Feb. 14, 1967 J. W. CRAWFORD 3,303,802

SOLENOID BOBBIN WINDERS

Filed Feb. 19, 1964 2 Sheets-Sheet 1

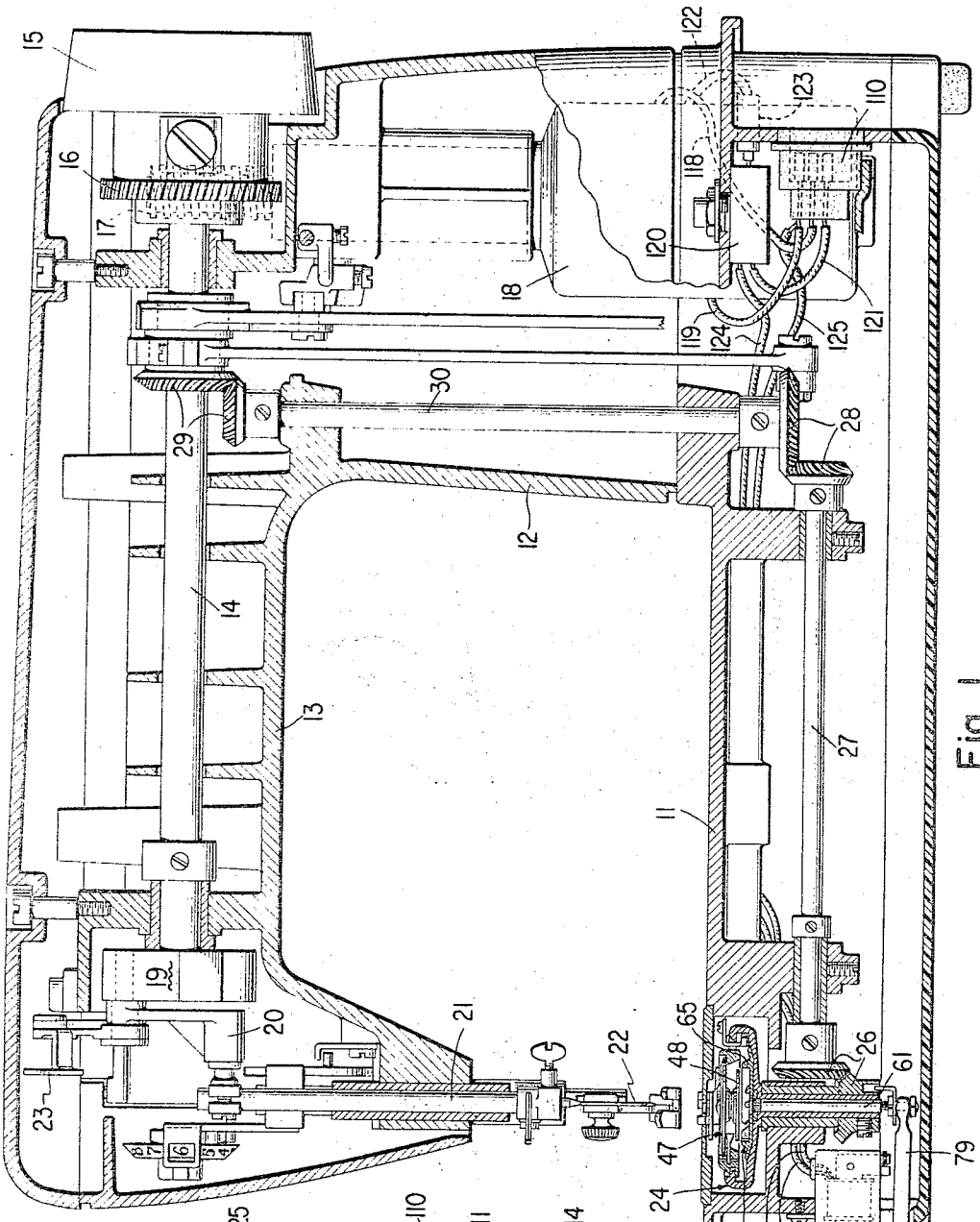


Fig. 1.

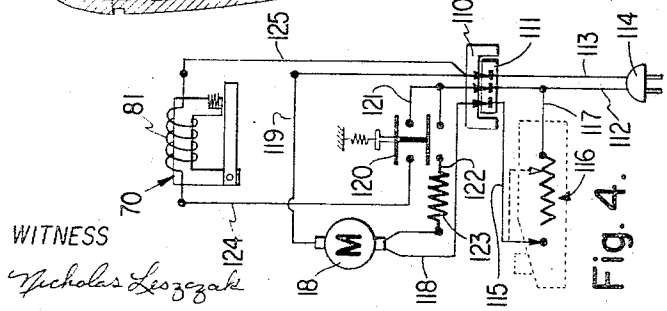


Fig. 4.

WITNESS

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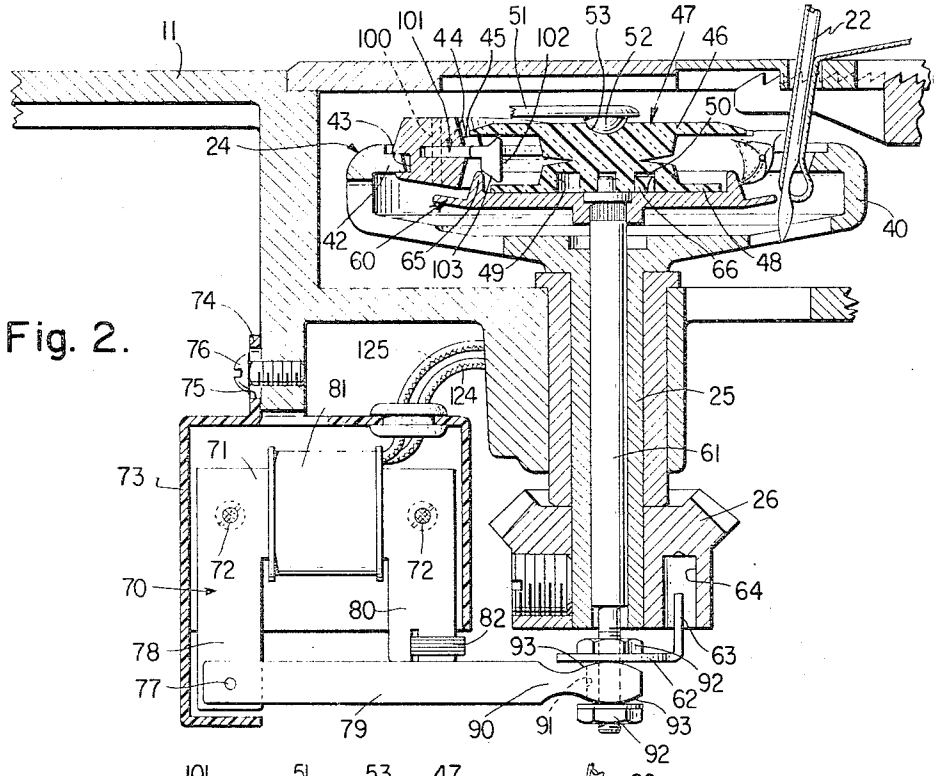


Fig. 2.

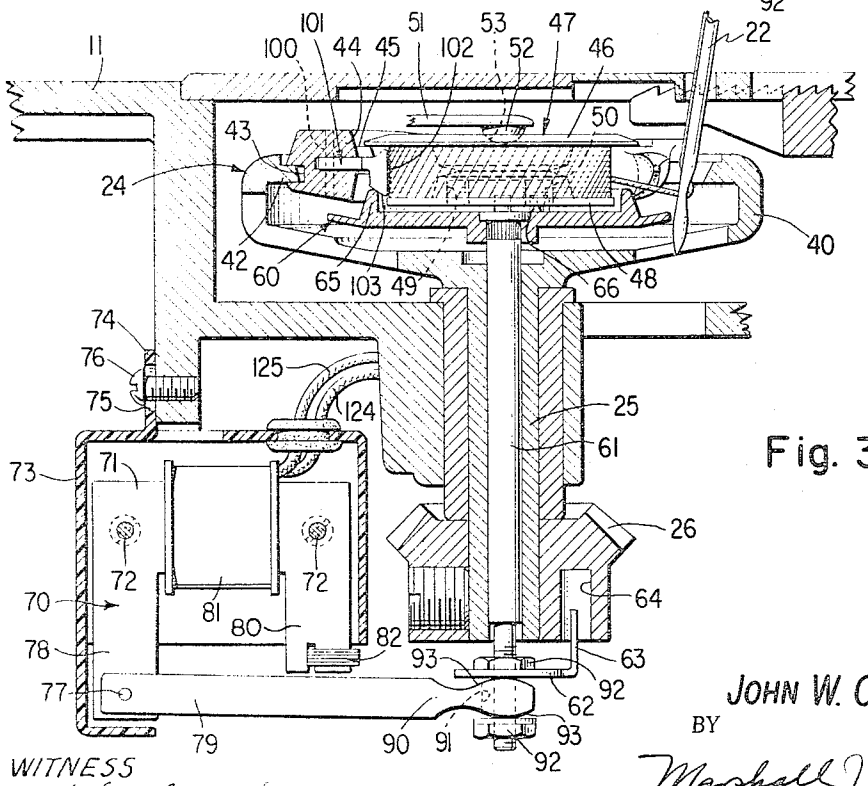


Fig. 3.

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SOLENOID BOBBIN WINDERS

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This invention relates to lock stitch sewing machines of the type including mechanism for winding thread on the bobbin in place in the loop taker, and more particularly, to a novel and improved means for operating the bobbin winding mechanism.

It is an object of this invention to provide a solenoid carried by the sewing machine and operatively connected so as to effect shift of the bobbin winding mechanism into operative position.

In the operation of a mechanism for winding thread on a bobbin in place in the sewing machine loop taker during normal interrelated movements of the needle and loop taker as are required for the formation of stitches, a problem exists in providing a means for preventing or deterring overwinding of the bobbin, which overwinding can occasion jamming of the loop taker and breakage of parts. Heretofore, it has been known to use switching mechanism responsive to the sensing of fully wound condition of the bobbin for terminating the winding operation. This approach to the problem, however, requires that delicate switching components be provided and that a highly critical arrangement of these switching components be maintained. It has also been known heretofore to provide a means responsive to the sensing of fully wound condition of the bobbin for overloading the sewing machine drive motor to deter overwinding of the bobbin, but this approach to the problem raises the possibility of damage to the relatively costly sewing machine drive motor.

It is another object of the present invention to provide a novel means for actuating a bobbin winding mechanism in place in a sewing machine loop taker which will function to signal the onset of bobbin overwinding without switching components or the like and without imposing an overload condition on the sewing machine drive motor.

In accordance with this invention, the shift of the bobbin winding mechanism of the sewing machine into operative bobbin winding position is accomplished by an alternating current operated solenoid which may be energized by the same power supply as is used to drive the conventional sewing machine drive motor.

The solenoid is arranged such that its armature seats or bottoms in the operative bobbin winding position of the bobbin winding mechanism when the bobbin is not fully wound. By arranging the device for sensing the fully wound condition of the bobbin so as to effect a shift of the solenoid armature slightly out of seated or bottomed position, the hum incident to the alternating current actuated solenoid operation is materially increased, thus providing an audible signal useful to deter overwinding of the bobbin.

It is also an object of this invention to provide a novel control circuit for the solenoid which will simultaneously actuate the bobbin winding mechanism solenoid and the sewing machine drive motor in complete independence from the conventional sewing machine drive motor control. This novel control circuit arrangement is advantageous in that it provides for the termination of the drive to the sewing machine mechanism upon termination of the bobbin winding operation and thus obviates sudden unexpected initiation of stitch forming operations. Moreover, this novel control arrangement is also advantageous in that it provides for preselection of the operating condition of the sewing machine drive motor to an optimum value for bobbin winding during the bobbin winding operation.

With the above and additional objects and advantages in view as will hereinafter appear, this invention comprises the devices, combinations, and arrangements of parts hereinafter described and illustrated in the accompanying drawings in which:

FIG. 1 represents a vertical cross sectional view of a sewing machine having this invention applied thereto,

FIG. 2 represents an enlarged vertical cross sectional view of the loop taker of the sewing machine of FIG. 1 together with the bobbin winding mechanism actuating solenoid with the solenoid turned bodily at right angles to the position shown in FIG. 1 more clearly to illustrate the relationship of parts and with the parts illustrated in the bobbin winding position and the bobbin not fully wound,

FIG. 3 represents a vertical cross sectional view of the loop taker and solenoid similar to that of FIG. 2 but with the parts illustrated in the bobbin winding position with the bobbin fully wound, and

FIG. 4 is a wiring diagram illustrating the control circuit for the bobbin winding mechanism solenoid and for the sewing machine drive motor.

Referring to the drawings, this invention is illustrated as applied to a sewing machine of the type including a provision for winding replenishment thread on the bobbin in place in the loop taker such as is disclosed in the United States patent of S. J. Ketterer, No. 3,115,855, December 31, 1963, to which reference may be had. The sewing machine includes a frame having a bed **11**, a standard **12** rising from the bed, and a bracket arm **13** extending from the standard and overhanging the bed. Journaled in the bracket arm is a main drive shaft **14** to which is secured a handwheel **15** and a worm wheel **16** which meshes with a worm **17** fast on the drive shaft of an electric motor **18** which may be housed within the standard as illustrated in FIG. 1. A crank **19** carried on the main drive shaft serves by way of a drive link **20** to reciprocate a needle bar **21** which is journaled for endwise movement in the bracket arm and carries at its lower extremity a needle **22**. The crank **19** also serves to impart oscillatory motion to a needle thread take up member **23**. Journaled in the bed **11** in a position to cooperate with the needle in the formation of stitches is a loop taker indicated generally as **24**. The loop taker is fast on a hollow loop taker shaft **25** which is drivingly connected by miter gears **26** to a bed shaft **27** connected in turn by miter gears **28** and **29** and a vertical shaft **30** in the standard to the main drive shaft **14**. It will be understood that the main drive shaft **14** and the gear drive **26**, **28** and **29** constitute an actuating mechanism for imparting interrelated motion to the needle and loop taker as is required for the formation of lock stitches.

Referring particularly to FIGS. 2 and 3, the loop taker **24** is formed with a cup-shaped body portion **40** of which the rim is formed with an annular bearing rib **42** embraced by an annular raceway **43** formed in a bobbin case **44** which is constrained from rotation with the loop taker body portion as is well known in sewing machine art. Resting upon an annular shoulder **45** formed on the bobbin case is the upper flange **46** of a thread carrying bobbin **47** which is formed with a lower flange **48** having an annular groove **49** formed therein, in which groove a driving abutment **50** is formed. The bobbin **47** is constrained against the bobbin case shoulder **45** by a spring-loaded lever **51** which is carried on the bobbin case **44** and is formed with a spherical protuberance **52** seated in a depression **53** in the upper flange **46** on the bobbin.

For winding replenishment thread on the bobbin in place in the loop taker while the needle and loop taker

partake of normal interrelated motions as are required for the formation of lock stitches, a bobbin winding member **60** is provided within the cup-shaped body portion **40** of the loop taker and beneath the bobbin. The bobbin winding member **60** is fast on a rod **61** which is slidable endwise in the hollow loop taker shaft **25**. A bracket **62** which is fast on the rod **61** beneath the loop taker shaft is formed with an upturned lug **63** which enters an aperture **64** in that miter gear of the miter gear set **26** which is fast on the loop taker shaft, so that the bobbin winding member **60** is constrained to rotate with the loop taker. The bobbin winding member **60** is formed with an upwardly extending flange **65** which serves to embrace the lower flange **48** of the bobbin when the bobbin winding member and the rod **61** are shifted upwardly as illustrated in FIGS. 2 and 3. In addition, the bobbin winding member **60** includes a driving lug **66** which enters the annular groove **49** in the lower flange **48** of the bobbin when the bobbin winding member **60** is raised, and thereby assumes a bobbin driving relationship with the abutment **50** formed with the annular groove **49**. As explained more completely in the above referenced United States Patent No. 3,115,855 to which reference may be had, the bobbin winding member **60**, when raised into the position illustrated in FIGS. 2 or 3, serves to effect winding of replenishment thread on the bobbin by virtue of the flange **65** on the bobbin winding member which deflects thread being manipulated by the loop taker into the space between the bobbin flanges, and by virtue of the driving relationship between the driving lug **66** and the abutment **50** which serve to rotate the bobbin with the loop taker, thus to wind on the bobbin a thread extending from the needle **22**. When the bobbin winding member **60** is lowered into the position illustrated in FIG. 1 in which the flange **65** of the bobbin winding member is completely beneath the lower flange **48** of the bobbin, needle thread loops seized and manipulated between loop taker beak **41** are free to pass beneath and about the bobbin, thus to concatenate with thread wound on the bobbin to form lock stitches.

For effecting elevation of the bobbin winding member **60** into operative bobbin winding position, a solenoid indicated generally at **70** is employed in this invention. The solenoid includes a core **71** which may be of conventional laminated construction and is secured as by fastenings **72** to a casing **73**. An outturned lug **74** on the solenoid casing is slotted as at **75** to accommodate a fastening screw **76** by which the solenoid core may be secured to the sewing machine bed **11** with provision for limited adjustment of the position of the solenoid in a direction axially of the loop taker. Articulated relatively to the armature core as by a pivot pin **77** passing through one pole **78** of the solenoid core is an armature **79** which is thus shiftably supported for movement into and out of engagement with the other pole **80** of the armature core **71**. A solenoid coil **81** wound on the core **71** when energized serves to draw the armature **79** into seated or bottomed relation against the pole **80** of the armature core. A shading coil **82** may be provided on the pole **80** of the armature core to provide for a continuity of magnetic flux when the solenoid coil is energized by an alternating current so as to minimize the vibration of the armature relatively to the solenoid core when the armature is seated or bottomed against the pole **80** of the solenoid core.

The solenoid **70**, which is thus adapted for alternating current operation, is formed with an extended armature extremity **90** which is apertured as at **91** to embrace the lower extremity of the bobbin winding member rod **61** and is preferably constrained relatively to the rod **61** between spaced nuts **92** threaded thereon. The armature extension **90** may also be slightly crowned as at **93** so that the pivotal motion of the armature will not conflict with the translatory endwise sliding movement of the rod **61**. The solenoid fastening screw **76** in the slotted lug **74** of the solenoid casing may be used to secure the solenoid to the sewing machine bed in a selected position in which the solenoid armature **79** will occupy a seated or bottomed position against the solenoid core pole **80** when the solenoid is energized and the bobbin winding member is raised into operative bobbin winding engagement with the bobbin as illustrated in FIG. 2 and the bobbin is not fully wound with thread. In this position of the parts, as the bobbin thread replenishing process begins and while the bobbin is less than fully wound, the solenoid **70** will operate with a minimum of vibration or hum.

Pivoted on a pin **100** set into the bobbin case **44** is a bobbin thread sensing member **101** having a thread engaging shoe **102** extending between the flanges **46** and **48** of the bobbin. The bobbin thread sensing member **101** also is formed with an inclined cam surface **103** disposed for engagement with the upturned flange **65** of the bobbin winding member when the bobbin thread sensing member is forced outward by engagement of the thread engaging shoe **102** with thread that is being wound on the bobbin. As illustrated in FIG. 3, the cam surface **103** is positioned relatively to the thread engaging shoe **102** so as to engage and depress the flange **65** of the bobbin winding member as the thread approaches the fully wound condition on the bobbin **47**. The rod **61** associated with the bobbin winding member will, in being depressed with the bobbin winding member **60**, force the solenoid armature **79** slightly out of seat or bottomed relation against the armature core pole **80** as illustrated in FIG. 3 of the drawing in which condition the influence of the shading coil **82** of the solenoid will be materially decreased resulting in a noticeable increase in the vibration and hum developed by the alternating current actuation of the solenoid. This hum is of such a noticeable nature as to serve as a persistent audible signal to the sewing machine operator that the bobbin is in fully wound condition. Furthermore, it is pointed out that the influence of the bobbin thread sensing member in camming the bobbin winding member **60**, the rod **61**, and the solenoid armature **79** downwardly in response to the fully wound condition of the bobbin does not materially influence the driving force required of the sewing machine actuating mechanism and therefore, does not impose any appreciable overload condition upon the sewing machine drive motor **18**.

Referring to FIG. 1, the wiring in the electrical circuit for both the sewing machine drive motor **18** and for the solenoid **70** is associated in the sewing machine with a three pin receptical **110** which is adapted, as is conventional in the sewing art, to accommodate a plug **111** to which is directed conductors **112** and **113** to a source of power supply indicated at **114** and also a conductor **115** to a foot controller **116**. Referring to the circuit diagram illustrated in FIG. 4, the foot controller **116**, which is of the type including an on-off switch and a rheostat for controlling the sewing machine drive motor speed at the will of the sewing machine operator is connected by a conductor **119** to the conductor **112** and is wired in series with the sewing machine drive motor **18** by the conductors **118** and **119** within the sewing machine. Indicated at **120** is a double circuit push button switch which is preferably spring loaded into the normally open position and must be held closed by the operator of the sewing machine. The switch **120** is connected by the conductor **121** to the conductor **112** and controls simultaneously two circuits across the conductors **112** and **113** from the power source. The sewing machine drive motor **18** is connected into one of the circuits controlled by the switch **120** by a conductor **122** in which circuit a motor speed controlling resistor **123** may be included so as to provide for a preselected motor speed when the switch **120** is closed and the foot controller **116** is not operated. The other circuit controlled by the switch **120** serves by way of conductors **124** and **125** to connect the solenoid coil **81** across the conductors **112** from the power source **113**. With this arrangement closure of the push button switch **120** by the

sewing machine operator serves to energize simultanously the sewing machine drive motor **18** and the solenoid **70** which initiates a bobbin winding operation. When an audible signal is provided to the sewing machine operator by virtue of the hum produced by the solenoid when the fully wound condition of the bobbin is sensed, release of the push button switch **120** by the operator will serve to terminate the bobbin winding operation and to deenergize the sewing machine drive motor so that the sewing machine will not suddenly revert to normal sewing operation. Thereafter, the motor **18** may be energized to control the sewing machine during sewing by the use of the foot controller **116**.

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

1. In a lock stitch sewing machine having a frame, a thread carrying needle endwise reciprocable in said frame, a circularly moving loop taker journaled in said frame, a thread carrying bobbin journaled within said loop taker, actuating mechanism in said frame operatively connecting said needle and said loop taker for interrelated movements as are required for the formation of lock stitches, a bobbin winding member carried within said loop taker, and means shiftably supporting said bobbin winding member for movement axially of said loop taker into and out of operative engagement with said bobbin, means for at will shifting said bobbin winding member axially of said loop taker into operative engagement with said bobbin comprising a solenoid including a core provided with a solenoid coil, an armature shiftably supported relatively to said core, means operatively connecting said armature to said bobbin winding member, and means securing said solenoid core to said sewing machine frame with said solenoid armature in seated relation against said solenoid core in the operative engaged position of said bobbin winding member with said bobbin.

2. In a lock stitch sewing machine having a frame, a thread carrying needle endwise reciprocable in said frame, a circularly moving loop taker journaled in said frame, a thread carrying bobbin journaled within said loop taker, actuating mechanism in said frame operatively connecting said needle and said loop taker for interrelated movements as are required for the formation of lock stitches, a bobbin winding member carried within said loop taker, and means shiftably supporting said bobbin winding member for movement axially of said loop taker into and out of operative engagement with said bobbin, the combination of means for shifting said bobbin winding member axially of said loop taker into operative engagement with said bobbin comprising a solenoid including a core provided with a solenoid coil, an armature shiftably supported relatively to said core, means operatively connecting said armature to said bobbin winding member, and means securing said solenoid core to said sewing machine frame with said solenoid armature in seated relation against said solenoid core in the operative engaged position of said bobbin winding member with said bobbin, a bobbin thread sensing member shiftably supported in said loop taker in position for movement under the influence of a predetermined quantity of thread wound on said bobbin, and means operatively connecting said bobbin thread sensing member with said solenoid armature for effecting a shift of said solenoid armature out of said seated relation against said solenoid core upon movement of said bobbin thread sensing member in response to said predetermined quantity of thread wound on said bobbin.

3. In a lock stitch sewing machine having a frame, a thread carrying needle endwise reciprocable in said frame, a circularly moving loop taker journaled in said frame, a thread carrying bobbin journaled within said loop taker, actuating mechanism in said frame operatively connecting said needle and said loop taker for interrelated movements as are required for the formation of lock stitches, an electric motor drivingly connected to said actuating mechanism, a bobbin winding member carried within said loop taker and means shiftably supporting said bobbin winding member for movement axially of said loop taker into and out of operative engagement with said bobbin, means for at will shifting said bobbin winding member axially of said loop taker into operative engagement with said bobbin comprising a solenoid carried by said sewing machine frame and including a core provided with a solenoid coil, an armature shiftably supported relatively to said core, means operatively connecting said armature to said bobbin winding member, and a control circuit for said electric motor and said solenoid coil from a common source of electrical supply comprising a first switch means operatively connecting only said electric motor to said source of supply, and a second switch means operatively connecting both said electric motor and said solenoid coil simultaneously to said source of supply.

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