April 22, 1969 P. ZUK 3,439,638

AUTOMATIC NEEDLE POSITIONER

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Fig. 1

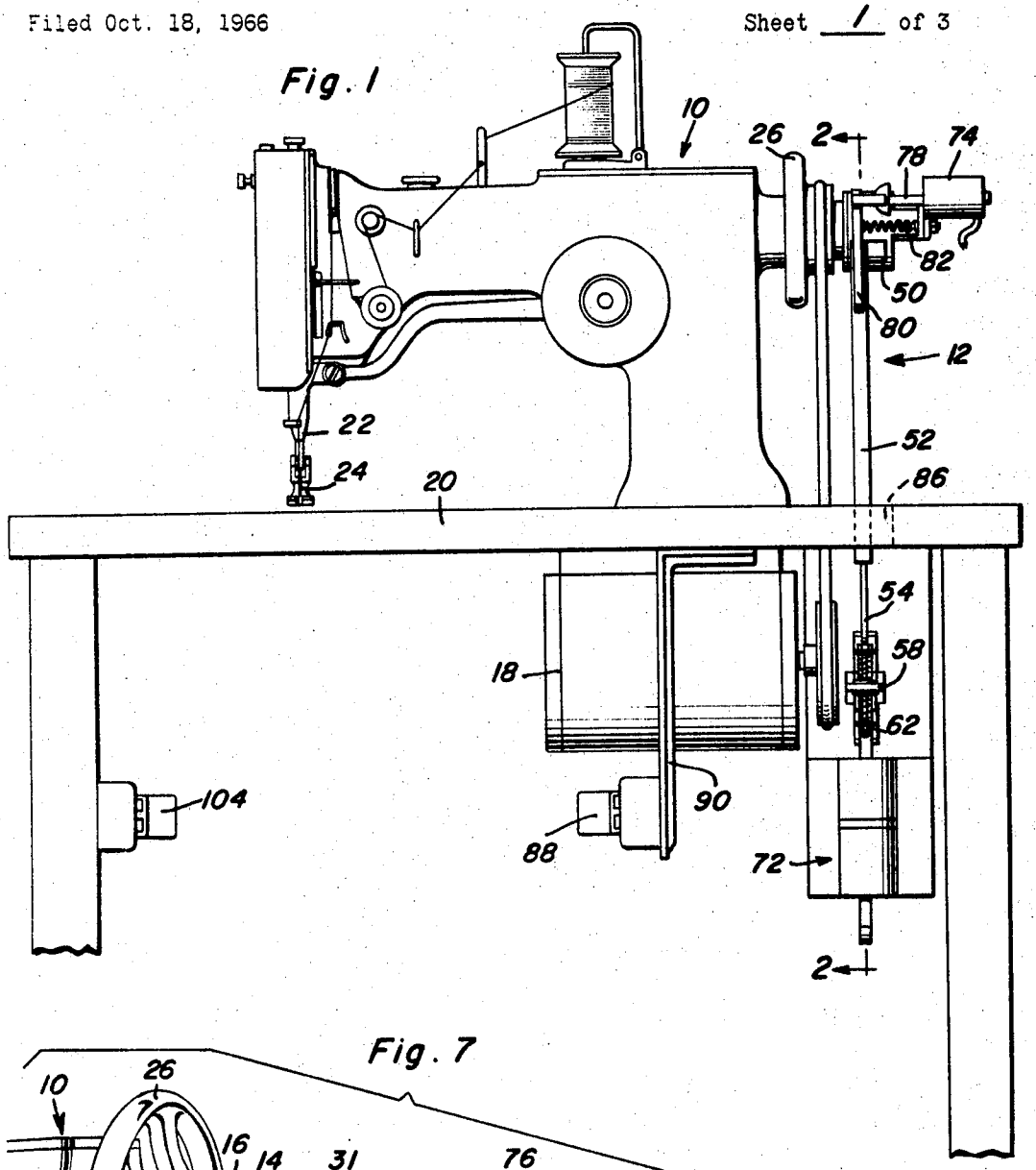
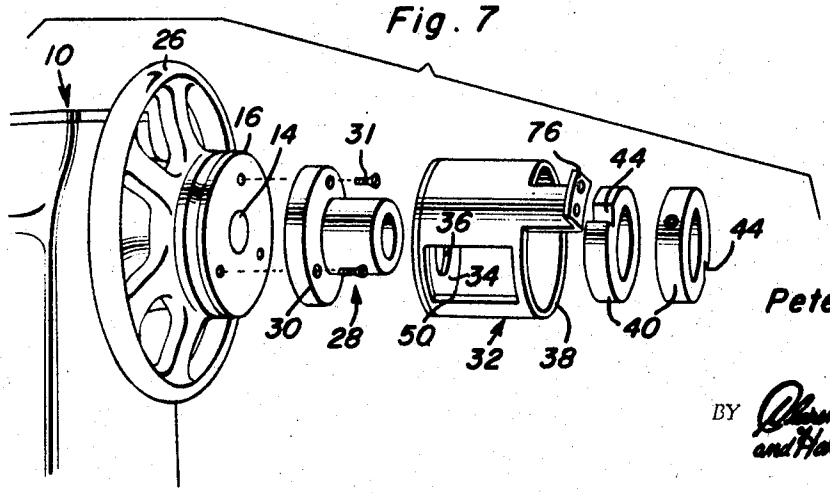


Fig. 7



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Fig. 2

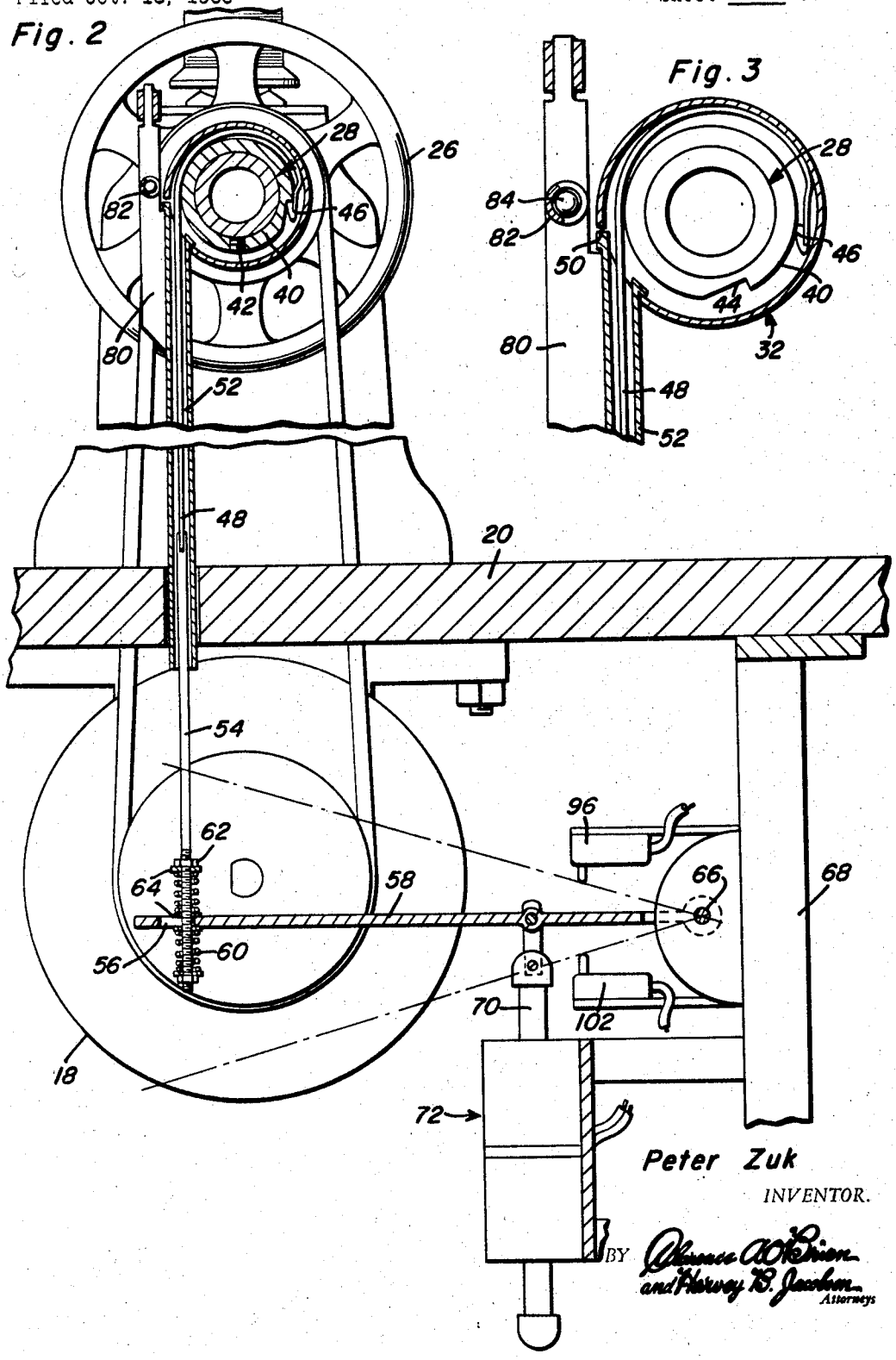


Fig. 3

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Fig. 4

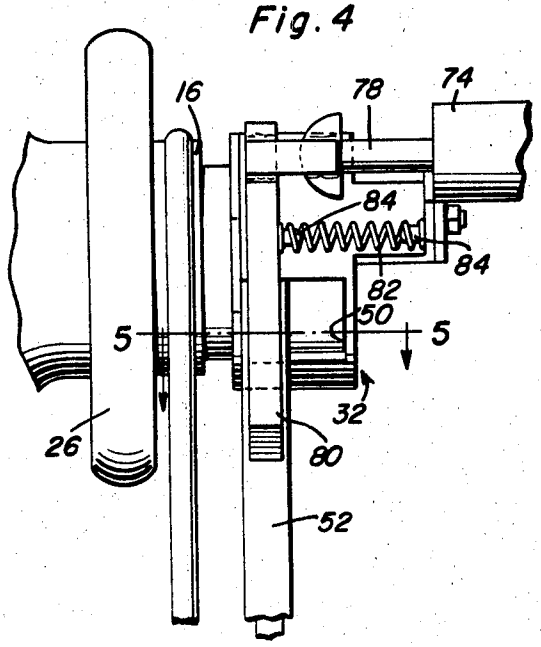


Fig. 5

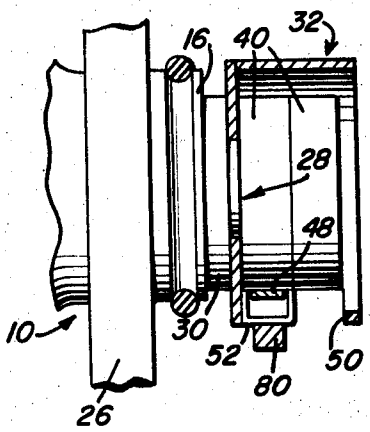


Fig. 6

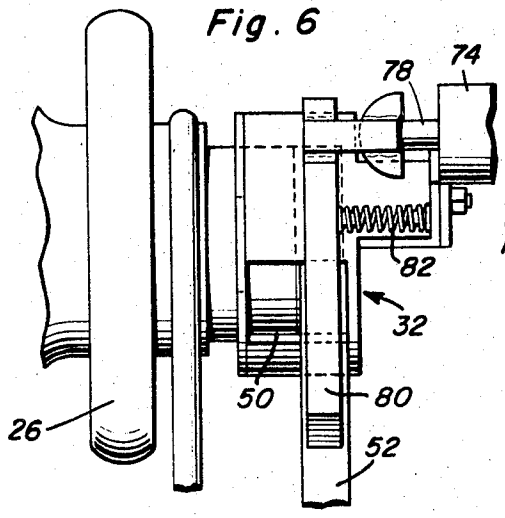
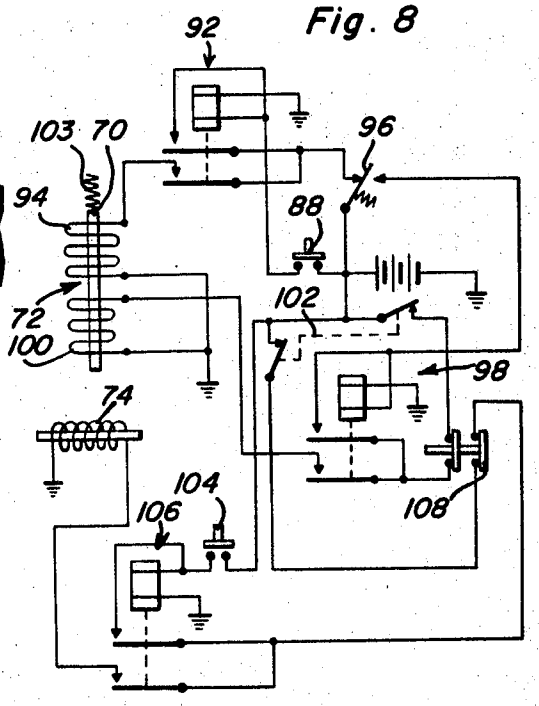


Fig. 8



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3,439,638

AUTOMATIC NEEDLE POSITIONER

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Int. Cl. D05b 69/12; F16h 27/02, 31/00
U.S. Cl. 112—219 13 Claims

ABSTRACT OF THE DISCLOSURE

A needle positioner including an extension on the drive shaft of a sewing machine, a strap reciprocally movable transversely cross the extension, a cylindrical housing for guiding the strap about the extension, a pair of laterally spaced rotationally offset notches on said extension, a pawl on the end of said strap selectively engageable with either of said notches for turning the shaft and positioning the needle, and means for automatically laterally shifting the strap for engaging one or the other of the notches.

The instant invention generally relates to an automatic positioning device, and is more particularly concerned wtih an attachment mountable upon a sewing machine or the like and operative so as to automatically position an element, i.e., the sewing needle, thereof.

As will be appreciated, in utilizing automatic sewing machines, especially in commercial establishments, there is a frequent necessity for positioning the sewing needle in either an "up" position or a "down" position. In order to effect either or both of these adjustments, many automatic devices have been devised. However, most of the heretofore known devices are of a generally complex construction which require extensive modifications of the sewing machine itself, and in some instances, are only adaptable for particular types of sewing machines.

Accordingly, it is a primary object of the instant invention to provide a needle positioning attachment which is of a highly unique although relatively simple construction and which is capable of being quickly and easily mounted upon substantially any available automatic sewing machine in a manner whereby a positive positioning of the sewing needle thereof can be effected rapidly and automatically.

Another significant object of the instant invention is to provide an attachment which can be quickly mounted in a manner so as to require only a minimum amount of space and be positioned so as to not interfere with the normal operation of the sewing machine.

Additionally, it is an object of the instant invention to provide a needle positioning attachment which can be operated by the operator using his or her knees, thereby leaving both hands free for any movement of the workpiece as might be necessary.

Basically, in order to achieve the above objects, the attachment of the instant invention is to include either one or two positioning collars fixed to the main drive shaft horizontally extended through the sewing machine, and an elongated flexible strap selectively engageable with one collar during a reciprocating movement thereof so as to effect, through the collar, a rotation of the shaft to a predetermined position. The extension of the strap, engagement with the collar, and retraction of the strap is to be effected automatically, as is the selection of the particular collar to be engaged.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is an elevational view of a sewing machine, from the operator's side thereof, with the attachment of the instant invention mounted thereon;

FIGURE 2 is an enlarged cross-sectional view taken substantially on a plane passing along line 2—2 in FIGURE 1;

FIGURE 3 is an enlarged detail taken sectionally through the upper portion of the positioning attachment;

FIGURE 4 is an enlarged elevational view of the upper portion of the mounted attachment illustrating the positioning thereof for engagement with the first positioning collar;

FIGURE 5 is a cross-sectional detail taken substantially on a plane passing along line 5—5 in FIGURE 4;

FIGURE 6 is an elevational detail similar to FIGURE 4 illustrating the positioning attachment shifted for engagement with the second positioning collar;

FIGURE 7 is an exploded perspective view of the elements comprising the upper portion of the positioning attachment; and

FIGURE 8 is an exemplary electrical diagram of the electrical system involved.

Referring now more specifically to the drawings, reference numeral **10** is used to designate a substantially conventional automatic sewing machine to which the positioning attachment **12** is secured.

The sewing machine **10** includes the conventional horizontally elongated shaft **14** which, through a suitable pulley **16** mounted on the end thereof, is belt driven from the motor **18** positioned beneath the table top **20** of the machine **10**. The shaft **14** in turn drives a vertically reciprocating shaft **22** upon which the needle **24** is mounted. In addition, as will be recognized from the drawings, a conventional enlarged handwheel **26** is also affixed to the shaft **14** immediately inward of the belt receiving pully **16**. As will be appreciated, this handwheel **26** can be manually manipulated or rotated for positioning the needle **24** where desired. It is to avoid the necessity of manually manipulating the handwheel, and at the same time providing for an automatic, rapid and exact positioning of the needle that the attachment **12** of the instant invention has been devised. In achieving this, the attachment **12** is to be affixed to the shaft **14** and is to result in an actual rotation of the shaft in the same manner as if the handwheel **26** itself was being turned.

In order to mount the attachment **12** on a conventional sewing machine, reference being had to FIGURE 7, a mounting hub **28** is utilized. This hub **28** includes an enlarged annular flat base **30** which is directly bolted, by suitable bolts **31** extending therethrough, to the end of the shaft **14**, or in this particular instance the pulley **16** rigidly affixed to the shaft and hence for all intents and purposes integral therewith. It should be appreciated that should the attachment **12** be factory mounted as an integral part of the machine **10**, the shaft **14** can be extended so as to eliminate the necessity of providing a separate mounting hub **28**.

An enlarged cylindrical housing **32** is slidably received over the hub **28** with the closed inner end **34** of the housing **32** seating against the base **30**, this closed inner end **34** having a suitable central aperture **36** therethrough which rotatably receives the hub **28**. The outer end **38** of the hollow cylindrical housing **32** is open for the slidable reception therein of two independent positioning collars **40**. Both of the collars **40** are rotatably adjustable about the hub **28** and selectively locked thereto by suitable setscrews **42** for rotation with the hub and sewing machine shaft **14**. It will be appreciated that the collars **40** act so as to retain the housing **32** on the hub **28** in that the central aperture through the closed inner end **34** of the housing **32** is only sufficient so as to rotatably receive the hub **28**.

Each of the positioning collars 40 is provided with a positioning notch 44 therein, this notch being selectively engaged by a pawl or hook 46 on an elongated vertically reciprocating flexible strap 48 for moving the sewing machine shaft 14 in a manner whereby a desired positioning of the needle 24 is achieved, the collars 40 normally being orientated to provide a positioning of the needle in its extreme up position through an engagement of the outer collar 40, and a positioning of the needle in its extreme down position through an engagement of the inner collar.

With reference to FIGURES 2 and 3, it will be noted that the strap 48, which may be steel or the like, extends upwardly through a laterally enlarged opening 50 in the front of the housing 32 and lies generally about the inner wall of the housing 32 for sliding movement thereabout. The hook or pawl end 46 of the strap 48 is offset inwardly so as to bias the pawl 46 resiliently against the surface of either of the collars 40 for an automatic introduction of the pawl 46 into the corresponding notch 44 upon an alignment therewith. The other end of the strap 48 extends vertically through a hollow rigid sleeve 52, the sleeve 52 extending vertically downward from the housing opening 50 to a point just below the table top 20. The lower portion of the strap 48, within the sleeve 52, is rigidly affixed to a vertically elongated rigid rod 54. The lower end of the rod 54 is threaded for a portion of the length thereof and freely received through an elongated slot 56 in the outer end of an actuating lever 58, the rod 54 being resiliently cushioned and retained relative to the lever 58 by means of a pair of expanded compression springs 60 engaged between the upper and lower faces of the lever 58 and stop nuts 62 adjustably threaded on the rod 54 in outwardly spaced relation to the lever 58. Suitable washers 64 can be provided as needed so as to provide appropriate bearing surfaces for the opposite ends of the springs 60.

The opposite end of the elongated lever 58 is pivoted, as at 66, to the frame 68 of the machine 10 for vertical movement in response to a vertically orientated solenoid plunger 70 pivotally engaged with the lever 58 inward of the pivotal mounting 66 thereof. It is contemplated that, in operation, upon an appropriate energization of the solenoid 72 which controls the plunger, the pawl 46 will be advanced about the interior of the housing either to or beyond the appropriate collar notch 44 and subsequently retracted so as to, through an engagement with the notch 44, rotate the collar 40 and correspondingly position the needle 24 through a rotation of the sewing machine shaft 14.

With reference to FIGURE 3 in particular, it will be noted that the upper end of the strap receiving sleeve 52 has the ends thereof engaged against the edges of the housing opening 50. In this manner, rotation of the housing 32 about the hub 28 is prevented, while at the same time allowing for a lateral sliding of the sleeve 52 within the opening 50 so as to engage the strap pawl 46 with the appropriate collar 40.

A solenoid 74 is utilized for effecting an automatic positioning of the pawl 46 for engagement with either the inner or outer collar 40. The solenoid 74 is mounted, through a suitable integral mounting arm bracket 76, laterally outward of the housing 32 and includes a plunger 78 rigidly affixed to the upper end of a vertical brace 80 affixed to the outer surface of the sleeve 52. The normal position of the sleeve 52 is toward the inner end of the housing 32 so as to engage the pawl with the inner or needle down positioning collar 40. The sleeve is retained in this position by an elongated expanded coiled compression spring 82 engaged over and between a pair of stubs 84, one fixed to the bracket 76 and the other fixed to the brace 80 affixed to the sleeve 52. When it is desired to move the sleeve 52 and strap mounted pawl 46 to the right for engagement with the outer collar 40, the solenoid 74 is energized to retract its associated plunger 78 against the biasing force of the spring 82. It should be appreciated, relative to the slight lateral movement of the sleeve 52, that the table top 20 is itself provided with a suitably enlarged aperture 86 through which the sleeve 52 passes, while the engagement between the rod 54 and rod moving lever 58 allows for a relative pivotal movement there-between at least sufficient to accommodate the limited movement which will occur at this point, this of course being in addition to the sliding movement of the lower end portion of the rod 54 within the elongated slot 56 effected upon a pivotal movement of the lever 58 as indicated in phantom lines in FIGURE 2.

In actual operation, upon a stopping of the sewing machine 10, the needle 24 will be positioned at any point between the extreme up position and the extreme lower position. Should the operator of the machine 10 wish to position the needle 24 in its extreme down position, a switch 88, preferably positioned below the table top 20 by bracket means 90 and knee actuated, is closed. This in turn operates a holding relay circuit 92 which energizes the advance coil 94 of the solenoid 72 which in turn advances the solenoid plunger 70. Upon an advancing of the solenoid plunger 70, the lever 58 is pivoted upwardly about pivot mounting 66 so as to move the inward positioned strap 48 upwardly about the interior of the housing 32 to the full limit of travel of the pawl 46 thereon. In this extreme inward position of the pawl 46, the pawl will be located within or beyond the notch 44 whereby, upon a return movement of the strap 48, the corresponding collar 40 will be rotated along therewith. Incidently, it should be appreciated that the notch 44 is so defined as to provide a positive abutment for the inwardly biased pawl 46 during the positioning operation. Such a notch has been illustrated in FIGURE 3 wherein rotation of the shaft end collars 40 thereon is to be counterclockwise. As the pawl 46 approaches its extreme inward position, a suitable limit switch 96 is engaged and momentarily released so as to operate the return relay circuit 98 for energizing the return coil 100 of the solenoid 72. This in turn results in a retraction of the solenoid plunger 70 until a second limit switch 102 is engaged to de-energize the return coil, this occurring simultaneously with an approach of the needle, through a rotation of the shaft 14, to its extreme down position. If so desired, a suitable spring 103 can be incorporated within the solenoid 72 so as to resiliently retain the plunger 70, and thereby the pawl 46, in a retracted position, upon a de-energization of the solenoid 72, thus retaining the pawl 46 clear of the notch 44 to facilitate a lateral shifting of the strap.

When it is desired to position the needle in its extreme up position, the strap 48 and pawl 46 must be shifted to the right, viewing FIGURES 1, 4 and 6, so as to engage the outer collar 40. This shifting is effected by the solenoid 74 which is operated through a second knee switch 104. This second knee operated switch 104 operates a holding relay circuit 106 which energizes the solenoid 74 so as to shift the plunger 78 thereof to the right and move the pawl bearing strap 48 into alignment with the outer collar 40. The relay circuit 106 will maintain the solenoid 74 energized until the solenoid 72 is operated and completes its return stroke and engages the limit switch 102, at which time the plunger 70 of the solenoid 72 will be appropriately retained by the spring 103, and the strap containing sleeve 52 will be returned to its left hand position in alignment with the inner collar 40. When engaging the outermost collar 40, through an initial actuation of the switch 104, it will be appreciated that the operation of the pawl bearing strap 48 is exactly as described above, differing only in the particular collar 40 engaged and the final position of the needle 24. If desired, an appropriate off-on switch 108 can also be provided for the positioning attachment 12. Further, while the two collars 40 will normally be mounted so as to provide the two extreme positions of the needle 24, these collars can be adjusted about the hub 28 and locked

thereto by the associated setscrews **42** so as to provide for any desired positioning of the needle **24**.

From the foregoing, it will be appreciated that a relatively simple although highly unique needle positioning attachment has been devised. This attachment is easily mounted upon substantially any conventional sewing machine in a manner which requires only a minimum amount of room. In operation, a pawl mounting elongated flexible strap is selectively extended into engagement with a collar fixed to the conventional sewing machine shaft, and subsequently retracted so as to effect a rotation of the shaft to a predetermined position, this in turn vertically positioning the sewing machine needle at a predetermined point. In addition, in order to provide for the positioning of the needle at two separate vertical heights, for example an extreme up position or an extreme down position, a second positioning collar is provided in conjunction with a unique shifting mechanism for laterally orientating the pawl mounting strap for selective engagement with either collar. The operation of the positioning attachment is effected through a pair of knee actuated switches which will leave the hands of the operator free to perform other tasks as may be necessary with the workpiece itself. The actual operation of the positioning attachment is effected through a pair of solenoids, one providing for the actual manipulation of the shaft moving strap, and the other providing for a positioning of the strap for engagement with either of the collars, depending upon whether the needle is to be positioned up or down. Incidently, it will also be appreciated that the second noted solenoid, solenoid **74**, also directly supports the guide sleeve **52** for the strap **48** with the sleeve in turn engaging and positioning the housing and being itself positioned by engagement through a suitable aperture **86** in the table top supporting the machine **10**.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to.

What is claimed as new is as follows:

1. A needle positioner for a sewing machine having a rotatable drive shaft and a vertically reciprocating needle operatively associated with the shaft, comprising a mounting member aligned with and constituting a rigid coaxial extension of said shaft for rotation therewith, strap means reciprocally movable transversely of said member, means for selectively reciprocatingly moving said strap means, circumferentially extending means on said mounting member for guiding said strap means, said strap means including a forward end selectively advanced and returned circumferentially about said member in response to reciprocal movement of said strap means, catch means on said mounting member releasably engageable with said forward end subsequent to the advance thereof and during its return whereby a rotation of said member to a predetermined point by the continued return of said forward end is effected, said circumferentially extending means comprising a cylindrical housing surrounding said mounting member and defining a circumferential path thereabout for the forward end of the strap, said housing having an opening defined transversely thereinto for the reception of the strap means therethrough, second catch means on said member laterally and rotatably spaced from said first-mentioned catch means, means for laterally adjusting the forward end of the strap means for selective engagement with either catch means, and a guide sleeve freely surrounding said strap means, said sleeve including an upper end positioned adjacent the housing opening, said means for laterally adjusting the forward end of the strap means engaging the sleeve adjacent the upper end thereof for effecting a selective lateral movement thereof and consequently a lateral adjustment of the forward end.

2. The device of claim **1** wherein said means for laterally adjusting the forward end of the strap means includes means for resiliently biasing said sleeve into alignment with one of said catch means.

3. The device of claim **2** wherein said means for reciprocating said strap means comprises a solenoid having a plunger therein, and advance and return coils for effecting an advance and return of said plunger upon an energization of said solenoid, and means engaging the rear end of said strap means with the plunger for movement therewith.

4. The device of claim **3** wherein the means engaging said plunger with the rear end of said strap means comprises an elongated lever pivotally mounted at one end at a point fixed relative to the sewing machine, the second end of said lever being engaged with the rear end of said strap means, and means pivotally securing said plunger to said lever between the opposite ends thereof.

5. The device of claim **3** wherein said means for laterally adjusting the forward end of the strap means includes a solenoid having a plunger therein rigidly fixed to said sleeve and supporting the upper end of said sleeve adjacent said housing.

6. The device of claim **5** including bracket means on said housing mounting said last-mentioned solenoid, the upper end of said sleeve engaging and stabilizing said housing against rotational movement with the shaft engaged member.

7. The device of claim **5** wherein each of said catch means comprises a collar having a notch, said collar being rotatably adjustable about said member, and means for fixing each collar to said member in an adjusted position thereon.

8. The device of claim **7** wherein the forward portion of said strap means is resiliently flexible, said forward end of the strap means defining a pawl biased into continuous engagement with said mounting member for automatic engagement in either of said notches upon alignment therewith.

9. Means for selectively rotating a shaft comprising mounting hub means for engagement with the shaft, a cylindrical housing freely surrounding said hub means and defining a circular path thereabout, said housing having an opening defined therein, an elongated hub rotating means extending into said housing through said opening, the portion of said hub rotating means within said housing following said circular path, catch means at a predetermined point about said hub means, means for selectively extending said hub rotating means inwardly relative to said housing and subsequently retracting said hub rotating means outwardly relative to said housing, and means on the inner end of said hub rotating means selectively engageable with said catch means upon a retracting movement of said inner end past said catch means for a rotational movement of said hub means in conjunction with the retracting movement of said hub rotating means.

10. The device of claim **9** wherein said catch means comprises a collar having a notch therein, said collar being rotatably adjustable about said hub means, and means for fixing said collar to said hub means in an adjusted position thereon.

11. The device of claim **10** including second catch means on said hub means laterally and rotatably spaced from said first-mentioned catch means, said second catch means comprising a collar having a notch therein, said second catch means collar being rotatably adjustable about said hub means, and means for fixing said second catch means collar to said hub means in an adjusted positioned thereon, and means for laterally adjusting the inner end of said hub rotating means for selective engagement with either catch means.

12. A needle positioner for a sewing machine having

a rotatable drive shaft and a vertically reciprocating needle operatively associated with the shaft, comprising an extension on said shaft for rotation therewith, strap means reciprocally movable transversely of said extension, means for selectively reciprocatingly moving said strap means, means on said extension for guiding said strap means thereabout, said strap means including a forward end selectively advanced and returned circumferentially about said extension in response to reciprocal movement of said strap means, catch means on said extension releasably engageable with said forward end subsequent to the advance thereof and during its return whereby a rotation of said extension and shaft to a predetermined point by the continued return of said forward end is effected, second catch means on said extension laterally and rotatably spaced from said first-mentioned catch means, means for laterally adjusting the forward end of the strap means for selective engagement with either catch means, and a guide sleeve freely surrounding said strap means, said sleeve including an upper end positioned adjacent the means for guiding the strap means about the extension, said means for laterally adjusting the forward end of the strap means engaging the

sleeve adjacent the upper end thereof for effecting a selective lateral movement thereof and consequently a lateral adjustment of the forward end.

13. The device of claim **12** wherein each of said catch means comprises a notch, said forward end of the strap means defining a pawl selectively engageable in either of the notches, the forward portion of said strap means being resiliently flexible and the pawl defining forward end of the strap means being biased into continuous engagement with said extension for automatic engagement in either of said notches upon alignment therewith.

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