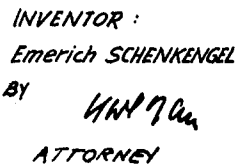


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NEEDLE POSITIONING APPARATUS FOR
POWER-DRIVEN SEWING MACHINES
Filed April 30, 1963

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NEEDLE POSITIONING APPARATUS FOR POWER-DRIVEN SEWING MACHINES

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Filed Apr. 30, 1963, Ser. No. 276,889

Claims priority, application Germany, May 2, 1962, P 29,302

12 Claims. (Cl. 112—219)

The present invention relates to needle stop or positioning apparatus for a power-driven sewing machine, more particularly to apparatus for arresting a reciprocating needle in a predetermined position of its operating cycle upon stopping of said machine.

In the operation of a conventional power-driven sewing machine it is desirable to stop the machine with the needle being in a desired predetermined position, such as the "up" or "down" position, or position of withdrawal from or insertion in the work or fabric, respectively. As an example, stopping in the "up" position is necessary for the threading of the needle or changing the position of the work, while the "down" position is required for the turning of the work relative to the needle during a sewing operation. The desired positions may be adjusted manually in a known manner by rotation of the hand or balance wheel after the power drive has been disconnected or the machine brought to a stop.

In order to effect the stoppage of a sewing machine at a desired needle position, relatively complex and costly arrangements are required in utilizing the previously known stopping devices and methods. On the other hand, there has also become known stopping apparatus of a less complex nature whereby the stoppage of the machine is effected by first disconnecting the driving motor by the opening of an electric switch controlled by the linkage mechanism associated with a conventional foot pedal control, whereupon an abutment plate or stop is advanced into the path of a positioning pin, rotating together with the drive shaft, through a cam and follower arrangement mounted below the bed or sewing table of the machine.

With sewing machines thus equipped, it is not possible, however, to effect the stoppage at an exactly defined needle position, inasmuch as the machine may come to a rest anywhere within an angle of the drive shaft greater than 180°. As a consequence, the thread take-up lever of the machine at the instant of stoppage may assume such an unfavorable position within said angle as to impede or prevent the withdrawing of enough thread necessary for the next stitching operation. Besides, with the stop or abutment plate being ordinarily fitted with a nose or projection deflecting, at the lower dead center position of the needle, the positioning pin rotating with the drive shaft of the machine, there exists the danger of the upper thread penetrating into the path of or encroaching upon the loop taker, inasmuch as the machine may be caused to rotate in a direction opposite to the normal driving direction as a result of the deflection of said pin.

Other known needle positioning apparatus involves the stoppage of the machine at a random position followed by renewed starting of the drive shaft and displacement of a stop into the path of a braking member rotating with said shaft, to arrest the machine at a predetermined angular position of the shaft and, in turn, of the needle. In order to carry out the various operations by the actuation of a single control member (foot pedal, etc.), complex and costly control devices are required which cannot be incorporated within a conventional machine in a simple and economical manner.

Among the objects of the present invention is, there-

2

fore, the provision of improved needle stop apparatus for a power-driven sewing machine by which the previous and related difficulties and shortcomings are substantially eliminated; which apparatus is both simple in design and efficient in operation; which will require only a limited amounting space to enable its structural incorporation in conventional sewing machine constructions, including those designed for household use; which will enable the control or operation of the needle stop apparatus by the utilization of the presser foot control or actuating lever; and which can be fabricated economically and such as not essentially to interfere with conventional sewing machine designs.

The invention, both as to the foregoing and ancillary objects, as well as novel aspects thereof, will be better understood from the following detailed description of a preferred practical embodiment, taken in conjunction with the accompanying drawing forming part of this specification and in which:

FIG. 1 is an elevational view of a sewing machine embodying needle stop apparatus constructed in accordance with the principles of the invention;

FIG. 2 is a partial perspective view more clearly showing the needle stop control mechanism embodied in FIG. 1, the position shown corresponding to the operative position of the parts in effecting a needle positioning operation; and

FIG. 3 is an electrical wiring diagram of the control apparatus of the invention.

Like reference numerals denote parts in the different views of the drawing.

With the foregoing objects in view, the invention involves generally the provision, in connection with a power-driven sewing machine of the type having a drive shaft, an electric motor to drive said shaft, a reciprocating needle operably coupled with said shaft, such as through a crank or the like mechanism, control means to start and stop said motor for the carrying out of a sewing operation, and a work presser foot having actuating means, such as a conventional presser foot lifting lever, to operate the same between a first or lowered and work-engaging position and a second predetermined or raised position of disengagement from the work, of needle positioning apparatus comprising essentially a first stop member radially extending from and rotating together with said shaft, a second stationary and adjustable stop member, preferably in the form of a double lever pivotally supported upon the casing of the sewing machine. Said second stop member is normally resiliently urged, by the action of a biasing spring or the like, to a retracted position, or position out of the path of rotation of the first stop member, to allow of free and unobstructed rotation of the machine during its normal use or operation.

There is further provided, in accordance with the present invention, auxiliary control and operating means being effective in response to the operation of the presser foot actuating means or lever to a position beyond said predetermined or raised position, in such a manner as to advance said second stop member into the path of said first stop member, to thereby arrest said shaft in a predetermined angular position by the first stop member forming an abutment upon restarting of the machine at a reduced operating speed. As an example, the first stop member may have an angular position in relation to said shaft, or the needle oscillating path, respectively, such as to arrest or stop the needle in the "up" position. In the same manner, displacement of the stop member by 180° will result in the needle stoppage in the "down" position, as will be understood.

The driving motor is advantageously rotated at reduced speed during the needle positioning operations, such as by

simultaneously controlling an auxiliary operating circuit in synchronism with the operation of said second stop member through a remote controlled auxiliary electric switch, or equivalent remote control and motor starting means. The use of the presser foot lifting lever as a means to control the needle positioning apparatus in accordance with the underlying concept of the present invention has the advantage, among others, of simplicity of construction and ease of operation, whereby to render such a needle stop especially suitable for structural incorporation in conventional, including household-type, sewing machine. Further details regarding the operation of and the means for carrying into effect the invention will become more apparent from the following detailed description of the embodiment shown by the drawing.

Referring to the latter, the numeral 1, FIG. 1, denotes the sewing table of a conventional sewing machine comprising further a casing 2 composed in a known manner of an upright and overhanging arm being parallel to said table and terminating in a sewing head 3. Mounted within the overhanging arm of the casing 2 is the drive or armshaft 4 carrying a flywheel 5 at one end and a crank 6 at its opposite end, the latter forming part of the coupling mechanism between said shaft and the reciprocating needle mounted in the head 3, in a manner well known to and understood by those skilled in the art.

Secured to the shaft of an electric driving motor 7 mounted within the upright of the casing 2 is a pulley 8 which is coupled with the flywheel 5 through a transmission belt 9 or the like, to drive the shaft 4. Further secured, in the example shown, to a radial extension of the crank 6, FIG. 2, is a brake or stop element 10 which has a front edge 11 forming a shoulder or first stop member rotating together with the shaft 4. A bracket 12 secured to the inside of the casing 2 serves as a support for a double operating lever 13 being pivoted thereto by a screw 14 and forming a second adjustable stop co-operating with the rotating stop 10 in the manner further described in the following.

For the latter purpose, there is secured to one arm of the lever 13 a second stop member 15 having a front edge 16 arranged relative to a projection 17 of the bracket 12, whereby the latter serves as an abutment to absorb the impact force upon the lever 13 upon the stop member 10 striking the member 15 as shown in the drawing during the operation of the device described in the following. The opposite arm of the stopping lever 13 carries a pin 18 being parallel to the pivot axis and to the end of which is linked an operating rod or bar 19. Bar 19 is provided with a pair of vertical longitudinal slots 21 and 22, the latter serving to guide said bar in the vertical direction by the headed screw 24 passed through slot 22 and being secured to an angular support or bracket 23 mounted upon the inside of the casing 2.

The operating bar 19 and lever 13 are urged to a normal or inoperative position, such as by the action of a spring 27 having one end secured to the casing 2, as at 26, and having its opposite end secured to said lever, as at 25, whereby to cause the stop member 15 to be in retracted position from or out of the path of rotation of the stop member 10, as distinct from the operative or engaged position of the stops shown in the drawing.

The operating lever 13 is fitted with a further (vertical) arm 28 including an angle with the remaining lever arms and having linked to its upper end end a U-shaped connecting element 29 to which is, in turn, secured one of the ends of the flexible wire 30 of a Bowden cable 31 forming a remote control mechanism and leading to an auxiliary motor control provided for the carrying out of a needle positioning operation. Extending from the lever arm 28 below the element 29 is an auxiliary actuating member 32, in the form of a knurled rod or the like as shown, and projecting to the outside of the machine through a slot of the casing 2.

The Bowden mechanism comprises a threaded sleeve 34 passing the wire 30 and being secured to a support 36 which is mounted upon the casing 2 by the aid of a screw 35 and held in place by a securing nut 37. The core or wire 30 of the cable 31 extends into the interior of a control or switch box 38 being mounted below the sewing table 1, the end of the wire 30 forming a threaded portion 39 being fitted with an actuating member 40 which is fixed in position by a pair of securing nuts 41. Arranged between the member 40 and the inner wall of the box 38 is a compression spring 42 encircling the portion 39 of the wire 30. Further disposed within the box 38 is an electric switch 43, preferably in the form of a snap or micro switch and having an actuating lug or the like 44 arranged to be engaged by the member 40 by a pull upon the wire 30 upon rotation of the operating lever 13 to its operative position shown in the drawing.

Journalled in a bore of the casing 2 is a pin or trunnion 45 to which is secured the presser foot lifting lever 46 by means of a screw 47. Further connected to the journal pin 45 at right angle thereto is a coupling pin 48 adapted to move within and to be coupled with the slot 21 of the connecting bar 19. The conventional presser foot lifting rod 49 may be supported at its upper end in a known manner by a bore and threaded sleeve (not shown) in the head 3 of the machine.

Secured to the lower end of the rod 49, by means of a screw 51, is the presser foot or work clamp 50. A compression spring 52, encircling the lifting rod 49 and engaging said threaded sleeve (not shown) at one end and engaging a lifting sleeve 53 secured to said rod at its opposite end, serves to normally urge the presser foot 50 to the work-engaging or lowered position, while a lateral arm 54 connects the sleeve 53 with the actuating or lifting lever 46 for the raising and lowering of the presser foot, in a manner customary with conventional sewing machines.

Referring to FIG. 3 which shows the electrical wiring diagram of the needle positioning apparatus of the preceding figures, the lead 55 connects one pole of the driving motor 7 with one terminal of a suitable power source the remaining terminal of which is connected, through the flexible lead 59, to the other pole of the motor through a conventional variable starting resistance 57 comprising an operating or sliding contact 58. The latter may be coupled with any suitable operating device, such as a foot pedal (not shown) for the starting and normal operation of the motor during the carrying out of a sewing operation.

Further connected, in accordance with the present invention, between a fixed point of the resistance 57 and the pole of the motor 7 adjacent to said resistance is a lead 60 serially including the switch 43 which, in the example shown, comprises a pair of fixed contacts 61 and 62 and a bridging contact, to temporarily connect the motor to the power source through a predetermined portion of said resistance, to operate the motor at a reduced speed during a needle positioning operation, in a manner as will become further apparent from the following description of the operation of the invention. Item 64 is a usual interference-suppression capacitor connected in parallel to the switch contacts 61 and 62.

The operation of the needle-positioning apparatus described in the foregoing is as follows:

In order to carry out a sewing operation, the drive motor 7 of the sewing machine is energized by way of the starter-resistance 57 and slidable contact 58 to drive the machine via the pulley 8, belt 9 and the flywheel 5. Upon completion of the sewing operation, the starter (not shown) is returned to its rest position, as shown in FIG. 3, thereby arresting the machine at a random position of the shaft 4 and, in turn, of the needle within its oscillating path.

On the other hand, it may be advisable or necessary to

stop the machine with the needle in the "up" or "down" position, or any other position for any special reason or purpose.

As an example, in order to remove the sewing goods or for the threading of the needle, it is necessary to raise the presser foot 50 by the operation of the lifting lever 46 from its lowered or work-engaging position to a predetermined raised position. If it is now further desired to position the needle at its upper dead center point, or in the "up" position, for the threading of the needle or for any other reason, the lever 46 is simply farther raised beyond said predetermined position, being determined in the example shown by the flat upon said lever engaging the underside of the arm 54, whereby to rotate the lever 13 in anticlockwise direction against the action of the spring 27 by the coupling pin 48 entering and engaging the lower edge of the slot 21 of the operating bar 19. The pin 48 and slot 21 are so designed as to cause said pin to be normally disengaged from said slot, that is, in the lowered position of the presser foot, and to enter and engage said slot during raising of the presser foot for the operation of the lever 13 and stop member 15 into the path of the stop member 10, in the manner shown and described.

At the same time, that is, during operation of the stop member 15, the wire 30 of the Bowden cable being connected to the lever arm 28 is pulled towards the left against the action of the spring 42. As soon as the stop member 15 has been advanced into the path of rotation of the stop member 10, as shown in FIG. 2 of the drawing, the actuating member 40 at the opposite of the cable or wire 30 engages the lug 44 of the switch 43. As a consequence, the switch contacts 61 and 62 are bridged or closed and the motor 7 energized through the resistance 57, in such a manner as to start rotation of the shaft 4 and, in turn, of the stop member 10 at a reduced speed, compared with the normal operating speed of the sewing machine, in the direction of the arrow A shown in the drawing, until the front edge 11 of the stop member 10 strikes the front edge 16 of the stop member 15 in the manner shown, whereby to arrest the shaft 4 and with it the needle in a predetermined such as the "up" position, depending upon the design and relation of the members, as will be readily understood.

The striking force upon the front edge 16 of the stop member 11 upon the member 10 engaging the member 15 is absorbed by the abutment 17 upon the casing 2, whereby to relieve both the lifting lever 46 and the auxiliary actuating members from any ensuing impact or vibration.

Upon release of the lifting lever 46 and return to its normal raised position by the spring 27, the lever 13 and the switch 43, are returned to their normal or rest positions.

Aside from the initiation of the needle positioning operation by the actuating of the presser foot beyond its normal raised position, in the manner described hereinbefore, the needle may also be positioned in the lowered or work-engaging position of the presser foot by the operation of the auxiliary member 32 towards the left, or in the direction of the arrow B, whereby to again adjust the lever 13 and to control the switch 43 in substantially the same manner as described. During this operation of the positioning apparatus, that is, in the lowered position of the presser foot, the coupling pin 48 is disengaged from the slot 21 of the connecting bar 19, whereby the latter will remain without effect on the presser foot or needle positioning operation, respectively.

In the foregoing the invention has been described in reference to a specific illustrative device or embodiment. It will be evident, however, that variations and modifications, as well as the substitution of equivalent parts or elements for those shown herein for illustration, may be made without departing from the broader spirit and purview of the invention as set forth in the appended claims. The specification and drawings are accordingly to be re-

garded in an illustrative rather than in a restrictive sense.

I claim:

1. In combination with a power-driven sewing machine having a drive shaft, a reciprocating needle operably coupled with said shaft, an electric motor to drive said shaft having a main operating circuit, control means to open and close said circuit to start and stop said motor for the carrying out of a sewing operation, and a work presser clamp having actuating means to operate the same between a first work-engaging position and a second predetermined position of disengagement from the work; of needle positioning apparatus comprising an auxiliary operating circuit for said motor, to operate said motor at reduced speed compared with its normal operating speed, a first stop member carried by and rotating with said shaft, a second adjustable stop member, resilient means to normally urge said second stop member to a position of retraction from the path of rotation of said first stop member, an electrical switch in said auxiliary circuit, and common operating means effective in response to the operation of said presser clamp to an auxiliary position beyond said predetermined position, to advance said second stop member into the path of said first stop member against the action of said resilient means and to close said circuit and start said motor at reduced speed, whereby to arrest said shaft rotating at said reduced speed in a predetermined needle position by said first stop member engaging said second stop member.

2. In needle positioning apparatus for sewing machines as claimed in claim 1, said first stop member having an angular position relative to the needle oscillating path such as to arrest said shaft in the "up" position of said needle.

3. In needle positioning apparatus for sewing machines as claimed in claim 1, said second stop means being comprised of a double lever having a first arm carrying a stop operable into and out of the path of said first stop member, and means to operably connect the second arm of said lever with said presser clamp actuating means in said predetermined presser clamp position.

4. In needle positioning apparatus for sewing machines as claimed in claim 1, said needle being coupled with said shaft through a crank extending radially from said shaft and having a shoulder, and said first stop member being affixed to the periphery of said shoulder.

5. In combination with a power-driven sewing machine having a sewing table, an upright and an overhanging arm supported thereby and terminating in a sewing head, a drive shaft mounted within said arm, a reciprocating needle mounted within said head and operably coupled with said shaft, an electric motor to drive said shaft having a main operating circuit, control means to open and close said circuit, to operate said motor for the carrying out of a sewing operation, and a work presser foot having a presser foot lifting bar slidably mounted in said head and actuating lever therefor, to operate said bar between a lowered position and a raised position; of needle positioning apparatus comprising an auxiliary operating circuit for said motor, to operate said motor at reduced speed compared with its normal operating speed, a first stop member carried by and rotating with said shaft, a second adjustable stop member mounted within said arm, resilient means to normally urge said second stop member to a position of retraction from the path of rotation of said first stop member, coupling means effective in response to the operation of said bar by said lever to an auxiliary position beyond said raised presser foot position, to advance said second stop member to an operative position in the path of said first stop member against the action of said resilient means, an electrical switch in said auxiliary circuit, and remote control means connecting said second stop member with said switch, to close said switch in the operative position of said second stop member, to start said motor at reduced speed and to stop said shaft in a predetermined needle position by said first stop member engaging said second stop member.

7

6. In needle positioning apparatus for sewing machines as claimed in claim 5, said second stop member being comprised of a double lever having a first lever arm carrying an abutment element operable into and out of the path of said first stop member, and said remote control means being comprised of a third arm of said lever including an angle to said first and second arms, and a Bowden cable connecting said third lever arm with said switch.

7. In needle positioning apparatus for sewing machines as claimed in claim 5, said second stop member being comprised of a double lever having a first arm carrying an abutment element operable into and out of the path of said first stop member, and means to couple said second arm with said presser foot actuating lever comprising a slidable member having one end linked to said second lever arm and provided with a slot, and a pin rotatable with said actuating lever and adapted to enter and effect operative connection with said slot in said raised presser foot bar position.

8. In needle positioning apparatus for sewing machines as claimed in claim 7, said motor control means comprising a variable starter resistance serially connectible to a power source and said motor, and said auxiliary control means including a predetermined fractional portion of said resistance connectible to said source and motor by said switch.

9. In needle positioning apparatus for sewing machines

8

as claimed in claim 5, including means to independently operate said second stop member and switch, to carry out a needle positioning operation in the lowered position of said presser foot.

10. In needle positioning apparatus for sewing machines as claimed in claim 5, said first stop member being angularly related to said shaft such as to arrest said shaft in the "up" position of said needle.

11. In needle positioning apparatus for sewing machines as claimed in claim 5, said needle being coupled with said shaft through a crank extending radially from said shaft and having a shoulder, and said first stop member being affixed to said shoulder.

12. In needle positioning apparatus for sewing machines as claimed in claim 5, including a fixed abutment member adapted to absorb the impact force upon said second member upon engagement by said first stop member.

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