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Tölle

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[54] **WORK CLAMP MECHANISM FOR SEWING MACHINES**

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[52] **U.S. Cl.** **112/76**

[51] **Int. Cl.**..... **D05b 3/04**

[58] **Field of Search** 112/76, 70, 65, 77

[56] **References Cited**

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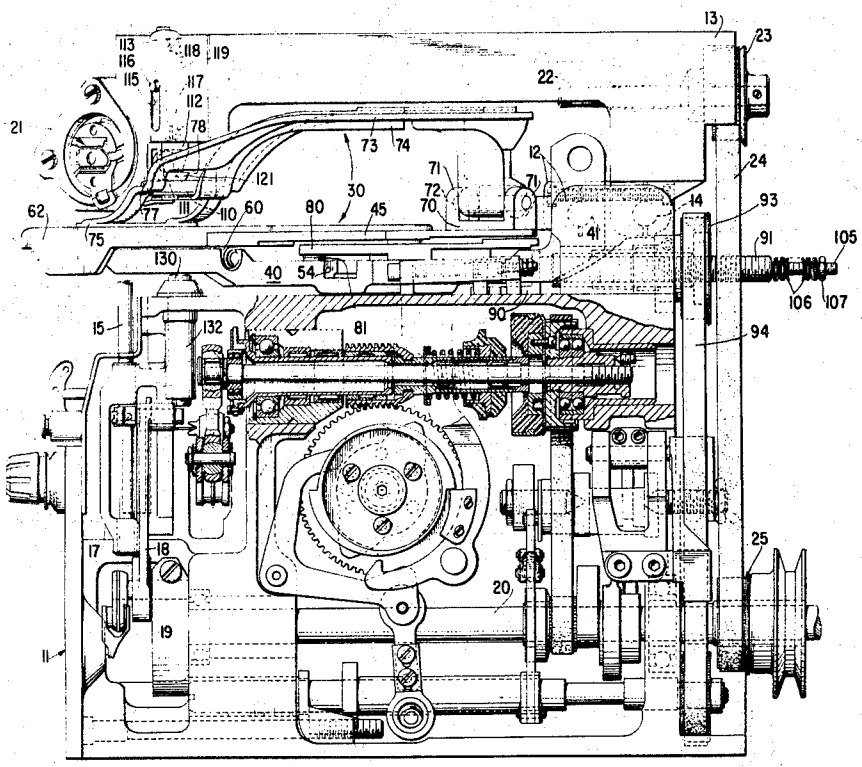
Primary Examiner—H. Hampton Hunter

Attorney—Marshall J. Breen et al.

[57] **ABSTRACT**

A work holding clamp for a cyclic sewing machine in which the stitch forming instrumentalities are organized with the loop taker arranged above the work and the needle therebeneath. The loop taker supporting bracket arm can be raised and lowered and a spacing member is provided between the loop taker supporting bracket arm and the upper jaw of the work clamp to provide uniform spacing between the work and the loop taker during sewing despite work thickness variation. The work clamp is also pivoted to the machine frame and articulated with respect to the work feeding mechanism so that the entire work clamp may be swung up to provide access to the needle.

8 Claims, 6 Drawing Figures



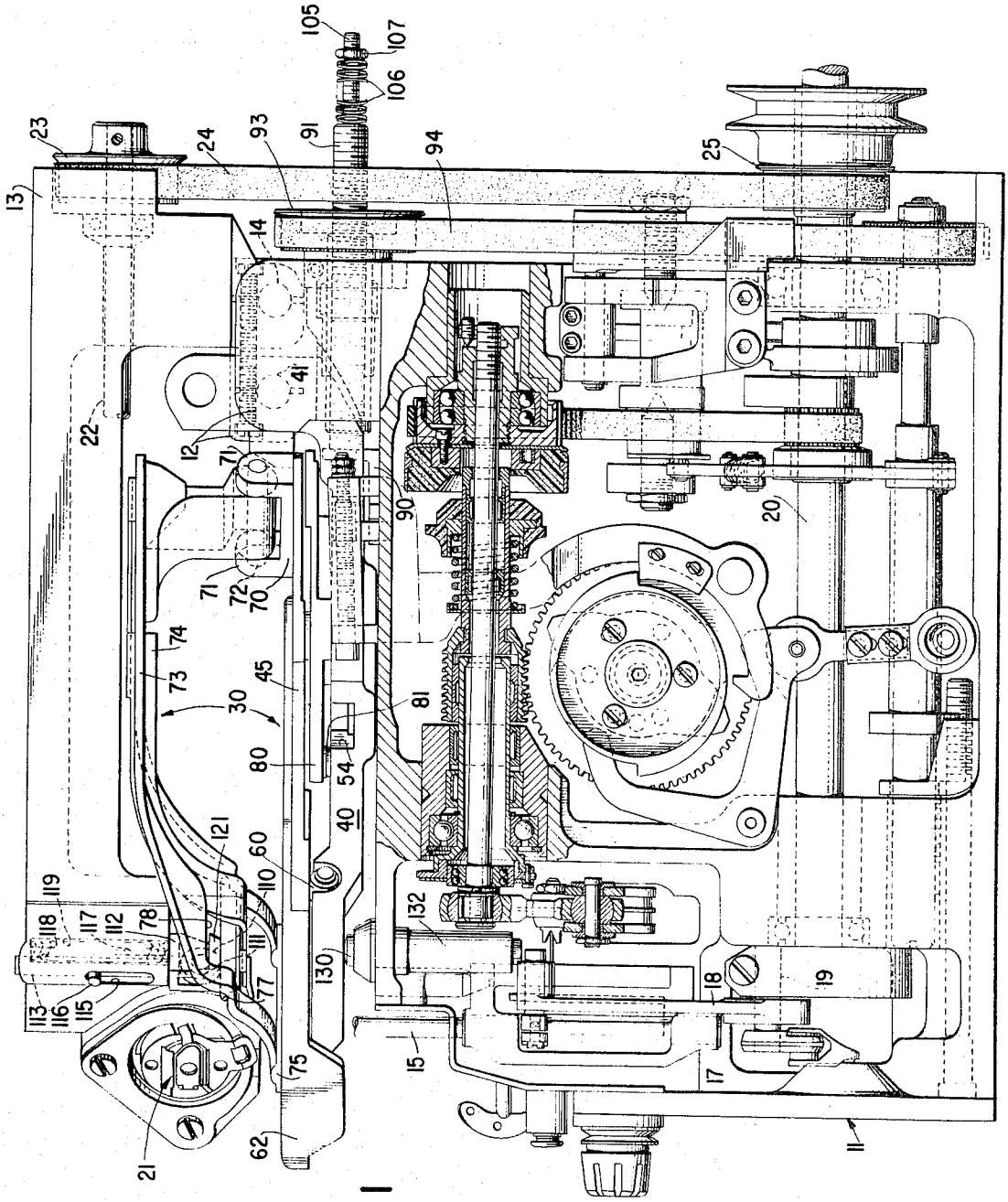

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Fig. 1

Fig. 3

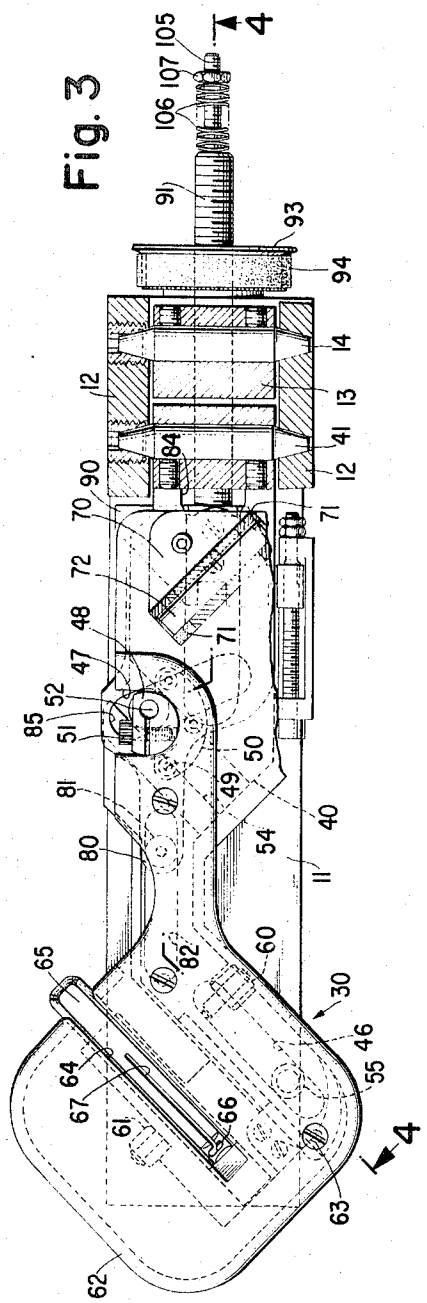
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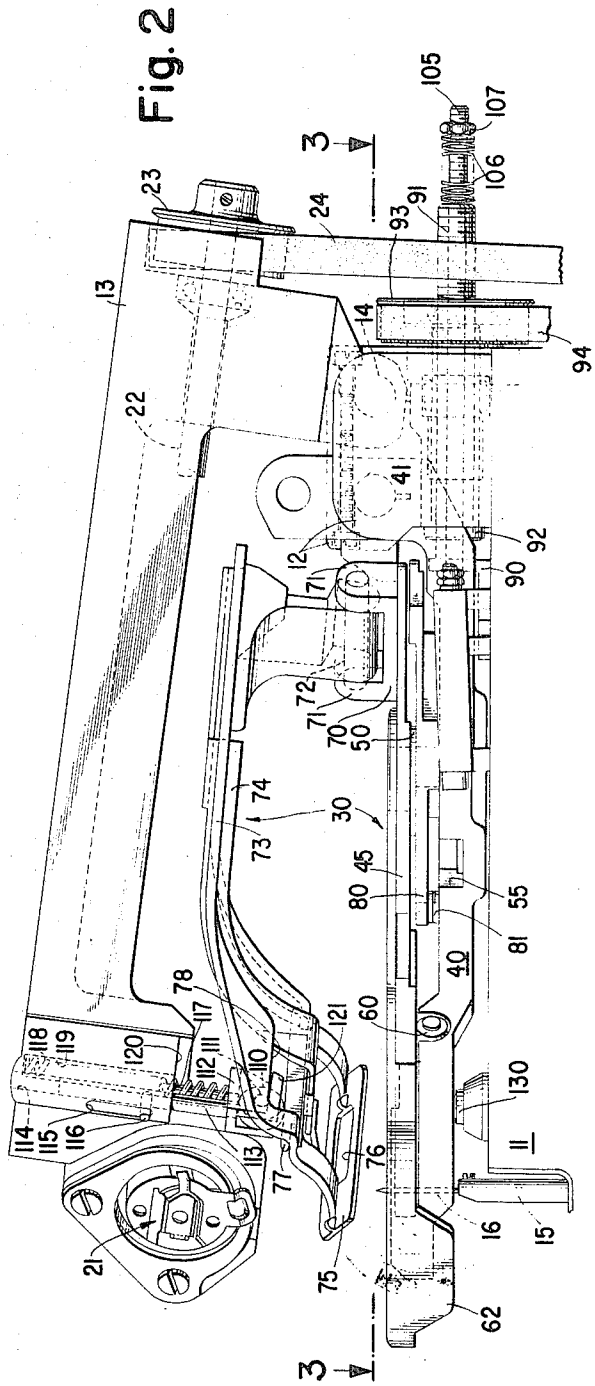
Fig. 2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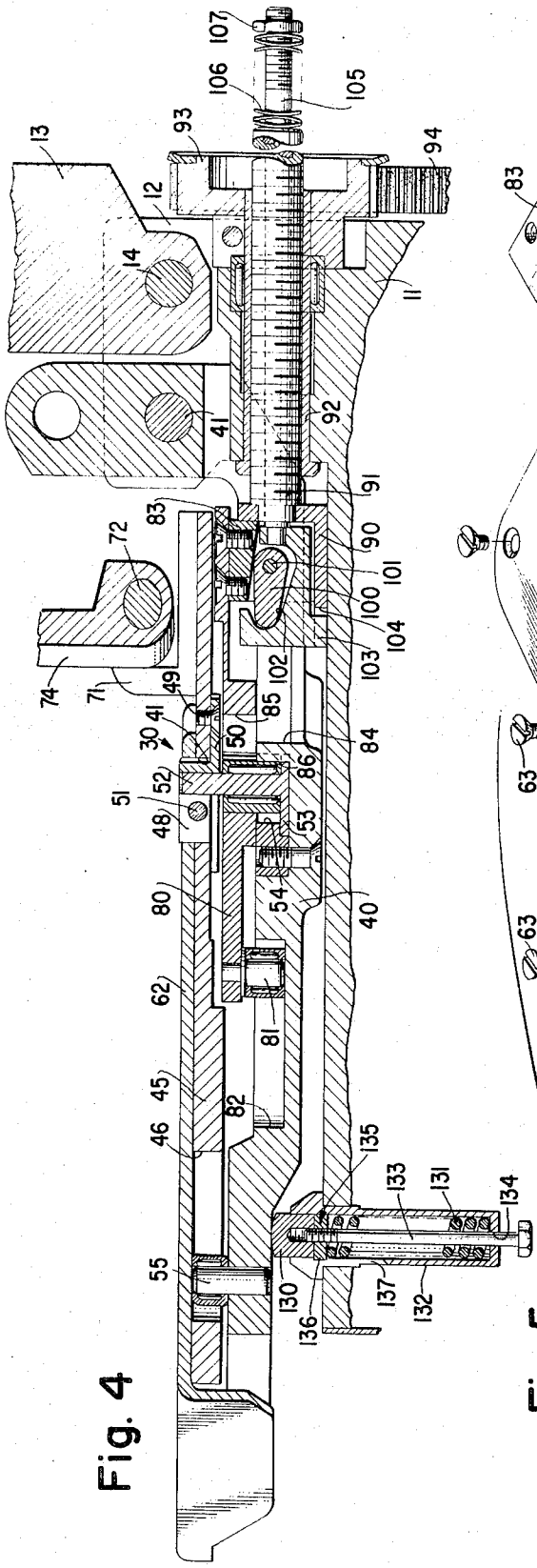

Fig. 4

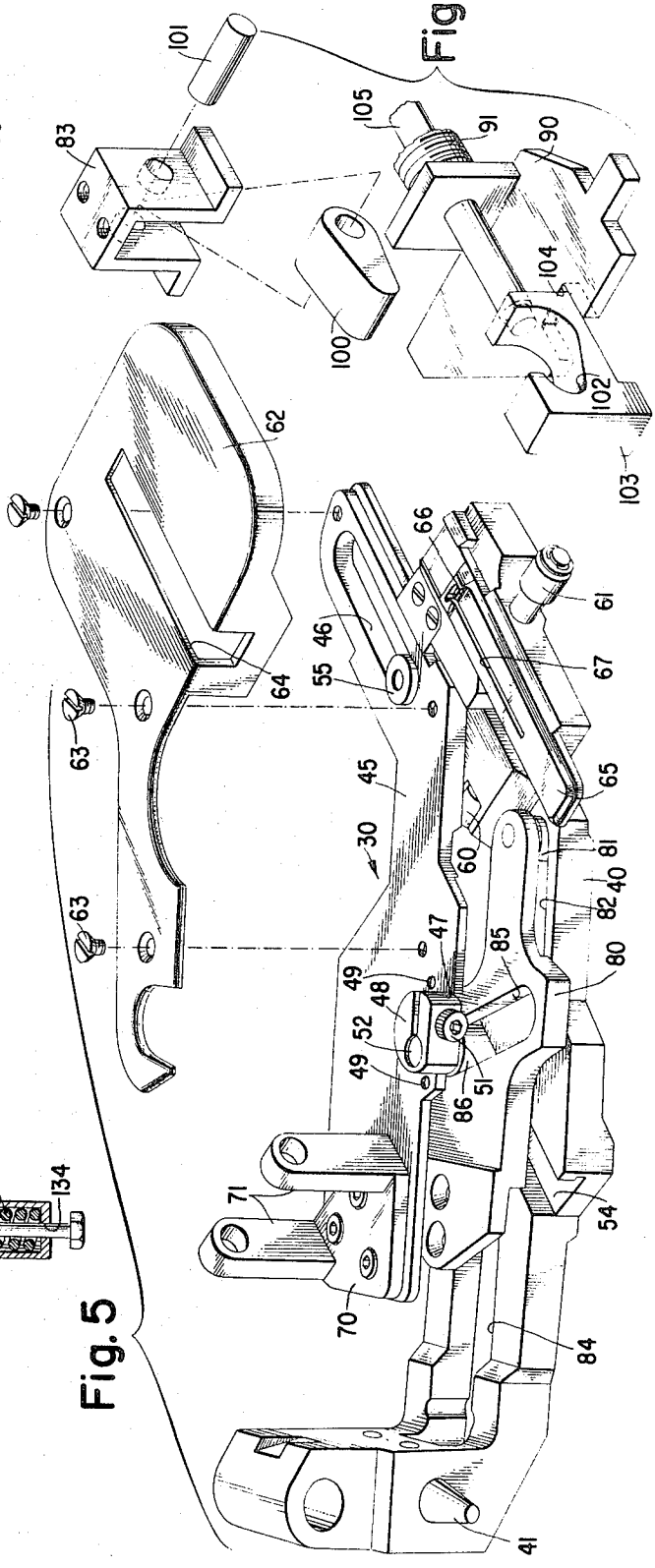

Fig. 5

Fig. 6

WORK CLAMP MECHANISM FOR SEWING MACHINES

BACKGROUND OF THE INVENTION

It has been proposed heretofore to invert a sewing machine so that the loop taker will be arranged above the work and the needle disposed therebeneath. The present invention, which pertains to a group stitch or cyclically operable sewing machine such as a buttonhole sewing machine in which the work is held and shifted relatively to the sewing machine stitch forming instrumentalities by a work clamp, comprehends a novel arrangement in which the positions of the needle and loop taker are inverted but in which the work clamp is not. The upper jaw of the work clamp may be raised to accommodate work fabrics face up therein and the loop taker will be arranged above the face of the work and the needle carried therebelow.

A number of advantages accrue from the arrangement of this invention. Raised or pearl lockstitches set above the face of the work, which are traditional in buttonhole stitching, can be formed using a preponderance of needle thread so that the bobbin in the loop taker need be replenished less frequently. Greater proportionate use of needle thread, moreover, reduces thread breakage because each unit length of needle thread will be worn less by passage back and forth through the needle eye.

Certain problems arise, however, in providing a reversal of the conventional arrangement between the work clamp and the stitch forming instrumentalities of a cyclically operated sewing machine.

One problem which arises is that of maintaining a constant distance from the loop taker to the surface of the work fabric despite variations in work thickness. Maintenance of this relationship, which is essential to proper cooperation of the stitch forming instrumentalities, is preserved in conventional sewing machine construction by provision of a fixed work supporting throat plate. The use of a fixed throat plate is not possible with the inverted arrangement of the loop taker and needle in this invention because it would abut and cover the face of the work in which the stitches are being formed.

Another problem which arises is the need not only for opening the jaws of the work clamp for exchange of work fabric between stitching cycles, but for moving away the entire work clamp to provide access to the needle for adjustment, threading, or the like.

SUMMARY OF THE INVENTION

This invention provides a work clamp for a buttonhole sewing machine in which the needle is arranged beneath the work and the loop taker is carried above the work in an arm which may be swung upwardly to provide clearance for removing and replacing work fabrics. The work clamp is organized right side up, i.e. with opposed jaws including a work supporting plate beneath the work and a work holding foot having an open space for the buttonhole and arranged above the work. The problem of maintaining constant distance between the loop taker and the work despite work thickness variation is solved by providing a spacing element preferably including an anti-friction roller between the swinging loop taker carrying arm and the work holding foot of the work clamp together with resilient means acting beneath the work supporting plate which can yield to accommodate varying thicknesses of work fabrics.

The work clamp includes a base plate pivoted to the machine frame so that the entire work clamp may be swung up to provide access to the needle for threading or the like. A pivoted connecting element which is retained within a socket of the work clamp shifting mechanism when the work clamp is swung up to expose the needle prevents any disruption of the feed connections to the work clamp.

DESCRIPTION OF THE DRAWINGS

A preferred form of this invention is illustrated in the drawings in which:

FIG. 1 represents a side elevational view partly in vertical cross-section of a sewing machine having this invention applied thereto showing the bracket arm lowered and the work clamp closed,

FIG. 2 is a side elevational view of the bracket arm portion of the sewing machine of FIG. 1 showing the bracket arm swung up and the work clamp open,

FIG. 3 is a top plan view of the lower jaw of the work clamp with the parts being cut away substantially along line 3—3 of FIG. 2

FIG. 4 is a vertical cross-sectional view of the lower jaw of the work clamp taken substantially along line 4—4 of FIG. 3,

FIG. 5 is a perspective view of the lower jaw of the work clamp viewed from the rear of the machine and with the work supporting plate disassembled, and

FIG. 6 is a disassembled perspective view of the connection elements between the work clamp and the work clamp shifting mechanism.

As shown in the drawings, the sewing machine to which this invention is applied comprises a stationary frame base portion **11** formed with ears **12** with which a bracket arm frame portion **13** is pivotally mounted on a pivot pin **14.** A needle bar **15** to which a thread carrying needle **16** is clamped in endwise reciprocable in a gate **17** carried in the stationary frame base portion **11.** The needle bar is reciprocated endwise by a drive link **18** from a crank pin **19** fast on a main drive shaft **20.** A loop taker **21** journaled in the bracket arm **13** is driven in timed relation with the needle by an arm shaft **22** in the bracket arm carrying a sprocket **23** driven by a timing belt **24** from a sprocket **25** on the main drive shaft **20.**

As shown in FIG. **2,** the bracket arm **13** may be swung up to elevate the loop taker **21** out of cooperative relation with the needle for exchange of work fabrics therebetween or for servicing of parts of the machine. Any known means may be employed for effecting pivotal movement of the bracket arm open and closed and for instance, a construction may be used such as disclosed in the co-pending which is incorporated herein by reference.

The needle and loop taker arrangement described above represents an inversion of the arrangement which is conventional in sewing machines. The sewing machine disclosed in the accompanying drawings and with which the present invention is concerned moreover, is a cyclic or group stitch sewing machine that is, a sewing machine organized to produce a predetermined stitch group during each cycle of operation such as a tack, a buttonhole, or the like. It is well-known in the art of cyclic or group stitching sewing machines to provide a work clamp such as is indicated generally at

30 in the accompanying drawings for gripping and shifting a work fabric relatively to the stitch forming instrumentalities so as to provide the predetermined stitch group in the work fabric.

As shown in the drawings and best illustrated in FIG. 5, the work clamp is associated with and shiftably supported relatively to a base plate 40 which is pivotally mounted on a pivot pin 41 carried in the ears 12 of the stationary machine frame base 11. The base plate 40 is thus stationary and although it cannot move with the work clamp during formation of stitches, the base plate may be swung up about the pivot pin 14 when the bracket arm 13 is raised between stitching cycles.

Referring to FIG. 5, the work clamp 30 includes a lower jaw formed with a guide slot 46 and an aperture 47 in which a split clamp 48 is secured by means of fastening screws 49 which pass through a flange 50 of the split clamp and are threaded into the lower jaw 45. By means of a clamp screw 51 the split clamp 48 may be secured to a guide stud 52 of which the head 53 is constrained in an undercut guide slot 54 in the base plate 40. By means of the guide slot 54 and a guide roller 55 carried by the base plate and engaging the guide slot 46 in the lower jaw 45, the work clamp will be constrained to move at an inclination to the base plate 40 as shown in FIG. 3. It is pointed out, however, that this invention is not limited to a work clamp movable at such an inclination, but may be applied equally well to a work clamp movable parallel to the sewing machine base.

A roller 60 may be carried by the base plate 40 underlying the lower jaw of the work clamp to facilitate free movement thereof. A similar roller 61 is provided on the base plate engageable beneath a work supporting tray 62 secured by screws 63 on top of the work clamp lower jaw 45. The tray 62 is formed with an aperture 64 exposing an anvil 65 on the base plate 40 which is formed with a needle aperture 66 and with an elongated slot 67 to facilitate cutting of the work material after a buttonhole has been stitched therein.

The lower jaw 45 of the work clamp carries a bracket 70 formed with spaced upstanding posts 71 carrying a pivot pin 72 for the upper jaw 73 of the work clamp. Preferably, the upper jaw includes an arched arm 74 carrying at its free extremity a work engaging shoe 75 formed with an opening 76 large enough to encompass the largest buttonhole which can be stitched by the sewing machine. The arched arm 74 of the work clamp upper jaw carries a track 77 extending parallel to the buttonhole opening 76 in the work engaging shoe. The arched arm 74 is also formed with a lip 78 extending parallel to the track 77. The track 77 and lip 78 serve, as will be described hereinbelow, to cooperate with means for raising and lowering the work clamp upper jaw.

As shown in FIGS. 4 and 5, a sliding plate 80 is interposed between the lower jaw 45 of the work clamp and the base plate 40. The sliding plate carries a roller 81 engaged in a guide slot 82 in the base plate and also carries a block 83 which is slidable in a guide slot 84 in the base plate. The block 83 and the roller 81 guide the sliding plate 80 in movement lengthwise of the sewing machine frame base 11. An inclined slot 85 formed in the sliding plate 80 embraces a roller 86 journaled on the stud 52 which guides the work clamp. Because of the inclination of the slot 85, the work clamp can partake of movement at an angle to the direction of movement of the slide plate 80.

As best shown in FIGS. 1 and 4, the mechanism for shifting the work clamp is carried by the stationary base portion 11 of the sewing machine frame and includes an angle bracket 90 secured to a hollow threaded stud shaft 91. Threads on the stud shaft engage threads formed on an internally threaded sleeve 92 journaled in the sewing machine frame base 11. By way of a sprocket 93 clamped to the sleeve and engaged by a timing belt 94 the sleeve 92 may be turned in either direction to shift the angle bracket 90 back and forth.

While any conventional means might be provided for influencing work feed movements of the work, reference is made to to which reference may be had for a detailed description of the mechanism disclosed in FIG. 1 for selectively indexing the timing belt 94 in increments first in one direction and then in the other to feed the work clamp back and forth along the length of a buttonhole.

The connection between the work clamp and the angle bracket 90 provides a resilient coupling which can accommodate swinging movement of the base plate 40 about the pivot pin 41 without disrupting the driving connection with the angle bracket 90 which cannot swing up. The resilient coupling as illustrated in FIGS. 4 and 6 comprises a finger 100 pivoted on a pin 101 in the block 83 and accommodated in a clearance seat 102 formed in a constraining block 103 slidable in a guide slot 104 in the angle bracket 90. A rod 105 attached to the constraining block 103 extends through the hollow stud shaft 91 and accommodates dished spring washers 106 beyond the hollow stud shaft and against a nut 107 for applying spring bias to force the block 83 tightly against the angle bracket 90 as shown in FIG. 4.

Referring to FIGS. 1 and 2, the cooperative relation between the sewing machine frame portions 11 and 13 and the work clamp 30 will now be described.

The minimum spacing between the loop taker 21 and the work engaging shoe 75 of the work clamp upper jaw is maintained by a wheel 110 which is journaled on a pivot pin 111 in a clevis 112 sustained beneath the bracket arm 13. The clevis 112 is maintained in a position interposed between the bracket arm and the work clamp by a slide rod 113 which is constrained in a bore 114 in the bracket arm. An elongated slot 115 which is formed in the bracket arm and opens on to the bore 114, accommodates a lateral pin 116 carried by the slide rod 113. The pin 116 serves not only to prevent turning of the clevis 112, but provides a stop limiting the distance which the clevis may be lowered beneath the bracket arm as shown in FIG. 2. A guide rod 117 on the clevis 112 constrains a light coil spring 118 within a blind bore 119 in the bracket arm so as to bias the clevis away from the bracket arm. The periphery of the wheel 110 engages a track 77 on the arched arm 74 of the work clamp upper jaw and when the bracket arm is lowered into effective position for sewing as shown in FIG. 1, the clevis 112 will abut the bottom surface 120 of the bracket arm to define with the wheel 110 a predetermined minimum spacing between the loop taker and the work clamp upper jaw.

When the bracket arm is raised as shown in FIG. 2 a lateral finger 121 on the clevis 112 which engages beneath the lip 78 on the arched arm 74 of the work draws the upper jaw upwardly into open position of the work clamp when the lateral pin 116 of the slide rod

113 engages the lower extremity of the elongate slot 115.

When the upper jaw of the work clamp is elevated as the bracket arm is swung up, the lower jaw 45 and the base plate 40 with which the lower jaw is associated, may also be swung up if they are grasped and elevated by the machine operator. Elevation of the lower jaw and base plate may be desirable, for instance, to gain clearance for threading the needle eye or the like. The resilient coupling between the work clamp and the work clamp shifting mechanism will accommodate such upward movement of the base plate without damage to or interference between parts.

When the bracket arm 13 is lowered into sewing position of the loop taker, the upper jaw of the work clamp will be pressed downwardly against the lower jaw and the base plate 30 will be urged downwardly against and in opposition to a plunger 130 which is shiftably supported against a heavy coil spring 131 in a guide tube 132 secured in the stationary bed portion 11 of the sewing machine frame. A guide stud 133 threaded into the plunger 130 and passing through the coil spring and through a guide aperture 134 in the inside of the guide tube 132 aids in aligning the plunger in the guide tube and provides a stop preventing the plunger from accidentally being moved upwardly out of the guide tube. A washer 135 secured beneath the plunger is formed with a lateral tongue 136 accommodated in a vertical slot 137 in the side of the guide tube to prevent rotation of the plunger relatively to the guide stud 133.

Having set forth the nature of this invention, what is claimed herein is:

1. A sewing machine including a stationary frame portion having a needle carrying bar supported therein, a bracket arm frame portion having a loop taker supported therein, a pivotal connection between said frame portions for movement of the loop taker into and out of a cooperative sewing position with relation to said needle carrying bar, a work engaging member supported between said frame portions contiguous to said loop taker, characterized in that spacing means is provided for establishing a predetermined minimum distance between the work engaging member and the loop taker when the loop taker is moved into cooperative sewing position, and means carried on said stationary frame portion is effective when the loop taker occupies cooperative sewing position for urging work fabrics against said work engaging member.

2. A sewing machine as set forth in claim 1 characterized in that said work engaging member is carried by one jaw of a work clamp which is shiftably supported between the sewing machine frame portions.

3. A sewing machine as set forth in claim 2 characterized in that said spacing means includes a roller carried by the bracket arm frame portion and with a track carried on the work clamp jaw and disposed substantially parallel to the path along which said work clamp is shiftably supported.

4. A sewing machine as set forth in claim 1 characterized in that the spacing means also includes constraining means for limiting the maximum distance which can exist between said loop taker and said work engaging member when said bracket arm is shifted out of sewing position.

5. A sewing machine as set forth in claim 4 characterized in that the spacing means includes a clevis carried by a support rod which is guided in a transverse bore formed in said bracket arm and in that said constraining means comprises a lateral projection formed on said clevis and engaging said work clamp jaw and a lateral projection on said support rod and engaging said bracket arm.

6. A sewing machine as set forth in claim 2 characterized in that said work engaging member is formed with an opening larger than the stitch pattern produced by the sewing machine, in that the opposing jaws of the work clamp are shiftably supported on a base plate pivotally connected to said sewing machine frame, and in that the work clamp jaws are pivotally interconnected on an axis which is shiftable relatively to the pivotal connection between said base plate and said sewing machine.

7. A sewing machine as set forth in claim 6 characterized in that a work clamp shifting mechanism is carried by said stationary sewing machine frame portion is provided with a resilient coupling with said work clamp to accommodate movements of said base plate about which said pivotal connection with said sewing machine frame.

8. A sewing machine as set forth in claim 7 characterized in that said resilient coupling between said work clamp shifting mechanism and said work clamp comprises interengaging abutment elements on said work clamp shifting mechanism and on said work clamp providing for a positive driving connection therebetween in one direction of work clamp movement, and in that spring means is arranged in compression resiliently maintaining said abutment elements in engagement during work clamp movements in the opposite direction.

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