April 11, 1944. D. B. THORNTON 2,346,241

WORK CLAMPING MECHANISM

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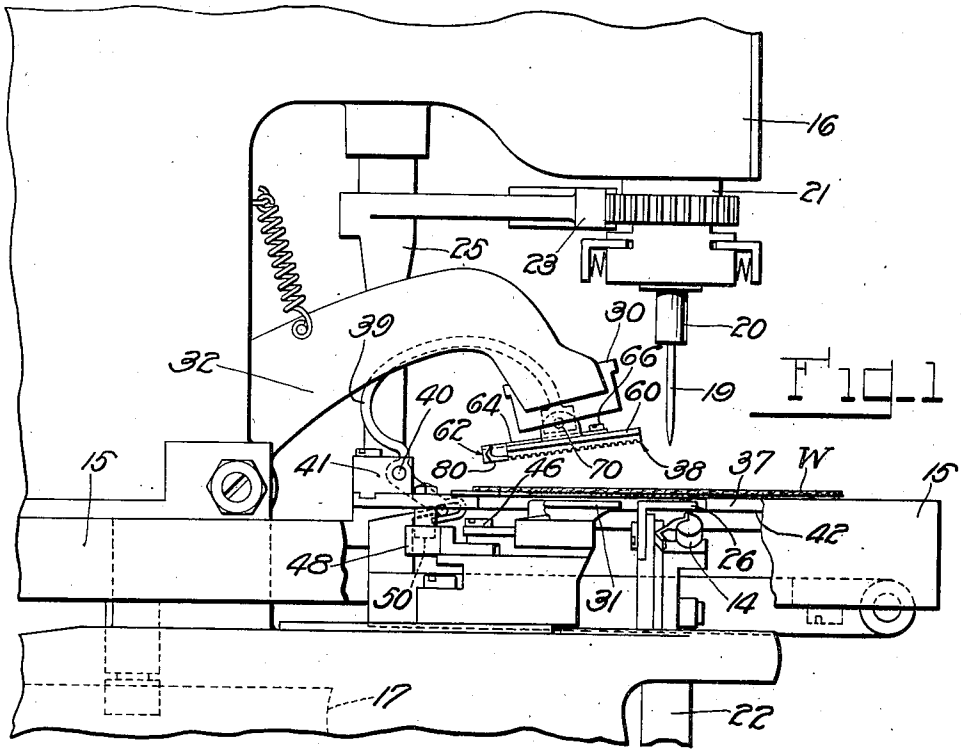

Fig. 1

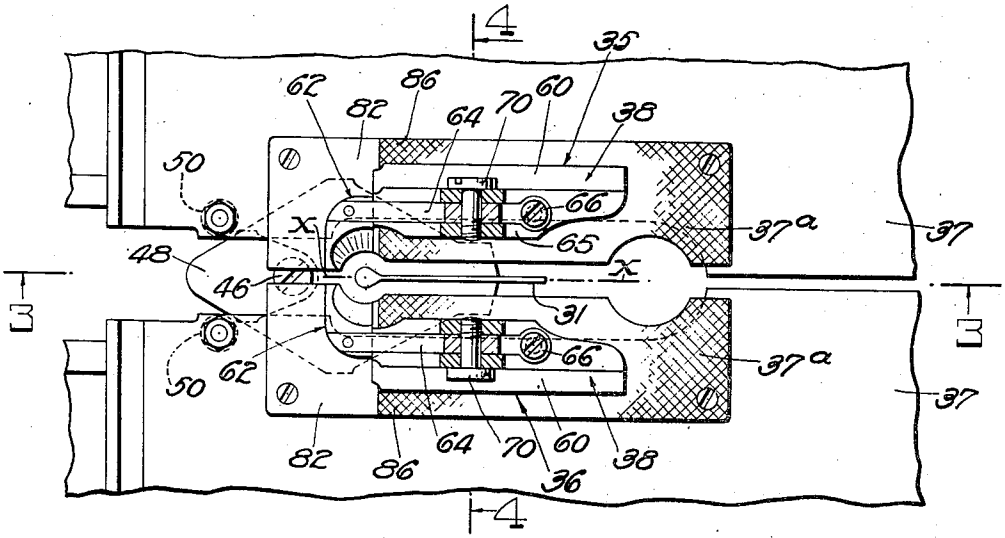

Fig. 2

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Fig. 3

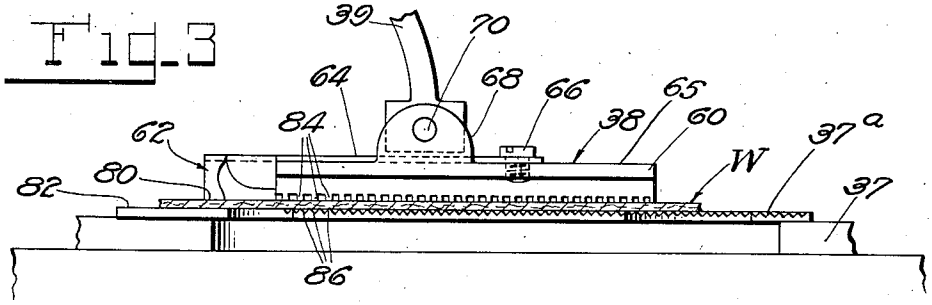


Fig. 4

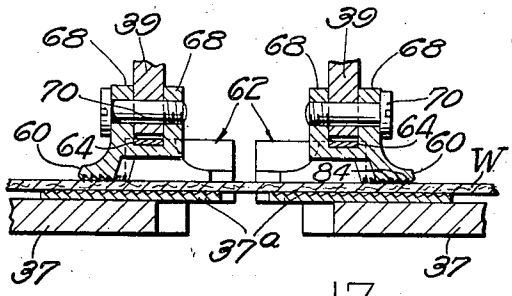
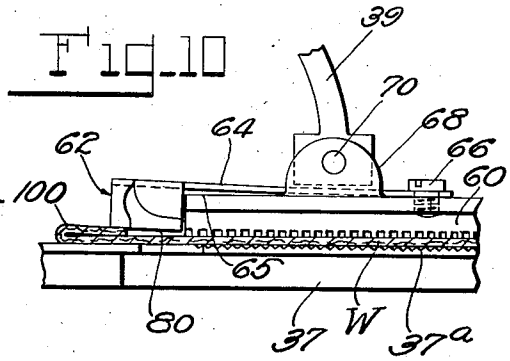


Fig. 10



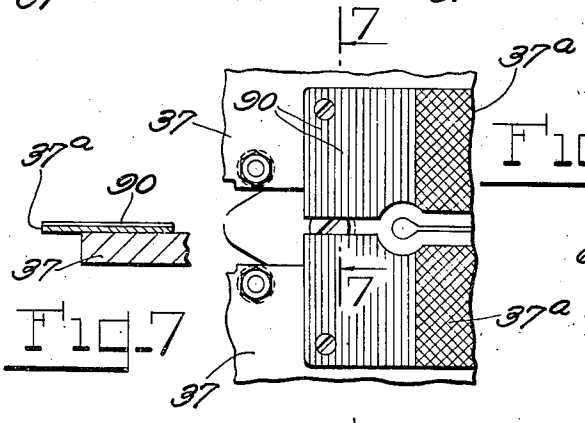


Fig. 7

Fig. 6

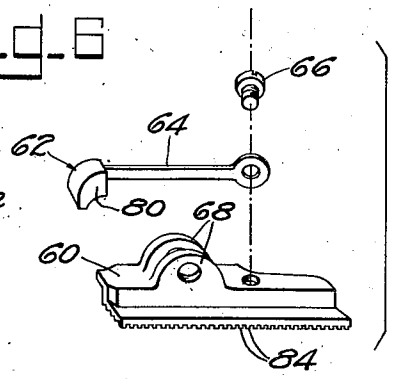


Fig. 5

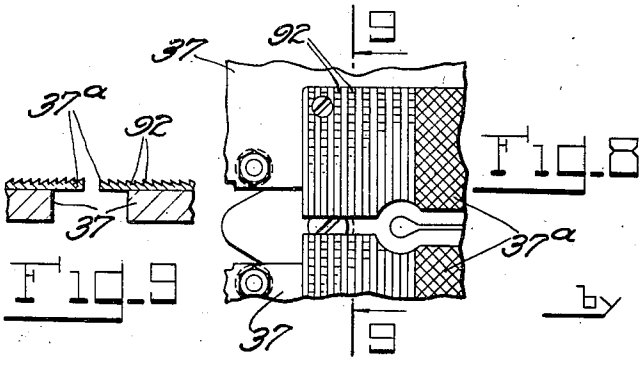


Fig. 8

Fig. 9

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2,346,241

WORK CLAMPING MECHANISM

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Application October 26, 1940, Serial No. 362,985

14 Claims. (Cl. 112—74)

This invention relates to sewing machines of the type designed to sew a suitably positioned line of stitches around an area or opening in the work such as a buttonhole, and more particularly to the work-clamping mechanism employed in such machines.

In buttonhole and similar sewing machines, the work-clamping mechanism usually comprises two clamps on the bed frame of the machine which are movable to and from each other. Each of these clamps consists of a work-supporting plate and a cooperating clamping foot between which and the plate the work is clamped. After clamping the work and, in most cases, cutting the buttonhole or other slit therein, it is customary to spread the clamps by moving the plates with their respective clamping feet slightly away from each other in order to spread said slit, including the round or oval eye end of a buttonhole if such an eye end is contemplated and stretch the material thereabouts for the subsequent sewing operation around the edges of the slit. It is a well known fact, however, that each stitched end of a slit, and particularly the round or oval eye end of a buttonhole, is distorted and puckered when the material is released from the clamps after the sewing operation. Moreover, such a distorted buttonhole eye is prevented from recovering its original, intended shape by the staying action of the stitches placed therearound, with the result that the eye end remains permanently distorted. Even when a buttonhole with an eye end is first sewed and then cut, as in some instances, the customary stretching of the uncut material by spreading the work clamps for the sewing of the buttonhole as before, results in a permanently distorted eye with puckered edges because the staying action of the stitches thereat permits only a partial recovery of the material on release from the clamps.

It is the primary aim and object of the present invention to provide in machines of the type under consideration a work-clamping mechanism which tensions a part of the material, wherein a buttonhole or other slit is cut or will be cut, as the case may be, in such a manner that the material at the straight sides of the buttonhole is evenly tensioned as heretofore, while the material at a buttonhole end, such as an eye end, is spread to such an extent only that said end will not be noticeably distorted or its sewed edge puckered on release of the material from the work-clamping mechanism after the sewing operation.

Before explaining in detail the present invention, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation, and it is not intended to limit the invention claimed herein beyond the requirements of the prior art.

In the drawings:

Fig. 1 is a fragmentary side elevation, partly in section, of a sewing machine including a work-clamping mechanism which embodies the present invention.

Fig. 2 is a fragmentary plan view of the machine, partly in section, and with the stitch frame thereof omitted for better illustration of the work-clamping mechanism underneath.

Figs. 3 and 4 are enlarged sections, taken on the lines 3—3 and 4—4, respectively, of Fig. 2.

Fig. 5 shows perspectively the disassembled parts of a clamping foot of the work-clamping mechanism.

Fig. 6 is a fragmentary plan view of a modified portion of the work-clamping mechanism.

Fig. 7 is a section taken on the line 7—7 of Fig. 6.

Fig. 8 is a fragmentary plan view of another modified portion of the work-clamping mechanism.

Fig. 9 is a section taken on the line 9—9, Fig. 8.

Fig. 10 illustrates the action of the present work-clamping mechanism on a garment having a hem.

Referring to the drawings and particularly to Fig. 1 thereof, the present invention is shown as applied to a buttonhole sewing machine of a well-known type, comprising a stationary bed frame or work support 15 which carries the work-clamping mechanism hereinafter described, a movable stitch frame or head 16 with the stitching mechanism, and mechanism on the stitch frame for cutting a buttonhole or the like. The stitch frame 16 is movable longitudinally over the bed frame 15 to bring the stitching and cutting mechanisms alternately into operative relationship with the work, and is also movable both longitudinally and laterally to position the stitches in accordance with the work to be performed, by means of feeding mechanism operated by a main cam 17 which is carried by the stitch frame 16 and rotated by any suitable power driven shaft (not shown). This feeding mechanism is well known

in the art, being shown, for example, in the patents to Reece No. 240,546, April 26, 1881, and No. 655,637, August 7, 1900, and many others, and requires no detailed description herein.

The stitching mechanism comprises a needle 19 carried by a needle bar 20, and looper mechanism 14 which may be substantially as shown in the patent to Grip No. 1,905,854, April 25, 1933, said needle bar and said looper mechanism being carried by upper and lower turrets 21 and 22, respectively, which are rotated in unison at the proper time by gear segments (one being shown at 23 in Fig. 1) that are carried by a rock shaft 25, operated by the main cam 17 in a manner further described in the Reece patents above referred to. The lower turret 22 also carries a throat plate 26 through which the needle 19 passes in order to cooperate with the looper mechanism 14. The needle bar 20 is reciprocated vertically and vibrated laterally in its turret 21 in a manner substantially as shown and described in the patent to Reece No. 1,991,627, February 19, 1935. The looper mechanism 14 is operated in a manner substantially as shown and described in the patent to Grip above referred to and in the patent to Dunnell No. 1,935,083, November 14, 1933.

The cutting mechanism comprises upper and lower cooperating cutting elements 30 and 31, respectively, the former being carried by a lever or arm 32 which is operated at the proper time from the main cam 17 in a manner described more fully in the patent to Kiewicz No. 1,841,133, January 12, 1932.

It will be understood that in machines of this character suitable mechanism is provided whereby the machine, when started, will perform its operative cycle and then stop automatically, said cycle including, first, the clamping of the work by the work-clamping mechanism, then a movement of the stitch frame from the cutting position shown in Fig. 1, in which the cutting elements 30, 31 are adjacent the stitching region or area of the work, into the stitching position in which the stitch-forming instrumentalities are adjacent said area, next, a stitching operation of the character determined by the design of the feed mechanism, then a return of the stitch frame into the cutting position, and finally the release of the work from the work-clamping mechanism, said cycle also including a cutting operation which may be performed either before or after the stitching operation according to the design or adjustment of the machine.

Except as hereinafter pointed out, or as they enter into combination with the parts hereinafter described, the mechanisms above referred to specifically form no part of the present invention and may be as shown and described in the patents referred to, or otherwise, as will be well understood by those skilled in the art.

The work clamping mechanism consists of two relatively movable work clamps 35 and 36, each comprising a work-receiving clamp plate 37 with a matrix 37a and a cooperating clamping foot 38 which is carried by a slightly resilient arm 39, pivotally mounted at 40 on a block 41 (Fig. 1) which is mounted on said clamp plate 37 in the manner shown in Fig. 1. The clamp plates 37 are slidably supported on the upper machined surface 42 of the bed frame 15.

The clamp plates 37 are guided for linear movement at right angles to the longitudinal axis x—x (Fig. 2) of the line of stitching which is determined by the design of the feed mechanism. Hence, the clamp plates 37 are separated equal amounts throughout their length. This is accomplished by mechanism fully shown and described in the patent to Nichols, 2,201,449. The clamp plates 37 are normally urged toward each other by spring means (not shown) underneath the bed frame and stopped in their approach in the relative position shown in Fig. 2 by an adjustable stop fully shown and described in said Nichols patent and, hence, not disclosed herein. Suitably mounted at 46 on the stitch frame 16 is a spreader block or cam 48 (Figs. 1 and 2) which is adapted to engage followers 50 on the underside of the clamp plates 37 and force the latter away from each other into a maximum separated position against the normal tendency of said clamp plates to move toward each other. This is accomplished after the work W has been clamped and while the stitch frame 16, and with it the spreader block 48, is moved by the feeding mechanism from the cutting position shown in Figs. 1 and 2 into the stitching position, i. e., to the left as viewed in Figs. 1 and 2. The result is a tensioning or spreading of the clamped work. For reasons mentioned in said Nichols Patent 2,201,449, the spreader cam 48 is so constructed and arranged on the stitch frame 16 that it will have completely cleared the followers 50 of the clamp plates 37 when the stitch frame arrives in the stitching position. To prevent, however, that the spread clamp plates 37 yield toward each other after the spreader cam 48 has cleared the followers 50, mechanism fully shown and described in the patent to Collins, No. 2,292,432, August 11, 1942, automatically holds the clamp plates in their maximum separated position until the end of the operating cycle. For the purposes of the present invention it suffices to understand that, once the clamping feet 38 have been lowered into clamping engagement with the work W and the clamp plates 37 have been forced into their maximum separated position by the spreader cam 48, said clamp plates are automatically held in their maximum separated position until the clamping feet 38 are again raised from the work W after a completed sewing operation.

After the machine has been started for an operating cycle and before the stitch frame 16 is moved from the cutting position to the stitching position, i. e., before the work clamps are spread into their maximum separated position by the spreader block 48, the clamping feet 38 are automatically lowered by conventional means (not shown) and pressed against the work W on the clamp plates 37 until the end of the operating cycle.

The clamping feet 38 are identical and each consists of two work-engaging or clamping parts 60 and 62 (Figs. 2, 3 and 10) of which the parts 60 are directly mounted on the clamp arms 39 while the parts 62 are mounted on the parts 60 yieldable away from the work. More particularly, each clamping part 62 is located adjacent one end of its respective clamping part 60 and suitably secured to one end of a leaf spring 64 which lies normally flat against the top surface 65 of said part 60 and is in turn secured with its other end to said top surface by a screw 66 or the like. Each clamping part 60 has on its top surface 65 two spaced lugs 68 for the reception of a screw 70 by means of which said part is pivotally mounted on its respective clamp arm 39. The leaf spring 64 on each clamping part 60 extends between, and abuts the adjacent side walls of, the spaced mounting lugs 68 thereof, whereby the clamping part 62 carried by said leaf spring is rendered immovable relative to

its respective clamping part **60** in all directions except toward and away from the work.

When the clamping feet **38** are lowered into engagement with the work W on the clamp plates **37**, the laterally alined yielding parts **62** of said clamping feet will engage the work with less force than the parts **60** thereof, as will be readily understood. When the work clamps are then spread into their maximum separated position as before mentioned, the work between the parts **60** of the clamping feet **38** is equally spread throughout, while the work extending between the yielding parts **62** of the clamping feet **38** will be spread to a lesser extent, depending upon the strength of the leaf springs **64**. While the stretch customarily imparted by spread work clamps to a material is satisfactory across the straight sides of a buttonhole, for instance, this same stretch across a round or oval eye end of the buttonhole is detrimental for earlier explained reasons. To remedy this situation, the laterally alined yielding parts **62** of the clamping feet **38** are located on opposite sides of the region where the stitching mechanism sews around the eye end of the buttonhole, while the parts **60** of said clamping feet are located on opposite sides of the region where the stitching mechanism sews along the straight sides of the buttonhole. It is then obvious that the material will be less stretched or spread across the eye end of the buttonhole than across the straight sides thereof. To enhance the difference in the spread of the material across the straight sides of a buttonhole therein and across a round or oval eye end thereof, the work-engaging surfaces **80** of the yielding clamping parts **62** as well as the opposite surface portions **82** of the matrices **37***a* on the clamp plates **37** are preferably plane (Figs. 1 to 3), while the work-engaging surfaces of the clamping parts **60** as well as the opposite surface portions of said matrices **37***a* are provided with work-gripping deformations **84** and **86**, respectively. The deformations **84** are preferably teeth arranged in orderly rows on the work-engaging surfaces of the clamping parts **60**, while the deformations **86** on the matrices **37***a* are preferably formed by knurling.

If further regulation of the spread of the material across the eye end of a bottonhole therein is advisable, the surface portions of the matrices **37***a* opposite the yielding parts **62** of the clamping feet **38** may be laterally ridged to provide a multiplicity of ribs **90** (Figs. 6 and 7), or they may be provided with teeth **92** arranged in the fashion shown in Figs. 8 and 9, for instance.

If it is desired to prevent even the slight puckering usually occurring at the buttonhole end opposite the eye end thereof in consequence of an excessive stretch in the material thereat during the sewing operation, an additional work-clamping part may be located at the other end of each clamping part **60** and yieldably mounted on the latter in the same manner in which the yieldable parts **62** are mounted on said clamping parts **60**. These additional work-clamping parts would naturally be located on opposite sides of the region where the stitching mechanism sews around the buttonhole end which is opposite the eye end thereof. As such an arrangement appears self-evident, it is not deemed necessary to show the same in the drawings. The reduced spread of the material adjacent the ends of a buttonhole also avoids a severe strain on the material at the ends of the buttonhole slit and, hence, avoids any tendency to tear the material at these points. Also, where the overall length of the clamping feet **38** is greater than the length of a buttonhole, an additional yielding work-clamping part on the other end of each clamping part **60** may make up the excess length of each clamping foot **38** from adjacent the buttonhole end opposite the eye end thereof. Such an arrangement is of advantage in buttonhole sewing machines having provisions to vary the length of the buttonhole, in which case said additional yielding clamping parts preferably extend from adjacent the end of a buttonhole of minimum length as will be readily understood.

The yielding end parts **62** of the clamping feet **38** are of further advantage where a buttonhole extends near or into the hem **100** of a garment, such as a vest. In that case the end parts **62** yield in the manner shown in Fig. 10, while the parts **60** of the clamping feet uniformly press against the flat material.

I claim:

1. In a sewing machine, the combination of a work-supporting surface; and two clamps closable against the supported work and relatively movable laterally away from each other parallel to said surface to stretch the clamped work therebetween, certain laterally aligned lengths of the work-engaging surfaces of the clamps being yieldable away from the clamped work relative to the remaining lengths of said clamp surfaces so that the work portion between said yieldable surface lengths is less stretched than the remainder of the work between the clamps.

2. In a sewing machine, the combination of a work-supporting surface; and two sidewise arranged clamps closable against the supported work and relatively movable laterally to and from each other parallel to said surface, certain laterally aligned lengths of the work-engaging surfaces of the clamps being plane and yieldable away from the clamped work relative to the remaining work-engaging clamp surfaces which are provided with work-gripping deformations.

3. A work clamp comprising two sidewise arranged clamping units relatively movable laterally away from each other to spread the clamp, each unit consisting of a work-supporting device and a clamping device closable thereagainst to clamp the work, two cooperating lengths of the clamping surfaces of each clamping unit being plane and the remaining clamping surfaces thereof being provided with work-gripping deformations, and said plane surface lengths of the clamping units being laterally aligned and one of said plane cooperating surface lengths of each clamping unit being yieldable away from the clamped work.

4. A work clamp comprising two sidewise arranged clamping units movable laterally away from each other to spread the clamp, each unit consisting of a work support and a clamping member closable thereagainst to clamp the work, certain laterally aligned lengths of the work-engaging surfaces of said clamping members being plane and yieldable away from the clamped work relative to the remaining lengths thereof which are provided with work-gripping deformations, and the portions of the work-engaging surface of said work support cooperating with said plane and remaining lengths, respectively, of the surfaces of the clamping members being laterally ridged and provided with work-gripping deformations, respectively.

5. A work clamp comprising two sidewise arranged clamping units movable laterally away

from each other to spread the clamp, each unit consisting of a work support and a clamping member closable thereagainst to clamp the work, certain laterally aligned lengths of the work-engaging surfaces of said clamping members being plane and yieldable away from the clamped work relative to the remaining lengths thereof which are provided with work-gripping deformations, and the portions of the work-engaging surfaces of said work supports opposite said plane and remaining lengths, respectively, of the surfaces of the clamping members being provided with different work-gripping deformations, respectively.

6. A buttonhole clamp comprising two clamping units on opposite sides of a buttonhole in the work having an eye end, each unit consisting of a work support and a work clamping member closable thereagainst to clamp the work and said units being movable away from each other to spread the clamped work, each clamping member comprising two parts of which one part extends along a straight side of the buttonhole and the other part is adjacent the eye end thereof and carried by said one part yieldable away from the clamped work.

7. In a buttonhole sewing machine, work clamping mechanism including two clamp sections adapted respectively to clamp the work at opposite sides of the buttonhole slit and means for relatively moving said sections away from one another to apply a spreading tension to the work, said sections comprising means for causing substantially constant spreading tension throughout the length of the slit and means for causing a different spreading tension adjacent an end of the slit.

8. In a buttonhole sewing machine, work clamping mechanism including two clamp sections adapted respectively to clamp the work at opposite sides of the buttonhole slit and means for relatively moving said sections away from one another to apply a spreading tension to the work, said sections comprising means for causing substantially constant spreading tension throughout the length of the slit and means for causing a less spreading tension adjacent an end of the slit.

9. In a buttonhole sewing machine, work clamping mechanism including two clamp sections adapted respectively to clamp the work at opposite sides of the buttonhole slit and means for relatively moving said sections away from one another to apply a spreading tension to the work, said clamp sections consisting each of more than two work-engaging parts so cooperating as to grip the work with a clamping pressure which is different in different regions longitudinally of the buttonhole slit.

10. In a buttonhole sewing machine, work clamping mechanism including two clamp sections adapted respectively to clamp the work at opposite sides of the buttonhole slit, each of said sections comprising cooperating clamping elements, and means for relatively moving said sections away from one another by a substantially even or constant amount throughout their length, said clamping elements comprising means for permitting slippage of the clamped work with respect to said clamp sections in certain regions longitudinally thereof when said sections are moved, and means for gripping the work more firmly in other regions.

11. In a buttonhole sewing machine, work clamping mechanism including two clamp sections adapted respectively to clamp the work at opposite sides of the buttonhole slit, each of said sections comprising cooperating clamping elements, and means for relatively moving said sections away from one another by a substantially even or constant amount throughout their length, said clamping elements comprising means for permitting slippage of the work with respect to said clamp sections in the region adjacent an end of the slit when said sections are moved, and means for gripping the work more firmly along the edges of the slit.

12. In a buttonhole sewing machine, work clamping mechanism including two clamp sections adapted respectively to clamp the work at opposite sides of the buttonhole slit, each of said sections comprising cooperating clamping elements, and means for relatively moving said sections away from one another by a substantially even or constant amount throughout their length, one of the elements of each of said sections comprising two parts of which one part is yieldingly mounted on the other part.

13. In a buttonhole sewing machine, work clamping mechanism including two clamp sections adapted respectively to clamp the work at opposite sides of the buttonhole slit, each of said sections comprising cooperating clamping elements, and means for relatively moving said sections away from one another by a substantially even or constant amount throughout their length, one of the elements of each of said sections having a portion for engaging the work along the edge of the slit and a portion for engaging the work in a region adjacent the end of the slit, said last named portion being yieldingly mounted on said first named portion.

14. In a buttonhole sewing machine, work clamping mechanism including two clamp sections adapted respectively to clamp the work at opposite sides of the buttonhole slit, each of said sections comprising a plate and a cooperating clamping foot, and means for relatively moving said sections away from one another by a substantially even or constant amount throughout their length, the clamping foot of each of said sections having a portion for engaging the work along the edge of the slit and a portion for engaging the work in a region adjacent an end of the slit and a flat leaf spring connecting said last named portion with said first named portion.

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