

May 17, 1955

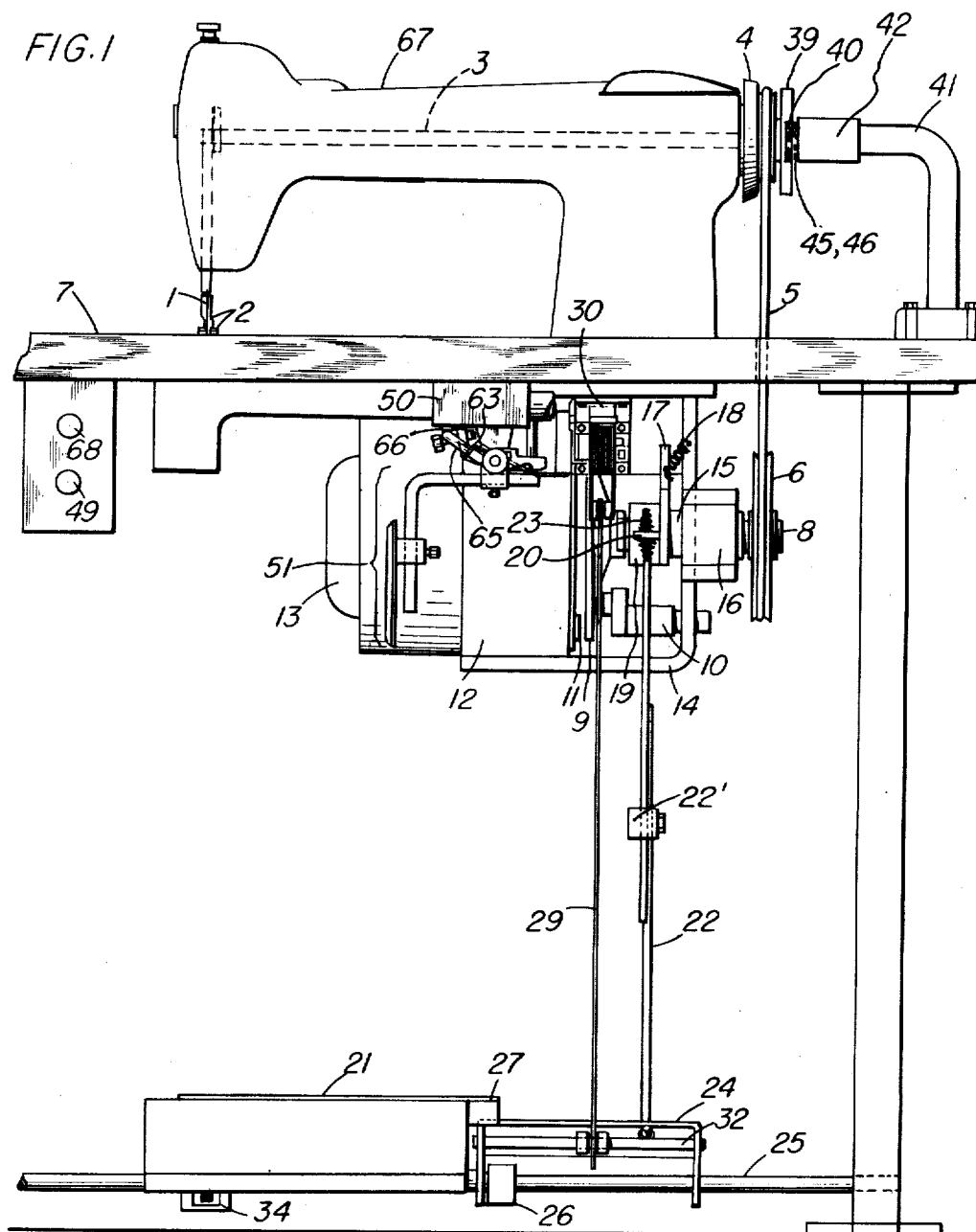
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2,708,415

NEEDLE STOP APPARATUS FOR POWER-DRIVEN SEWING MACHINES

Filed Aug. 25, 1950

8 Sheets-Sheet 1



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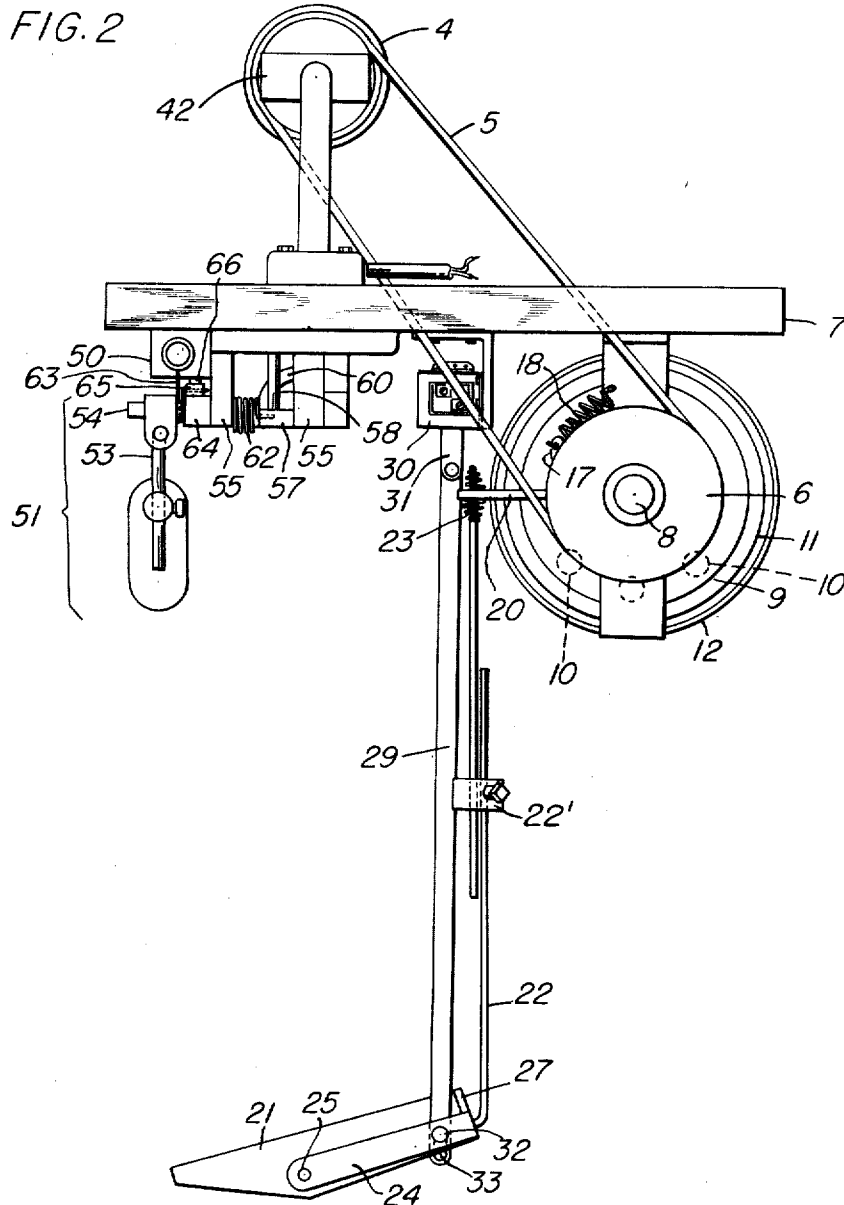
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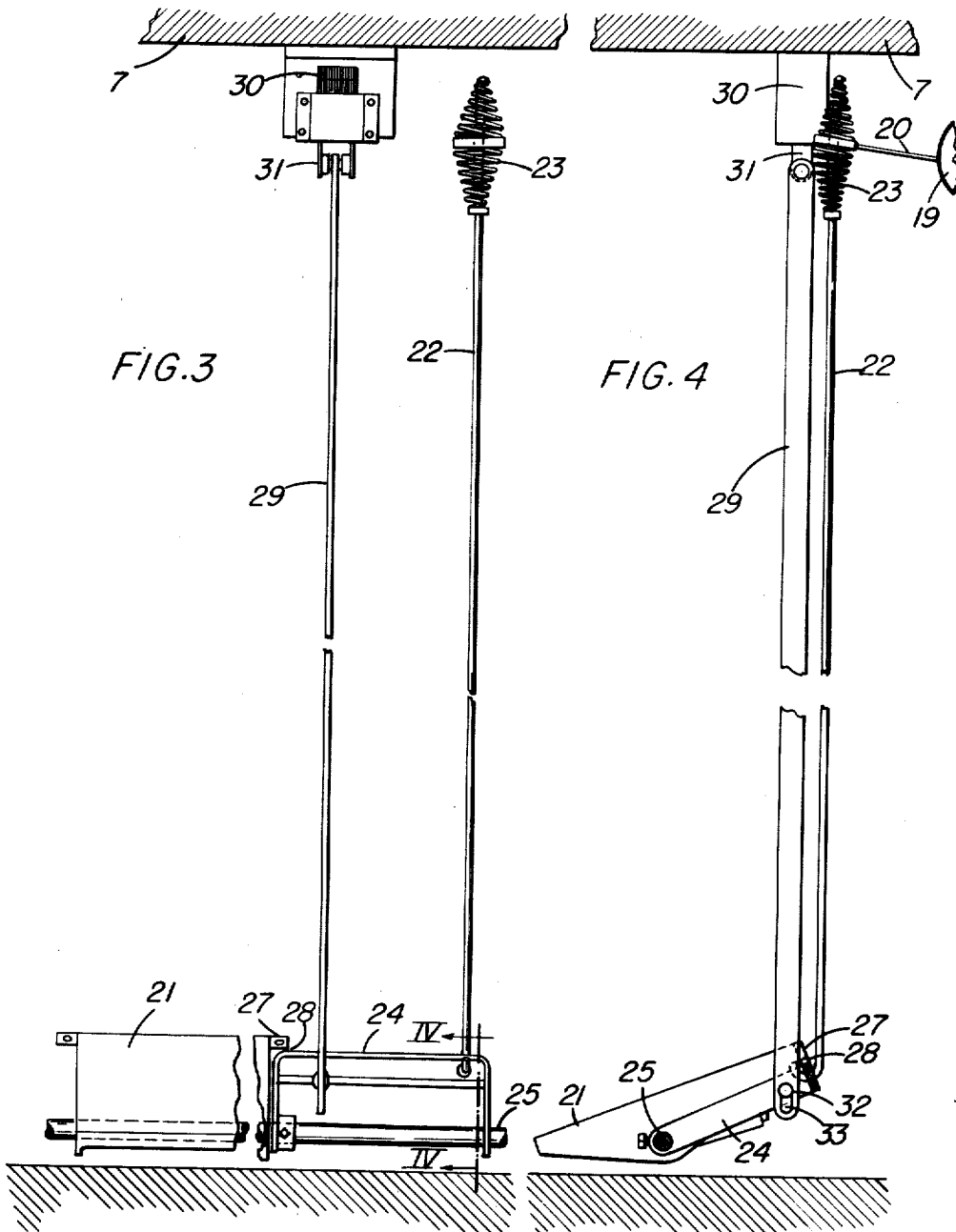
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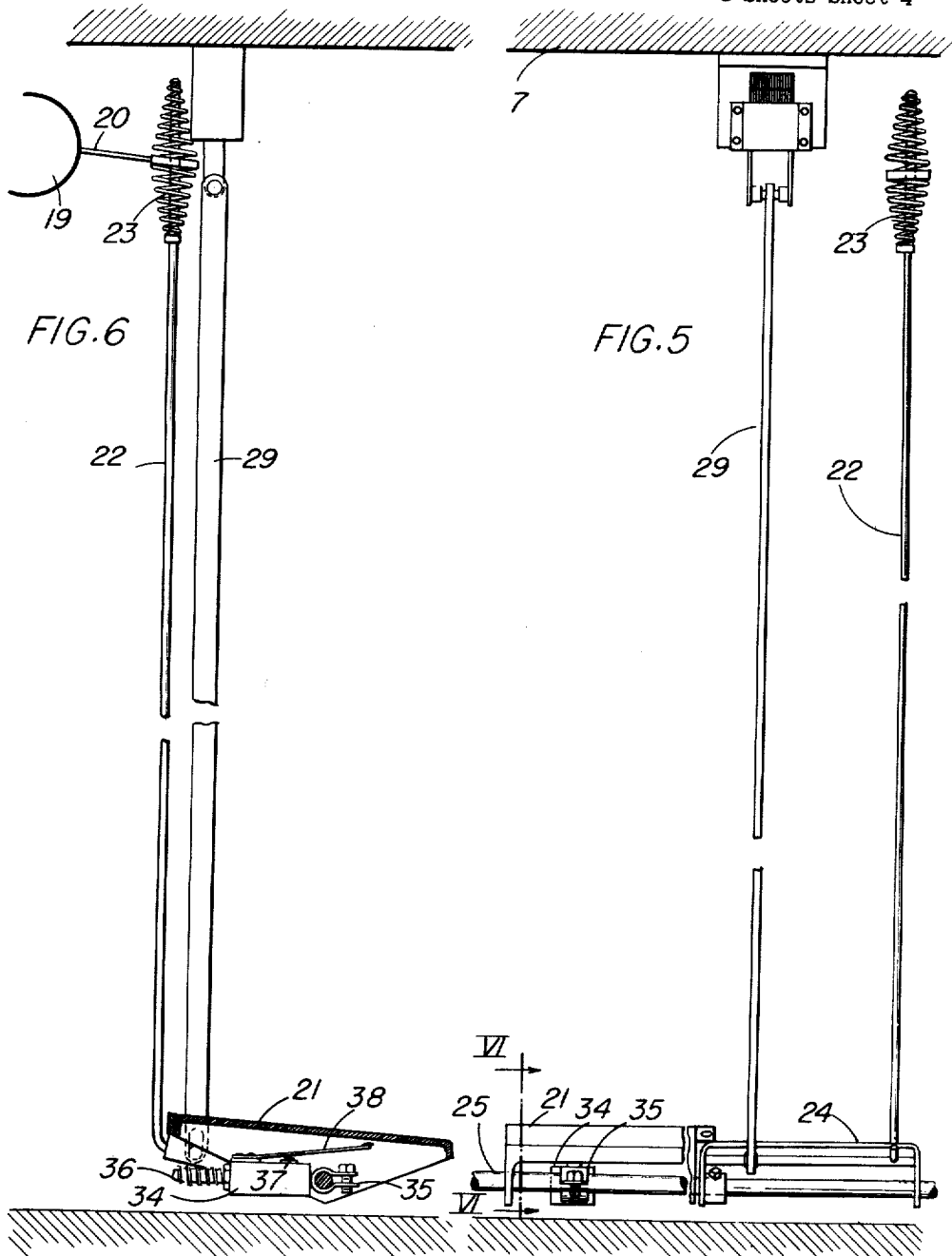
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8 Sheets-Sheet 4



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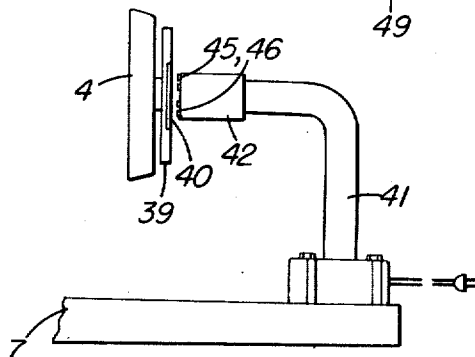
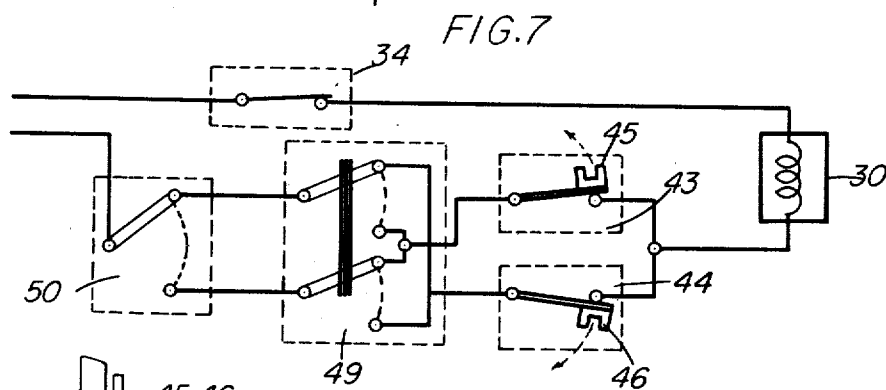
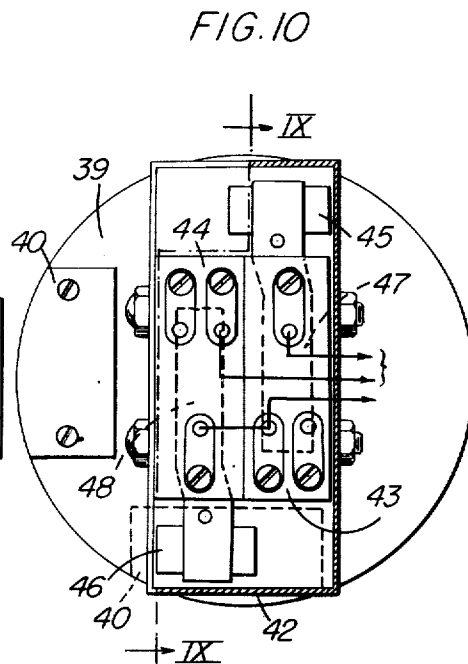
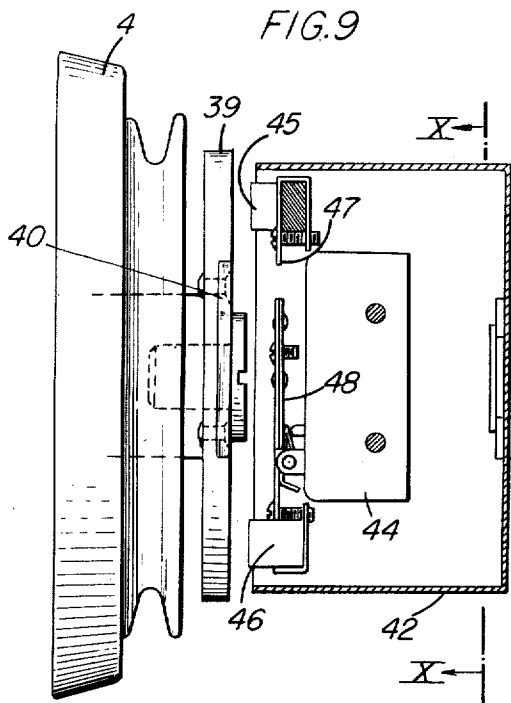
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8 Sheets-Sheet 5



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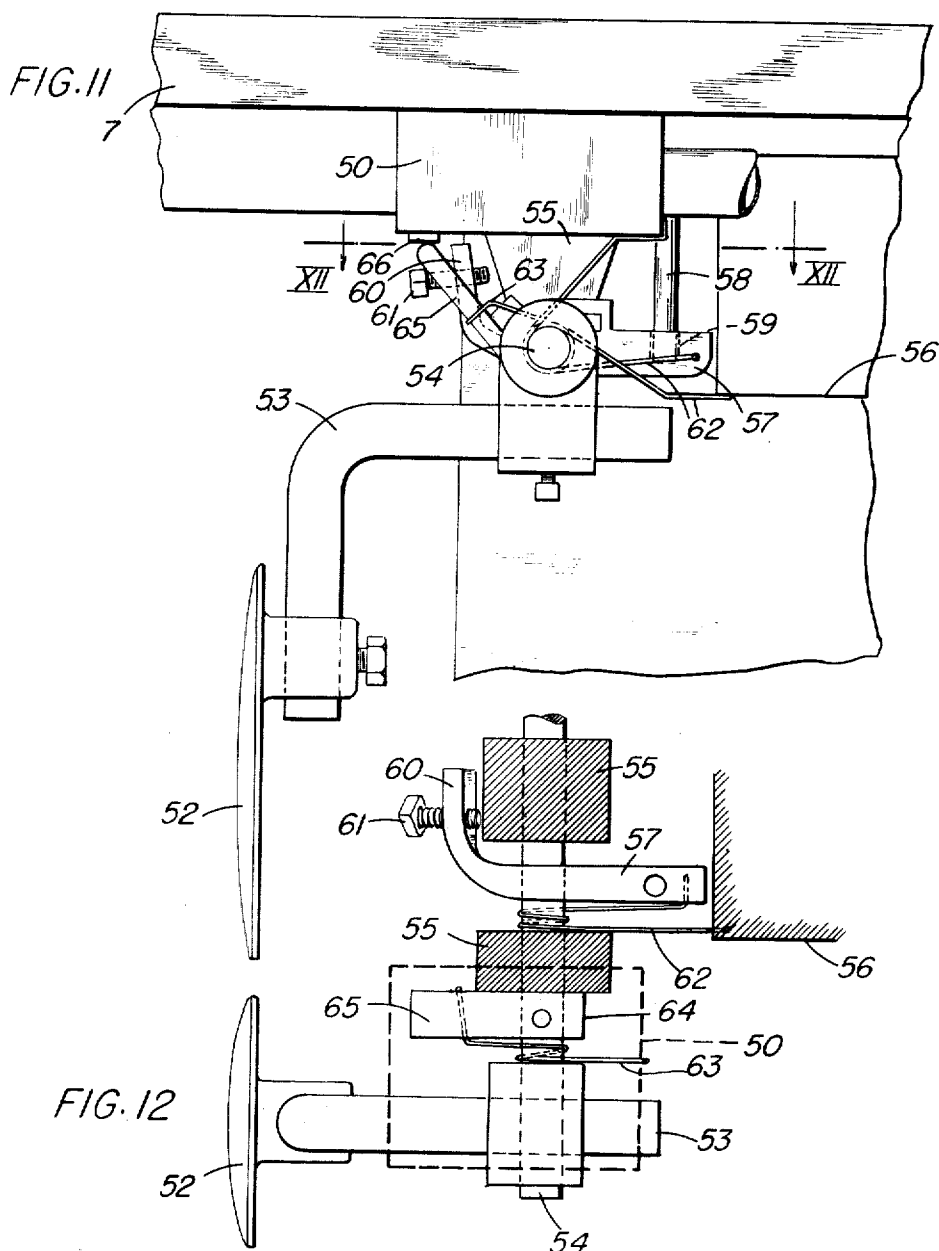
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8 Sheets-Sheet 6



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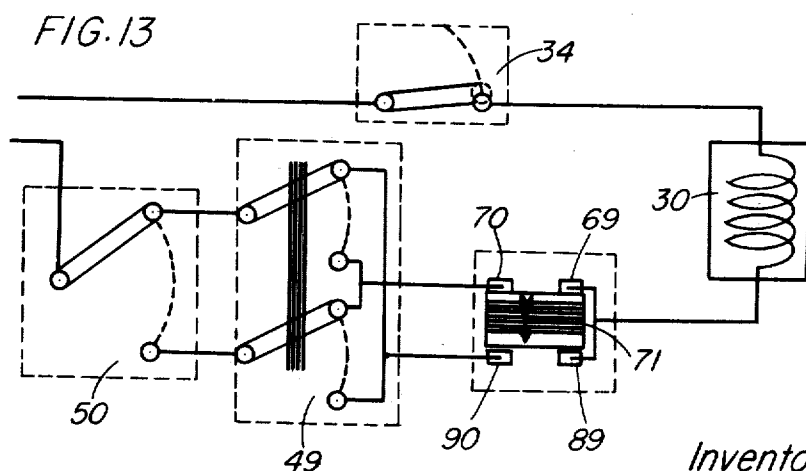
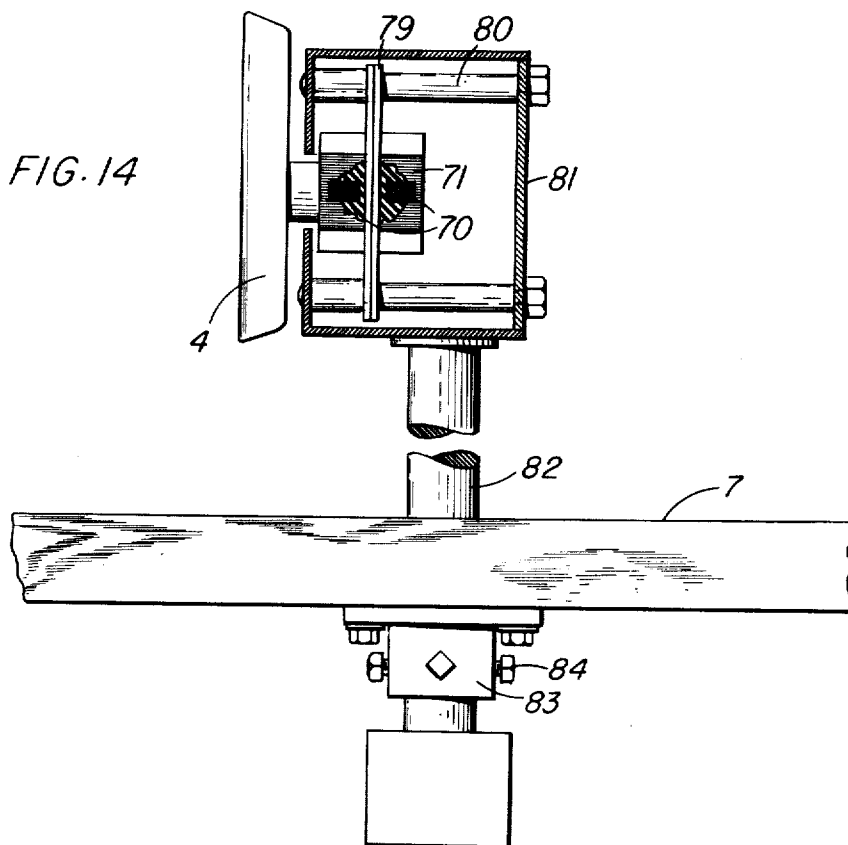
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8 Sheets-Sheet 7



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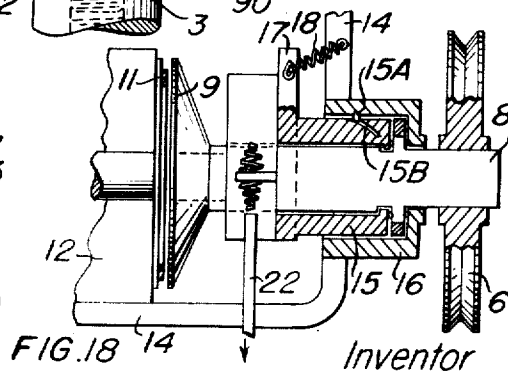
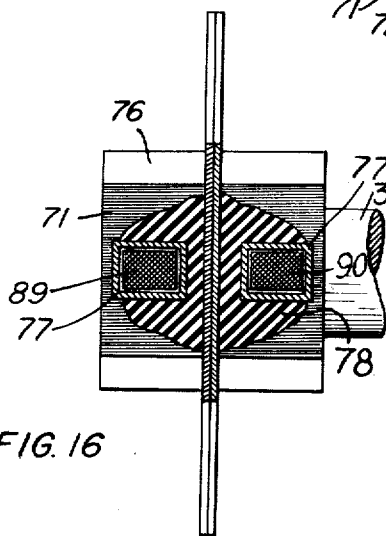
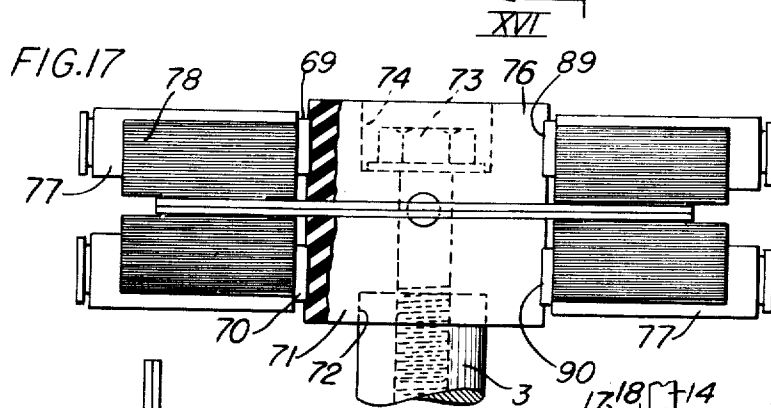
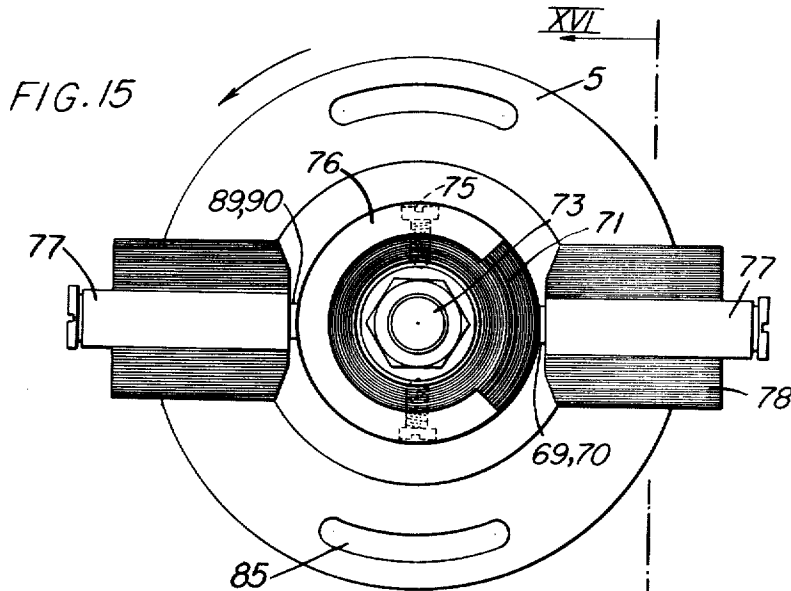
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8 Sheets-Sheet 8



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2,708,415

NEEDLE STOP APPARATUS FOR POWER-DRIVEN SEWING MACHINES

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Application August 25, 1950, Serial No. 181,501

12 Claims. (Cl. 112—219)

This invention relates to a needle stop mechanism for power-driven sewing machines and more particularly to apparatus for causing a reciprocating needle to stop in a predetermined position. Such power-driven machines normally operate at 1500 to 5000 revolutions per minute of the needle driving shaft. It is desirable to have a sewing machine stop with the needle in its "up" position when threading the needle, changing the bobbin thread on a lock stitch sewing machine or changing the position of the needle in the fabric. It is desirable to leave the needle in its "down" position during sewing when it is necessary to turn the fabric without removing the needle from the fabric, as in the case of turning a line of stitching. It has been time-consuming and bothersome to bring the ordinary reciprocating needle of the sewing machine to a stop and place it in a specific "up" or "down" position for any of these purposes. Generally the position is achieved by turning the balance wheel by hand after the machine has been stopped. I have devised an apparatus which achieves this positioning automatically and it is particularly adapted for high speed power-driven sewing machines. When using my apparatus, the operator uses only the usual pedal and knee controls. Furthermore, my novel apparatus is manipulated by special movements of the pedal and knee controls such as the usual knee lift, without causing any change in the machine actuation obtained by the ordinary movements of the pedal and knee lift. According to my invention, I provide automatic needle stop apparatus adapted to be activated by manually operable means such as the usual control pedal for the clutch of the machine. This apparatus is adapted to cause the machine to move the needle to a predetermined position if the brake brings it to a stop in any other position. Other features and advantages of my invention will be described in connection with the detailed description of the construction and operation of the embodiment of the invention which will be hereinafter set forth.

I will show and describe the invention incorporated in one of the well-known high speed sewing machines with a single needle producing lock stitch. I will describe it in connection with this particular machine, but it should be understood that the invention is equally applicable to any power-driven sewing machine having a needle which operates in a reciprocating manner to place stitches in the fabric.

In the drawings:

Fig. 1 is a front elevation of a power-driven sewing machine embodying my invention, only pertinent parts being shown and the pedal and associated parts being shown in slow speed position.

Fig. 2 is a view in elevation from the right end of the machine of Fig. 1 with the right leg of the table removed.

Fig. 3 is a diagrammatic view on a large scale of the pedal, transmitter rod and solenoid of Figs. 1 and 2, viewed from the front of the machine, with the pedal shown raised in my novel automatic control position.

Fig. 4 is a diagrammatic view from the right end of

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the machine corresponding to Fig. 3, taken on the line IV—IV of Fig. 3 closely adjacent the transmitter rod, looking in the direction of the arrow.

Fig. 5 is a diagrammatic view similar to Fig. 3 showing the pedal down in full speed position.

Fig. 6 is a diagrammatic view from the left end of the machine, of the parts in the position of Fig. 5, on line VI—VI.

Fig. 7 is a schematic wiring diagram of the electrical circuit of the preferred embodiment of Figs. 1 and 2.

Fig. 8 is a view of the mounting of the magnet operated interrupter unit of Fig. 1.

Fig. 9 is a plan view of the interrupter unit of Figs. 1, 2 and 8, cut away horizontally on the line IX—IX of Fig. 10 to show the switch levers.

Fig. 10 is a view in elevation from the right side of Fig. 9, on the line X—X of that figure, looking in the direction of the balance wheel.

Fig. 11 is a view in elevation from the front of the machine, on an enlarged scale, of the knee lift and my novel controls associated therewith.

Fig. 12 is a plan view taken on the line XII—XII of Fig. 11, showing, in dotted lines, the micro switch which is operated by the knee lift.

Fig. 13 is a schematic wiring diagram for an alternate form of interrupter unit using brush type contacts.

Fig. 14 is a view in elevation, from the front of the machine, of the brush type interrupter unit used in Fig. 13, the casing of the interrupter being shown cut away.

Fig. 15 is a view in elevation from the right end of the machine, of the brush type interrupter of Figs. 13 and 14.

Fig. 16 is a sectional view of the contact member itself, taken on the line XVI—XVI of Fig. 15.

Fig. 17 is a plan view of the brush type interrupter of Fig. 15.

Fig. 18 is a view in vertical longitudinal section through part of a general type of power means, clutch and brake such as suitable for use in sewing machines according to my invention.

Heretofore, in operating a power-driven sewing machine, whether the power supply is a line shaft or belt or an individual motor, when stopping the machine it has been a great loss of time and a source of annoyance to the operator to have to adjust the needle to get it to either its "up" or "down" position.

Efforts have heretofore been made to devise mechanisms to insure that the needle would stop in the desired position at the end of its reciprocating movement, but these devices have involved separate control motors and overrunning clutches, or have otherwise been expensive or unsatisfactory. I have devised needle stop apparatus which can be added to an existing sewing machine with minimum trouble and expense and which, because of the manner in which it is operated, does not disturb the usual controls of the machine or require any retraining of operators. The important cooperating parts of my invention are a control means preferably activated by the pedal and an automatic interrupter unit operating in synchronism with the needle movements to stop the needle in a predetermined end position. I also provide means preferably combined with the knee lift, to select or change the stop position during sewing operations.

I will first describe the pedal control means, then the preferred interrupter unit for stopping the machine in the desired position, the knee lift mechanism and, finally, an alternate form of the interrupter unit.

In the embodiments shown in the drawings there is the usual needle 1 reciprocating vertically through the presser foot 2. The needle is driven by a rotating shaft 3, on one end of which is the usual balance wheel 4. A belt 5 connects the balance wheel to a driving pulley 6 located below the sewing table 7. The pulley is on a hori-

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zontal shaft 8 carrying a clutch disc 9. (See Figs. 18, 1 and 2.) The center of this disc is slightly conical. One side face of the periphery of the disc faces brake members 10, and the other side a continuously revolving member or ring 11 on the flywheel of the electric motor 13 which drives the entire machine. The motor and its drum are suspended from the table by a frame 14 which underlies the drum 12 and extends upwardly to the table at such a point that it acts as a support for the brake member 10 and the clutch shaft 8. The brake member 10 is in the form of a bracket presenting suitable friction surfaces to the clutch disc at two points. The motor may be considered as the primary power means and the brake as the primary friction means.

The manner in which the clutch shaft 8 is carried on the frame 12 will now be set forth. Surrounding the shaft is a longitudinally movable sleeve bearing 15 which controls the longitudinal position of the shaft 8. The sleeve bearing can rotate on its axis independently of the shaft. This ability of the sleeve bearing is taken advantage of to move the clutch disc between the brake and motor-engaging positions. The sleeve bearing is encased at its midpoint by a fixed bearing 16 mounted on the frame 14. There is a curved spline 15A on the surface of the sleeve bearing inside the fixed bearing and a cooperating groove 15b in the fixed bearing. Rotation of the sleeve bearing thus moves the clutch disc between the brake and driving positions. There is an arm 17 on the sleeve bearing between the fixed bearing 16 and the clutch disc 9 to which is attached one end of a tension spring 18 whose other end is attached to the frame 14. The spring and arm are so located as to turn the sleeve bearing in a direction which moves the clutch disc 9 away from the clutch ring 11 and in engagement with the braking means 10. Thus the clutch which rotates the drive shaft 3 is normally braked. The arm 17 can be attached to a transmitter collar 19 fixed on the sleeve bearing.

This collar is part of a general type of transmitter or clutch-motor which is well known in the art. Such transmitters are always provided with an arm 20 for connection to a pedal and which is pulled down against spring pressure to move the clutch from braked position into frictional engagement with a power-driven member. The distance that the transmitter arm is pulled down determines the amount of slippage between the clutch and the power-driven member, which in turn determines the speed of the machine.

The transmitter arm 20 is used to connect the clutch to a control pedal 21. The elements in my apparatus for connecting the pedal 21 and transmitter arm are the following. There is the usual vertical transmitter rod 22 which is adjustable in length by set-screw sleeve 22'. The upper end of the rod is connected to the arm by a double cushion spring 23.

The lower end of the transmitter rod 22, instead of being connected directly and positively to the pedal 21, is connected through the intermediary of a pivoted element 24. This takes the form of a yoke alongside the pedal but it is pivoted on the same horizontal rod 25 as the pedal. This yoke constitutes means coordinated with the pedal in the following manner. As can be seen from the drawings, the two ends of the yoke 24 are swivelled on the rod 25, and by means of a collar 26 on the rod, one leg of the yoke is kept closely adjacent to the side of the pedal. Extending across the upper end of the pedal, and extending laterally to one side of it for a short distance, as shown in Fig. 1, is a flat bar 27. One end of this bar overlies the top of the yoke, the yoke not being as high as the pedal. The transmitter rod 22 is hooked in a hole in the center portion of the yoke and the adjustment of the parts is such that when the pedal is back in its automatic control position, there is a slight space 28 between the yoke and the overlying end of the bar (see Figs. 3 and 4). It will be seen that the pedal

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can be depressed a short distance from its automatic control position before engaging the yoke and moving the transmitter rod 22. The yoke 24 also has attached to it a vertical rod 29 leading upwardly to a solenoid 30 having a plunger 31 to be pushed downwardly when the solenoid is energized. This plunger is pivotally connected to the vertical rod 29. The solenoid is electrically connected in a circuit hereinafter described, so that when energized the solenoid will push its rod 29 down a certain distance against the resistance of the transmitter spring. The solenoid may be considered as the supplemental power means.

As shown in the drawings, the solenoid 30 is mounted on the underside of the sewing table. The actual connection between the solenoid push rod 29 and the yoke 24 is by means of a round rod 32 secured to the side legs of the yoke. It is approximately parallel to the main pivot rod 25. The round rod 32 lies in a slot 33 in the push rod so that the yoke can be moved pivotally downward by the pedal to full speed position, which is farther than it can be pushed down by the solenoid. For this purpose the length of the rod 22 is adjusted so that the solenoid pushes the arm 20 only far enough to run the machine at low speed. It is desired to note that while the left end of the yoke 24 is overlapped by the bar 27 on the pedal, so that, though the operator can lower the transmitter rod 22 after the pedal has moved down to bring the bar 27 in contact with yoke 24, the operator cannot raise the transmitter rod 22 at all. The raising of the transmitter rod is caused by the tension spring 18. This tension spring can be adjusted to raise the transmitter rod to its extreme upward position in which the driving pulley 6 is not only disengaged from the clutch but is fully braked by pressure of disc 9 against brake members 10. It simultaneously raises the pedal to its normal "at rest" position. The machine therefore normally is stopped with the brake on and the clutch disconnected. This customary adjustment need not be disturbed when my invention is added to a sewing machine.

The control circuit for the above-mentioned solenoid 30 includes an energizing switch 34 located under the pedal 21. It is mounted on the main pivot rod 25 of the pedal by means of a clamp 35, the electrical wires coming to this switch through a flexible wire BX conduit 36. The switch 34 is a micro switch having an operating button 37 projecting from its upper face. This operating button is adapted to be actuated by a spring 38 adjusted to close the switch when depressed by the heel side of the pedal when the toe side is raised beyond the "at rest" position. The parts are so dimensioned that the switch is able to open itself when the toe side of the pedal has been depressed as far as the "at rest" position. This also is sufficient to close the space or gap 28 between the bar 27 on the pedal and the yoke 24. Thus it will be seen that the switch is closed only when the pedal is above its "at rest" position. The construction is so made that the spring 38 forming part of the micro switch 34 will lower the toe side of the pedal to its "at rest" position as shown in Fig. 6 whenever the pressure of the operator's foot is released. As can be seen by reference to Fig. 7 or Fig. 13, the switch 34 is connected in series with the solenoid 30 and the solenoid can be activated only when the pedal is in the automatic control position.

As can be seen from the schematic wiring diagrams, Figs. 7 and 13, the circuit passing through the solenoid 30 not only has to be completed at switch 34 but also has to be completed by the automatic interrupter unit which I have provided in association with the balance wheel of the sewing machine. These means also are in the above-mentioned electrical circuit.

I will now describe the interrupter unit of the preferred form which is shown in Figs. 1, 2 and 7-10 of the drawings. As shown in the wiring diagram of Fig.

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7, this means of breaking the circuit is on the opposite side of the solenoid 30 from the switch 34 in the pedal. Attached to the end of the needle drive shaft 3 beside the balance wheel 4 is a non-magnetic disc 39 spaced slightly from the balance wheel and having therein a soft iron segment 40 near the periphery of the disc and exposed on the side away from the balance wheel. This segment is so located that when the needle is in its uppermost position the segment will be in its left-hand position opposite magnet 46, as shown in dotted lines in Fig. 10. Supported on a bracket 41 on the right-hand end of the sewing table is a hollow casing 42 made of non-magnetic material. In this hollow casing are carried two single-pole normally-closed micro switches 43, 44 having permanent magnets 45, 46 mounted on non-magnetic switch levers 47, 48 in such manner that when the iron segment passes each magnet at low speed, it will have time to attract and move the magnet. The parts are so placed that the movement of the magnet toward disk 39 will open the switch in each case, but the movement of each switch is so limited that the magnet cannot actually touch the iron segment 40 or any other part of the disc 39. Referring now to the wiring diagram of Fig. 7, the line connections at the upper left of the figure can be made by means of the attachment plug cap shown in Fig. 8 and brought in to the switches through the hollow bracket 41.

As described above, switches 43 and 44 have their respective operating levers 47 and 48 adapted to carry magnets 45 and 46, respectively, as shown in Figs. 9 and 10. The levers are substantially horizontal so the weight of the magnets does not move them from normal position. All metal parts of switches 43 and 44 and casing 42 are of non-magnetic material so that there is nothing to cause operating movement of the levers except the attraction of the magnets to iron segment 40. As shown in Fig. 7, switch 44 is connected to the line and switch 43 is not. Therefore, if switch 44 is closed the solenoid will be energized until segment 40 reaches magnet 46 at slow speed, at which point magnet 46 operates lever 48, opening switch 44 deenergizing the solenoid, resulting in immediate full braking by spring 18 with the needle in its uppermost position. If switch 49 or 50 is thrown to opposite position, switch 43 will be connected to the line and full braking will result when segment 40 reaches magnet 45 and the needle is down. Note that it is impossible for both switches 43 and 44 to be connected to the line at any time.

The mass and area of the iron segment 40 are factors in determining the maximum speed of the disc 39 at which the magnets will operate their respective switches at approximately the points described. At high speeds the magnets will be subject to a pulsating attraction toward the disc. This pulsation will be roughly integrated into an attraction equivalent to that of a flat ring of soft iron of the form generated by a revolution of the iron segment 40 and having a total mass equal to the mass of the segment 40 itself. As this attraction will be substantially less than one-third of the attraction of segment 40 while passing one of the magnets at slow speed, I space the magnets at such a distance from the disc that inertia will prevent operation of the switches until deceleration of the machine by normal braking action reaches a speed which permits complete braking action within the fraction of a revolution during which one of the magnets is moved by attraction to segment 40. The holes for the bolts which hold the bracket to the sewing table can be availed of to adjust the space between the magnets and the disc for this purpose.

It will be observed that the permanent magnet is adapted to cause relative movement between two other parts, i. e., it moves the switch lever on which it is mounted, thereby breaking the electric circuit. This means of breaking the electric circuit is particularly useful in a high speed power-driven electric sewing machine, be-

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cause there is no mechanical engagement between the rotary means and the current-carrying parts. There is also no mechanical wear on the switch contacts during high speed because the inertia of the magnets prevents sufficient movement of the switch levers to close and open the contacts except at slow speed.

The solenoid is activated by raising the pedal to what I term the "automatic control" position. This position is located above the "at rest" or normal back position. The automatic control mechanism which I provide is adapted to cause the clutch to drive the needle only until the needle is near a predetermined end position of its cycle of movement. In this way the needle can be stopped in the end position automatically merely as a result of raising the pedal to the automatic control position. Any automatic movements of transmitter rod 22 accompanying such stoppage will not disturb the pedal which is beyond the reach of yoke 24.

The manually operated means, i. e., the pedal, is adapted to close this electric circuit when the pedal is moved to a special, otherwise ineffective, position. In the example shown, this position is beyond the fully braked position, i. e., on the opposite side from the normal running positions. This special position of the pedal is higher, i. e., further back than the normal "at rest" position. The effect of this positioning of the pedal is to cause the solenoid to push down on the yoke 24 and bring the clutch to slow speed position and hold it there until the solenoid is de-energized.

For the majority of purposes the stopping of the needle is followed by raising of the presser foot 2. In the ordinary commercial sewing machine the presser foot is raised by a so-called knee lift 51. In Figs. 1, 2, 11 and 12 I have shown such a knee lift modified to give an improved manipulation of my novel parts. The knee lift, taken in connection with the parts heretofore described, provides for the greatest saving of time and labor for the operator and, further, simplifies the installation of my needle stop.

The most economical installation is to have the single pole switch 50 operated by the knee lift and the double pole switch 49 operated by hand, though the results of the operations are not affected if the switch 49 is operated by the knee lift and the switch 50 operated by hand. I have shown the switch 49 mounted on the left side of the table 7 beside the main motor switch 68 which supplies the power for the power supply of the sewing machine. I will now describe the mounting of switch 50 as used in connection with the knee lift. The position of the two switches can be reversed and the single pole switch placed on the sewing table and the double pole switch placed underneath the table with the knee lift.

The knee pad 52 of the knee lift is carried on a bent extension arm 53 connected to a horizontal main operating shaft 54. The connection is such that when the operator presses against the pad with her knee, the shaft 54 is turned about its longitudinal axis. This shaft is suspended from the table 7 by lugs or bearings 55. These bearings may be formed as part of the casting of the oil pan 56 or as independent castings suspended directly from the bottom of the table. The operating shaft 54 has on it the usual arm or front stop dog 57 extending to the right, as viewed in Fig. 11. This dog engages with a vertical pin 58 extending upwardly a short distance and connecting with any usual mechanism which raises the presser foot. These parts are so arranged that when the knee pad is pushed to the right, as viewed in Fig. 11, the presser foot is raised. The connection between the dog 57 and the pin 58 is by means of a notch 59 in the dog. The notch and other adjustments are of such depth that the dog can be swung downwardly until the lower end of the pin is separated from the bottom of the notch without allowing the pin to come out of the notch. This extra movement, which does not disturb the setting of the presser foot, is useful in connection with

the special movement which will be set forth herein-after.

The front stop dog 57 also acts as an adjustment stop by virtue of a bent lug 60 extending on the opposite side of the main shaft 54 from the presser foot pin 58. As can be seen from Fig. 12, this lug is bent upwardly and toward the rear of the machine, in line with the rear bearing 55. In the end of this lug 60 is a set screw and lock nut 61 facing toward the bearing. This set screw is adjusted to permit a small additional movement of the knee pad to the left after the presser foot is lowered.

Associated with the front stop dog 57 is a coiled spring 62, one end of which is connected to the dog 57 near the presser foot pin 58. From this end the spring is coiled around the main shaft 54 in front of the dog, and the other end of the spring is placed under the oil pan 56 under tension. Since the dog 57 is tight on the main shaft 54, it will be seen that this spring has the tendency of lowering the presser foot pin 58 and pushing the knee pad out until set screw 61 bears against the bearing 55. An additional spring 63 may be provided, if desired, to strengthen the normal movement of the knee pad to the left, as viewed in Fig. 1. Such a spring would be fastened around the main shaft 54 back of the bent arm 53 which carries the knee pad, in a manner similar to spring 62. Between the bent arm 53 carrying the knee pad and the bearing 55 I place a dog 64 having an arm 65 extending upwardly to the left, as viewed in Fig. 1, for the purpose of operating the double throw switch. In the drawings I have shown the single pole double throw switch 50 mounted directly on the underside of the sewing table 7 with its button 66 facing downwardly and in contact with the arm 65. The dog being tight on the operating shaft, the adjustment of the parts is such that the two springs 62 and 63 keep the knee pad normally to the left against the added spring resistance of switch button 66 which, in this position, is pressed into the switch by the arm 65. It will be seen that if the operator presses on the knee pad, the first movement to occur will be release of the button 66 of the switch 50. This serves to throw the switch on to the other contact. This operation occurs and is completed before the knee pad has been depressed farther than the customary loose motion provided by adjustment of set screw 61. Reverting to Figs. 7 to 10, it will be understood that operation of the knee lift while the pedal is in "automatic" position will cause the needle to move to "down" position; also that operation of the knee lift after the pedal is returned from "automatic" to "at rest" position will leave the needle in "up" position.

As already pointed out, I have shown the switch 50 used as the knee switch, but if it is desired to locate one of the double throw switches on the barrel or arm 67 of the sewing machine so that the operator can manipulate it quickly without moving her hands away from the work, the switch 50, being smaller, can be placed on the barrel 67 and the switch 49 can be fitted underneath the sewing table as the knee switch.

The coordination of the pedal and knee lift control in my invention provides a widened range of manipulations without disturbing the manner in which any of the previously possible sewing operations are obtained. It is well first to note the "feel" of the mechanism. When the pedal is raised by the operator's foot to the highest or automatic control position of the pedal, the pedal feels free and disconnected from the transmitter spring. When the pedal returns to its "at rest" position there is no automatic control and the needle will not move under the automatic control, no matter how much the knee lift is operated. Thus, as soon as the pedal is depressed enough to feel the normal pressure of the transmitter spring, the operator need pay attention only to the pedal and knee lift operations to which she was accustomed before my invention was incorporated in the machine.

I will now explain some of the novel manipulations obtainable by means of my pedal and knee lift control, assuming the parts are adjusted as shown in Figs. 7 to 10, using my magnetic interrupter. If the operator raises the pedal to the automatic control position, the machine will be stopped with the needle up. If, after the machine stops, the operator lets the pedal return to "at rest" position and then presses the knee lift to raise the presser foot, the needle will remain in its "up" position because the electric circuit is open. If, on the other hand, the operator wishes to stop the machine with the needle in its "down" position, she can change the stopping position of the needle from "up" to "down" merely by shifting one of the double throw switches in time to affect the breaking of the electric circuit by the magnets 45, 46. The operation for her is simply to raise the pedal to automatic control and press the knee pad. This throws the double throw switch 50 to the other side, activating the other circuit, thereby changing by exactly 180° the point at which the soft iron segment 40 will break the electric circuit. Thus the rotating drive shaft 3 for the needle will be stopped when the needle is down.

If desired, the operator could throw the double pole double throw switch 49 at the left of the sewing table manually any time when the pedal is not in automatic control position, and the stopping position of the needle will be reversed the next time the machine is stopped by automatic control. If this is done, then simple operation of the pedal and knee lift will leave the needle up, and the operation of the knee lift after return of the pedal from "automatic" to "at rest" position will leave the needle down.

Sometimes it is desired to add just a single stitch in the fabric. My mechanism makes it possible to add a single stitch automatically and to repeat the operation if desired. It can be done whether the machine has been stopped with the needle up or with the needle down. If the pedal is then in automatic control position or raised to that position, the electric circuit is complete except through the interrupter. If one of the double throw switches is reversed, the circuit is completed, the solenoid 30 will depress the transmitter rod 22 and the machine will start. If the double throw switch just moved is left in its new position, the circuit will be broken almost immediately and the needle will stop as soon as it reaches the other end of its reciprocation. However, if one of the double throw switches is immediately put back in the other position, the circuit is returned to the original magnet and the needle will complete one cycle before being stopped. Thus, all that is necessary to add one stitch to the sewing is for the knee switch 50 to be reversed by a touch of the knee to the knee lift and immediately released so that it returns to its original position. This can be done without pushing the knee pad far enough to raise the presser foot 2. Obviously the switch 49 could be operated manually to achieve the same end. The knee pad could be touched more than once in succession if more than one stitch were desired to be added. If the operator stops the machine with the needle in the wrong position, she can change by holding the pedal in automatic control position and applying light pressure on the knee pad until the needle has moved to the other end. Then the pedal should be released before or simultaneously with the knee pad.

It will be seen that these operations are very advantageous in the case of shirt collars, cuffs, pockets, and many other operations where high production and sharp-cornered seams are necessary. The operator can sew to the corner of the fabric at the usual high speed. If she finds that she is short a stitch to pass inspection, a nudge of the knee pad will put it in. Having once reached the point of turning the corner, the presser foot is raised, the needle is down, the work is turned rapidly, the presser foot comes down, and the work is resumed at high speed. Many other techniques will doubtless be developed mak-

ing use of my invention and the flexible control which it brings without disturbing practices that have been established by decades of training and production.

I set forth below a tabulation showing the various results obtainable with different movements of the parts and the conditions and motions of the individual parts to reach those results. This tabulation includes not only the parts heretofore described but also the alternate type of interrupter described after the tabulation.

77 with helical compression springs (not shown) between the brushes and the closed ends of the sleeves to hold the brushes against the cylinder and flexible wires connecting the brushes to the terminals at the closed ends of the sleeves. The sleeves are set in plastic 78 and the plastic grips two brush holder disc plates 79. These plates are supported on horizontal rods 80 carried by a casing 81 surrounding the interrupter. The casing is supported on a vertical post 82 carried by the sewing

Operator-Controlled Motions and Conditions			Results
Pedal	Knee Switch	Toggle Switch	
Fully Down.....			Full Speed.
Half Down ¹			Slow Speed.
Quarter Down ¹			Free Position; balance wheel can be turned by hand if desired.
"At Rest" Back Position.....			Fully Braked.
	Normal ²	Up.....	Needle "Up."
	Pressed.....	do.....	Needle "Down."
Fully Back. This is "Automatic Control" position of the pedal. When heel pressure is released spring 38 will return pedal to "At Rest" position.	Pressed momentarily and released.....	do.....	Needle travels "Down" and back to "Up" position adding a stitch.
	Normal ²	Down.....	Needle "Down."
	Pressed.....	do.....	Needle "Up."
	Pressed momentarily and released.....	do.....	Needle Travels "Up" and back to "Down" position adding a stitch.

¹ Approximate.

² If the knee switch is combined with the knee lift, the result listed opposite this condition will remain true if the pedal is returned to any position between "At Rest" and "Quarter Down" before knee lift is operated; or, the toggle switch may be reversed to give the listed result with presser foot up. For very fast operators, switch 49 may be operated by the knee lift and switch 50 may be a toggle clamped to the arm 67 of the machine.

Motions and Conditions of Parts Causing the Listed Results

Pedal Switch 34	Toggle Switch 49	Knee Switch 50	Interrupter		Solenoid	Transmitter
			Brush Type	Magnetic		
Open.....					Idle.....	Full clutch engagement.
Do.....					do.....	Light clutch engagement.
Do.....					do.....	Neutral.
Closed.....					do.....	Full brake engagement.
Do.....	Per Wiring Diagram.	Per Wiring Diagram.	90 to 89 Open.....	44 Open.....	Momentarily energized ¹	
Do.....	do.....	Reversed.	70 to 69 Open.....	43 Open.....	Momentarily energized	
Do.....	do.....	Momentarily Reversed.	70 to 69 starts and 90 to 89 finishes.	43 starts and 44 finishes.	do.....	Momentary slow speed clutch engagement, then return to full brake engagement when solenoid is deenergized.
Do.....	Reversed.	Per Wiring Diagram.	70 to 69 Open.....	43 Open.....	do.....	
Do.....	do.....	Reversed.	90 to 89 Open.....	44 Open.....	do.....	
Do.....	do.....	Momentarily Reversed.	90 to 89 starts and 70 to 69 finishes.	44 starts and 43 finishes.	do.....	

¹ The solenoid is de-energized when the interrupter reaches the listed condition.

In Figs. 13 to 17, I have illustrated an alternate form of interrupter. It may be termed a brush type of interrupter. The type gets its name from the pairs of electrical brushes 69, 70 and 89, 90 hereinafter described. Attached to the end of the needle drive shaft 3 beside the balance wheel 4 is a cylindrical contact member. This cylinder 71 is made of insulating material and is bored out axially at 72 to receive the end of the shaft 3. The cylinder is held on the shaft by an axial bolt 73 whose head lies in a recess 74 in the end of the cylinder away from the shaft (see Fig. 17). Two screws 75 lying radially in the cylinder in counterbored holes serve to hold in position on the surface of the cylinder an electrically conductive curved sector 76. This sector is fitted into a milled-out portion of the periphery of the cylinder. Only this one sector is electrically conductive and the remaining part of the peripheral surface is non-conductive. The electrical sector 76 encloses the cylinder for about 270° but extends the full length of the cylinder. The surface of the cylinder is contacted by the pairs of brushes 69, 70 and 89, 90. The cylinder rotates in the direction of the arrow in Fig. 15. The two brushes of each pair are side by side and connected in the electric circuit. The circuit is complete through the two brushes when the conductive sector 76 connects the two brushes of a pair. It is broken when the non-conductive part of the periphery of the cylinder, and not the sector 76, is in contact with the brushes.

The brushes are slidably positioned in metal sleeves

table 7 in a vertically adjustable manner (Fig. 14). This adjustment consists of a sleeve 83 bolted to the bottom of the table and surrounding the post 82. Screws 84 in the sleeve lock the post at the desired elevation. The horizontal rods are made in two parts and pass through slots 85 in the discs. By this means the two parts of each post grip the plates in their properly adjusted angular relation to the cylinder 71.

Similarly to the case of the magnet type interrupter, if one of the double throw switches, such as the knee switch 50, is operated momentarily when using the brush type interrupter, a special and novel advantage is obtained. If this switch is operated long enough for the conductive copper sector 76 to reach the brushes 69, 70 from the position shown in Fig. 13 and the switch is then thrown out, the machine will cause the needle to complete one cycle of operation, making a single complete stitch. It then stops again in the position called for by the closed position of the knee switch 50. Thus, assuming, as above indicated, that Fig. 13 shows the machine about to stop with the needle in its "up" position, momentary operation of the switch 49 long enough for the conductive sector 76 to reach brushes 69, 70 will cause the needle to perform one complete cycle, making a single stitch and stopping again in "up" position.

Fig. 13 shows solenoid control by brushes 89 and 90. If knee switch 50 is thrown the control will be shifted to brushes 69 and 70. Therefore if the operator stops the machine by pushing the pedal to its automatic po-

sition when the brake is fully on, and thereafter raises the presser foot by operation of the knee lift, the machine will be stopped with the needle up. If, on the other hand, the operator wishes to have the needle stop in its "down" position, she makes the same movement of the pedal before actuating the knee lift. After the machine is stopped, she returns the pedal to "at rest" position and then actuates the knee lift, raising the presser foot, and the needle remains in its "down" position because energizing switch 34 is open. On the other hand, if the operator chooses to operate switch 49 manually, that will reverse the position of the needle on the next operation. If, after the pedal is in its uppermost position, the operator gives only a slight momentary pressure on the knee pad, the presser foot will not be raised but the needle will be reversed to its other position and back again. This adds one stitch to the fabric, whether it is the switch 49 or the knee switch 50 which is operated at that moment.

One special advantage of my invention lies in the fact that in connection with any starting and stopping of the sewing machine it is impossible to energize the solenoid for more than a few seconds. Such necessarily intermittent use provides the ideal condition for satisfactory performance and durability of a compact solenoid of adequate power.

It is also of interest to note that if, owing to the high speed of rotation of the machine after the electrical circuit is broken and the transmitter brake applied, the machine is not able to stop turning within the span of the break in the segment 40, the machine will make one more revolution but at a slower speed and will stop on the second revolution. This stop will occur with the needle in its predetermined position, just as if the machine had stopped on its first revolution.

In the event that the operator neglects to raise the pedal beyond "at rest" position, the machine will stop with the needle in random position, but if the pedal is afterward moved to "automatic" position the needle will immediately travel to the position which accords with the chartered and described manipulation of the controls. It is to be understood that all needle movements referred to herein are caused by rotation of shaft 3 in its normal direction of operation.

It will be seen that I have devised a mechanism for stopping the needle in a predetermined position without making it necessary to connect or disconnect anything at high speed. My controls stop the needle without in any way interfering with its normal high speed operation. The controls stop the needle when it is at low speed.

Many modifications within the scope of my invention will occur to those skilled in the art. Therefore I do not limit it to the specific embodiments shown.

I claim:

1. In a power-driven sewing machine, a sewing machine needle having an operating cycle, a needle-driving member, primary power means, braking means, a clutch member for engaging the needle-driving member with the primary power means to operate the needle or with the braking means to stop the needle, means adapted normally to cause the clutch to maintain engagement between the needle-driving member and the braking means, manual means for moving the clutch out of engagement with the braking means and into engagement with the primary power means, in combination with needle-positioning means in which there are clutch moving power means for moving the clutch out of engagement with the braking means and into sufficient engagement with the primary power means to start the needle-driving member, a control circuit for energizing the clutch moving power means, a special connection for energizing the control circuit, a source of energy for said circuit, and automatic control means in series with the special connection adapted to be operated by the needle-driving

member in synchronism with the operating cycle of the needle, for de-energizing the control circuit when the needle reaches a predetermined point in its cycle.

2. In a power-driven sewing machine according to claim 1, the provision in said manual means of a pedal and an element therein having a lost-motion connection with the pedal whereby the described movement of the clutch member by the clutch moving power means takes place without disturbing the pedal.

3. In a power-driven sewing machine in accordance with claim 1, the provision in the said clutch moving power means of a solenoid adapted to move the clutch member into the said sufficient engagement with the primary power means to start the needle-driving member, and a connection between the solenoid and the clutch member adapted to permit more complete engagement of said primary power means by the said manual means for full-speed sewing.

4. In a power-driven sewing machine in accordance with claim 1, the provision in the said automatic control means of a pair of contacts and rotatable means adapted to alternately open one and the other of said contacts when the needle reaches first and second preselected parts of said cycle, respectively.

5. In a power-driven sewing machine installation having needle-positioning means, a sewing machine needle, a rotary shaft adapted to operate the said needle in a definite cycle, a driving member for actuating the rotary shaft, a brake therefor, a spring-urged clutch member for normally braking the driving member by means of the brake, a rotating power member, and a clutch arm for disengaging the clutch from the brake and establishing frictional engagement between the clutch member and the power member for rotating the driving member, the engagement having a slippage which decreases as the engagement is completed, a pedal for moving the clutch arm to establish any desired degree of frictional engagement, in combination with an electromagnetic power device adapted to move the clutch arm far enough to establish a sufficient degree of said frictional engagement to start the rotary shaft and to keep it rotating, a control circuit for said device, a source of energy for said circuit, a pair of automatically operated contacts in the circuit for selectively controlling the said device, rotatable means carried by the rotary shaft and adapted to open one and the other of said contacts when the needle reaches first and second preselected parts of said cycle, respectively, and a manually operated double-throw switch in the circuit for selecting which of said contacts is to control said device.

6. Automatic needle stop control apparatus for a sewing machine having a needle driven in a definite operating cycle from a normally-braked clutch, a continuously-driven member, the stop control apparatus including automatic means adapted to move the clutch from braked condition into low-speed engagement with the continuously-driven member, and means for energizing the clutch moving means, in combination with automatic control means adapted to be synchronized with the operating cycle of the needle, for de-energizing the automatic clutch moving means when the needle reaches a predetermined point in its operating cycle, there being in the automatic control means a rotary electrical contact member having part of its surface of non-conducting material and a complementary part of its surface of conducting material, said rotary contact member being adapted to be mounted to move in synchronism with the needle, a pair of stationary brush-type terminal members mounted to bear on said conducting material, and a control circuit including said terminal members and rotary contact member, the terminal members being adapted to bear on said non-conducting material to open said circuit at said predetermined point in the operating cycle of the needle.

7. Needle-positioning apparatus adapted to be used in a power-driven sewing machine installation where

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there is a sewing machine having a needle, a rotary shaft for operating said needle in a definite cycle, a transmitter having a power-driven member, a fixed brake member, a clutch member, the clutch member being adapted to be held in normal engagement with the brake member by a spring, and a clutch arm for moving the clutch member away from the brake member and into frictional engagement with the power-driven member, the amount of such movement determining the amount of slippage in said frictional engagement and the resulting speed of the power-driven member, and a belt for connecting the power-driven member to said rotary shaft; the novel needle-positioning apparatus comprising the combination of at least an electromagnetic power device for moving the clutch arm against the resistance of said spring, far enough to establish sufficient frictional engagement between the clutch member and the power-driven member to start the sewing machine and to keep it running until the electromagnetic power device is de-energized, a control circuit for said power device, a source of energy for said circuit, a manually operated switch for energizing said circuit, a normally-closed circuit contact in said circuit, and means adapted to be carried by the rotary shaft to automatically open said contact when the needle reaches a predetermined part of its cycle, whereby the device is de-energized.

8. Needle-positioning apparatus in accordance with claim 7 in which the electromagnetic power device has a solenoid, and adjustable means connecting the solenoid to the clutch arm, whereby the speed of the sewing machine resulting from the closing of the solenoid may be regulated by said adjustable means.

9. Needle-positioning apparatus in accordance with claim 7 in which in the claimed combination there is a second normally-closed circuit contact, said means being adapted to move in synchronism with said needle cycle to operate the two circuit contacts automatically to open one and the other of said contacts alternately when the needle reaches first and second preselected parts of said cycle, respectively, and to close each contact before the other is opened; and there being a manually operated double-throw switch in said circuit for selecting control of the electromagnetic power device by one of said contacts; whereby the needle may be moved from one preselected position to another by operating said double-throw switch while the circuit is energized.

10. In a power-driven sewing machine, the elements comprising a sewing machine needle, a rotary shaft to operate the needle, a power means therefor, a normally braked clutch and brake device connecting the shaft and power means, a clutch lever for controlling the rotation of the rotary shaft and a pedal connected to the lever, in combination with needle-positioning means in which there are clutch moving means connected to the clutch lever and adapted to move the clutch lever to shaft-rotating position without disturbing the pedal, an electrical control circuit including a normally-closed switch and the clutch moving means and adapted to energize the latter, and control means mounted in operative relation to the rotary shaft and to the operating cycle of the needle and adapted to open the normally closed switch for needle positioning purposes.

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11. A power-driven sewing machine including a rotary needle-shaft, rotary power means, normally effective braking means, and clutching means for selectively connecting the needle-shaft either to the rotary power means for normal sewing purposes or to the normally effective braking means, in operative combination with automatic means, adapted to bring the needle-shaft to rest at a predetermined point in its rotary cycle; said automatic means comprising an electrical power device operatively connected to said clutching means to move said clutching means into engagement with said rotary power means to effectuate unidirectional rotation of the needle-shaft in its normal sewing direction, an electrical circuit for energizing said electrical power device, a control contact in series in said circuit, and means associated with and operated in synchronism with the needle-shaft to open said contact at said predetermined point; whereby the normally effective braking means stops the needle shaft at that predetermined point.

12. A pedal-manipulated power transmitter for driving the rotary needle-shaft of a sewing machine when the pedal is depressed and for bringing the needle-shaft to rest at a predetermined point in its rotary cycle when the pedal is retracted, comprising a continuous-duty unidirectional rotary power-driven member, a brake member, a sleeve bearing member, a transmitter shaft journaled in said sleeve bearing member and having a driving pulley and clutch means mounted on said transmitter shaft means for operatively connecting the driving pulley to the needle shaft, resilient means for urging the sleeve bearing member in one direction to effect engagement between the clutch means and the brake member, and means for connecting the pedal for manually moving said sleeve bearing member in the opposite direction to effect engagement between the clutch means and the power-driven member; in combination with an electrical power device positioned in operative relation to the transmitter and mechanically connected to said sleeve bearing member to move the same to effectuate unidirectional rotation of the transmitter shaft in its normal sewing direction, an electrical circuit for energizing said device, an energizing switch in the circuit positioned to be closed by retraction of the pedal, and contact making and breaking means connected in series with the energizing switch and operatively associated with the needle-shaft for opening said contact at said predetermined point.

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