# United States Patent [19]

**Doyel**

[11] **3,837,306**

[45] **Sept. 24, 1974**


[54] **PORTABLE LIGHTWEIGHT HAND-HELD SEWING MACHINE**


[76] Inventor: **John S. Doyel,** 404 W. 20th St., New York, N.Y. 10011



[22] Filed: **Mar. 26, 1973**

[21] Appl. No.: **344,608**

**Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 286,719, Sept. 6, 1972, abandoned.

[52] **U.S. Cl.** ..... **112/169,** 112/216

[51] **Int. Cl.** ..... **D05b 1/00,** D05b 27/02

[58] **Field of Search** ..... 112/169, 199, 197, 166, 112/165, 237, 218 R, 218 A, 215, 216; 223/102, 104



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*Primary Examiner*—James R. Boler



[57] **ABSTRACT**

A portable, lightweight, hand-held, chainstitching sewing machine having: a reliable and inexpensive device for raising and locking the presser foot carrier rod; a pivoted spool spindle moveable between a storage position in which it is nearly flush with a side wall of the sewing machine housing and a working position in which it extends perpendicularly away from that wall; a uniquely shaped feed dog cooperating with the needle and with the hook to facilitate loop forming; a uniquely shaped hook providing reliable loop forming; and a needle support biased to a position facilitating loop forming.


**8 Claims, 23 Drawing Figures**

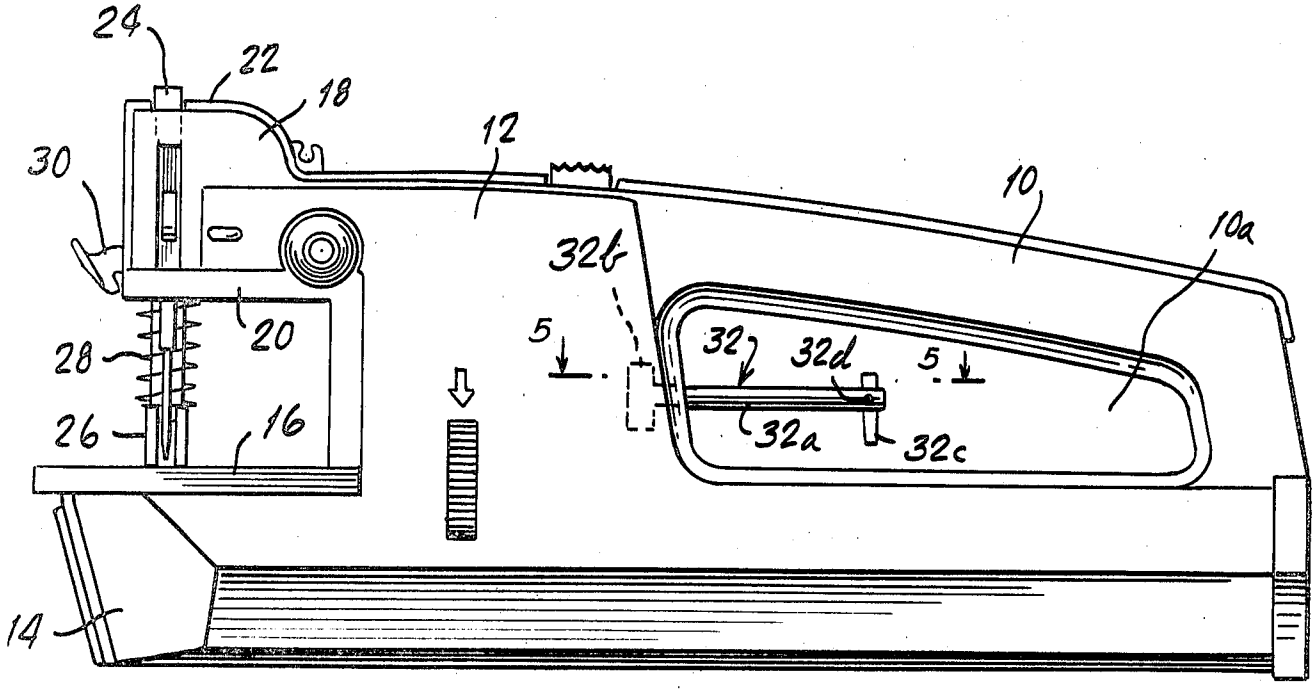


Fig. 1.

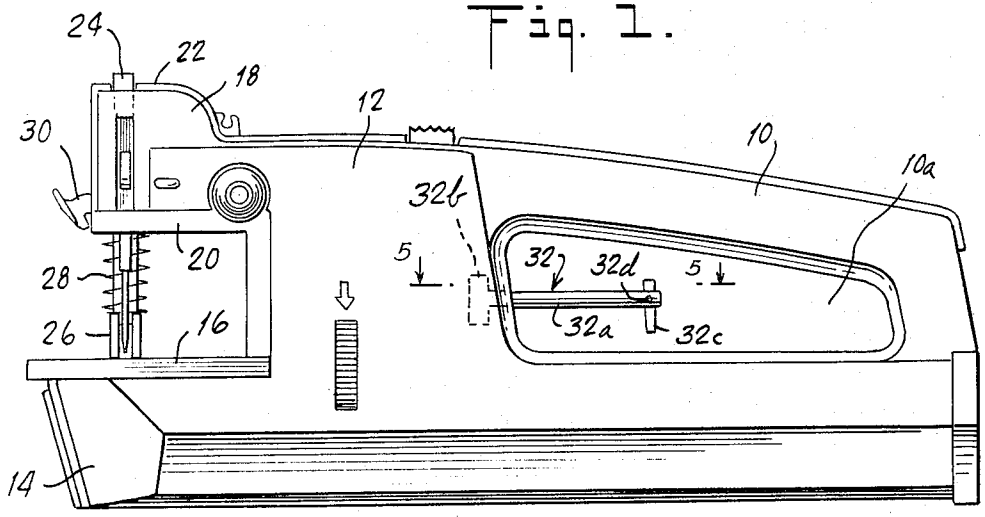



Fig. 2.

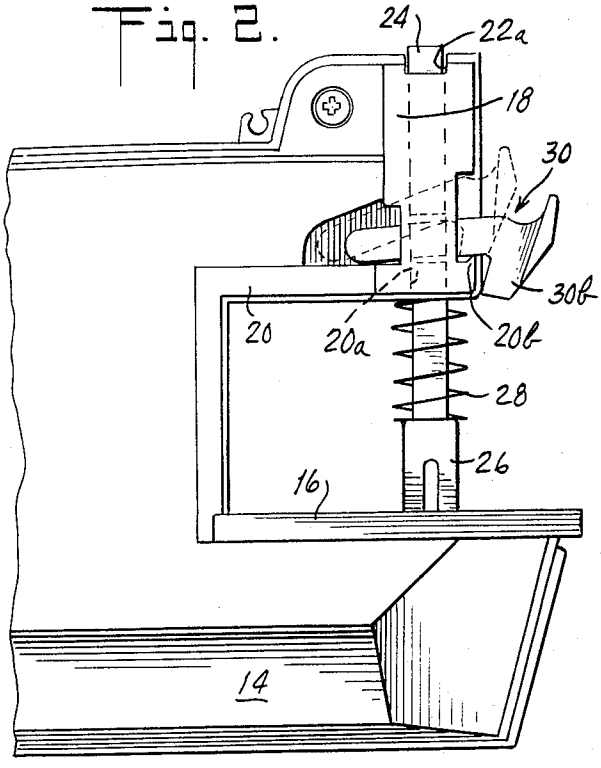



Fig. 3.

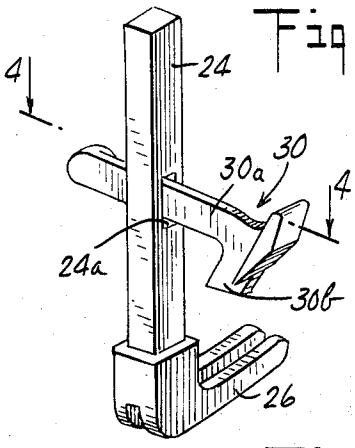



Fig. 4.

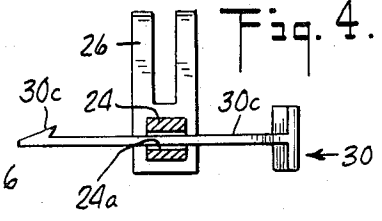
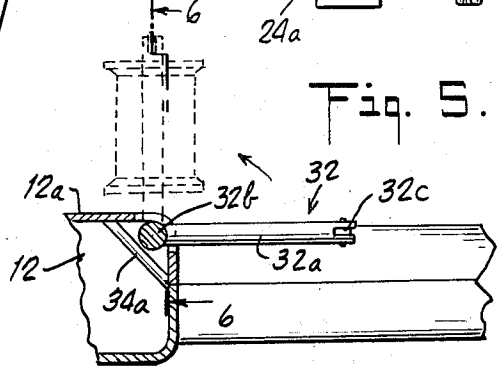



Fig. 5.



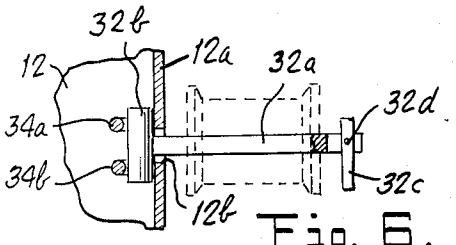




Fig. 6.

Fig. 7.

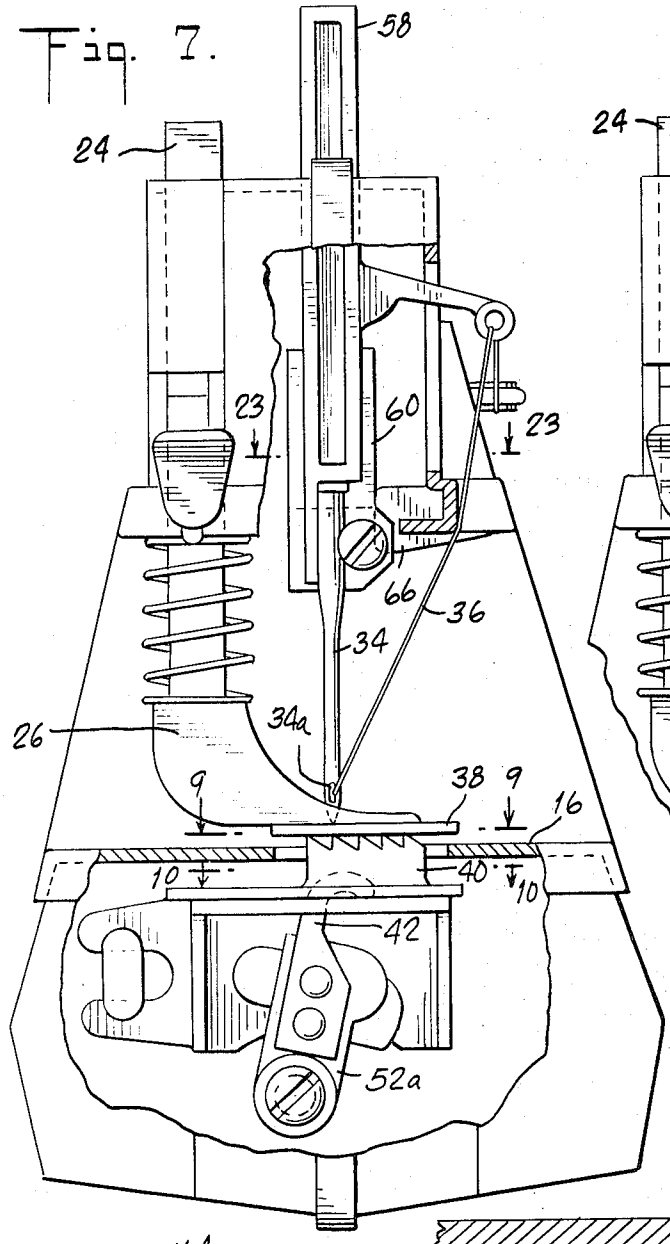
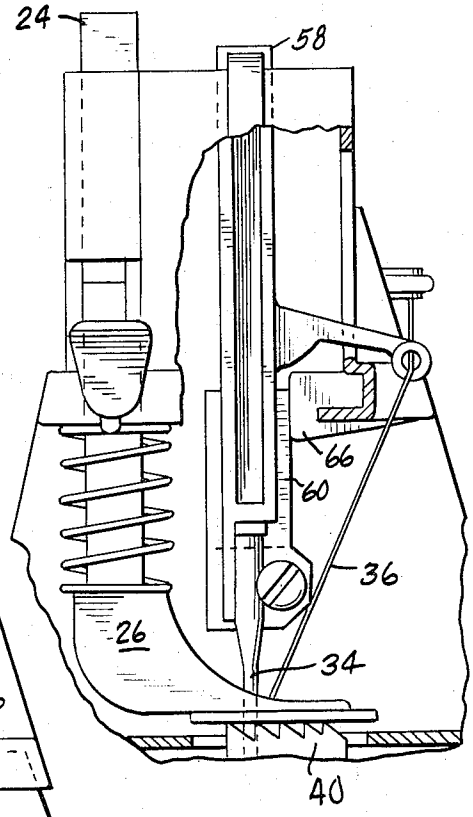



Fig. 8.



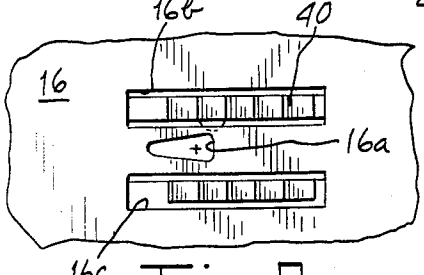




Fig. 9.

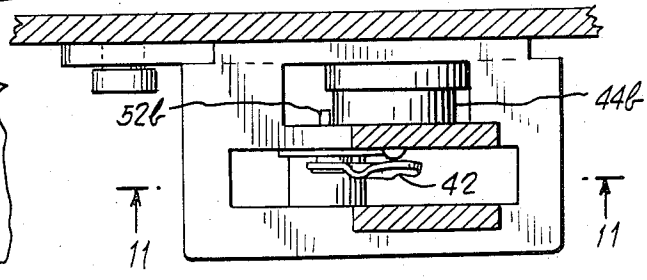



Fig. 10.

Fig. 11.

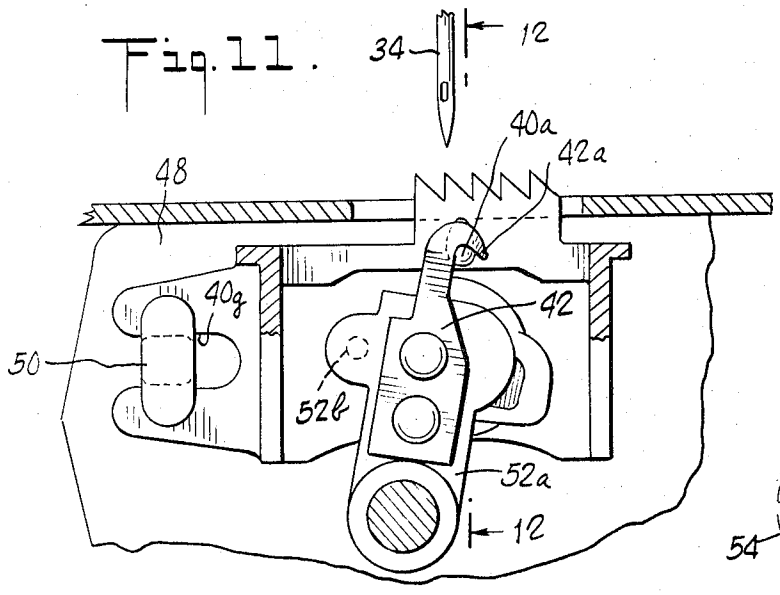



Fig. 12.

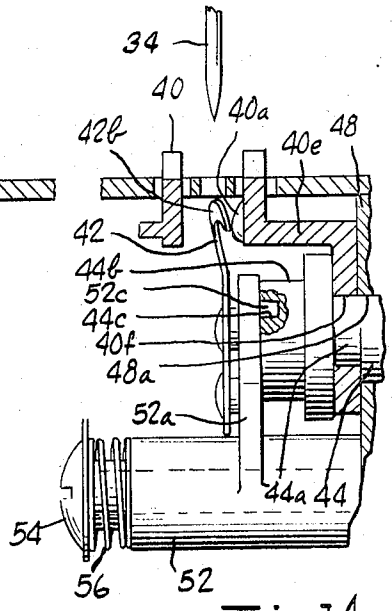



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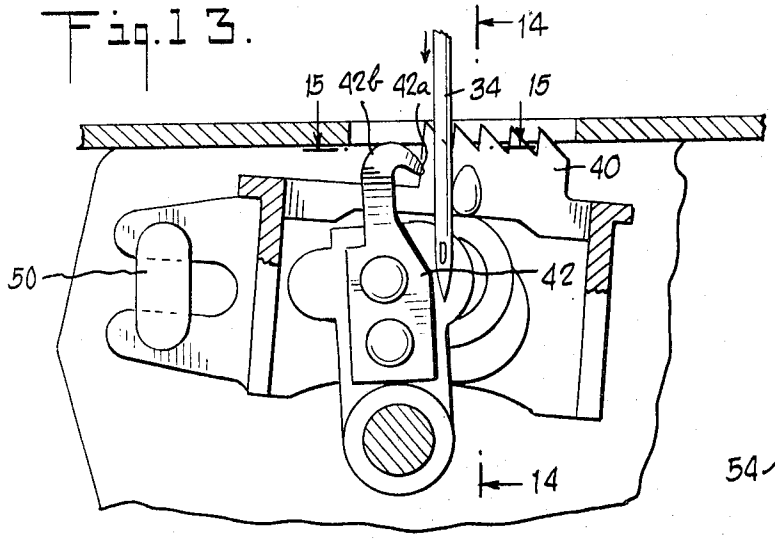



Fig. 14.

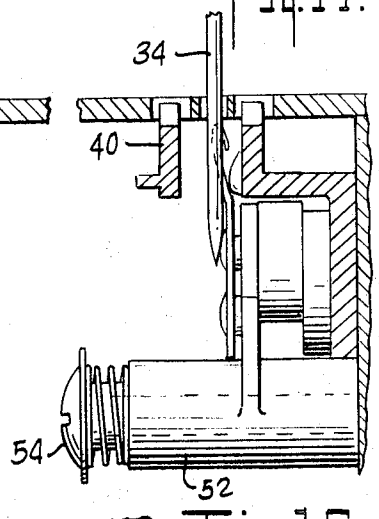



Fig. 15.

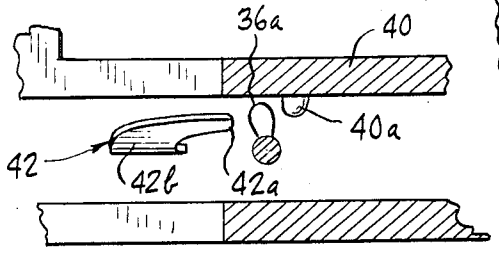



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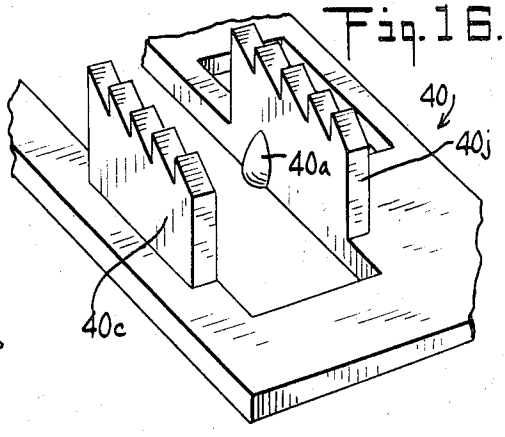


Fig. 17.

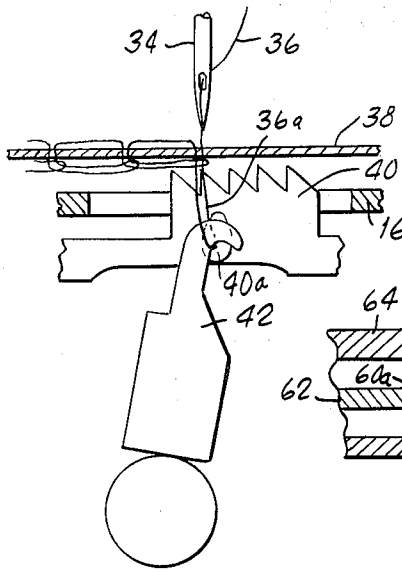



Fig. 23.

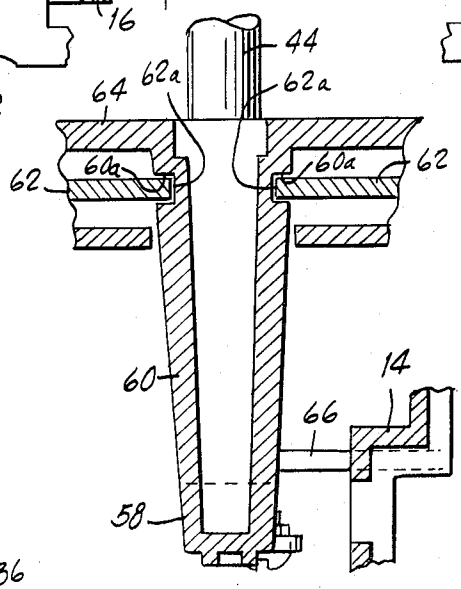



Fig. 18.

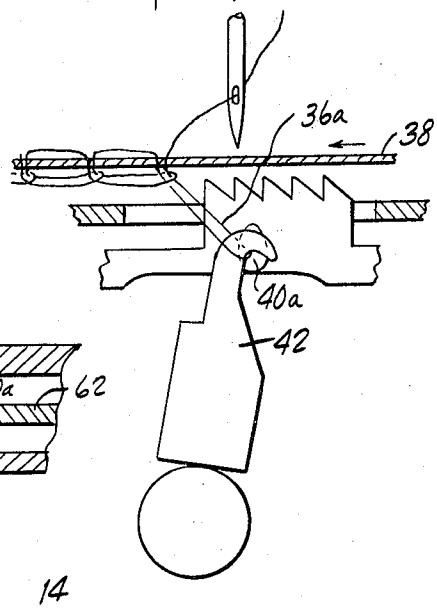



Fig. 19.

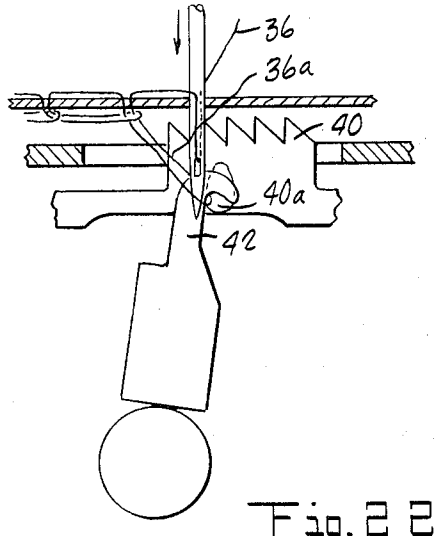



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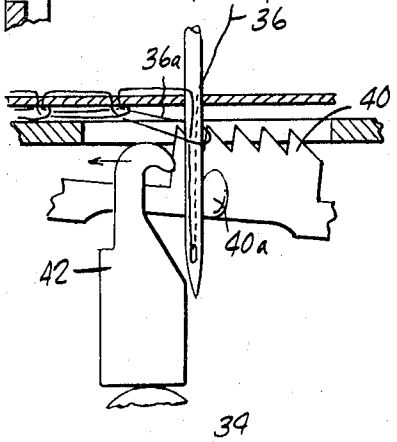
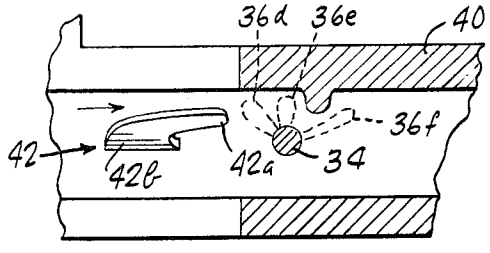



Fig. 22.



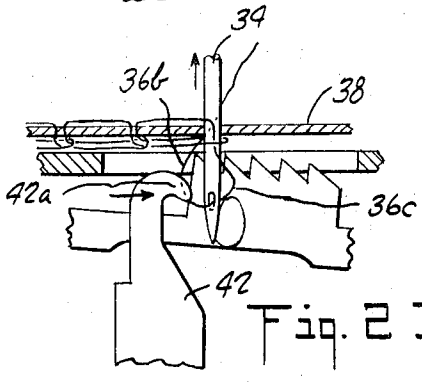




Fig. 21.

# PORTABLE LIGHTWEIGHT HAND-HELD SEWING MACHINE

## CROSS-REFERENCES TO RELATED APPLICATIONS

This application is a continuation-in-part of U.S. Pat. application Ser. No. 286,719 filed on Sept. 6, 1972 by the same inventor now abandoned in favor of the subject continuation-in-part part patent application.

## BACKGROUND OF THE INVENTION

The invention relates to portable lightweight hand-held sewing machines, and particularly to chain stitchers of the type disclosed in U.S. Pats. Nos. 2,594,534; 2,637,288; 2,778,328; and 3,034,459. In basic principles of operation, the sewing machine disclosed herein is similar to the machine disclosed in U.S. Pat. No. 2,778,328.

Desirable characteristics of sewing machine of the type disclosed herein are light weight, general simplicity of operation, inexpensive construction and reliable operation. An object of the subject invention therefore is to simplify, and enhance the reliability of, certain aspects of lightweight, portable hand-held sewing machines, and the subject invention concentrates specifically on: means for raising and locking the presser foot carrier rod; a spool spindle which can be conveniently moved to a storage position in which it is nearly flush with a side wall of the machine and can be moved therefrom to a working position in which it extends perpendicularly away from that side wall; and a feed dog, a loop taking hook and a biased needle support which cooperate to facilitate loop forming.

## SUMMARY OF THE INVENTION

An object of the invention is to provide a portable, hand-held chain stitching sewing machine which is simple in construction and in operation, which is inexpensive, and which provides reliable service.

The machine disclosed herein comprises a housing having a handle adapted to be hand-held, a base portion, and an upper portion disposed over the base portion and spaced therefrom. The base portion includes a horizontal upwardly facing throat plate serving as a work support surface, and the upper portion includes a downwardly facing plate which is over and spaced from the throat plate. The upper portion of the housing supports for vertical reciprocation a presser foot carrier rod which has a presser foot at its lower end. A spring urges the presser foot downwardly toward a working position in which it is pressed against the throat plate. The presser foot can be raised to a nonworking position, in which it is spaced from the throat plate to allow the insertion of work fabric therebetween, by a pin received in an aperture within the presser foot carrier rod and usable as a lever to raise the presser foot and also as a lock to lock the presser foot in its raised nonworking position.

The machine also includes a T-shaped spool spindle which has a stem portion extending outwardly of the machine housing through an opening in the side wall thereof, and an anchor portion pivotally mounted within the housing. This arrangement allows the spindle to be pivoted to a storage position in which it is nearly flush with the housing side wall to minimize the overall dimensions of the housing for easier storage. The spindle can be pivoted outwardly, from the storage position to a working position in which it extends nearly perpendicularly outwardly of the housing to allow for conveniently mounting a spool thereon. The outward tip of the spool spindle has a lock to retain a spool mounted on the spindle.



Reliable loop forming is facilitated by a device which tends to push loops toward the loop taking hook, and by a hook which is uniquely shaped.

In particular, the machine includes a feed dog moving in a periodic motion along a defined path in a timed relationship with the vertical reciprocation of the needle. The feed dog includes a loop assist projection extending from the feed dog toward the needle in the area where a loop is formed while the needle is moving up. The motions of the needle, the feed dog and the hook are in such timed relationship that while the needle is moving up from its lowest position, a thread loop forms and extends from the needle toward the wall of the feed dog which has the loop assist projection. As the needle continues moving up the hook moves toward the needle and engages the loop, while the feed dog and its loop assist projection move in a direction opposite that of the hook to thereby tend to push the loop toward the hook and to facilitate loop forming.

Loop forming is further facilitated by the unique shape of the hook and its position with respect to the needle and with respect to the feed dog.

In order to insure reciprocation of the needle along a well defined and fixed vertical path without using high precision components, the needle support is made of a stiffly resilient material and is biased against the resiliency of the material to avoid any play between components which may result in deviation of the needle from a defined path.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view of a portable hand-held sewing machine embodying the invented features.

FIG. **2** is an enlarged side elevational view of the front portion of the sewing machine shown in FIG. **1**, when viewed from the side opposite that shown in FIG. **1**.

FIG. **3** is a perspective view of means for raising and locking the presser foot carrier rod of the sewing machine shown in FIG. **1**.

FIG. **4** is a sectional view along line **4—4** of FIG. **3**.

FIG. **5** is a sectional view along line **5—5** of FIG. **1**.

FIG. **6** is a sectional view along line **6—6** of FIG. **1**.

FIG. **7** is a partly plan, partly broken front elevational view of the sewing machine.

FIG. **8** is a detail of the view in FIG. **7** and shows a needle and a needle support means in a position different from that in FIG. **7**.

FIG. **9** is a partial sectional view taken along line **9—9** of FIG. **7**.

FIG. **10** is a partial sectional view taken along line **10—10** of FIG. **7**.

FIG. **11** is a partial sectional view of a detail of FIG. **7**.

FIG. **12** is a sectional view taken along line **12—12** of FIG. **11**.

FIG. **13** is a view similar to FIG. **11** but showing a different position of the elements shown in FIG. **11**.

FIG. 14 is a sectional view taken along line 14—14 of FIG. 13.

FIG. 15 is a sectional view taken along line 15—15 of FIG. 13.

FIG. 16 is a perspective partial view of a feed dog having a loop assist projection.

FIGS. 17, 18, 19, 20 and 21 are partial sectional views of a detail of FIG. 11 showing different stages of loop forming.

FIG. 22 is a partial sectional view similar to FIG. 15, but showing several possible positions of a thread loop.

FIG. 23 is a partial sectional view along line 23—23 of FIG. 1.

## DETAILED DESCRIPTION

Referring to FIG. 1, the sewing machine comprises a housing including a handle 10 adapted to be hand-held, a body 12 enclosing conventional components (not shown here) such as an electric motor, batteries and driving gear, a base portion 14 topped by a horizontal throat plate 16 which serves as a work support surface, and an upper portion 18 disposed above the lower portion 14 and spaced therefrom. The upper portion 18 includes a downwardly facing plate 20 and an upper plate 22. The plates 20 and 22 have apertures 20*a* and 22*a* respectively (FIG. 2) which loosely receive a vertical presser foot carrier rod 24. The presser foot carrier rod 24 terminates at its lower end in a presser foot 26. A coil spring 28 is disposed between the presser foot 26 and the downwardly facing plate 20 and urges the presser foot 26 downwardly toward a working position against the throat plate 16. The apertures 20*a* and 22*a*, in the plates 20 and 22 respectively, provide a guideway for vertical reciprocating motion of the presser foot carrier rod 24.

It is conventional to provide some means for moving the presser foot carrier rod of a sewing machine in reciprocating vertical motion between a working position thereof in which it is against the throat plate and a nonworking position in which it is raised up from the throat plate to allow the insertion of a work fabric therebetween. In the subject invention, raising the presser foot and locking it in the nonworking position is done by raising and locking a pin 30 (FIG. 3) which consists of a backwardly extending stem portion 30*a* and a forward head portion having a downwardly extending lock foot 30*b*. The stem 38 of the pin 30 is loosely received within a slot aperture 24*a* through the presser foot carrier rod 24. As seen in FIG. 2, the stem 30*a* of the pin 30 is at all times intermediate the upper wall of the slot aperture 24*a* and the downwardly facing plate 20. A back portion of the stem 30*a* extends backwardly of the carrier rod 24 and is over the portion of the plate 20 which extends backwardly of the aperture 20*a* therein. A forward portion of the pin 30 extends forwardly of the carrier rod 24. When the presser foot is in its working position, the forward portion of the stem 30*a* is above a lip 20*b* which forms the front marginal end of the plate 20, and the lock foot 30*b* is in front of the lip 20*b* and clears it.

To raise the presser foot 26 and to lock it in its nonworking position, the pin 30 is moved from the solid line position shown in FIG. 2 to the dotted line position shown therein. In particular, the forward end of the pin 30 is grasped and lifted upwardly such that the stem 30*a* of the pin 30 acts as a lever having as one arm thereof the back portion of the stem 30*a* and as another arm thereof the forward portion of the stem 30*a*. The stem 30*a* thus acts against the upper wall of the slot aperture 24*a* in the carrier rod 24 and lifts the carrier rod against the action of the spring 28. When the forward end of the pin 30 is lifted sufficiently so that the lock foot 30*b* is over the lip 20*b* and clears it, the pin 30 is pushed backwardly to the dotted line position shown in FIG. 2. In that position, the lock foot 30*b* is against the lip 20*b* and is pressed against it by the force exerted on the stem 30*a* by means of the spring 38 which pulls the carrier rod 24 downwardly.

In order to retain the stem 30*a* of the pin 30 within the slot aperture 24*a* of the pressor foot carrier rod 24, the back end of the stem 30*a* is provided with a resilient hook 30*c* (FIG. 4) which allows insertion of the pin 30 into the slot aperture 24*a* of the carrier rod 24, but prevents complete withdrawal of the pin 30 once it is in place. The pin 30, as well as all other components shown in FIGS. 1–5, except for the spring 28, are made of a plastic material.

It is noted that the pin 30 also serves to hold the presser foot rod 24 to the housing 14 and to guide it in its vertical reciprocation; note that the stem 30*a* of the pin 30 extends between walls 14*g* and 14*h* which are an integral part of the housing 14.

One of the requirements for lightweight hand-held portable sewing machines of the type disclosed herein is compactness. For the purpose of facilitating compactness, the sewing machine disclosed herein is provided with a spool spindle which can be moved to a storage position in which it is nearly flush with a side wall of the sewing machine and thus minimizes the overall dimensions of the sewing machine to allow storage thereof in a minimal size container, and which is moveable from the storage position to a working position in which it provides a convenient, simple and reliable support for a spool of thread. Referring to FIG. 1, a T-shaped spool spindle 32 having a stem 32*a* and a bar 32*b* at the back end of the stem 32*a* is pivotally supported by the side wall 12*a* of the housing 12 which is opposite the side viewed in FIG. 1. Referring to FIGS. 5 and 6, the bar 32*b* of the spool spindle is inwardly of the side wall 12*a*, i.e., it is inside the housing 12, and the stem 32*a* of the spindle 32 extends outwardly of the housing 12 through a suitable aperture 12*b* in the side wall 12*a*. The spool spindle 32 is shown in FIG. 5 in solid lines in its storage position and in dotted lines in its working position. It is seen from FIGS. 1 and 5 that when the spool spindle 32 is in its storage position, it is nearly flush with the side wall 12*a* of the housing 12. In particular, referring to FIG. 1, it is seen that the spool spindle 32 is substantially within the opening below the handle 10 when it is in its storage position. When in its working position (FIG. 5), the spool spindle 32 extends outwardly of the housing 12 and is substantially perpendicular to the shown portion of the side wall 12*a*. Referring to FIGS. 5 and 6, the spool spindle 32 is provided with spool locking means comprising a finger 32*c* which is pivoted within the bifurcated forward end of the stem 32*a* by means of a pivot pin 32*d*. As seen in FIG. 6, the finger 32*c* moves between the solid line position so that a spool may be admitted on the spool spindle 32, and the broken line position shown in FIG. 6 so that the spool admitted on the spool spindle 32*a* may be locked in place. The finger 32*c* is frictionally retained in either of its two positions

shown in FIG. 6. The bar portion 32*b* of the spindle 32 is retained in its pivotally mounted positions by means of suitable pins affixed to the housing 12. Two of these pins, namely pins 34*a* and 34*b*, are shown in FIG. 6.

With respect to the position of the spool spindle 32, it is noted that when in the storage position, the spool spindle stem 32*a* is within the hand opening 10*a* below the handle 10, and that the opening 10*a* is sufficiently large to accommodate a spool remaining on the spindle 32 when the spindle is in a storage position.

The disclosed sewing machine is a chain stitcher and forms the conventional chain stitch, which is briefly illustrated in FIGS. 17 through 21.

Referring to FIG. 7, a needle 34 is reciprocated along a defined vertical path, and has a needle eye 34*a* carrying a thread 36. A work fabric 38 is intermittently moved leftwardly by a feed dog 40 which moves along a defined periodic path in a defined timed relationship wih the needle 34. Loops formed by the thread carrying eye needle 34 below the work support surface 16 are engaged by a hook 42 which is moved along a defined periodic path in a defined timed relationship with the needle 34 and with the feed dog 40.

A typical chain stitch is illustrated in FIGS. 17 through 21, where FIG. 17 shows the needle 34 in its up position and the hook 42 engaging a loop 36*a*. While the needle 34 is in its up position and the hook 42 holds the loop 36*a*, the feed dog 40 moves the work fabric 38 leftwardly. The needle 34 then comes down through the fabric and through the loop 36*a*, as shown in FIG. 19. Specifically, the needle tip strikes the forwardly and upwardly facing top portion of the hook 42 and slides between the hook 42 and the adjacent portion of the thread that forms the loop 36*a*. Once the needle 34 has gone through the loop 36*a*, the hook 42 starts moving leftwardly (as the needle 34 goes further downwardly), as shown in FIG. 20, and releases the loop 36*a*. Once the loop 36*a* is released, it is tightened as shown in FIG. 20 by the leftward motion of the work fabric 38 and by the further downward motion of the needle 34. The needle 34 then moves upwardly. As the needle 34 moves upwardly, a loop 36*b* forms behind the needle and a loop 36*c* forms in front of the needle. At that time the hook 42 is moving toward the needle 34, as shown in FIG. 21, and its tip 42*a* goes through the loop 36*b*, i.e., between the thread forming the loop 36*b* and the lower part of the needle 34, just above the needle eye 34*a*. As the hook 42 continues its motion to the right and the needle 34 continues its motion upwardly, the hook and the needle come to the relative positions shown in FIG. 17, and the cycle is repeated.

Referring to FIG. 22, it is seen that when the thread loop which forms when the needle 34 moves up is on the side of the approaching hook 42, the loop should be engaged by the hook, but that when the loop points away from the approaching hook, it may be missed by the hook. Thus, when the loop is similar to the loop 36*d* shown in FIG. 22, and points toward the approaching hook 42, there should be no difficulty with the loop being engaged by the hook. Similarly, there should be no difficulty when the loop points toward the adjacent face of the feed dog 40, as the loop 36*e* in FIG. 22. However, when the loop points away from the approaching hook 42, as the loop 36*f* in FIG. 22, it may be impossible for the hook 42 to engage the loop, with the result that a stitch may be missed. This is particularly undesirable with chain stitching sewing machines, and missed loops have long been a problem with chain stitchers.

In the sewing machine described here, special means are provided for facilitating loop forming and loop taking, in order to reduce substantially the possibility of missed loops. In particular, referring to FIGS. 15, 16 and 22, the feed dog 40 includes a loop assist projection 40*a* which tends to push the loops toward the approaching hook 42, so as to ensure their engagement by the hook 42. Specifically, the purpose of the loop assist projection 40*a* is to tend to prevent the formation of loops such as the loop 36*f* shown in FIG. 22.

The operation of the chain stitching sewing machine described herein is as follows. The throat plate 16 (FIGS. 7 and 9) which serves as a work support surface is provided with a needle aperture 16*a* and a pair of feed dog apertures 16*b* and 16*c* which flank the needle aperture 16*a*. The feed dog 40 comprises (FIG. 16) a pair of vertical walls 40*d* and 40*c* which are spaced from each other and face each other, and which have serrated upper portions that protrude, at least intermittently, through the feed dog apertures 16*d* and 16*c* respectively (FIGS. 7 and 9). The loop assist projection 40*a* extends from the side of the vertical wall 14*b* which faces the needle 34 (FIGS. 15 and 16). The feed dog 40 includes a back vertical wall 40*e* (FIG. 12) provided with a circular aperture 40*f* which receives an offset portion 44*a* of the shaft 44 which is selectively rotated by a suitable motor (not shown) that can be turned on and off by depressing and releasing a switch 46 (FIG. 1). It is noted that the cam portion 44*a* of the shaft 44 is offset from the center of the shaft 44 for reasons which will become apparent in the description below. The main portion of the shaft 44 is rotatably received within a suitable opening 48*a* in a vertical wall 48 which forms a part of the housing 14. The left-hand side of the back wall 40*e* of the feed dog 40 terminates in a fork (FIG. 11) whose opening 40*g* receives slidably the stem of a headed pin 50 extending forwardly from the wall 48. As the shaft 44 is rotated, the feed dog 40 moves periodically along a path which is defined by the offset of the shaft portion 44*a* from the center of the shaft 44 and by the sliding motion of the feed dog 40 with respect to the pin 50.

The hook 42 is suitably secured to a support comprising a hollow shaft 52 which is pivotally supported by a bolt 54 secured to the wall 48, and is biased toward the wall 48 by a spring 56. The hook 42 is affixed to a vertical arm 52*a* (FIG. 11) which extends upwardly from the shaft 52 and has a backwardly extending cam follower projection 52*b* (FIG. 10) which cooperates with a cam surface 44*b* formed integrally with the shaft 44, and another backwardly extending cam follower projection 52*c* (FIG. 12) which cooperates with a cam raceway 44*c* that also forms a part of the shaft 44. The motion of the hook 42 is thus defined by the axis of rotation of the shaft 52 and by the shape of the cam surface 44*b* and of the cam raceway 44*c*, and by the positions of the cam follower pins 52*b* and 52*c*.

The needle 34 is suitably secured to a needle shaft 58 (FIGS. 7, 8 and 23) which is formed integrally with a vertical plate 60 extending backwardly from the needle shaft 58 in the plane of the vertical path of the needle 34. The plate 60 is received for vertical reciprocation in a vertical slot 62*a* of a plate 62 which forms a part of the housing 14. A transverse cam plate 64 is integral with the plate 60 and is positioned just beyond the plate

62. The plate 64 forms a part of a conventional cam arrangement cooperating with the driving shaft 44 to reciprocate the plate 60, and hence the needle shaft 58 and the needle 34 along a vertical path. The timing of the vertical reciprocation of the needle 34 is thus defined by the cam connection between the plate 64 and the driving shaft 44. Any other suitable means for vertical reciprocation of the needle shaft 58 may be used, such as, for example, the means for reciprocating the needle shaft shown in U.S. Pat. No. 3,094,955 issued in 1963 to Fischbein et al.

The relative timing between the respective motions of the needle 34, the feed dog 40 and the hook 42 is such that when the needle 34 is in the lowest position of its vertical path (FIG. 13), the hook 42 is in its leftmost position and the right-hand side of the feed dog 40 is in its lowest and rightmost position. As the needle 34 starts moving up, the tip 42*a* of the hook 42 starts moving towards the needle, while the feed dog 40 remains substantially stationary. When the hook 42 comes to about the position of FIG. 21, the right-hand side of the feed dog 40 starts moving upwardly and leftwardly while the needle 34 is moving up and the hook tip 42*a* is moving rightwardly. It is noted that at this stage of the relative motions between the needle 34, the feed dog 40, and the hook 42, a thread loop 36*a* is formed and the loop assist projection 40*a* tends to push that loop 36*a* towards the approaching tip 42*a* of the hook 42, to facilitate the engagement of that loop by the hook.

The needle 34 continues moving up, the hook 42 continues moving to the right such that its tip 42*a* engages the thread loop 36*a* (FIG. 17) and the feed dog 40 continues its motion such that its right-hand end moves leftwardly and upwardly. As the needle 34 moves up far enough to clear the work fabric 38, the upward and leftward motion of the feed dog 40 accelerates, and the serrated upper edges of the feed dog 40 engage the work fabric 38 and move it leftwardly by a defined distance while the needle 34 is above the work fabric 38. When the leftward motion of the feed dog 40 is completed, the relative positions of the needle 34, the feed dog 40 and the hook 42 are as shown in FIG. 18. The needle 34 then starts its downward path, and the right-hand side of the feed dog 40 starts moving downwardly and rightwardly while the hook 42 remains for a while in the position shown in FIG. 18. With the hook 42 remaining in the position of FIG. 18, the tip of the needle 34 strikes the upper, forwardly facing surface of the hook 42 (FIGS. 15 and 19) and its point goes through the loop 36*a* which at this time is being held by the hook 42 (FIG. 19). After the needle 34 is through the loop 36*a*, the hook 42 starts pivoting leftwardly (FIG. 20) while the needle 34 continues downwardly and the right-hand side of the feed dog 40 continues moving downwardly and rightwardly.

In order to facilitate loop taking, the hook 42 has a uniquely shaped upper portion. The upper portion of the hook 42 terminates in a rightwardly pointing tip 42*a*, and the side of its upper portion which faces the needle path is convex. Referring to FIGS. 12, 15 and 22, the upper portion of the hook 42 includes a face 42*b* which faces forwardly and upwardly to engage the needle 34 and to facilitate entry of the needle point into a formed looped (see FIG. 19). In its downward path, the tip of the needle 34 first strikes the face 42*b* of the hook 42, just above the loop engaged thereby, and is somewhat deflected forwardly from its vertical path by the face 42*b* of the hook 42. Both the hook 42 and the needle 34 are somewhat resilient, and both bend somewhat upon engagement with each other: the needle bends outwardly, and the hook bends inwardly. Meanwhile, the needle tip goes through the loop held by the hook, as seen in FIG. 19, so that the loop can be retained by the needle 34 after the hook 42 starts moving leftwardly, as shown in FIG. 20.

In order to make sure that the hook 42 engages the loop 36*b* which is behind the needle 34 (FIG. 21) rather than the loop 36*c* which is forwardly of the needle 34, the tip 42*a* of the hook 42 points away from the needle (FIGS. 12 and 15) toward the wall 40 of the feed dog which has the loop assist projection 40*a*.

While it is desirable that the needle 34 reciprocate along a strictly defined vertical path, so that it consistently engages in the same manner with the hook 42, it is also desirable that the needle support means utilize components which are not precision parts, so that the cost of making the sewing machine can be reduced. For the purpose of accommodating these conflicting goals, the subject invention provides a needle support which is resiliently biased such that it reciprocates the needle 34 along a fixed vertical path in spite of possible substantial play between components. Referring to FIGS. 1, 7, 8, and 23, the needle 34 is suitably secured to a vertical needle bar 58, and the needle bar 58 is integrally formed with a backwardly extending vertical plate 60 whose back end is integrally formed with a transverse plate 64. The plate 60 reciprocates vertically with the needle 34, and the vertical reciprocation path is defined by means of the facing edges 62*a* of plates 62 which are integral with the machine housing 14. The facing edges 62*a* of the plates 62 serve as key guides and fit loosely within vertical key grooves 60 *a* in the plate 60. The assembly including the plates 64 and 60 and the needle rod 58 and the needle 34 is reciprocated vertically by means of a suitable cam (not shown) affixed to the shaft 44 and a suitable cam raceway (not shown) forming a part of the plate 64.

When low precision components are used, there would normally be considerable play between the key grooves 60*a* and the keys 62*a* fitting therein. In order to ensure reciprocation of the needle 34 along a fixed vertical path in spite of this possible play, the plate 60 is biased leftwardly by means of a bias cam 66 (FIG. 66) which is carried by the housing 14 and whose left end slidably engages the right side of the plate 60 and pushes the forward end of the plate 60 leftwardly against the natural resiliency of the plate 60, which is made of a stiffly resilient plastic material. In this manner, any play is taken by the resilient biasing of the plate 60, and the needle 34 is caused to reciprocate along a fixed vertical path.

It is understood that orientation terms such as "horizontal", "vertical", etc. are used merely for description convenience, and relate to only one of the many possible positions of the sewing machine disclosed here.

I claim:

1. A portable lightweight hand-held sewing machine comprising a housing having a handle adapted to be hand-held, having a base portion, and having an upper portion disposed over the base portion and spaced therefrom, with both the base portion and the upper portion spaced from the handle, said base portion of the housing including a horizontal upwardly facing

throat plate, said upper portion of the housing including: a downwardly facing plate having an aperture therein, said downwardly facing plate further having a lip extending forwardly of the aperture and a back portion extending backwardly of the aperture, a vertical presser foot carrier rod extending through said aperture and having a lower portion disposed intermediate the downwardly facing plate and the throat plate, a presser foot depending from the lower end of the rod, said rod having an upper portion extending above the downwardly facing plate and having a vertically extending slot aperture with an upper wall, means for supporting the presser foot carrier rod for reciprocating vertical movement, spring means for urging the presser foot toward a working position against the throat plate; and means for raising the presser foot carrier rod to a nonworking position and for locking it in the nonworking position, comprising: a raising and locking pin having a shank slidably and pivotally received in and extending through the slot aperture in the upper portion of the presser foot carrier rod and disposed intermediate the upper wall of the slot aperture and the downwardly facing plate, said shank having a back portion extending backwardly of the rod over the back portion of the downwardly facing plate and a forward portion extending forwardly of the plate lip when the presser foot is in its working position, said raising and locking pin further having a head comprising a downwardly extending lock foot clearing the plate lip and extending downwardly thereof when the presser foot is in its working position, said raising and locking pin moveable vertically to move therewith the presser foot carrier rod upwardly from the presser foot working position to the nonworking position and to move the pin lock foot to a position in which it is above the lip of the downwardly facing plate, said pin additionally moveable backwardly within the presser foot carrier rod slot aperture until the pin lock foot is over said lip to lock therewith when released, with the spring means urging the presser foot carrier rod downwardly, and with the upper wall of the slot aperture in the rod pressing downwardly against the pin shank and thereby pressing the lock foot against the plate lip.

**2.** A sewing machine as in claim **1** including a side wall of the housing having a side facing opening, a spool spindle having a stem extending outwardly of the housing through said opening therein and having an anchor back portion disposed inwardly of the side wall, means for pivotally supporting the anchor portion of the spindle to allow pivoting the spindle between a storage position in which the spindle stem is adjacent and substantially parallel with a portion of the side wall and a working position in which the spindle stem extends outwardly of the housing side wall and is substantially perpendicular to a portion thereof.

**3.** A lightweight, hand-held, chain stitching sewing machine comprising:

a housing including an upwardly facing work support surface having means defining a needle aperture and a feed dog aperture in the work support surface;

a thread carrying eyed needle and needle support means secured to the housing for endwise reciprocation of the needle along a vertical path through the needle aperture;

a loop taking hook and hook support means secured to the housing for periodic movement of the hook along a defined path below the work support surface;

means for feeding a work fabric along the work support surface and over the needle aperture in a defined direction transverse to the needle path, said feeding means including a feed dog having a fabric engaging portion which protrudes at least intermittently upwardly through said feed dog aperture in the work support surface and a wall portion located below the work support surface adjacent and facing the needle path, said wall portion having means for engaging thread loops extending thereto and coming into contact therewith, and feed dog support means secured to the housing for periodic movement of the feed dog along a defined path;

means for driving the needle support means, the hook support means and the feed dog support means in such timed relationship that while the needle is moving up from the lowest position along its vertical path, a thread loop forms and extends from the needle toward said wall portion of the feed dog, as the needle continues moving up the hook moves toward the needle and engages said loop, and the feed dog and said wall portion thereof move, as the needle moves up, in a direction opposite the direction in which the hook moves to engage said loop, whereby said wall portion of the feed dog tends to engage a loop extending towards it from the needle and to move the loop toward the approaching hook to thereby facilitate engagement of the loop by the hook.

**4.** A chain stitching sewing machine as in claim **3** wherein the means for engaging thread loops comprise a loop assist projection affixed to the wall portion of the feed dog and extending toward the needle, said loop assist projection tending to engage successive loops extending toward it from the needle and to move said loops toward the hook for engagement thereby.

**5.** A chain stitching sewing machine as in claim **4** wherein the hook includes a loop taking portion which is disposed between the needle and said loop assist projection for at least a portion of the periodic movement of the hook along the defined path.

**6.** A chain stitching sewing machine as in claim **5** wherein the loop engaging porion of the hook terminates in a tip facing away from the needle toward said wall portion of the feed dog, and wherein the hook further includes a needle engaging portion which is further away from said wall portion of the feed dog than the hook tip and engages the needle for at least a portion of the periodic movement of the hook along its defined path.

**7.** A chain stitching sewing machine as in claim **6** wherein the hook intercepts the vertical path of the needle for at least a portion of its periodic movement and deflects the needle tip from its vertical path.

**8.** A chain stitching sewing machine as in claim **7** wherein the needle support means comprises a stiffly resilient plate extending away from the needle along a plane including the vertical path of the needle, means for slidably supporting the plate within the housing for vertical reciprocation of the plate, and biasing means extending from the housing and engaging said plate to bias the plate toward one side of its plane.

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