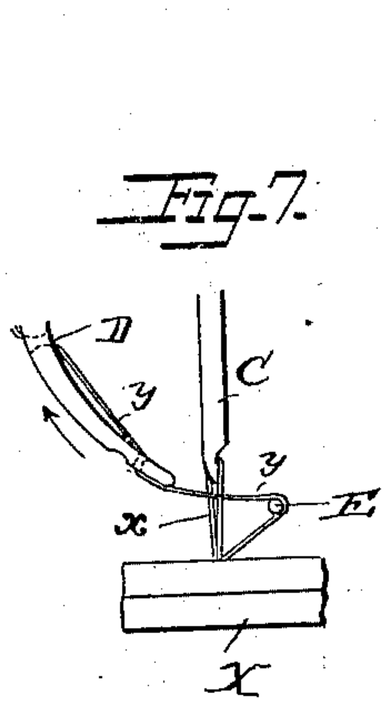

Fig. 8.

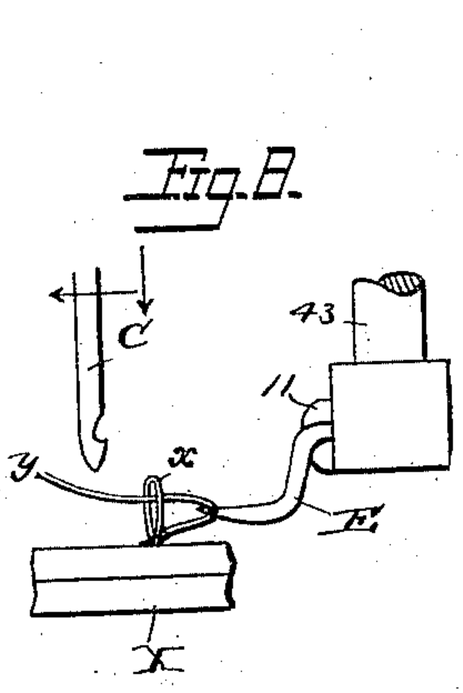

Fig. 9.

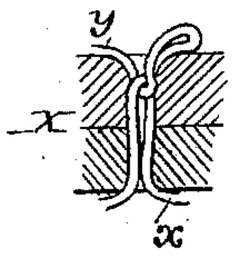

Fig. 10.

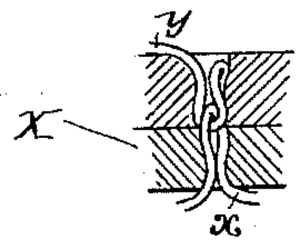

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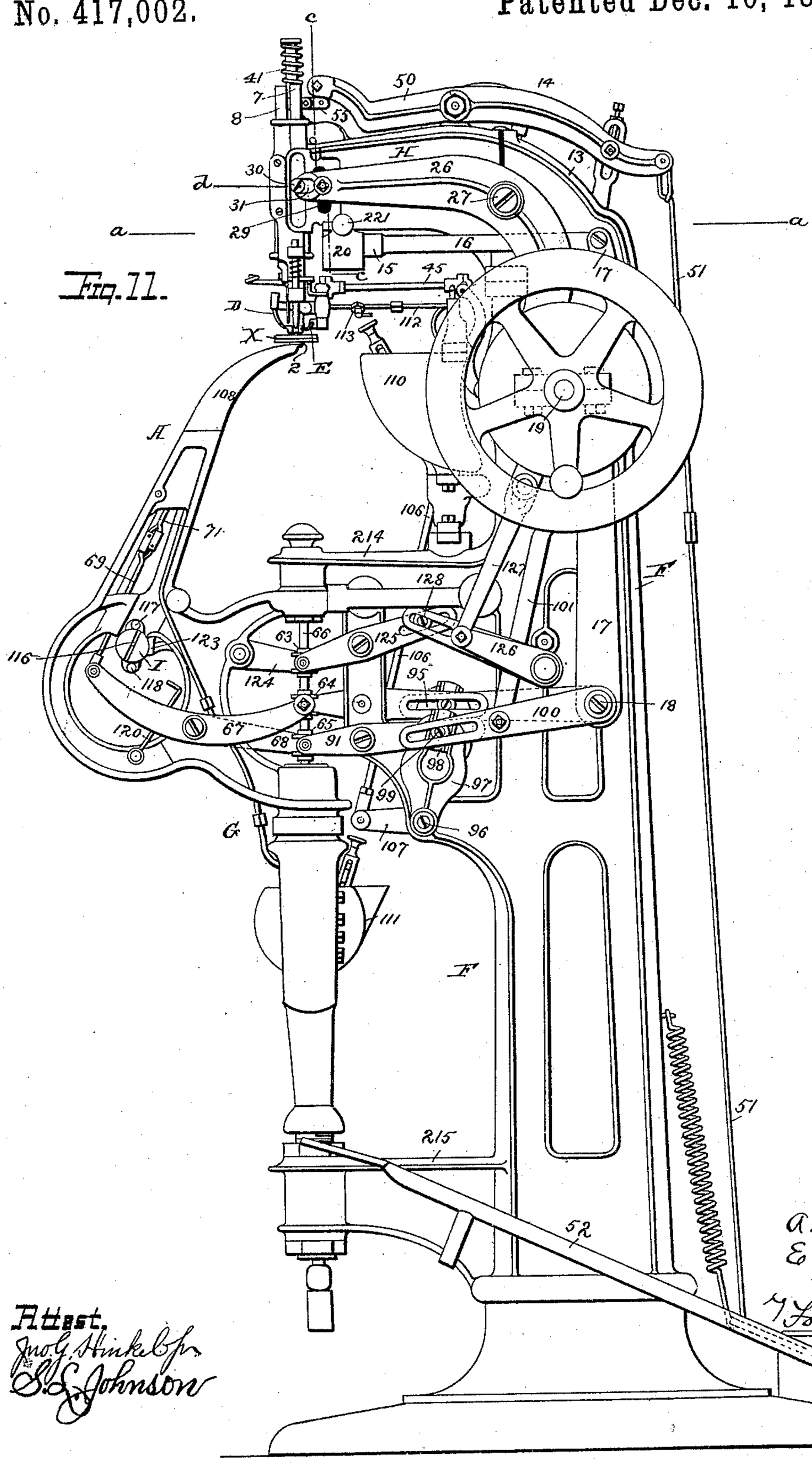
FIG. 11.



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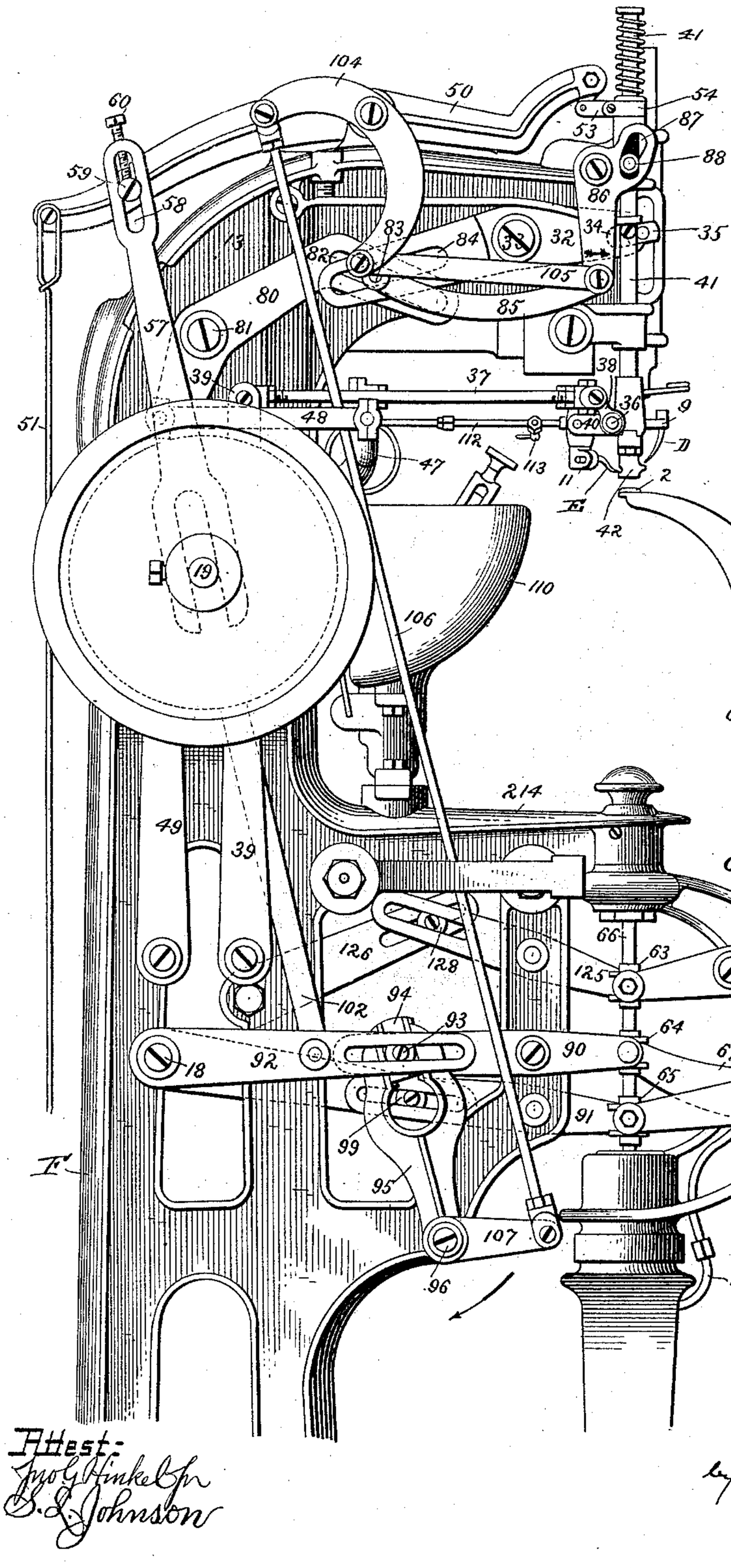

Fig 12.

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Fig. 13.

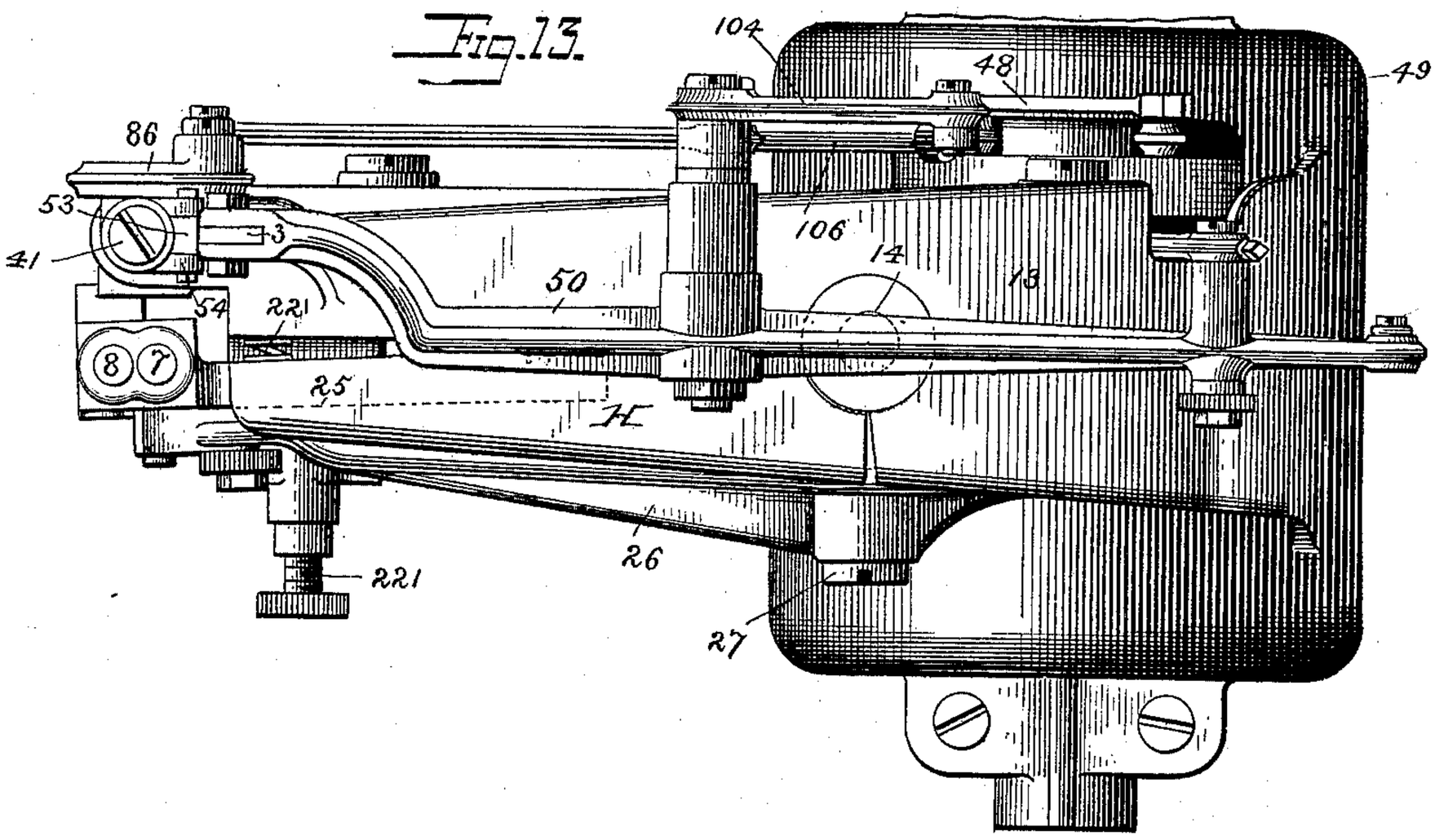
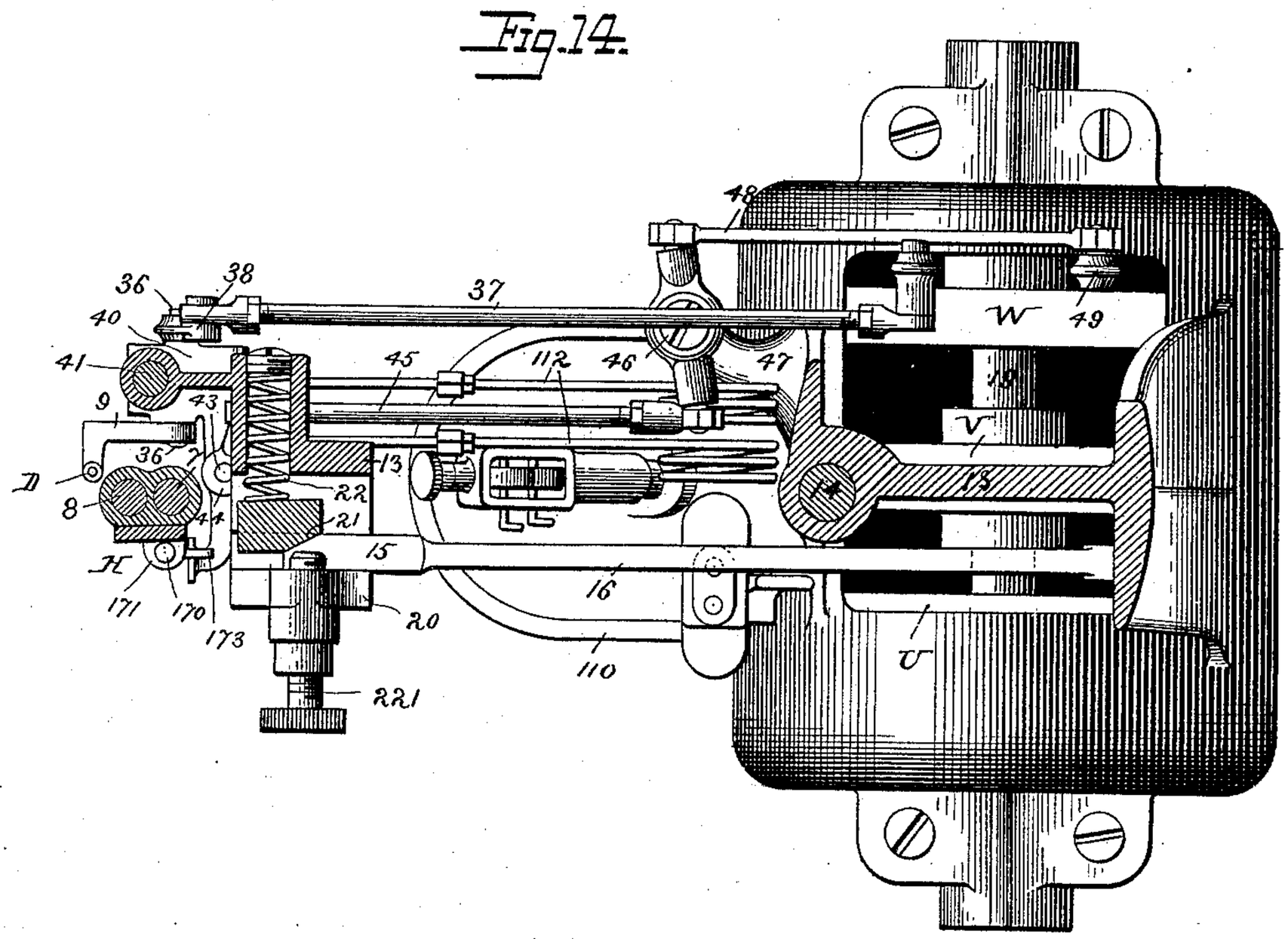


Fig. 14.



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WAX THREAD SEWING MACHINE.

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Fig. 15.

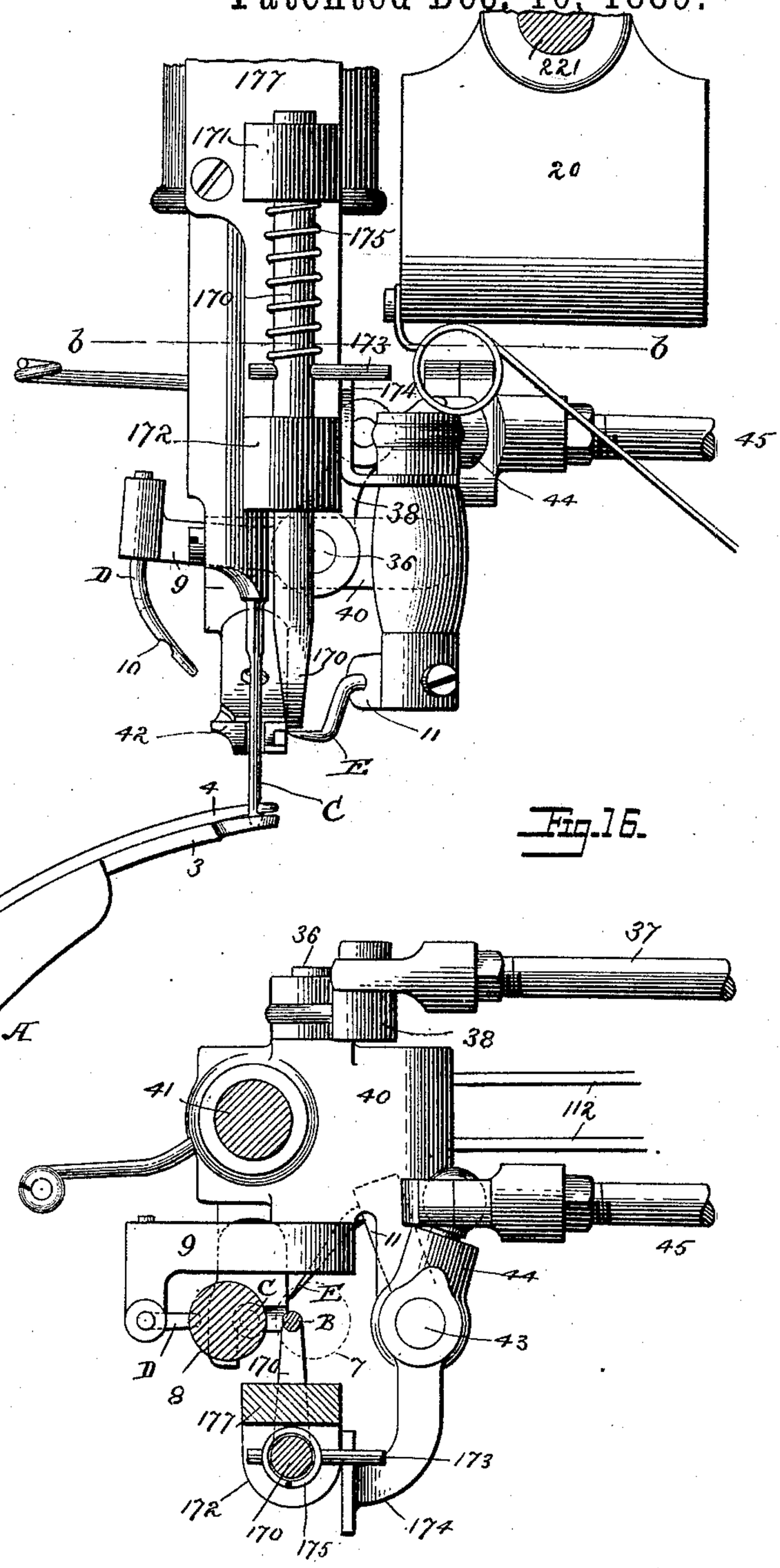

Fig. 16.

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WAX THREAD SEWING MACHINE.

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Fig. 17.

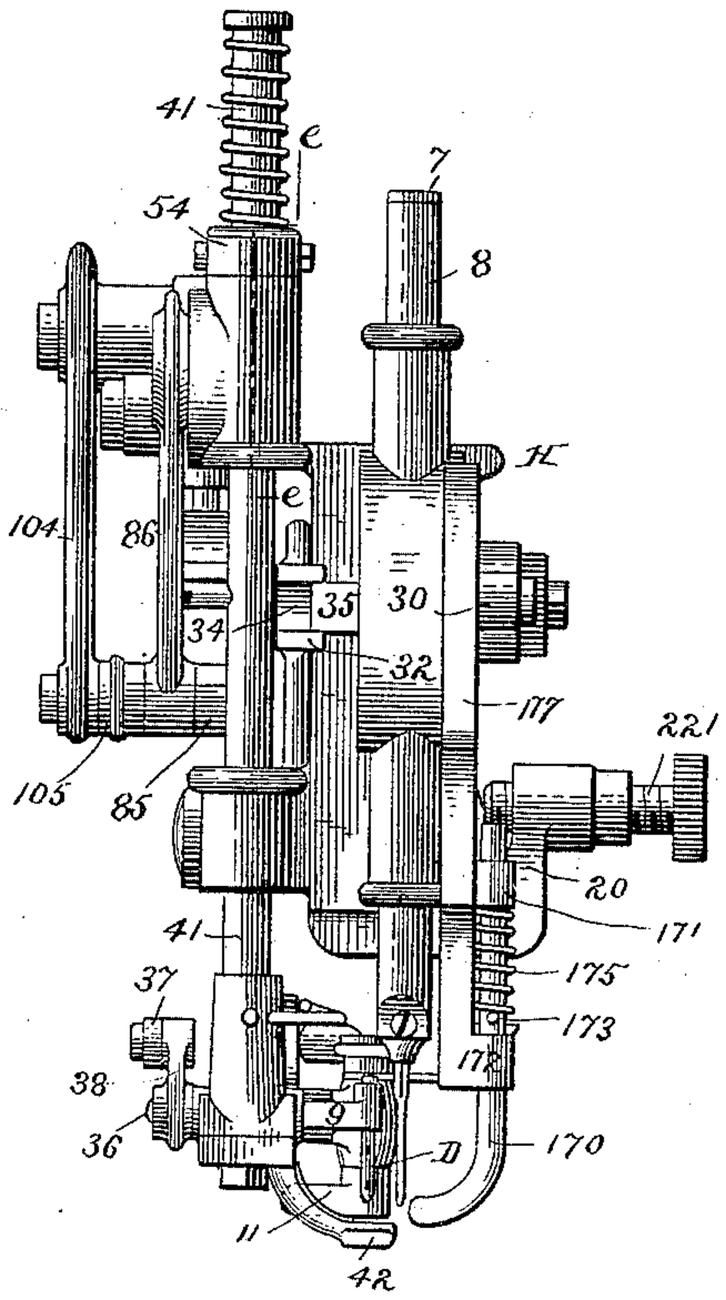

Fig. 18.

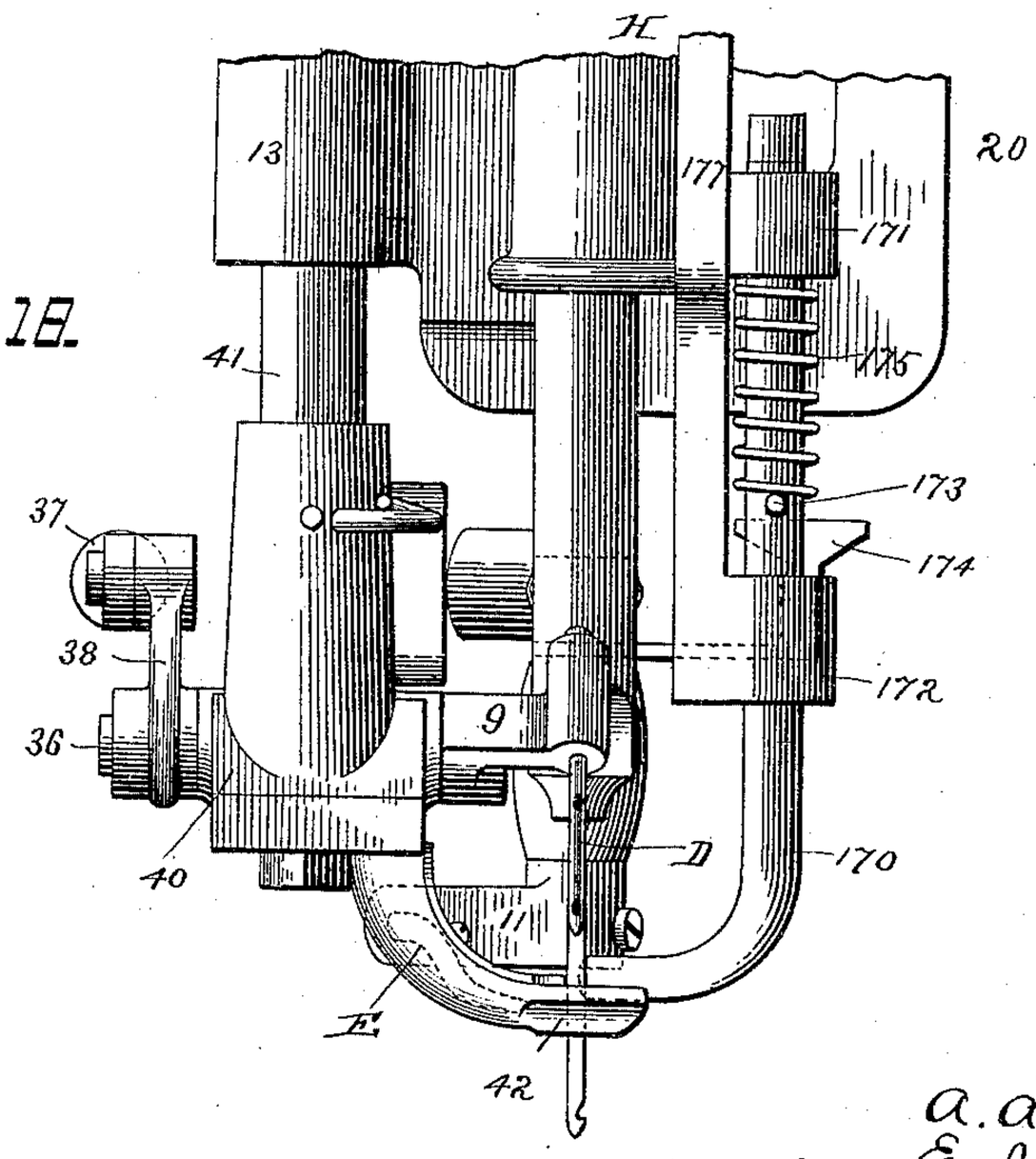

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Fig. 19.

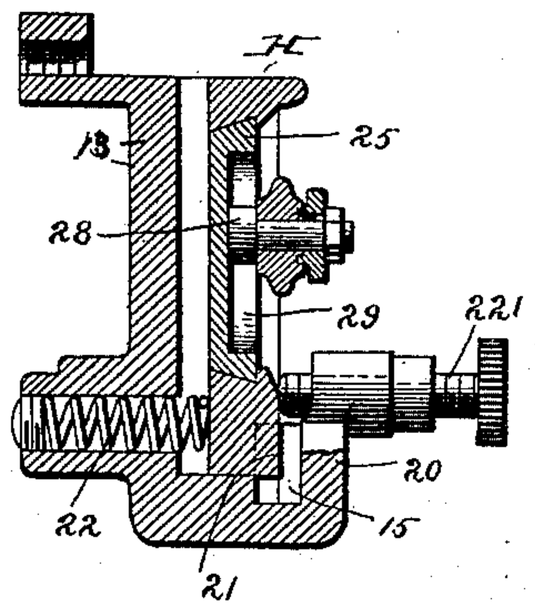

Fig. 21.

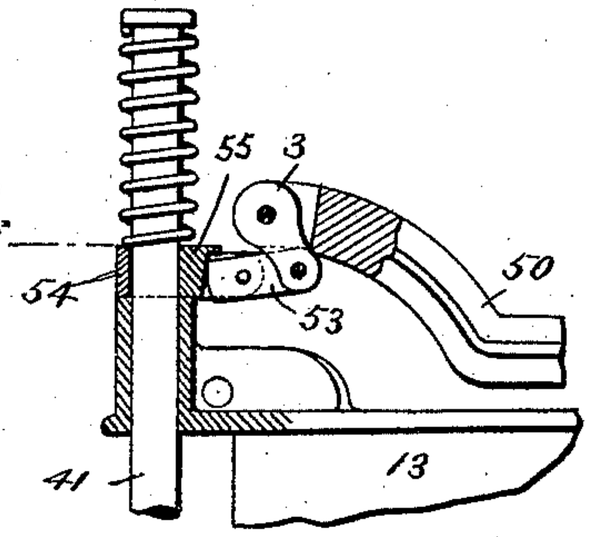

Fig 22

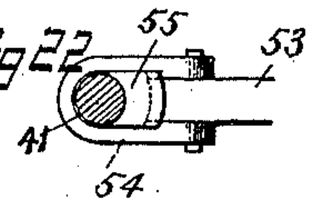

Fig. 20.

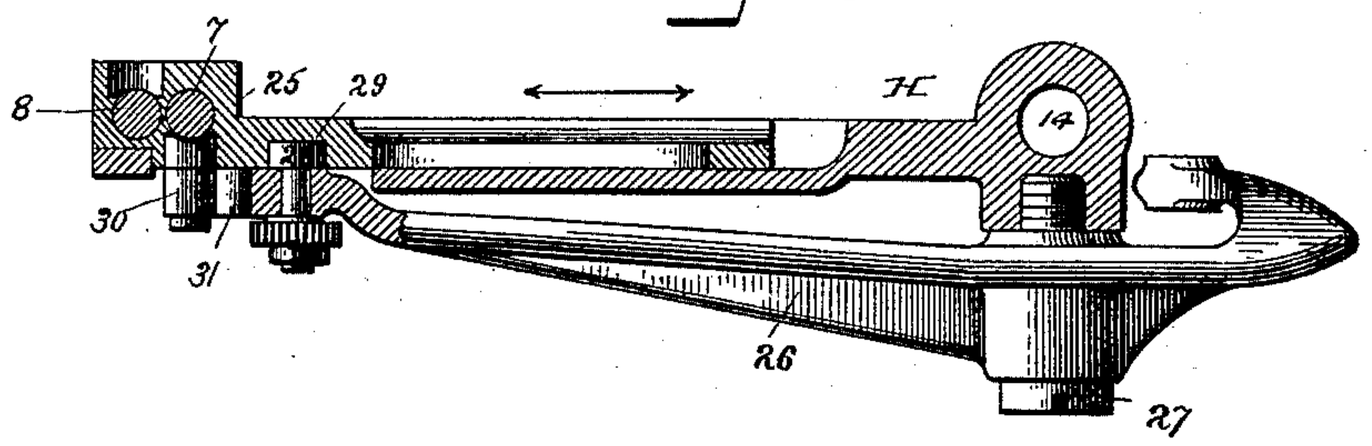

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Fig. 24.

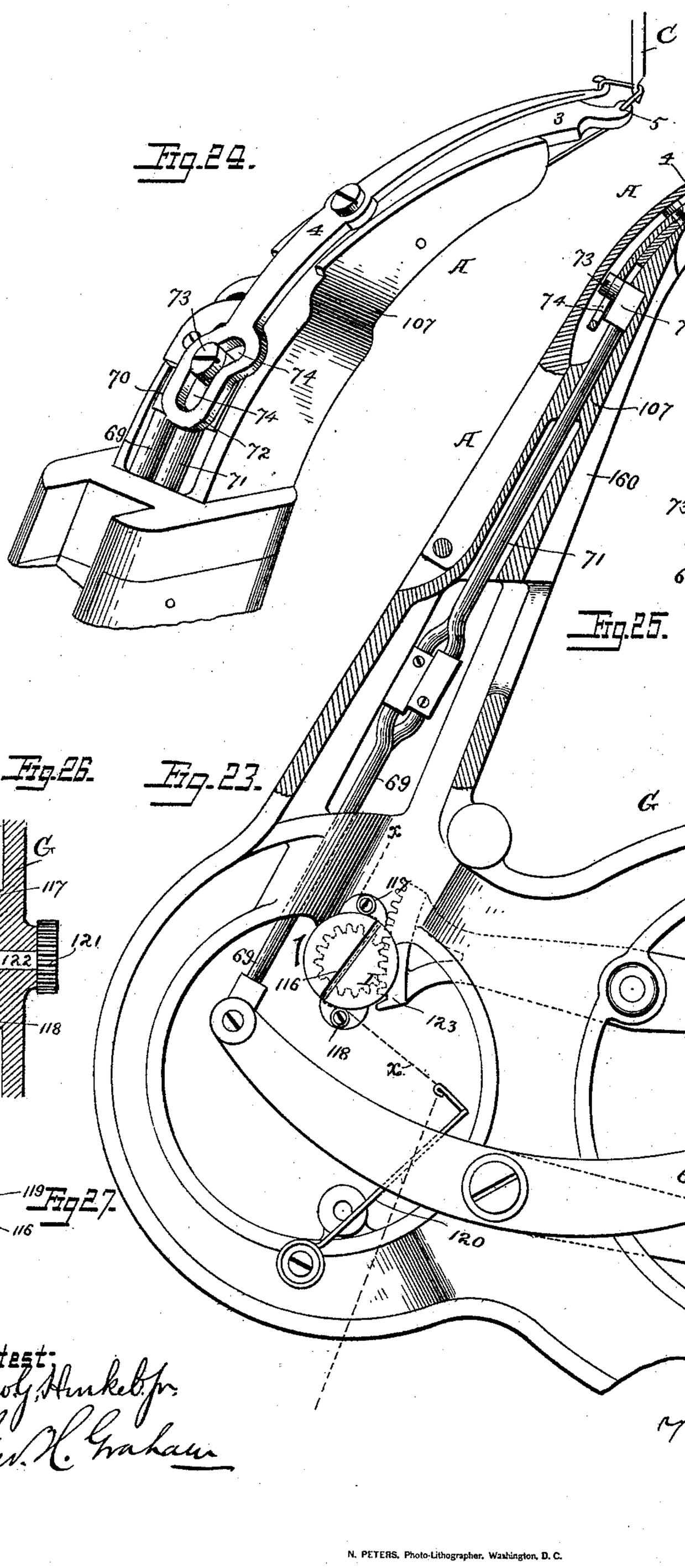

Fig. 25.

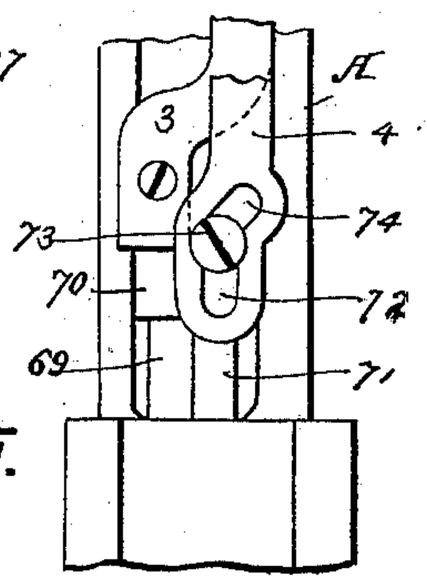

Fig. 26.

Fig. 27.

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Fig. 29.

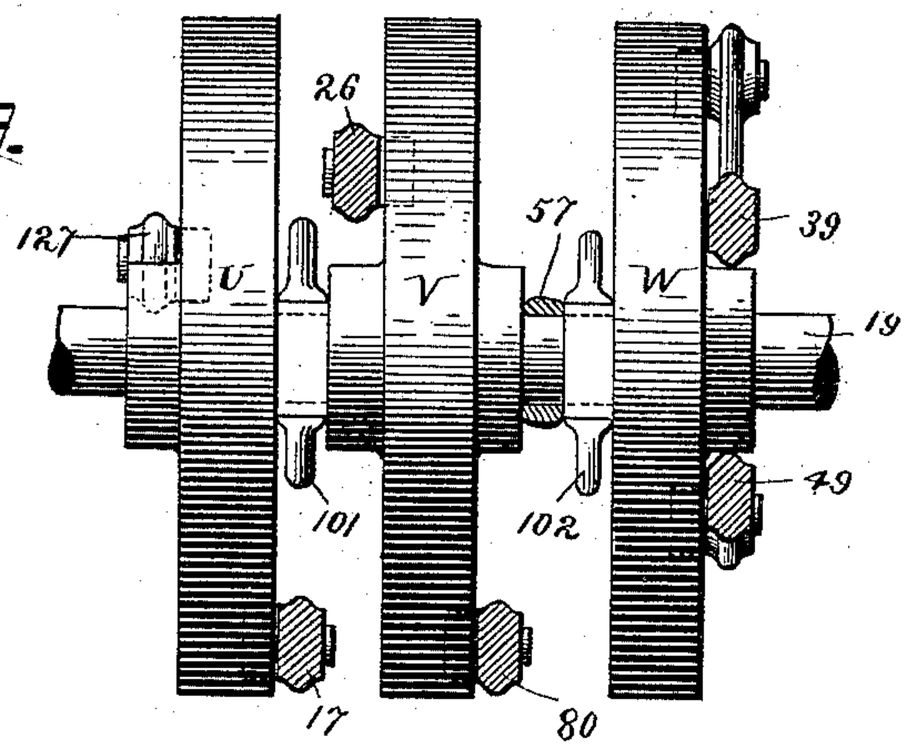


Fig. 28.

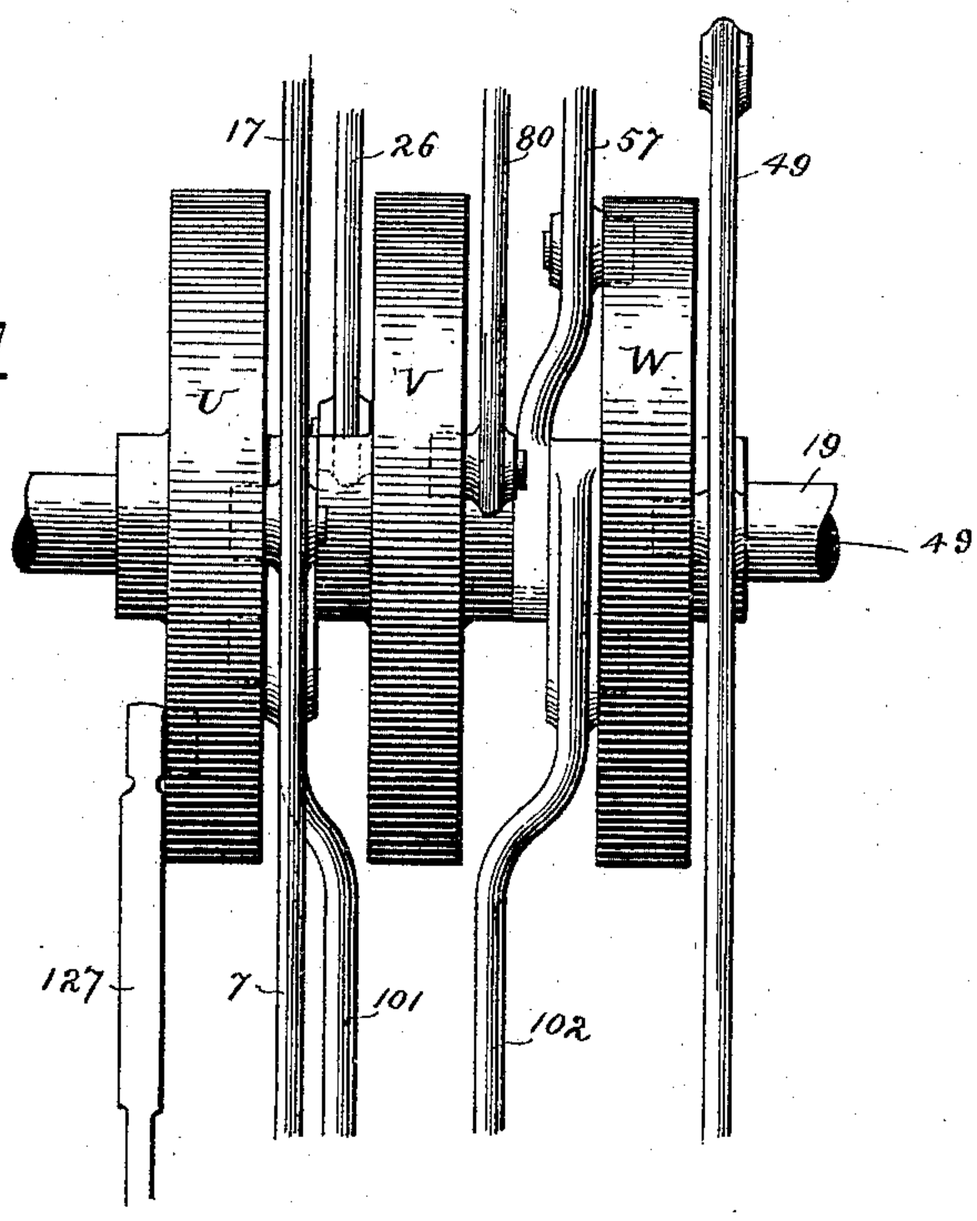
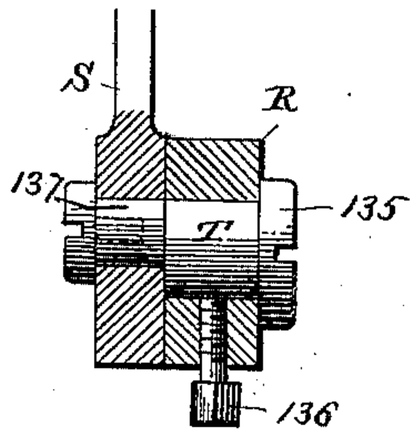


Fig. 30.



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UNITED STATES PATENT OFFICE.

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WAX-THREAD SEWING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 417,002, dated December 10, 1889.

Application filed June 30, 1888. Serial No. 278,681. (No model.) Patented in England January 23, 1889, No. 1,275.

To all whom it may concern:

Be it known that we, ALFRED A. CUMING and EDWIN J. PEIRCE, Jr., both citizens of the United States, and residents of Hingham, county of Plymouth, Massachusetts, and Woonsocket, Providence county, Rhode Island, respectively, have invented certain new and useful Improvements in Wax-Thread Sewing-Machines, of which the following is a specification.

The present invention relates to that class of sewing-machines adapted to employ two threads—an upper and under thread—in the formation of the stitches; and it consists in the novel structure hereinafter fully set forth, and which are also contained in the following-named foreign Letters Patent—to wit, English, No. 1,275, January 23, 1889.

In the drawings, Figures 1 to 8, inclusive, are diagrams, in perspective and side elevation, illustrating the operation of the sewing and feeding instrumentalities and the manner in which the stitches are formed; and Figs. 9 and 10 are sectional views illustrating the looped and formed stitch and the position the loops occupy between the two surfaces of the fabric. Fig. 11 is a side elevation of a machine embodying the present improvements. Fig. 12 is an enlarged side elevation of the major portion of the machine, looking from the opposite side of that shown in Fig. 11. Fig. 13 is an enlarged plan view. Fig. 14 is an enlarged horizontal section taken on the line *a a* of Fig. 11. Fig. 15 is an enlarged side elevation of the instrumentalities supported at the forward end of the overhanging arm of the machine and the upper portion of the horn, showing particularly the needle, thread-carriers, loop-holder, and deflector. Fig. 16 is a horizontal section of the same, taken on the line *b b* of Fig. 15, the horn being omitted. Fig. 17 is a front elevation of the instrumentalities supported at the forward end of the overhanging arm, on a scale somewhat reduced from that of Figs. 15 and 16. Fig. 18 is an enlarged front elevation of the lower portion of the instrumentalities shown in Fig. 17. Fig. 19 is an enlarged cross-sectional elevation through the overhanging arm, taken on the line *c c* of Fig. 11. Fig. 20 is an enlarged horizontal section taken on the line *d*, Fig. 11, showing particularly the carrier H and the awl-driving lever. Fig. 21 is a vertical section, taken on the line *e e* of Fig. 17, showing particularly the devices for raising the presser-foot bar; and Fig. 22 is a horizontal section of the same, taken on the line *f* of Fig. 21. Fig. 23 is an enlarged sectional elevation of the upper portion of the swinging frame G and the horn. Fig. 24 is a perspective view of the horn, its case being removed to expose its thread carrier and deflector. Fig. 25 is a front elevation of a portion of the horn and its thread carrier and deflector. Fig. 26 is a cross-sectional elevation taken centrally through the take-up disk I, shown in Fig. 23; and Fig. 27 is an elevation of said disk, looking at one end of its central slot. Fig. 28 is a rear elevation, and Fig. 29 a plan view, of the cams upon the main driving-shaft and their immediate connections. Fig. 30 is a sectional elevation of one of the pivotal connections between a pair of levers or a lever and rod.

Before describing the parts of the machine which impart movement to those devices which operate directly upon the material to be sewed and upon the threads I will describe the construction and operation of the said devices in connection with the material and thread, referring for this purpose to the digrammatic views Figs. 1 to 10.

The fabric to be sewed is designated by X, and is shown in section in Figs. 1 to 5, 9, and 10, in order to illustrate the effects of the awl and positions of the threads, the section being on the line of stitching, and the work-plate 2 is represented as being supported by a hollow case A in the form of a horn, within which are arranged a reciprocating thread-carrier 3 and a vibrating thread-deflector 4, that is pivoted to the carrier to reciprocate therewith, the carrier having an eye 5 for the passage of the thread *x*, which is conducted from below through suitable guides from the wax-pot, as set forth hereinafter. The work-plate has a central opening 6, and above the work-plate are supported the awl B, needle C, upper

thread-carrier D, and loop-holder E. (See Figs. 6, 7, and 8.) The awl B is carried by an awl-bar 7, which has a vertically-reciprocating motion and which moves back and forth in the direction of the double arrow 1, Fig. 1, as does also the needle-bar 8, and both the awl and the needle-bar have also a reciprocating movement at right angles to the line of the movement indicated by the arrow 1, and a direction parallel to the line of the stitching. The thread-carrier D carries the upper thread *y*, having two eyes, through which the said thread is passed, and being curved to correspond substantially with a circle constituting the fulcrum of an arm 9, which supports the carrier, and at the outer side of the carrier, near the point, is a notch 10, for the purpose described hereinafter. The loop-holder E, Figs. 6, 7, and 8, is carried by an arm 11, which rocks around a vertical axis, so as to carry the loop-holder in a curved path at about right angles to that of the thread-carrier D.

Assuming that the above-described devices have operated to perform a part of a line of stitches, that one stitch is complete, the lower thread *x* extending upward from the eye 5 of the lower thread-carrier 3 past the hook of the deflector 4, which is in the position shown in Fig. 1, and that the upper thread also extends from the carrier D to the fabric, the operations of forming an additional stitch will be as follows: The awl B will be carried to the right to a point distant from the preceding stitch equal to the length of the new stitch, and will then descend until its point penetrates the fabric for a short distance, as shown in Fig. 1. The awl is carried into the fabric sufficiently far to cause the fabric to adhere frictionally to the awl when the latter is lifted for a short distance on the next movement, which is effected for slightly raising the fabric for relieving its pressure upon the work-plate 2, thereby reducing the frictional resistance to the feeding of the fabric, which is now effected by the movement of the awl in a line at right angles to that indicated by the arrow 1 until the awl is vertically above the opening 6 in the work-plate. The awl now descends completely through the fabric into the opening of the work-plate far enough to make the desired opening for the passage of the needle, after which the awl ascends until its point is above the fabric. The awl and needle then move back in the line of the arrow 1 until the needle is directly above the awl-hole, when the needle descends through the fabric.

Prior to the entrance of the needle into the opening in the fabric the deflector 4 is swung to the left in the direction of the arrow, as shown in Fig. 3, carrying the lower thread *x* away from the lower carrier to the position shown in Fig. 3, and after the needle has descended to its full extent the carrier and deflector together are moved forward in the direction of the arrow, Fig. 4, thereby carrying the transverse portion of the thread *x* into the notch of the needle. As the needle ascends it draws a loop of the thread *x* upward through the opening in the fabric, as shown in Fig. 5, and above the same, as shown in Fig. 6, when the movement of the needle is arrested, and the upper thread-carrier D, swinging in the direction of the arrow, Fig. 6, penetrates the loop of thread *x*, carrying with it the upper thread *y*, and the loop-holder E, then swinging to the right, passes below the upper thread-carrier D, through the notch 10, and between the thread-carrier D and thread *y*, to hold it, the notch 10 enabling it to pass over the thread *y* without catching the latter. The upper carrier D now swings forward in the direction of the arrow, Fig. 7, leaving a loop of the upper thread *y* upon the holder E and extending through the loop of the lower thread *x*, as shown in said figure, after which the needle C, moving both downward and forward to the position shown in Fig. 8, disengages itself from the loop of thread *x*, the loop-holder E holding the thread *y* until the take-up (hereinafter described) has drawn the loop of the thread *x* down to the surface of the fabric, when it will move back, disengaging itself from the loop of said thread *y*. Thus the thread *x* is drawn downward into the fabric, as in Fig. 9, holding the loop-thread *y* in a doubled loop, and, being further drawn downward, carries it into the fabric, the two loops being finally locked together between the faces of the fabric, as shown in Fig. 10, forming a stitch of the character illustrated.

It will be evident that different mechanisms may be employed for imparting the above-described series of operations to the awl, needle, and thread-carriers, and that the lower thread may be deflected by different means than those described, so as to hold it in position to carry it into the notch of the needle. We will, however, now describe means for effecting these results, which we have found to be very effective in practical operation.

The operating parts are supported by a frame consisting of a hollow standard F, Figs. 11 and 12, enlarged at the lower end to constitute a suitable base, and extended at the upper end to form an arm 13, and having lateral arms 214 and 215, between which is pivoted the frame G, that supports the horn A, the latter extending upward and over the arm 214 to hold the work-plate 2 with its central opening in a line with the axis of the frame G.

The needle-bar 8 and the awl-bar 7 are fitted to slide vertically in bearings in a movable carrier H, which is a movable hinged portion of the arm 13, the said movable portion being connected to the body of the arm by a vertical pivot 14, as shown in Figs. 11 to 14, upon which pivot the carrier swings back and forth to carry both the needle and the awl to and from the remaining fixed por-

tion of the arm 13. This lateral movement of the carrier is imparted by the longitudinal reciprocation of a wedge 15, carried by a bar 16, connected with a lever 17, pivoted to a stud 18 upon the standard, and the said lever 17 is reciprocated by a cam upon the driving-shaft 19 in a manner too apparent to need description. The wedge 15 is arranged between an upturned flange 20 upon the frame 13, Figs. 14 and 19, and a bearing 21 of the carrier H, and the bevel is at one side, as shown in Fig. 14, so that the backward movement of the wedge will permit the carrier H to swing inward toward the arm to an extent which may be limited to any desired degree by means of an adjusting-screw 221, passing through the flange 20, the reverse movement being imparted by a spring 22, confined within a box within the frame, as shown in Fig. 19, and bearing upon the side of the carrier H. The swinging movement thus imparted to the carrier imparts a similar movement to the awl, by means of which the feeding of the fabric is effected, the extent therefore of the feed being limited by the position of the adjusting-screw 221, which regulates the play of the carrier H.

The backward and forward movement of the needle-arm and needle-bar, whereby the needle is brought into line with the opening previously punched by the awl, is effected by the reciprocation of a slide 25, in which the needle-bar and awl-bar have their bearings, the said slide being fitted to bearings in the carrier H, as shown in Fig. 20.

The reciprocation of the slide in the direction of its arrow, Fig. 20, is effected by means of a lever 26, Figs. 11, 13, and 20, pivoted at 27 to the carrier H, and carrying a stud 28, which enters an ogee cam-groove 29 in the side of the slide 25, so that as the forward end of the lever 26 moves up and down the stud 28 will bear upon the sides of the cam-groove and reciprocate the slide back and forth, bringing the awl and needle alternately in line with the opening 6 in the work-plate. The lever 26 is also used as a means for imparting the vertical reciprocating movement to the awl-bar, a stud 30 on the latter extending into a slot 31 in the end of the lever.

The needle-bar 8 is reciprocated vertically by means of a lever 32, swinging upon a pin 33, extending into the arm 13, Fig. 12, the lever 32 having a slot 34, receiving a stud 35 from the needle-bar.

The means for imparting vibration to the lever 32 will be fully set forth hereinafter.

The rocking movement imparted to the shaft 36, that carries the arm 9, supporting the upper thread-carrier D, is effected by means of a reciprocating rod 37, connected to an upwardly-extending arm 38, that is reciprocated by the vibration of a lever 39, operated by a cam upon the shaft 19. (See Figs. 12, 15 to 18.)

The shaft 36, that operates the thread-carrier, has its bearings in a bracket 40 on the lower end of the presser-bar 41, carrying a presser-foot 42 and extending upward through bearings in the arm 13, and the said bracket also carries the vertical shaft 43, to which is connected the arm 11, supporting the loop-holder E, so that whatever may be the adjustment of the presser-foot the upper thread-carrier and the loop-holder will always maintain their relative positions.

The loop-holder shaft 43 is provided with an arm 44, to which is connected through a ball-and-socket joint a rod 45, that is in turn connected at its opposite end through a similar joint to a rock-lever 46, vibrating upon a bracket 47, extending from the standard, and a rod 48, Figs. 12 and 14, connects the lever 46 with another lever 49, pivoted at its lower end to the standard and vibrated by a cam upon the shaft 19.

The presser-bar and with it the presser-foot are lifted by means of a lever 50, pivoted to a stud at the top of the arm 13 and connected by a rod 51 to a treadle 52. The lever 50 is not connected positively to the presser-bar, but is connected by a link 3 to a short cam-lever 53, pivoted between the arms of a yoke 54, which embraces the presser-bar 41 and receives a loose block 55, against which the end of the cam-lever 53 is brought to bear when the lever 50 is raised, thereby causing the block and the yoke to bite against the presser-bar when the lever 50 is lifted, so that the presser-bar will be carried with it. (See Figs. 21 and 22.) When the presser-bar descends and the presser-foot takes its bearing upon the fabric, the yoke may slide downward into contact with the arm 13, and however thick or thin the fabric may be, the next movement of the cam to elevate the presser-foot will always lift it to the same extent above the goods. If the extent of the movement of the presser-foot above the goods is fixed at, say, one-tenth of an inch, the presser-foot after being seated upon the fabric will be lifted to that extent by the cam action to ease the fabric for feeding, as before described, this lifting being effected just before the awl moves upward on its first lifting movement prior to carrying the fabric forward to bring the awl in line with the opening in the work-plate.

In order to enable us to employ a small awl and avoid the necessity of depending upon the size and stiffness of the awl to prevent it from being deflected in the act of feeding the fabric, we provide a bearing for the awl at a point below that to which the point of the awl rises and as close as possible to the surface of the fabric. As shown, Figs. 15 to 18, the bearing consists of a bent rod 170, sliding in ears 171 and 172 upon the slide 177, with its lower end in a position to bear against the side of the awl when the latter is in the fabric. A projection or cross-pin 173, Fig. 18, extends from the bearing 170 and rests upon an arm 174, connected with the support for the presser-foot, so that when the latter is lifted the bearing 170 will also be lifted, and

a spring 175 throws down the bearing 170 when the presser-foot is depressed. It is necessary to lift the presser-foot slightly before the awl makes its first lifting movements to ease the fabric from the work-plate prior to feeding it forward, and this movement of the presser-foot is effected by the vibration of the lever 50 through the medium of a link 57, having a slot through which the shaft 19 passes to guide it, and another slot 58 to receive a stud 59, carried by the lever 50 and reciprocated by means of a cam, Fig. 28, upon the driving-shaft 19. The lever 50 is raised at the forward end by the descent of the link 57, the slot 58 in the link permitting an independent movement of the lever 50 under the action of the treadle, so that the presser-foot may be lifted by means of the treadle, whatever may be the position of the presser-foot upon the goods during the operation of the machine.

In order to regulate with ease and precision the extent to which the presser-foot is lifted by the cam above the fabric, the link 57 is provided with an adjusting-screw 60, extending through the upper end of the slot 58, thereby limiting the play of the stud in said slot.

As the frame G, carrying the horn A, is pivoted to the standard F, as described, the said horn may be swung around its center to the various positions necessary to present a boot or shoe properly to the operating devices, and in order to operate the lower thread guide and deflector, whatever may be the position of the horn, we impart the movements to these parts through the medium of heads 63 64 65, sliding upon a vertical line coincident with the axis of the frame G. As shown, the said heads slide upon a shaft or bar 66, extending between the arms of the frame G, and each head is in the form of a spool or bobbin, between the flanges of which extends a stud upon a lever carried by the frame. As shown, there are two levers 67 68, pivoted to the frame G on opposite sides thereof, the lever 67 being connected by a rod 69 with a block 70, to which is attached the thread-carrier 3, as best shown in Figs. 23 to 25, and the lever 68 is connected by a rod 71 to a block 72, carrying a stud 73, that enters an angular slot 74 in the lower end of the deflector 4. The two levers reciprocate together to carry the lower thread carrier and deflector to and from the opening in the work-plate; but when the deflector has to swing to one side the movement of the lever 67 is arrested, while that of the lever 68 is continued, thereby causing the stud 73 to traverse the slot 74 and vibrating the deflector 4.

It will be seen that by the use of the sliding thread carrier and deflector and by imparting the vibration or take-up action to the deflector we are enabled to arrange these parts so as to work effectually within the limited area possible in a small curved horn of a character adapted to operate within shoes of the smallest dimension, and that the movements imparted are positive, uniform, and simple in their character.

In the peculiar class of stitch heretofore referred to it is essential to effective and uniform work that each loop of the upper thread shall be drawn into the fabric to the same extent from the surface as every other loop. If the fabric were of uniform thickness, the adjustment of the parts so as to produce a single stitch of the proper character would be sufficient, as the succeeding stitches would simply be duplicates in their positions of the first; but in the class of fabrics upon which the machine above described is intended to operate the thickness of the material that is passed over the work-plate varies from time to time and to a very material extent, so that without some automatic adjustment of the operating parts the loops of upper thread would be drawn too far into the fabric where it was thickest and not far enough at the thinnest portions.

In order to secure the uniform action desired, we provide means whereby the upward throw or movement of the needle varies according to the thickness of the fabric, so that the loop of lower thread is always drawn to the same extent above the surface of the fabric, which, in the case of a fabric of varying thickness, will be a varying extent above the surface of the work-plate, and a take-up having a uniform action is employed, so that after the parts are once adjusted to produce the desired stitch the loop of lower thread will always be drawn downward to the same extent below the surface of the fabric, whatever may be the varying position of the surface as regards its distance from the work-plate, and thereby each loop of upper thread is drawn into the fabric to precisely the same extent below the surface as the other loops.

Different means may be employed for automatically regulating the movements of the needle to maintain the same upward draft from the surface of the fabric. We will now proceed to describe those which have proved to be very effective. In order to effect this result, we vary the fulcrum of the lever which drives the needle-bar by means of a connection with the presser-foot or other bearing upon the surface of the fabric in such manner that in proportion as the said foot is lifted by an increase in the thickness of the fabric the fulcrum will be changed to lift the needle to a corresponding extent, and when the said fulcrum or piece is lowered by a decrease in the thickness of the fabric the fulcrum will be varied to limit the upward movement of the needle to a corresponding extent. An effective arrangement for securing this result is shown in Fig. 12, in which there is a lever 80, pivoted to a stud 81 at the side of the arm 13 and provided with a slot 82 in the end, which end overlaps the end of the lever 32, that operates the needle-bar, and a stud 83 passes through the slot 82 and through a slot

84 in the overlapping end of the lever 32, and is connected to an arm 85, jointed to the lower end of a lever 86, pivoted to the head of the machine and having a curved slot 87, receiving a stud 88, extending laterally from the presser-bar. The arrangement of these parts is such that when the presser-bar is raised the lever 86 will be swung in the direction of its arrow, drawing forward the stud 83, thereby shortening the effective working-arm of the lever 32, to which motion is imparted from the lever 80, and correspondingly lengthening the arm of the lever 80 and increasing the throw of the lever 32 and correspondingly increasing the upward throw of the needle, a reverse movement of the presser-bar resulting in throwing back the stud 83 and decreasing the extent of the upward movement of the lever. The extent to which the needle is moved downward, however, is never varied, because when the overlapping arms of the levers 80 and 32 are at the limit of their upward movements the slots 82 and 84 will coincide and be parallel, so that any movement of the stud 83 therein will not have any effect in varying the relative positions of the needle.

If the movement of the needle were depended upon to control the delivery of the lower thread from the thread-holder, any increased elevation of the needle would result in drawing the thread through the hook of the needle during its passage through the fabric and above the same, and would result in fraying and weakening the thread; or, if a constant amount of thread were drawn by the lower looping mechanism to supply the needle in its ascent through and above the leather, which amount would necessarily be sufficient only for a given thickness of fabric sewed any increase in its thickness would result in a rendering of the thread through the hook of the needle and a consequent chafing of its thread. To avoid this we vary the movements of the thread-controllers within the horn, so that when the fabric increases in thickness and the loop must be carried to an increased extent from the work-plate the said thread-controllers will, after laying the thread around the needle, draw back to an increased extent, thereby drawing an extra quantity of thread from the thread-holder below, forming a loop of extra length, which is delivered as the needle moves upward through the fabric and is carried upward therewith in the form of a loop without any material sliding movement of the thread through the hook of the needle.

In order to automatically vary the draft of the thread-controller to correspond to the increased upward movement of the needle, we connect the devices which impart the sliding movement to the said controller with the devices which regulate the movements of the needle. Thus, as shown in Fig. 12, the heads 64 and 65 are reciprocated upon the rod 66, respectively, by levers 90 and 91, pivoted to the standard, and each deriving its movement through a sliding bearing on the lever vibrated from a cam upon the shaft 19. Thus the lever 90 is slotted at the inner end and is overlapped by the slotted end of the lever 92, and a sliding bearing-pin 93, which extends through the slots of both levers, is carried by a slide 94 between the prongs of a forked arm 95, pivoted to a rock-shaft 96, passing through the standard. On the opposite end of the shaft 96, Fig. 11, is a similar but shorter forked arm 97, carrying a slide 98, provided with a bearing-pin 99, which passes through the slots in the overlapping ends of the lever 91, and a lever 100, swinging upon the same stud 18 as does the lever 92. A rod 101 extends from the lever 100 to an operating-cam carried by the shaft 19, and a rod 102 extends from the lever 92 to an operating-cam, also carried by the shaft 19.

By swinging the shaft 96 the bearings 93 99 are changed in position, so as to vary the throw of the levers 90 91 67 68 and correspondingly vary the reciprocation of the lower thread-controller, and the position of the shaft 96 is controlled by the position of the stud 83 by connections between them, as best illustrated in Fig. 12. Thus a lever 104, pivoted to the side of the arm 13, is connected by a rod 105 to the lever 86, that controls the position of the stud 83, and the said lever 104 is also connected by a rod 106 with an arm 107, upon the shaft 96. As a result of this arrangement, when the presser-foot and its bar rise and swing the lower end of the lever 36 forward, thereby causing an increased elevation of the needle, the shaft 96 is swung in the direction of its arrow and the bearings 93 99 are shifted, so as to impart an increased throw to the levers 90, 91, 67, and 68, and thereby draw back the thread-controller and increase the distance from the needle corresponding in extent to the increase in the length of the loop which is supplied to the needle.

While we have described a certain arrangement of levers and shifting-bearings therefor, it will be evident that any skilled mechanic may vary such arrangements without departing from the main features of our invention, consisting in interposing between the thread-controller and its actuating device and between the needle and its actuating device variable connections controlled by the position of the surface of the fabric, so as to vary the extent to which the needle rises above the work-plate and maintain a uniform movement above the surface of the fabric, and so as to vary the extent of the loop drawn round the needle below the work-plate to correspond to the extent to which the loop must be drawn above the work-plate.

By bending the horn and the thread-controllers within the horn to a curve extending from the angle of the horn into a horizontal plane at the end we are enabled to introduce the horn into the contracted ends of

small shoes and work effectively upon a class of articles which cannot be sewed upon a horn of ordinary construction, and we can effect this without wounding or straining the upper in any degree.

By producing the drawing and spreading actions by a sliding movement of the controller instead of rotary movements, as heretofore, we are enabled to effect the desired results within a much more contracted space than would otherwise be practicable.

In order to permit easy access to the thread-controller, we make the upper portion of the horn in the form of a curved arm or base 107, (see Figs. 23 and 24,) which carries the thread-controller, and of a pivoted case or cap 108, which covers the thread-controller and carries the work-plate, the said cap being pivoted to the outside of the horn at the lower end, so that it can be thrown outward to the position shown in dotted lines, Fig. 12, without contact with any of the parts carried by the overhanging arm of the machine.

In order to avoid the necessity of uncovering the thread-controller by lifting the case 108, we extend the ends of the thread carrier and deflector beyond the arm 107, as shown in Fig. 23, and provide a guiding-slot 160 and guide-roller 109 at the inside of said arm, so that the thread can be conducted along the said arm on the inside and over the roller 109, directly through the eye of the carrier.

When waxed threads are used, we provide two wax-pots, one 110 adjacent to the overhanging arm for the passage of the upper thread, and another 111 for the passage of the lower thread, the pot 111 being arranged within a recess in the frame G, and each pot is provided with a suitable stripper, and guides are properly arranged to conduct the threads from the strippers to the upper thread-carrier and to the horn.

In order to maintain the wax upon the upper thread in a soft condition, we arrange in immediate proximity to the parts operating upon the upper thread adjacent to the presser-foot a hollow steam-casing, to and from which steam is conducted by means of a pair of steam-pipes 112, the inlet-pipe being provided with a cock 113, by means of which the steam may be cut off or regulated, and in order to prevent strain or fracture of the pipes from the movement of the presser-foot the said pipes are bent at their rear ends into coils, as shown in Figs. 12 and 14, so as to permit them to spring sufficiently to accommodate the movements of the parts to which they are connected. In the construction shown the steam-case is formed by making a portion of the bracket 40 hollow and connecting the pipes with this hollow portion. The wax upon the lower thread is maintained soft by means of a steam-pipe 114, extending along the horn upon one side and downward along the other side in proximity to the course of the thread.

Inasmuch as the presser-foot and parts carried thereby are movable vertically and the connecting-rods by which movements are imparted to these parts are connected with levers upon the stationary frame of the machine, we make the connections by ball-and-socket joints, permitting the necessary changes of angles without straining to the varying positions.

Any desired form of take-up may be employed in connection with the lower thread, which is the only thread that is necessary to be drawn upon for the purpose of forming the loop. We will now describe one which has proved most effective in connection with appliances for imparting variable action according to the amount of thread required to be delivered.

The take-up is carried by the frame G at the base of the horn A, and consists, essentially, of a disk I, having a transverse slot 116 across one face and two studs or rollers 117 118 arranged opposite the edge of the disk upon opposite sides. The thread x is passed through the slot 116, across one side of the roller 118, and across the other of the roller 117, and so long as the slot 116 is in a line with the bearing-faces of the rollers the thread can pass freely without resistance; but when the disk is turned in the direction of the arrow, Fig. 23, the thread is laid upon the edge of the disk upon opposite sides, creating a frictional resistance to the movement of the thread, which resistance is increased, so as to absolutely prevent any movement by forming a narrow V-shaped notch 119 at the edge of the disk, and into which the thread is drawn as the disk turns to carry the slot 116 away from the roller 117. The extent to which the disk may be turned will determine the extent to which the thread is drawn from a wax-pot around the roller 118 and from the thread-controller around the roller 117, and by varying the extent of the rocking motion of the disk the desired amount of thread is taken up, and when the disk is returned to its position with the slot 116 in line with the bearing-faces of the rollers the thread can again pass freely and without obstruction. As the rocking disk will draw upon the wax-pot more than is necessary to supply the next stitch, we pass the thread between the wax-pot and the take-up through the eye of a spring-arm 120, which, as the disk rocks back to its first position, will take up any slack, prevent the thread from escaping from the roller 117, and will yield with a nominal resistance when the thread is drawn through the slot 116.

One means of imparting movement to the take-up disk I is through the medium of a pinion 121 upon the shaft 122 of the said disk, gearing with a toothed rack 123 upon the end of a lever 124, pivoted to the side of the frame G with a stud at the end that enters between the flanges of the head 63, which is reciprocated upon the rod 66 by the vibration of a lever 125, pivoted to the frame of the machine. The lever 125 derives its motion from the vi-

bration of a lever 126, to which is connected a rod 127, Fig. 11, leading to an operating cam upon the shaft 19. The extent of the vibration of the levers operating the rack 123 may be varied by adjusting a stud 128 in a slot in the lever 126, the said stud entering a slot in the lever 125.

At different points in the above machine where levers are connected to actuating links or rods we secure a nice adjustment, so as to time all the movements with extreme accuracy, by making the connections adjustable. The means of effecting this adjustment are illustrated in Fig. 30, in which R represents one of the levers, and S one of the connecting-rods and T the connecting-pin. The pin T extends through the lever R, and may be turned by a head 135 and secured in any position by means of a set-screw 136, or by any other device. From the end of the pin T projects an eccentric stud 137, which extends through a connecting-rod S, and is headed or otherwise constructed to maintain the latter upon the eccentric stud. By loosening the nut 136 and turning the pin T the stud 137 is carried to or from the fulcrum of the lever, thereby varying with great nicety the extent of movement imparted to the lever by the reciprocation of the rod S.

We have referred to the different parts of the machine as being operated from the cams on the driving-shaft 19. There are three of these cams U V W, illustrated diagrammatically in Figs. 28 and 29, and each cam is grooved upon the opposite faces for the reception of anti-friction studs extending from the adjacent rods and levers. Thus the cam W has upon one face two grooves to receive the studs upon the levers 39 and 49, and on the opposite face two grooves to receive the studs upon the connecting-rods 57 and 102. The cam V has a groove upon one face to receive a stud upon the needle-operating lever 80, and a groove upon the opposite face to receive a stud upon the awl-operating lever 26. The cam U has upon one face two grooves to receive studs upon the lever 17, from which movement is imparted to the wedge 15, and a stud on the rod 101, from which movement is imparted to the thread-controller, and on the opposite side with a groove to receive a stud on the rod 127, that operates the take-up.

Without limiting ourselves to the precise construction and arrangement of parts shown, we claim—

1. The combination, in a sewing-machine, of a work-plate and arranged above the work-plate a reciprocating awl, a reciprocating needle and movable supports therefor, whereby the awl and needle may be brought, respectively, over the opening in the work-plate, a reciprocating thread-carrier arranged above the work-plate in position to penetrate the loop held by the needle, and a reciprocating loop-holder, also above the work-plate, arranged in position to engage the thread carried by the thread-carrier, substantially as set forth.

2. The combination, with a horn carrying a perforated work-plate, and a lower-thread controller below the same, of a reciprocating and vibrating awl, a reciprocating and vibrating hooked needle, and reciprocating upper-thread carrier and loop-holder, all arranged above the work-plate, substantially as set forth.

3. The combination, with the work-plate and a controller carrying and operating a lower thread, of an overhanging arm supporting a reciprocating needle, vibrating upper-thread carrier, vibrating looper, a presser-foot, and a reciprocating awl and support therefor, and means, substantially as described, for vibrating said support with the awl to feed the fabric, substantially as set forth.

4. The combination, with the reciprocating perforating and feeding awl and perforated work-plate, of awl-operating mechanism, substantially as described, whereby the following movements are imparted to the awl: first, a partial downward movement to penetrate the fabric without passing through the same, then a vibrating movement to feed the fabric, and then a further downward movement to pass entirely through the fabric and through the opening in the work-plate, substantially as described.

5. The combination of the reciprocating needle, an upper-thread carrier, a loop-holder reciprocating in a horizontal plane below the path of the upper-thread carrier, all above the work-plate, and a thread-carrier and a thread-deflector below the work-plate, substantially as described.

6. The combination, in a sewing-machine having an upper hooked needle, of the work-plate, a horn curved at the upper end and supporting the work-plate, and a reciprocating thread-controller having an eye and a thread-deflector, and operating devices whereby the controller lays the thread in the hook of the needle, said controller arranged within the curved horn, substantially as set forth.

7. The combination, with the hollow horn curved at the upper end, and a hook-needle supported above the horn, of a thread-controller consisting of a thread-carrier and a laterally-movable thread-deflector, substantially as described.

8. The combination, with a reciprocating hook-needle and perforated work-plate, of a thread-controller carrying the lower thread arranged below the work-plate and consisting of a thread-carrier and a movable thread-deflector pivoted upon the carrier, and means, substantially as described, for moving the deflector laterally with respect to the carrier, substantially as described.

9. The combination, with the reciprocating hook-needle and perforated work-plate, of a hollow bent horn supporting the work-plate, and a thread-controller for the lower thread

supported and operated within the horn, said thread-controller consisting of a longitudinally-reciprocating thread-carrier and a vibrating thread-distender, each bent to conform with the curve of the horn, substantially as described.

10. The combination, with the curved and hollow horn, of a thread-controller consisting of a curved thread-carrier and a thread-distender pivoted thereto, a rod connected with the thread-carrier and with an operating-lever below the horn, and another rod connected with another lever below the horn and carrying a stud bearing upon the cam-edge of the thread-distender, substantially as set forth.

11. The frame G, carrying a horn, a thread-controller and levers connected to operate the thread-controller and other appliances upon the frame, in combination with reciprocating heads having their bearings axially in line with the axis of the frame and provided with bearings for the said levers, substantially as set forth.

12. The combination of the frame G, swinging upon a vertical axis and carrying a horn and thread-controller, and operating-levers 67 68 therefor, and a vertical rod in line with the axis of the frame and reciprocating heads upon said rod having bearings upon the said levers, substantially as set forth.

13. The combination, with the swinging frame, thread-controller, and take-up, of a lever connected to operate the take-up, and a reciprocating head having a bearing for said lever in line with the axis of the frame, substantially as set forth.

14. The combination, with the slotted take-up disk I, of a pinion 121, connected with the disk, and a rack-lever gearing with the pinion and supported upon a swinging frame G, having bearings for the disk-shaft, and a reciprocating head moving upon bearings in line with the axis of the frame and having bearings for the end of the rack-lever, substantially as set forth.

15. The combination, with a horn and a thread-controller supported thereby, of a cap covering the thread-controller and hinged to the horn to swing to and from the same, substantially as set forth.

16. The combination, with the horn and thread-controller supported thereby and with the work-plate, of a hinged casing supporting the work-plate and covering the thread-controller, substantially as set forth.

17. The combination, in a sewing-machine provided with an upper thread and a lower thread, of a reciprocating needle above the work-plate, and a vertically-adjustable presser-bar carrying a presser-foot, and a reciprocating upper-thread carrier and reciprocating loop-holder supported by the presser-bar, and reciprocating lower-thread carrier below the work-plate, substantially as set forth.

18. The combination, with the upper-thread carrier, loop-holder, and with the presser-foot of a sewing-machine, of a vertically-adjustable presser-bar having bearings for the shafts of the thread-carrier and loop-holder, and operating-levers upon the frame of the machine, and connecting-rods between said levers and said shafts provided with universal jointed connections, substantially as and for the purpose set forth.

19. The combination, with the adjustable presser-bar, of a movable bracket supporting the presser-foot and the shafts of a thread-carrier and a loop-holder, and a steam-casing attached to and moving with said bracket and communicating with inlet and outlet steam-pipes, substantially as set forth.

20. The combination of the reciprocating needle-bar, slotted operating-lever, driving-lever, slotted and movable bearing connected with the adjustable presser-foot and entering said slots, the latter being arranged to coincide with each other upon a horizontal line when the needle is at the limit of its downward movement, substantially as described.

21. The combination, with the reciprocating needle-bar above the work-plate and reciprocating thread-controller beneath the work-plate and operating appliances, of a vertically-movable foot bearing upon the fabric, and movable bearings between the needle bar and controller and their operating appliances connected with said foot, whereby the extent of the movements of the needle bar and controller are regulated by the position of said foot, substantially as set forth.

22. The combination, with the thread-controller, of levers 90 and 91, driving-levers 92 and 100, a movable bearing between the levers 90 and 92, and with a movable bearing between the levers 91 and 100, a vertically-movable foot bearing upon the fabric, and connections between said foot and said movable bearing, substantially as set forth.

23. The combination, with the lower-thread controller, levers 90 and 91, from which movements are imparted to the thread-controller, of overlapping driving-levers pivoted at separate points, the overlapping portions of the levers being slotted and bearings movable in said slots, and a movable presser-foot and connections between the said bearings and the said presser-foot, substantially as and for the purpose set forth.

24. The combination, in a sewing-machine, of a work-plate, a stationary overhanging arm carrying the upper-thread carrier and looper, reciprocating needle and awl bars, and a carrier therefor pivotally supported at one side of the overhanging arm and adapted to swing laterally with said needle and awl bars, substantially as described.

25. The combination, with the overhanging arm of a sewing-machine, of a pivoted wing constituting a carrier for the needle and awl bars, and a reciprocating wedge moving in contact with the bearing of said carrier to reciprocate the same laterally, substantially as set forth.

26. The combination, with the overhanging arm, movable wing, and reciprocating wedge, of the adjusting-screw 221 and spring 22, substantially as and for the purpose set forth.

27. The overhanging arm provided with a laterally-adjustable carrier swinging on a vertical pivot, of a slide movable back and forth in said carrier and carrying the vertically-sliding needle and awl bars, substantially as set forth.

28. The combination, with the overhanging arm, of a swinging carrier supporting a movable slide, in which reciprocate the needle and awl bars, and a lever pivoted to said carrier connected with one of said bars and provided with a stud bearing upon the cam edge of the slide, substantially as set forth,

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