

April 7, 1964

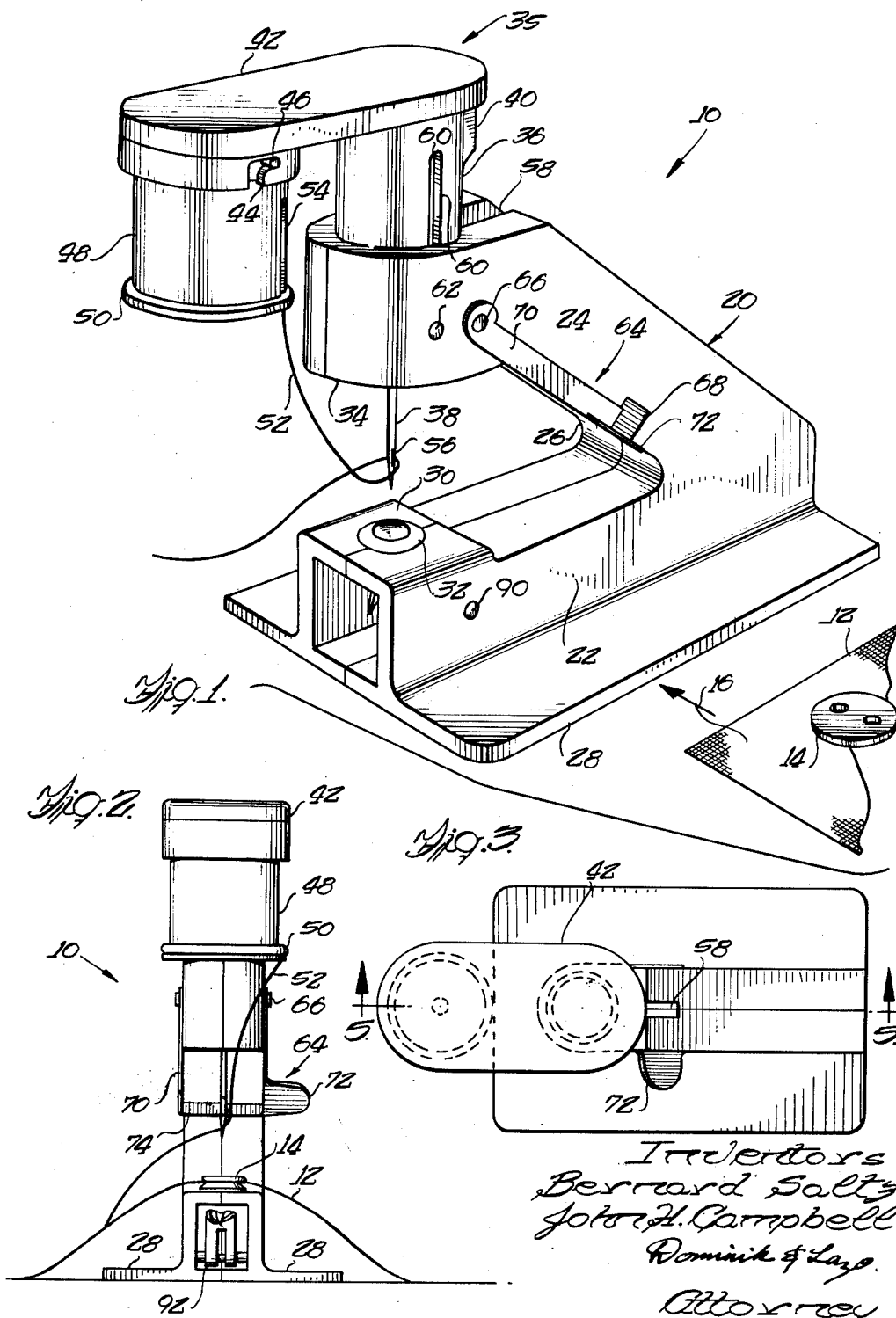
B. SALTZ ETAL

3,127,859

HAND OPERATED BUTTON STITCHING SEWING MACHINE

Filed Feb. 29, 1960

4 Sheets-Sheet 1



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HAND OPERATED BUTTON STITCHING SEWING MACHINE

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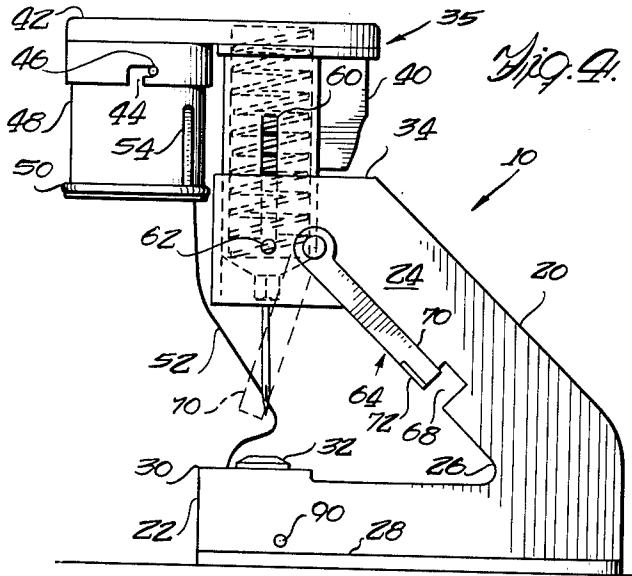


Fig. 4.

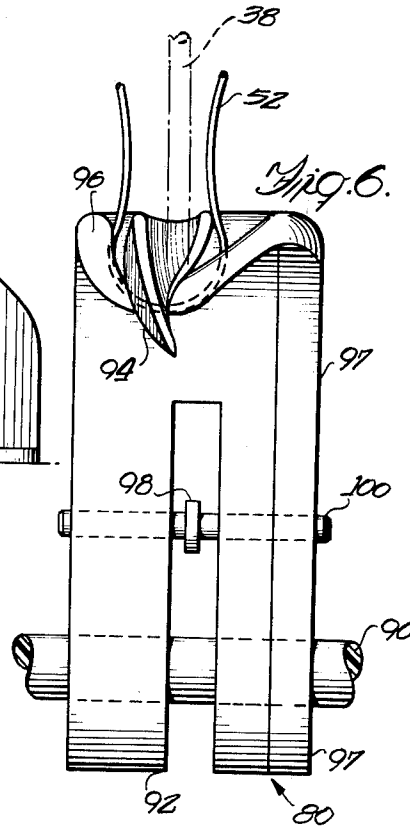


Fig. 6.

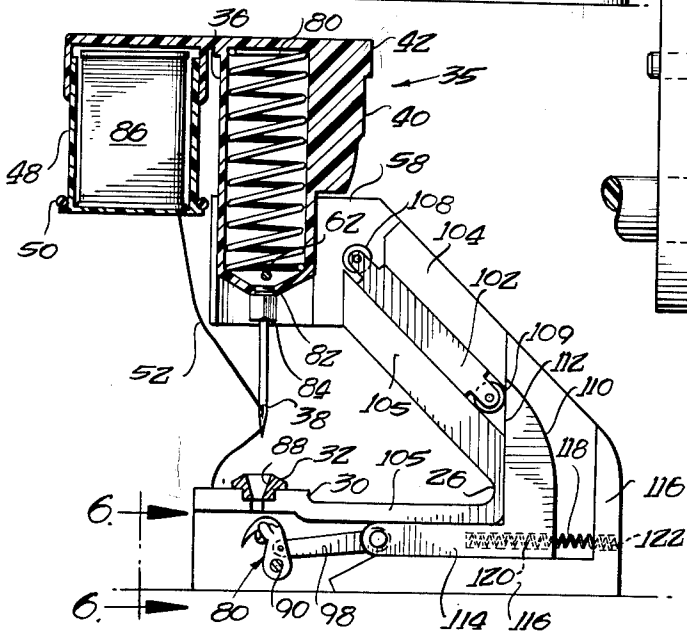


Fig. 5.

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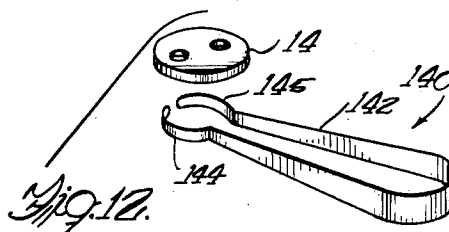
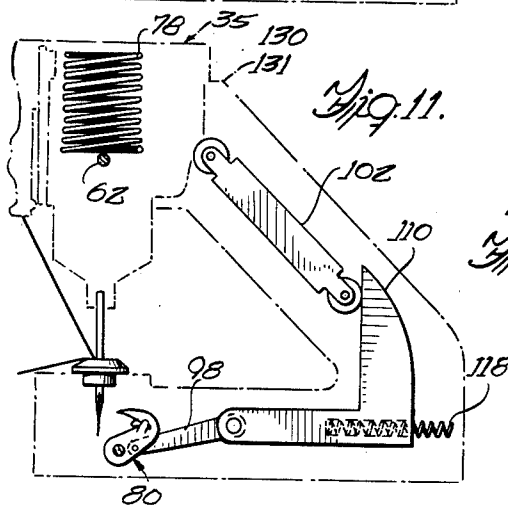
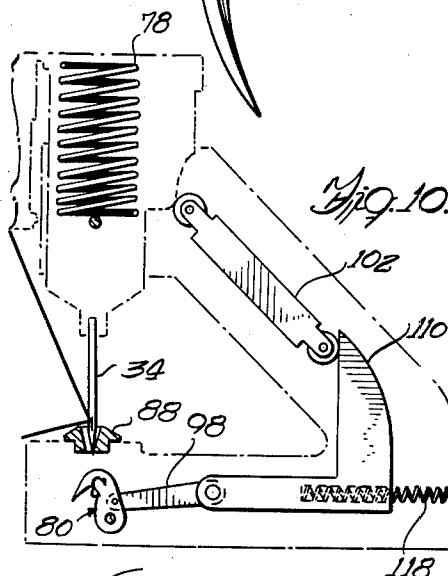
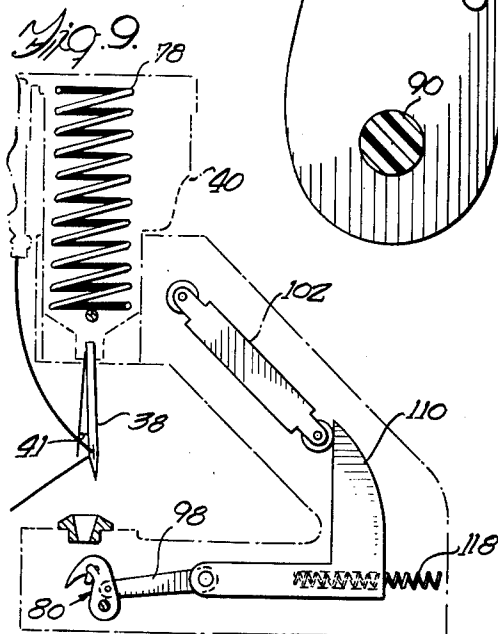
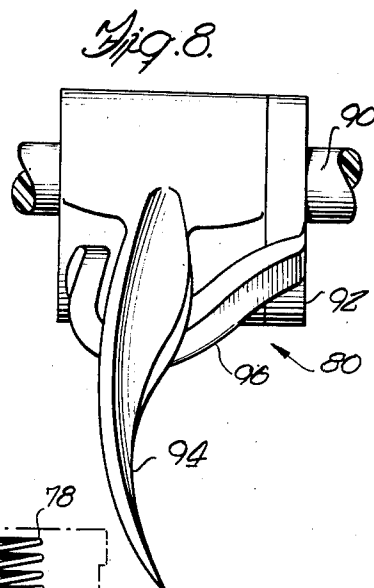
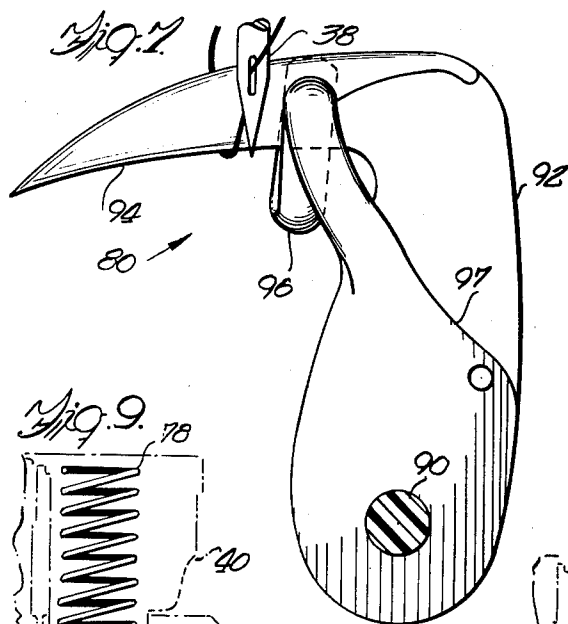
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HAND OPERATED BUTTON STITCHING SEWING MACHINE

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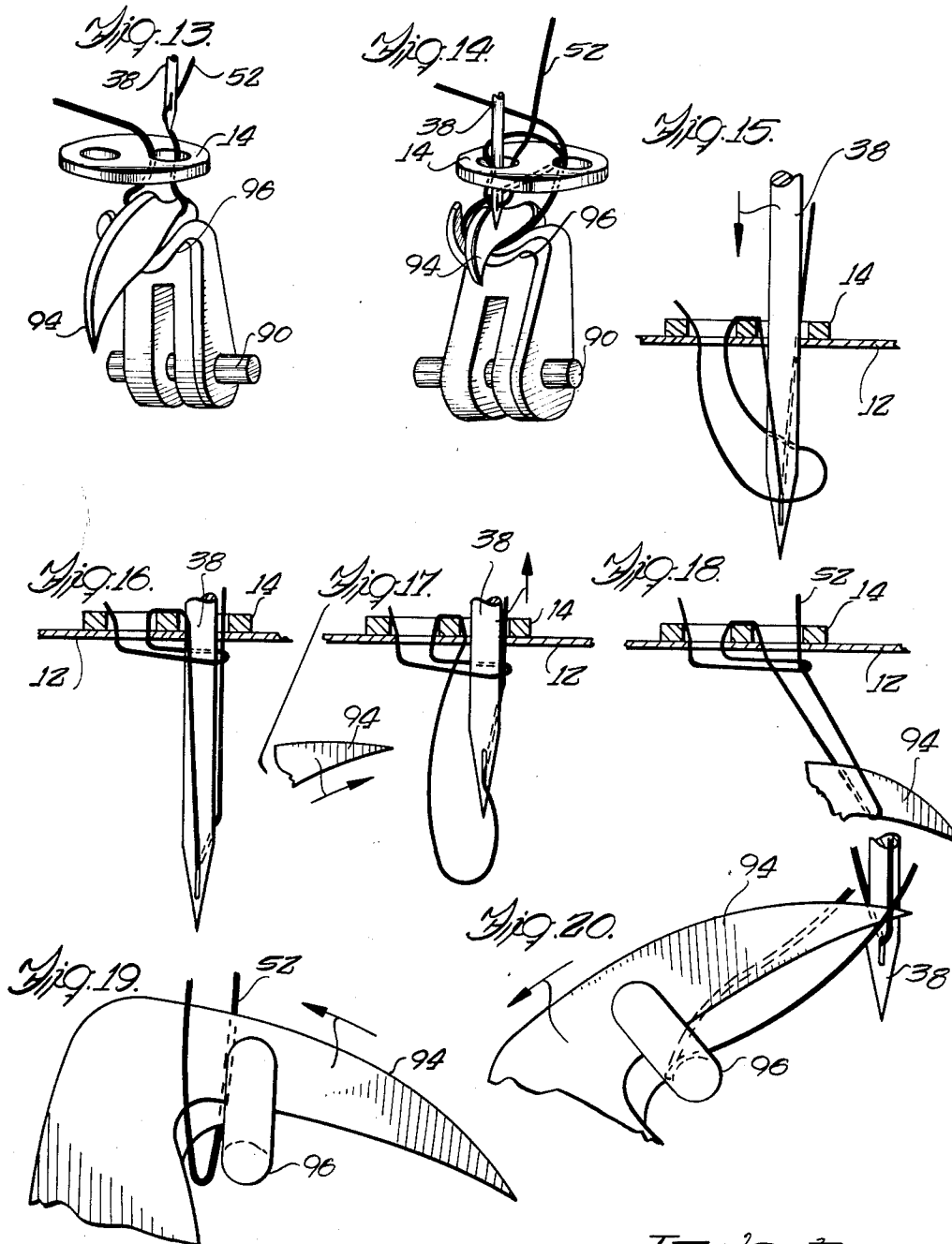
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HAND OPERATED BUTTON STITCHING SEWING MACHINE

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4 Sheets-Sheet 4



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3,127,859

HAND OPERATED BUTTON STITCHING SEWING MACHINE

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17 Claims. (Cl. 112-169)

The present invention relates primarily to a button stitcher, and particularly to a compact unit which is especially adapted for hand operation.

In the present commercial sewing machines, the mechanism for achieving the proper timing between the reciprocation of the needle and the looper which engages a thread carried by the needle is a complicated kinematic chain comprising a series of levers, rocker arms, gears, and the like which usually involve manual inspection and setting in order to achieve the proper timing. It is also characteristic of such sewing machines that thread-tensioning devices generally involve springs, rocker arms, bell cranks, or the like, in order to apply tension to the thread for stripping at the proper time with relation to the needle and looper. Machines having these characteristics offer impediments to inexpensive automation and mass-production by requiring some manual operations in setting or timing and in inspection of the timing.

Accordingly, it is an object of the invention to provide a sewing machine having a simplified mechanism for accomplishing the proper timing between the needle and the looper. It is another object of the invention to provide a sewing machine having a simplified thread-tensioning device. It is also an object of the invention to provide a sewing machine having a timing mechanism suitable for automated or mass production which, in the preferred embodiment, substantially eliminates manual timing adjustments in production. It is still a further object of our invention to provide a sewing machine capable of hand operation that includes one, the other, or all of the foregoing objects. It is also within the objects of the invention to provide a sewing machine having a novel means for overcoming malfunctions caused by loose stitches or loops. Another object is to provide a thread cutter that cooperates with the remainder of the machine in a novel manner to terminate a sewing operation. It is still another object of the invention to provide a sewing machine having one or all of the foregoing objects and advantages and which is particularly well adapted to sewing buttons or other fasteners on sheet-like materials such as cloth. It is within the objects of the invention to include the methods involved in accomplishing the foregoing listed objects. Other objects, advantages, and features will become apparent from the following disclosure, drawings, and claims.

The drawings illustrate a preferred embodiment of the invention wherein:

FIGURE 1 is a perspective assembly view with a button and cloth being moved into operating position.

FIGURE 2 is a front elevation of the assembly of FIGURE 1.

FIGURE 3 is a top plan view of the assembly of FIGURE 1.

FIGURE 4 is a side elevation of the assembly of FIGURE 1 showing certain internal features and the thread cutter operation.

FIGURE 5 is a cross section taken through section 5-5 of FIGURE 3, showing, inter alia, the principal parts and mounting thereof of the timing mechanism.

FIGURE 6 is an enlarged view taken at section 6-6 of FIGURE 5 showing the needle, thread, and looper relationship.

FIGURES 7 and 8 are enlarged views of the looper.

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FIGURE 9 is a simplified side cross section view with the head in the topmost or "full-up" position.

FIGURE 10 is a simplified side cross section view with the head in an intermediate position.

FIGURE 11 is a simplified side cross section view with the head in the bottom-most or "full-down" position.

FIGURE 12 illustrates a pair of tweezers for manipulating a button, and

FIGURES 13 through 20 illustrate in a schematic, representative fashion the cooperation between the needle and the looper.

The invention contemplates a novel sewing machine having a frame slidably supporting a head carrying a needle, thread tensioner, and cam. The frame restrains a means for engaging the cam to translate motion defined thereby to a looper disposed beneath a needle well in the frame. The frame is sufficiently open between the needle and needle well to allow manipulation of a button. The needle is supported in the head for reciprocation into and out of the needle well. A spool of thread and the cam are preferably both secured to the head for moving in unison therewith. The cam frictionally engages and moves a linkage composed of reciprocating members that are restrained by the frame and serve to translate the motion defined by the cam into pivotal (i.e., reciprocal arcuate) motion of a looper mounted beneath the needle well. The thread tensioning device comprises a frictional engagement of the thread between a resilient frictional elastomeric member and a rigid body, the latter two being secured to the head and moving in unison therewith; the thread passes from the spool between the body and resilient member before being threaded through the eye of the needle. The looper engages the thread in such a manner that thread is stripped from the spool when the head and needle are moved out of the needle well, i.e., stripping is done on the upstroke. Thread tension is maintained during stripping by frictional engagement of the thread between the resilient member and the body. A thread cutter with a dull cutter bar is swingably mounted to engage and sever thread while maintaining tension therein through failure to readily cut and also to strip additional thread for tying off.

Referring now to FIGURES 1, 2, 3, and 4, there is seen a button stitching sewing machine 10 in which a work-piece such as a piece of fabric and a button 14 are manually emplaced at the proper position in the machine by the operator initially moving the same in the direction of the arrow 16. In the preferred embodiment of a hand-operated sewing machine, the entire machine 10 is sized suitably for manual operation by manipulation of the moving head by the operator's finger or by a conventional foot-operated treadle.

The sewing machine generally comprises a generally hollow frame or support member 20 having a horizontal arm 22 and an upwardly extending oblique arm 24, the two respective arms being joined together at a bight 26. For convenience in manufacture, the frame 20 can be made in right and left-hand portions, each being the mirror image of the other, and each providing a flange 28 on the button of the horizontal arm, if desired, for stability when the machine is mounted on a horizontal surface such as a table top. The two halves can be bolted together by bolts at suitable selected places after the internal parts of the machine have been assembled within the hollow frame 20. For the sake of clarity, the bolts are not shown. However, the bolts must be disposed at places where they will not interfere with the working of the mechanism disposed inside of the frame.

When the right and left-hand halves are assembled to form the frame 20, they provide at the outer extremity of the horizontal arm 22 (furthest away from the bight

26), an anvil 30 which receives and supports a needle well 32, hereinafter described. At the outboard end of the oblique arm is a bearing means 34 to receive and slidably support a head assembly 35.

The head assembly includes a cam and needle body 36 to support and position a needle 38 in position for reciprocating in and out of the needle well 32. The head also carries a cam 40 which is secured or affixed for movement in unison with the head and the needle during reciprocating motion in and out of the needle well. The cam and needle body 36 is preferably a hollow generally cylindrical member having therein an axial slot 60 for receiving a retaining pin 62. As best seen in FIGURE 9, the needle is formed to depart slightly from the vertical by the angle 41. The needle is bent backward, toward the right to permit sliding engagement with the tapered passage in the needle well.

Extending forwardly from the cam and needle portion (as viewed in FIGURE 1 and FIGURE 4) is a flange 42 having therein the J-slots 44 for receiving the J-slot pins 46 which latter are attached to a spool retaining body 48. The body 48 carries a frictional, resilient, elastomeric ring such as rubber O-ring 50 as a thread-tensioning means for the thread 52 which is led off a spool disposed inside the body 48, through a thread slot 54, between the body 48 and the elastomeric ring 50, thence to the eye 56 in the needle. The J-slot and pin provide means for detachably securing the spool retaining body to the head 35. It is to be understood of course that the body 48 can actually be positioned relative to the needle body 36 on either side or even rearwardly thereof when desired as for improved visibility of the needle well. The oblique arm also includes an appropriately-sized slot 58 for the cam 40 to move into and out of.

The thread cutter 64 is swingably mounted by means of a pin 66 from the outboard end of the oblique arm 24. A notch 68 is provided in the oblique arm to receive a portion of the thread cutter. The thread cutter comprises a generally U-shaped member 70 having a finger tab 72 extending from the lower end of one side thereof. The horizontal portion of the thread cutter, the cutter bar 74, is intentionally dull and comprises the instrumentality by which thread is cut as hereinafter described. The vertical arms of 70 are long enough to swing the cutter bar in a radius to pass between the needle when full-up and a button or the like disposed on top of the needle well.

Having described now the general arrangement of mechanism for the invention, FIGURES 4 and 5 are referred to for a more detailed description of the head 35. The cam and needle body portion of the head 36 is a generally cylindrical, hollow body. The flange or arm 42 is removably secured to the body 36, as by a threaded engagement at the uppermost end of 36. Disposed within the body is a helical spring 78 that is maintained in compression by its disposition, speaking of the vertical direction, between the pin 62 and the flange or arm 42. This normally biases the entire head assembly 35 to the full-up position. The flange 42 cooperates with the upper surface (131 of FIG. 11) of the head-supporting means 34 to define a lower vertical limit stop for the travel of the head assembly 35 as it carries the needle down into the needle well. Pin 62 also cooperates with the sides of the slot to maintain the head in its proper alignment so the shaped portion of the needle cooperates with a looper 80 and so the cam 40 can cooperate with the members it engages, as hereinafter described. The alignment includes maintaining the cam 40 positioned for travel within the slot or notch 58. Pin 62 engages the bottom of slot 60 when the head is full-up to thereby form an upper vertical limit stop.

At the bottom of the needle and cam body 36, is a chuck assembly that includes a slotted, threaded, resilient member 82 secured to the body as by being molded therein, it being understood that body 36 is made of plastic

or a similar material, and a nut 84 which compresses the threaded member 82 against the needle to secure the latter in position. The slotted portions of the threaded member 82, which are covered by nut 84, include a plurality of slots parallel to the length of the needle, thereby forming a chuck in the conventional sense. The resilient action of the material out of which member 82 is manufactured is such as to spread it apart to receive the needle and to compress together to seize the needle as the nut 84 is screwed onto a tube. This is a conventional chuck construction. Alternatively, the end of the needle is fitted with a threaded member (e.g., 82) having a shoulder (e.g., 84) thereon to limit or position the depth it is screwed into the bottom of the body 36. A suitable threaded female bushing is secured in the bottom of 36 to engage the threaded member.

The needle well comprises a generally frusto-conical body having a shoulder extending beyond an inset bottom portion for seating on and reception by the anvil 30 of the horizontal arm. A tapered needle passage 88 defining an inverted frusto-conical space passes completely through the needle well body. The major diameter of the tapered passage is at the upper end of the needle well body and the minimum diameter of the tapered passage is disposed at the lower end adjacent the looper 80. The needle well is made of a hard, corrosion-resistant metal such as a chromium steel. The back edge of the tapered passage 88 is slidably engaged by the needle to position the latter relative to the looper. The bottom of the needle well is contoured (FIG. 18) to closely parallel the path defined by the looper in its arcuate reciprocal pivoting.

When the needle is carried downwardly by moving the head, it strikes the back edge of the passage through the needle well 32 and is flexed from its bent-backward position to a proper relation to the looper (FIG. 10). An alternative to the bent-backward needle is to use a straight, vertical needle and to position it in the head in alignment with the wall of the well that defines the tapered passage. In this fashion straight line vertical motion of the head causes the needle to slidably engage the wall and to thereby be flexed into the desired position for coacting with the looper.

The looper 80 is pivotally secured by the pin 90 which is journaled in the horizontal arm at a position generally beneath the anvil 30. The looper moves arcuately to and fro in a plane generally parallel or coincident with a vertical plane that passes through both arms of the frame 20. Referring now to FIGURES 6 through 8, the looper comprises three principal portions—a looper base 92 through which the pin 90 passes, a looper arm 94 cantilevered out from the base in such a manner as to be generally disposed underneath the needle well, and a looper collar 96 which is a relatively rigid member cantilevered from the base. The looper collar is spaced from and partially encircles the underside of that end of the looper arm adjoining the base and is also spaced horizontally from the base in the direction of the arm. The purpose of the looper collar is to frictionally engage loose stitches of loops in order to overcome malfunctions so the machine can stitch tightly. It provides, as seen in FIGURES 7 and 8, a minimum clearance, just enough for the thread to pass freely between the collar and the base end of the arm. The collar is conveniently a cantilevered extension of a blank plate 97 that generally corresponds in shape to the base 92 and is secured thereto by glue, rivets, or the like. The path of the needle 38 relative to the looper arm 94 is best understood by reference to FIGURE 7 and FIGURES 13-20.

The rear (right) end of the looper base 92, as best seen in FIGURE 2, is preferably bifurcated to receive a connecting rod 98 for a pivotal connection to the inner bifurcated portion of the looper arm by the pin 100 (FIGURE 6). The looper passes very close to the needle during the course of its operation in one cycle of the sewing machine. Accordingly, the looper arm has a particular

shape and contour as best seen in FIGURES 6-8, 13 and 14. This contour permits the looper arm to pass close to the needle while the needle is completing a downward stroke or just beginning to return to its full-up position from such a downward stroke. The manner of shaping and contouring the looper arm and the needle to cooperate therewith is well-known in the art and we will not attempt further description.

The novel means for timing the cooperation of the needle with the looper 80 is best understood by reference to FIGURES 5, 7, 9, 10, and 11. A push bar 102 is slidably mounted in a groove in the oblique arm that is formed by the shoulders 104 and 105. The push bar has, if desired, a friction-reducing means comprising a roller 108 that is rotatably supported at one end of the push bar. Preferably, the roller 108 is received into a bifurcated portion of the push bar at this end. The other end of the push bar 102 is constructed in a like manner, with the roller 109 at that end engaging an L-bar 110 and more particularly, engaging the vertical surface 112 of the latter. The L-bar 110 has a horizontal extension 114 that fits in a groove between the horizontal extension of the shoulder 105 after it bends around the bight 26 (see FIGURE 5), and the shoulder 116 which is a portion of the horizontal arm. The inner wall of 105 at the bight forms a horizontal limit stop for the L-bar by engaging the vertical surface 112 and limiting its motion to the left as viewed in FIGURES 5 and 9 through 11. The vertical extension 112 of the L-bar moves in a horizontal direction and between the horizontal limit stop just described and the opposite end of the bight, or the right side as viewed in FIGURE 5. The right-hand horizontal limit stop is formed by the vertical extension of the wall 116 and leaves sufficient horizontal clearance for adequate motion of the L-bar in the manner described below. An L-bar spring 113 is held in compression between the L-bar and the frame 20 and preferably is inserted in a hole 120 drilled in the horizontal extension of the L-bar and resiliently engages the frame member by being compressed by threaded member screwed into the frame, such as an "Allen" screw.

The combination of the push bar, the L-bar and the connecting rod 98 all comprise a means restrained by the frame or support member for engaging the cam surface 40 and responding thereto in order to translate motion from the cam to the looper. As can be seen, there are only three principal links, the push bar 102, the L-bar 110, and the cam 40 itself. The engagement of one part with another is frictional, in the main. The connecting rod is a refinement and, of course, constitutes a fourth link in the chain. The connection between the L-bar and the connecting rod is preferably achieved by a bifurcated joint, with the L-bar being bifurcated to receive the connecting rod therewithin as illustrated, for example, in FIGURES 5 and 9 through 11.

It is to be particularly noted that by the novel construction described, the invention maintains in one vertical plane that passes through the central portion of the frame 20 (i.e., along the plane denoted as 118 in FIGURE 2 and which passes along the parting line between the two halves of the frame as more clearly seen in FIGURE 1), all of the elements connecting the cam to the looper. The advantages of simple construction, simple design of the tools and dies for mass-producing the sewing machine, and ease of assembly are thus realized. This is particularly true where the machine is designed to be a small model for hand operations and for hand operations in the sewing on of buttons. It enables the molding of such parts as the frame, the head 35, the pusher bar, the L-bar, the looper and the connecting rod out of plastic, the other parts being made principally of metal and preferably of steel. "Nylon" is preferred for the looper 80.

A machine constructed according to the invention does not require any adjustment at the factory in order to

insure that the timing of the needle and the looper is proper. Also, it is not necessary to selectively fit parts, because any misalignment due to parts not fitting together is sensed when the needle does not properly pass through the needle well. However, by employing the tapered passage 88, the non vertical needle is guided into a proper position by a sliding cooperation with the tapered walls of the well. This places the eye of the needle and the thread in the proper relationship for the looper 80 to engage them when the needle is full-down at the end of a downward stroke. The push bar 102 is made long enough so that it will, in all events, properly engage the cam 40, particularly at the portion of the cycle where the cam operates the push bar, L-bar, connecting rod to retract the looper from beneath the needle well during the terminal portion of the downward stroke and then to return the same to beneath the needle well during the initial portion of an upward stroke from the full-down position. Clearance between reciprocating parts are advantageously such as to retain liquid lubricants in place by capillary action.

The mode of operation is best understood by reference to FIGURES 9 through 11. The machine is placed on a horizontal surface such as a table. FIGURE 9 shows the parts in the position when the needle is in the "full-up" position to which the parts are urged by the respective springs such as head spring 80 and L-bar spring 118. In this position, the looper, particularly the looper arm 94, is referred to as being beneath the needle well. In the interests of clarity, the button and workpiece being sewed are eliminated from these figures. It will be understood, however, that such pieces are present therein during an actual sewing operation. The cam end of the push bar 102 does not, at this time, actively engage the cam 40, to enable easy operation during the first portion of the downstroke, only the head spring force and friction in 34 having to be overcome. Subsequent portions of the downstroke have to additionally overcome the friction in the means for translating when the cam engages the push bar.

When the needle is moved down to about halfway between FIGURES 9 and 10, the operator temporarily stops the downward motion if previous sewing has been done. In the halfway position, there is enough slack in the thread to permit moving the workpiece or cloth so the needle pierces it at a different place, e.g., through a different hole in the button. The cloth is moved during the temporary stopping. The extent of cloth movement is limited by the slack in the thread which is in turn controlled by the exact position of stopping. When stitching buttons, the movement must locate another button hole for piercing by the needle. The cloth movement is mainly sideways, i.e., generally perpendicular to the plane in which the looper pivots.

Referring now to FIGURE 10, there is shown a position of the elements when the head has been moved partially downward to where the cam 40 just begins to engage the push bar 102. At this point, the L-bar is still against the left-hand horizontal limit stop. The needle is just entering the needle well, sliding down the taper of 88, carrying the thread thereto, and the looper, particularly the looper arm, is still in position beneath the needle well. As the head 35 is continued to be moved downwardly, it reaches the low limit of its stroke and arrives at the position shown in FIGURE 11, which is referred to as the "full-down" position. In so doing, the connecting rod 98, being pulled by the L-bar, in turn removes or retracts the looper 80 from beneath the needle well (FIGURES 9 and 10) to the position shown in FIGURE 11. In this full-down position, the looper does not engage the needle or the thread.

When full-down, the head spring 78 is compressed its maximum extent, as is the L-bar spring 118. The extension of flange 42 beyond the diameter of needle body 36 provides a shoulder 130 that engages the corresponding

lower vertical limit stop 131 on the oblique arm when full-down. In this position, the L-bar 112 is also moved its maximum horizontal distance to the right, as viewed in these figures.

The machine is conveniently returned to full-up position by releasing the downstroke force on the head. Springs 80 and 113 then return the various elements to the position of FIGURE 9.

Attention is directed to the contour of the cam 40 as shown in the various figures, particularly the various side views such as FIGURES 4, 5, and 9 through 11. The contour of the cam is such that there is no cam-push bar contact during the initial part of the downstroke, i.e., while the needle is traveling to approximately the position shown in FIGURE 10 and even slightly further down to that of FIGURE 14; it follows that there is no substantial movement of the looper from beneath the needle well. Thereafter, the cam and push bar engage and the looper is gradually partially retracted as the needle continues down. When the needle eye passes the looper arm, the terminal portion of the downstroke is reached. The contour of the cam is such that during the terminal portion of the downstroke, just before the needle reaches the full-down position of FIGURE 11, the looper is rapidly retracted from beneath the needle well to the position of FIGURE 11. In one embodiment, the last $\frac{1}{16}$ "- $\frac{3}{32}$ " of downstroke of the needle moves the looper about $\frac{1}{4}$ " to the fully retracted position of FIGURE 11.

The timing, of course, can be modified by varying the shape of the cam, looper arm, needle, and proportions of the means for translating. For example, a perfectly straight vertical portion of the cam may be provided to engage the push bar so that after the looper is retracted, there is a dwell period where it does not move from the retracted position. However, it is preferable to have a cam contour producing a rapid motion away from the needle and a commensurate rapid return when the head 35 is moved from the full-down position of FIGURE 11 back through the intermediate position of FIGS. 14 and 17, then to that of FIGURE 10 and finally to the full-up position of FIGURE 9. Therefore, the vertical portion of the cam shown does not actively frictionally engage the push bar during the terminal portions of a sewing cycle (one downstroke and one upstroke).

The purpose of the looper 30 is to cooperate with the needle and the thread to form chain stitches. More particularly, the looper engages the thread and cooperates with the needle in the manner shown in FIGURES 6, 7, and 13-20. One of the things the looper does in the course of normal operation is to engage the thread at such a time in such a manner that slack in the stitches is pulled out before any thread is stripped off the spool. The advantage of tight or snug stitches is obtained by stripping after slack removal. By reason of the novel frictional engagement of O-ring 50 controlling thread tension, only the amount of thread needed after removal of slack is pulled off the spool. In case a stitch is accidentally missed, or when the thread is unusually loose, as during the initial stitches, the looper collar 96 frictionally engages the thread in such a manner as to cause proper loop formation and the novel upstroke stripping action causes the slack to be removed on the upstroke.

FIGURES 13 through 18 show one cycle of sewing machine operation comprising one downstroke and one upstroke. The needle 38, thread, and looper 30 are shown in FIGURE 13 in their relative positions after at least one prior cycle, whereupon the looper arm positively engages the thread to form a first substantially vertical loop depending through the fabric or workpiece 12, 14 down around the bottom of the looper arm, thence back through the workpiece to the needle eye and O-ring 50. In normal operation, the depending loop around the arm 94 is in tension, when full-up as in FIGURES 9 and 13.

As the needle is started down in FIGURE 14, the tension in the thread is slightly relaxed, but the looper arm

begins to retract after the cam 40 engages the push bar 102. Of course, the cloth has been moved so that the needle is starting to pierce it at a different place than after the first stroke, i.e., at a different place than that shown in FIGURE 13. Frictional engagement of the cloth with the depending loop plus the contour of the bottom of the looper arm 94 coact in normal operation so that frictional drag on the first depending loop along the bottom of the arm angles or tips the depending loop away from the vertical position. Continued retraction of the looper responsive to the contour of cam 40 maintains a depending loop in this angled or tipped position. This presents a target for the needle to pierce.

Some license has been taken in the presentation of FIGURES 13 through 20 because of the necessity of making a clear showing of a rather complex movement in the forming of a chain stitch. For example, the needle well has been omitted from FIGS. 13-17. Another example is: in reality the button is moved perpendicular or obliquely to the plane of rotation of the looper. FIGURES 15 through 18, in particular, show a different button and cloth motion: they show the button and cloth moved generally parallel to the looper rotation plane in order to thereby expose a different hole in the button for the needle to pass through. In practice, this results in a thread at the time the needle pierces the loop thereof, as in FIGURE 14, being actually at about 90° to the position shown in FIGURE 15. In other words, the thread, in practice, is angled or tipped vertically to have a slope opposite to that of FIGURE 14. In this same connection, the depending loop of FIGURE 13 and that of FIGURE 18 is actually in a substantially vertical position when the needle is full-up. This could be surmised by a study of the loop as would appear in FIGURE 9. Accordingly, when the needle is moved on a downstroke and the looper begins to retract, the thread is tipped oppositely to a direction shown in FIGURES 15 through 17 to present a horizontal component of the loop that is kept spread apart by the looper arm for piercing by the needle. Of course, the needle well aids in positioning the spread-apart depending loop of FIGURES 13-18 relative to the needle. The sliding engagement of the needle with the tapered passage is such as to move the needle through the loop.

FIGURE 15 shows a needle piercing the angled first depending loop and carrying in the needle eye what will subsequently become a second loop through the depending loop. Also, this figure does not show the looper in a position that is disengaged from the first depending loop. The needle continues to move on until it reaches the full down position of FIGURE 16 in which it can be seen that the needle has successfully carried thread in its eye through the first depending loop. The first loop no longer depends, it having been tightened and therefore having moved up the needle to increasingly assume or approach a horizontal position.

The needle is then started up on the upstroke as seen in FIGURE 17. Compare FIGURES 16 and 17. In FIGURE 16 frictional engagement with the cloth of the thread carried by the needle eye has pulled the thread starting through the needle eye sufficiently so that it is snug and under a light tension. When the upward motion of FIGURE 17 is started, as by a bias action of the head spring 78 and looper spring 113 this snugness is relieved to the extent where the thread bows outwardly. The bowing action is such that the return motion of the looper is presented with a target in the form of another loop for the looper arm to pierce and thereby engage the thread. During this time, a first formed loop that was present in FIGURE 13 has been reduced in size and therefore has traveled further up the needle so that the looper arm engages the bowed thread at a point beneath the location of the former depending loop.

Having now engaged the thread, the parts are moved to their full up position. Due to the upstroke stripping

action, any slack in the thread that extends from the bottom of the looper arm to the needle eye thence to the O-ring 50 and the spool, is removed during an initial portion of the upstroke: this places the thread in tension sufficient to strip the thread off the spool by pulling it past the O-ring 50 and then through the needle eye. It is important that the slack be removed first because otherwise the stripping will not take place. The cycle is normally completed when the head assembly and the needle return to full up (FIG. 9), having formed a chain stitch as in FIGURE 18 where the second loop depends through the now horizontal first loop and where the thread is pulled up tightly and exists in tension. Inasmuch as the spool and the needle travel together and thus have a constant distance therebetween, the stripping action is due to the increasing distance in going from full-down to full-up between the needle and the looper arm. Thus, it is also seen that the invention, contemplates stripping on the upstroke by using a device where the needle and the spool travel together, in unison, with there being no relative motion between the two.

The unique stripping action maintains the thread in tension during the upstroke. Slack appears in the thread between the O-ring, needle eye and the looper arm only on the downstroke. The looper collar 96 is provided to take up slack as is discussed below with reference to FIGURES 13-23. The result of this construction is to provide a tight stitch in second and subsequent stitches.

When a malfunction occurs, as by the operator's hand striking the thread between the needle eye and O-ring thereby stripping an undesired excess portion off of it, or immediately after the very first stitch, there is considerable slack in the thread. The looper collar is provided to compensate for this slack. FIGURES 19 and 20 illustrate the collar operation. When the thread is slack the depending loop is slack. This creates a tendency for the loop to hang straight down from the looper arm, as shown in FIGURE 19, thereby preventing frictional engagement with the looper arm 94 to permit the angling or tipping of FIGURES 14 and 15. This would of course prevent the needle from piercing the loop to form the chain stitch.

The looper collar underlies the looper arm and prevents the loop from dropping down very far when there is slack, as in FIGURE 20. If slack does cause the loop to drop down just a very small amount, it is engaged by the looper collar and friction between the slack loop and the looper collar is enough to cause a tipping or angling sufficient to enable the needle to pierce the depending loop and form the chain stitch. This action occurs on the downstroke, and the subsequent upstroke removes the slack in the usual manner. Occasionally there may be so much slack that no upstroke stripping takes place. In such a case, several cycles of operation are necessary to remove the slack. Thus, it is seen that the depending loop is engaged either internally (by the looper arm) or externally (by the looper collar), tipped from the vertical, and then passed through by the needle.

The thread is cut at the conclusion of the sewing operation in such a manner as to leave the needle threaded, to leave a length of thread for knotting on the workpiece and to pull tight the last bit of thread that is in the sheet or cloth that is being sewn. The thread cutter 70 is used. This is accomplished when the needle is full up (FIG. 4) by swinging the thread cutter out from the position in notch 68 of FIGURE 4 to where the cutter bar 74 engages the thread, and continuing to swing it to a position somewhere to the left of the needle (as in FIGURE 4). In so doing, the cutter bar engages that portion of the thread between the needle and the workpiece or button. The cutter bar 74 is intentionally somewhat dull in order to tension the thread and thereby strip some off the spool for knotting and to pull the last stitch tight. The dull edge abrades the thread to a failure under the ten-

sion. The cut end of the thread is long enough for use as a wrapping under the button in conventional fashion.

In FIGURE 12 is shown a pair of tweezers suitable for holding a button while manipulating it and the cloth to which it is to be sewn back and forth underneath the needle. Manipulation is done manually by the operator when a button-sewing operation is carried out. A pair of tweezers 140 having a U-shaped, or horse-shoe-shaped, resilient spring steel member 142 is used to grip the button 14. At the outboard or tip ends of the two arms of 142 are a pair of generally semi-circular or partially circular button-gripping arms 144 and 145. The arms do not have to be of the spring steel or resilient material of which 142 is constructed. However, a preferred design of the arms does require that they have a channel-shaped cross section so that a flange overlies both the top and bottom surfaces of the button and the actual gripping action is between the two webs of the respective grippers. The button-gripping arms are spread apart so the button spreads them even further, thus using the resilient action of the spring member 142 to hold the button with no effort by the operator. This action permits resiliently engaging buttons of various sizes with the tweezers.

While the invention is disclosed with respect to a preferred embodiment and to a specific construction, it is not our intention to be limited to only those features, arrangements and details which we have disclosed, but to include in the invention, all of those modifications, substitutions of art-recognized equivalents, rearrangements and the like which would be obvious to one skilled in the art with our disclosure before him.

We claim:

1. A hand operated sewing machine for chain stitching comprising in combination, a V-shaped support member having a first horizontal arm and a second arm sloping upwardly from said first arm; a needle well with a tapered passage therethrough supported in said first arm; a movable head supported by the second arm of said member for reciprocal motion having means for securing a spool of thread and a needle to said head, and having a non-linear cam surface externally thereof facing toward the bight of said member; a needle bent toward the bight of said support member and secured to said head in alignment for sliding engagement with said tapered passage as reciprocal motion of said head carries the needle through said passage; a looper pivotally supported on said first arm of said member, underneath the needle well; an L-shaped member supported for reciprocation relative to said first arm and providing a branch extending into said second arm; a connecting rod pivotally connected at one end to said looper and pivotally connected at the other end to said L-shaped member; a push bar reciprocally supported in said second arm to engage said branch of said L-shaped member and extending along said second arm a distance to engage said cam surface when said movable head is moved toward said first arm; and a spring biasing said looper to a thread-engaging position under said needle well.

2. A hand-operated sewing machine for chain stitching comprising in combination, a V-shaped support member having a first horizontal arm joined at a bight to a second arm sloping obliquely upwardly from said first arm; a needle well having a passage therethrough defining an inverted frusto-conical space; a needle; a movable head assembly reciprocally supported by said second arm and having means for securing a spool of thread and said needle to said head, and having a cam surface externally thereof facing toward the bight of said support member, said needle being disposed on said head for reciprocal movement into and out of said needle well by slidably engaging the walls of said needle well passage; a looper pivotally supported on said first arm of said member underneath the needle well; a resilient member mounted on said assembly for frictionally engaging thread from a spool; an L-shaped member with a horizontal branch

supported for reciprocation relative to said first arm and providing a vertical branch extending into said second arm; a connecting rod pivotally connected at one end to said looper and pivotally connected at the other end to said L-shaped member; a push bar restrained for reciprocal motion by said second arm to engage said vertical branch of said L-shaped member and extending along said second arm to engage said vertical branch of said L-shaped member and extending along said second arm a distance to engage said cam surface when said movable head assembly is moved toward said first arm; and spring means for biasing said head assembly away from said needle well and for biasing said looper to a thread-engaging position under said needle well; said cam surface defining a looper motion whereby downward movement of the head assembly carries the needle through the needle well passage to pierce a thread loop formed by the looper while the cam frictionally engages the push bar with said cam surface to pivotally retract said looper from the thread-engaging position and subsequent upward motion under the bias of said spring means returns said looper to the thread-engaging position to thereby strip thread from a spool under thread tension maintained by said resilient member.

3. A hand operated sewing machine for chain stitching comprising in combination, a V-shaped support member having a first horizontal arm joined at a bight to a second arm sloping obliquely upwardly from said first arm; a needle well in said first arm; a needle; a movable head assembly reciprocably supported by said second arm and having means for securing a spool of thread and said needle to said head, and having a cam surface externally thereof facing toward the bight of said support member, said needle being disposed on said head assembly for reciprocal movement into and out of said needle well; a looper pivotally supported on said first arm of said member underneath the needle well; an L-shaped member with a horizontal branch supported for reciprocation relative to said first arm and providing a vertical branch extending into said second arm; a connecting rod pivotally connected at one end to said looper and pivotally connected at the other end to said L-shaped member; a push bar restrained for reciprocal motion by said second arm to engage said vertical branch of said L-shaped member and extending along said second arm a distance to engage said cam surface when said movable head assembly is moved toward said first arm; and means for biasing said head assembly away from said needle well and for biasing said looper to a thread-engaging position under said needle well.

4. A sewing machine for chain stitching comprising in combination, a support member having a first horizontal arm and a second arm sloping upwardly from said first arm; a needle; a movable head reciprocably supported by the second arm of said member, having means for securing a spool of thread and said needle to said head, and having a cam surface externally thereof facing toward the bight of said member; a looper pivotally supported on said first arm of said member, underneath the needle well; an L-shaped member supported for reciprocation relative to said first arm and providing a branch extending into said second arm; a connecting rod pivotally connected at one end to said looper and pivotally connected at the other end to said L-shaped member; and a push bar restrained for reciprocal motion by said second arm to engage said branch of said L-shaped member and extending along said second arm a distance to engage said cam surface when said movable head is moved toward said first arm; and spring means for biasing said head assembly away from said needle well and for biasing said looper to a thread-engaging position under said needle well; said cam surface defining a looper motion whereby downward movement of the head assembly carries the needle through the needle well passage to pierce a thread loop forward by the looper while the cam frictionally engages

the push bar with said cam surface to pivotally retract said looper from the thread-engaging position and subsequent upward motion returns said looper to the thread-engaging position thereby to strip thread from a spool under thread tension maintained by said resilient member.

5. A sewing machine comprising in combination, a support member having a first horizontal arm joined at a bight to a second arm sloping obliquely upwardly from said first arm; a needle well in said first arm; a needle; a movable head assembly reciprocably supported by the second arm of said member, having means for securing a spool of thread and said needle to said head, and having a cam surface externally thereof facing toward the bight of said support member, said needle being secured to said head assembly for reciprocal movement into and out of said needle well; a looper supported on said first arm of said member at a thread-engaging position underneath the needle well; an L-shaped member with a horizontal branch supported for reciprocation relative to said first arm and providing a vertical branch extending into said second arm; means for connecting said looper to said L-shaped member; and a push bar restrained for reciprocal motion by said second arm to engage said branch of said L-shaped member and extending along said second arm a distance to engage said cam surface when said movable head is moved toward said first arm, and spring means for biasing said head assembly away from said needle well and for biasing said looper to a thread-engaging position under said needle well; said cam surface defining a looper motion whereby downward movement of the head assembly carries the needle through the needle well passage to pierce a thread loop formed by the looper while the cam frictionally engages the push bar with said cam surface to pivotally retract said looper from the thread-engaging position and subsequent upward motion returns said looper to the thread-engaging position.

6. A sewing machine comprising a support member having a needle well; a looper pivotally mounted on said supporting member beneath said well; a needle; a head, having means for carrying said needle, and slidably supported from said member to move said needle in and out of said needle well; a cam surface defining a looper motion secured to said head; a timing means to connect the needle and looper for relative timed motion including means slidably supported from said support member for frictionally engaging said cam surface and said looper and for translating said motion from said cam to said looper to retract said looper from beneath said well responsive to movement of said head and said cam surface toward said needle well, the looper retraction defined by the cam normally releasing a loop of thread to the needle from the looper as the needle passes the looper; and means for biasing said head away from said needle well and for biasing said looper to a position beneath said needle well.

7. A sewing machine for chain stitching comprising in combination, a support member having a first horizontal arm joined at a bight to a second arm sloping obliquely upwardly from said first arm; a needle well having internal walls defining a passage therethrough; a needle; a movable head reciprocably supported by the second arm of said member, having means for securing a spool of thread and a needle to said head, and having a cam surface externally thereof facing toward the bight of said member; a looper pivotally supported on said first arm of said member at a thread engaging position underneath the needle well; an L-shaped member supported for reciprocation relative to said first arm and providing a branch extending into said second arm; a connecting rod pivotally connected at one end to said looper and pivotally connected at the other end to said L-shaped member; a push bar restrained for reciprocal motion along said second arm to engage said branch of said L-shaped member and extending along said second arm a distance to engage said cam surface when said

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movable head is moved toward said first arm; and spring means for biasing said head assembly away from said needle well and for biasing said looper to a thread-engaging position under said needle well; said cam surface defining a looper motion whereby downward movement of the head assembly carries the needle through the needle well passage to pierce a thread loop formed by the looper while the cam frictionally engages the push bar with said cam surface to pivotally retract said looper from the thread-engaging position and subsequent upward motion returns said looper to the thread-engaging position thereby to strip thread from a spool under thread tension maintained by said resilient member.

8. A sewing machine comprising in combination a frame having a horizontal arm and an upwardly extending oblique arm, both arms being joined together at a bight; a needle well having walls defining a tapered passage therethrough disposed in said horizontal arm; a needle; a head slidably supported from said oblique arm and including means for aligning said needle for slidably engaging the walls of said needle well as the head is slidably moved relative to said oblique arm; a looper pivotally connected to said horizontal arm for pivotal rotation in a plane passing through both said arms; a cam affixed to said head; a vertical member slidably mounted in said horizontal arm for horizontal reciprocal motion parallel to said horizontal arm; a push bar slidably restrained by said oblique arm and having a first end disposed for engaging said cam and second end disposed to engage said vertical member; and means for connecting said vertical member to said looper.

9. In a sewing machine having a frame slidably supporting a reciprocable head that receives and supports a needle, and a needle well disposed in the frame beneath said head through which is passed a needle carried by the head when the latter is linearly reciprocated toward said needle well, a mechanism for timing the operation of the head with a looper supported beneath the well and comprising a cam having an irregular face affixed to said head for reciprocable linear movement therewith; means frictionally engageable by said cam and connected to said looper, for translating into a predetermined motion of said looper the motion defined by said cam during a preselected portion of the reciprocable linear movement of said head, the predetermined motion comprising retracting said looper from an initial position beneath said needle well responsive to and during downward motion of said cam in unison with said head and returning said looper to the initial position responsive to and during movement in the opposite direction of said cam in unison with said head.

10. In a sewing machine having a frame slidably supporting a linearly reciprocable head that receives and supports a needle, and a needle well disposed in the frame beneath said head through which is passed a needle carried by the head when the latter is linearly reciprocated toward said needle well, a mechanism for timing the operation of the head with a looper supported and comprising means for pivotally supporting said looper beneath said well, a cam with a timing face affixed to said head for reciprocable linear movement therewith; means engageable by said cam and connected to said looper, for translating into a predetermined pivotal motion of said looper the motion defined by said cam during a preselected portion of the reciprocable linear movement of said head, the predetermined motion comprising pivotally retracting said looper from an initial position beneath said needle well responsive to and during downward motion of said cam in unison with said head and pivotally returning said looper to the initial position responsive to and during movement in the opposite direction of said cam in unison with said head.

11. In a sewing machine having a frame slidably supporting a linearly reciprocable head, the head having a needle securing means; a needle well disposed beneath said head in said frame at a position such that when

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the head carrying a needle is reciprocated, the needle passes into and out of the well; and a looper supported from the frame and disposed underneath the well to engage any thread carried by a needle; a means for timing movement of the looper with reciprocal motion of the head thereby to retract and return the looper from and to, respectively, a thread-engaging position beneath the well during respective predetermined terminal portions of a reciprocation of the head toward and away from the well, and comprising a cam affixed to said head for linear reciprocal movement in unison therewith; means, supported by said frame between said cam and said looper to be engageable with each of the latter, for retracting said looper out of and returning it to a thread engaging position responsive to the motion defined by said cam when said head is linearly reciprocated; said cam having a contour defining retraction and return of said looper during said predetermined terminal portions of a reciprocation of the head; said looper including a looper base movably supported from said frame generally beneath said well, a looper arm cantilevered out from said base, and a looper collar spaced from the underside of said arm and from said base.

12. In a sewing machine having a frame slidably supporting a linearly reciprocable head, the head having a needle securing means; a needle well disposed beneath said frame at a position such that when the head carrying a needle is linearly reciprocated, the needle passes into and out of the well; and a looper supported from the frame and disposed generally underneath the well to engage any thread carried by a needle; a means for timing movement of the looper with reciprocal linear motion of the head thereby to retract and return the looper from and to, respectively, a thread-engaging position beneath the well during respective predetermined terminal portions of a reciprocation of the head toward and away from the well, and comprising a looper having a looper base pivotally supported from said frame generally beneath said well, a looper arm cantilevered out from said base, and a looper collar spaced from the underside of said arm and from said base; a cam affixed to said head for linear reciprocal movement in unison therewith; means, supported by said frame between said cam and said looper to be engageable with each of the latter, for pivoting said looper out of and into a thread engaging position responsive to the motion defined by said cam when said head is linearly reciprocated; said cam having a contour defining retraction and return of said looper during said predetermined terminal portions of a reciprocation of the head; at least one of said looper arm and collar engaging the thread to form a forward falling loop of thread passed through by the needle in the terminal portion of a downstroke.

13. A sewing machine comprising in combination a frame having a horizontal arm and an upwardly extending oblique arm, both arms being joined together at a bight; a needle well disposed in said horizontal arm; a head slidably supported from said oblique arm and including means for carrying a needle into and out of said needle well as the head is slidably moved relative to said oblique arm; a looper pivotally connected to said horizontal arm for pivotal rotation in a plane passing through both said arms; a cam affixed to said head; a first reciprocable member, slidably supported from said horizontal arm for horizontal movement relative thereto, having a vertical branch angling upwardly at the end of said member adjacent said bight; a second reciprocable member slidably mounted from said oblique arm for movement parallel thereto responsive to engagement of one end of the second member by said cam, the other end of the second member being disposed to engage said vertical branch; and means for connecting said second member to said looper arm; said cam having a contour so proportioned that said looper is pivotally retracted from a position beneath said well in response to motion translated from said cam by said first and second members and said

means when said head is moved from full up to full down and that said looper is pivotally returned to said position by said response when said head is subsequently moved from full down in the opposite direction.

14. A sewing machine comprising in combination a frame having a horizontal arm and an upwardly extending oblique arm, both arms being joined together at a bight; a needle well disposed in said horizontal arm; a head slidably supported from said oblique arm and including means for removably supporting a spool and means for carrying a needle into and out of said needle well as the head is slidably moved relative to said oblique arm; said means for supporting a spool including a removable hollow cylindrical body with a longitudinal thread slot therein and a ring of elastomeric frictional material surrounding one end of said body; a looper pivotally connected to said horizontal arm; a cam affixed to said head; a first reciprocable member, slidably supported from said horizontal arm for horizontal movement relative thereto, having a vertical branch angling upwardly at the end of said member adjacent said bight; a second reciprocable member slidably mounted from said oblique arm for movement parallel thereto responsive to engagement of one end of the second member by said cam, the other end of the second member being disposed to engage said vertical branch; and means for connecting said second member to said looper arm; said cam having a contour so proportioned that said looper is pivotally retracted from a position beneath said well in response to motion translated from said cam by said first and second members and said means when said head is moved from full up to full down and that said looper is pivotally returned to said position by said response when said head is subsequently moved from full down in the opposite direction.

15. A sewing machine comprising in combination a frame having a horizontal arm and an upwardly extending oblique arm, both arms being joined together at a bight; a needle well disposed in said horizontal arm; a head slidably supported from said oblique arm and including means for removably supporting a spool and means for carrying a needle into and out of said needle well as the head is slidably moved relative to said oblique arm; said means for supporting a spool including a removable hollow cylindrical body with a longitudinal thread slot therein and a ring of elastomeric frictional material surrounding one end of said body; a looper pivotally connected to said horizontal arm; a cam affixed to said head; a first reciprocable member, slidably supported from said horizontal arm for horizontal movement relative thereto, having a vertical branch angling upwardly at the end of said member adjacent said bight; a second reciprocable member slidably mounted from said oblique arm for movement parallel thereto responsive to engagement of one end of the second member by said cam, the other end of the second member being disposed to engage said vertical branch; means for connecting said second member to said looper arm; said cam having a contour so proportioned that said looper is pivotally retracted from a position beneath said well in response to motion translated from said cam by said first and second members and said means when said head is moved from full up to full down and that said looper is pivotally returned to said position by said response when said head is subsequently moved from full down in the opposite direction; and a thread cutter having a dull cutter bar swingably mounted from said oblique arm at a radius to swing out from said arm to engage thread extending from a needle in said head to a workpiece over said well.

16. A sewing machine comprising in combination a frame having a horizontal arm and an upwardly extending oblique arm, both arms being joined together at a bight; a needle well disposed in said horizontal arm and having tapered walls defining an inverted frusto-conical passage therethrough, a needle; a head slidably supported from said oblique arm and including means for carrying said needle into slidably engagement with the tapered wall of said well concurrently with movement of the needle into and out of said well as the head is slidably moved relative to said oblique arm; a looper pivotally connected to said horizontal arm and having means for engaging a loop of thread both internally and externally of the loop; a cam affixed to said head; a first reciprocable member, slidably supported from said horizontal arm for horizontal movement relative thereto, having a vertical branch angling upwardly at the end of said member adjacent said bight; a second reciprocable member slidably mounted from said oblique arm for movement parallel thereto responsive to engagement of one end of the second member by said cam, the other end of the second member being disposed to engage said vertical branch; and means for connecting said second member to said looper arm; said cam having a contour so proportioned that said looper is pivotally retracted from a position beneath said well in response to motion translated from said cam by said first and second members and said means when said head is moved from full up to full down and that said looper is pivotally returned to said position by said response when said head is subsequently moved from full down in the opposite direction.

17. A sewing machine comprising in combination a frame having a horizontal arm and an upwardly extending oblique arm, both arms being joined together at a bight; a needle well disposed in said horizontal arm; a head slidably supported from said oblique arm and including means for carrying a needle into and out of said needle well as the head is slidably moved relative to said oblique arm; a looper pivotally connected to said horizontal arm for pivotal rotation in a plane passing through both said arms; a cam affixed to said head; a vertical member slidably mounted for horizontal reciprocal motion parallel to said horizontal arm; a push bar having one end disposed for engagement by said cam as the head is moved relatively to said oblique arm and the opposite end disposed to engage said vertical member; and means for connecting said vertical member to said looper whereby sliding the head toward said needle well engages the cam with the push bar to retract the looper from beneath said needle well.

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