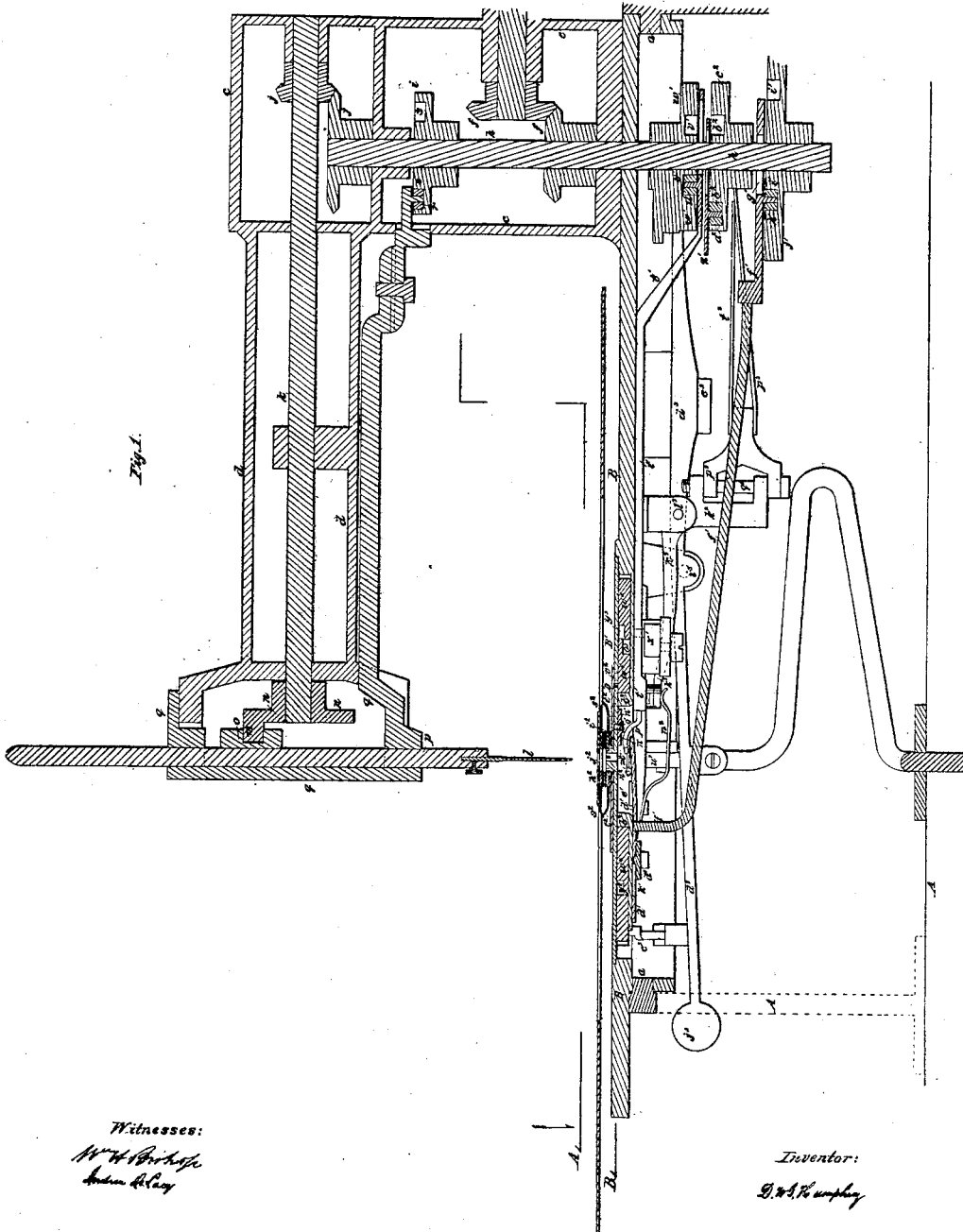


D. W. G. HUMPHREY.
BUTTON HOLE SEWING MACHINE.

No. 50,253.

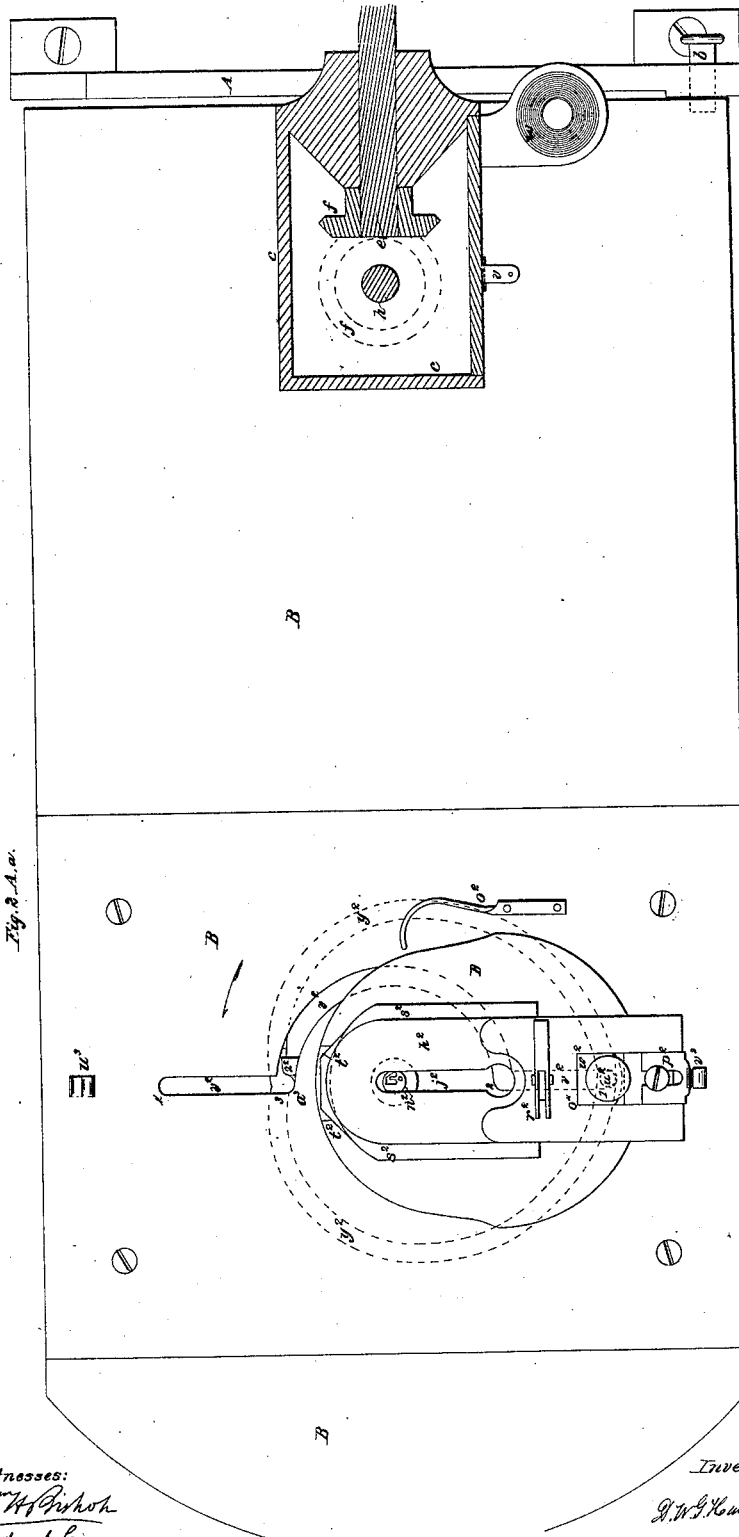
Patented Oct. 3, 1865.



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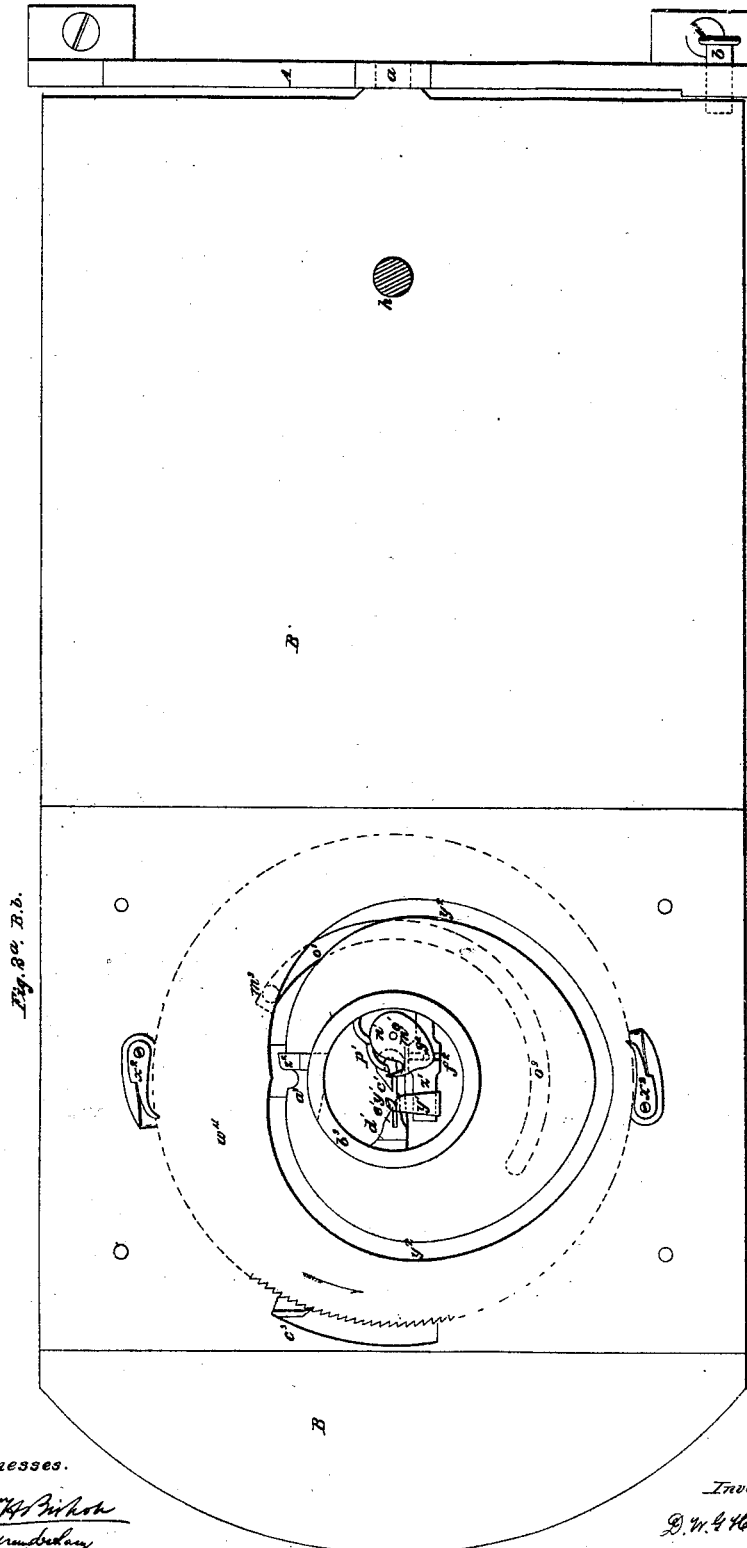
Witnesses:
Wm. H. Fisher
Arthur Bailey

Inventor:
D. W. G. Humphrey

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Witnesses.

James H. Nichols
Andrew S. S. S.

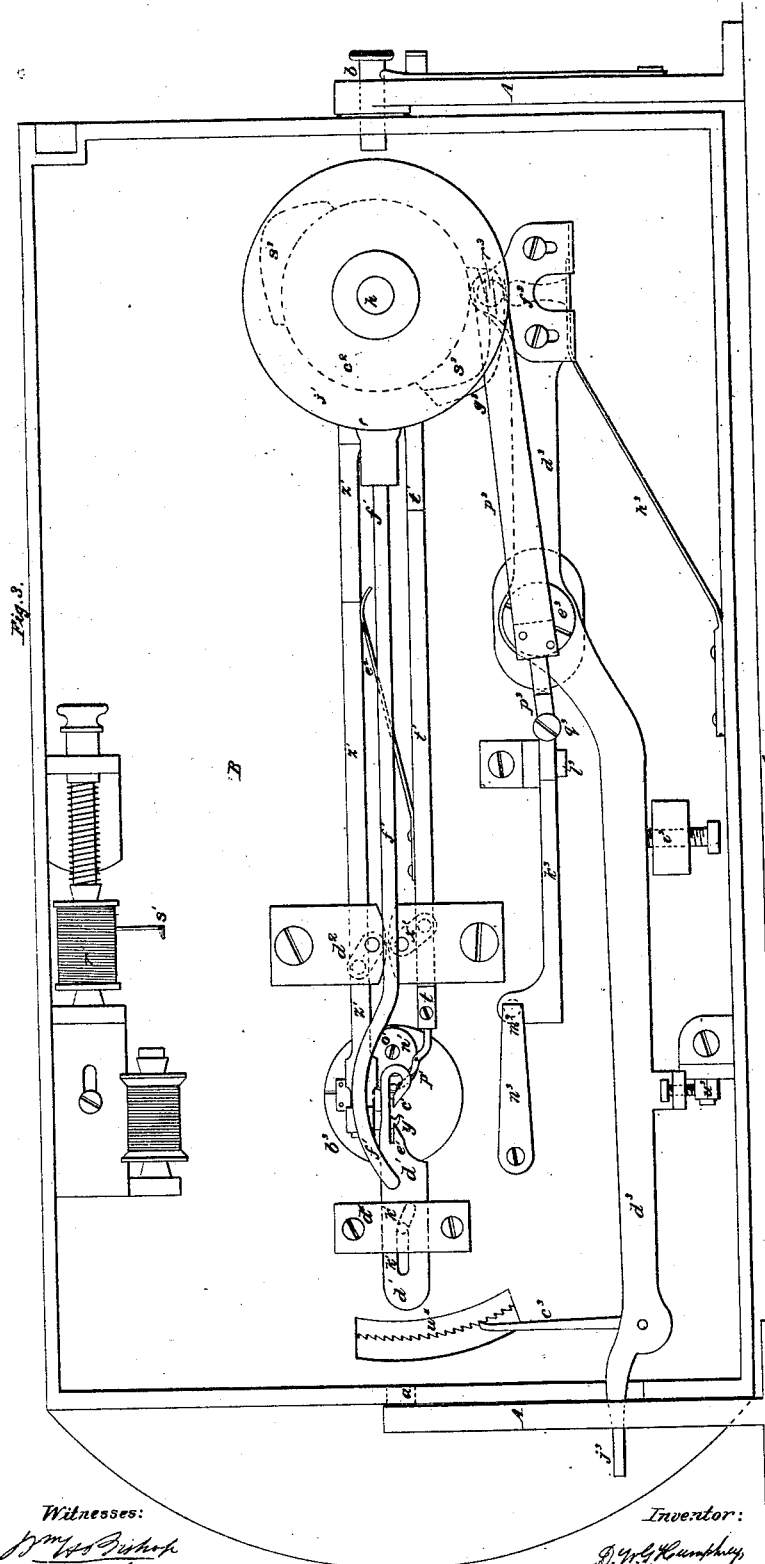
Inventor:

D. W. G. Humphrey

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Witnesses:

J. M. Bishop
Arthur W. Carey

Inventor:

D. W. G. Humphrey

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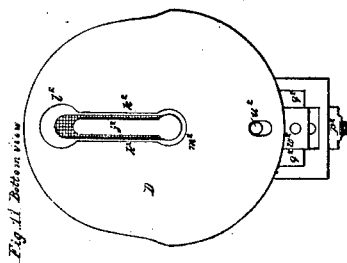


Fig. 11 Bottom view

Fig. 5. Cam (c) for moving needle bar carrier; also for operating governor (g).

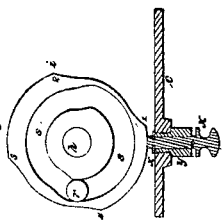


Fig. 7. Cam (c) for operating loop carrier (b) and loop governor (g).

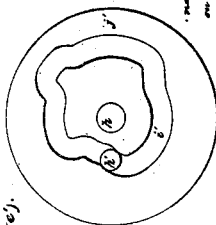


Fig. 8. Finger (m) on plate (n).



Fig. 13 Under face of feed ring.

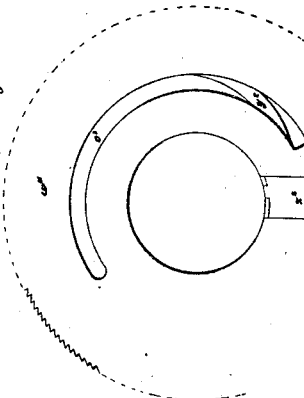


Fig. 9. Cam (w) for operating interlocking needle (v); cam (b) for operating feed lever on straight part of frame; and cam (d) for action feed.

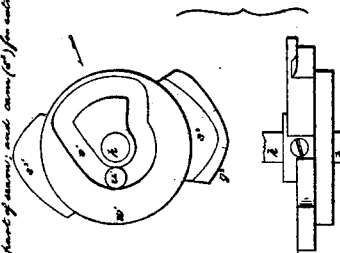
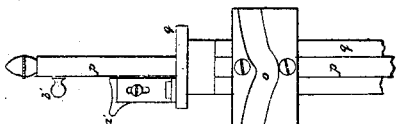
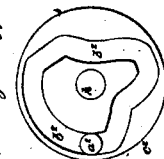


Fig. 10. Cam (c) for operating hook (h).



Inventor:
D. W. Humphrey

D. W. G. HUMPHREY.
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Fig. 12. form of $\text{clot}(v^2)$ in table.

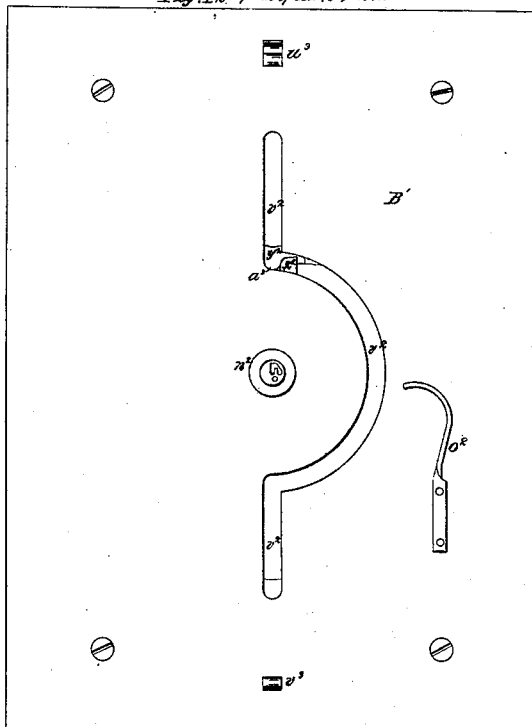
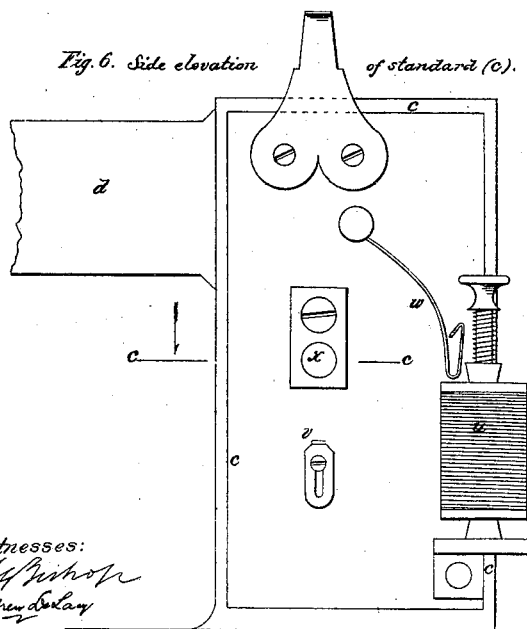


Fig. 6. Side elevation of standard (C).



Witnesses:
 J. H. Bishop
 Andrew D. Lay

Inventor:
D. W. Humphrey

UNITED STATES PATENT OFFICE.

D. W. G. HUMPHREY, OF CHELSEA, MASSACHUSETTS.

IMPROVEMENT IN BUTTON-HOLE SEWING-MACHINES.

Specification forming part of Letters Patent No. 50,253, dated October 3, 1865.

To all whom it may concern:

Be it known that I, D. W. G. HUMPHREY, of Chelsea, in the State of Massachusetts, have invented certain new and useful Improvements in Machinery for Sewing or Working Button-Holes; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a longitudinal vertical section taken in the plane of the needle; Fig. 2, a horizontal section taken at the line A *a* of Fig. 1; Fig. 2^a, another horizontal section taken at the line B *b* of Fig. 1, just below the table; and Fig. 3, a bottom view of the machine, to represent the mechanism below the table. Other views will be hereinafter explained.

The same letters indicate like parts in all the figures.

In the accompanying drawings, A represents the foundation-frame, consisting of a bed-plate and two end standards, in which is mounted the table B (such as is usually employed in sewing-machines) by means of a journal, *a*, at each end. The mechanism is all attached to the said table B, and much of it to the under side of it, so that by reason of its being mounted by journals on the standards of the bottom frame it can be readily turned up to give ready access to that portion of the mechanism which is attached to its under side. One of the end standards of the lower frame is provided with a spring-bolt, *b*, to hold the table in a horizontal position.

On the top of the table B is secured a hollow standard, *c*, from which projects a horizontal arm, *d*, and in the standard *c* is mounted the driving-shaft *e*, to which the motive power is to be applied in any appropriate manner. By bevel-gear wheels *f f* motion is communicated from the driving-shaft *e* to a vertical shaft, *h*, which carries a cam, *i*, for a purpose to be presently described; and this vertical shaft, by other bevel-gears, *j j*, communicates motion to a horizontal shaft, *k*, mounted in the arm *d*, and termed the "needle-shaft," as its office is to give the usual up-and-down motion to the needle *l* by means of a crank-pin, *m*, projecting from the face of a wheel, *n*, on its front end, the said crank-pin traveling in its revolution in a cam-groove, *o*, in the face of a plate on the needle-bar *p*. The form of this

cam-groove is represented in Fig. 4. The length of the crank-pin and the depth of the groove should be such as to admit of a lateral motion which is to be given to the needle-bar *p* and its needle. The needle-bar *p*, instead of being adapted to work in slides in the forward end of the arm *d*, as is usual in some sewing-machines, is fitted to slide vertically in the front end of what may be termed the "needle-bar carrier" *q*, which is fitted to slide longitudinally in the arm *d*, its rear end extending to the inside of the standard *c*, where it is provided with a roller or pin, *r*, fitted to work in a cam-groove, *s*, in the upper face of the cam *i*, before mentioned, on the vertical shaft *h*. The form of this cam-groove *s* is represented in section, Fig. 5.

The object of giving the lateral motion to the needle by the mechanism described is that during one motion down and up to form one stitch it shall pass through the slit of the button-hole or by the edge thereof, and at the next operation through the cloth by the side of the button-hole or edge, and so alternately throughout the operation, and therefore the needle should be moved up and down twice to one back-and-forward motion of the needle-bar carrier, which can be effected by so proportioning the bevel-gear wheels *j j* that the needle-shaft *k* shall make two revolutions to one of the vertical shaft *h* with a cam-groove of the form represented at Fig. 5.

The needle-thread from a spool, *u*, passes through a guide, *v*, at the side of the standard *c*, then through a loop in a spring, *w*, (shown in Fig. 6, which is a side elevation of the standard *c*;) the tension of which spring takes up the usual slack of the thread, and from this loop the thread passes through a gripping mechanism, *x*, by which, at certain parts of the operation, it is gripped and held fast. This gripping mechanism is represented in Fig. 5 by a horizontal section taken at the line C *c* of Fig. 6.

The griper *x* has a stem of smaller diameter, which is fitted to slide in a hole in a piece, *y*, attached to the standard *c*, and the inner end of this griper is pressed against the periphery of the cam *i* by a spring, *z*, attached to the inside of the standard *c*. The stem is notched at one side, so that when the griper is pushed out the thread can be readily introduced, and when between the inner surface of the griper

x and the outer surface of the piece y , by the tension of the spring z , the thread is gripped between the two, and will not be drawn through by the operations of the machine; but when the griper x is forced out by the cam i , then the thread will be free to be drawn by the needle. The form of the cam i is fully represented in Fig. 5. The sections of its periphery from 1 to 2 and from 3 to 4 are of such form that they do not act on the stem of the griper x , and the sections from 2 to 3 and from 4 to 1 are of such form that they act on the stem to force the griper out to liberate the thread.

When the needle l is working in the slit of the button-hole the needle-thread is gripped after the eye of the needle has passed below the cloth, and it is liberated as soon as the loop of the thread is taken by the mechanism below, which takes place, as will be seen hereinafter, during the upward motion of the needle; and when the needle passes through the cloth by the side of the button-hole the thread is gripped as the eye of the needle reaches the surface of the cloth, and it is released at the same part of the upward stroke of the needle as in the previous operation. The reason for this slight difference in duration of the periods of action of the griper on the thread will become apparent when the whole operation of forming the stitch shall have been described.

In addition to the griper x , above described, for controlling the thread, there is an adjustable rest, a' , (see Fig. 4,) attached to the arm d by the side of the needle-bar, over the upper edge of which the thread passes before passing through a guide, b' , attached to and moving with the needle-bar. The upper edge of the rest a' , is rounded, so as not to cut the thread as it passes over it, and it is made of two parts connected by a screw passing through an elongated slot, so that the upper edge over which the thread passes can be elevated or depressed for adjustment, its average position being about the middle of the range of motion of the thread-guide b' , which moves with the needle-bar, so that as the guide b' , in its descent, passes by the rest a' the thread will be held back by it, and the eye of the needle, in moving down below the cloth, must draw the thread from the loop formed during the previous downward motion of the needle, and thus draw the previous stitch tight. So soon as the needle has descended through the cloth by the side of the button-hole and begins to rise, forming the thread between its eye and the cloth into a loop, an instrument termed the "loop-carrier," and represented at c' , enters between the needle and its thread, spreads and carries it in the form of a loop across the slit in the cloth made for the button-hole, and there holds it until the needle rises and descends in the slit of the button-hole and through the said loop so previously formed and held. The loop-carrier c' is formed near one end of a plate, d' , and facing another instrument, e' , formed in the same plate, and termed the "loop-opener," but which operates on the reverse motion of the

loop-carrier c' , and on the loop of the needle-thread, which is formed after the needle has passed through its own loop held by the loop-carrier. This plate d' is attached to the bent-up end of a rod, f' , the other end of which is formed with a slot, g' , to embrace and slide on the vertical shaft h below the table, and provided with a roller, h' , which works in a cam-groove, i' , in the face of a wheel, j' , on the shaft h .

The cam-groove i' is represented in Fig. 7 of the accompanying drawings, and is of such a form as to slide the plate back and forth at the periods required; but for the purpose of spreading the loop of the needle-thread that the needle may enter at the next descent, a slot or mortise, k' , is formed in the plate d' , which slot is straight for some distance, and then diagonal, and fitted to slide on a guide-pin which projects upward from a plate, d'' , attached to the under surface of the table B, so that the loop-carrier will have a movement the reverse of the form of the said slot. The cam i' is formed so as to move the loop-carrier by the needle to take the loop, then to hold it still as the needle rises, and then move it diagonally to the position under the slit of the button-hole where the needle is next to descend, thereby opening the loop and placing it so that the needle shall enter it and carry its thread through it at the next operation; but during the period of rest of the loop-carrier just described another operation is performed. If the motions of the loop-carrier to take the loop from the needle and spread it so as to permit the needle to enter it at its next descent were completed, the loop would be stretched obliquely from the under face of the table on which the cloth rests, and as the thread is double and the two parts close to each other at the under side of the table, the point of the needle would be liable to miss the loop or puncture the thread, and thus spoil a stitch. To prevent this that part of the loop which is close to the under side of the table is held back before the loop-carrier makes its second movement to completely open the loop. This operation is performed by a finger, m' , formed on the edge of a plate, n' , (more clearly represented in Fig. 8.) This plate is secured to the under face of the table B by a screw, o' , on which it turns as a fulcrum, and this plate is turned on its fulcrum sufficiently to bring the finger m' on the left-hand side of the loop, and then the loop-carrier completes its operation, and thereby stretches the loop under the said finger m' , to insure a sufficient opening of the loop for the entrance of the needle. The mechanism for operating this finger will be described hereinafter. As the needle descends through the loop, formed and held as above described, the loop-carrier is drawn back to liberate the loop which it held, that the continued descent of the needle may draw it tight around itself, which it must do, as the thread cannot be supplied from the spool, as it is held back by the griper x and the rest a' , before described; and so soon as the needle

begins to rise from its second descent the loop-opener e' , which is on the same plate with and opposite to the loop-carrier c' , is moved toward the needle by the back movement of the plate d' , and enters between the needle and its thread below the previously formed loop and opens a second loop. While this second loop is kept open the needle rises and moves back laterally to its original position, and at the same time an interlacing-needle, p' , enters this second loop of the needle-thread and carries with it an interlacing-thread. This needle p' is an eye-pointed needle which carries a thread from a spool, r' , which passes through a guide, s' , and thence through the eye of the said needle. This needle is on the end of a bar, t' , the rear end of which is slotted to embrace and slide on the vertical shaft h , and it is provided with a roller or pin, u' , fitted to work in a cam-groove, v' , in the face of a cam-wheel, w' , on the shaft h . This cam-groove is represented at Fig. 9. The bar t' , a little back of the needle p' , is connected with the under side of the table B by a short joint-link, x' , which gives to the point of the needle, as it is moved back and forth by the cam-groove v' , a curvilinear motion around the needle l to carry its thread into the second loop of the main thread while it is held open by the loop-opener e' , before described; and while the needle p' is in this position it remains at rest sufficiently long to enable a hook, y' , to take the loop of its thread, and so soon as this has taken place the needle p' returns to its original position, leaving its loop in the second loop of the main needle-thread and under the control of the hook y' . The needle l then rises and the hook y' moves back to open the loop of the interlacing-thread, that the needle l , in its third descent, may pass through it, by which operation it tightens the second loop of its own thread around the first loop of the interlacing-thread. The series of operations before described are then repeated, the loop-carrier again taking the thread of the needle l to form a loop, as in the first operation described, but below the loop of the interlacing-thread, which was not the case at the first operation.

The motions of the hook above described are given in the following manner: It is secured on the end of a bar, z' , the opposite end of which is slotted to embrace and slide on the vertical shaft h , and it is provided with a roller or pin, a' , fitted to run in a cam-groove, b' , in the face of a cam-wheel, c' , on the shaft h . This cam-groove is represented at Fig. 10, and a curvilinear motion is given to the hook y' in the same manner as to the interlacing-needle p' by a joint-link, d' , the curve being reversed as the link is reversed. A spring, e' , is interposed between the two bars t' and z' , to make the motions of the interlacing-needle and hook steady without the necessity of making the joints too close and binding.

On the upper side of the bar z' of the hook y' there is a cross-slot, f' , (see Fig. 2^a.) which

receives a pin, g' , on the lower face of the plate n' of the finger m' , before described, and as this bar z' moves back and forth to operate the hook y' it imparts the required vibratory motion to the finger m' .

The cloth or other material in which a button-hole is to be worked is first prepared by cutting with a suitable tool of the usual construction a slit through it of the required length for the intended button-hole, and with an eyelet at the end where the rounded part of the button-hole is to be formed. The cloth so prepared is properly placed in a clamp, D, and between a top and bottom clamping-plate, h^2 and i^2 . These clamping-surfaces are roughened in any suitable manner to prevent the cloth from slipping between them. The two clamping-plates are formed each with a slot, j^2 , of the general form of a button-hole, but larger. The bottom clamping-plate is secured to the upper surface of the base-plate D, and this base-plate has a mortise through it of the form represented at k^2 , Fig. 11, which represents a bottom view of the said plate. Both ends of this mortise are circular, as at l^2 and m^2 , the end l^2 being the largest, and large enough to pass freely over the flat head of a button, n^2 , that projects upward from the surface of the table B, and the straight sides of this mortise are at a less distance apart than the diameter of the head of the button, and just so as to work freely on the shank of the said button, which acts as a guide when the clamp is required to move in a straight line, the upper surface of the plate being rabbeted for the head of the button, so that the clamp is held down to the face of the table B by the head of the button, except when the enlarged end l^2 of the mortise reaches it. The other rounded end, m^2 , of the mortise is smaller than the button; but its diameter is as much greater than the shank of the button and the space between the straight part of the mortise as is equal to the diameter of the eyelet of the intended button-hole; and on the table there is a spring, o^2 , which bears against the edge of the base-plate of the clamp to press one side of the mortise k^2 against the shank of the button n^2 , so that when the rounded end m^2 of the mortise reaches the button n^2 and begins to turn, the spring moves the clamp laterally, keeping the edge of the rounded and enlarged part of the mortise m^2 against the shank of the button, thereby making the line of seam in the form of an eyelet while the clamp is turning.

From the foregoing it will be seen that by making the straight part of the mortise k^2 wider than the diameter of the shank of the button any desired width of opening can be given to the slit or straight part of a button-hole, and that by varying the size of the rounded end m^2 of the mortise any desired size of eyelet can be given.

The upper jaw, h^2 , of the clamp is mortised at o^4 to fit over a part of the base, and it is

held down at the rear end by a cap-plate, p^2 , and screw, and it is pressed up against the rear end of this cap-plate by the tension of springs q^2 , which tend constantly to throw up its forward end to unclamp the cloth; and it is forced down against the tension of such springs to clamp the cloth by a cam-faced hand-lever, r^2 , which will hold it in any desired position.

It is desirable to spread the slit of the intended button-hole at the time it is clamped, so that the needle shall not pierce the edges of the cloth in that part of its operations in which it forms the edging. To effect this stretching of the slit two springs, $s^2 s^2$, are secured on each side of the upper jaw, h^2 , and two corresponding ones, $t^2 t^2$, on the lower jaw. These four springs are curved transversely, and their edges gripe the cloth before the clamp-faces do, so that as the clamps approach each other the springs will be flattened, and by reason of having previously gripped the cloth they will stretch it as they are flattened, and thereby open the slit, so that the needle will work in it without piercing the edges of the cloth.

Near the rear end of the clamp D there is a round pin, u^2 , which projects below its lower surface, and which fits in a slot, b^2 , in the table B. It is by acting on this pin that the required motions are imparted to the clamp for spacing the stitches and for giving the required form to the button-hole; and as the head of the button n^2 holds the clamp down to the surface of the table B without the necessity of using pressers or other means such as have heretofore been employed in sewing-machines, and it frequently becomes necessary to remove the clamp from the table of the machine before the operation is complete, the pin u^2 is made to slide in a standard, w^2 , of the clamp, and is held down by the tension of a helical spring, (not necessary to be shown in the drawings,) so that it can be lifted out of the slot b^2 of the table, and then the clamp can be removed by drawing it back until the enlarged end t^2 of the slot h^2 reaches the button n^2 .

The slot v^2 in the table B is of the form represented at Fig. 12, with two straight parts connected by about a half-circle. When the pin u^2 is in either of the straight parts of this slot the clamp D can only move in a straight line; but when it reaches the semicircular part of the said slot, then the clamp can turn until the pin u^2 reaches the other straight part. The button n^2 is not concentric with the circular part of the slot v^2 , but as much eccentric, and toward the middle of the circular part of the slot as is equal to the diameter of the eyelet of the intended button-hole, so that the outer edge of the circular part of the slot v^2 , bearing against the pin u^2 , will, together with the spring o^2 , keep the edge of the rounded part m^2 of the mortise h^2 against the stem of the button.

For working button-holes without an eyelet the slot v^2 can be concentric with the button; but, if desired, the said slot can be made con-

centric for all kinds of button-holes if the circular part of the slot v^2 be made gradually as much wider from each end to the middle as the diameter of an eyelet, in which case the spring o^2 alone will control the clamp and keep the edge of the mortise h^2 against the stem of the button in turning.

That part of the table marked B', which has the button n^2 , and in which the slot v^2 is made, is a thin plate separate from and secured to the upper surface of the table B, and the button n^2 is the surface on which the stitching is performed, and hence it must be pierced with the requisite holes for the passage of the needle and thread, and the main table B is cut out below the central portion of the plate B', that the stitching mechanism below may operate in close proximity to the under surface of the plate B'.

A flat ring, w^2 , (represented in Fig. 2^a), is fitted to turn in a recess in the upper surface of the table B and just under the plate B'. The outer periphery of this ring, which may be termed the "feeding-ring," is formed with ratchet-teeth, by which it is turned, as hereinafter described, two (more or less) spring-catches, a^2 , being employed to prevent it from turning except in the direction of the arrow. In the face of this ring there is a groove, y^2 , in the form of a heart, and the cylindrical pin u^2 of the clamp D extends through the slot v^2 of the plate B' into this groove. The ring and clamp being in the relative positions represented in the drawings, (see Fig. 2,) with the pin u^2 in the groove y^2 , and near the point of the heart, if the ring be turned in the direction of the arrow, the groove y^2 will act on the pin u^2 and cause it and the clamp with it to travel along the straight part of the slot v^2 from 1 to 2, and when that part of the heart-shaped groove y^2 which is nearest the center reaches the pin u^2 it (the pin) will have reached the beginning of the semicircular part of the slot v^2 . At this time the pin u^2 comes in contact with a stop, z^2 , which stands partly across the groove y^2 , and by which it is stopped, so that by the continued rotation of the ring the pin u^2 will be caused to travel along the semicircular part of the slot v^2 until it reaches the other straight part at 3, having thereby turned the clamp D half a revolution.

The result of the motions of the clamp above described is that the part of the cloth in which the intended button-hole is to be worked has traveled under the needle l from the pointed end of the button-hole in a straight line to the eyelet, then around the eyelet, and back in a straight line to the pointed end, so that if the needle and other parts had been in operation the entire button-hole would have been worked, although the clamp was turned only half-way around.

The stop z^2 is on a plate fitted to slide radially in a recess in the under face of the feeding-ring, and it is held in its position partly across the groove y^2 by the edge of its plate

bearing against the outer edge of a rim, b^3 , of the table B, within the feeding-ring; but this rim b^3 is cut out at that part of its circumference which corresponds with the position of the stop z^2 at the time the clamp approaches the end of its turning motion, so that the pin u^2 , acting on the beveled or rounded side of the stop z^2 , will force it out of the groove y^2 , that it (the pin u^2) may enter the other part of the groove y^2 , by which it will be caused to travel along the other straight part of the slot v^2 , from 3 to 4. The recess in the periphery of the rim b^3 (represented by dotted lines in Fig. 2^a) is beveled on the opposite side, so as to push back the stop z^2 to its original position after the pin u^2 has passed it. As the circular part of the slot v^2 is eccentric to the button n^2 and to the feeding-ring for the purpose of pushing the clamp laterally in working the eyelet of the button-hole, the pin u^2 of the clamp will have a slight motion toward and from the center of the feeding-ring while the clamp is being turned, and to make allowance for this a recess or enlargement, a^3 , is formed in that part of the groove y^2 which is nearest the center of the feeding-ring.

The feeding-ring is turned to give the feeding motion to the clamp D for spacing the stitches by a spring-pawl or ratchet-hand, c^3 , (see Fig. 3,) which acts on the ratchet-teeth of the said ring. The pawl c^3 works in a mortise in the table B, and is connected with a lever, d^3 , below the table B. It vibrates on a fulcrum-pin at e^3 , and is provided with a face, f^3 , (see Fig. 3,) that bears against the periphery of a cam, g^3 , on the shaft h . The form of this cam is represented at Figs. 3 and 9, and as this cam is on the shaft h , which makes but one revolution to two of the needle-shaft, there will be but one feed motion to every two stitching motions of the needle l —one through the cloth and one in the slit of the button-hole. It may, however, be made to feed at each operation of the needle. A spring, k^3 , bears the lever against the cam. A set-screw, i^3 , gages the range of back motion of the lever, so that by the turning of this screw the feeding motion can be readily adjusted to any desired spacing of the stitches. The said feed-lever d^3 extends to the outside of the frame, where it has the form of a handle, j^3 , for the convenience of operating the feed by hand, whenever desired.

The feeding mechanism, so far as described, is for operating the feed motion along the straight parts of a button-hole; but while the clamp is being turned to form the eyelet of the button-hole the range of motion of the pawl c^3 is required to be considerably greater, and for this purpose an additional mechanism is brought into action at the time the pin u^2 of the clamp reaches the curved part of the slot v^2 , and thrown out of action when the said pin passes from the curved into the other straight part of the slot v^2 .

A lever, k^3 , is mounted on a fulcrum-pin, l^3 , under the table B, so as to vibrate in a verti-

cal plane. One end of the said lever carries a pin, m^3 , which works in a hole in the table B, and capable of being forced up by a spring, n^3 , above the upper surface of the said table and into a concentric groove, o^3 , in the under face of the feeding-ring w^4 . The form and extent of this groove are represented at Fig. 13. While the pin m^3 is in the groove o^3 the feeding motion above described is in action; but when, by the rotation of the feeding-ring, the pin u^2 of the clamp reaches the curved part of the slot v^2 of the plate B', the end of the groove o^3 (the face of which is beveled for the purpose) reaches the pin m^3 , forces it down, and thereby depresses that arm of its lever k^3 . To the other arm of the said lever k^3 is connected an extra arm, p^3 , by a hinged joint, q^3 , which will permit a play in a horizontal, but not in a vertical, plane. This extra arm p^3 carries a pin, r^3 , which passes through a hole in that arm of the feed-lever d^3 (before described) which is acted upon by the cam g^3 , and when the pin m^3 is depressed by the feeding-ring the pin r^3 of the extra arm of the lever k^3 is projected above the top of the feed-lever and within the range of motion of a double cam, $s^3 s^3$, on the shaft h , the peripheries of which (represented at Figs. 3 and 9) will alternately act on the said pin to operate the feed-lever, thereby suspending the action of the cam g^3 . In this way two feeding motions are given to each revolution of the shaft h , and any desired range of feed motion may be given to turn the clamp; but so soon as the pin u^2 of the clamp reaches the other straight part of the slot v^2 in the plate B' the commencement of the groove o^3 of the feeding-ring reaches the pin m^3 , permits it to rise, and the pin r^3 is withdrawn from the range of the cams s^3 , which permits the feeding motion to be resumed by the cam g^3 for the other straight part of the button-hole.

To avoid any possible conflict of the parts in making the change, the extra arm p^3 , which carries the pin r^3 , is made of a spring which will readily yield if the pin r^3 , in rising, should come against the face of either of the cams $s^3 s^3$; but so soon as the cam shall have passed the pin will then be forced up to the required position to be acted upon by the periphery of the cams at the next operation. As it is important, however, that the pin r^3 should be drawn down out of action at the required time, and it is attached to a spring, such spring might yield to any binding of the pin. To prevent this the spring-arm p^3 is prevented from yielding in the opposite direction by a brace, t^3 .

Button-holes of various lengths are required to be made, and that is determined by feeding the clamp forward by the handle j^3 of the feed-lever by hand, so as to bring the desired part of the cloth under the needle before commencing the stitching operation; but as it is desirable to finish the other side of the button-hole just at the same distance from the eyelet that the first side was commenced, and to stop the feeding automatically to insure accuracy, there

is a spring stop-lever, w^3 , one arm of which projects above the table B' , so as to be pushed outward against the tension of its spring by the clamp as it reaches the end of its motion. The lower arm of this lever, when thus vibrated, strikes against the feed-lever d^3 , and thereby stops the feed motion until the clamp is withdrawn. The part of the clamp which thus strikes the stop-lever w^3 is the outer end of the plate p^2 , before described, which holds down and forms the fulcrum of the upper jaw of the clamp; and as it is adjustable by the fastening-screw and slot, its tail end can be adjusted to any desired length of button-hole. On the opposite side of the table to the stop-lever w^3 there is a fixed gage, v^3 , to determine the point of starting. After the cloth has been fastened in the clamp and the clamp put over the button n^2 , it is drawn back until the tail end of the plate p^2 strikes the gage v^3 . The feed-lever is then operated by hand to turn the feed-ring w^4 until the required part of its groove reaches the pin u^2 of the clamp, when it is forced into the said groove by the tension of its spring. The machine is then ready for operation.

Instead of the two sets of springs on the clamp for spreading the cloth and opening the slit of the button-hole, it will be obvious that the same result in kind can be accomplished by using one set only, with a smooth resisting-surface on the opposite side for the cloth to slide on.

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

1. The mode of clamping and holding back the needle-thread, that the needle may draw the loop tight which was formed at the previous operation, in combination with the double-

acting cam, which makes the duration of the gripping operation different when the needle descends through the cloth than when it descends in the slit or by the edge of the button-hole, substantially as and for the purpose specified.

2. Holding the clamp down to the face of the table by a button, or the equivalent thereof, which at the same time acts as a guide for the motions of the clamp, substantially as described.

3. Making the curved part of the slot in the table in which the pin of the clamp works eccentric to the button which acts as a guide to the motions of the clamp, substantially as described, to admit of the required lateral motion to work the eyelets in button-holes, as described.

4. Making the pin of the clamp by which the required motions are communicated to the clamp so that it can slide up and down therein, in combination with the button that holds the clamp down to the table, substantially as described, so that the clamp can be removed from the table by drawing the pin up out of the groove in the feeding-ring and out of the slot in the table, as described.

5. The springs for spreading the cloth, in combination with the clamp, substantially as described.

6. In combination with the feeding mechanism and the clamp, the stop-lever for stopping the feed motion when the button-hole is finished, as described.

D. W. G. HUMPHREY.

Witnesses:

WM. H. BISHOP,
ANDREW DE LACY.