Nov. 17, 1936. J. GOGAN 2,061,070

QUENCHING MACHINE

Filed May 16, 1935 3 Sheets-Sheet 1

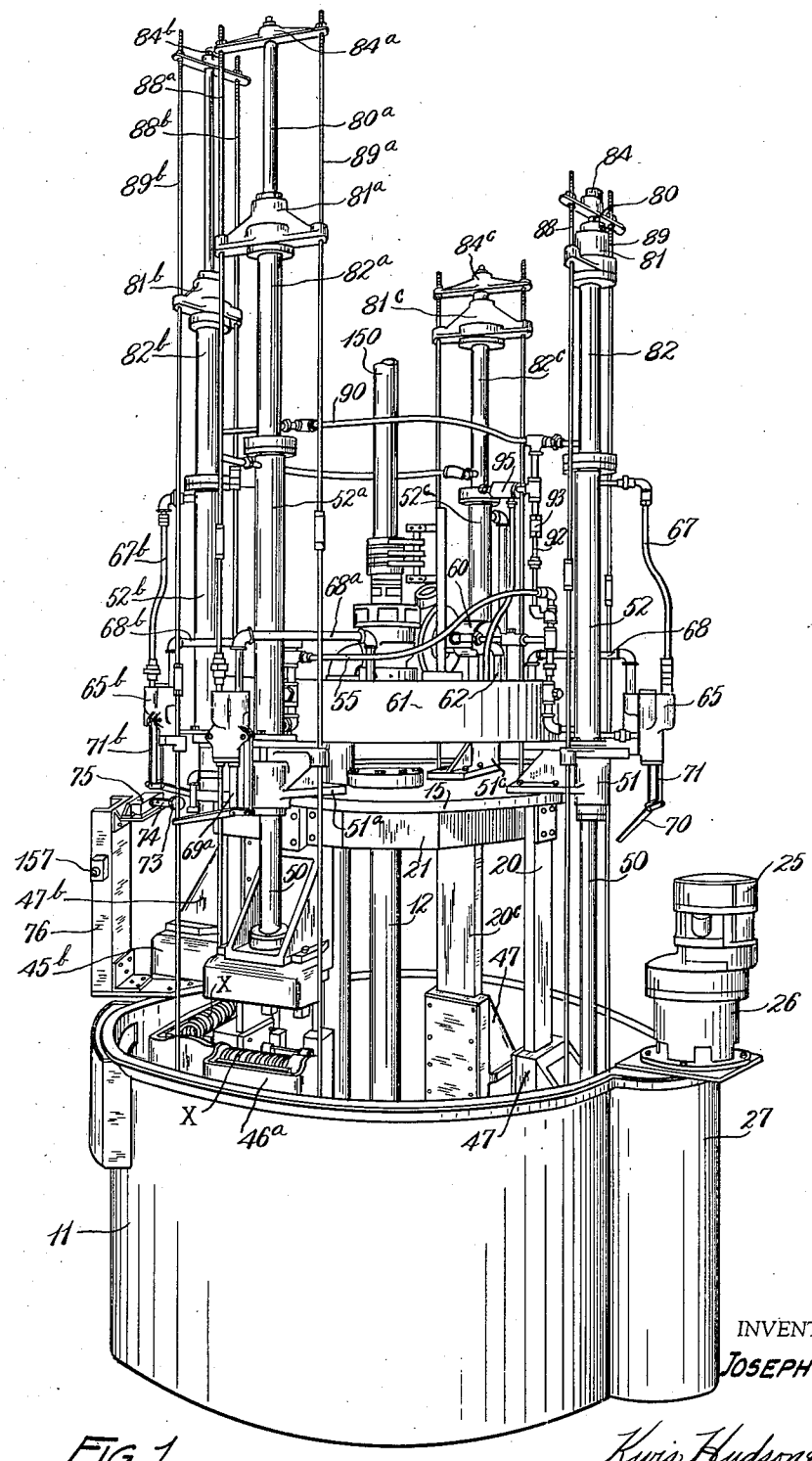



FIG. 1

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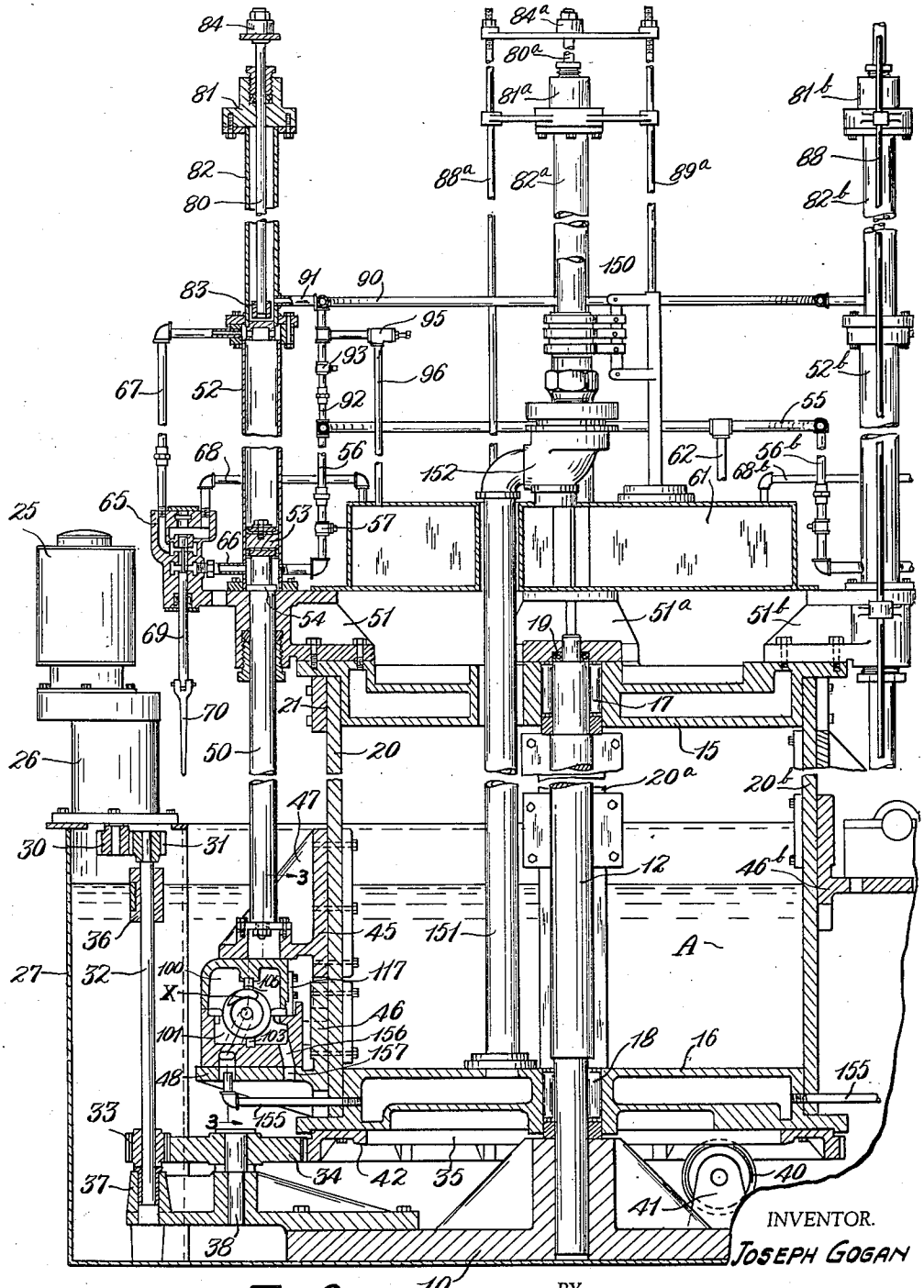



FIG. 2

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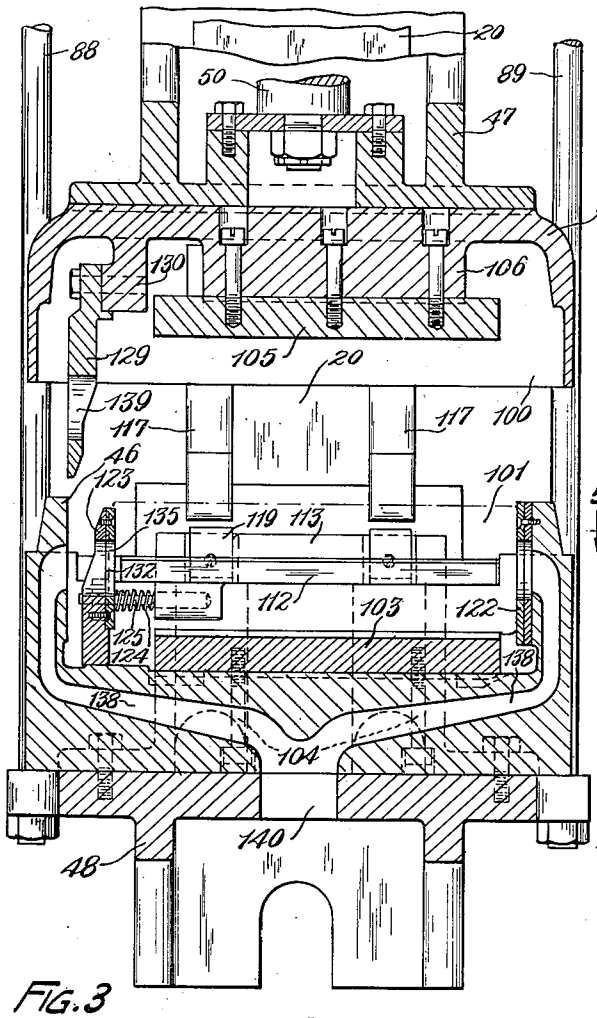



FIG. 3

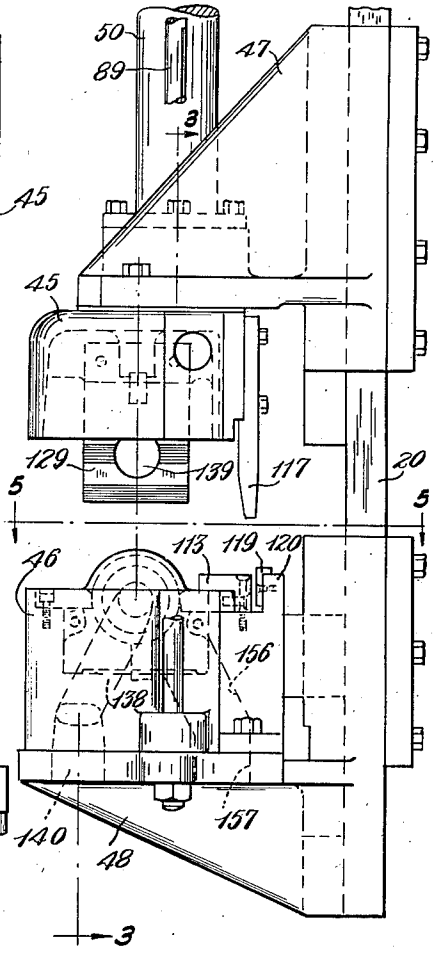



FIG. 4

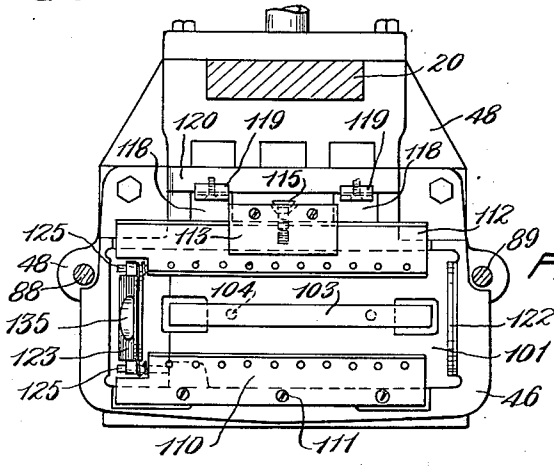



FIG. 5

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2,061,070

# UNITED STATES PATENT OFFICE

2,061,070

## QUENCHING MACHINE

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Application May 16, 1935, Serial No. 21,749

8 Claims. (Cl. 266—6)

The present invention relates to quenching machines and more particularly to machines for and methods of quenching helical springs.

Heretofore in the art articles such as helical springs have ordinarily been quenched by merely submerging the same in a quenching medium, usually a manual operation. This method of quenching is not only inefficient and expensive but unsuited to modern production requirements. Furthermore, the aforesaid method of heat-treating produces articles of non-uniform size and quality due to distortion, etc., during the quenching operation. This is particularly true of springs.

An object of the present invention is the provision of a novel method of heat treating articles, particularly helical springs, which comprises sizing and quenching the article simultaneously.

Another object of the invention is the provision of a novel quenching machine particularly adapted for quantity production purposes which will be simple and inexpensive in construction and efficient and reliable in operation.

Another object of the invention is the provision of a novel quenching machine for quenching articles, particularly helical springs, which comprises a plurality of work supporting members movably supported upon a rotatable turret and reciprocable into and out of the quenching medium.

Another object of the invention is the provision of a novel machine for sizing and heat-treating articles, particularly helical springs, which comprises sizing dies provided with means for quenching an article while held within said dies.

Another object of the invention is the provision of a novel machine for sizing and quenching hollow articles, particularly helical springs, which comprises a plurality of sizing dies slidably supported on a rotatable turret and reciprocable into and out of a quenching medium, together with means for applying quenching medium to the interior of the article.

The invention, so far as the machine is concerned, resides in certain novel details of construction, and arrangements and combinations of parts, and further objects and advantages thereof will be apparent from the following description of the preferred embodiment described with reference to the accompanying drawings, in which

Fig. 1 is a perspective view of a combination sizing and quenching machine for treating helical springs embodying the present invention;

Fig. 2 is a vertical section through the center of the machine shown in Fig. 1;

Fig. 3 is a section approximately on the lines 3—3 of Figs. 2 and 4 with the dies partly closed;

Fig. 4 is an enlarged end elevation of the sizing dies shown in Fig. 3; and

Fig. 5 is a section approximately on the line 5—5 of Fig. 4.

The present invention is particularly applicable to the production of helical springs, and the preferred embodiment thereof herein illustrated and described is a combination sizing and quenching machine designed for sizing and quenching helical springs such as used in individual wheel suspensions of automobiles. Referring to the drawings, in which similar reference characters designate corresponding parts throughout the several views thereof, a machine provided with four sizing and quenching units is illustrated, although, as will be hereinafter apparent, any number of units may be employed.

Generally speaking, the machine comprises a stationary part or base which, in addition to forming a support for a rotatable turret, etc., forms a tank or receptacle for the quenching medium. The turret carries a plurality of hydraulically operated sizing and quenching units, in the present instance four spaced 90° apart. Each unit is adapted to size and quench a helical spring, designated by the reference character X, upon each rotation of the turret. In operation, the turret is intermittently rotated, and the sizing and quenching units are loaded and unloaded in sequence as they pass a position referred to as the loading position or station. After the units are loaded, the dies are closed to size the spring, quenching oil is applied to the interior thereof and the entire die assembly is submerged in the quenching oil carried in the base of the machine. As the units approach the loading position, the die assembly is raised and the dies open to permit removal of the treated spring and the insertion of another.

The stationary element or base comprises a member 10 positioned in the center of a circular tank 11 preferably made of welded sheet metal. The member 10 rests on the bottom of the tank 11, is secured thereto so as to prevent any relative movement therebetween, and supports a central vertical shaft 12 about which the turret is rotatably supported. The turret comprises upper and lower hollow disk members 15 and 16, respectively, rotatably supported about the shaft 12 by means of suitable roller bearings 17 and 18 and an anti-friction thrust bearing which carries the

weight of the turret. The disk members 15 and 16 are connected together by a plurality of metal strips or plates 20 bolted or otherwise secured to flat faces 21 formed thereon.

The turret is adapted to be rotated by an electric motor 25 supported on the upper end of a speed reducer 26 bolted or otherwise secured to an offset portion 27 of the tank 11. The speed reducer 26 is connected to the turret through the medium of gears 30 and 31 fixed to the lower speed shaft of the reducer 26 and the upper end of a shaft 32, respectively, a gear 33 fixed to the shaft 32 near the lower end thereof, an idler gear 34, and a gear 35. The shaft 32 is rotatably supported in the offset portion 27 of the tank 11 by a bracket 36 secured to the tank and bracket 37 bolted to the member 10. The idler gear 34 is rotatably supported by a short shaft 38 fixed to the bracket 37, and the gear 35 is bolted to the lower disk member 16 of the turret. Most of the weight of the turret is preferably carried by the thrust bearing 19 but some or all of the weight can be carried by a plurality of rollers 40 rotatably supported in brackets 41 attached to the member 10. The rollers 40 are tapered and engage an inclined or frusto-conical surface 42 on the gear 35.

Each of the sizing and quenching units comprises upper and lower dies of generally rectangular shape, bolted or otherwise secured to angular bracket members slidably secured to the plates 20 and moved vertically to close and submerge the same in the quenching fluid by hydraulic motors supported thereabove. The four sizing and quenching units illustrated are identical in construction and operation and only one thereof will be described in detail, the corresponding parts of the other units being designated by the same reference characters with the letters *a*, *b*, and *c* affixed thereto, designating the second, third, and fourth units, respectively.

The upper die 45 is secured to the bracket member 47 which in turn is attached to the lower end of a piston rod 50 slidably supported in a bracket 51 bolted to the member 15, and a cylinder 52 secured to the top of the bracket. The upper end of the piston rod 50 is provided with a piston 53 located within the cylinder 52, and a collar or flange 54, formed integral therewith but spaced from the piston head, adapted to engage the upper face of the bracket 51 and thereby limit the movement of the piston in a downward direction. The lower end of the cylinder 52 is connected to a header 55 by a pipe 56 provided with a check valve 57 intermediate the ends thereof. The header 55 is constantly supplied with oil under pressure by a pump 60 of conventional construction from a sump or tank 61 supported on the brackets 51, and the piston 53 is continuously urged in an upward direction, that is, in a direction to open the dies. The pump 60 is connected to the header 55 by the pipe 62.

The piston rod 50 is of such a diameter that the effective area of the upper side of the piston head 53 is much greater than the lower side thereof, and the piston is moved in a downward direction to close the dies and submerge the same in the quenching fluid by the admission of fluid under pressure to the upper end of the cylinder 52. The ingress and egress of fluid under pressure to the upper end of the cylinder 52 is under the control of a valve 65 supported by the bracket 51. The valve 65 is connected to the source of fluid pressure by a pipe 66 connected to the lower end of the cylinder 52 which, as previously stated, is constantly under pressure. A pipe 67 connects the valve to the upper end of the cylinder 52 and the exhaust from the cylinder is returned to the sump 61 by a pipe 68. The valve 65 illustrated is of the piston type, and the piston 69 thereof is attached to a lever 70 pivoted to a link 71 connected to the valve casing. The valve 65 is adapted to be manually operated but can be automatically operated if desired. In the embodiment of the invention illustrated, provision is made for automatically moving the valve to connect the upper end of the cylinder 52 to exhaust, at a predetermined point in the rotation of the turret. This means comprises a roller 73 carried on the free end of a spring pressed lever or arm 74 pivotally supported in a switch box 75, adapted to engage the under side of the lever 70. The switch box 75 is supported by a bracket 76 fixed to the tank 11 and encloses a normally closed limit switch in the control circuit of the motor 25. The switch in the box 75 is adapted to be actuated by movement of the arm 74 in a downward direction, and simultaneous with the actuation of the valve 65 by the roller 73, the switch is actuated to open the control circuit to the motor and the rotation of the turret stopped.

The lower die 46 is continuously urged in an upward direction by a fluid pressure actuated motor comprising a piston rod 80 slidably supported in a bracket 81 secured to the upper end of a cylinder 82 supported on the upper end of the cylinder 52. The lower end of the piston rod 80 has secured thereto a collar 83 which acts as a stop when the piston is moved in an upward direction and the upper end thereof which projects through the bracket 81 carries a member 84 fixed thereto. The piston rod 80 is operatively connected to the lower die 46 by a plurality of rods 88 and 89 attached to the bracket 48 which carries the die 46 and to the member 84. The rods 88 and 89 are adjustably connected to the member 84 so that the length thereof can be adjusted, and, in the present instance, are also provided with turnbuckles intermediate their ends. The lower end of the cylinder 82 is continuously connected to a source of fluid pressure from a header 90 through a pipe 91 connected to the lower end of the cylinder and the header. The header 90 is connected to the supply pump by a pipe 92 provided with a check valve 93 intermediate the ends thereof. An adjustable pressure relief valve 95 connected to the pipe 92 above the check valve 93 is provided with a return pipe 96 leading to the sump. The effective area of the piston 80 is small and is readily overcome by the piston 53 upon the downward stroke of the latter. The fluid exhausted from the cylinder 82 by the downward stroke of the piston 80 is returned to the sump through the relief valve 95.

The dies 45 and 46 have recesses 100 and 101, of general rectangular shape, formed in the adjacent sides thereof for the reception of the spring to be sized and quenched. In order to accommodate springs of different sizes and to provide for wear, adjustment, etc., the recesses are made larger than required and provided with detachable and/or movable members or inserts which engage the spring. A member 103 detachably secured in the bottom of the recess 101 by screws 104 forms a support for the spring when it is placed in the die and in cooperation with a similar member 105 detachably secured to a projection 106 in the bottom of the recess 100 sizes the spring in a vertical plane, when the dies are closed.

The spring is sized in a horizontal plane by a replaceable member 110 secured to the front wall of the die 46 by screws 111 and a similar member 112 slidably supported on the upper face of the rear wall of the die by an angular member 113, the projecting forward end of which overlies the member 112. A screw 115 threaded onto the member 112 and free to move in an aperture in the member 113 permits movement of the member 112 but maintains the same in assembled relationship with the member 113, etc. As the dies are closed the member 112 is moved towards the member 110 to clamp and size the spring positioned therebetween, by a plurality of wedges 117 bolted to the rear wall of the upper die 45, the lower ends of which are tapered and engage behind the member. The wedges 117 project in suitable apertures 118 in the lower die when the dies are closed, and the rear sides thereof engage replaceable rear blocks 119 secured to a projection 120 on the lower die.

Springs of different lengths can be sized by attaching the required number or size of replaceable washer shaped members 122 to the right hand wall of the recess 101 as viewed in Figs. 3 and 5. The spring is sized lengthwise between the right hand wall of the recess 101 and a movable member 123 slidably supported in the left hand end of the recess. The member 123 is continuously urged towards the left as viewed in Figs. 3 and 5 by springs 124 supported on pins 125 fixed in the lower dies 46, and projecting through suitable apertures in projections formed on the member 123 which assist in grading the same. The member 123 is moved towards the right as viewed in Figs. 3 and 5, by a tapered wedge member 129 bolted to a projection 130 in the bottom of the recess 100. The face of the member 123 adjacent the spring is provided with one or more replaceable washer-shaped members 132 similar to the members 122. The member 123 is provided with an aperture 135 which registers with a cored out duct 138 formed in the die member 46, and the member 129 is provided with an aperture 139 which registers with the aperture 135 when the dies are closed. The duct 138 is provided for the ingress of quenching oil, etc., to the interior of the dies and communicates with both ends of the recess 101 in the lower die and with an aperture 140 in the bracket 48.

Quenching fluid is supplied to the tank from a storage and cooling reservoir not shown, through a central pipe 150 secured to the building structure or supported in any convenient manner, and connected to a pipe 151 carried by the turret by a rotary or universal coupling 152. The lower end of the pipe 151 communicates with the interior of the member 16, which is open to the interior of the quenching tank through a plurality of pipes 155 supported therein, the upturned ends of which are in alignment with the apertures 140 in the brackets 48.

While the machine is in operation oil or quenching medium is continuously forced through the pipes 155 and as the dies are submerged, oil is forced into the interior thereof, quenching the springs from the inside. Aligned apertures 156 and 157 in the lower die 46 and the bracket 48 communicate with the interior of the dies externally of the spring positioned therein, and in addition to permitting a certain amount of quenching medium to enter the dies as the same are submerged, provide for draining the recess 101 in the lower die 46 when the same is in its raised or up position. An overflow pipe (not shown) connected to the tank 11, returns the quenching medium to the storage and cooling reservoir and maintains the level thereof constant.

It is believed that the operation of the machine will be apparent from the foregoing description, suffice it to say that as the dies successively enter the front position as viewed in Fig. 1, which in the present instance is the loading station, the quenched and sized spring therein is removed and a new blank inserted. After the loading operation has been performed, the dies are closed and submerged in the quenching medium by manual actuation of the valve lever 70 and a push button switch 157 attached to the side of the bracket 76, in shunt circuit with the limit switch in the box 75, temporarily closed. The turret is thereupon rotated 90° or until the valve lever 70 of the next following unit engages the roller 73 and actuates both the limit switch and the valve. In addition to being simultaneously sized and quenched, the spring is quenched from the inside rather than from the outside as is customary in the art. Quenching in this manner produces superior physical characteristics in the material located at the smallest diameter of the coil where the greatest strain occurs in operation.

While the preferred embodiment of the invention has been illustrated and described, it is to be understood that I do not intend to be limited to the construction shown which may be varied within the scope of this invention. The present application is intended to cover all adaptations, modifications, and variations of the construction illustrated as come within the practice of those skilled in the art to which it pertains, and I particularly point out and claim as my invention the following:

Having thus described my invention I claim:

1. In a quenching machine of the character referred to the combination of a stationary base having a reservoir therein for the reception of the quenching medium, a turret rotatably supported by said base, means for rotating said turret, cooperating upper and lower sizing dies slidably supported by said turret, yieldable means for continuously urging the lower die into its raised position above the quenching medium, and means for moving said upper die into and out of the quenching medium.

2. In a quenching machine of the character referred to the combination of a stationary base having a reservoir therein for the reception of the quenching medium, a turret rotatably supported by said base, means for rotating said turret, a plurality of pairs of cooperating upper and lower sizing dies slidably supported by said turret, fluid pressure actuated means for continuously urging the lower die of each pair into its uppermost position above the quenching medium, and fluid pressure actuated means for lowering and raising said upper dies and in turn the lower dies into and out of the quenching medium.

3. In a quenching machine of the character referred to the combination of a stationary base having a reservoir therein for the reception of the quenching medium, a turret rotatably supported by said base, means for rotating said turret, cooperating sizing dies adapted to size a helical spring supported by said turret, and means for conducting quenching medium into the interior of a helical spring positioned in said dies.

4. In a quenching machine of the character

referred to the combination of a stationary base having a reservoir therein for the reception of a quenching medium, a turret rotatably supported by said base, means for rotating said turret, cooperating sizing dies adapted to size a helical spring slidably supported by said turret, means for moving said dies into and out of the quenching medium, and means for conducting quenching medium into the interior of a helical spring positioned in said dies.

5. In a quenching machine of the character referred to the combination of a stationary base having a reservoir therein for the reception of the quenching medium, a turret rotatably supported by said base, means for rotating said turret, and a plurality of sizing and quenching units carried by said turret, each of said units comprising cooperating upper and lower sizing dies adapted to size a helical spring, means for moving said dies into and out of the quenching medium, and means for conducting a part of the quenching medium into the interior of the helical spring being sized and quenched.

6. In a quenching machine of the character referred to the combination of a stationary base having a reservoir therein for the reception of the quenching medium, a turret rotatably supported by said base, means for rotating said turret, a plurality of sizing and quenching units carried by said turret, each of said units comprising cooperating upper and lower sizing dies adapted to size a helical spring, fluid pressure actuated means for first closing said dies and then moving the same into the quenching medium, and means for introducing a part of the quenching medium into the interior of the spring simultaneous with the submersion of the dies therein.

7. In a quenching machine of the character referred to the combination of a stationary base having a reservoir therein for the reception of the quenching medium, a turret rotatably supported by said base, means for rotating said turret, cooperating sizing dies slidably supported by said turret and adapted to size a hollow member, means for closing said dies and then moving the same into the quenching medium, means for conducting a part of the quenching medium into the interior of the member being sized and quenched simultaneous with its submersion therein, and automatic means for moving said dies out of the quenching medium controlled by the rotation of said turret.

8. In a quenching machine of the character referred to the combination of a stationary base having a reservoir therein for the reception of a quenching medium, a turret rotatably supported by said base, means for rotating said turret, a plurality of pairs of cooperating sizing dies slidably supported by said turret and adapted to size and quench a hollow article, fluid pressure actuated means for raising and lowering said dies whereby said dies are opened and closed and moved into and out of the quenching medium, and means for introducing a part of the quenching medium into the interior of the article being sized and quenched simultaneous with its submersion therein.

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