The invention relates to a heater mechanism for heat treating coil springs. The heater mechanism of this invention is particularly adaptable for use with a coil spring producing machine, such as disclosed in application Serial No. 700,197, filed by William E. Wunderlich on September 30, 1945, now Patent No. 2,654,202 of July 22, 1953, for individually heat treating the coil springs as they are formed by the machine.

The principal object of this invention is to provide an improved heater mechanism for heat treating coil springs wherein the end turns of the coil spring are securely clamped and electrically contacted for passing electrical current therethrough thereby eliminating spring and providing uniform heat treatment throughout the length of the coil spring, wherein electrical current is applied to the coil spring only when the end turns thereof are securely clamped and electrically contacted, wherein the interval of time during which electrical current is applied may be readily adjusted for obtaining the desired heat treatment of the coil springs, wherein the application of electrical current to and the clamping and electrically contacting of the coil springs are positively and mechanically synchronized for foolproof operation, wherein the heater mechanism may be readily adjusted for accommodating coil springs having different lengths, diameters, wire gauge and the like, wherein the heater mechanism may be readily applied to coil spring producing machines for synchronous operation therewith, and wherein the heater mechanism is simple in construction, foolproof in operation and inexpensive to manufacture.

Briefly, the heater mechanism of this invention includes two pairs of clamping members, one pair clamping and electrically contacting one end turn of a coil spring and the other pair clamping and electrically contacting the other end of the coil spring. Each pair of clamping members includes a normally stationary clamping member and a clamping member movable toward and away from the normally stationary clamping member. A pair of cams, operated by a rotatable shaft, move the movable clamping members toward and away from the normally stationary clamping members for securing clamping and electrically contacting each coil spring applied thereto. Means are provided for applying electrical energy to the clamping members electrically to heat treat the springs clamped thereby. Control means including switch means and cam means operated by the rotatable shaft applies electrical energy to the clamping members and hence to the coil spring only when the coil spring is securely clamped and electrically contacted by the clamping members. The control means is adjustable to regulate the time interval during which electrical energy is applied to the clamped coil springs. The rotatable cam shaft may be driven in synchronism with a coil spring producing machine for heat treating the coil springs as they are fabricated. The positions of the rotatable cam shaft and the various clamping members and cams operated thereby may be adjusted to accommodate coil springs of different lengths, diameters, wire gauges and the like.

Further objects of this invention reside in the details of construction of the heater mechanism and in the cooperative relationships between component parts thereof.

Other objects and advantages of this invention will become apparent to those skilled in the art upon reference to the accompanying specification, claims and drawings, in which:

Fig. 1 is a diagrammatic illustration of a coil spring producing machine of the type disclosed in the aforementioned William E. Wunderlich application with the heat treating mechanism of this invention applied thereto;

Figs. 2 and 3 are perspective views of a coil spring which may be heat treated by the heat treating mechanism of this invention, Fig. 2 illustrating the spring before heat treating and Fig. 3 illustrating the spring after heat treating;

Fig. 4 is a schematic wiring diagram of the means for applying electrical energy to the coil springs being heat treated and the control means thereof;

Fig. 5 is a front elevational view partly in section of the heat treating mechanism of this invention illustrating the clamping members separated for receiving a coil spring;

Fig. 6 is a front elevational view of the heat treating mechanism showing a coil spring clamped by the clamping members for heat treating the coil spring;

Fig. 7 is a top plan view of the heat treating mechanism;

Fig. 8 is an end elevational view of the heat treating mechanism looking from the left of Figs. 5 and 7;

Fig. 9 is a vertical sectional view taken substantially along the line 9—9 of Fig. 7;

Fig. 10 is a sectional view taken substantially along the line 10—10 of Fig. 7;

Fig. 11 is a view illustrating the position of the left end of the coil spring, as illustrated in Figs.
5 and 6, and it is clamped by the left-hand clamping members.

Fig. 12 is a view similar to Fig. 11 but illustrating the position of, and the manner in which, the right-hand of the coil spring, as illustrated in Figs. 5 and 6, is clamped;

Fig. 13 is an enlarged sectional view through a pair of clamping members taken substantially along the line 12—13 of Fig. 14;

Fig. 14 is an elevational view of the right-hand clamping member of Fig. 13 looking from the left; and

Fig. 15 is an exploded perspective view illustrating the manner in which the portion of the clamping member utilized for clamping the coil spring is constructed.

Referring first to Figs. 2 and 3, a coil spring to be heat treated is generally designated at 15. It includes a plurality of inner convolutions or turns 11 and a pair of end turns 12. The end turns 12 terminate in knots 13. The coil spring may be plain as illustrated or the end turns thereof may be crimped or offset if so desired. When the coil spring is originally fabricated the knots 13 are located out of line, as illustrated in Fig. 2, so that when the coil spring is heat treated the knots line up, as illustrated in Fig. 3, the heat treating of the coil spring causing a twisting within the coil spring.

Any suitable machine may be utilized for the purpose of fabricating the coil spring 10 and for purposes of illustration in this application the coil spring producing machine generally designated at 18 which may be of the type disclosed in the aforementioned William E. Wunderlich application. The machine 15 includes a base or standard 18 and a coil forming mechanism 17 for rolling wire into the double ended coil spring 10. When the coil spring 10 is thus formed it is grasped by fingers 19 carried by radial arms 18 of a transfer mechanism 20 which is intermittently rotated in a counterclockwise direction, as illustrated in Fig. 1. The coil springs 10 thus formed and grasped by the fingers 18 are advanced to a knotted mechanism 21 wherein one end of the coil spring 10 is knotted as at 13, and, if desired, crimped into an offset. The coil springs 10 are then advanced to a second knotting mechanism 22 wherein the other end of the coil spring is knotted and may also be crimped into an offset if so desired. The knotted coil springs 10 are then advanced by the transfer mechanism to the heat treating mechanism of this invention, generally designated at 23. After the coil springs 10 are heat treated they are advanced by the transfer mechanism to a stacked mechanism 24 wherein the heat treated coil springs are stacked in nested form. Since the coil spring producing machine, diagrammatically illustrated in Fig. 1, is fully disclosed in the aforementioned William E. Wunderlich application, a further description thereof is not considered necessary.

The heat treating mechanism 23 of this invention includes a supporting base 25 in the form of an angle member which is secured to the standard or support 18 of the coil spring producing machine by means of bolts 27. The upwardly extending leg of the supporting base 25 is provided with a plurality of holes 29 and is provided adjacent each end with vertically arranged slots 29. A pair of bearing blocks 30 are secured to the supporting base by screws 31 extending through the slots 29 and nuts 32. A rotatable cam shaft 33 is rotatably journaled by bearings 34 in the bearing blocks 30. By reason of the vertical slots 29 the bearing blocks 33 and, hence, the cam shaft 33 may be vertically adjustably positioned as desired.

The right-hand end of the rotatable cam shaft 33, as viewed in Figs. 5 and 7, has a hub 35 keyed thereto by a key 36 along with a set screw 37 for holding the hub in proper position on the cam shaft. A gear 38 is secured to the hub 35 by means of bolts 39 so that as the gear 38 is driven, the cam shaft 33 is correspondingly rotated. As shown in Fig. 1, the gear 38 meshes with a driving gear 40 carried by a shaft 41 which drives the knotting mechanism 22. The shaft 41 makes one complete revolution in its operation of the knotting mechanism 22 and this is done during each cycle of operation of the coil spring producing machine. The gear 40 is preferably twice the size of the driving gear 40 so that during each cycle of operation of the coil spring producing machine the rotatable cam shaft 33 is driven through one-half a revolution.

The rotatable cam shaft 33 slidably carries a pair of sleeves 42 and 43. A rotatable and slidably carries a pair of camming members, a normal stationary camming member 47 and a movable camming member 48 which is movable toward and away from the stationary camming member 47. Since the sleeves and the clamping members and elements associated with each sleeve are identical in construction, like reference characters have been utilized for like purposes.

The normally stationary camming member 47 is journaled for rotation with respect to the sleeve 45 by a bearing 50 and, likewise, the movable camming member 48 is journaled for rotation on the sleeve 45 by a bearing member 50. The normally stationary camming member 47 abuts against a thrust bearing 51 which is positioned on the sleeve 45 by a screw-threaded collar 52, which in turn is locked in adjusted position by a locking collar 53. The collars 52 and 53 may be adjustably positioned on the screw threaded portion of the sleeve 45 by means of a suitable tool extending into radial openings 54 in the collars 52 and 53. Thus the collar 52 determines the relative lengthwise positions of the normally stationary camming member 47 and the sleeve 45. A knotted camming member 47 and the movable camming member 48 for normally separating these members.

A cam member 56 is secured to the movable camming member 48 by means of screws 57 and this cam member 56 is provided with a pair of diametrically opposed and longitudinally extending cam surfaces 58. A cam 59 is slidably carried by the sleeve 45 and abuts against a ring 55 secured in an annular groove in the sleeve 45, the ring 55 limiting inward movement of the cam 59. The cam 59 is keyed to the sleeve 45 by a key 56 so that the cam 56 rotates with the sleeve 45 and, hence, with the shaft 33, although the cam 55 may move longitudinally on the sleeve 45. The cam 59 is also provided with a pair of diametrically opposed longitudinally extending cam surfaces 52 which cooperate with the cam surfaces 58 on the cam member 56. The cam 59 is normally maintained against the ring 55 by means of a spring 63, one end of which abuts the cam 59 and the other end of which abuts a collar 64 screw-threaded on the sleeve 45. The collar 64 is locked in adjusted position on the sleeve 45.
by means of a screw-threaded lock collar 65, radial openings 66 in the collars 64 and 65 facilitates their adjustment. When the cam surfaces 58 and 62 are not in engagement, as illustrated in Figs. 7, the springs 59 separate the clamping members 47 and 48, as illustrated in Figs. 5 and 7. However, when the cam shaft 33 and, hence, the sleeve 45 rotate to a position wherein the cam surfaces 59 and 62 engage each other, as illustrated in Fig. 6, the movable clamping members 47 and 48 are normally clamped between the upwardly extending leg of the supporting base 26 and a bar 88, this being accomplished by a bolt 99 extending through one of the holes 25 in the supporting base and a hole in the bar 88 along with a nut 90. Thus, when desired to clamping the normally stationary clamping members 47 in desired positions, also operates to prevent rotation of the clamping members 47 as the cam shaft 33 and, hence, the sleeve 45 are rotated. The movable clamping members 48 being narrower than the normally stationary clamping members 47 are not clamped to the supporting base 26 so that these clamping members 48 may be moved toward and away from the normally stationary clamping members 41. However, the bar 88, cooperating with the supporting base 26, does hold the movable clamping members 48 against rotation as the cam shaft 33 and, hence, the sleeve 45 are rotated. By loosening the bolt 99 the stationary clamping members 47 may be adjusted to desired positions along the cam shaft 33 for accommodating any desired length of coil spring 18. When the normally stationary clamping members 41 are thus moved to the desired positions, the sleeves 45 and the other parts carried thereby are correspondingly moved. When the desired adjustment is obtained, then the bolt 99 is tightened to maintain this desired relationship. The plurality of holes 25 in the supporting base 25 permit positioning of the clamping members substantially anywhere along the cam shaft 33. To accommodate coil springs of different diameters the cam shaft 33 and, hence, the clamping members carried thereby may be vertically raised or lowered by manipulation of the bearing blocks 30. To adjust the pressure at which the clamping members 41 and 48 clamp the end turns of the coil springs, all that is necessary is to adjust the positions of the collars 52 and 53. The adjustment should be such that the electrodes 73 bite firmly the end turns 12 of the coil springs. The cam shaft 33, an angle member for rotation therewith a cam point 40 that is diametrically opposed cam surfaces 97, the cam 95 being secured to the cam shaft by a set screw 96. A conventional normally open electric switch 58 is secured underneath the cam 95 to the adjacent bearing block 30 by means of screws 81. This normally open switch 58 is provided with a plunger 100 in turn carrying a cam follower 1011 which is operated by the cam surfaces 97 on the cam 95. Thus, when the cam shaft 33 and, hence, the cam 95 are rotated, the cam surface 97 engages the cam follower 101 momentarily to close the switch 98. The cam 95 is so positioned on the cam shaft 33 that the switch 98 is momentarily closed only after the clamping members 47 and 48 have securely clamped the end turns 12 of the coil springs to be heat treated. The switch 98 is provided with a suitable connector 102 for accommodating the lead wires thereof.

The end of the cam shaft 33 also carries another cam 105 having a pair of diametrically opposed cam surfaces from which the cam 105 being adjusting secured to the cam shaft 33 by a set screw, not shown. Rotatably mounted on the cam shaft 33 between the cam 105 and the bear-
ing block 30 is a switch supporting plate 107 having a lower outwardly extending portion 108 which carries a normally closed electric switch 109. The switch 109 is provided with a plunger 110 which in turn carries a cam follower 111 to be engaged by the cam surface 106 as the cam shaft 33 is rotated. When a cam surface 105 engages the cam follower 111 the switch 109 is momentarily opened. The switch 109 is also provided with a suitable conduit connector 112 for accommodating the switch leads. The switch supporting plate 107 is fitted with an upper outwardly extending portion 114 to which is secured a handle 115. By moving the handle 115 the plate 107 and the switch 109 are correspondingly moved about the axis of the cam shaft 33 so that the switch 109 may be momentarily opened at various points in the rotation of the cam shaft 33, depending upon the adjustment of the switch carrying plate 107. Thus, the time at which the switch 109 is momentarily opened with respect to the time at which the switch 98 is momentarily closed may be adjusted at will by manipulation of the handle 115. The switch carrying plate 107 is provided with an arcuate slot 116 which is concentric with the axis of rotation of the cam shaft 33.

Owinging the switch carrying plate 107 is a plate 118 having a lower inwardly extending portion 119 which is secured to the bearing block 30 by screws 120. The upper end of this plate 118 is provided with indicia 121 cooperating with a suitable marker on the upwardly extending portion 114 of the switch carrying plate 107 to indicate the interval of time between the closing of the normally opened switch 98 and the opening of the normally closed switch 109.

The top of the bearing block 30 has a bracket 122 secured thereto by screws 123 and a screw 124 is staked thereto. This screw 124 extends through the arcuate slot 116 and through a hole in the outer plate 118. A wing nut 125 carried by the screw 124 clamps the switch carrying plate 107 in adjusted position between the bracket 122 and the plate 118.

Electrical energy is applied to the clamping members 47 and 48 and, hence, to the coil spring clamped thereby by means of a low voltage high current transformer which is designated generally at 153 in Fig. 4. This transformer is of conventional construction and has a primary 131 and a secondary 132, the secondary 132 being connected by suitable leads 133 to the connectors 45 carried by the electrodes 73. Electrical energy is supplied to the primary of the transformer by means of conductors 135 and 136 leading from some source of power not shown. The application of electrical energy to the primary 131 of the transformer 130 is controlled by a relay having an operating coil 138 for operating switches 137, 138, and 139. When the relay coil 138 is energized the switches 137, 138, and 139 are closed and when the relay coil 138 is deenergized these switches are opened. The switches 137 and 138 control the application of electrical energy to the transformer primary 131 so that when the relay is energized, electrical energy is applied to the transformer and when it is deenergized the application of electrical energy is interrupted.

The switch 139 of the relay operates to complete a maintaining circuit for the relay.

The relay winding 136 is controlled by the normally opened switch 98 and the normally closed switch 108 operated by the cam shaft 33.

It may also be controlled by a switch 141 and a start and stop switch 142. The switches 141, 142, 98 and 99 are connected in series with the relay coil 35 and the relay switch 139 is connected in shunt with the normally opened switch 98 in order to energize the relay coil 138; the switches 141, 142, 109, and 139 independently of the switch 98 until switch 109 or switches 141 and 142 are opened.

Assuming that the switches 98 and 142 are closed and that the coil spring producing machine is in operation with a coil spring to be heat treated moved between the clamping members 47 and 48 and securely clamped therebetween, the normally opened switch 98 is thereafter closed to complete a circuit from the conductor 135 through switches 141, 142, 109, 98 and relay coil 136 to the transformer 130. This energizes the relay coil 135 for closing the switches 137, 138, and 139.

Closure of the switches 137 and 138 applies electrical energy to the transformer 130 and, hence, causes electrical energy to flow through the coil spring 10 for heating the same. Closure of the switch 135 upon energization of the relay coil 135 completes a maintaining circuit for the relay coil 135 independent of the switch 98 so that when the switch 98 opens the relay coil remains energized. Upon further rotation of the cam shaft 33 the normally closed switch 109 is opened at a point in the cycle depending upon the adjustment of that switch with respect to the cam shaft 33. Upon opening of the switch 109 the maintaining circuit to the relay coil 135 is broken and the relay becomes deenergized for opening the switches 137, 138 and 139.

Opening the switches 137 and 138 interrupts the application of electrical energy to the coil spring 10 being heat treated. Opening of the switch 135 of the relay prevents the relay from again being energized until such time as the normally opened switch 98 is closed during the next cycle of operation. Thus electrical energy is applied to each coil spring clamped between the clamping members 47 and 48 and the interval of time at which the electrical energy is so applied is determined by the adjustment of the normally closed switch 98.

In all instances electrical energy is applied to the electrodes 73 only when the end turns of the coil spring 12 are securely clamped by the clamping members 47 and 48. By adjusting the normally closed switch 189 the amount of heat treatment applied to each coil spring may be regulated at will.

An indicating lamp 145 may be connected across the conductors 135 and 136 to indicate that the heat treating mechanism is in condition for operation and an indicating lamp 145 may be connected across the primary 131 of the transformer 130 for indicating the period of application of electrical energy to the coil spring being heat treated.

The switch 141 in series with the relay coil 135 is operated by the clutch mechanism of the coil spring producing machine 15 so that the relay may be energized and electrical energy applied to the electrodes of the clamping members only when the coil spring producing machine is in operation. This effectively automatically prevents application of electrical energy to a coil spring when the coil spring producing machine is shut down. The start and stop switch 142 is conveniently located on the coil spring pro-
ducing machine 15 so that the application of electrical energy through the electrodes of the heat treating mechanism may be interrupted at the will of the machine operator.

While for purposes of illustration one form of this invention has been disclosed, other forms the same may become apparent to those skilled in the art upon reference to this disclosure and, therefore, this invention is to be limited only by the scope of the appended claims.

We claim as our invention:

1. A heater mechanism for heat treating coil springs comprising, a supporting base, a shaft rotatably mounted on the base, a first pair of clamping members fixedly mounted at one position along the shaft for clamping and electrically contacting one end turn of a coil spring and including a normally stationary clamping member and a clamping member movable toward and away from the normally stationary clamping member, a second pair of clamping members fixedly mounted at another position along the shaft for clamping and electrically contacting the other end turn of the coil spring and including a normally stationary clamping member and a clamping member movable toward and away from the normally stationary clamping member, and a pair of cam means carried and rotated by the shaft for engaging and moving the movable clamping members of the two pairs of clamping members.

2. A heater mechanism for heat treating coil springs comprising, a supporting base, a shaft rotatably mounted on the base, a first pair of clamping members fixedly mounted at one position along the shaft for clamping and electrically contacting one end turn of a coil spring and including a normally stationary clamping member and a clamping member movable toward and away from the normally stationary clamping member, a second pair of clamping members fixedly mounted at another position along the shaft for clamping and electrically contacting the other end turn of the coil spring and including a normally stationary clamping member and a clamping member movable toward and away from the normally stationary clamping member, a pair of cam means carried and rotated by the shaft for engaging and moving the movable clamping members of the two pairs of clamping members, means for applying electrical energy to the two pairs of clamping members electrically to heat treat the coil spring clamped thereby, and control means for controlling said last mentioned means including switch means and cam means carried and rotated by the shaft for energizing the relay and a second cam operated switch operated by the shaft for deenergizing the relay to apply electrical energy to the two pairs of clamping members only when the coil spring is clamped thereby, one of said cam operated switches being adjustable to regulate the time interval during which the relay is energized and electrical energy is applied to the two pairs of clamping members.

3. A heater mechanism for heat treating coil springs comprising, a supporting base, a shaft rotatably mounted on the base, a first pair of clamping members fixedly mounted at one position along the shaft for clamping and electrically contacting one end turn of a coil spring and including a normally stationary clamping member and a clamping member movable toward and away from the normally stationary clamping member, a second pair of clamping members fixedly mounted at another position along the shaft for clamping and electrically contacting the other end turn of the coil spring and including a normally stationary clamping member and a clamping member movable toward and away from the normally stationary clamping member, a pair of cam means carried and rotated by the shaft for engaging and moving the movable clamping members of the two pairs of clamping members, means for applying electrical energy to the two pairs of clamping members electrically to heat treat the coil spring clamped thereby, and control means for controlling said last mentioned means including switch means and cam means carried and rotated by the shaft for energizing the relay and a second cam operated switch operated by the shaft for deenergizing the relay to apply electrical energy to the two pairs of clamping members only when the coil spring is clamped thereby, one of said cam operated switches being adjustable to regulate the time interval during which the relay is energized and electrical energy is applied to the two pairs of clamping members.

4. A heater mechanism for heat treating coil springs comprising, a supporting base, a shaft rotatably mounted on the base, a first pair of clamping members fixedly mounted at one position along the shaft for clamping and electrically contacting one end turn of a coil spring and including a normally stationary clamping member and a clamping member movable toward and away from the normally stationary clamping member, a second pair of clamping members fixedly mounted at another position along the shaft for clamping and electrically contacting the other end turn of the coil spring and including a normally stationary clamping member and a clamping member movable toward and away from the normally stationary clamping member, a pair of cam means carried and rotated by the shaft for engaging and moving the movable clamping members of the two pairs of clamping members, means for applying electrical energy to the two pairs of clamping members electrically to heat treat the coil spring clamped thereby, and control means for controlling said last mentioned means including switch means and cam means carried and rotated by the shaft for energizing the relay and a second cam operated switch operated by the shaft for deenergizing the relay to apply electrical energy to the two pairs of clamping members only when the coil spring is clamped thereby, one of said cam operated switches being adjustable to regulate the time interval during which the relay is energized and electrical energy is applied to the two pairs of clamping members.

5. A heater mechanism for heat treating coil springs comprising, a supporting base, a shaft rotatably mounted on the base, a first pair of clamping members fixedly mounted at one position along the shaft for clamping and electrically contacting one end turn of a coil spring and including a normally stationary clamping member and a clamping member movable toward and away from the normally stationary clamping member, a second pair of clamping members fixedly mounted at another position along the shaft for clamping and electrically contacting the other end turn of the coil spring and including a normally stationary clamping member and a clamping member movable toward and away from the normally stationary clamping member, a pair of cam means carried and rotated by the shaft for engaging and moving the movable clamping members of the two pairs of clamping members, means for applying electrical energy to the two pairs of clamping members electrically to heat treat the coil spring clamped thereby, and control means for controlling said last mentioned means including switch means and cam means carried and rotated by the shaft for energizing the relay and a second cam operated switch operated by the shaft for deenergizing the relay to apply electrical energy to the two pairs of clamping members only when the coil spring is clamped thereby, one of said cam operated switches being adjustable to regulate the time interval during which the relay is energized and electrical energy is applied to the two pairs of clamping members.

6. A heater mechanism for heat treating coil springs comprising, a supporting base, a shaft rotatably mounted on the base, a first pair of clamping members fixedly mounted at one position along the shaft for clamping and electrically contacting one end turn of a coil spring and including a normally stationary clamping member and a clamping member movable toward and away from the normally stationary clamping member, a second pair of clamping members fixedly mounted at another position along the shaft for clamping and electrically contacting the other end turn of the coil spring and including a normally stationary clamping member and a clamping member movable toward and away from the normally stationary clamping member, a pair of cam means carried and rotated by the shaft for engaging and moving the movable clamping members of the two pairs of clamping members, means for applying electrical energy to the two pairs of clamping members electrically to heat treat the coil spring clamped thereby, and control means for controlling said last mentioned means including switch means and cam means carried and rotated by the shaft for energizing the relay and a second cam operated switch operated by the shaft for deenergizing the relay to apply electrical energy to the two pairs of clamping members only when the coil spring is clamped thereby, one of said cam operated switches being adjustable to regulate the time interval during which the relay is energized and electrical energy is applied to the two pairs of clamping members.
trodes for clamping and electrically contacting one end turn of a coil spring and including a normally-stationary clamping member and a clamping member movable toward and away from the normally stationary clamping member, a second pair of clamping members fixedly mounted at another position along the shaft having facing insulated electrodes for clamping and electrically contacting the other end turn of the coil spring and including a normally stationary clamping member and a clamping member movable toward and away from the normally stationary clamping member, a pair of cam means carried and operated by the shaft for engaging and moving the movable clamping members of the two pairs of clamping members, and insulating means overlying the edges of at least one of the electrodes of the clamping members to prevent intermediate turns of the coil spring from electrically contacting the electrodes.

7. A heater mechanism for heat treating coil springs comprising, a supporting base, a shaft rotatably mounted on the supporting base, a first pair of clamping members at one position along the shaft for clamping and electrically contacting the one end turn of a coil spring and including a normally stationary clamping member carried by the shaft and a clamping member carried by the shaft and movable toward and away from the normally stationary clamping member, and a second pair of clamping members fixedly mounted at another position along the shaft for clamping and electrically contacting one end turn of a coil spring and including a normally stationary clamping member carried by the shaft and a clamping member carried by the shaft and movable toward and away from the normally stationary clamping member, means for holding the movable clamping members in such a position on the shaft as to engage the normally stationary clamping members and means for holding the movable clamping members in such a position on the shaft as to engage the normally stationary clamping members.

8. A heater mechanism for heat treating coil springs comprising, a supporting base, a shaft rotatably mounted on the supporting base, a first pair of clamping members at one position along the shaft for clamping and electrically contacting the one end turn of a coil spring and including a normally stationary clamping member carried by the shaft and a clamping member carried by the shaft and movable toward and away from the normally stationary clamping member, a second pair of clamping members at another position along the shaft for clamping and electrically contacting the other end turn of the coil spring and including a normally stationary clamping member carried by the shaft and a clamping member carried by the shaft and movable toward and away from the normally stationary clamping member, a pair of cam means carried by the shaft and movable toward and away from the normally stationary clamping member, means for holding the movable clamping members in such a position on the shaft as to engage the normally stationary clamping members and means for holding the movable clamping members in such a position on the shaft as to engage the normally stationary clamping members.

9. A heater mechanism for heat treating coil springs comprising, a supporting base, a shaft rotatably mounted on the supporting base, a first pair of clamping members fixedly mounted at one position along the shaft for clamping and electrically contacting one end turn of a coil spring and including a normally stationary clamping member carried by the shaft and a clamping member carried by the shaft and movable toward and away from the normally stationary clamping member, and a second pair of clamping members fixedly mounted at another position along the shaft for clamping and electrically contacting the other end turn of the coil spring and including a normally stationary clamping member carried by the shaft and a clamping member carried by the shaft and movable toward and away from the normally stationary clamping member, means for holding the movable clamping members in such a position on the shaft as to engage the normally stationary clamping members and means for holding the movable clamping members in such a position on the shaft as to engage the normally stationary clamping members.

10. A heater mechanism for heat treating coil springs comprising, a supporting base, a shaft rotatably mounted on the supporting base, a first pair of clamping members fixedly mounted at one position along the shaft for clamping and electrically contacting the one end turn of a coil spring and including a normally stationary clamping member carried by the shaft and a clamping member carried by the shaft and movable toward and away from the normally stationary clamping member, and a second pair of clamping members fixedly mounted at another position along the shaft for clamping and electrically contacting the other end turn of the coil spring and including a normally stationary clamping member carried by the shaft and a clamping member carried by the shaft and movable toward and away from the normally stationary clamping member, means for holding the movable clamping members in such a position on the shaft as to engage the normally stationary clamping members and means for holding the movable clamping members in such a position on the shaft as to engage the normally stationary clamping members.

11. A heater mechanism for heat treating coil springs comprising, a supporting base, a shaft rotatably mounted on the supporting base, a first pair of clamping members fixedly mounted at one position along the shaft for clamping and electrically contacting one end turn of a coil spring and including a normally stationary clamping member carried by the shaft and a clamping member carried by the shaft and movable toward and away from the normally stationary clamping member, and a second pair of clamping members fixedly mounted at another position along the shaft for clamping and electrically contacting the other end turn of the coil spring and including a normally stationary clamping member carried by the shaft and a clamping member carried by the shaft and movable toward and away from the normally stationary clamping member, means for holding the movable clamping members in such a position on the shaft as to engage the normally stationary clamping members and means for holding the movable clamping members in such a position on the shaft as to engage the normally stationary clamping members.
tactizing the other end turn of the coil spring and including a normally stationary clamping member carried by the shaft and a clamping member carried by the shaft and movable toward and away from the normally stationary clamping member, means for adjustable positioning the shaft with respect to the normally stationary base and for adjustable positioning the clamping members of the two pairs of clamping members along the shaft and for holding the same against rotation with the shaft, and a pair of cams carried by the shaft and rotatable therewith and adjustable therealong and engaging the normally stationary clamping members of the two pairs of clamping members for moving the same with respect to the normally stationary clamping members.

12. A heater mechanism for heat treating coil springs comprising, a support base, a shaft rotatably mounted on the support base, a first pair of clamping members fixedly mounted at one position along the shaft for clamping and electrically contacting one end turn of a coil spring and including a normally stationary clamping member carried by the shaft and a clamping member carried by the shaft and movable toward and away from the normally stationary clamping member, means for holding all of the clamping members against rotation with the shaft, springs located between the normally stationary and the movable clamping members of the two pairs of clamping members for normally separating the same, a cam slidable by each sleeve and keyed thereto for rotation therewith for engaging the movable clamping members to move the same toward the normally stationary clamping members against the action of the springs, a second collar adjustably secured to each sleeve, a spring located between each said second collar and its associated cam for permitting movement of the cams away from their respective normally stationary clamping members on the event that movement of the movable clamping members toward their respective normally stationary clamping members is impeded, means for adjustably positioning the sleeves and the elements carried thereby along the shaft and for securing the normally stationary clamping members in adjusted position to the supporting base and for holding the normally stationary clamping members against rotation with the shaft and sleeves, and means for holding the movable clamping members against rotation with the shaft and sleeves.

14. A heater mechanism for heat treating coil springs comprising, a support base, a shaft rotatably mounted on the support base, a first pair of clamping members fixedly mounted at one position along the shaft for clamping and electrically contacting the other end turn of the coil spring and including a normally stationary clamping member carried by the shaft and a clamping member carried by the shaft and movable toward and away from the normally stationary clamping member, means for holding all of the clamping members against rotation with the shaft, a pair of cams carried by the shaft and rotatable therewith and engaging the movable clamping members of the two pairs of clamping members for moving the same toward the normally stationary clamping members against the action of the springs, and means including spring means for permitting movement of the normally stationary clamping members in the event that movement of the movable clamping members toward their respective normally stationary clamping members is impeded.

13. A heater mechanism for heat treating coil springs comprising, a support base, a shaft rotatably mounted on the support base, a pair of sleeves slidable on the shaft and keyed to the shaft for rotation therewith, a first pair of clamping members for clamping and electrically contacting one end turn of a coil spring and including a normally stationary clamping member rotatably and slidable by each of the sleeves and a clamping member rotatably and slidable by said sleeve and movable toward and away from the normally stationary clamping member, a second pair of clamping members rotatably and slidable by each of the sleeves and a clamping member rotatably and slidable by said sleeve and a clamping member rotatably and slidable by said sleeve and movable toward and away from the normally stationary clamping member, a collar adjustably secured to each sleeve for limiting lengthwise movement of the normally stationary clamping members carried thereby, springs located between the normally stationary and the movable clamping members of the two pairs of clamping members for normally separating the same, a cam slidable by each sleeve and keyed thereto for rotation therewith for engaging the movable clamping members to move the same toward the normally stationary clamping members against the action of the springs, a second collar adjustably secured to each sleeve, a spring located between each said second collar and its associated cam for permitting movement of the cams away from their respective normally stationary clamping members on the event that movement of the movable clamping members toward their respective normally stationary clamping members is impeded, means for adjustably positioning the sleeves and the elements carried thereby along the shaft and for securing the normally stationary clamping members in adjusted position to the supporting base and for holding the normally stationary clamping members against rotation with the shaft and sleeves, and means for holding the movable clamping members against rotation with the shaft and sleeves.
clamping member carried by the shaft and movable toward and away from the normally stationary clamping member, means for holding all of the clamping members against rotation with the shaft, a pair of cams carried by the shaft and rotatable therewith and engaging the movable clamping member, the two pairs of clamping members for moving the same with respect to the normally stationary clamping members, means including a relay, a first cam operated switch operated by the shaft for energizing the relay and a second cam operated switch operated by the shaft for deenergizing the relay to apply electrical energy to the two pairs of clamping members only when the coil spring is clamped thereby, one of said cam operated switches being adjustable to regulate the time interval during which the relay is energized and electrical energy is applied to the two pairs of clamping members.

16. A heater mechanism for heat treating coil springs comprising, a supporting base, a shaft rotatably mounted on the supporting base, a pair of sleeves slidable on the shaft and keyed to the shaft for rotation therewith, a first pair of cam-operated means for clamping and electrically contacting one end turn of a coil spring and including a normally stationary clamping member rotatably and slidably carried by one of the sleeves and a clamping member rotatably and slidably carried by said sleeve and movable toward and away from the normally stationary clamping member, a second pair of clamping members for clamping and electrically contacting the other end turn of the coil spring and including a normally stationary clamping member, a collar adjustable secured to each sleeve for limiting lengthwise movement of the normally stationary clamping members carried thereby, springs located between the normally stationary and the movable clamping members of the two pairs of clamping members for normally separating the same, a cam slidably carried by each sleeve and keyed thereto for rotation therewith for engaging the movable clamping members to move the same toward the normally stationary clamping members against the action of the springs, a second collar adjustable secured to each sleeve, a spring located between each said second collar and its associated cam for permitting movement of the cams away from their respective normally stationary clamping members in the event that movement of the movable clamping members toward their respective normally stationary clamping members is impeded, means for adjusting position of the sleeves and the elements carried thereby along the shaft and for securing the normally stationary clamping members in adjusted position to the supporting base and for holding the normally stationary clamping members against rotation with the shaft and sleeves, means for holding the movable clamping members against rotation with the shaft and sleeves, means for applying electrical energy to the two pairs of clamping members electrically to heat treat the coil spring clamped thereby, and control means for controlling said last mentioned means including switch means and cam means carried and operated by the shaft for operating the switch means to apply electrical energy to the two pairs of clamping members only when the coil spring is clamped thereby.

17. A heater mechanism for heat treating coil springs comprising, a supporting base, a shaft rotatably mounted on the supporting base, a pair of sleeves slidable on the shaft and rotatable to rotate the shaft and operate the heater means for the coil spring for the coil spring, one of said cam-operated means for clamping and electrically contacting one end turn of a coil spring and including a normally stationary clamping member rotatably and slidably carried by one of the sleeves and a clamping member rotatably and slidably carried by said sleeve and movable toward and away from the normally stationary clamping member, a second pair of clamping members for clamping and electrically contacting the other end turn of the coil spring and including a normally stationary clamping member rotatably and slidably carried by said sleeve and a clamping member rotatably and slidably carried by said sleeve and a clamping member rotatably and slidably carried by said sleeve and a clamping member rotatably and slidably carried by the other sleeve and a clamping member rotatably and slidably carried by said last mentioned sleeve and movable toward and away from the normally stationary clamping member, a collar adjustable secured to each sleeve for limiting lengthwise movement of the normally stationary clamping members carried thereby, springs located between the normally stationary and the movable clamping members of the two pairs of clamping members for normally separating the same, a cam slidably carried by each sleeve and keyed thereto for rotation therewith for engaging the movable clamping members to move the same toward the normally stationary clamping members against the action of the springs, a second collar adjustable secured to each sleeve, a spring located between each said second collar and its associated cam for permitting movement of the cams away from their respective normally stationary clamping members in the event that movement of the movable clamping members toward their respective normally stationary clamping members is impeded, means for adjusting position of the sleeves and the elements carried thereby along the shaft and for securing the normally stationary clamping members in adjusted position to the supporting base and for holding the normally stationary clamping members against rotation with the shaft and sleeves, means for holding the movable clamping members against rotation with the shaft and sleeves, means for applying electrical energy to the two pairs of clamping members only when the coil spring is clamped thereby, one of said cam-operated means for controlling said last mentioned means including switch means and cam means carried and operated by the shaft for operating the switch means to apply electrical energy to the two pairs of clamping members only when the coil spring is clamped thereby.

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