Sept. 17, 1957 C. J. STOFKO 2,806,507

SPRING WINDING MACHINE

Filed Aug. 16, 1954 4 Sheets-Sheet 1

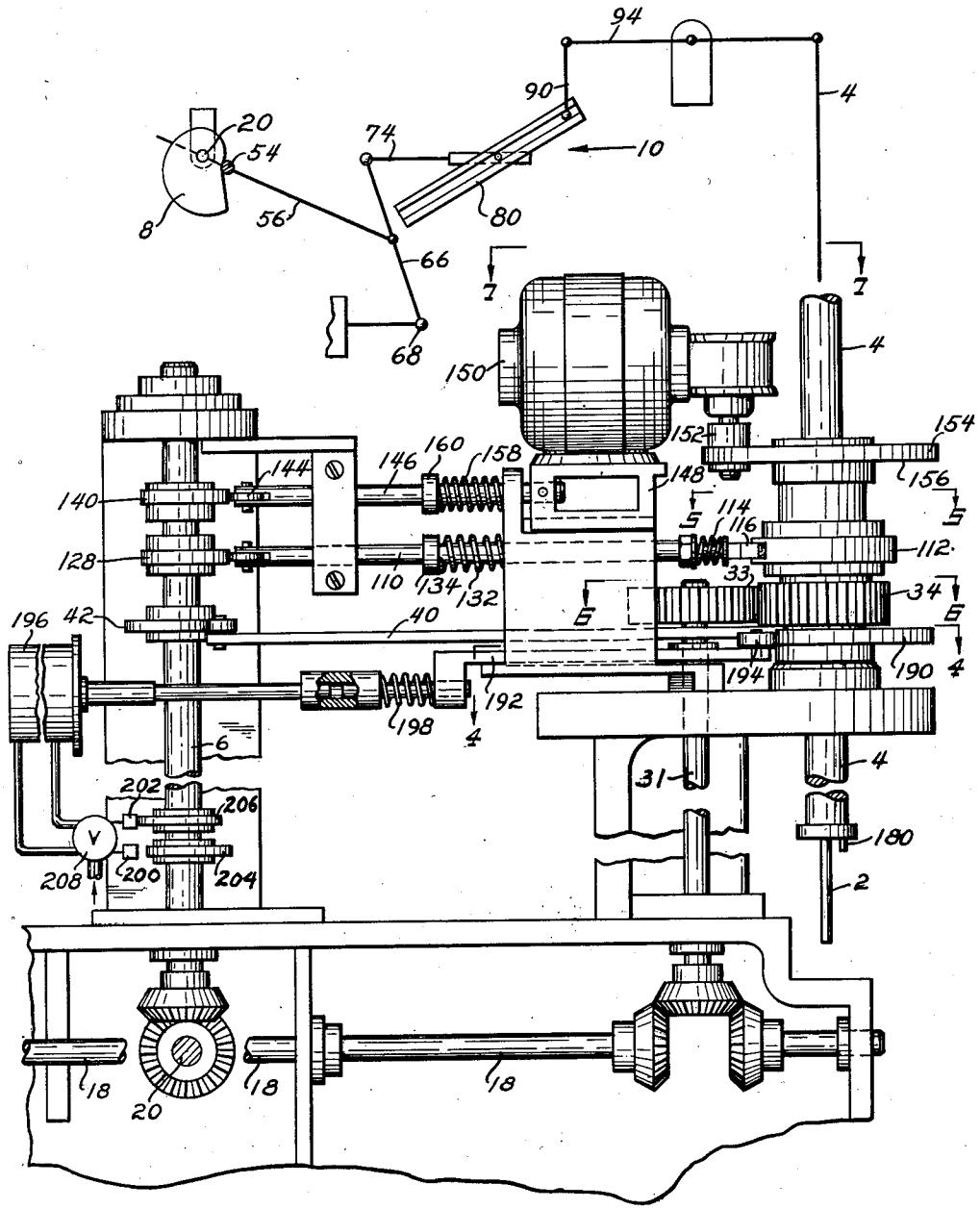


FIG. 1

INVENTOR
CHARLES J. STOFKO

BY Scrivener & Parker
ATTORNEYS

Sept. 17, 1957 C. J. STOFKO 2,806,507

SPRING WINDING MACHINE

Filed Aug. 16, 1954 4 Sheets-Sheet 2

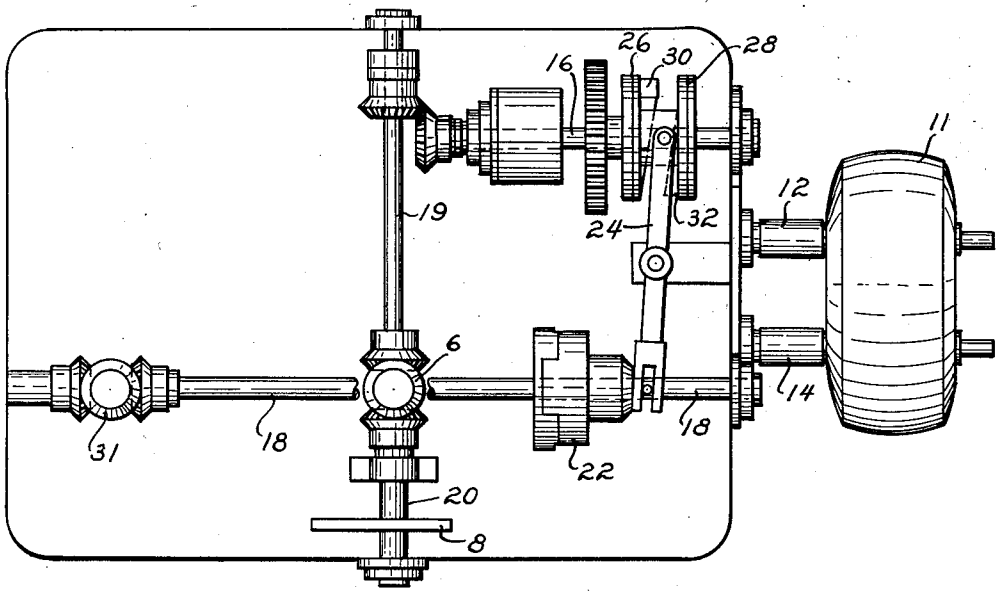


Fig. 2

INVENTOR
CHARLES J. STOFKO

BY Scrivener & Parker

ATTORNEYS

Sept. 17, 1957 C. J. STOFKO 2,806,507

SPRING WINDING MACHINE

Filed Aug. 16, 1954 4 Sheets-Sheet 3

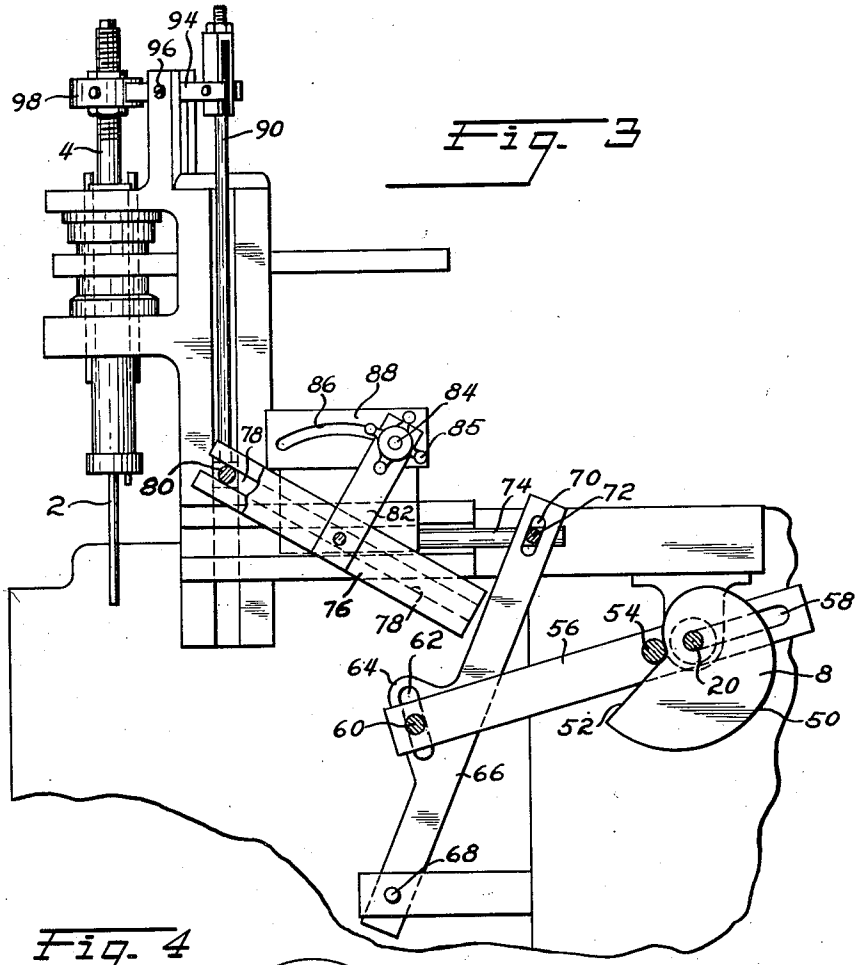


Fig. 3

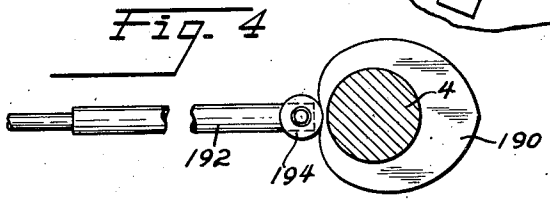


Fig. 4

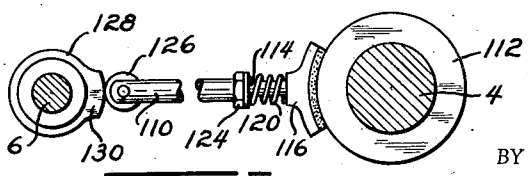


Fig. 5

INVENTOR
CHARLES J. STOFKO

BY Scrivener & Parker
ATTORNEYS

Sept. 17, 1957 C. J. STOFKO 2,806,507

SPRING WINDING MACHINE

Filed Aug. 16, 1954 4 Sheets-Sheet 4

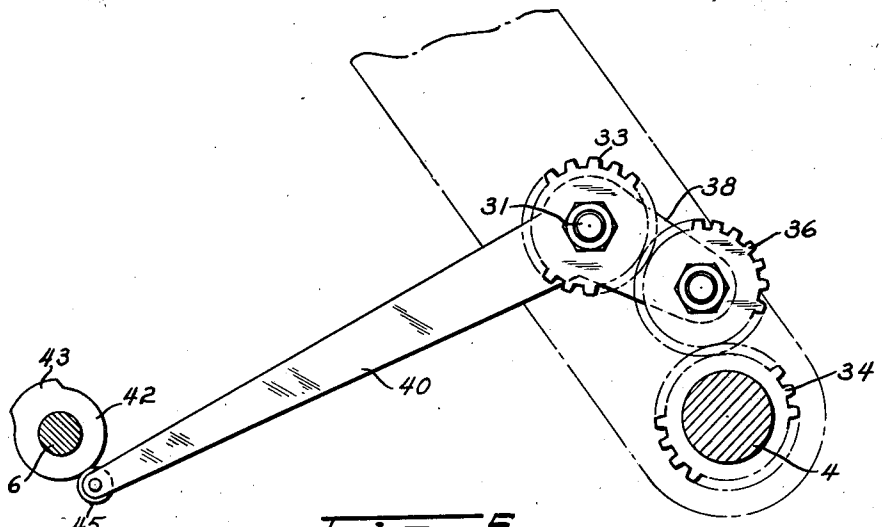


Fig. 6

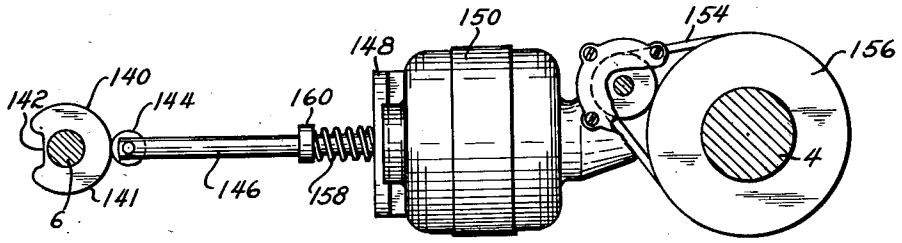


Fig. 7

INVENTOR

CHARLES J. STOFKO

BY Scrivener & Parker

ATTORNEYS

United States Patent Office

2,806,507

Patented Sept. 17, 1957

2,806,507

SPRING WINDING MACHINE

Charles J. Stofko, Bristol, Conn., assignor to Associated Spring Corporation, Bristol, Conn., a corporation of Delaware

Application August 16, 1954, Serial No. 449,929

1 Claim. (Cl. 153—67)

This invention relates broadly to spring making machines and, more particularly, to fully automatic machines for winding helical torsion springs.

Machines of the particular type to which this invention relates are now known and in use. In these known machines a spindle is rotated and simultaneously moved axially whereby a length of wire which is fixed at its one end to the spindle is wound about the spindle in a helix to form the spring, after which the spindle is stopped and returned axially to its original position in order to have another length of wire fixed to it, after which the spring winding operation is repeated. In these known machines the spring winding operation of the spindle and the return of the spindle each occupy one-half of a full operative cycle of the machine, by reason of which the machine is in productive operation, by which it is meant that it is actually winding springs, for only one-half of the time that it is in use. It has been a principal object of my invention to provide a machine of the described type which is so constructed and operative that the productive, or spring winding, part of a full cycle of operations is more than half of the full cycle and in which the non-productive part of the cycle is correspondingly reduced, thus increasing the productive capacity of the machine during a given period of use.

Another problem involved in the operation of machines of the described type is the provision of means for positioning the empty spindle to receive the end of a length of wire at the beginning of the spring winding operation, and it has been a further object of my invention to provide improved and fully automatic means for effecting this positioning of the spindle.

These principal objects of the invention, as well as others which will appear hereinafter and to those skilled in the spring making art, are provided by the machine which is described in the following specification and illustrated in the accompanying drawings, in which:

Fig. 1 is an enlarged side view of the spring winding parts of the machine and the means for effecting and controlling its various operations, certain of the latter being shown diagrammatically;

Fig. 2 is a horizontal sectional view, turned 180° with respect to Fig. 1, of parts of a machine according to this invention, showing particularly the means for supplying power to various parts of it;

Fig. 3 is an enlarged side view of the means which are provided by the invention for moving the spring winding spindle axially and which are shown diagrammatically and as seen from the side opposite to the side shown in Fig. 1;

Fig. 4 is a top plan view of parts of the spindle positioning means provided by the invention, taken on line 4—4 of Fig. 1;

Fig. 5 is a top plan view of the means provided by the invention for braking the spindle, taken on line 5—5 of Fig. 1;

Fig. 6 is a top plan view of the means provided by the invention for intermittently rotating the spindle, taken on line 6—6 of Fig. 1, and

Fig. 7 is a top plan view of part of the means provided by the invention for reversing the direction of rotation of the spindle after completion of the winding operation, taken on line 7—7 of Fig. 1.

The machine provided by this invention is operative fully automatically first to rotate a spindle, on which a helical torsion spring is to be wound, to proper position to receive the end of a length of wire, then to rotate the spindle and move it axially to wind the wire in a helix about the spindle, then to stop the rotation of the spindle, then to momentarily rotate the spindle in reverse direction to remove the spring, then to move the spindle axially to its original position, and lastly to again rotate the spindle to proper position to receive the end of the next length of wire to be wound on it. Conventional devices such as wire feed and wire cut-off means must, of course, be provided but such devices form no part of the invention and are not shown in the drawings or described in the specification.

The principal operative and control parts of the machine of this invention are illustrated in Fig. 1 of the drawings and comprise a spindle **2** which extends axially downwardly from the center of a vertical spindle shaft **4** which is journaled in the machine frame for rotary and axial movement. Various gears, cams and other devices which form part of the means for driving, stopping and positioning the spindle shaft are mounted on the shaft and are keyed to it so that they will rotate, but not move axially, with it. A vertical camshaft **6** is provided which is spaced from the spindle shaft and on which are mounted various cams and micro-switches which operate or control the gears, cams and other devices mounted on the spindle shaft. A cam **8** and linkage **10** which connects the cam to the upper end of the spindle shaft are provided for moving the spindle shaft and spindle upwardly and downwardly and are shown diagrammatically in Fig. 1 and fully in Fig. 3. All of these parts and the means for operating and controlling them will now be described.

The means provided by the invention for supplying rotational and other force to the parts of the machine which provide the spring winding operation are illustrated in Fig. 2 and comprise a variable drive device **11** driven by an electric motor, not shown, and having two output shafts **12, 14** which are geared, respectively, to the two main power shafts **16, 18** of the spring winding machine. Shaft **16** is continuously rotated by shaft **12** and is connected through bevel gears to a cross-shaft **19** which, in turn, is connected through bevel gears to the lower end of a vertical camshaft **6** and to a stub shaft **20** which is axially aligned with shaft **19** and on which is mounted the cam **8** which operates the means for moving the spindle shaft **4** axially, whereby the camshaft **6** and cam **8** are continuously rotated. Shaft **18** comprises two parts which are connected through a clutch **22**, the parts of which are operated into and out of engagement with each other by a yoke lever **24** which is pivoted at its center to the machine frame. One end of this lever is operatively connected to one of the clutch parts, and the other end is positioned adjacent shaft **16** between two adjacent but spaced plates **26, 28** which are mounted on shaft **16** and are rotatable therewith and which have oppositely inclined and oppositely positioned cam faces **30, 32** on their adjacent faces which engage the end of lever **24** and rock it back and forth about its pivotal support, thus connecting and disconnecting the parts of clutch **22** to intermittently rotate that part of shaft **18** which is not geared to shaft **14**. The intermittently rotated part of shaft **18** is connected through bevel gears to the lower end of a vertical shaft **31**, which is adjacent the spindle shaft **4**, as shown in Figs. 1 and 6, and on

the upper end of which there is mounted a gear 33. Another gear 34 is keyed to the spindle shaft 4 and a third gear 36 is provided which is rotatably mounted on the short arm 38 of a lever which is fulcrumed on the vertical drive shaft 31 and has a long arm 40 extending into proximity to the camshaft 6 where it engages the periphery of a cam 42 which is mounted on the camshaft. The surface of cam 42 is concentric with shaft 6 throughout the greater part of its circumference and the remainder is outwardly extended as shown at 43. The parts are so positioned and arranged that when the roller 45 on the end of lever arm 40 is engaged by the lower part of cam 42 the lever is so positioned that gear 36 is in mesh with gears 33 and 34, thus imparting the rotation of shaft 31 to the spindle shaft, while engagement of lever arm 40 with the raised part 43 of cam 42 moves the lever about its fulcrum to disengage gears 36 and 34 to remove rotational force from gear 34 and the spindle shaft. It will be seen from the foregoing that during operation of the machine the camshaft 6 and the cam 8 are constantly rotated, and the spindle shaft 4 is intermittently rotated.

Means are provided by the invention for moving the spindle shaft and spindle axially upwardly, or downwardly if desired, during rotation thereof to cause wire wound about the spindle to take the form of a helix and thereafter to move these parts in the opposite direction to their starting position. Such means comprise the cam 8 which, as already described, is constantly rotated by shafts 12, 16, 19 and 20 and the connecting gearing. As shown in Figs. 1 and 3, this cam has a curved surface 50 of constantly increasing radius extending through an arc of 270° and the ends of which are connected by a straight-line surface 52. These surfaces engage a pin 54 which is carried by a rod 56 which is mounted through lost motion slot 58 on shaft 20 and which is generally horizontally positioned. One end of rod 56 carries a pin 60 which is received in a slot 62 in an ear 64 formed on the side, and midway the length, of a second rod 66 which is pivotally mounted at its lower end on the machine frame at 68 and extends upwardly therefrom and at its upper end has an elongated slot 70 which receives a pin 72 which extends laterally from one end of a third rod 74 which is mounted in the machine frame for horizontal reciprocating sliding movement. The other end of rod 74 has attached to it at an angle a bar 76 which has a longitudinally extending groove 78 in which is loosely received a pin 80 carried by the lower end of a vertical rod 90, the purpose of which will be described hereinafter. The bar 76 is mounted at its midpoint for pivotal movement with respect to rod 74 and, also at its midpoint, has an arm 82 extending laterally therefrom the outer end of which has a screw 84 extending laterally therefrom which is received within an arcuate slot 86 formed in a plate 88 which is fixed to the slidable rod 74. A handle 85 is attached to screw 84 and may be operated to cause the screw to clamp the bar 76 in any angular position to which it may be moved as the screw 84 is moved along slot 86. The upper end of rod 90 is pivotally connected to one end of a horizontal lever 94 which is pivotally mounted at its center on the machine frame at 96, and the other end of which is pivotally connected through adjusting means 98 to the upper end of the spindle shaft 4. The described apparatus for imparting axial movement to the spindle shaft is conventional in spring winding machines, with the exception of the cam 8 and its described construction.

In the operation of imparting axial movement to the spindle shaft and spindle, rotation of the cam 8, in a counterclockwise direction as viewed in Fig. 3, from a starting posititon in which the pin 54 engages the juncture of cam surface 50 and straight-edge surface 52, will cause the cam surface 50 to bear with its increasing radius on pin 54, thus moving the rod 56 to the left as seen in Fig. 3. This will move the rod 66 in a counterclockwise direction about its pivotal support 68, causing the upper end of rod 66 to move rod 74 to the left, causing bar 76 to move to the left. As this bar is angularly disposed to the horizontal path of travel of rod 74 its movement will force pin 80 to move downwardly as it travels along the slot 78. Such downward movement of pin 80 and rod 90 will rock lever 94 about its pivotal support 96 to move the spindle shaft upwardly and such movement of the spindle shaft will continue so long as the cam surface 50 of cam 8 is in engagement with pin 54. When pin 54 reaches the end of cam surface 50 it will move along the straight-edge surface 52 from the point of greatest radius of surface 50 to the point of minimum radius thereof and when this occurs, spring means (not shown) which constantly urge the spindle shaft downwardly will operate to move that shaft to its lowermost position in which it may begin another spring winding operation. Suitable means, such as a spring may also be provided to return to normal positions the linkage which connects the cam 8 and spindle 4.

The above-described operation assumes that the rod 76 is angularly related to plate 88 and rod 74 in such a way that as the rod 74 moves to the left as viewed in Fig. 3 under the influence of cam surface 50 the pin 80 and rod 90 will be moved downwardly, thus moving the spindle upwardly during the spring-winding operation. If it is desired to move the spindle downwardly during the spring-winding operation the screw 84 is loosened by operation of handle 85 and the bar 76 and arm 82 are rocked about their pivotal support to bring the screw 84 to the left-hand end of slot 86, thus changing the initial position of pin 80 and the inclination of bar 76 so that pin 80 and rod 90 will be moved upwardly upon rotation of cam 8 in the spring winding operation. The length of stroke of the spindle in the spring-winding operation may be adjusted by adjusting the position of screw 84 along slot 86, the maximum length of spindle movement being achieved when the screw is at one or the other extremity of the slot.

It will be seen from the foregoing description that the spindle shaft and spindle are moved upwardly or downwardly to wind a spring on the spindle during three-quarters of the complete rotation of the cam 8 and that the return movement of the spindle shaft and spindle take up only one-quarter of the complete rotation of the cam. The machine is therefore operative to effect spring winding during three-quarters of its operation, thus increasing its output above that of known machines in which the spring-winding and return operations each require one-half of the full cycle of the machine.

Means are provided by the invention for stopping the rotation of the spindle shaft at the end of the spring winding operation. When cam 8 has rotated through 270° to bring pin 54 to the end of cam surface 50, the cams 30, 32 on shaft 16 reach a position in which lever 24 is rocked about its pivotal support to a position in which the parts of clutch 22 are disengaged, thus disconnecting the spindle shaft from the variable drive device 11. Means are provided for now braking the spindle shaft. These means are disclosed in Figs. 1 and 5 and comprise an elongated rod 110 which is mounted in horizontal position on the machine frame for sliding movement. One end of this rod is adjacent a brake drum 112 which is keyed to the spindle shaft 4 and the other end is axially bored to slidingly receive a rod 114 which carries on its outer end an arcuate brake shoe 116 which is provided with suitable brake lining. A compression spring 120 surrounds rod 114 and bears at its one end on the brake shoe and at its other end on an abutment 124 on the end of rod 110. The other end of rod 110 is provided with a roller 126 which bears on the surface of a cam 128 which is keyed to camshaft 6. The surface of cam 128 is concentric with camshaft 6 throughout the greater part of its extent but is provided with a short outwardly extending part 130, all as shown in Fig. 5. A compression spring 132 surrounds rod 110 and bears at its one end

on a part of the machine frame and at its other end on an abutment 134 on rod 110, the parts being so arranged and positioned that this spring constantly urges rod 110 to a position in which the brake shoe is removed from, but closely adjacent, the brake drum 112. The part 130 of the cam 128 is so positioned with respect to other parts of the machine that it engages the roller 126 on rod 110 at the same moment that pin 54 reaches the point of greatest radius of surface 50 of cam 8. Thus, at this moment, the cam surface 130 will move rod 110 toward brake drum 112 and the brake shoe 116 will be forced into engagement with the brake drum to stop rotation of the spindle shaft 4. The spring 120 will act to cushion the engagement of the brake lining on the brake drum but is of sufficient strength to permit effective and immediate braking. The spring 132 returns the rod to its normal position, in which the brake shoe is removed from the brake drum, when the cam surface 130 moves away from roller 126. It will be apparent that the circumferential length of cam surface 130 must be such that it will be moved away from roller 126, and the brake shoe thereby removed from the brake drum, when pin 54 is in position to be engaged by the surface 50 of cam 8 at its point of minimum radius, at which the spring winding cycle begins. It will also be apparent that the cams 128 and 42 must be so positioned with respect to each other that the braking operation controlled and effected by cam 128 will immediately precede the disengagement of gear 36 from gear 34. The disengagement of these gears is effected by engagement of roller 45 by the raised part 43 of cam 42, thus moving lever 38, 40 in a counter-clockwise direction as viewed in Fig. 6 to move gear 36 out of mesh with gear 34. Thus, rotation of the spindle shaft is stopped by disconnecting shaft 18 from the variable drive 11 by operation of clutch 22, followed by the braking action of the brake shoe 116 and the disconnection of the spindle from any driving element by moving gear 36 out of mesh with gear 34. These operations are initiated, in the order stated, immediately upon arrival of pin 54 at the end of the surface 50 of cam 8. The raised part 130 of cam 128, which operates the brake shoe, is of very short circumferential extent and the brake shoe is withdrawn from the brake drum 112, by action of spring 132 almost immediately after engaging the brake drum, it having been found that a forceful application of the brake shoe for a very short period of time is sufficient to effectively stop rotation of the spindle.

Means are provided by the invention for reversing the direction of rotation of the spindle shaft and spindle after release of the braking means, in order to slightly unwind the spring to permit it to drop from the spindle. These means are illustrated in Figs. 1 and 7 and comprise a cam 140 which is keyed to camshaft 6 and the greater part 141 of the circumference of which is of constant radius, and which has a part of lesser radius, forming a depression 142 of relative small length. The surface of cam 140 bears on a roller 144 carried by one end of a rod 146 which is mounted for horizontal sliding movement in the machine frame and which extends toward the spindle shaft. At its outer end rod 146 is attached to a frame 148 which is slidably mounted on the machine frame for limited movement toward and away from the spindle shaft and to the upper surface of which there is attached an electric motor 150 which is constantly operated during operation of the machine. The armature of this motor is geared or otherwise connected to a vertical shaft which is supported by the motor and which carries a pulley 152. A belt 154 extends about this pulley and about a drum 156 which is keyed to the spindle shaft. A compression spring 158 surrounds shaft 146 and bears at its one end on the machine frame and at its other end on an abutment 160 on shaft 146 and constantly urges shaft 146 and the frame 148 in a direction away from the spindle shaft. So long as the raised part 141 of cam 140 bears on the roller 144, rod 146, frame 148 and motor

150 are held in a position toward the spindle shaft, in which position the spring 158 is compressed and the belt 154 slips on pulley 156. When the depressed part 142 of the cam is engaged by roller 144 the rod 146, frame 148 and motor 150, are moved away from the spindle shaft by spring 158 and the belt 154 is tightened about pulleys 152 and 156, causing the pulley 156 and attached spindle shaft to be rotated in a direction opposite to that in which the spindle shaft is normally rotated, thus imparting a reverse twist to the spring which has just been wound on the spindle, thus opening it slightly and causing it to drop from the spindle. As stated hereinbefore, the depressed part 142 of cam 140 is of very short circumferential length and therefore engages roller 144 for only a very short length of time, whereby the reverse rotation of the spindle shaft in the described manner is also of very short duration. The depressed part 142 of cam 140 must engage roller 144 just after the pin 54 leaves the part of greatest radius of surface 50 of cam 8 and must move out of engagement with the roller before pin 54 is engaged by the part of minimum radius of surface 50 of cam 8 to begin another spring winding cycle. Further, the depressed part 142 of cam 140 must be so positioned with respect to the raised part 130 of the cam 128, which controls the braking means, that the reverse winding operation will not begin until the brake shoe has been withdrawn from the brake drum.

It will be obvious that means must be provided to cut the wound spring on the spindle from the length of wire from which it was wound, but as such wire cut-off means are conventional and form no part of the present invention they are not specifically described or illustrated.

The end of the wire fed to the spindle must be caused to rotate with the spindle and, in order to effect this, a short pin 180 is attached to the lower end of the spindle shaft and extends downwardly therefrom in parallel and spaced relation to the spindle, as shown in Fig. 1. The spindle 2 and pin 180 must always be in the same position at the beginning of the spring winding cycle in order that the wire being fed to the spindle will be received between them, and means are provided by the invention for so positioning these parts. These means are illustrated in Figs. 1 and 4 and comprise a heart-shaped cam 190, which is keyed to the spindle shaft 4, and a rod 192 having a roller 194 at its one end which is positioned adjacent but normally removed from, the surface of cam 190 and, at its other end, is connected to the piston within a cylinder 196. The rod 192 may be formed in two axially-aligned parts connected by a spring 198 in order to provide a cushioned effect as roller 194 is driven against the heart-shaped cam. The surface of cam 190 comprises two curved parts, which begin at a point of minimum radius and continue in opposite directions, each through 180°, with constantly and equally increasing radius to a point of maximum radius, thus providing a heart-shaped surface. Microswitches 200, 202 are positioned adjacent cam-shaft 6 for operation by cams 204, 206 on the camshaft and control a valve 208 which admits and releases fluid or air under pressure to and from cylinder 196 to operate the piston therein. The cams 204, 206 are so positioned with respect to each other and to the other operating parts of the machine that the one cam 204, which operates the microswitch 200 which controls the supply of fluid to cylinder 196 to force the piston and rod 192 toward the heart-shaped cam, engages the microswitch immediately after the reverse rotation of the spindle to remove the spring, as described hereinbefore. The second cam 206, which operates the microswitch 202 which controls the supply of fluid to cylinder 196 to move the piston and rod 192 in the opposite direction, engages the microswitch immediately after engagement of roller 194 with the part of minimum radius of cam 190. Both microswitches must be operated, and the positioning of the cam 190 and the spindle shaft completed, after completion of the reverse winding operation and before pin

54 reaches the point of minimum radius of surface 50 of cam 8. The roller 194 is forced against the surface of heart-shaped cam 190 by operation of the piston within cylinder 196 at a time in the cycle of operation of the machine when the spindle shaft is not rotating, having been stopped by the braking means described hereinbefore, and the pressure of the roller on the heart-shaped surface of the cam, regardless of where the roller may engage it, will cause the cam and the spindle shaft to be rotated to a position in which the roller engages the point of minimum radius of the cam surface, as shown in Fig. 4. In this position the spindle 2 and pin 180 are positioned to receive between them the end of the wire being fed to the spindle by the wire feed means, thereby to cause the wire to be wound about the spindle in a subsequent spring winding cycle.

A full cycle of operation of the machine will now be described, it being assumed that the pin 54 is at the point of minimum radius of surface 50 of cam 8. In this position, the spindle shaft 4 and spindle 2 are in their lowermost positions and the spindle and pin 180 are positioned to receive the end of the wire between them. The cams on camshaft 6 are in such position that the piston in cylinder 196 has been operated to move roller 194 out of engagement with the heart-shaped cam 190, the lever 38, 40 is in such position that gears 36, 34 are out of mesh, the brake 116 has been moved from the brake drum 112, and the motor 150 has been moved toward the spindle shaft so that the belt 154 slips on the pulley 156. At this point the cam 42 on the constantly rotating camshaft 6 arrives at a position in which the raised part 43 of the cam moves away from the roller on lever 38, 40 thus causing the lever to bring gear 36 into mesh with gear 34, which is keyed to the spindle shaft. At the same time, the cams 30, 32 on shaft 16 operate lever 24 to move the parts of clutch 22 into engaged position to cause shaft 18 to be rotated. The spindle shaft is thereupon rotated by the variable drive 11 through shaft 18, clutch 22, shaft 31 and gears 33, 36, 34. Cam 8 is constantly rotating in a counter-clockwise direction as viewed in Fig. 3 and the surface 50 of the cam, which is of increasing radius, will bear against pin 54 on rod 56 and move the rod and its attached linkage in the described manner to move the spindle shaft and spindle vertically upwardly. The simultaneous upward movement and rotation of the spindle will cause the wire caught between the spindle and pin 180 to be wound in a helix about the spindle. This winding operation will continue so long as the spindle is moved upwardly by engagement between the surface 50 of cam 8 and the pin 54 and, while the cams on camshaft 6 are being rotated during this period because of the fact that the camshaft is continuously rotated during operation of the machine, the shapes of these cams are such that the parts controlled and operated by them are maintained in the positions and conditions described hereinbefore in this paragraph.

When cam 8 has rotated through 270° the surface 50 of the cam no longer engages pin 54 and the pin and the parts which connect it to the spindle shaft are freed to be moved, as by spring means, in the direction opposite to that in which they have been moved by surface 50 and the spindle shaft will be moved to its lowermost position. During the interval between completion of one spring winding cycle and the beginning of another the pin 54 moves across the straight-line surface 52 of cam 8, and the various cams on camshaft 6 operate their respective parts as described hereinbefore. During this period the cams 30, 32 on shaft 16 operate lever 24 to move the parts of clutch 22 out of engagement with each other, thus removing rotational force from the spindle shaft, the cam 128 on camshaft 6 then arrives at a position in which the raised part 130 thereof engages the roller on rod 110 to force the brake shoe 116 into engagement with the brake drum 112 on the spindle shaft, thus stopping rotation of the spindle shaft, the cam 42 on camshaft 6 then arrives at a position in which the raised part 43 thereof engages the roller on lever arm 40 and moves this lever to disengage gear 36 from gear 34, thus causing the spindle shaft to idle, whereby the action of the braking means is made immediately effective, after which the raised part 130 of cam 128 moves away from the roller 126 on rod 110 and spring 132 moves the brake shoe out of engagement with the brake drum on the spindle shaft. The cam 140 on camshaft 6 then arrives at a position in which the depressed part 142 thereof engages the roller 144 on rod 146 and the spring 158 thereupon moves frame 148 and motor 150 in a direction away from the spindle shaft, thus tightening belt 154 on pulleys 152, 156 to cause the pulley 156 and the spindle shaft to be rotated by the motor 150 in a direction opposite to that in which these parts are normally rotated. This reverse rotation continues for only the very short period in which the depressed part 142 of cam 140 engages the roller 144 and is only of sufficient duration to cause a slight reverse twisting of the spring which is wound about the spindle, thus opening the spring slightly and permitting it to slide from the spindle. Cut-off means are simultaneously made operable to sever the wound spring on the spindle from the length of wire stock. The cam 204 on camshaft 6 then engages microswitch 200 to cause air or fluid under pressure to be admitted to cylinder 196 through valve 208 to move roller 194 on rod 192 into engagement with the periphery of the heart-shaped cam 190. As the spindle shaft is now free to rotate, the forcible engagement of the roller 194 with the heart-shaped cam moves the cam and the attached spindle shaft from any position which it may be occupying to that in which the roller 194 engages the point of minimum radius of the cam, in which position the spindle 2 and pin 180 are positioned to receive between them the end of the wire stock being fed to the spindle. The cam 206 on camshaft 6 now engages microswitch 202 to cause air or fluid under pressure to be admitted to cylinder 196 through valve 208 to move the piston in the cylinder in a direction to move the roller 194 out of engagement with the heart-shaped cam. The pin 54 has now arrived at the point of minimum radius of surface 50 of cam 8 and the machine and all of its parts and mechanisms are in position to effect another spring winding cycle in the manner described hereinbefore.

While I have described and illustrated but one embodiment of my invention, it will be apparent to those skilled in the art that other embodiments, as well as modifications of that disclosed, may be made and practised without departing in any way from the spirit or scope of the invention, for the limits of which reference must be made to the appended claim.

What is claimed is:

A spring winding machine comprising a spindle mounted for rotary and axial movement, means for rotating the spindle, rotating means operable through approximately three-quarters of its rotary movement to move said spindle axially of itself in one direction to cause wire fixed to the spindle to be wound in a helix about the spindle as the same is rotated, means operable during the remaining period of the rotation of said means to move the spindle in the opposite direction, means operable during said remaining period of rotation to stop the rotation of the spindle, a cam connected to said spindle and rotatable therewith and having a heart-shaped surface surrounding the spindle, a roller positioned adjacent but normally removed from said heart-shaped surface, and means operable upon stopping of the rotation of the spindle for forcing said roller into engagement with said heart-shaped surface to thereby rotate the spindle to a pre-determined position to receive the end of a length of wire being fed to the spindle.

(References on following page)

References Cited in the file of this patent

UNITED STATES PATENTS

375,064	Graham	Dec. 20, 1887
1,048,352	Saylor	Dec. 24, 1912
1,673,185	Des Combes	June 12, 1928
1,696,453	Reid	Dec. 25, 1928
2,054,196	Gogan	Sept. 15, 1936
2,120,146	Halvorsen	June 7, 1938
2,163,019	Blount	June 20, 1939
2,439,893	Iden	Apr. 20, 1948
2,466,227	Gilman	Apr. 5, 1949
2,705,027	Sanborn	Mar. 29, 1955