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BUTTONHOLE ATTACHMENT FOR SEWING MACHINES.

(Application filed Mar. 1, 1901.)

Fig. 1.

Fig. 2.

Fig. 3.

Witnesses.

William H. Hargraves.

By his Attorney.

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Fig. 4.

Fig. 5.

Fig. 6.

Witnesses.

James K. Kendall

By his Attorney.

William M. Merchant.
To all whom it may concern:

Be it known that I, WILLIAM H. HARGRAVES, a citizen of the United States, residing at Allentown, in the county of Lehigh and State of Pennsylvania, have invented certain new and useful Improvements in Buttonhole-Working Attachments; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

My invention has for its object to provide an improved buttonhole-working attachment for sewing-machines; and to this end it consists of the novel devices and combinations of devices hereinafter described, and defined in the claims.

As hitherto constructed all efficient buttonhole attachments for sewing-machines have been of such high cost that they have not found sale to any considerable extent for family use.

It has been the primary object of my invention to simplify the construction and reduce the cost of these attachments and at the same time to maintain a high degree of efficiency. These objects are attained by my present invention, which is illustrated in the accompanying drawings, and wherein like characters indicate like parts throughout the several views.

Figure 1 is a view in side elevation showing a portion of a sewing-machine with my improved buttonhole attachment applied in working position thereto. Fig. 2 is a plan view of the attachment, with the needle-bar and presser-bar sectioned on the line $a^1a^2$ of Fig. 1. Fig. 3 is a diagram view illustrating the manner in which the buttonhole is stitched. Fig. 4 is a bottom plan view of the attachment, corresponding to Fig. 2 in the position of its parts. Fig. 5 is a horizontal section taken approximately on the line $a^1a^2$ of Fig. 1, but illustrating a different position of the parts from that shown in Figs. 1, 2, and 3. Fig. 6 is a horizontal section taken on the line $a^1a^2$ of Fig. 1, but corresponding to Fig. 5 in the position of its parts. Fig. 7 is a vertical section on the line $a^1a^2$ of Fig. 2, some parts being broken away. Fig. 8 is a vertical section taken approximately on the line $a^1a^2$ of Fig. 1, some parts being shown in full. Fig. 9 is a detail view in plan with some parts broken away, showing a clutch device which constitutes part of the feed mechanism. Fig. 10 is a vertical section approximately on the line $a^1a^2$ of Fig. 9, some parts being shown in full. The numeral 1 indicates the head, the numeral 2 the needle-bar, the numeral 3 the needle, and the numeral 4 the presser-bar, of an ordinary sewing-machine.

The various parts of the improved buttonhole attachment are mounted directly or indirectly on a horizontally-extended support or bed-plate $a$, which is provided at its forward end with a vertically-projecting standard $a'$, bifurcated at its upper end to embrace the presser-foot $b$ and provided with a thumb-screw $a^2$ for detachably securing the said standard and bed-plate in operative position on the said bar $a$, as shown in Figs. 1 and 2.

The cloth-clamp slide $b$, which, as shown, underlies the bottom of the bed-plate $a$, is mounted for both lateral and longitudinal movements thereon in a manner and by means presently to be described. At its rear end said slide $b$ is turned upward and then forward over the adjacent end of the bed-plate $a$, as indicated at $b'$, and is provided with a transversely-extended slot $b'$. At its forward end the said slide $b$ has a cloth-engaging foot $b^1$, with a needle-passage $b^2$ and teeth $b^3$. In its main body portion the slide $b$ is provided with cam-seating slots $b^4$ and $b^5$, which have parallel longitudinally-extended sides. A polygonal cam $c$ works within the slot $b^4$, and another cam $d$ works in the slot $b^5$. On account of the functions which they perform the said cams $c$ and $d$ are hereinafter designated, respectively, as the "slide-vibrating cam" and the "slide-shifting cam." Both of said cams have such dimensions that they will always closely engage the parallel sides of the respective slots $b^4$ and $b^5$, and thus prevent improper lateral vibrations of the cloth-clamp slide $b$. However, the said slots $b^4$ and $b^5$ permit the free longitudinal feed movements of the said slide $b$.

The slide-vibrating cam $c$ is secured on the
lower end of a very short vertical shaft, shown as afforded by a screw $e$ passed through the bed-plate $a$ and having secured thereto on top of said plate $a$ a combined ratchet-wheel and cam-disk $e'$. To the extreme lower end of the screw $e$ is screwed a very thin disk or washer $e''$, the edges of which overlap the slide $b$, as best shown in Figs. 1, 7, and 8, and thereby supports the intermediate and forward portions of the said slide. The ratchet $e'$ is subject to a pawl-lever $f$, which is pivoted to a lug $g^2$ on the bed-plate $a$ and is bifurcated at its free end at $f'$ to embrace a stud or projection $b$ on the needle-bar $2$. The pawl-lever $f$ is provided with a laterally-yielding pawl $f_2$, which is subject to a light coiled spring $f_3$ on the stud $f_4$, carried by the said arm $f$. This pawl $f_2$ under the vibrations of the lever $f$ will, as is evident, engage one after the other of the teeth of the ratchet $e'$, and thus impart to the same and to the vibrating cam $c$ their intermittent movements. The shifting-cam $d$ has a vertically-projecting stud $d'$, that is passed upward through a suitable seat formed in the bed-plate $a$ and has secured to its upper end for rotation therewith one member of a pair of elliptical gears $g, g'$. The stud $d'$ or, as shown, the elliptical gear $g$ is provided with a radial crank portion $g_2$. This crank portion $g_2$ is provided with a radial slot $g_3$, in which a nut $g_4$ (see Fig. 1) works adjustable. A thumb-screw $g_5$, which is passed through the slot $b'$ of the cloth-clamp slide $b$, is screwed into the nut $g_4$, and thereby held and caused to act as a crankpin to the said crank-arm $g_2$. The elliptical gear $g'$ bears against the bed-plate $a$ and is mounted to rotate on a stud $k$, that is screwed into the plate $a$. Between the head of the screw $k$ and the hub of the gear $g'$ is a spring $k'$, shown as afforded by a single coil, which presses the gear $g'$ against the bed-plate $a$ with such force that the said gear will be frictionally held against accidental movements or against all movements except those positively imparted to the same. Loosely mounted on the hub of the gear $g'$ is a pawl-carrying ring or clutch member $m$, that is slotted as $m'$ and is yieldingly drawn in the one direction by a light tension-spring $m_2$, secured thereto and to the bed-plate $a$. A friction-pawl $m_3$ is pivoted, by means of a pin $m_4$, to the ring $m$, with its inner end within the slot $m'$ and in position to fractionally engage the hub of said gear $g'$. A light tension-spring $m_3$ connects the intermediate portion of the pawl $m'$ with the bed-plate $a$ and tends to hold the inner end of the same out of engagement with the said hub $g'$, although as a matter of fact the spring $m_3$ will keep the inner end of said pawl in light engagement with said hub. A motion-transmitting lever $p$ is pivoted to the bed-plate $a$ at $p'$ and is provided at its free end with a slot $p''$. A nutted thumb-screw $p^3$ cooperates with the slot $p''$ to adjustably secure the end of a link $p^1$, the other end of which link is pivoted to the outer end of the friction-pawl $m_3$. The inner end of the lever $p$ is subject to a direct camming action from the teeth of the ratchet-wheel $e'$. In other words, each movement of the ratchet-wheel $e'$ imparts vibratory movement to the lever $p$, and this movement through the friction-clutch just above described is imparted to the elliptical gears and from these gears through the crank $g^2$ to the slide $b$. Thus a longitudinal feed movement is given to the cloth-clamp slide $b$. When the feed-lever $p$ is moved by the ratchet $e'$ against the tension of the springs $m_3$ and $m_2$, the inner end of the pawl $m_3$ is tightly forced against the hub of the gear $g'$ and motion is imparted to the said gear. Under a reverse movement of said feed-lever $p$ the 85 pawl $m_3$ is released from the said hub, and the springs $m_3$ and $m_2$ cooperate to restore the parts of the friction-clutch to their normal positions, as shown in the drawings. The manner in which the buttonhole is 90 stitched is indicated in diagram in Fig. 9, wherein the character $z$ indicates the zigzag marginal stitches and $x'$ the end or bar-forming stitches. The stitches $z$ are of course much closer together than indicated in this 95 diagram.

All of the movable parts of the attachment are, as has already been indicated, driven from the needle-bar through the pawl-lever $f$. The shifting-cam $d$ acts as the fulcrum for the cloth-clamp slide $b$, and the lateral vibratory movements necessary to form the stitches $z$ are imparted by the slide-vibrating cam $c$. It may be here noted that the cam $c$ has one-half as many sides as the ratchet-wheel $e'$ has teeth. Furthermore, said cam $c$ has an odd number of sides, and I have found that the best results are obtained by forming the same with five sides. With this arrangement it follows that for each tooth's throw of the ratchet-wheel $e'$ the cam $c$ will be rotated one-half the distance in degrees embraced by one of its sides, so that the slide $b$ will be alternately thrown from one extreme position to the other. While the slide $b$ is being fed approximately from one end of the buttonhole to the other the slide-shifting cam $d$, although it continues to rotate, does not change its fulcrum action on the said slide; but as the ends of the buttonhole are being formed the said cam $d$ changes its fulcrum action, or, in other words, laterally shifts the rear end of the slide, and consequently changes the zone of lateral movement of the clamping-foot $b'$ at the forward ends of the said slide $b$, with the result that both sides of the buttonhole are worked in succession, as indicated in Fig. 3. It is evident that when the crank $g^2$ of the gear $g'$ is rotated it will reciprocate the slide $b$ longitudinally and impart thereto its intermittent feed movement. It is also evident that the farther the crank-pin or screw $g^2$ is set from the center or axis of the gear $g'$ the greater will be the movement of the said.
plate $b$ and correspondingly longer will be the buttonhole which will be worked.

Attention is here directed to an important relation between the feed-crank and the elliptical gears $g' g'$. It is of course evident that if the crank be rotated at a constant speed the stitches would be very long at the intermediate portion of the buttonhole and very much shorter toward the end of the same.

Now it will be noted by reference to Fig. 2 that when the said crank stands at a right angle to its dead-center—or, in other words, parallel to the slot $b^2$ in the upper end $b'$ of the slide $b$—the elliptical gear $g'$ (which is the driver) acts with its shorter leverage on the end or longest dimension of the driven gear $g$. On the other hand, it will be noted by reference to Fig. 3 that when the said crank $g'$ stands on its dead-center, or at a right angle to the slot $b^2$, the driving-gear $g'$ acts with its longest leverage on the side or shortest dimension of the driven gear $g$. Hence it is evident that a compensating action is introduced by the elliptical gears, which causes the cloth-clamp slide $b$ to move with an approximately even intermittent motion throughout nearly the entire length of the buttonhole. At the ends of the buttonhole the shifting-cam $d$, acting on the slide $b$, moves the cloth in which the buttonhole is being worked, and as this movement takes place while the crank $g'$ is on its dead-centers, or very closely in the vicinity thereof, the cross-stitches are assembled in a transverse line to bar the buttonhole, as indicated at $e'$ in Fig. 3. By adjusting the screw $p$, the throw given to the clutch-pawl $m$, and hence to the other parts driven thereby, under one stop of movement of the ratchet-wheel $e'$ may be varied.

Hence the proper stitch may be maintained regardless of the length of the buttonhole which is being worked.

It will be noted that the ratchet-wheel $e'$ serves the double function of a ratchet for cooperation with the driving-pawl lever and as a cam for action on the feed-lever $p$.

The arrangement of the elliptical gears and cooperating crank for a compensating feeding action on the cloth-clamp slide I consider, broadly, new and desire to claim the same as a pioneer invention.

What I claim, and desire to secure by Letters Patent of the United States, is as follows:

1. In a buttonhole-worker, the combination with a support, of a cloth-clamp slide mounted on said support and provided with a transverse slot, means for vibrating said slide laterally, a crank mounted on said support and working in the transverse slot of said slide, a pair of elliptical gears imparting motion to said crank, and means actuated by the needle-bar of the sewing-machine and imparting motion to said elliptical gears.

2. In a buttonhole-worker, the combination with a support, of a cloth-clamp slide mounted on said support and provided with a transverse slot, means for vibrating said slide laterally, a crank mounted on said support and working in the transverse slot of said slide, a pair of elliptical gears imparting motion to said crank, and means actuated by the needle-bar of the sewing-machine and imparting motion to said elliptical gears.

3. In a buttonhole-worker, the combination with a support, and a cloth-clamp slide mounted thereon, of means for vibrating said slide laterally, and means for imparting longitudinal feed movements to said slide, involving a pair of elliptical gears, a crank driven by said gears, with a compensating action, and a variable-throw friction-clutch for driving said gears, substantially as described.

4. In a buttonhole-worker, the combination with a suitable support and a cloth-clamp slide mounted thereon, of a ratchet-wheel mounted on said support, a vibrating pawl-lever acting on the teeth of said ratchet-wheel, and means for imparting feed movements to said cloth-clamp slide, involving a movable part mounted on said support and subject to a direct camming action from the teeth of said ratchet-wheel, substantially as described.

5. A buttonhole-worker, comprising a support and a cloth-clamp slide mounted thereon, a ratchet-wheel mounted on said support, a vibrating pawl-lever operating on the teeth of said ratchet-wheel, a slide-vibrating cam rotatable with said ratchet-wheel, a pair of elliptical gears mounted on said support, a crank driven by said gears and operating on said slide to impart longitudinal feed movements thereto, a clutch device operating on one of said gears, and a clutch-actuating lever pivoted on said support and subject to a direct camming action from the teeth of said ratchet-wheel, substantially as described.

6. In a buttonhole-worker, the combination with a suitable support and a cloth-clamp slide mounted thereon and having a transverse slot, a crank-arm having a radially-adjustable crank-pin, working in the transverse slot of said slide, a pair of elliptical gears cooperating with said crank to feed said slide with a compensating action, means for driving said gears, and means for vibrating said slide laterally, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM H. HARGRAVES.

Witnesses:

H. L. CUNNINGHAM, J. SIDNEY HEILIG.