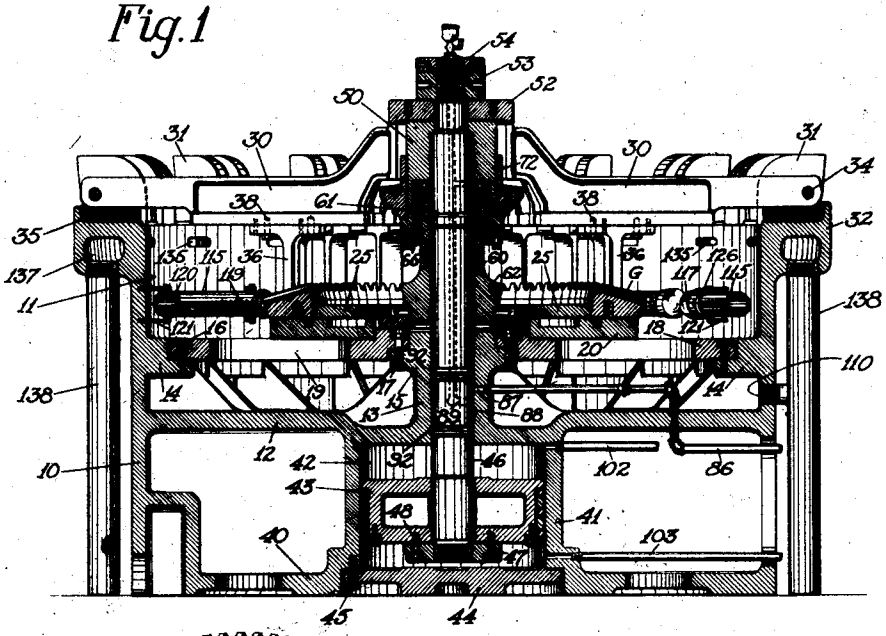
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QUENCHING PRESS

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Fig. 1



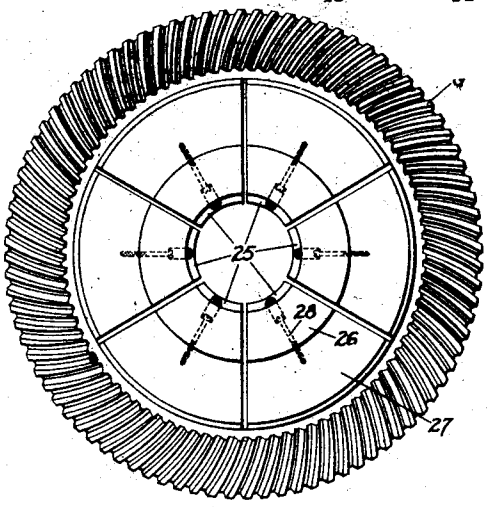


Fig. 4

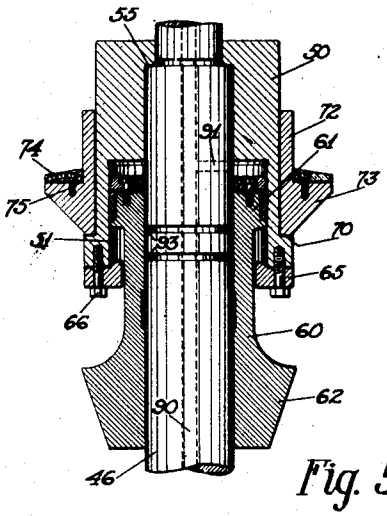


Fig. 5

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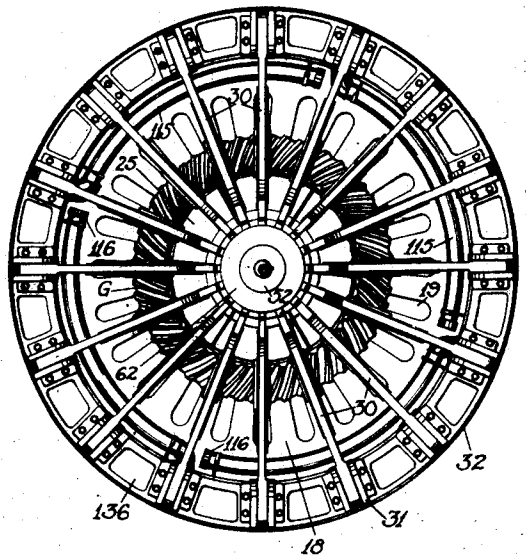


Fig. 2

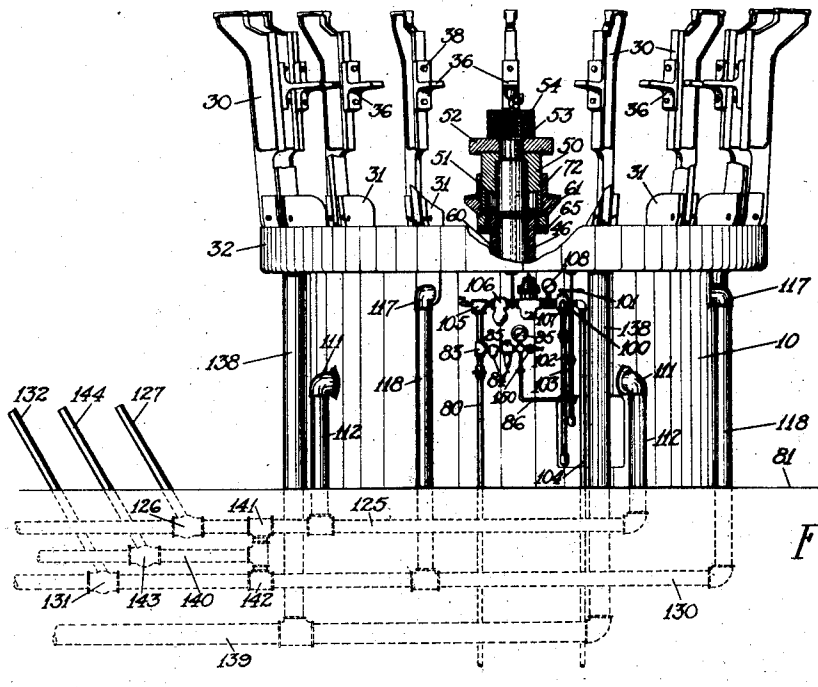


Fig. 3

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QUENCHING PRESS

Application filed January 30, 1929. Serial No. 336,273.

The present invention relates to quenching presses and particularly to presses for quenching gears or similar articles for hardening the same after heat treatment.

One of the objects of this invention is to provide a quenching press with which a gear or similar article can be held in such way as to prevent distortion during the quenching operation, to provide a press on which gears of large sizes can be quickly and expeditiously handled and one which will be simple and efficient in operation.

Other objects of this invention will be apparent hereinafter from the specification and from the recital of the appended claims.

A preferred embodiment of the invention is illustrated in the accompanying drawings in which:

Figure 1 is a vertical sectional view of a quenching press built according to this invention, showing the parts in the position they assume in the quenching operation;

Figure 2 is a plan view of this press;

Figure 3 is a side elevation of the press with parts broken away and parts shown in section, showing the control mechanism and showing the parts in inoperative position;

Figure 4 is a plan view of the expansible gripping member in gripping engagement with a gear; and

Figure 5 is a view on an enlarged scale showing in section details of the fluid pressure control mechanism for operating the expander.

Referring to the drawings by numerals of reference, the press shown is provided with a base 10 which is constructed in such manner as to provide a reservoir 11, the bottom wall of which is indicated at 12. The base 10 is of general cylindrical shape. Formed integral with the bottom wall 12 of the reservoir and extending upwardly into the reservoir is a sleeve or guide member 13. This member 13 is provided with a central bore for a purpose which will hereinafter appear.

The side wall of the base or frame 10 is provided internally above the bottom wall 12 of the reservoir with an internal ring or flange 14. The sleeve member 13 is also provided with a flange, designated at 15, extending externally of said sleeve or guide. The two flanges 14 and 15 serve as a support or rest upon which there is secured by means of the screws 16 and 17, a ring member or plate 18 which is provided with spaced holes or apertures 19 for a purpose which will hereinafter appear. The base or frame is provided at intervals around the flange 14 with reinforcing ribs as is clearly shown in the drawings, (Fig. 1).

The ring or plate 18 serves as a support for a lower die member 20 on which the gear G or other article to be quenched is placed for the quenching operation.

Resting partly on the plate 18 and partly on the lower die 20 is a plurality of segmental gripping members 25 which together form an expansible gripping device adapted to engage the bore of the gear G to center and round up the same and hold the gear against distortion during quenching. Each of the segmental gripping pieces 25 is made in two parts as indicated at 26 and 27, the two parts being connected together by a screw 28.

The lower die 20 has its upper face shaped to conform to the lower face of the gear G to be quenched and the gear rests flatly on the die member, and during quenching the gear is held under pressure on the seat formed by the lower die member 20 to prevent any possible warpage of the gear.

For holding the gear on the lower die, as just described, an upper die is provided comprising, in this instance, a plurality of arms 30 which extend radially of the center of the reservoir. These arms 30 are pivoted at their outer ends between ears 31 formed integral with an annular boss or curb 32 which is formed on the upper end of the base or frame 10.

The quenching press shown is especially adapted for the quenching of large gears and to keep the area of the press within as small a compass as possible, the arms 30 are mounted between the ears 31 so as to permit their being swung upward about the pivot 34 to the position shown in Figure 3 to permit of the gear G to be quenched being lowered

onto the lower die 20 between the upwardly raised arms. Hardened blocks 35 are provided around the curb 32 to limit the downward movement of the arms 30.

Each of the arms 30 carries at a point intermediate its length a member 36 which will hereinafter be termed a foot. The feet 36 have beveled bottom faces in the instance shown, the bevel conforming to the taper of the upper face of the bevel gear G to be quenched. These feet are detachably secured to their respective arms 30 and they can be removed and others substituted therefor when a gear of a different cone angle from that shown is to be quenched. They are secured upon the arms 30 by the screws 38.

In the operation of the quenching press, the gripping members 25 are moved radially outwardly to engage the interior of the bore of the gear and the arms 30 are forced down into engagement with the upper face of the gear to hold the gear on the die 20 so that as the oil or other coolant flows around the gear, the gear will be held securely against distortion or warpage. The means for expanding the gripping device and the means for forcing the arms 30 into engagement with the gear G will now be described.

The bottom 12 of the reservoir 11 is spaced above the bottom wall 40 of the base or frame 10 and the two walls 12 and 40 are connected by a cylindrical wall 41 which forms a cylinder or chamber 42 in which the piston 43 reciprocates. The lower end of this chamber is closed by the plate 44 which is detachably secured in position by the screws 45.

A piston rod 46 is detachably secured to the piston 43 by a nut 47 and the screws 48. This piston rod 46 extends through the upper wall of the cylinder 42, through the bore of the sleeve or guide 13 in which it slides and upwardly above the base or frame 10.

Near its upper end, the piston rod 46 carries a sleeve 50 which is hollowed out at its lower end to form a chamber or cylinder 51. The sleeve 50 is secured against movement on the piston 46 by the plate 52 and the nuts 53 and 54 which serve to force the sleeve against a shoulder 55 formed on the piston rod 46 by reducing its diameter adjacent its upper end.

The piston rod 46 serves as a guide for a member 60 which is bored to surround and slide on the rod 46. This member 60 is formed at its upper end with a piston 61 which reciprocates in the cylinder or chamber 51 provided in the sleeve 50. At its lower end, the member 60 is belled out and formed to provide a conical portion 62 which serves as an expander to operate the expansible device, constituted by the gripping members 25, on downward movement of the piston 61. The lower end of the chamber 51 is closed by a ring or plate 65 which is secured to the sleeve 50 by screws 66. The sleeve 50 is formed externally with a shoulder as indicated at 70 (Fig. 5). This shoulder forms a rest or support for an annular member or sleeve 72 which surrounds the sleeve 50. The sleeve 72 is provided with a flange or seat 73 which is adapted to receive the hardened ring 74 which is secured in position on the flange 73 by screws 75.

The plate 52 and ring 74 extend far enough outwardly of the center line of the piston rod 46 to engage the inner ends of the arms 30, when these arms are lowered to the position shown in Figure 1, as the piston rod moves downwardly and upwardly, respectively. The plate 52 and ring 74 are spaced apart vertically a distance greater than the height of the arm 30 at their inner ends so as to permit of a slight movement of the piston rod 46 in either direction before the plate 52 or ring 74, as the case may be, engages the arms 30 to move the same.

Both the expander 60 and the piston 43 are actuated by fluid pressure, preferably by compressed air.

80 (Fig. 3) designates the air supply line. 81 designates the floor line in Figure 3 and the air may be pumped into the supply line 80 from a suitably located compressor. The upper end of the piston 61 is connected at all times with the air supply line 80 so that a head of air is continuously urging the piston 61 and expander 62 downwardly into operative position. This connection is maintained through the T 83, the strainer 84, the valve 85, the piping 86 (Figs. 3 and 1), the port 87 in the side wall of the sleeve 13 (Fig. 1), the longitudinal slot 88 formed in the piston rod 46 and the ducts 89, 90, and 91 drilled in this piston rod 46. The duct 91 communicates with the cylinder or chamber 51 above the upper end of the piston 61. The slot 88 is formed for a portion only of the length of the piston rod 46 and to prevent leakage of the air from the slot along the rod, piston rings 92 or any other suitable packing may be provided on the piston rod 46 above and below the slot. To prevent leakage of the air between the piston 61 and the piston rod 46, other piston rings 93 may be placed on the piston rod 46 below the duct 91. Through the means just described, it will be seen that the chamber 51 is constantly connected with the air supply 80 in such manner that the air tends to force the piston 61 at all times downwardly in the chamber 51. The amount of air pressure in the line 86 can be adjusted by the valve 85 to meet conditions and may be read against the gage 95 (Fig. 3).

100 designates a four-way valve which is controlled manually by the handle 101 (Fig. 3). The valve 100 is connected with opposite ends of the piston 43 by pipes 102 and 103 (Fig. 1). This valve 100 is, also, connected with a permanent exhaust line 104 (Fig. 3). It is connected with the supply line 80 by the

elbow 105, the strainer 106 and the valve 107. Through the valve 107, the amount of pressure flowing through the pipe 102 or 103 can be adjusted and this pressure can be read by the gage 108. It will be clear that when the handle 101 is moved in one direction, the pipe 102 will be put on supply and the pipe 103 on exhaust to force the piston 43 downwardly in the chamber 42 and that when the handle 101 is moved in the opposite direction, the pipe 102 will be put on exhaust and the pipe 103 on supply to force the piston 43 upwardly in the chamber 42.

For quenching the gear, oil or any other suitable coolant is employed. This is forced into the reservoir 11 to flood the same and cool quickly the previously heated gear, thereby to harden the operating surfaces of the teeth and any other parts of the gear which may require hardening. To obtain the high rate of circulation of oil required for the quenching, ducts are provided above and below the plate or ring 18 (Fig. 1) to supply a maximum volume of oil quickly around the gear. The ducts below the ring 18 may take the form simply of holes or apertures 110 which are provided in the side wall of the base or frame 10 and which are connected by elbows 111 (Fig. 3) with the oil supply pipe 112. The ducts above the plate 18 are preferably in the form of arcuate pipes 115. In the press shown, four of these pipes 115 are provided extending around the inside wall of the reservoir. One end 116 of each pipe is closed and the opposite end is connected by an elbow 117 (Fig. 3) with a supply pipe 118.

Each of the pipes 115 is provided with a plurality of openings or apertures 119 through which the oil flows into the reservoir. The pipes 115 are secured in position in the reservoir by the clamps 120 and the screws 121 (Fig. 1).

The slots 19 in the plate 18 (Figures 1 and 2) are to permit the oil to flow upwardly from the ducts 110 to and around the gear. If desired, the lower die 20 may also be slotted to permit the oil to flow from below inside the gear.

The pipes 112 are connected with a supply pipe 125 which in turn is connected to a suitable oil reservoir or tank. The supply of oil to this pipe 125 is controlled by a valve 126 which is inserted in the line and which can be manipulated by the lever 127. The pipes 118 are connected with a supply pipe 130 which may be connected to the same reservoir or tank as the pipe 125. The supply of oil to the pipe 130 is controlled by a valve 131 inserted in the line which valve may be manipulated by the lever 132.

In practice, it is ordinarily desirable to flood the gear during the initial stages of quenching with a fast moving body of oil and to this end, both the valves 126 and 131 may be opened simultaneously to permit the maximum flow of oil. After the initial drastic chill has been applied, the volume may be diminished by shutting off the valves 126 and 131 to a certain extent or closing one of these valves entirely.

The overflow from the reservoir is carried off through the series of openings 135 and 136 provided, respectively, in the inside and upper walls of the trough or curb 32. These openings communicate with conduit 137 cast in this trough and the conduit in turn communicates with the pipes 138 which, in turn, are connected with the pipe 139 that leads back to the reservoir or tank.

For draining the reservoir at any time, a drain pipe 140 (Fig. 3) is provided. This is connected with the supply pipes 125 and 130 by T's 141 and 142. A valve 143 controls this drain pipe. This valve 143 can be manipulated by the lever 144.

In operation, with the parts as shown in Figure 3, that is, with the arms 30 in raised position and with the piston rod 46, piston 50 and associated parts in the position shown in that figure, the hot gear to be quenched can be lowered onto the lower die 20. The feet 36 of the arms 30 will have been previously selected to provide seats having a taper on their lower faces equal to the taper of the outer conical surface of the gear to be quenched and the valves 85 and 106 (Fig. 3) controlling the air pressure to the pistons 61 and 43 (Fig. 1) will have been previously set to provide a pressure suitable for the conditions met in quenching this gear. The lower die 20 will also have been selected to suit the gear to be quenched and the segmental gripping pieces 25, (Fig. 4) will, also, have been previously built up to suit the internal diameter of the gear to be quenched. Gears of different diameters can be accommodated because the gripping pieces 25 are made in two parts 26 and 27 and parts 27 of different sizes can be attached to the parts 26 by the screws 28 to accommodate the different diameters of gears.

With the hot gear to be quenched resting on the lower die 20, the arms 30 are lowered. Their inner ends will rest on the hardened ring 74 of the sleeve 72 which is at this time in the upper position shown in Figure 3. The operator now turns the valve control handle 101 (Fig. 3) to admit air to the cylinder 42 above the piston 43 through the pipe 102 and exhaust it from this cylinder below the piston 43 through the pipe 103. This causes a downward movement of the piston 43 and piston rod 46.

As already described, the air pressure admitted to the upper end of the piston 61 through the air line 86 and the ducts 89, 90, and 91 tends constantly to move this piston downwardly. In the extreme upper position of the piston rod 46 shown in Figure 3, the piston 61 is held at the lower limit of its

movement in the cylinder 51 by the head of air in the cylinder and further downward movement of the piston 61 is prevented by the ring 65 which is secured to the sleeve 50.

As the piston rod 46 moves downwardly, the arms 30 move downward about their pivots 34 following the rest 74 and the piston 61 moves downward following the ring 65 under impulse of the head of air in the chamber 51. The tapered end 62 of the expander now comes into engagement with the correspondingly tapered portions of the segments 25 forcing these segments outwardly to engage the bore of the gear and center it on the die 20. The movement of the expander 60 is gradually slowed up and finally stopped when the gripping pieces 25 hold the gear G rigidly all the way around the interior of its bore. The piston 61 is thus held against further downward movement, but the sleeve 50 containing the chamber 51 continues to move downward with the piston rod 46. The head of pressure in the chamber 51 forces the gripping pieces 25 into such intimate engagement with the gear G that it is held so that it cannot distort in the quenching operation. To prevent building up too great a pressure in the further downward movement of the piston rod 46, a relief valve 150 (Fig. 3) is provided in the line 86.

In the further movement of the piston rod 46 downwardly, the arms 30 leave the rest 74 and are engaged at their upper ends by the plate or ring 52. Through this plate or ring 52, pressure is brought to bear upon these arms 30 to flatten the gear on the lower die and to hold it in such manner that warpage of the gear in the quenching operation is prevented. The blocks 35 are so placed, preferably, as to prevent movement of the arms 30 beyond a horizontal position. The position of the several parts during quenching is shown in Figure 1.

At the appropriate time, the operator moves the levers 127 and 132 (Fig. 3) to flood the reservoir with oil or other coolant. This circulates around the gear to produce the chill which hardens the gear.

When the quenching operation has been completed, the operator reverses the valve handle 101 (Fig. 3) to put the pipe 103 (Fig. 1) on supply and the pipe 102 on exhaust. The piston 43 and piston rod 46 now move upwardly. The sleeve 50 is preferably so constructed that at the extreme limit of downward movement of the part, the ring 74 is spaced below the arms 30 a less distance than the ring 65 is below the lower end of the piston 61, so that in the upward movement of the piston rod 46, the ring 74 strikes the arms 30 before the ring 65 engages the lower face of the piston 61. Consequently, the arms 30 are released from engagement with the gear before the ring 65 engages the piston 61 to release the expander 60 and the gripping pieces 25. The upward movement of the piston rod 46 continues until the piston 43 reaches its upper limit position in the chamber 42. The arms 30 can now be lifted to their raised position shown in Figure 3 and the now hardened gear taken off of the lower die. Figure 3 shows the inoperative position of the parts.

While the invention has been described in connection with a particular embodiment and with a particular use for this embodiment, it will be understood that the invention is capable of further modification and uses. In general, it may be said that this application is intended to cover and adaptations, uses, or embodiments of the invention, following in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practise in the art to which the invention pertains and as may be applied to the essential features hereinbefore set forth and as fall within the scope of the invention or the limits of the appended claims.

Having thus described my invention, what I claim is:

1. In a quenching press, a reservoir, a lower die fixedly secured in said reservoir and adapted to support the article to be quenched, a series of radially extending arms movably mounted on said reservoir and adapted to engage the opposite surface of said article, an expansible gripping device associated with the lower die, an expander for operating the gripping device, means for moving the expander into engagement with the gripping device, means for subsequently forcing said arms into engagement with the article, means for supplying a coolant to said reservoir, and means for conducting the overflow of coolant from said reservoir.

2. In a quenching press, a reservoir, a lower die fixedly secured in said reservoir above the bottom thereof and adapted to support an article to be quenched, a series of radially extending arms pivotally mounted on said reservoir adapted to engage the opposite surface of the article, an expansible gripping device associated with the lower die, an expander for operating the gripping device, means for moving the expander into engagement with the gripping device, means for subsequently forcing said arms into engagement with the article, means for supplying coolant to said reservoir above and below the lower die, and means for conducting the overflow of coolant from said reservoir.

3. In a quenching press for quenching tapered gears, a reservoir, a lower die fixedly secured in said reservoir and adapted to support the gear to be quenched, a series of radially extending arms pivotally mounted on said reservoir having tapered foot portions for engaging the beveled upper face of a gear, an expansible gripping device associated

with the lower die adapted to engage said gear, an expander for operating the gripping device, means for moving the expander into engagement with the gripping device, means for subsequently forcing the foot portions of said arms into engagement with the gear, means for supplying coolant to said reservoir and means for conducting an overflow of coolant from said reservoir.

4. In a quenching press, a lower die adapted to support the article to be quenched, an expansible member carried by the lower die adapted to engage said article, a cylinder, a piston reciprocable in said cylinder, a second cylinder secured to said piston, a piston reciprocable in the second cylinder, an expander secured to the second piston adapted to operate the gripping device, an upper die member, means on the first piston for moving the upper die into and out of engagement with the article to be quenched, means for supplying fluid pressure to one end of the second piston to urge the same continuously in one direction, means on the first piston for moving the second piston in the opposite direction, and means for admitting fluid pressure to opposite ends of the first piston to move the same in opposite directions.

5. In a quenching press, a reservoir, a lower die fixedly secured in said reservoir and adapted to support the article to be quenched, a series of radially extending arms pivotally mounted on said reservoir and adapted to engage the opposite face of said article, an expansible member carried by the lower die and adapted to engage said article, a cylinder, a piston reciprocable in said cylinder, a second cylinder secured to said piston, a piston reciprocable in said cylinder, an expander secured to the second piston for operating the gripping device, means on the first piston for moving the arms into and out of engagement with the article to be quenched, means for supplying fluid pressure to one end of the second piston to urge the same constantly in one direction, means on the first piston adapted to move the second piston in the opposite direction, and means for admitting fluid pressure to opposite ends of the first piston.

6. In a quenching press, a reservoir, a lower die fixedly mounted in said reservoir and adapted to support the article to be quenched, a series of arms pivotally mounted on said reservoir and adapted to engage the opposite face of said article, an expansible gripping device carried by the lower die adapted to engage said article, an expander adapted to operate the gripping device, fluid pressure operated means for moving said expander into engagement with the gripping device and fluid pressure operated means for subsequently moving said arms into engagement with said article, and means for supplying a coolant to said reservoir.

7. In a quenching press, a reservoir, a lower die fixedly mounted in said reservoir and adapted to support the article to be quenched, a series of arms pivotally mounted on said reservoir adapted to engage the opposite face of said article, an expansible gripping device carried by the lower die adapted to engage said article, an expander adapted to operate the gripping device, means for moving the expander into engagement with the gripping device, means for subsequently moving the arms into engagement with the article, means for withdrawing the arms from engagement with said article, and for subsequently withdrawing the expander, and means for supplying a coolant to said reservoir.

8. In a quenching press, a base having a reservoir formed therein, a lower die fixedly secured in said base above the bottom of said reservoir and adapted to support the article to be quenched, an upper die adapted to engage the opposite face of said article, an expansible member carried by the lower die provided with radially movable gripping members adapted to engage the interior of said article, a cylinder in the base below the bottom of said reservoir, a piston reciprocable in said cylinder and having a piston rod secured thereto which extends through the upper wall of the cylinder upwardly through said lower die and through the expansible member and having a second cylinder secured thereto, said second cylinder being provided with a cylindrical chamber surrounding said piston rod, a second piston mounted to slide in said chamber on said piston rod, an expander secured to the second piston adapted to operate the expansible member, means for admitting fluid pressure to both cylinders to move the pistons therein, and means for supplying a coolant to said reservoir.

9. In a quenching press, a base having a reservoir formed therein, a lower die fixedly secured in said base above the bottom of said reservoir and adapted to support an article to be quenched, an upper die adapted to engage the opposite face of said article, an expansible member carried by the lower die provided with radially movable gripping members adapted to engage the interior of said article, a cylinder in the base below the bottom of said reservoir, a piston reciprocable in said cylinder, a piston rod secured to said piston and extending through the upper wall of the cylinder upwardly through said lower die and through said expansible member, a second cylinder secured to said piston rod provided with a cylindrical chamber surrounding the piston rod, a second piston mounted to slide on said rod and reciprocable in said chamber, an expander secured to the second piston adapted to operate the expansible member, means for supplying fluid pressure to one end of the second piston to urge the expander constantly downwardly into op-

erative position, means for admitting fluid pressure to opposite ends of the first piston, and means for supplying a coolant to said reservoir.

10. In a quenching press, a base having a reservoir formed therein, a lower die fixedly secured in said base above the bottom of said reservoir and adapted to support an article to be quenched, a series of radially extending arms pivotally mounted on said reservoir adapted to engage the opposite face of said article, an expansible member carried by the lower die provided with radially gripping members adapted to engage the interior of said article, a cylinder in the base below the bottom of the reservoir, a piston reciprocable in said cylinder, a piston rod secured to said piston extending through the upper wall of the cylinder upwardly through said lower die and through the expansible member, a second cylinder secured to said piston provided with a cylindrical chamber surrounding said piston rod, a second piston mounted to slide in said chamber on said piston rod, an expander secured to the second piston adapted to operate the expansible member, means on the first piston for moving said arm into and out of engagement with the article to be quenched, a supply pipe and an exhaust pipe, piping connecting the supply pipe directly with one end of the second piston to admit fluid pressure thereto, pipes connected to opposite ends of the first piston, a four-way valve for controlling the connections of the last named pipes with the supply and exhaust pipe to control the admission of fluid pressure to the first chamber, and means for supplying a coolant to said reservoir.

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