(No Model.) 2 Sheets—Sheet 1.

E. DRAKE.

BUTTONHOLE SEWING MACHINE.

No. 540,301. Patented June 4, 1895.

Fig: 1.

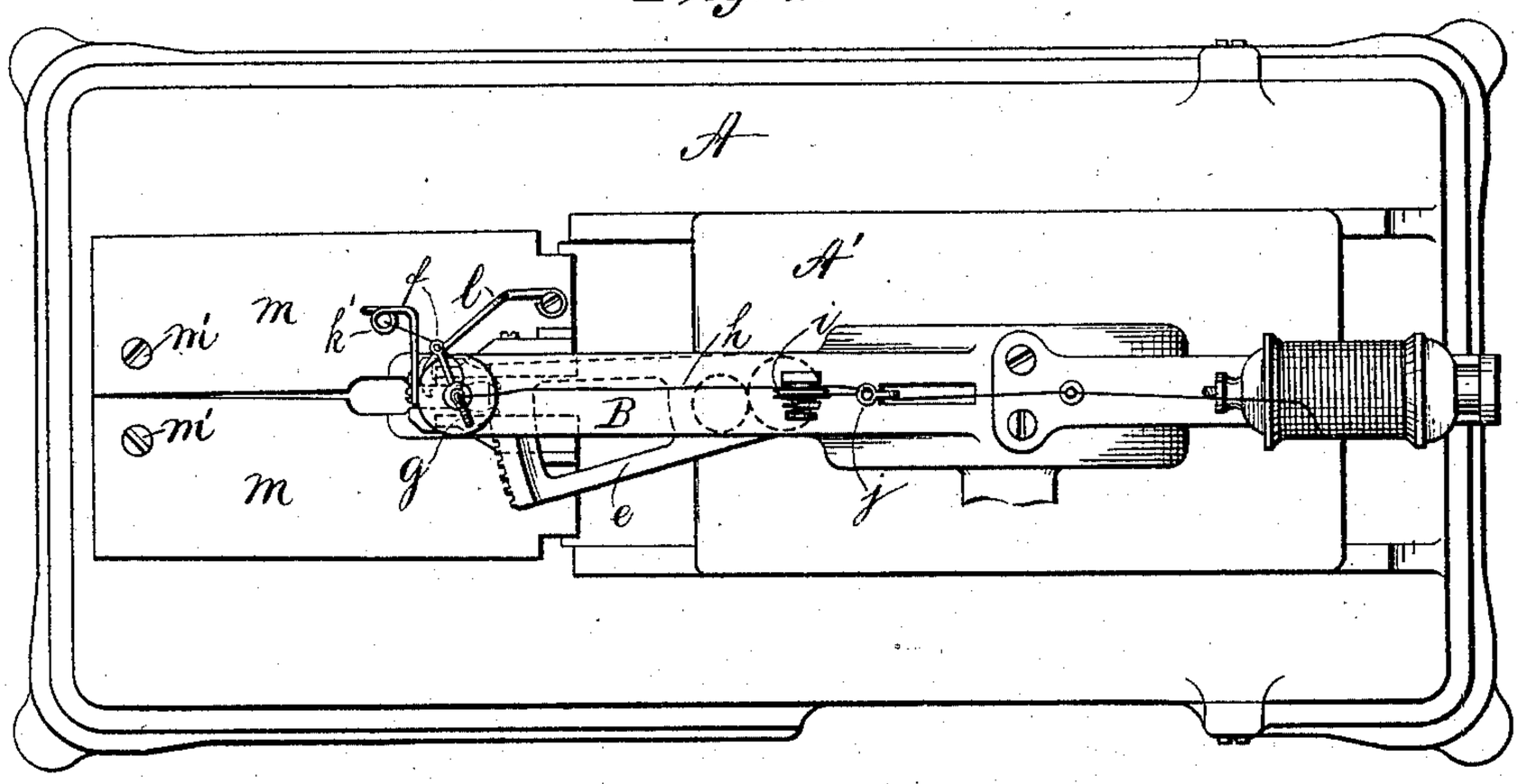
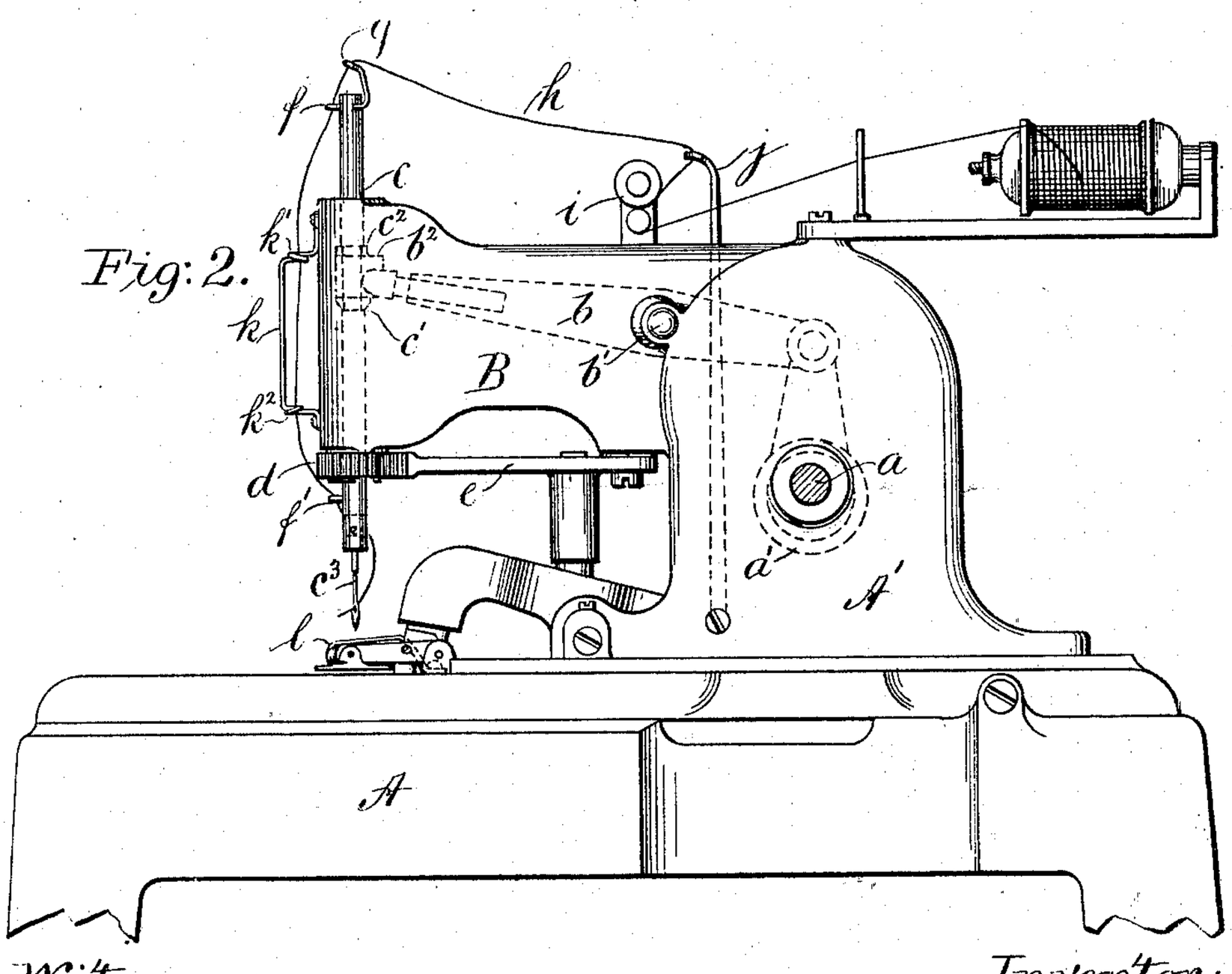


Fig: 2.



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James A. Williams

Inventor:
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(No Model.) 2 Sheets—Sheet 2.

E. DRAKE.

BUTTONHOLE SEWING MACHINE.

No. 540,301. Patented June 4, 1895.

Fig. 3.

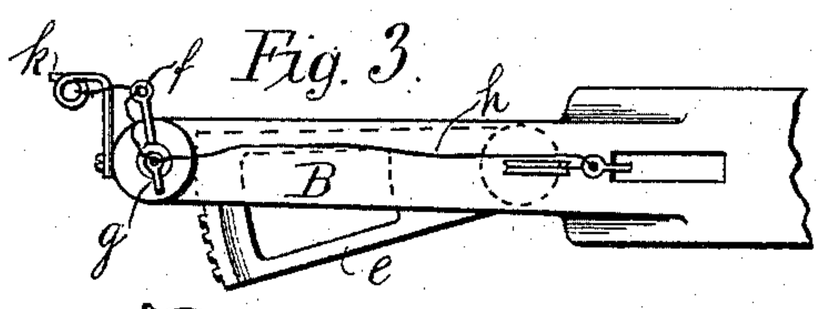
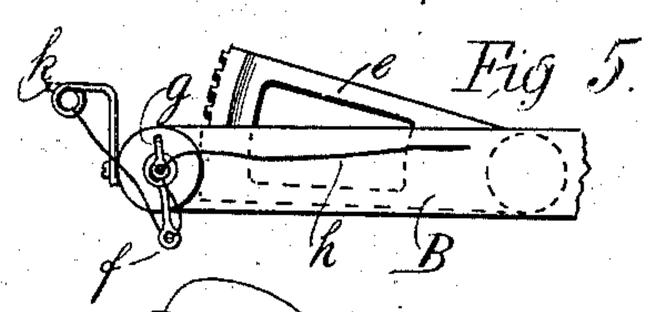


Fig. 5.



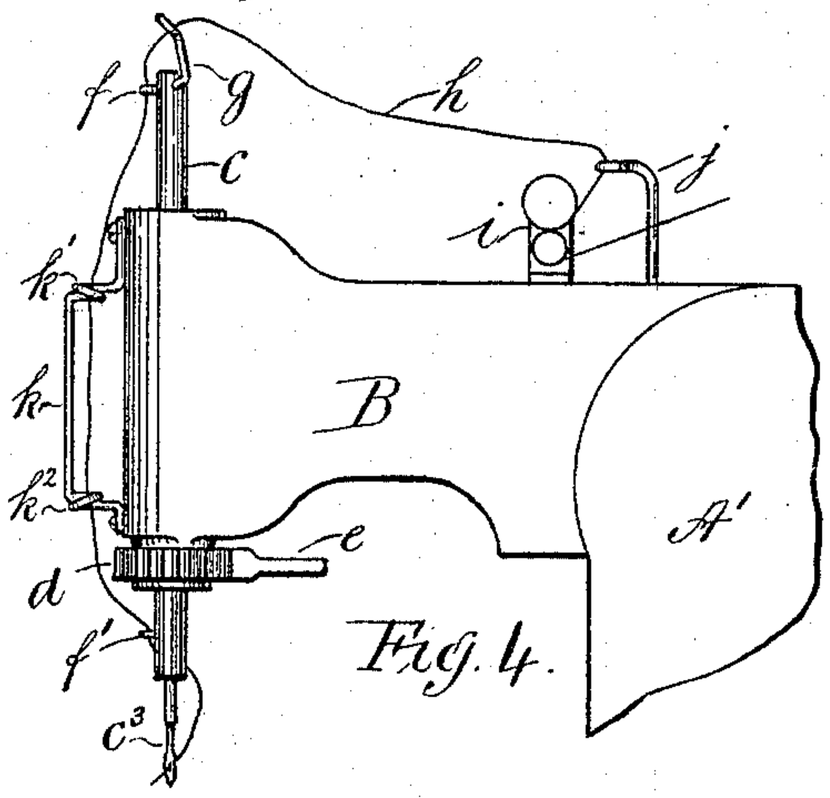


Fig. 4.

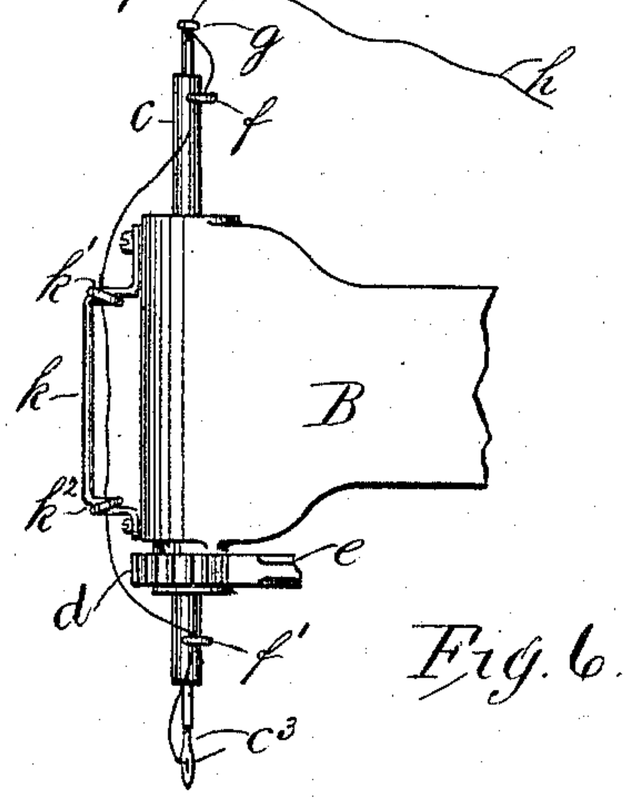


Fig. 6.

Fig. 9.

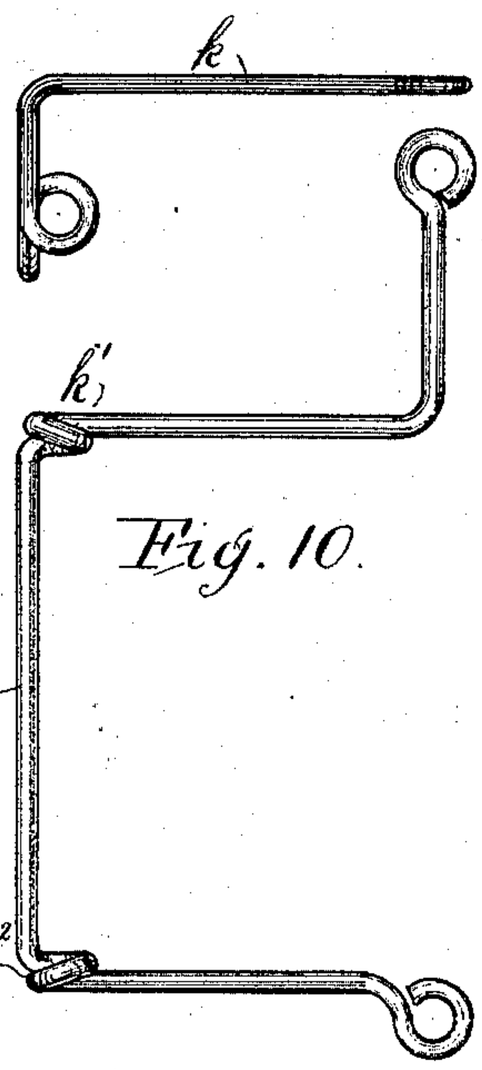


Fig. 10.

Fig. 11

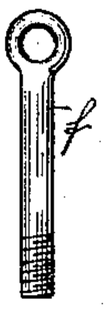
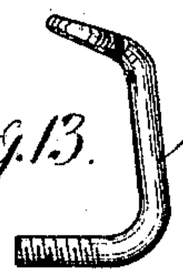


Fig. 12

Fig. 13.



Witnesses:
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Atty

UNITED STATES PATENT OFFICE.

ELLIS DRAKE, OF STOUGHTON, MASSACHUSETTS.

BUTTONHOLE SEWING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 540,301, dated June 4, 1895.

Application filed December 3, 1891. Serial No. 413,881. (No model.)

To all whom it may concern:

Be it known that I, ELLIS DRAKE, of Stoughton, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Buttonhole Sewing-Machines; and I do hereby declare the following specification, taken in connection with the accompanying drawings, forming a part of the same, to be a full, clear, and exact description thereof.

The invention hereinafter described relates to sewing machines for stitching buttonholes of that class represented in the Letters Patent of the United States granted to John Reece, No. 240,546, dated April 26, 1881, and No. 349,359, dated September 21, 1886, in which the stitching mechanism is made to travel first along one side of the buttonhole slit, then around the the eye of the buttonhole, and then along the other side of the slit, said stitching mechanism being mounted upon a traveling frame-work, and the needle bar having, in addition to its regular reciprocations vertically, an intermittent rotary movement at each end of the buttonhole slit.

The object of the present invention is to lessen the number of hand manipulations on the part of the operator in the operation of stitching a buttonhole with a machine of the class referred to, thereby saving time and labor incident to such hand manipulations, and at the same time enabling the machine to be run at a higher rate of speed, and thus increasing the number of buttonholes which may be stitched in a given length of time, such lessening of the hand manipulations resulting in a material saving of thread, and, in connection with the greater rate of speed obtained, also resulting in a marked improvement in the character of the work and the appearance of the finished buttonhole.

In machines of the character referred to, as heretofore constructed, it has been necessary for the operator to perform the following hand manipulations in the operation of stitching each buttonhole: Assuming the machine to be threaded, and with a short end of the thread projecting through the eye of the upper needle, as it would be left after the thread had been cut upon the completion of the last previous buttonhole, the operator has, first, to seize with one hand the end of the thread projecting from the eye of the upper needle; second, to pull with the other hand a certain amount of thread through the tension, and at the same time take up the slack thus produced by pulling the thread through the eye of the needle, it being necessary to obtain an additional length of thread over what was left by cutting the thread at the completion of the last buttonhole, in order to have a sufficient length of thread to start the next buttonhole and prevent the end of the thread from pulling out of the eye of the needle, and also to furnish the operator with a sufficient length of thread to get hold of for breaking it off; third, after a few stitches have been formed sufficient to hold the end of the thread, to break off the surplus end of the thread left projecting at the beginning of the stitching; fourth, to cut off the thread upon the completion of the stitching, and, fifth, to feed along the work for the formation of the next buttonhole. For the performance of these several hand manipulations a considerable amount of time is required, which has necessitated the stopping of the machine after the formation of each buttonhole, to enable the operator to perform the necessary manipulations in preparation for the commencement of the next buttonhole in the series.

By the improvements hereinafter described all of the above hand manipulations are rendered unnecessary except simply cutting the upper thread at the end of each buttonhole and feeding the work from one buttonhole to the next, the remaining operations above enumerated being either entirely dispensed with or performed automatically.

For the accomplishment of these results, the first feature of invention consists in an improvement in the construction and arrangement of the needle bar thread guides.

Another feature of invention consists in the combination, with the needle bar and the mechanism for rotating the same, of surplus thread gathering mechanism, whereby during the formation of the successive stitches at the eye of the buttonhole a certain quantity of surplus thread will be automatically accumulated between the tension device and the eye of the needle, such surplus thread being gathered step by step at each movement of the needle bar in its rotation around the eye of

the buttonhole, and the total quantity of surplus thread so gathered being sufficient to prevent the loose end of the thread from pulling out of the eye of the needle at the commencement of the next buttonhole.

Referring to the drawings, Figure 1 represents a plan view of so much of a buttonhole-stitching machine of the character referred to as is necessary to illustrate the present improvements. Fig. 2 is a side elevation of the same. Figs. 3 and 4 are a top view and a side elevation, respectively, of a portion of the head of the machine, showing the parts in the position occupied before the commencement of the thread-gathering operation. Figs. 5 and 6 are a top view and a side elevation of the same, showing the parts in the position occupied at the conclusion of the thread-gathering operation. Figs. 7 and 8 are a top view and a side elevation, respectively, of a part of the surplus-thread-gathering mechanism. Fig. 9 is a view of one of the needle-bar thread-guides. Figs. 10 and 11 are a top view and a side elevation, respectively, of a needle-bar thread-guide of my invention.

The general construction and operation of the machine, portions of which are illustrated in the drawings, are substantially the same as the machine shown and described in the Letters Patent to Reece, No. 349,359, above referred to, to which reference is made for a full and complete description thereof, and it will be sufficient in this connection to describe only the construction, arrangement and mode of operation of the parts constituting the present features of invention. It will be understood, however, that the improvements hereinafter described are applicable to other specific forms of machine than that which constitutes the subject of said Reece patents, the machine of said patents being taken merely as a type of a general class of machines, and for convenience in illustrating the manner of applying the present improvements to such class of machines.

A represents the stationary bed-plate of the machine, upon which is mounted the traveling frame-work A′, arranged to slide in ways on the bed-plate. This movable frame-work carries all the stitching mechanism and other moving parts, and is provided with suitable journals to support the main shaft a of the machine. Upon said main shaft is an eccentric provided with an eccentric strap a' for driving the needle bar, said eccentric and strap being connected with one end of the needle actuating lever b, all as shown in dotted lines, Fig. 2. The lever b has its fulcrum at b' and is connected in the usual manner with a block b^2 on the needle bar c, said block being loosely mounted on the needle bar so that said bar may be free to turn in said block, the movements of the lever b being communicated to the needle bar to reciprocate the same vertically by means of a shoulder c' on the needle bar below the block b^2 and a nut or washer c^2 above said block, as customary in machines of this character, and as shown in dotted lines, Fig. 2. The needle bar carries at its lower end the needle c^3.

Mounted in the bracket arm B of the movable frame A′ is a pinion d provided with a tubular axle which is held in the lower end of said bracket arm so as to be capable of turning therein, said axle serving as the lower bearing for the needle bar, all as more fully explained in said patents to Reece. The needle bar is connected with the pinion d, or with a slotted guide plate depending from it, by a groove and spline connection, whereby the needle bar, while free to be reciprocated vertically, will be turned or rotated about its own axis by the turning of the pinion d. The pinion d is engaged by the teeth of the toothed sector e which is arranged to be moved at the proper times by mechanism such as is fully described in the patents to Reece above referred to and which consequently is not shown in the accompanying drawings, so as to partially rotate the pinion d and with it the needle bar.

Heretofore in machines of this character the needle bar has been provided at its upper end with a vertical axial hole extending for some distance into the upper end of the bar, and also with a transverse hole in the side of the needle bar, said transverse hole communicating with said vertical hole and forming substantially a right angle therewith, and the upper thread, as it comes from the tension device and take-up, has been led down through the vertical hole and into and out of the transverse hole in the upper end of the needle bar, and thence to two guide-eyes projecting at right angles from the needle bar, one near the top and one near the bottom of said needle bar. With this construction and its attendant arrangement of the thread, there is not only an undue strain upon the thread in the operation of the machine, but this strain is to a great degree uneven and irregular, by reason of the short bights in the thread and the sharp angles which it has to turn in passing into and through the holes in the needle bar and thence to the upper guide projecting at right angles from the needle bar. By reason of the undue strain so brought upon the thread between the tension and the needle, it becomes necessary for the operator, even after the requisite amount of slack thread has been pulled through the tension and the eye of the needle, to hold on to the loose end of the thread projecting through the eye of the needle at the starting of the machine, as otherwise the thread would not go down freely with the needle, and the end of the thread would be liable to pull out of the eye of the needle. Moreover, by reason of these short bights and sharp angles, the thread was liable to become kinked or twisted, especially during the oscillation of the needle bar, and, as the holes in the thread guides projecting at right angles from the needle bar were made of small diameter, the thread was consequently liable to become

caught or cramped in said guides, resulting in the breaking of the thread.

The first feature of the present invention has for its object to obviate the difficulties above referred to, and to that end said feature of invention consists in the combination with the needle bar of an independent thread guide having its eye above the top of said bar and substantially in line with the axis thereof, whereby the vertical transverse holes in the needle bar are dispensed with, the sharp angles and consequent short bights in the thread in the old arrangement are avoided, the course of the thread straightened, and the resistance to the passage of the thread between the tension and the needle materially reduced.

Referring to the drawings, it will be seen that the thread is not led into and through any holes in the upper end of the needle bar. Instead, the needle bar is provided, in addition to the usual thread guides *f*, *f'*, projecting at right angles from the needle bar near the top and bottom thereof, with a third independent detachable thread guide *g*, represented upon an enlarged scale at Figs. 10 and 11, so connected to the needle bar that the eye in said guide *g* will be located a short distance above the top, and substantially in line with the axis, of said bar. The eyes in the thread guides *f*, *f'*, are also made materially larger than heretofore to furnish more room for the passage of the thread. The thread *h*, as it comes from the tension device *i* and the take-up *j*, is led through the eye of the guide *g*, and thence downward and outward through the eye of the upper guide *f*, thence through the eyes of the part *k*, to be more fully referred to hereinafter, thence through the eye of the lower guide *f'*, thence to the usual retention spring, not shown in the drawings, at the lower end of the needle bar, and thence to the eye of the needle.

It will be seen that with the combination of parts, and with the arrangement of the thread above described, the thread, as it passes from the take-up to the needle, turns no sharp corners and has no short bights in it, but instead passes in easy angles through large holes, with the result that there is no undue strain upon the thread between the tension and the needle, and that what strain there is is much more even and uniform than heretofore.

The second feature of invention has for its object to automatically gather the requisite amount of surplus thread between the tension and the needle step by step during the rotation of the needle bar in forming the successive stitches around the eye of the buttonhole, and to that end said feature of invention consists in the combination, with the needle bar and its thread guides and the mechanism for rotating the same, of a part or device co-operating with said needle bar thread guides to gather surplus thread, whereby the desired amount of surplus thread will be automatically gathered step by step at each movement of the needle bar in its rotation around the eye of the buttonhole, and without materially affecting the tension on the thread.

Referring to the drawings, *k* represents the part or device referred to, shown upon an enlarged scale at Figs. 9 and 10, which may be formed from a piece of wire bent into substantially the shape shown in the drawings, and adapted to be secured to the bracket arm B in the position shown in Figs. 1 to 6, said device being provided with guide eyes *k'*, *k²*, one above the other, for the thread. It will be seen that the guide eyes of the device *k* are offset in both directions with relation to the needle bar, and are also farther removed from the axis of the needle bar than the eye of the guide *f*, and so that the thread as it passes from the eye of said guide *f* extends diagonally, that is, outward and downward, to the upper eye *k'* of the part *k*, thence downward parallel with the head of the machine to the lower eye *k²* of the part *k*, and thence diagonally downward and inward to the eye of the lower thread guide *f'* on the needle bar.

It being understood that in the operation of the machine in stitching a buttonhole an intermittent rotary movement is given to the needle bar, by means of the pinion *d*, the sector *e* and its operating mechanism, to swing said needle bar around the eye of the buttonhole, such rotation being effected by a step by step movement corresponding with the formation of the successive stitches, and it being further understood that before such rotation commences the needle bar with its thread guides is in substantially the position shown in Figs. 1 to 4 inclusive,—(in the actual machine said thread guides will stand at this time at practically right angles to the bracket arm, while in the drawings they have been changed somewhat from this position in order to more clearly illustrate the parts)—it will be seen that at each step in the rotation of the needle bar the eyes of the thread guides *f*, *f'*, will be swung in the arc of a circle, and in so swinging will be carried step by step farther away from the eyes of the part *k*, which is fixed in position, until the eyes of said guides *f*, *f'*, are finally brought to the position shown in Figs. 5 and 6. This step by step movement of the thread guides *f*, *f'*, with relation to the eyes in the part *k*, and which results in increasing the distance between said eyes, will necessarily cause a little extra thread to be pulled through the tension at each step in the movement of the thread guides *f*, *f'*, with the result that when the thread guides *f*, *f'*, have reached the position shown in Figs. 5 and 6, a total amount of extra or surplus thread will have been pulled through the tension equal in length to twice the difference between the distance of the eyes of the thread guides *f*, *f'*, from the eyes *k'*, *k²*, when the parts are in the position shown in Figs. 5 and 6, and the distance between said eyes when the parts are in the position shown in Figs. 3 and 4. The surplus thread so gathered will, when the needle bar

with the thread guides *f*, *f'*, are returned to their former position for the commencement of the next buttonhole, constitute slack thread between the tension and the eye of the needle, the thread guides *f*, *f'*, being then at their shortest distance from the eyes in the part *k*. When the needle bar and needle descend for the formation of the first stitch in the next buttonhole, the short loose end of the thread projecting through the eye of the needle will be, by reason of such slack thread between the tension and the needle, prevented from pulling out of the eye of the needle, and such projecting loose end of thread will be carried by the needle down to and into the work, the amount of projecting thread being sufficient to keep it in the eye of the needle until the needle enters the work, when the end of the thread will be gripped between the needle and the work, and under the friction thus created be carried to a position where the end of the thread will come flush with the surface of the work and there held, thus forming a firm and smooth beginning for the buttonhole with no projecting surplus of thread to be broken off and wasted. The exact length of surplus thread to be gathered so as to leave the end of the thread flush with the work upon the formation of the first stitch may be determined and regulated by adjusting the position of the fixed eyes in the part *k* with relation to the eyes in the thread guides *f*, *f'*, which may be readily effected by bending the thread gatherer. It will thus be seen that three of the hand manipulations heretofore required are entirely dispensed with, viz: first, seizing the projecting end of thread at the eye of the needle; second, pulling the requisite amount of surplus thread through the tension and the eye of the needle, and, third, breaking off the projecting surplus after the formation of a few stitches. Moreover, this breaking off of the projecting surplus gathered by the old method was very liable to pull out or to more or less injure the first few stitches of the buttonhole, and to leave the end so that the following stitches would be liable to ravel out, which liability is entirely obviated by the improvement above described. The surplus thread gathered by the automatic thread gathering mechanism, and existing between the tension and the needle, is taken up by the first downward movement of the needle bar and by the take-up, which begins to move backward at the same time that the needle bar moves downward, and so that the first stitches of the buttonhole will be formed with substantially the same tension as the remaining stitches.

It will be observed that, as the amount of surplus thread is not gathered all at once, but gradually step by step at the formation of each successive stitch, the pull upon the thread in gathering such surplus is a uniform pull and such as not to materially affect the tension on the thread.

By the employment of the improvements above described all of the most objectionable hand manipulations above referred to, and those consuming the most time, are entirely dispensed with, leaving only the cutting of the upper thread at the end of each buttonhole and the feeding of the work from one buttonhole to the next to be done by hand, both of which operations may be done practically simultaneously. As the result of thus dispensing with or performing automatically the several manipulations heretofore required to be performed by hand, a great amount of time and labor is saved and the machine may be run at a much higher rate of speed than heretofore, and not only is there no necessity for stopping the machine after each buttonhole, as has been heretofore the case, but, in addition, the needle bar may be returned to its normal position for the commencement of the next buttonhole at a much quicker speed than heretofore, resulting in a corresponding increase in the speed of the stitching mechanism. Thus not only is all lost time between successive buttonholes avoided, everything being always ready for the commencement of the next buttonhole in series as soon as the previous one is completed, but, in addition, each individual buttonhole may be stitched more quickly than before, resulting in a further and increased saving of time. Furthermore, the greater rate of speed obtained results in a greater uniformity and regularity in the tension and in the formation of the stitches, which, together with the fact that the beginning and end of the buttonhole are formed with a smooth and even finish, with no raveled stitches or projecting ends of thread, results in the production of buttonholes of improved appearance and greater durability. Moreover, as there are no projecting ends to be broken off, there is no waste of thread, whereby a very large and important saving is effected.

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

1. The combination, with the needle bar, of a thread guide attached to said needle bar and arranged with its thread eye above and substantially in line with the axis of the needle bar, whereby the course of the thread as it runs from the tension device to the eye of the needle may be materially straightened, and undue strain thereon consequently avoided, substantially as set forth.

2. The combination, with the needle bar of a buttonhole stitching machine and its thread guides, and with the mechanism for rotating the same, of a part or device co-operating with said needle bar thread guides to gather surplus thread, whereby as the needle bar is rotated around the eye of the buttonhole a certain amount of surplus thread will be drawn through the tension, substantially as described.

3. The combination, with the needle bar of a buttonhole stitching machine and its thread guides, and with the mechanism for rotating

the same, of a part or device co-operating with said thread guides, said part being provided with a thread eye through which the thread passes on its way from the tension device to the needle, whereby as the needle bar is rotated around the eye of the buttonhole a certain amount of surplus thread will be gathered step by step during the formation of the successive stitches, which surplus will, when the needle bar is returned to its normal position, constitute slack thread between the tension and the needle, substantially as described.

4. The combination with the needle bar of a buttonhole stitching machine and its thread guides, and with the mechanism for rotating the same, of a part or device co-operating with said thread guides, said part being secured in a fixed position to the traveling frame-work of the machine, and provided with a thread eye for the passage of the thread, whereby as the needle bar and its thread guides are rotated around the eye of the buttonhole, the movement of the eyes in the needle bar thread guides with relation to the fixed eye of the part or device co-operating with said thread guides will serve to draw at each step in the oscillation of the needle bar a certain amount of extra or surplus thread through the tension device, substantially as described.

5. The combination, with the needle bar provided with thread guides f, f', and mechanism for rotating said needle bar and thread guides, of a part or device k provided with thread eyes k', k^2, whereby as the needle bar is rotated the eyes in the thread guides f, f', will be carried in the arc of a circle in a direction away from the eyes k', k^2, and a certain amount of surplus thread be thereby drawn through the tension device at each step in the rotation of the needle bar, and accumulated between the tension device and the needle, substantially as described.

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