Feb. 9, 1954 W. DARIN ET AL 2,668,349

SPRING WINDING MACHINE

Filed June 20, 1950 6 Sheets-Sheet 1

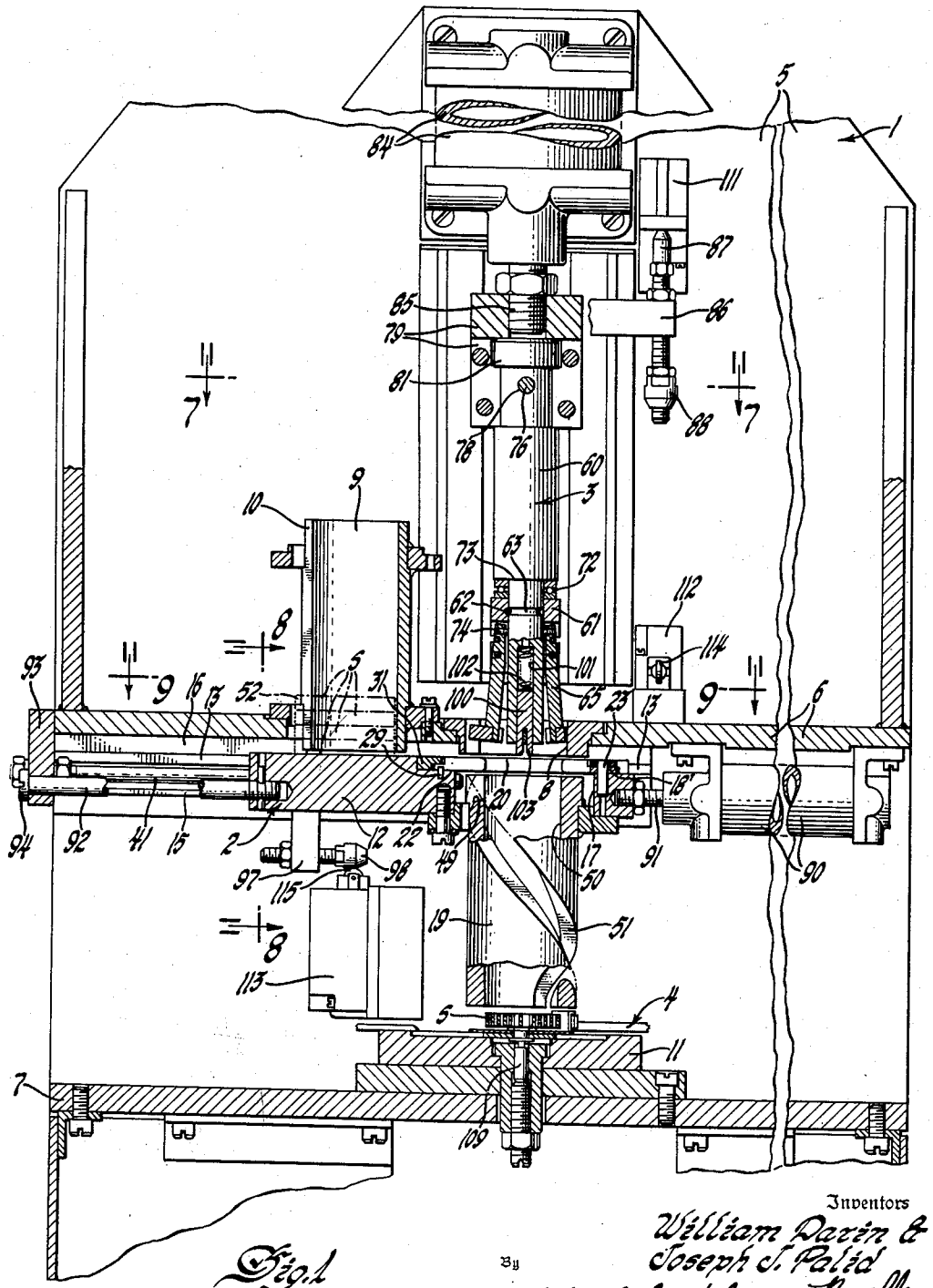


Fig. 1

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SPRING WINDING MACHINE

Filed June 20, 1950 6 Sheets-Sheet 2

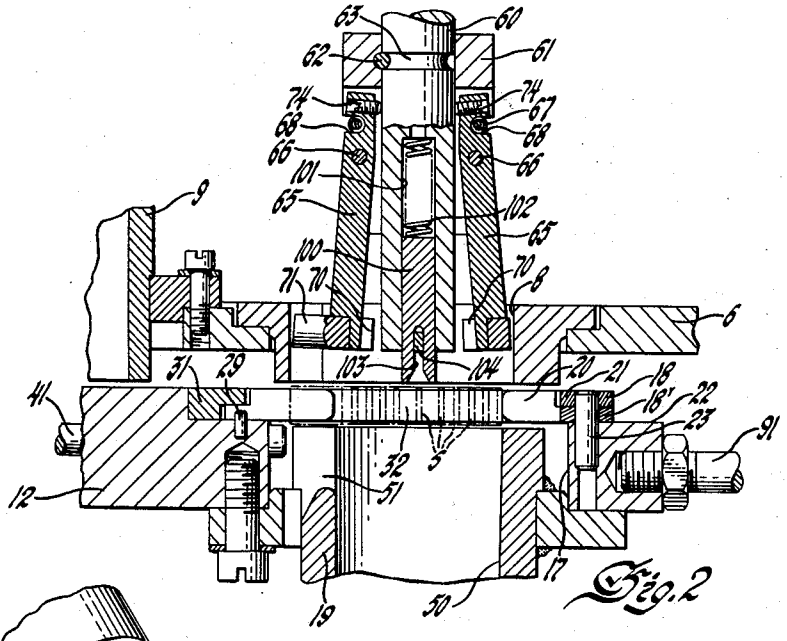


Fig. 2

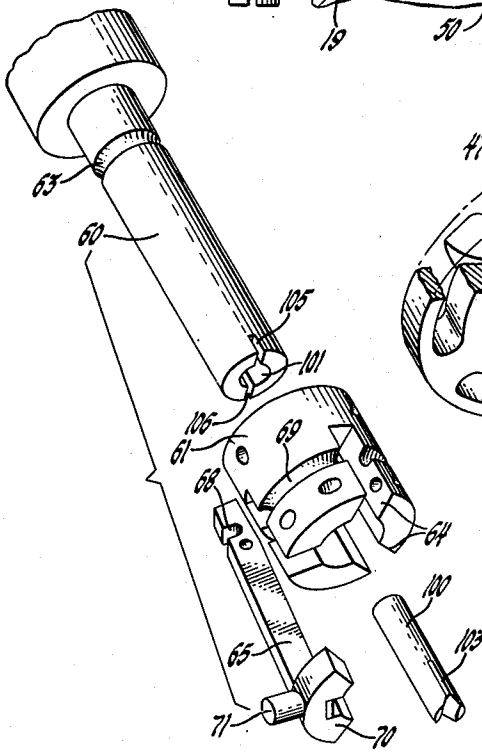


Fig. 3

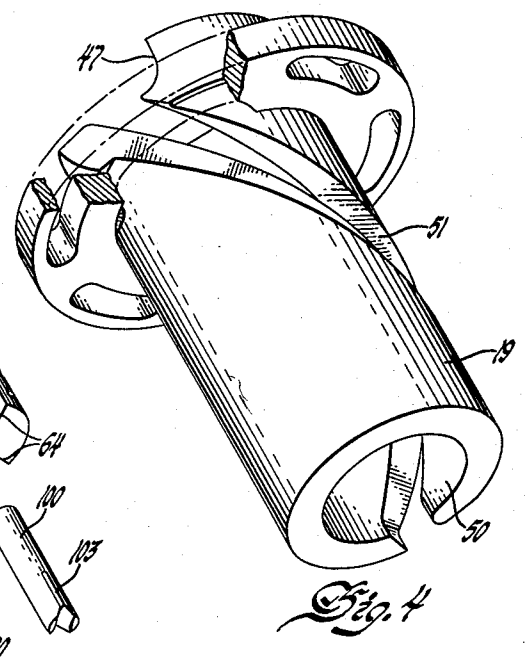


Fig. 4

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SPRING WINDING MACHINE

Filed June 20, 1950 6 Sheets-Sheet 3

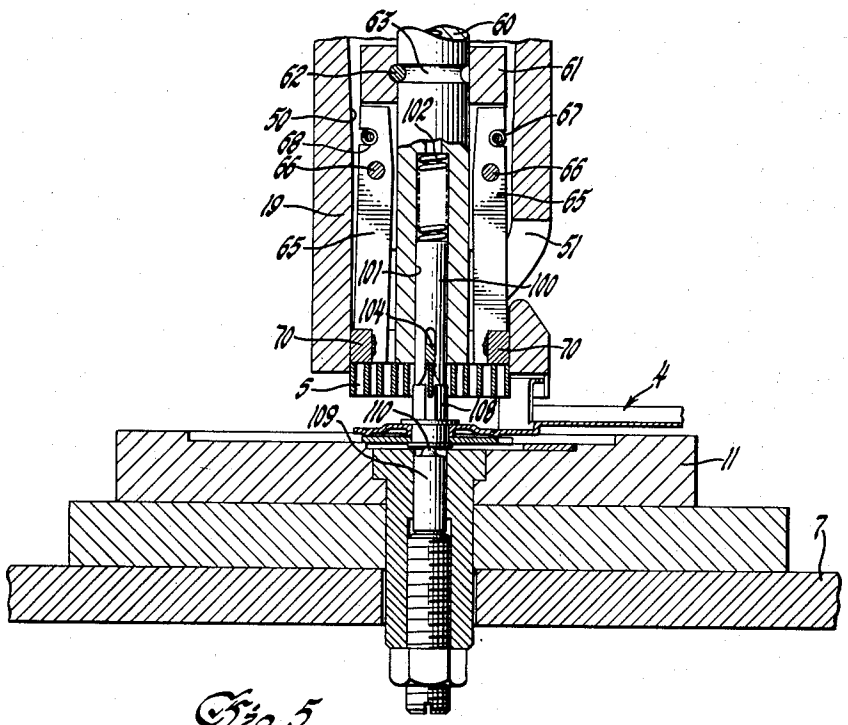


Fig. 5

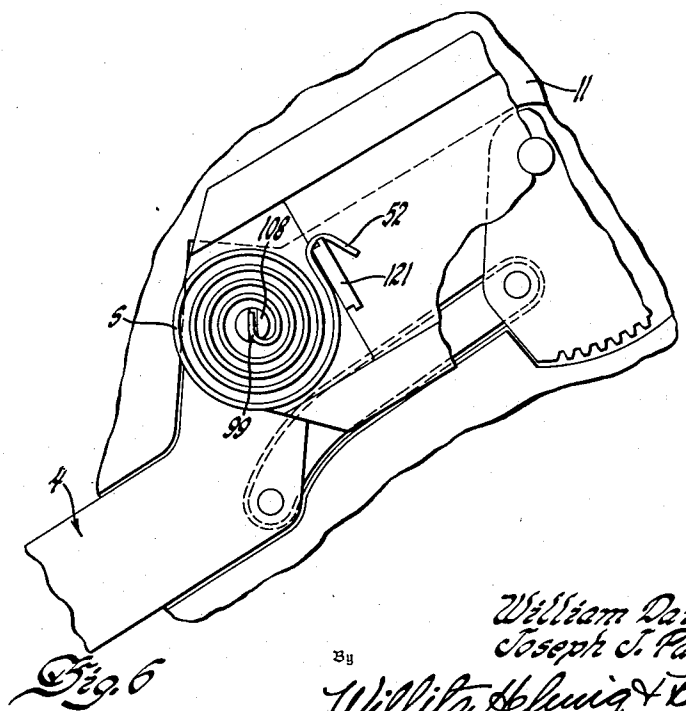


Fig. 6

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SPRING WINDING MACHINE

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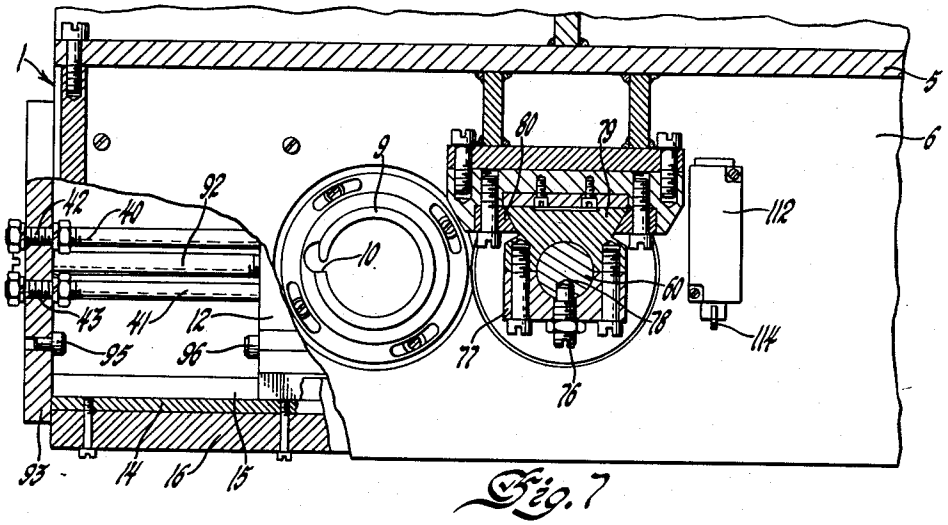


Fig. 7

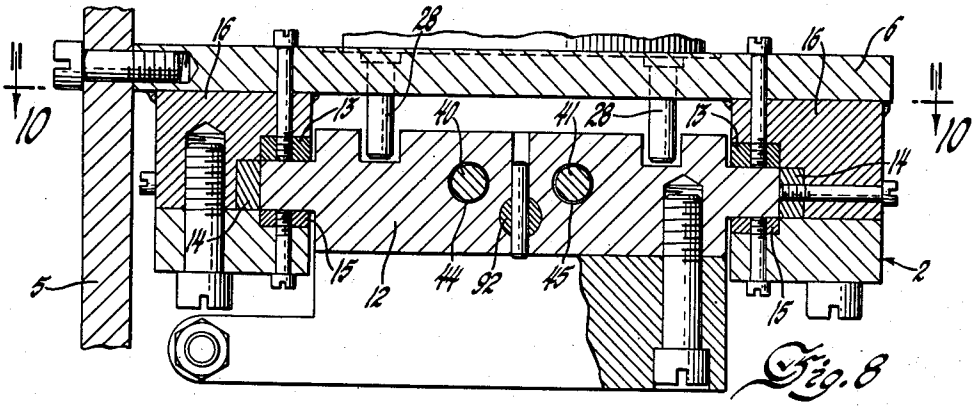


Fig. 8

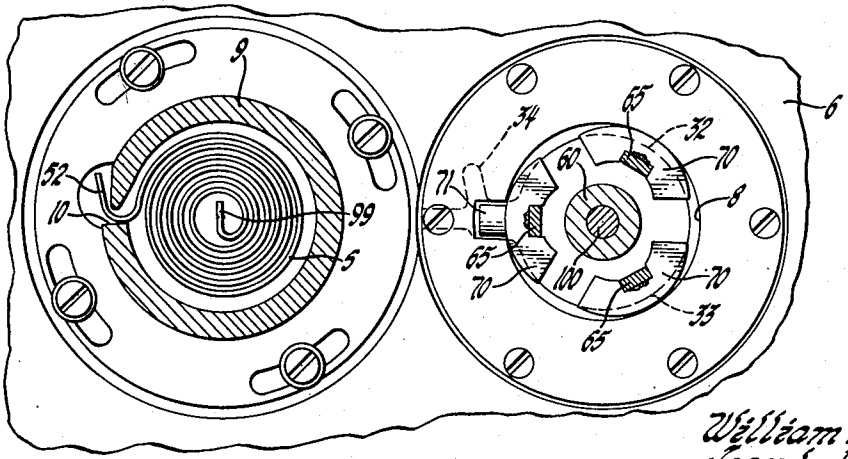


Fig. 9

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SPRING WINDING MACHINE

Filed June 20, 1950 6 Sheets-Sheet 5

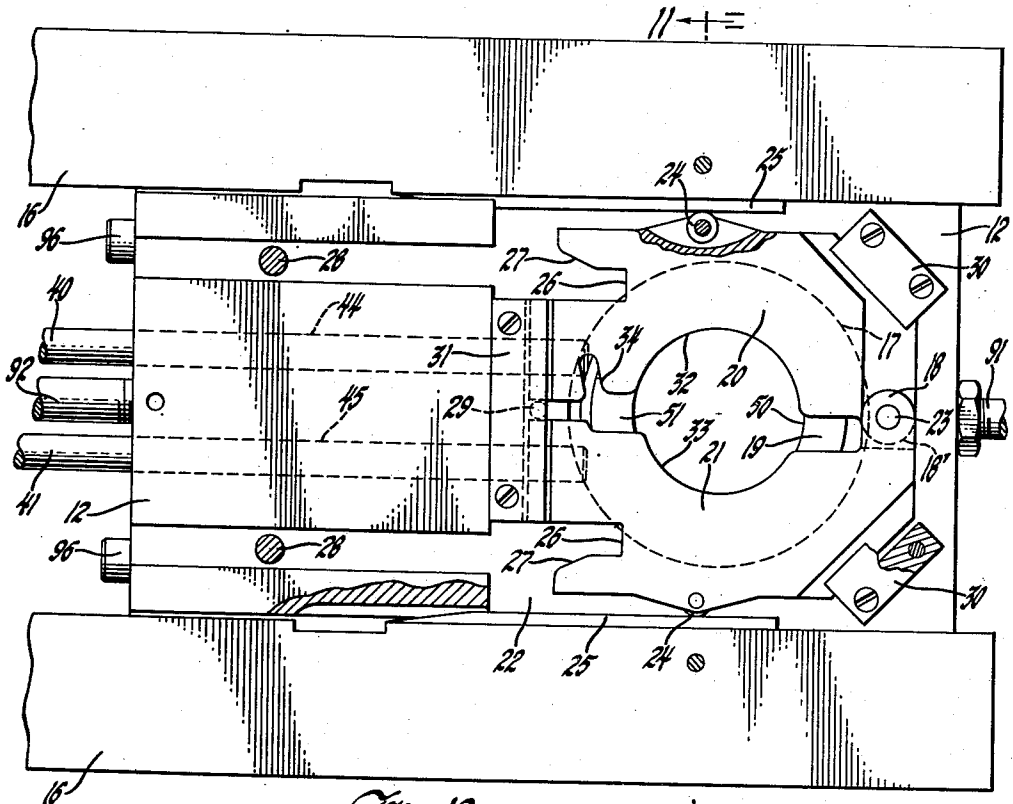


Fig. 10

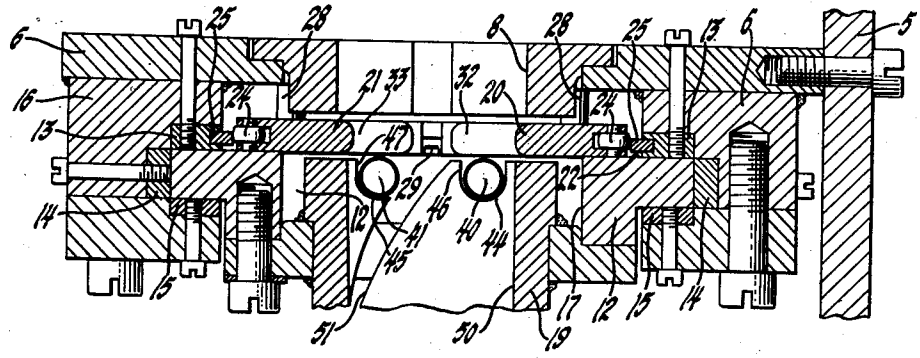


Fig. 11

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SPRING WINDING MACHINE

Filed June 20, 1950 6 Sheets-Sheet 6

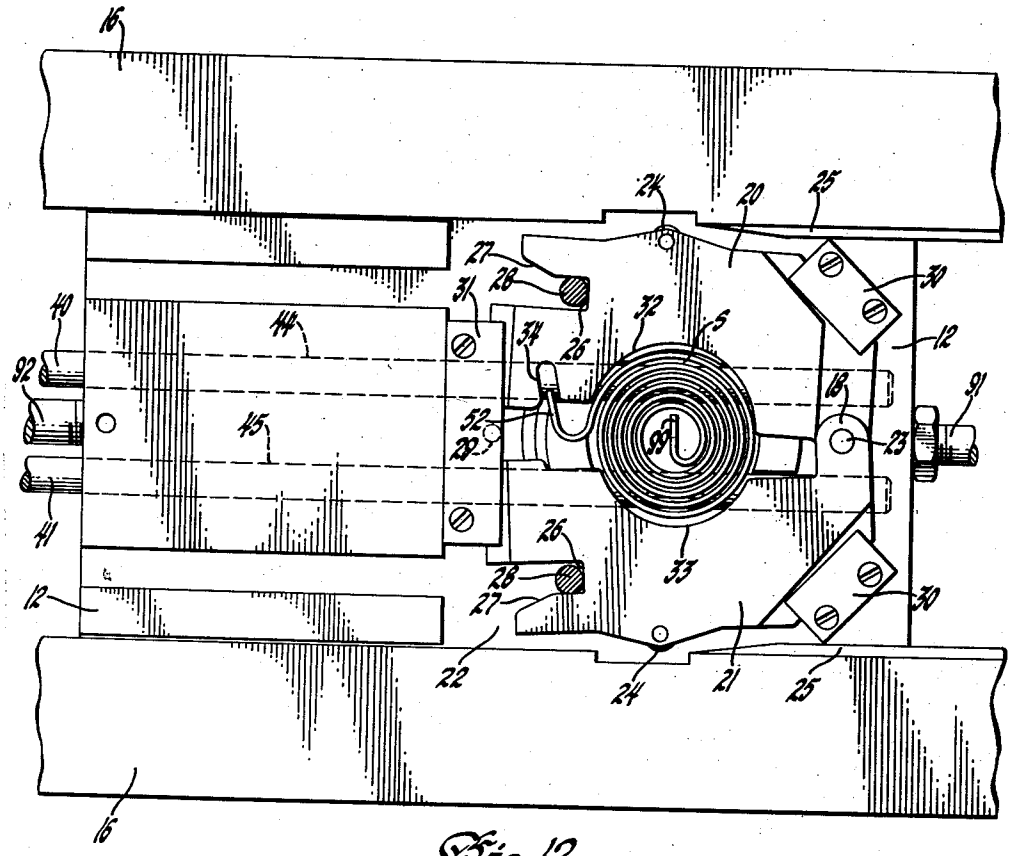


Fig. 12

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UNITED STATES PATENT OFFICE

2,668,349

SPRING WINDING MACHINE

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Application June 20, 1950, Serial No. 169,244

6 Claims. (Cl. 29—211)

1

This invention relates to spiral or clock type springs and more particularly to a machine for automatically winding such springs and installing them in wound condition in the mechanisms in which they are to function.

More specifically the instant invention concerns certain improvements in the spring winding machine disclosed in the Bianco application Serial No. 125,077 filed November 2, 1949. In said Bianco machine there is disclosed a horizontally reciprocal carriage for transferring springs to be wound from a vertical spring magazine to a vertically reciprocable ram which forces the spring through a spiral camming tube to the regulator assembly with which the spring is to be associated. During such transfer the spring is carried in a ring having an internal conical shelf on which the spring rests pending its discharge into the camming tube by the ram. While this ring has been found to be very satisfactory for springs which are substantially of the same diameter, it frequently happens that commercially produced springs vary sufficiently in diameter that the spring may not be properly supported in the ring and effect a cocked position therein at the time it is discharged by the ram into the camming tube. Accordingly, it is one of the principal objects of the invention to improve the means for transferring the spring from the spring magazine to its position opposite the ram, in a manner which precludes any possibility of the spring reaching its position opposite the ram in a cocked position and jamming during its passage through the camming tube.

A further object of the invention is to improve the ram mechanism, particularly the nose piece which secures the inner end of the spring against rotation during the spring winding operation.

In the drawings:

Figure 1 is a front elevational view of a spring winding machine embodying the improvements of our invention.

Figure 2 is an enlarged detail view similar to Figure 1 showing the relation of the parts just prior to the start of the spring winding operation.

Figure 3 is an exploded view in perspective of certain parts associated with the lower end of the spring winding ram.

Figure 4 is a perspective view of the cam member for effecting windup of the spring during the driving stroke of the ram.

Figure 5 is an enlarged detail view similar to Figure 1 showing the transfer of the wound clock spring from the ram to the window regulating device.

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Figure 6 is a fragmentary plan view of a conventional window regulating device with its wound clock spring installed.

Figure 7 is a sectional plan view taken substantially on line 7—7 of Figure 1.

Figure 8 is an enlarged detailed sectional view taken substantially on line 8—8 of Figure 1.

Figure 9 is an enlarged sectional plan view taken substantially on line 9—9 of Figure 1.

Figure 10 is a sectional plan view taken substantially on line 10—10 of Figure 8 and showing the spring clamping jaws in their "closed" positions.

Figure 11 is a sectional view taken substantially on line 11—11 of Figure 10.

Figure 12 is a view similar to Figure 10 but showing the jaws in their "open" positions.

Referring now to Figure 1 the numeral 1 designates generally the frame of the machine, 2 the horizontally reciprocable carriage, and 3 the vertically reciprocable ram. 4 is a conventional window regulating mechanism or the like in which the wound clock spring S is to be installed by the machine.

The machine frame 1 comprises principally a back plate 5 supporting upper and lower shelves 6 and 7. The upper shelf 6 is apertured at 8 for passage of the vertically reciprocable ram 3 and adjacent the ram it is provided with an opening through which the lower end of the cylindrical magazine 9 extends. This magazine has a slot 10 in its side wall and extending the full length thereof for slidably guiding the outer ends 52 of the clock springs S stacked therein, and is secured to the upper shelf 6 and back wall 5 of the machine frame by suitable brackets. On the lower shelf 7 and directly opposite the ram 3 is provided a platform 11 which is suitably arranged to support and locate the window regulating mechanism 4 while the latter is being delivered its wound clock spring S.

The carriage 2 includes a plate 12 which as shown in Figure 8 is slidably guided at its front and rear edges between ways 13, 14 and 15 supported in downwardly hanging brackets 16 from the upper shelf 6. This plate 12 has a vertically extending opening 17 therein into which extends the upper end of the camming tube 19 through which the ram 3 passes in effecting the winding and delivering of a clock spring S to the window regulator mechanism 4 below. Supported by the carriage on opposite sides of the entrance to the camming tube are a pair of generally C-shaped jaws 20 and 21 (best shown in Figures 10 and 12). These jaws slidably rest on a recessed platform

22 surrounding the opening 17 and have overlapping ends 18 and 18' pivotally secured together and to the plate 12 by a pin 23. The opposite, free ends of the jaws are arranged to swing toward and away from each other about the pin 23 in response to reciprocal movement of the carriage transversely of the ram. For effecting this opening and closing movement of the jaws each jaw is provided on its outward side with a roller 24 which travels on a cam strip 25 projecting inwardly from each upper way 13, and with a slot 26 having an inclined entrance surface 27 which slidably engages a stationary pin 28 depending from the upper shelf 6. A third pin 29 carried by and projecting upwardly from the plate 12 between the free ends of the jaws serves as a stop for limiting the pivotal movement of the jaws toward each other while the rollers 24 are in engagement with the cam strips 25 and the slots 26 are disengaged from the stationary pins 28. Retainer plates 30 fixed to the carriage plate 12 slidably overlie the jaws on opposite sides of the pivot pin 23, and a third retainer plate 31 also fixed to the carriage plate 12 slidably overlies the free ends of the jaws. The two jaws 20 and 21 have oppositely disposed spring clamping faces 32 and 33 of arcuate shape which coact with each other when the jaws are in closed position (Figure 10) to provide an opening between them of slightly smaller diameter than the minimum diameter of the spring S prior to winding. Jaw 20 is provided with a notch 34 into which projects the outer extremity 52 of the spring S during transfer of the spring from the magazine 9 to its position under the ram.

As will be clear from Figures 10 and 12 which show the jaws in their closed and opened positions respectively, the jaws are positively cammed toward and away from each other by the pins 28 and the cam strips 25 during reciprocation of the carriage. When the jaws are in open position as shown in Figure 12, the jaw clamping surfaces 32 and 33 loosely embrace the periphery of the spring S to be wound, and in such positions freely accommodate the reception of a spring S from the magazine 9. As the carriage moves toward the right from the magazine, the rollers 24 ride up on the cam strips 25, forcing the jaws to clamp about the spring with sufficient tightness to prevent the spring from falling by gravity into the camming tube 19.

Since it is necessary to support the spring S in a level position between the jaws pending their clamping engagement with the spring, there is provided a stationary platform in the form of two horizontally disposed parallel rods 40 and 41 which underlie the jaws 20 and 21. These rods are anchored at their ends 42 and 43 to the side portion 93 of the machine frame 1 and extend longitudinally of the carriage through bored passages 44 and 45 provided therefor in the carriage plate 12. The function of these rods, as aforesaid, is to slidably support the spring S during its transfer by the jaws from a position opposite the magazine 9 to a position opposite the ram 3. During this transfer of the spring, the jaws swing toward each other about their pivot pin 23, and by the time the spring S reaches its position opposite the ram the jaws have moved sufficiently to frictionally support the spring from falling into the camming tube 19.

The camming tube 19 has a bore 50 of the same diameter at its upper end as the diameter formed by the jaw clamping surfaces 32 and 33 when the jaws are in closed position. This camming tube bore 50 is preferably tapered inwardly from its upper end towards its lower end to compensate for the reduction in outside diameter of the springs as they are wound up in being passed through the tube 19. The upper end of the camming tube is notched at 46 and 47 to clear the rods 40 and 41 as shown in Figure 11.

As best shown in Figure 4, this camming tube 19 is provided with a helical slot 51 in its cylinder wall, the helical pitch of the slot being selected to effect the desired degrees of windup of the spring during passage of the spring therethrough. The purpose of the slot 51 is to cam the hook-shaped outer end 52 of the spring rotatably about the axis of the tube 19 during passage of the spring therethrough.

The vertically reciprocal ram 3 which serves to push the spring through the camming tube comprises a shaft 60 to the lower end of which is attached a swiveled head 61, the latter being retained on the shaft by a pin 62 anchored in the head 61 and engaging a peripheral groove 63 formed on the shaft 60. This head as best shown in Figure 3 is generally cylindrical in shape to receive the lower end of the shaft 60 and is provided with a plurality (3 as shown) of slots 64 extending through its side wall and upwardly from its lower end. Hinged fingers 65 swingably carried on pins 66 in the head 61 are positioned in the slots. The upper ends of the fingers 65, above the pins 66, are urged toward each other by a garter type spring 67 which engages the fingers in grooves 68 provided therein and encircles the head 61 within a peripheral groove 69. The lower ends of each of the fingers 65 carry a foot 70 which abuts the upper surface of the clock spring at circumferentially spaced positions thereon for forcing the spring through the camming tube 19. One of the feet 70 is preferably provided with an outwardly extending projection 71 which also engages the helical groove 51 in the camming tube and bears downwardly on the clock spring outer end 52 during winding to insure against any possibility of distortion of the clock spring as might result from the spring outer end binding in the camming slot 51. A conventional bore thrust bearing 72 (Figure 1) is interposed between the upper end of the head 61 and a shoulder 73 on the shaft 60 to accommodate the relative rotation between the head and shaft resulting from the inner action of the finger projection 71 with the camming slot. It will be understood that the pin 62 has a sufficiently loose fit in the groove 63 to permit the bearing 72 to take the thrust loads on the head during downward movement of the ram. Screws 74 are carried by the upper ends of the fingers 65 in position to abut the periphery of the ram shaft 60 for adjustably limiting the action of the garter spring 67.

Referring to Figure 7 it will be seen that the ram shaft 60 is keyed against rotation about its axis by a set screw 76 threadedly engaging a cap 77 and terminating in a recess or socket 78 in the shaft 60. The cap 77, in turn, is bolted to a dovetailed slide 79 which is guided for slidable vertical movement in ways 80 secured to the back wall 5 of the machine frame. An enlargement or collar 81 formed on the upper end of the shaft 60 is recessed in the slide 79 and the cap 77 to anchor the shaft against longitudinal movement relative to the slide.

Means for effecting the raising and lowering of the ram 3 is provided in the form of a double

acting fluid operated cylinder 84 (Figure 1) in which is mounted a piston (not shown) having a piston rod 85 terminating in locked threaded engagement with the upper end of the slide 79. The laterally extending arm 86 carried by the slide is provided with upwardly and downwardly extending switch actuating cam members 87 and 88.

A similar double acting fluid operated cylinder 90 (Figure 1) attached to the underside of the upper shelf 6 is provided for effecting the horizontally reciprocating movement of the carriage 2. Piston rod 91 of this cylinder is fixedly connected to one end of the carriage plate 12, and a bolt 92 extending from the opposite end of this plate is arranged to slidably pass through the side portion 93 of the machine frame during carriage reciprocation, the head 94 of this bolt serving as a stop for limiting travel of the carriage to the right as viewed in Figure 1. For limiting travel of the carriage in the opposite direction, there are provided cooperating abutments 95 and 96 (Figures 7 and 10) which are anchored opposite each other in the frame portion 93 and carriage plate 12 respectively. Other abutments (not shown) may be similarly employed to limit the extreme positions of the ram 3. The carriage plate 12 carries by means of the bracket 97 a switch actuating cam 98 (Figure 1).

As means for holding the inner end 99 of the clock spring S from rotating during its windup while being pushed through the camming tube 19, the extreme lower end of the ram shaft 60 carries a nose piece 100. This nose piece is in the form of a rod telescopically slidable in a socket 101 provided in the end of the ram shaft 60. A compression spring 102 between the nose piece 100 and the bottom of the socket 101 serves to bias the nose piece outwardly of the socket so as to maintain the bifurcated lower end 103 of the nose piece in engagement with the clock spring inner end 99 during each spring winding operation. To serve both as a means for anchoring the nose piece against rotation in the socket and to limit the outward movement of the nose piece by the spring 102, there is provided a key 104 which has a pressed fit at each end in the radial slots 105 and 106 provided in the lower end of the ram shaft 60. As shown in Figure 5, the bifurcation at the lower end of the nose piece is disposed in the same vertical plane as the bifurcation in the pivot pin 108 which forms a part of the window regulator assembly 4. To insure against any downward strain upon the pivot pin 108 during installation of the wound clock spring, there is provided an adjustable fixed abutment member 109 having a head 110 at its upper extremity which serves to support the pivot pin as the clock spring reaches its seated position thereon.

Mounted to the back wall 5 of the machine frame there are three electric limit switches 111, 112 and 113 (Figure 1) positioned such that depression of their respective spring biased switch operating buttons (114 and 115 for switches 112 and 113 being shown) are subject to engagement by the cams 87, 88 and 98 respectively. By means of conventional electrically responsive valves and interlocking circuit connections (not shown), these switches serve to control the admission of fluid pressure to the respective ends of the cylinders 84 and 90 to obtain the sequential timing of events in the operation of the machine as will now be described.

In the initial position, i. e., with the machine at rest, the carriage 2 is at its extreme left-hand position with the camming tube 19 directly under the spring magazine 9 from which the lowermost spring S will drop by gravity between the clamping jaws 20 and 21 and on to the rods 40 and 41. The spring at this time will be in the position shown in Figure 12, the jaws being held in open position by the pins 28 engaging the slots 26. Also at this time the ram 3 is at its extreme upper position, its switch actuating cam 87 depressing the button of switch 111. Upon the operator manually actuating a starting switch (not shown), fluid under pressure is admitted to the left-hand end of the cylinder 90, causing the carriage 2 to travel to its position as viewed in Figure 1. During this travel of the carriage the slots 26 of the jaws move out of engagement with the pins 28 and the rollers 24 on the jaws ride up on the cam strips 25 to force the jaws toward each other and into peripheral clamping engagement with the clock spring. Also, as previously explained, the clock spring is slidably supported by the rods 40 and 41 during this time. Prior to the spring reaching its position under the ram the jaws will have moved into full clamping engagement with the spring and will thus serve to support the spring as the same moves out of sliding engagement with the rods 40 and 41. Proper angular positioning of the clock spring relative to the ram is assured during this stroke of the carriage by the engagement of the spring outer end 52 in the slot 34 of the jaw 20. Upon the carriage reaching its extreme position in which the clock spring S is opposite the ram the switch actuating cam 98 trips the button 115 of switch 113 which causes fluid under pressure to be admitted to the upper end of the ram cylinder 84. The ram thence moves downwardly, the fingers 65 and nose piece 100 moving into engagement with the clock spring between the clamping jaws 20 and 21 and forcing the spring into and through the camming tube 19. At the start of this downward movement of the ram, the switch actuating cam 87 carried therewith moves out of engagement with the contact button (not shown) of switch 111, causing switch 111 to set up a holding circuit which maintains the supply of fluid under pressure in the left-hand end of cylinder 90, thus preventing any return movement of the carriage 2 while the ram is in operation.

As the clock spring is forced downward through the inwardly tapered bore 50 of the camming tube 19, the outer end 52 of the clock spring travels in the helical slot 51 while the inner end 99 of the clock spring is held against rotation by the nose piece 100, and the feet 70 on the ram fingers 65 are caused to bear against the upper surface of the clock spring outermost convolution due to the lever action produced by the garter spring 67 engaging the upper ends of the fingers 65.

As the ram approaches its lowermost position the clock spring is forced out of the lower end of the camming tube 19 and into its assigned position in window regulator assembly 4, the upstanding lug 121 of the regulator assembly 4 serving to anchor the outer end 52 of the clock spring as it leaves the camming slot 51 and the bifurcated upper end of the regulator pivot pin 108 simultaneously anchoring the clock spring inner end 99 as it leaves the bifurcation in the nose piece 100 of the ram. As will be clear from Figure 5, the nose piece 100 con-

tacts the regulator pivot pin 108 in advance of the ram fingers 65 moving the clock spring to its fully seated position on the regulator assembly, compression of the nose piece biasing spring 102 serving to accommodate the retraction of the nose piece into its socket 101 as the fingers 65 continue moving downward to the limit of travel of the ram.

As the ram reaches its lowermost position, the switch actuating cam 88 carried thereby trips the button 114 of switch 112, reversing the valve setting controlling the supply of pressure fluid to cylinder 84 such that fluid is now introduced into the lower end of cylinder 84 and the ram 3 thereupon returns to its fully raised position. Upon the switch actuating cam 87 reengaging the button of switch 111, the pressurizing of cylinder 90 is similarly reversed and the carriage 2 returns to its initial position at which time the lowermost clock spring S in the magazine 9 drops into place between the clamping jaws 20 and 21 preparatory to repeating the cycle just described.

The camming tube 19 now being clear of the window regulator assembly on the platform 11, this assembly can be removed and replaced with another to which a clock spring is to be assembled.

We claim:

1. In a spiral spring winding machine, a reciprocable carriage including a tube having its longitudinal axis perpendicular to the reciprocatory path of the carriage, said tube having a helical slot in its wall for rotatively camming the outer end of a spiral spring about said axis during passage of the spring coaxially therethrough, a stationary spring feeding magazine positioned to register with one end of the tube when the carriage is at one end of its stroke, a non-rotatable reciprocable ram positioned to move coaxially into and out of the tube when the carriage is at its opposite end of its stroke, means axially rotatable on one end of the ram for transmitting end-wise thrust to the outer convolution of the spring during movement of the ram into the tube, a nose piece slidably telescoping into said end of the ram and having a bifurcation terminating outwardly of the ram for engaging the inner end of the spring, a pin fixed to the ram and slidably received by said bifurcation for both limiting movement of the nose piece outwardly of the ram and restraining rotation of the nose piece axially of the ram, a pair of stationary horizontally spaced apart rods for vertically supporting a spring during its transfer from the magazine to a position opposite the ram, a pair of clamps mounted on the carriage above said rods and opposite the entrance to the tube, and stationary cam means engageable by the clamps during reciprocation of the carriage for spreading apart the clamps to receive a spring from the magazine during movement of the carriage toward the magazine and for moving the clamps toward each other into embracing frictional engagement with the received spring during movement of the carriage toward the ram.

2. In a spiral spring winding machine, a horizontally reciprocable carriage having a vertically extending opening sufficiently large to accommodate axial passage therethrough of a spring to be wound and carrying a pair of jaws on laterally opposite sides of said opening, at least one of said jaws being movable relative to the other during reciprocation of the carriage, a ram vertically reciprocable through said opening when the carriage is at one end of its stroke, means for moving

the jaws toward each other into clamping engagement with a spring in response to movement of the carriage toward the ram, other means for moving the jaws away from each other during movement of the carriage in the opposite direction, and a stationary platform below said jaws for vertically supporting a spring during movement of the carriage toward the ram pending the clamping of the spring between the jaws.

3. In a spiral spring winding machine wherein a carriage having a tube through which the springs are axially driven to effect their winding is laterally reciprocated to alternately position the tube in alignment with a spring feeding magazine and a spring driving ram respectively, the improvement consisting of a pair of coacting clamping members on the carriage for laterally locating the spring opposite the entrance to the tube during its movement toward the ram and for vertically supporting the spring upon its reaching a position opposite the ram, stationary cam means engageable by the clamping members during their reciprocal movement with the carriage to cause their clamping engagement with the spring during movement of the carriage toward the ram and a spreading apart of the clamping members sufficient to freely receive a spring from the magazine during movement of the carriage in the opposite direction, and stationary rods extending longitudinally of the carriage reciprocation for vertically supporting the spring during its movement with the carriage pending the spring being clampingly engaged by the clamping members, said rods being disposed opposite the magazine and below the clamping members.

4. In a spiral spring winding machine wherein a carriage having a tube through which the springs are axially driven to effect their winding is laterally reciprocated to alternately position the tube in alignment with a spring feeding magazine and a spring driving ram respectively, the improvement consisting of movable clamping means on the carriage opposite the entrance to the tube for supporting the spring during movement of the tube to its position of alignment with the ram, stationary cam means operative upon the clamping means to effect movement thereof into clamping engagement with the spring during movement of the tube toward the ram, and other stationary cam means operative upon the clamping means to effect its return during movement of the tube to its position of alignment with the magazine.

5. In a spiral spring winding machine wherein a carriage having a tube through which the springs are axially driven to effect their winding is laterally reciprocated to alternately position the tube in alignment with a spring feeding magazine and a spring driving ram respectively, the improvement consisting of clamping means on the carriage opposite the entrance to the tube and movable into and out of lateral clamping engagement with the spring during movement of the carriage toward and away from the ram, respectively, cam means operable on said clamping means in response to the reciprocal movement of the carriage to control the engagement and disengagement of the spring by said clamping means, and a stationary spring supporting platform extending between the clamping means and the tube along that portion of the carriage stroke while said clamping means are disengaged from the spring.

6. In a machine for winding and assembling pre-wound clock-type springs to window regula-

tor devices and the like having a frame, a ram reciprocably mounted on the frame, means fixed to the frame opposite one end of the ram for supporting one of said devices pending its receipt of a wound spring, a spring magazine laterally spaced from the ram, and a carriage having a helically slotted tube reciprocable on the frame between positions of alignment with the magazine and the ram through which the spring is driven by the ram to effect the winding and assembly of the spring with the device, the improvement consisting of movable clamps carried by the carriage for laterally locating the spring during its movement toward the ram and vertically supporting the spring upon its reaching a position opposite the ram, cam means on the frame engageable by the clamps during their reciprocal movement with the carriage to cause their clamping engagement with spring during movement of the carriage toward the ram and a spreading apart of the clamps sufficient to freely receive a spring from the magazine during movement of the carriage in the opposite direction, and a pair of rods fixed to the frame below the clamps for vertically supporting the spring pending its being clampingly engaged by the clamps, said rods extending longitudinally of the carriage reciprocation opposite the magazine and terminating intermediate the magazine and ram.

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