Aug. 10, 1965 R. J. BOSER ET AL 3,199,479

AUTOMATIC NEEDLE POSITIONER FOR SEWING MACHINES

Filed Oct. 14, 1963 3 Sheets-Sheet 1

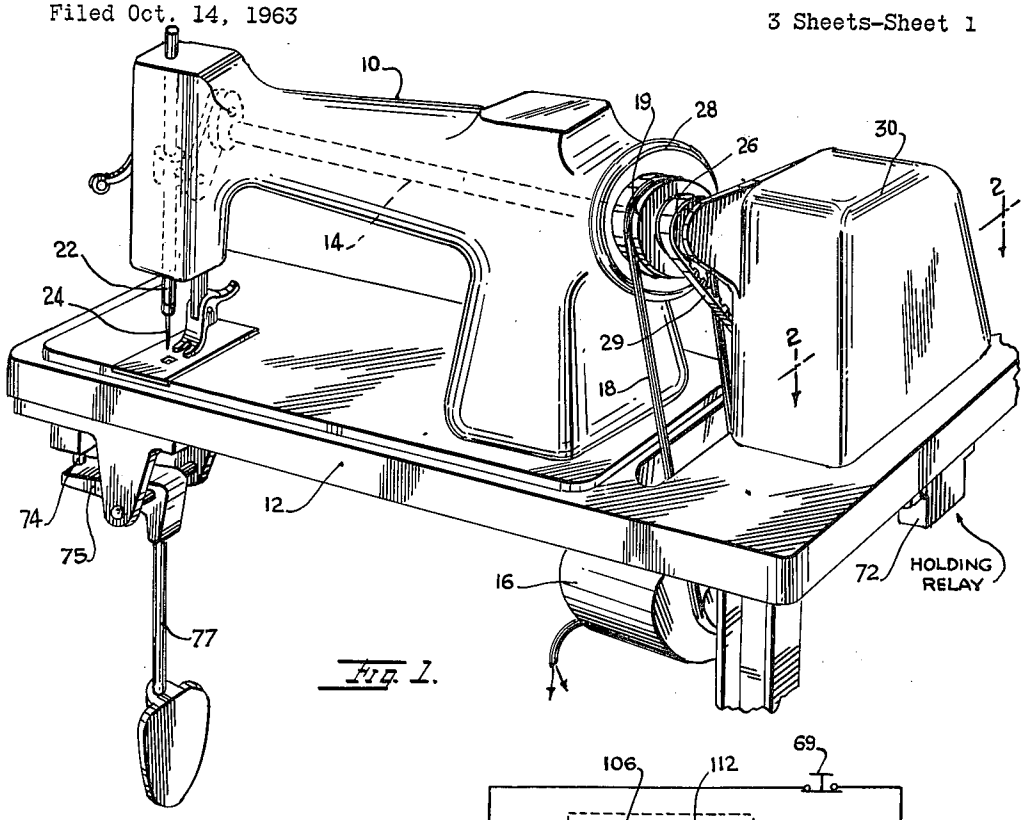


Fig. 1.

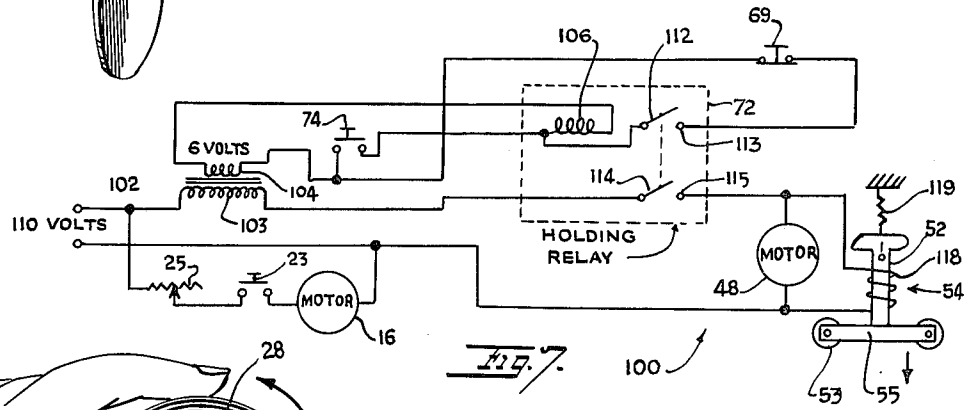


Fig. 7.

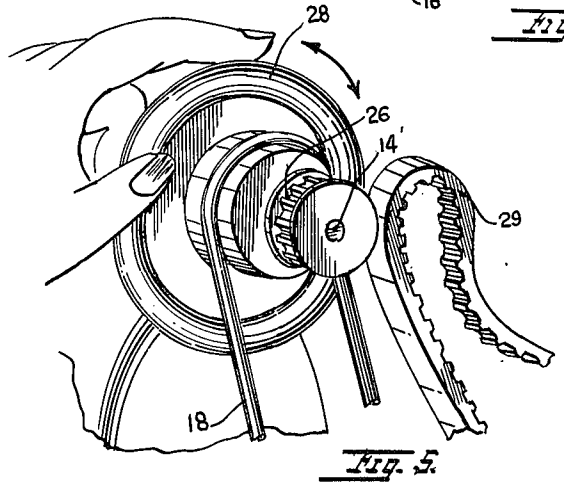


Fig. 5.

INVENTORS
RONALD J. BOSER
EUGENE L. WESCHLER
BY Golocketk & Salisbury
ATTORNEYS

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AUTOMATIC NEEDLE POSITIONER FOR SEWING MACHINES

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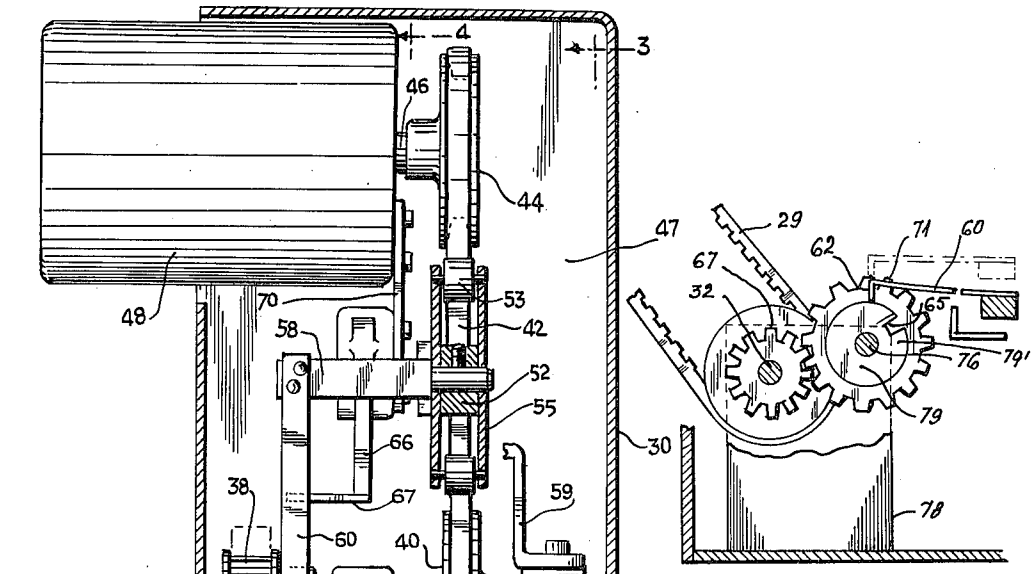


Fig. 9.

Fig. 2.

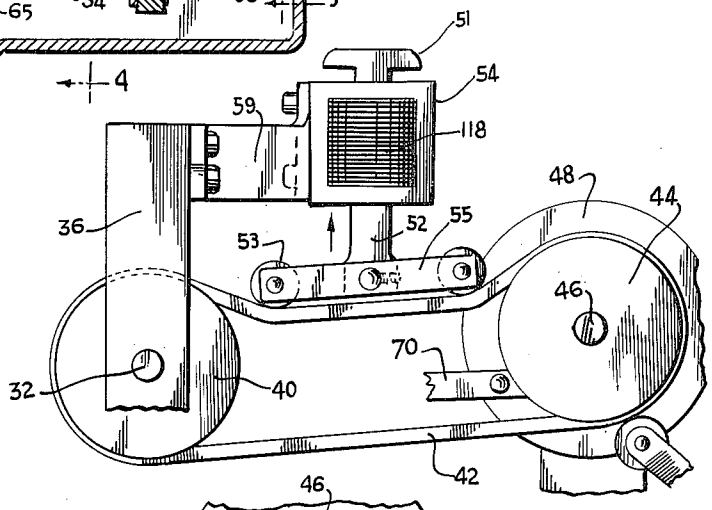


Fig. 3.

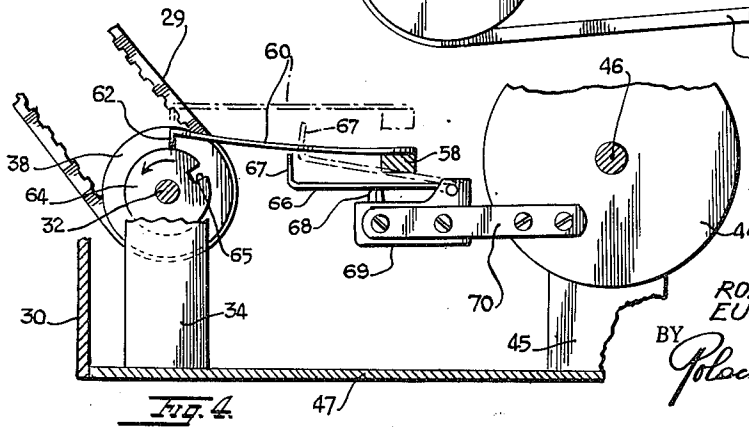


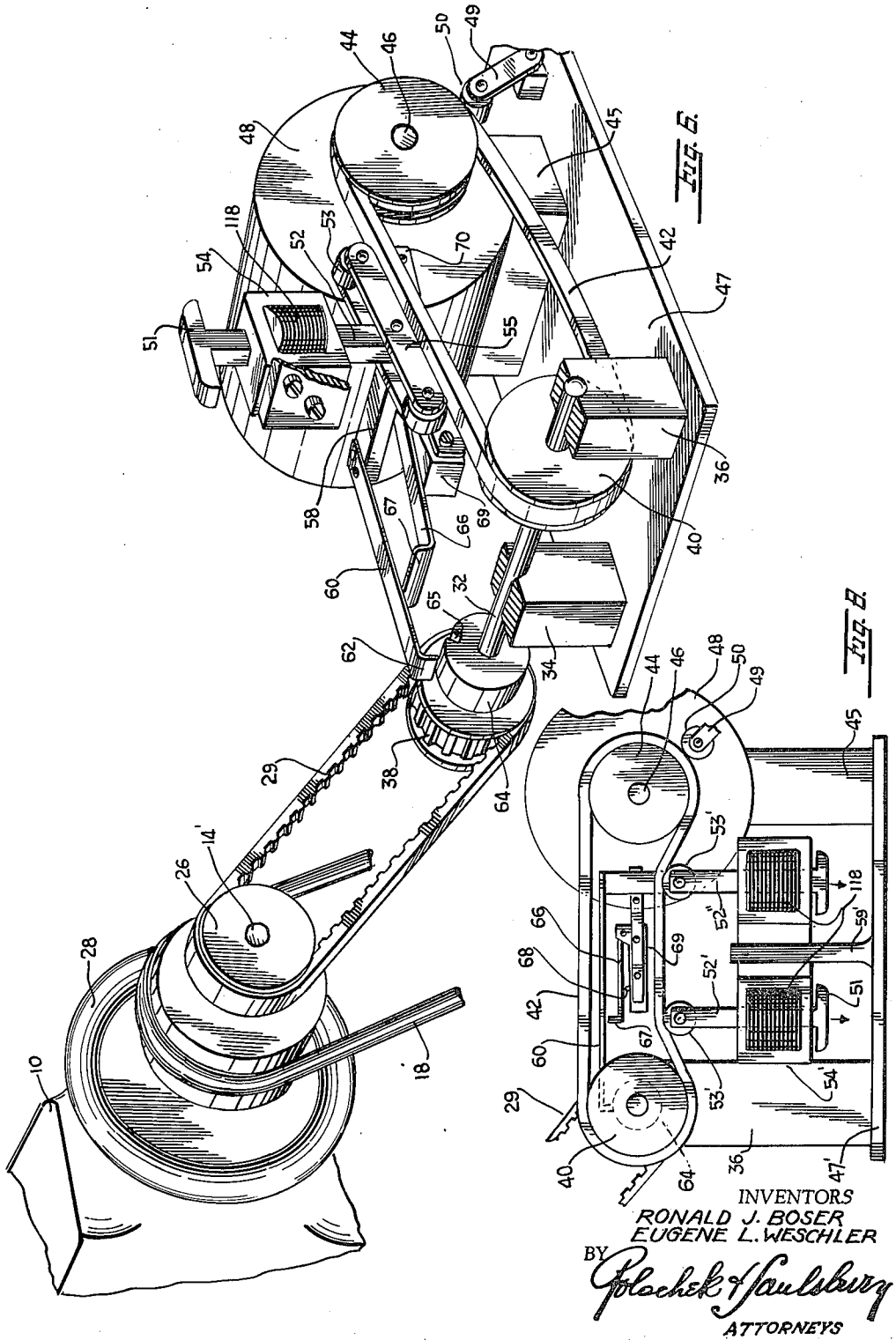
Fig. 4.

INVENTORS
RONALD J. BOSER
EUGENE L. WESCHLER
BY Polachek & Saulsbury
ATTORNEYS

Aug. 10, 1965 R. J. BOSER ET AL 3,199,479

AUTOMATIC NEEDLE POSITIONER FOR SEWING MACHINES

Filed Oct. 14, 1963 3 Sheets-Sheet 3



INVENTORS
RONALD J. BOSER
EUGENE L. WESCHLER
BY Golachek & Saulsbury
ATTORNEYS

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3,199,479

AUTOMATIC NEEDLE POSITIONER FOR SEWING MACHINES

Ronald J. Boser, 261—79 Langston Ave., Glen Oaks, N.Y., and Eugene L. Weschler, 288 Bel-Air Drive, Massapequa, N.Y.

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This invention concerns an accessory or attachment to a sewing machine for automatically positioning a sewing needle in a predetermined position.

One object of the invention is to provide an attachment which is adjustable so that the sewing machine needle will always be located in a predetermined position prior to the starting of sewing.

Another object is to provide an attachment of the character described including an auxiliary drive belt and means for engaging and driving the auxiliary belt at the end of a sewing period to locate the sewing needle in a desired elevated position.

For further comprehension of the invention, and of the objects and advantages thereof, reference will be had to the following description and accompanying drawings, and to the appended claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure:

FIG. 1 is a perspective view of a sewing machine head with an assembly embodying the invention installed thereon.

FIG. 2 is a sectional view on an enlarged scale taken on line 2—2 of FIG. 1.

FIG. 3 and FIG. 4 are fragmentary elevational and sectional views respectively, taken on lines 3—3 and 4—4, respectively, of FIG. 2.

FIG. 5 is an exploded perspective view of one end of a sewing machine head and part of a drive belt.

FIG. 6 is a perspective view of parts of the assembly embodying the invention, portions being broken away.

FIG. 7 is a diagram of an electrical circuit employed in the invention.

FIG. 8 is a fragmentary elevational view similar to parts of FIGS. 3 and 4 illustrating a modification of the invention.

FIG. 9 is a view similar to FIG. 4 showing a modified form of switch activating mechanism.

Referring first to FIG. 1, there is shown a sewing machine including a head 10 mounted on horizontal table 12. The head carries a shaft 14 driven by a motor 16 via an endless belt 18. The shaft 14 drives a vertically reciprocating shaft 22 carrying sewing needle 24. The motor is controlled by operation of a knee or treadle switch 23 and rheostat 25 which actuates in circuit with the motor 16; see FIG. 7. To the extent described the sewing machine is conventional.

According to the invention there is provided an extension 14' of the shaft 14; see FIGS. 5 and 6. On this extension is mounted a cog wheel 26. The handwheel 28 on shaft 14 of the sewing machine can be manually rotated for selectively positioning the needle 24 with respect to table 12. When the needle is located or elevated in a desired position an internally toothed belt 29 can be engaged on the cog wheel 26. Thereafter the assembly or mechanism embodying the invention will always stop the needle in this selected position without any further manual adjustment of the handwheel 28.

The mechanism is covered by a removable hood 30, shown in FIGS. 1 and 2. The mechanism includes a shaft 32 rotatably carried by spaced post bearings 34, 36 shown in FIG. 6. This shaft carries a cog wheel 38 engaged with and driving the belt 29 engaged with cog wheel

26. A drive pulley 40 is secured to the outer end of shaft 32. On this pulley is engaged a drive belt 42. The belt is engaged on another pulley 44 carried by shaft 46 of a small motor 48 inside of the hood 30. The motor is mounted on a stand or bracket 45 carried on a base plate 47 of the mechanism. A floating spring biased arm 49 has a roller 50 bearing on the belt 42 at pulley 44 to keep the belt engaged with the pulley. Normally this belt is rather slack so that slippage occurs between the belt and both pulleys 40 and 44.

In order to effect driving engagement between the belt and pulley 44, there is provided a plunger 52 of a solenoid or electromagnet 54. The plunger carries a pair of cross arms 55 having idler rollers 53 at opposite ends thereof. When the plunger 52 is lowered the upper course of the belt 42 is lowered as shown in FIG. 3 and the motor 48 drives pulley 44 via belt 42.

The solenoid is carried by bracket 59 on an upper part of the post bearing 36. The plunger has an upper crosshead 51 which serves to stop excess downward movement of the plunger. Attached to one of the cross arms 55 is a laterally extending bar 58 carrying a forwardly extending flexible arm 60. This arm has a tip 62 which rides on a wheel hub 64 integral with cog wheel 38 when the arm is in a lowered position. The arm 60 is lowered by downward movement of the plunger 52. In wheel hub 64 is a notch 65. The tip 62 engages in this notch during the course of one revolution of wheel 38. Underneath arm 60 is a flexible switch arm 66 having an upwardly extending tip 67 normally contacted by arm 60 when the tip 62 rides on wheel hub 64; see FIG. 4. Arm 66 bears on switch button 68 of a switch 69 carried by a support bar 70 on the casing of motor 48.

In FIG. 9, a modified form of switch actuating mechanism is shown wherein a gear 67 is mounted on shaft 32 and is driven by the toothed belt 29. A toothed cog wheel 71 is mounted on a shaft 76 on a post bearing 78 adjacent post bearing 34 and is driven by the gear 67. Cog wheel 71 is larger in diameter than the gear 67, of the ratio of two to one. The tip 62 of the flexible arm 79 rides on the wheel hub 79' of the wheel 71 and engages in the notch 65 of hub 79' during revolution of the wheel 71. The arm 79 actuates the switch 69 similarly to the arm 60 of FIG. 4.

FIG. 1 shows a holding relay 72 mounted under the right end of the table, and switch 74 under the left end of the table. Switch 74 is actuated by a lever 75 extending laterally of knee lever 77.

FIG. 7 shows an electrical circuit 100 employed with the mechanism embodying the invention. This circuit includes a stepdown transformer 102 for reducing the voltage of the A.C. power supply to six volts. The secondary winding 104 of the transformer is connected in series with switch 74 and coil 106 of relay 72. The relay has two movable contacts 112, 114. Contact 112 is connected in a holding circuit with secondary winding 104 and switch 69 for energizing the relay coil 106 when switch 74 is open. Contact 114 is connected in circuit with primary winding 103 of the transformer and motor 48. Coil 118 of the solenoid or electromagnet 54 is connected in parallel with motor 48 so that the solenoid is energized when the motor is energized. The plunger 52 of the solenoid is retracted downwardly when the motor is energized. Motor 16 is in series with switch 23, rheostat 25 and the A.C. power supply.

In operation of the apparatus, an operator will control the sewing machine by closing switch 23 to energize motor 16 which will drive the belt 18, pulley 19, shaft 14 and 22 and needle 24 for sewing in conventional manner. At the end of sewing the operator will open switch 23. The operator will then momentarily close

switch 74 by moving lever 77 to the left as viewed in FIG. 1 and then releasing it.

At the instant that switch 74 is closed relay coil 106 becomes energized and contacts 112, 114 close with contacts 113, 115 respectively. When switch 74 is released, coil 106 remains energized through closed contacts 112, 113 and normally closed switch 69. When contacts 114, 115 close motor 48 becomes energized and starts to turn pulley 44. At the same time coil 118 of the solenoid 54 becomes energized and the plunger 52 is retracted downward against the upward bias exerted by spring 119. Spring 119 is located inside the housing of the solenoid 54 and is not visible externally.

Plunger 52 pushes the rollers 53 down on the upper course of belt 42 to tighten this belt against pulleys 40, 44. The belt 42 then drives pulley 40 which rotates shaft 32 and cog wheel 38. Cog belt 29 is driven and this turns cog wheel 26 and shaft 14 so that the needle 24 moves either up or down with shaft 22 driven by shaft 14. At the same time, the tip 62 of arm 60 rides on hub 64 since the arm 60 is moved downwardly from the upper dotted line position of FIG. 4 when the plunger 52 is lowered. As the hub 64 turns, tip 62 finally encounters and falls into notch 65. This will occur in less than one full revolution of hub 64.

When the tip 62 engages in notch 65, arm 60 presses down on tip 67 of switch arm 66 and switch 69 opens. This opens the energizing circuit of relay 72. Coil 106 becomes energized, switch contacts 112 and 114 open with respect to contacts 113, 115. The power supply circuit of motor 48 is broken and the motor stops. At the same time the energizing circuit of electromagnet or solenoid 54 is broken and the plunger is retracted.

The engagement of tip 62 in notch 65 stops the hub 26 at precisely the point where needle 24 reaches its predetermined position with respect to the fixed table 12 and head 10. Immediately thereafter the tip 62 is withdrawn as arm 60 rises along with bar 58 and plunger 52 of the deenergized electromagnet.

The inertia of motor shaft 46 and pulley 44 may tend to drive them angularly for a short time after the motor is deenergized. However, the position of the hub 60 and needle 24 will not change because rollers 53 are elevated off of belt 42 so that the belt is slack and cannot drive pulley 40. It will be understood that once hub 26 comes to a complete stop it does not start again until motor 16 is again energized.

When the plunger 52 rises upon deenergizing of the electromagnet 54, switch 69 is released by spring arms 66 and 60 and the switch closes again. However, motor 48 remains deenergized since the relay 72 is now deenergized and its contacts are open. The needle positioning mechanism remains in this inactive position until switch 74 is again momentarily closed.

During the operation of motor 16, the belt 29 will drive cog wheel 38, shaft 32 and pulley 40. The engagement of pulley 40 with the slack belt 42 may cause this belt to drive pulley 44 as an idler. This will not affect the subsequent operation of the pulley as a drive pulley when motor 48 is energized. It is necessary that cog wheel 38 and hub 64 rotate in coordination with shaft 14, 14' and movement of needle 24 since the position of the notch 65 is coordinated with the elevated position of needle 24 at all times. One complete rotation of hub 64 corresponds to one complete up and down traverse of needle 24 or one complete stitching cycle. It will be apparent that the flexible belt 29 can be disengaged from cog wheel 26 as shown in FIG. 5 to reposition the needle up or down as wheel 28 is turned manually. Then the belt 29 can be repositioned on the cog wheel 26 and the location of the notch 65 will correspond to the new determined position of the needle 24.

FIG. 8 shows a modification of the mechanism in which parts corresponding to those already described are identically numbered. The mechanism of FIG. 8 employs

an electromagnet 54' which has two simultaneous acting plungers 52' and 52''. The plungers are normally biased downwardly and are elevated when the electromagnet is energized. The elevated plungers carry idler rollers 53' which engage the lower course of belt 42 to tension the belt on pulleys 40, 44. The electromagnet is carried by a post 59' on base plate 47' of the mechanism.

In both forms of the invention the belt 42 is tensioned on the pulleys 40, 44 when the single electromagnet 54 or the double electromagnet 54' is energized.

There has thus been provided according to the invention a mechanism which can be provided as an attachment or accessory to a sewing machine to effectively position a vertically moving needle at any point of its stitching cycle. This predetermined position can be easily changed without requiring use of any tools. The mechanism operates automatically once an operator momentarily closes an actuating switch. The mechanism can be operated before an operator starts a sewing operation or after a sewing operation is completed. The positioning of the needle by operation of the mechanism takes no more than one second of time. It is certain in operation, requires very little power to operate, and requires no particular skill to operate.

While we have illustrated and described the preferred embodiments of our invention, it is to be understood that we do not limit ourselves to the precise constructions herein disclosed and that various changes and modifications may be made within the scope of the invention as defined in the appended claims.

Having thus described our invention, what we claim as new, and desire to secure by United States Letters Patent is:

1. A needle positioner for a sewing machine having a drive shaft for moving the needle vertically through a stitching cycle, comprising a rotatable wheel hub, means operatively connecting the wheel hub and shaft so that the hub rotates in coordination with the shaft and completes one revolution while the needle moves through one stitching cycle, another shaft carrying said wheel hub, a pulley on said other shaft, a motor, another pulley driven by said motor, a belt loosely entrained on the pulleys for slipping with respect to the pulleys, a solenoid having plunger means for engaging and tensioning said belt when the solenoid is energized so that the motor drives the wheel hub, a normally closed switch in circuit with said motor, a first arm carried by the plunger and disposed to contact the wheel hub when the solenoid is energized, an obstruction on said wheel hub for engaging said arm at a certain point on the hub, a second arm engaged by the first switch arm and moved thereby when the first arm is engaged by said obstruction, said second arm being disposed adjacent to said switch for actuating and opening the same when the second arm is moved by the first arm, whereby the motor stops when said switch opens, the wheel hub stops rotation when engaged with the first arm, and the needle is positioned at a point coordinated with the position of said obstruction on the wheel hub.

2. A needle positioner for a sewing machine having a drive shaft for moving the needle vertically through a stitching cycle, comprising a rotatable wheel hub, a drive belt operatively connecting the wheel hub and shaft so that the wheel hub rotates continuously while the needle is moving and whereby the wheel hub completes one revolution while the needle moves through one stitching cycle, another shaft carrying said wheel hub, an obstruction on said wheel hub, and an arm disposed to ride on said wheel hub and engage said obstruction for stopping the wheel hub, a motor, a solenoid having a coil connected in parallel with said motor, a power supply, a normally closed switch, a normally open switch, a holding relay, the power supply, switches and relay being connected in series circuit with the motor and solenoid coil, whereby the motor and solenoid are energized when the normally

open switch is momentarily closed to actuate the holding relay, another shaft carrying said wheel hub, a pulley on said other shaft, another pulley driven by said motor, another belt loosely entrained on the pulleys for slipping with respect to the pulleys, said solenoid having plunger means for engaging and tensioning said other belt when the solenoid is energized so that the motor drives the wheel hub, another arm disposed to be mode by the first-named arm when said obstruction is encountered thereby, said other arm being disposed adjacent to the normally closed switch to actuate and open the same when the other arm is moved by the first-named arm, whereby said series circuit is opened and both the motor and solenoid are deenergized when the first-named arm encounters said obstruction and the wheel hub stops rotation so that the needle is then stopped at a predetermined position in its stitching cycle, and whereby said plunger means is retracted when the solenoid becomes deenergized to retract the first-named arm from the obstruction and to release said other arm so that the normally closed switch is released and closes again.

3. A needle positioner for a sewing machine having a drive shaft for moving the needle vertically through a stitching cycle, comprising a rotatable wheel hub, a drive belt operatively connecting the wheel hub and shaft so that the wheel hub rotates continuously while the needle is moving and whereby the wheel hub completes one revolution while the needle moves through one stitching cycle, another shaft carrying said wheel hub, an obstruction on said wheel hub, and an arm disposed to ride on said wheel hub and engage said obstruction for stopping the wheel hub, a motor, a solenoid having a coil connected in parallel with said motor, a power supply, a normally closed switch, a normally open switch, a holding relay, the power supply, switches and relay being connected in series circuit with the motor and solenoid coil, whereby the motor and solenoid are energized when the normally open switch is momentarily closed to actuate the holding relay, another shaft carrying said wheel hub, a pulley on said other shaft, another pulley driven by said motor, another belt loosely entrained on the pulleys for slipping with respect to the pulleys, said solenoid having plunger means for engaging and tensioning said other belt when the solenoid is energized so that the motor drives the wheel hub, another arm disposed to be moved by the first-named arm when said obstruction is encountered thereby, said other arm being disposed adjacent to the normally closed switch to actuate and open the same when the other arm is moved by the first-named arm, whereby said series circuit is opened and both the motor and solenoid are deenergized when the first-named arm encounters said obstruction and the wheel hub stops rotation so that the needle is then stopped at a predetermined position in its stitching cycle, and whereby said plunger means is retracted when the solenoid becomes de-energized to retract the first-named arm from the obstruction and to release said other arm so that the normally closed switch is released and closes again, said obstruction being a notch extending radially inward of the outer surface of the wheel hub, and wherein the first-named arm has a depending tip for engaging in said notch so that the first-named arm moves laterally and moves said other arm when the tip engages in said notch.

4. A needle positioner for a sewing machine having a drive shaft for moving the needle vertically through a stitching cycle, comprising a rotatable wheel hub, a drive belt operatively connecting the wheel hub and shaft so that the wheel hub rotates continuously while the needle is moving and whereby the wheel hub completes one revolution while the needle moves through one stitching cycle, another shaft carrying said wheel hub, an obstruction on said wheel hub, and an arm disposed to ride on said wheel hub and engage said obstruction for stopping the wheel hub, a motor, a solenoid having a coil connected in parallel with said motor, a power supply, a normally closed switch, a normally open switch, a holding relay, the power supply, switches and relay being connected in series circuit with the motor and solenoid coil, whereby the motor and solenoid are energized when the normally open switch is momentarily closed to actuate the holding relay, another shaft carrying said wheel hub, a pulley on said other shaft, another pulley driven by said motor, another belt loosely entrained on the pulleys for slipping with respect to the pulleys, said solenoid having plunger means for engaging and tensioning said other belt when the solenoid is energized so that the motor drives the wheel hub, another arm disposed to be moved by the first-named arm when said obstruction is encountered thereby, said other arm being disposed adjacent to the normally closed switch to actuate and open the same when the other arm is moved by the first-named arm, whereby said series circuit is opened and both the motor and solenoid are deenergized when the first-named arm encounters said obstruction and the wheel hub stops rotation so that the needle is then stopped at a predetermined position in its stitching cycle, and whereby said plunger means is retracted when the solenoid becomes deenergized to retract the first-named arm from the obstruction and to release said other arm so that the normally closed switch is released and closes again, a first cog wheel carried by the drive shaft and another cog wheel carried by said other shaft, the first-named belt having internal cogs engaged on the cog wheels so that the two cog wheels rotate in precise coordination, said wheel hub being integral with the other cog wheel, so that the wheel hub rotates in coordination with the first cog wheel.

5. A needle positioner according to claim 2, wherein said plunger means for engaging and tensioning said other belt includes a pair of cross arms with rollers at free ends thereof for contacting a course of said other belt between the pulleys.

6. A needle positioner for a sewing machine having a drive shaft for moving the needle vertically through a stitching cycle, comprising a rotatable wheel hub, a drive belt operatively connecting the wheel hub and shaft so that the wheel hub rotates continuously while the needle is moving and whereby the wheel hub completes one revolution while the needle moves through one stitching cycle, another shaft carrying said wheel hub, an obstruction on said wheel hub, and an arm disposed to ride on said wheel hub and engage said obstruction for stopping the wheel hub, a motor, a solenoid having a coil connected in parallel with said motor, a power supply, a normally closed switch, a normally open switch, a holding relay, the power supply, switches and relay being connected in series circuit with the motor and solenoid coil, whereby the motor and solenoid are energized when the normally open switch is momentarily closed to actuate the holding relay, another shaft carrying said wheel hub, a pulley on said other shaft, another pulley driven by said motor, another belt loosely entrained on the pulleys for slipping with respect to the pulleys, said solenoid having plunger means for engaging and tensioning said other belt when the solenoid is energized so that the motor drives the wheel hub, another arm disposed to be moved by the first-named arm when said obstruction is encountered thereby, said other arm being disposed adjacent to the normally closed switch to actuate and open the same when the other arm is moved by the first-named arm, whereby said series circuit is opened and both the motor and solenoid are deenergized when the first-named arm encounters said obstruction and the wheel hub stops rotation so that the needle is then stopped at a predetermined position in its stitching cycle, and whereby said plunger means is retracted when the solenoid becomes deenergized to retract the first-named arm from the obstruction and to release said other arm so that the normally closed switch is released and closes again, said plunger means including two individual plungers spaced

apart a predetermined distance at one course of said other belt, and idler rollers on ends of said individual plungers for engaging said other belt with rolling contact to tension the same on the pulleys.

7. In a needle positioner for a sewing machine, a wheel hub rotatable in coordination with movement of said needle during its stitching cycle, a shaft carrying said wheel hub, a pulley on said shaft, a motor, another pulley driven by said motor, a belt loosely entrained on the pulleys for slipping with respect to the pulleys, a solenoid having plunger means for engaging and tensioning said belt when the solenoid is energized so that the motor drives the wheel hub, a normally closed switch in circuit with said motor, a first arm carried by the plunger and disposed to contact the wheel hub when the solenoid is energized, an obstruction on said wheel hub for engaging said arm at a certain point on the hub, a second arm engaged by the first switch arm and moved thereby when the first arm is engaged by said obstruction, said second arm being disposed adjacent to said switch for actuating and opening the same when the second arm is moved by the first arm, whereby the motor stops when said switch opens, the wheel hub stops rotation when engaged with the first arm, and the needle is positioned at a point coordinated with the position of said obstruction on the wheel hub.

8. In a needle positioner for a sewing machine, a wheel hub rotatable in coordination with movement of said needle during its stitching cycle, a shaft carrying said wheel hub, a pulley on said shaft, a motor, another pulley driven by said motor, a belt loosely entrained on the pulleys for slipping with respect to the pulleys, a solenoid having plunger means for engaging and tensioning said belt when the solenoid is energized so that the motor drives the wheel hub, a normally closed switch in circuit with said motor, a first arm carried by the plunger and disposed to contact the wheel hub when the solenoid is energized, an obstruction on said wheel hub for engaging said arm at a certain point on the hub, a second arm engaged by the first switch arm and moved thereby when the first arm is engaged by said obstruction, said second arm being disposed adjacent to said switch for actuating and opening the same when the second arm is moved by the first arm, whereby the motor stops when said switch opens, the wheel hub stops rotation when engaged with the first arm, and the needle is positioned at a point coordinated with the position of said obstruction on the wheel hub, said plunger means including a cross arm with rollers at opposite ends thereof for contacting a course of said belt between the pulleys.

9. In a needle positioner for a sewing machine, a wheel hub rotatable in coordination with movement of said needle during its stitching cycle, a shaft carrying said wheel hub, a pulley on said shaft, a motor, another pulley driven by said motor, a belt loosely entrained on the pulleys for slipping with respect to the pulleys, a solenoid having plunger means for engaging and tensioning said belt when the solenoid is energized so that the motor drives the wheel hub, a normally closed switch in circuit with said motor, a first arm carried by the plunger and disposed to contact the wheel hub when the solenoid is energized, an obstruction on said wheel hub for engaging said arm at a certain point on the hub, a second arm engaged by the first switch arm and moved thereby when the first arm is engaged by said obstruction, said second arm being disposed adjacent to said switch for actuating and opening the same when the second arm is moved by the first arm, whereby the motor stops when said switch opens, the wheel hub stops rotation when engaged with the first arm, and the needle is positioned at a point coordinated with the position of said obstruction on the wheel hub, said plunger means including a cross arm with rollers at opposite ends thereof for contacting a course of said belt between the pulleys, said obstruction being a notch extending radially inward of the outer surface of the wheel hub, and wherein the first-named arm has a depending tip for engaging in said notch so that the first-named arm moves laterally and moves said second arm when the tip engages in said notch.

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ROBERT V. SLOAN, *Primary Examiner.*