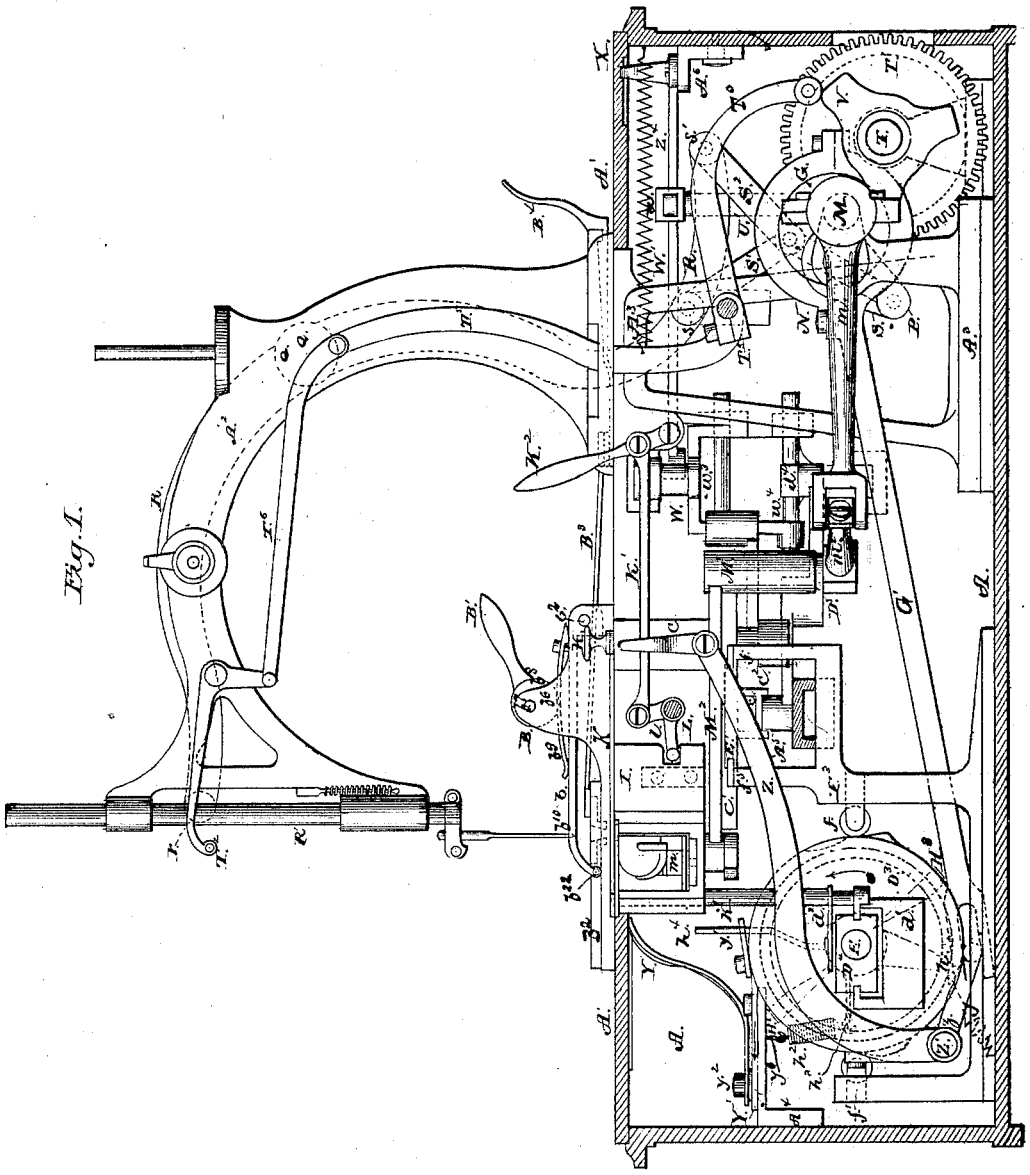
6 Sheets—Sheet 1.

E. MOREAU.

Button-Hole Sewing-Machine.

No. 204,873. **Patented June 11, 1878.**

Fig. 1.



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Wm Sm Mc. Atty

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E. MOREAU.

Button-Hole Sewing-Machine.

No. 204,873. Patented June 11, 1878.

Fig. 2.

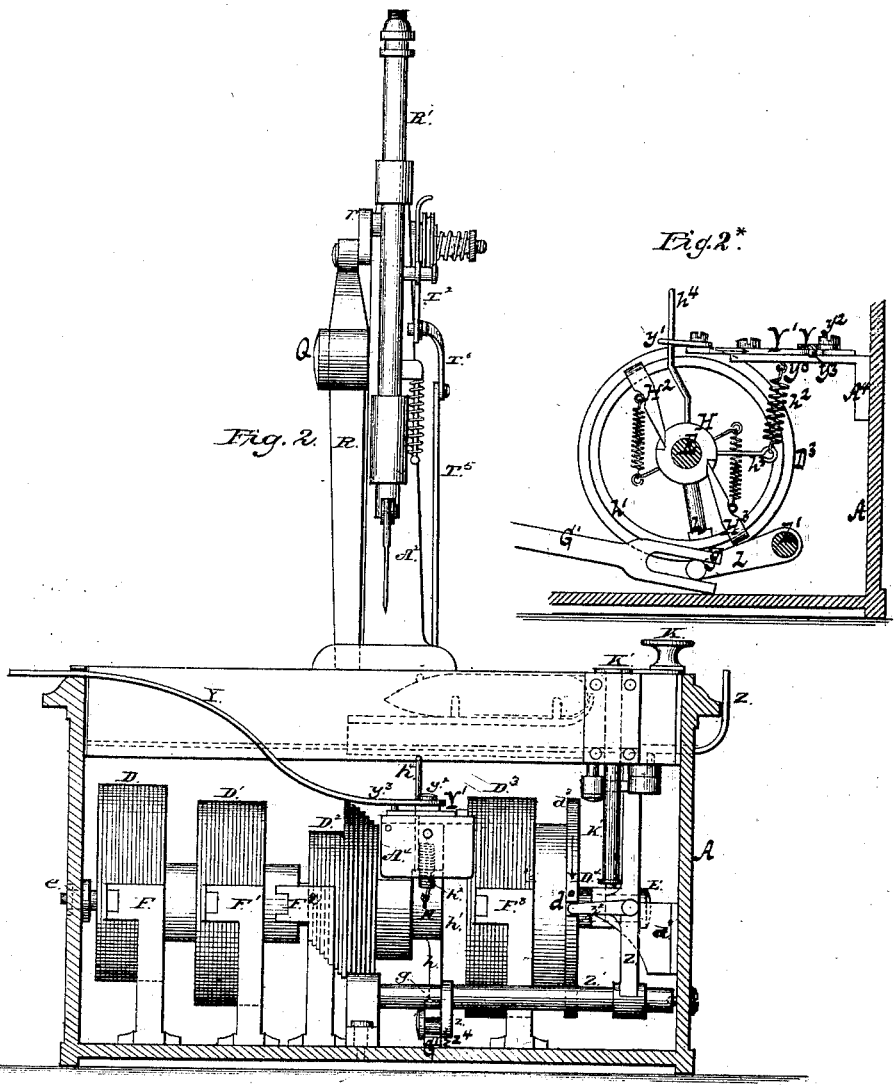

Fig. 2*.

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Button-Hole Sewing-Machine.

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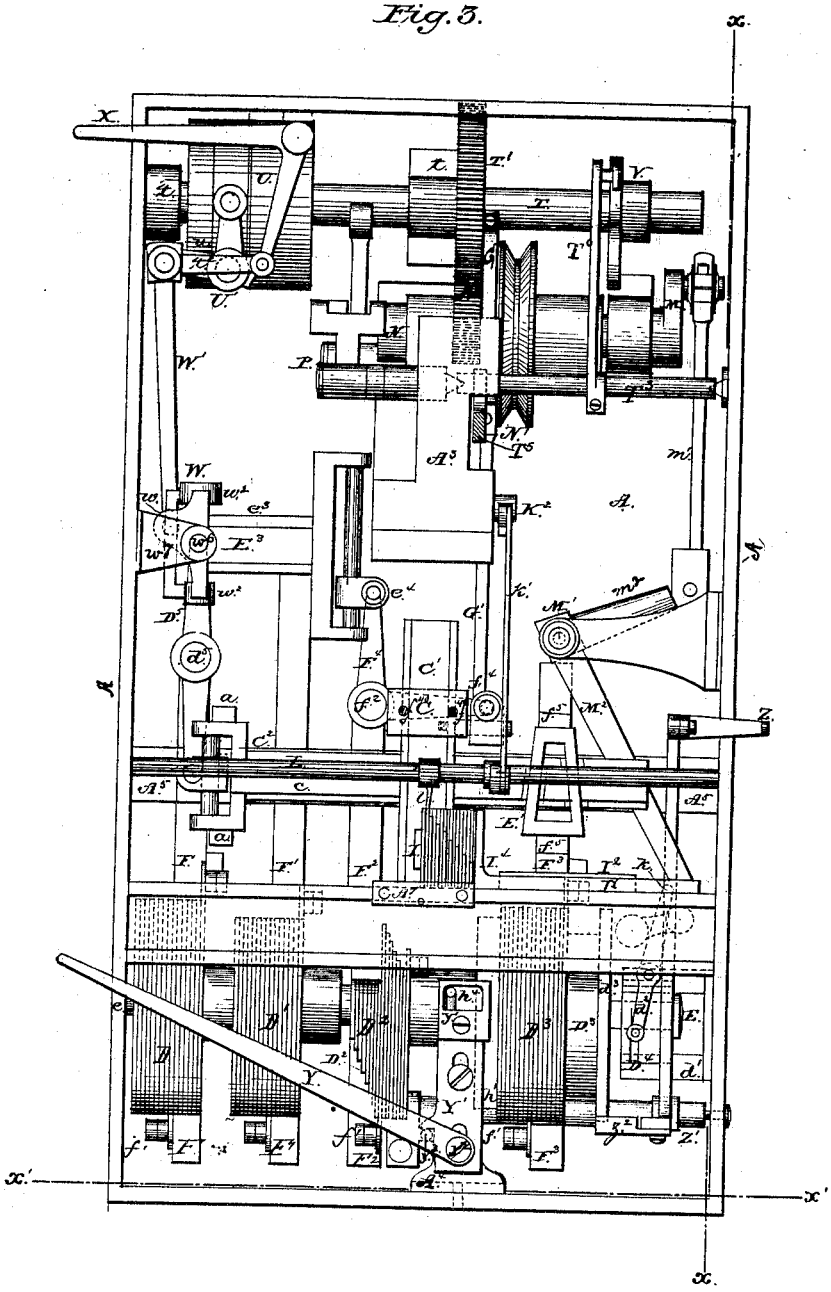
Fig. 3.



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Button-Hole Sewing-Machine.

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Fig. 4.

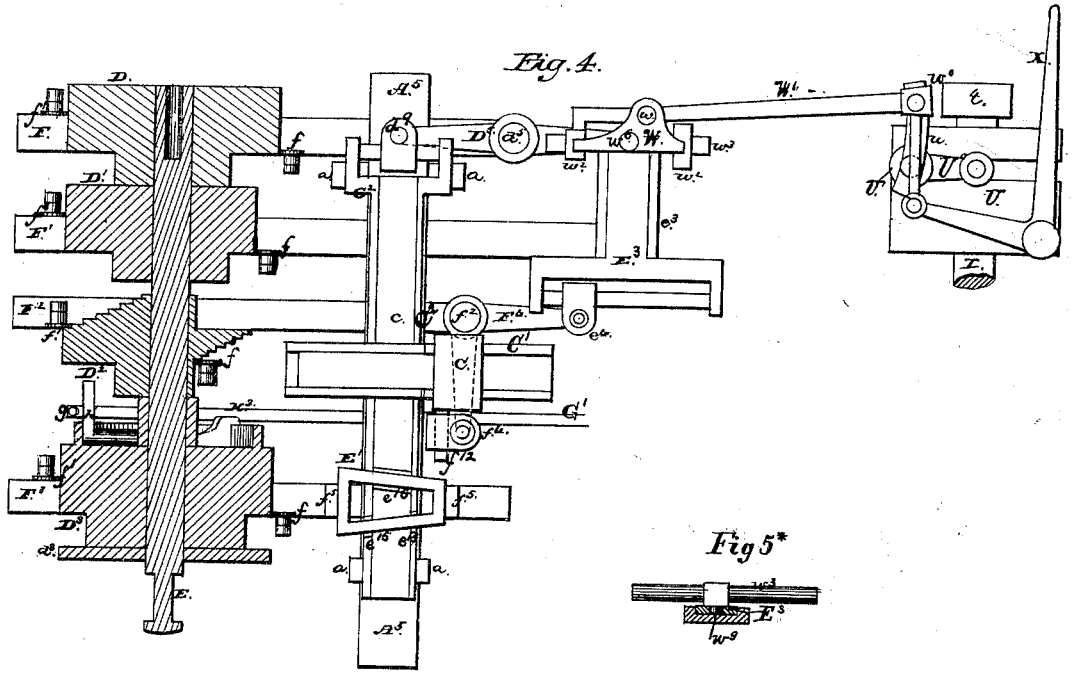

Fig 5*

Fig. 5.

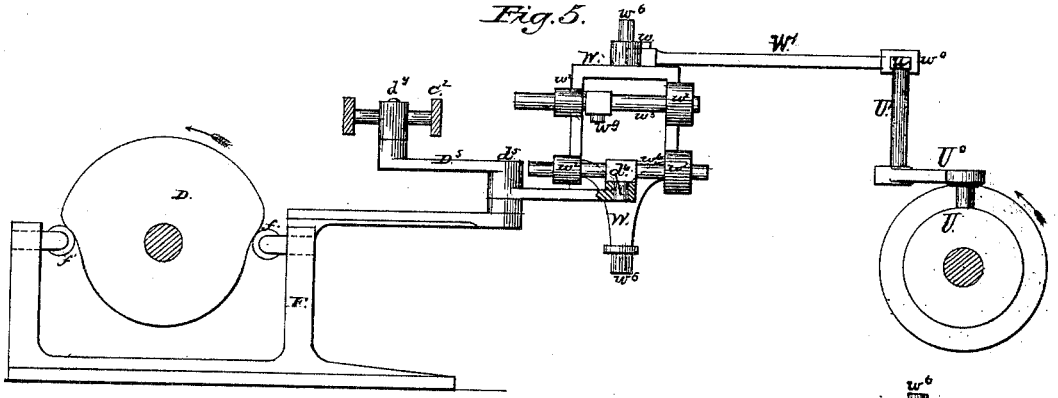

Fig. 6.

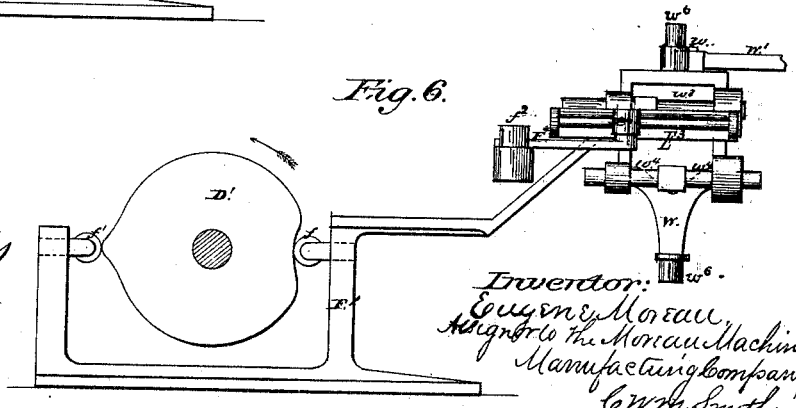

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Fig. 7.

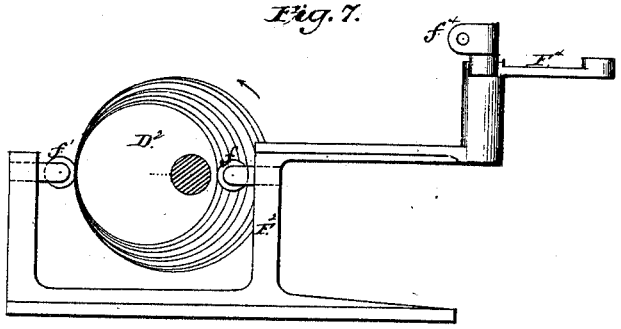


Fig. 8.

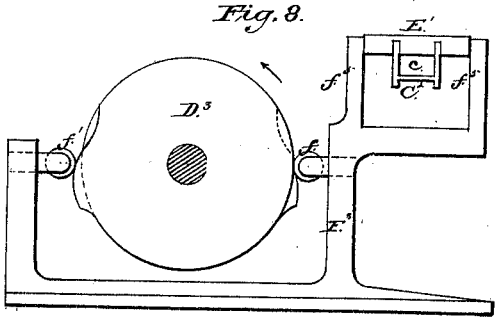


Fig. 9.

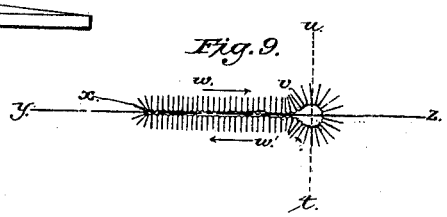
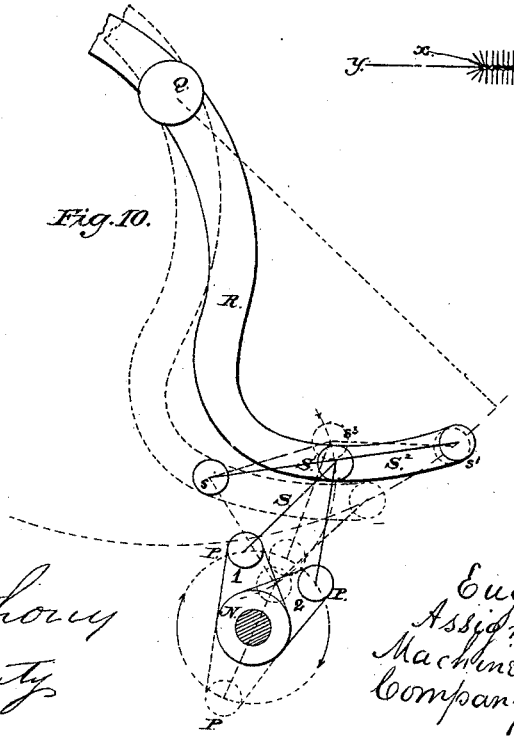


Fig. 10.



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E. MOREAU.

Button-Hole Sewing-Machine.

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Fig. 11.

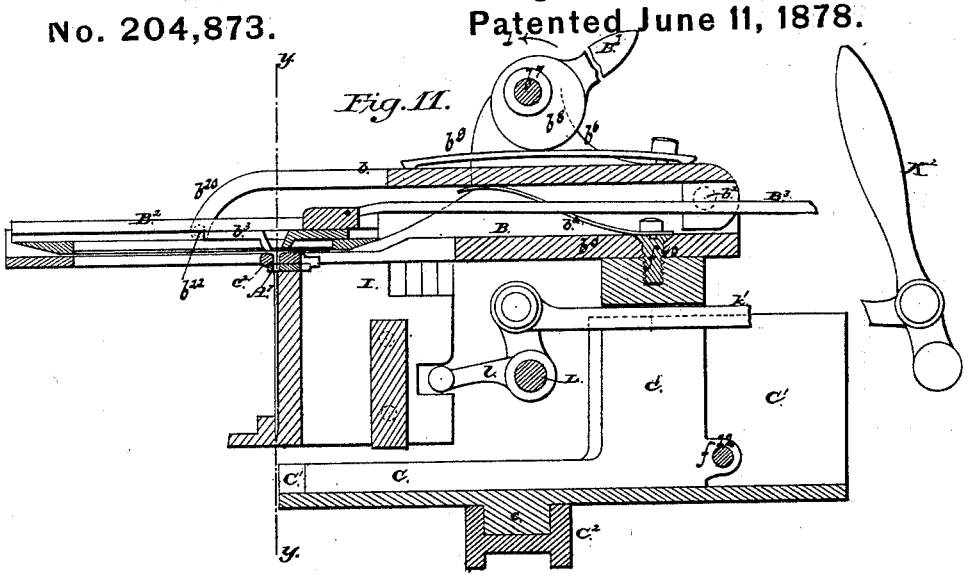


Fig. 12.

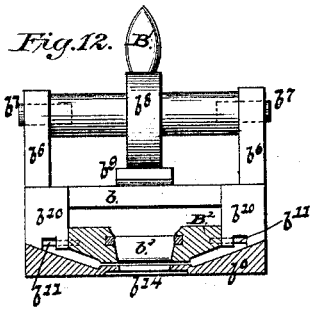


Fig. 14.

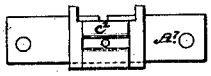


Fig. 13.

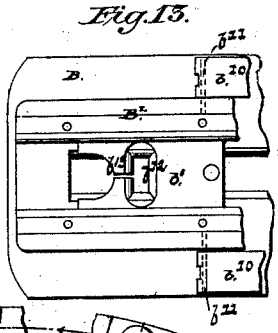
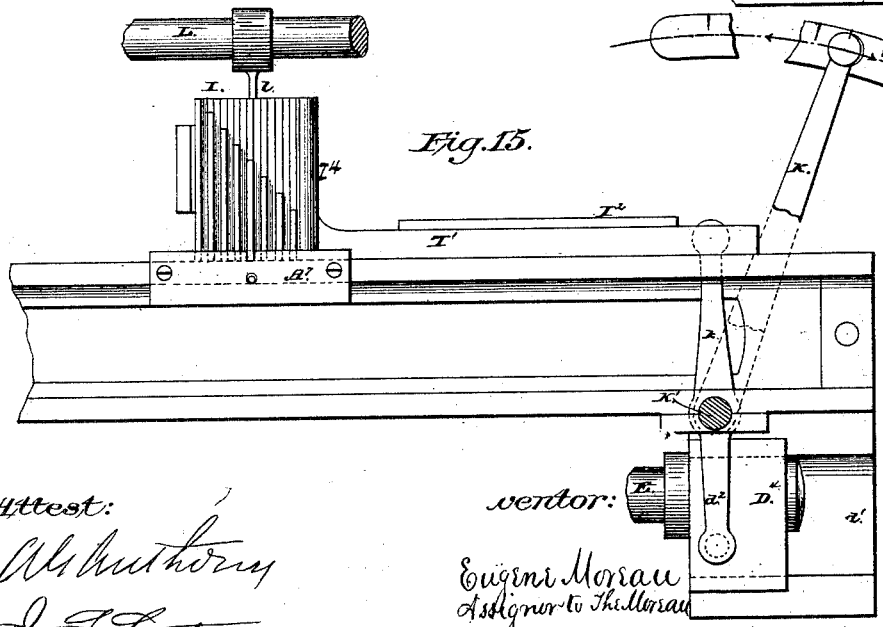


Fig. 15.



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UNITED STATES PATENT OFFICE.

EUGÈNE MOREAU, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO MOREAU MACHINE MANUFACTURING COMPANY, OF SAME PLACE.

IMPROVEMENT IN BUTTON-HOLE SEWING-MACHINES.

Specification forming part of Letters Patent No. **204,873**, dated June 11, 1878; application filed July 23, 1877; patented in England, November 6, 1873.

To all whom it may concern:

Be it known that I, EUGÈNE MOREAU, of the city and county of San Francisco, in the State of California, have invented a new and useful Improvement in Button-Hole Sewing-Machines, which invention is fully set forth in the following specification, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal vertical section in the plane *x x*, Fig. 3. Fig. 2 is a transverse vertical section in the plane *x' x'*, Fig. 3. Fig. 3 is a plan or top view of the machine, the cloth-plate and parts above it having been removed to expose the working mechanism below. Fig. 4 is a detached sectional plan view of the parts giving motion to the button-hole clamp. Figs. 5, 6, 7, and 8 are detached views of the cams and their connections for producing the longitudinal and side motions of the button-hole clamp. Fig. 9 is a diagram illustrating the movements of the button-hole clamp beneath the needle. Fig. 10 is a diagram illustrating the movements of the needle-actuating mechanism. Fig. 11 is a longitudinal vertical section of the button-hole clamp and carriage to which the same is attached, on a larger scale than the previous figures. Fig. 12 is a transverse section of the same in the plane *y y*, Fig. 11. Fig. 13 is a top view of that portion of the button-hole clamp situated in front of the line *y y*, Fig. 11. Fig. 14 is a top view of the stationary needle-plate and the transversely-sliding throat-plate. Fig. 15 is a top view of a part of the shuttle-race and button-hole gages attached to it, with the mechanism for operating them.

My invention relates to certain improvements in that class of sewing-machines chiefly designed for embroidering and stitching button-holes, as hereinafter more fully explained.

In the drawings, the letter A designates the box or case inclosing the working mechanism of my sewing-machine, and affording the proper support and bearings for the various parts. It is provided with a top plate or cover, A^1, which protects the parts within said case, and constitutes the cloth-plate or supporting-surface for the work to be sewed. The curved stationary arm or goose-neck A^2 is secured to the top of a standard, A^3, which rises from the bottom of the case A, and it supports the needle-bar and the tension.

B, Figs. 1, 11, 12, and 13, represents the clamp, which grasps the fabric and presents the slit or aperture previously cut in it to the action of the stitch-forming mechanism in a regular progressive manner, step by step, until the entire length of said slit has been brought beneath the needle, beginning at the point, running along one side thereof, then around its head or eye, and finally back on the other side to the starting-point.

The clamp B is secured to a carriage, C, by means of a screw, f^{40}, Figs. 3 and 11, and receives the required movements by a series of cams, D D^1 D^2 D^3, (see Figs. 2, 3, 4, 5, 6, 7, and 8,) which are secured to a horizontal shaft, E, with which they rotate. These cams act on a set of sliding standards, F F^1 F^2 F^3, one to each cam, and an intermittent rotary motion is imparted to the shaft E and its cams D D^1 D^2 D^3 by an eccentric, G, Fig. 1, rod G', feed-collar H, and its feed-dogs H^2 H^3, (best seen in Fig. 2*,) said feed-collar with its feed-dogs being constructed on the principle of the ordinary feed-wheel used in sewing-machines. The end of the rod G' is forked, (see Fig. 1,) and it embraces and slides upon a roller on the end of an arm, *z*, Figs. 1, 2, and 2*, which projects from a rock-shaft, Z'. (Best seen in Figs. 2 and 2*.) A lever, Z, which extends from this rock-shaft through the side of the case A, serves to turn the same so as to raise or lower the forked end of the eccentric-rod G'. From the end of this rod rises a pin, *g*, which engages with a toe, *h*, Figs. 1, 2, 2*, and 4, projecting from the feed-collar H, at each backward motion of said rod, provided the rock-shaft Z' has been turned so as to retain the rod G' in its elevated position. By these means the feed-collar, which is loose on the shaft E', receives a forward motion by each stroke of the rod G', and this motion is communicated to the shaft E by the feed-dogs H^2 H^3, which gripe the rim h^1, projecting from the side of the cam D^3. The backward movement of the feed-collar H is produced by the coiled spring h^2, Fig. 2*, which is secured at one end to the fixed point y^0, and at the other to the pin h^3, projecting from the collar, and

when this motion takes place the feed-dogs H^2 H^3 slip upon the rim h^1 and impart no motion to the cam-shaft E. When the rod G′ is elevated therefor, the cam-shaft E receives an intermittent rotary motion.

The lever Z, which governs the position of the rock-shaft Z′ and rod G′, is provided with an arm or catch, z^2, Figs. 2 and 3, which bears against the circumference of a disk, d^3, that is secured on the cam-shaft E, said arm being held in contact with said disk by the gravity of the lever Z, assisted by a spring, z^4, which is secured at one end to the arm z and at the other to the case A, Fig. 1. The disk d^3 is provided with a notch or recess, d^0, Fig. 2, and when the cam-shaft has turned far enough to bring this recess opposite to the catch z^2 this catch falls in, the rock-shaft Z′ turns, the rod G′ is lowered, and the motion of the cam-shaft E is stopped.

In order to start the motion of the cam-shaft, the lever Z is raised against the action of its spring z^4, causing the pin g of the rod G′ to act on the toe h of the feed-collar, and after the cam-shaft E has been propelled one step the catch z^2 bears against the full portion of the disk d^3, and the cam-shaft is turned until it has completed a full revolution, when the catch z^2 again drops into the recess d^0 of the disk d^3. The stop-lever and its catch also act to hold the cam in position with reference to the other moving parts of the machine and prevent them being accidentally thrown out of time, as they can only begin their rotary movement when the stop-lever Z is raised to liberate the catch z^2 from the recess in the disk d^3, and this cannot be done without raising the arm z and throwing the pin g on the rod G′ into action.

The amount of the feed-motion imparted to the cam-shaft E for each stroke of the eccentric-rod G′ is controlled by the following means:

From the feed-collar H extends a pin, h^4, through a slotted plate, y^1, which is secured to a slide, Y′, which is adapted to move back and forth on a bracket, A^4, firmly secured to the end of the case A. (See Figs. 1 and 2*.) A lever, Y, serves to adjust the slide Y′ with the slotted plate y^1. This lever turns on a pivot, y^2, secured in the bracket A^4, and it engages with a slot in the slide Y′ by means of a pin, y^3, projecting from its under side. (See Figs. 2 and 3.) By the action of the spring h^2, Figs. 1 and 2*, the feed-collar H is turned until the pin h^4 strikes the inner edge of the slot in the plate y^1, and if the slide Y′ is moved outward in the direction of the arrow shown on it in Figs. 1 and 2* the feed-collar is turned so as to throw the toe h back away from the pin g in the rod G′, and by moving the slide Y′ inwardly the toe h is caused to move toward the pin g by the action of the spring h^2. If toe h is moved back, the motion imparted to it by the action of the pin g on the rod G′ is decreased, and vice versa, and the amount of motion imparted to the cam-shaft E for each stroke of the rod G′ can thus be regulated by moving the lever Y, which controls the position of the slide Y′. This lever extends out through the side of the case A, so that it can be readily operated whenever it may be desirable to change the feed-motion of the cam-shaft E.

The eccentric G is firmly mounted on the main shaft N, Figs. 1 and 3, which receives motion by a belt and pulley, N^1, Fig. 3, or any equivalent means. On one end of this shaft is firmly mounted a crank, M, which connects, by means of a rod, m^1, and arm m^2, with a vertical rock-shaft, M^1, from which motion is transmitted to the shuttle-carrier m by means of a lever, M^2. On the opposite end of the shaft N is secured a crank, P, which imparts a vibratory motion to a curved lever R, which swings on a pivot, Q, secured in the arm or goose-neck A^2, and is connected by a link, r, Fig. 2, to the needle-bar R′.

The connection between the crank P and lever R is effected by a pitman, S, and two links, S^1 S^2, one of which is attached to the standard A^3 by a pivot, s, while the other is secured to the lever R by a pivot, s^1. The continuous rotation of the shaft N thus produces a horizontal reciprocating motion of the shuttle and a vertical reciprocating motion of the needle. The motion of the needle, however, is irregular, as will be readily understood from the diagram, Fig. 10. The crank P rotates in the direction of the arrow, and when it arrives in the position 1 the links S^1 S^2, being connected to the crank P by pitman S, are brought in a right line, and the lever R is caused to swing back to the extreme point of its motion, and consequently the needle reaches the lowest point of its motion.

As the motion of the crank progresses the pivot s^3, which connects the links S^1 S^2, is brought in the position shown in dotted lines in Fig. 10, and the needle is caused to move up a short distance; and when the crank P reaches the position 2 the needle is again depressed to its lowest position. The purpose of this intermediate upward movement of the needle is to form a loop on the needle-thread for the passage of the shuttle, and I am well aware that numerous devices have been used and proposed for the purpose of producing this effect in shuttle sewing-machines; but I have found that by the combination of the pitman S and links S^1 S^2 with the crank P and the needle-lever R the needle-bar can be run with great rapidity without danger of causing an objectionable noise or trembling of the machine and without an undue strain on the working parts.

The main shaft N is geared by a pinion, N^2, and cog-wheel T^1 with a shaft, T, Fig. 3, which carries two cams, U V, the former of which serves to impart motion to the oscillating frame W, while the latter controls the motion of the take-up lever T^2, as will be hereinafter more fully explained.

The material containing a slit which is to be formed into a button-hole is adjusted in the clamp B by means of a gage, I, which is situ-

ated beneath an opening in the cloth-plate A^1, and which can be raised and lowered by means of a lever, K^2, rod k', rock-shaft L, and arm l. (See Figs. 1, 3, and 11.) When the gage is raised it projects up into the clamp B, so that the slit in the material can be placed on said gage, and after the material has thus been adjusted in the proper position the clamp is closed and the gage is dropped.

The example shown in the drawing illustrates a machine constructed for sewing eight different sizes of button-holes, and I have therefore provided eight tongues (see Figs. 3 and 15) corresponding to these eight different sizes. This gage is secured to a slide, I^1, which moves in a suitable guide, I^2, Fig. 15, secured to the outside of the shuttle-race, and provided with a groove or recess to engage with an arm, k, which extends from a vertical shaft, K^1. This shaft rises above the cloth-plate, and to its upper end is firmly secured a lever, K, which moves over a suitable scale, indicating the size of the button-hole to which the machine is to be adjusted. In order to accomplish this object, the cams D D^1 D^2 D^3 are each composed of a graduated series of faces or steps, sixteen in number, the first eight of each series corresponding in form and number to the size and number of button-holes the machine is adapted to work, while the second eight in each series insure the correct operation of the first eight, as will be hereinafter more fully explained. For instance, if the largest button-hole to be made is one and three-eighths of an inch in length, the first steps in each of the cams must be so shaped that they impart to those portions of the mechanism actuated by them the necessary amount of motion for this size button-hole. The second steps in each of the cams correspond to the next smaller-size button-hole, and so on.

For the purpose of setting the cams to correspond to the size of the button-hole to be sewed, the shaft E, on which they are mounted, is adapted to slide in the direction of its length, its bearing at one end being in a box, D^4, Fig. 15, and on its opposite end on a pin, e, Fig. 2, which is secured in the side of the case A, and enters a socket bored for its reception in the shaft E. (Best seen in Fig. 4.) The box D^4 is adapted to slide on its support d^1, Figs. 2 and 15, and it is connected to an arm, d^2, which extends from the vertical rock-shaft K^1. By moving the lever K, therefore, which serves to adjust the gage-slide I^1, the cam-shaft E is adjusted to bring those steps of the cams in operation which correspond to the size of the button-hole to be sewed, while at the same time the gages I are moved, so that by the action of the lever K^2 the gage corresponding to the desired size of the button-hole is raised.

By referring to Figs. 4, 5, 6, 7, and 8 it will be seen that each of the sliding standards F F^1 F^2 F^3 is provided with two rollers, f f^1, one on each side of each of the cams D D^1 D^2 D^3, the rollers f being so situated as to run in contact with any one of the first eight steps of the corresponding cams, while the rollers f^1 are in such a position on their respective standards that they bear against the corresponding one of the second series of steps on the appropriate cam. For example, the front roller f on one of the standards being in contact with the first step of its cam, the other roller, f^1, on the inner part of the same standard must be in line with the ninth step, which is the first of the second series on the same cam; and, since these rollers are positively fixed upon their standard, the form of the ninth step must be the counterpart of that of the first step, and so on for each succeeding step of the series, in order to keep both rollers in contact with their cam, and to render the movements of the standards, and of the parts connected with and operated by them, positive in either direction.

The cams D D^1 D^2 D^3 serve to impart the requisite movements to the carriage C, which supports the button-hole clamp B, so as to cause the needle to descend alternately through the slit in the fabric, and then through the fabric itself close to the edge of the slit, while the fabric advances and then recedes until the stitches are laid all round the edges of the slit, as will be presently more fully explained.

The carriage C consists of an L-shaped piece, (see Fig. 11,) which moves smoothly within the slide C^1, and is provided in its vertical arm with a screw-hole to receive the screw f^{40}, which fastens the clamp to it, as already explained. It has no direct motion of itself except in a direction at right angles to the cam-shaft E, the remaining motions required to properly feed the button-hole clamp being imparted to the slide C^1. This slide is made in the form of a cross, (see Figs. 3, 4, and 11,) with a horizontal arm, c, at right angles to the part supporting the carriage C, and this arm fits into a flanged bar, C^2, to which a reciprocating motion is imparted, as will be hereinafter explained, and which is guided between lugs a a projecting from a fixed brace, A^5, that extends across the case A. The horizontal arm c of the slide C^1 is arranged to move within or upon the flanged bar C^2, sometimes with the same and at other times independently of it, in a direction at right angles to the carriage C, imparting to said carriage a movement parallel to the cam-shaft E.

The reciprocating movement of the flanged bar C^2 between the lugs a a is produced by the cam U, (see Figs. 3, 4, and 5,) said cam being provided with a groove, which engages with an arm, U^0, extending from a vertical shaft, U′. To the upper end of this rock-shaft is secured a curved arm, u, which extends through the end w^0 of a pitman, W′, the opposite end of which is connected to the oscillating frame W by a pivot, w. The end w^0 of the pitman W′ can be made to slide in or out on the arm u by means of a bell-crank

lever, X, which has its fulcrum on a pin secured in a bracket, A^6, Fig. 1, and thereby the throw of the oscillating frame W can be increased or diminished.

The frame W is provided with gudgeons w^6, (see Figs. 3, 4, 5, and 6,) which turn in brackets w^7, projecting from the inside of the case A, and it forms two pairs of bearings, w^2 w^2, for two sliding rods, w^3 w^4, situated one above the other, as shown in Figs. 1 and 5. The lower slide w^4 carries a stud, d^4, which extends through one end of a lever, D^5, which has its fulcrum on a pivot, d^5, secured in the sliding standard F, Fig. 5, and the opposite end of which is connected by a pivot, d^9, with the flanged bar C^2. As the cam D revolves the slide w^4, being connected to the sliding standard F, is caused to move in its bearings; and whenever the pivot d^4 comes in line with the gudgeons w^6, or with the axis of the oscillating frame W, it turns in the end of the lever D^5 without imparting any motion to it, while the motion of the lever D^5 increases the farther the pivot d^4 is moved away from the axis of the frame W.

The independent movement of the carriage C, supporting the button-hole clamp, is governed chiefly by the cam D^1 and the upper slide w^3 in the oscillating frame W in the following manner: The slide w^3 connects by a pivot, w^9, with a slide, E^3, which moves in a flanged bar, e^3, and connects by a pivot, e^4, with a bell-crank lever, F^4. This bell-crank lever has its fulcrum on a pivot, f^2, and it connects by a pivot, f^4, with a strap that embraces a pin, f^{12}, projecting from the side of the carriage C. The flanged guide-bar e^3 is secured to the sliding standard F^1, which is exposed to the action of the cam D^1. (See Figs. 4 and 6.) This cam is so formed that during the largest portion of its revolution the pivot w^9 is in line with the axis w^6 w^6 of the oscillating frame W, and consequently no motion is imparted to the slide E^3, bell-crank lever F^4, and carriage C; but when the said cam arrives in the position shown in Fig. 6, or in the position just reverse from that, the slide w^3 is moved so as to throw the pivot w^9 on one side or on the other of the axis w^6 w^6 of the oscillating frame, and during the short time the cam occupies such positions the carriage C receives a short reciprocating motion in a direction at right angles to the cam-shaft E.

The third cam, D^2, Figs. 4 and 7, acts to impart to its sliding standard F^2 an intermittent motion at right angles to the cam-shaft E, first in one direction, or forward, and then in the opposite direction, or back again to the starting-point. This sliding standard supports the fulcrum f^2 of the bell-crank lever F^4, and its motion is transmitted to this bell-crank lever and also to the carriage C, which is attached thereto, the pivot e^4, which forms the connection between the bell-crank lever and the slide E^3, being secured in a strap which is adapted to follow the motions of the sliding standard F^2. The face of the cam D^2 is composed of a series of graduated steps of eccentric form, eight in number, corresponding to the number of button-holes the machine is designed to work, and also of a second series of the same number, and of such form that the second roller, f^1, of the standard F^1 will run in close contact with any one of the second series of steps when the first roller, f, is in contact with the corresponding step of the first series. For instance, if the roller f is being actuated by the first step of the cam D^2, which is the largest one of the series, then the ninth step, or the first one of the second series, must be engaged with the second roller, f^1, and so on for each succeeding step of the series, in order that the first roller, f, may be properly held against the surface of the cam to receive its motion. Instead of using two series of steps in the several cams and two rollers in the several standards, however, a single series of steps and a single roller may be used, said roller being held in contact with the desired step by means of a spring; but I prefer to use two rollers, as described, so as to give a positive motion to the standards in either direction, and to facilitate the operation of moving the cam-shaft E in the direction of its length.

The fourth cam, D^3, Figs. 4 and 8, operates the sliding wedge E^1, and imparts to the same at the proper time a short longitudinal movement, first in one direction, or forward, then in a reverse direction, or backward, equal to twice the length of the forward movement, and then forward again to the starting-point, which is the position shown in Figs. 3 and 4. This wedge E^1 reciprocates with the flanged bar C^2, and it is free to slide between the lugs f^5 of the standard F^3; and as the face of the cam D^3 is of a circular form, except for a small portion of its circumference, the wedge E^1 has no motion imparted to it by the cam D^3 and standard F^3 while the roller f of the standard is running in contact with the circular portion of the cam; but it serves only to connect the slide c and flanged bar C^2 together. When the motion of the flanged bar is about to cease, however, which takes place when the cam D throws the pivot d^4, connecting the levers D^5 with the slide w^4, in line with the axis w^6 w^6 of the oscillating frame W, the cam D^3 moves the wedge E^1 a certain distance, causing it to slide within the lugs e^{15} of the bar C^2 and the lugs e^{16} on the top of the slide c, and to move said slide, together with the carriage C, in a lateral direction on the bar C^2, first to one side of its central position, then back again and to the opposite side an equal distance, and finally back to its first position.

By the combined action of the cams D D^1 D^2 D^3, as above described, the proper feeding movements are imparted to the clamp B, causing the button-hole held in the clamp to be presented in the required manner to the needle.

In order to show more clearly the purpose of these several motions, and the manner in which they actuate the button-hole clamp and its carriage, the diagram, Fig. 9, is introduced

in the drawings, in which the broken line *y z* represents a vertical plane extending through the needle, and, in a longitudinal direction, through the center of the clamp, coinciding with the slit of the button-hole at the time the needle enters said slit. The radiating lines around the button-hole indicate the position of the stitches. Since the needle has no motion besides its up-and-down motion in a vertical plane, a lateral movement must be imparted to the clamp B, in order to cause the needle to enter the material at a distance from the edge of the button-hole, and then the clamp must be moved back again to allow the needle to pass down through the slit. At the same time the clamp must have a progressive motion in the direction of line *y z*, to cause the stitches to be laid side by side in a regular manner along and around the edge of the button-hole. At the beginning the clamp is so situated that the needle passes down through the cloth in front of the slit, and when the feed-cam begins to act the clamp is moved forward, and the needle passes down through the slit at the point *x*, Fig. 9; and as the shuttle passes through the loop of the needle-thread and the needle ascends the shuttle-thread is carried up through the slit, the clamp is moved forward by the cam D^2, and the needle passes down a second time through the slit, the shuttle passing again through the needle-loop, after which the needle rises, and the shuttle-thread is again carried up through the slit. The clamp is again moved forward by the cam D^2, and a lateral movement is given to it by the action of the cam U, which makes only one revolution to three of the main shaft, or to three up-and-down strokes of the needle, so that the needle at its subsequent descent passes down through the material, and on its next ascent it carries the shuttle-thread up through the material, so that two loops of the shuttle-thread lie below and the third above the material, their ends being drawn together at the edge of the slit, while the needle-thread lies in a straight line along the edge of the slit, locking the loops of the shuttle-thread.

As the clamp moves in the direction of arrow *w* the next stitch is formed in the same manner as above described. The two movements of the clamp required for the formation of each stitch are produced by the oscillating frame W and the cam D^2 until the point *v*, Fig. 9, is reached, where the circular eye of the button-hole commences. At this point it is evident that an additional lateral movement is required in order to lay the stitches around the curve at the proper distance from the axis *x z*, and this object is effected by the wedge E^1, which, being operated by the cam D^3, imparts to the clamp-carriage and to the clamp a motion in a lateral direction to a distance equal to the radius of the eye of the button-hole, the center of which is situated in the line *y z*. At this portion of the button-hole, therefore, the clamp receives three movements—viz, the progressive movement, produced by the cam D^2, to space the stitches; the lateral reciprocating movement of the flanged bar C^2, to cause the needle to pass alternately through the slit and then through the material; and the side motion of the clamp-carriage, produced by the wedge E^1. When the point *u* in the eye is reached, the wedge begins to recede, causing the clamp to move laterally toward the axis *y z* until the head of the eye is reached. At this point the stitches are laid at right angles to those upon the side of the button-hole, and the motion of the flanged bar C^2 is stopped by the action of the cam D, throwing the pivot d^4, Fig. 5, in line with the axis w^6 w^6 of the oscillating frame W. At the same time the bell-crank lever F^4, Fig, 4, is brought in full play, imparting to the clamp-carriage a reciprocating movement in the direction of the axis *y z*, and causing the needle to pass down through the eye of the button-hole and then through the material near its head. At this point the standard F^2 of the cam D^2 has completed its inward stroke, and it begins to return, so as to draw the clamp-carriage back and to present the opposite side of the button-hole to the needle.

The wedge E^1 continues its backward motion, causing the clamp-carriage to move away from the axis *y z*, Fig. 9, toward the point *t* of the eye, and after this point has been passed the wedge E^1 advances until the straight portion of the button-hole is reached. At this point the motion of the wedge E^1 stops, and the flanged bar C^2 acts alone to move the carriage laterally toward and from the axis *y z*. The clamp is moved in the direction of arrow w^1, and, by the combined action of the lever D^5 and sliding standard F^2, Fig. 4, the stitches are laid regularly until the end of the button-hole is reached. At this point the reciprocating action of the bell-crank lever F^4 is brought again into play, the action of the flanged bar C^2 being momentarily arrested while the stitches are laid in line with the axis *y z*, until the point is reached where the sewing of the button-hole had been commenced.

From this explanation it will be seen that the required reciprocating movements of the clamp-carriage are produced by the cam U, the oscillating frame W, and the levers D^5 and F^4, and that these parts are thrown into and out of action by the cams D D^1; also, that the cam D^2 produces a longitudinal progressive movement of the clamp, and governs its length of travel, and consequently the length of the button-hole; and that the fourth cam, D^3, gives a side motion to the clamp-carriage by the action of the wedge E^1 upon the slide *c*, so as to shape the circular portion of the eye of the button-hole. By moving the lever X, Fig. 4, the throw of the oscillating frame W, and consequently the movements of the several parts connected to said frame, can be regulated.

In forming the stitches and in tightening the same at the proper times, as above stated, the take-up lever T^2 forms an essential element. This take-up lever is pivoted to the

goose-neck A^2, (see Fig. 1,) and it is operated by the cam V, Figs. 1 and 3, through the nemium of the curved arm T^0, rock-shaft T^3, lever T^5, and connecting-rod T^6, the cam V being mounted on the secondary shaft T, as already stated.

By the action of the take-up lever the needle-thread is alternately slackened as the needle descends to form a loop beneath the cloth for the passage of the shuttle, and then tightened as the needle rises, so as to draw up the shuttle-thread. Said cam is provided with three spurs, Fig. 1, and three intermediate depressed faces, and so timed with respect to the needle-actuating mechanism that the spurs raise the take-up lever at each ascent of the needle, and allow it to drop each time the needle descends, and thereby the needle-thread is kept in a state of tension as the two threads interlock on the edge of the button-hole, and it is caused to lie in a straight line along the edge of the slit in the form of a cord, with the loops of the shuttle-thread coiled round it. Furthermore, by the action of the cam V, one out of three of the loops of the shuttle-thread is drawn up through the material as the needle rises, and is laid upon the cloth and drawn to the edge of the button-hole as the lateral movement of the cloth takes place.

The clamp which holds and presents the material to be sewed to the needle is shown in Figs. 1, 11, 12, and 13. It is secured to the upright standard of the clamp-carriage C, which standard moves in an opening of the proper size in the top plate of the case. It consists of a bottom plate, b^0, provided with two side flanges or ears, b^6, which form the bearings for the pivots b^2 of a jaw, b, and also for a rock-shaft, b^7, carrying an eccentric, b^8, from which extends the handle B^1. This eccentric acts on spring b^9, so as to hold the jaw b down with a yielding pressure. When the eccentric is turned in the direction of arrow 1, Fig. 11, the jaw b swings open by the action of a spring, b^4. Said jaw is provided with downwardly-curved arms b^{10}, between which is situated a slotted plate, B^2, which swings on pivots b^{11} fastened in said arms, Figs. 12 and 13. This slotted plate forms the guide for a throat-piece, b^3, (see Figs. 11 and 13,) which is provided with an aperture, b^{12}, for the passage of the needle, and with a slit, b^{13}, which allows the thread to pass when the throat-piece is drawn back by the rod B^3 at the completion of a button-hole, and when the material is to be readjusted in the clamp for the sewing of the next button-hole.

The office of the throat-plate b^3 is to afford a bearing and holding surface immediately about the needle, and to strip the material from the needle as the latter rises. It is held in its proper position for the passage of the needle by the rod B^3, and said rod is itself held by a sliding catch, B^4, Fig. 1, in order that it may move laterally to permit the lateral movement of plate b^3, for the purpose hereinbefore mentioned.

For the purpose of operating my machine the following directions will be sufficient: The setting-lever K, Fig. 15, is moved to bring its end at the mark or figure designating the size of the button-hole to be worked, for the purpose of bringing the gage of that size into position, and of moving the corresponding steps or faces of the cams D^1 D^2 D^3 into place. The clamp-lever B^1 is then drawn forward, the jaw b of the clamp is raised and held up by the action of the spring b^4, Fig. 11, the throat-plate b^3 is drawn back by the handle B^4, Fig. 1, and the appropriate gage I is thrown up by moving the lever K^2. The slit previously cut of the proper size in the material is then placed over the gage I, the upper jaw of the clamp is brought down and pressed against the surface of the material by means of the clamp-lever B^1, the gage I is drawn down by the reverse movement of the lever K^2, and the throat-plate b^3 is pushed forward to its working position. By these successive operations the button-hole slit is accurately adjusted in the clamp and the successive operation of the machine is rendered independent of any skill of the person operating it. When the main shaft N is set in motion, and the stop-lever Z, Fig. 1, is raised to liberate the cams D D^1 D^2 D^3 and to throw the eccentric-rod G′ into action, the clamp moves beneath the needle in a regular manner, as above described, longitudinally and laterally, and presents the material to the action of the stitching mechanism until the button-hole is finished and the clamp has returned to the position whence it started. At this moment the cam-shaft E has made an entire revolution, the catch z^2, Fig. 3, of the stop-lever Z drops in gear with the rim d^3, the eccentric-rod G′ is thrown out of action, and the motion of the feed-cams is arrested.

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

1. The combination, with the stitch-forming mechanism of a sewing-machine, of a take-up lever and a cam, V, adapted to hold the needle-thread at periods of varying lengths at regular intervals, substantially as described.

2. In a button-hole sewing-machine, the combination of clamp B, carriage C, the series of sliding standards, and the series of cams operating upon said standards through intermediate devices, substantially as and for the purpose set forth.

3. The combination, with a holder or clamp, B, of an oscillating frame, W, having sliding rods W^3 W^4, levers D^5 F^4, connecting mechanism, substantially as described, and devices by means of which oscillatory motion is communicated to said frame, substantially as and for the purpose set forth.

4. The combination, with the clamp-carriage C, of mechanism for producing a lateral reciprocation of said clamp-carriage, the same consisting of the slide c C^1, flanged bar C^2, wedge E, lever D^5, oscillating frame W, sliding standard F, and mechanism, substantially as

specified, for reciprocating said standard, substantially as described.

5. The combination, with the clamp-carriage C, bell-crank lever F^4, oscillating frame W, flanged plate e^3, slide E^3, connected with said bell-crank lever, sliding standard F^1, cam D^1, and mechanism, substantially as described, for imparting motion to said cam and oscillating said frame W, substantially as and for the purpose set forth.

6. The combination, with the clamp or holder B, of a flanged bar C^2, slide C^1, carriage C, cam D^3, sliding standard F^3, and the sliding wedge E^1, for imparting to the clamp a side movement, substantially as shown.

7. The combination, with the cam-shaft E and eccentric G, of the forked connecting-rod G′, provided with the projecting pin *g*, the loose collar H, toe *h*, feed-dogs H^2 H^3, cam D^3, having the rim h^1, and a suitable device for producing the backward motion of the said loose collar H, substantially as described.

8. The combination, with the cam-shaft E and eccentric G, of the rod G′, having a strap surrounding said eccentric, and provided with a pin, *g*, loose collar H, provided with toe *h*, feed-dogs H^2 H^3, pin h^4, slotted plate y^1, lever Y, and a suitable device for producing the backward movement of the loose collar H, substantially as described.

9. The combination, with cam-shaft E and eccentric G, of the forked connecting-rod G′, suitably connected with said eccentric at one end, and provided with the toe *g* at its forked end, of the feeding devices operated by said rod, the arm Z, extending outward through case A, attached to a rock-shaft, Z′, from which projects an arm, *z*, having a wrist-pin projecting into the fork of said connecting-rod, the catch-arm z^2, projecting at right angles from the arm Z, and the notched disk d^3, as set forth.

10. The combination, with the clamp or holder B, of the gage I, having a series of tongues adapted to different lengths of button-holes, and a device for raising and lowering said gage, as desired, substantially as described.

11. The combination, with the stitch-forming devices of a button-hole sewing-machine, of a reciprocating fabric-clamp, a longitudinally-adjustable shaft, having mounted thereon a series of cams and intermediate devices, through which motion is communicated therefrom to said clamp, whereby the machine can be adapted to stitch button-holes of different lengths, substantially as set forth.

12. The combination, with a clamp or holder, B, and with a sliding shaft, E, carrying a series of graduated cams, of a series of gages, I, mounted on a slide, and a lever, K, which connects with the cam-shaft and with the gage-slide, substantially as and for the purpose described.

13. The combination, with the cloth-clamp B, carriage C, and the series of graduated cams D^2, of the sliding standard F^2 and connecting devices, substantially as described, whereby the proper progressive reciprocating motion is imparted to said clamp, essentially as set forth.

14. The combination, with the needle-bar R′, of the arm R, links S^1 S^2, pitman S, crank P, and suitable devices for operating said crank, substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand and seal this 29th day of May, 1877.

EUGÈNE MOREAU. [L. S.]

Witnesses:
C. W. M. SMITH,
EDWARD E. OSBORN.