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M. S. CLAWSON

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TEMPERING APPARATUS

Filed May 28, 1930

2 Sheets-Sheet 1

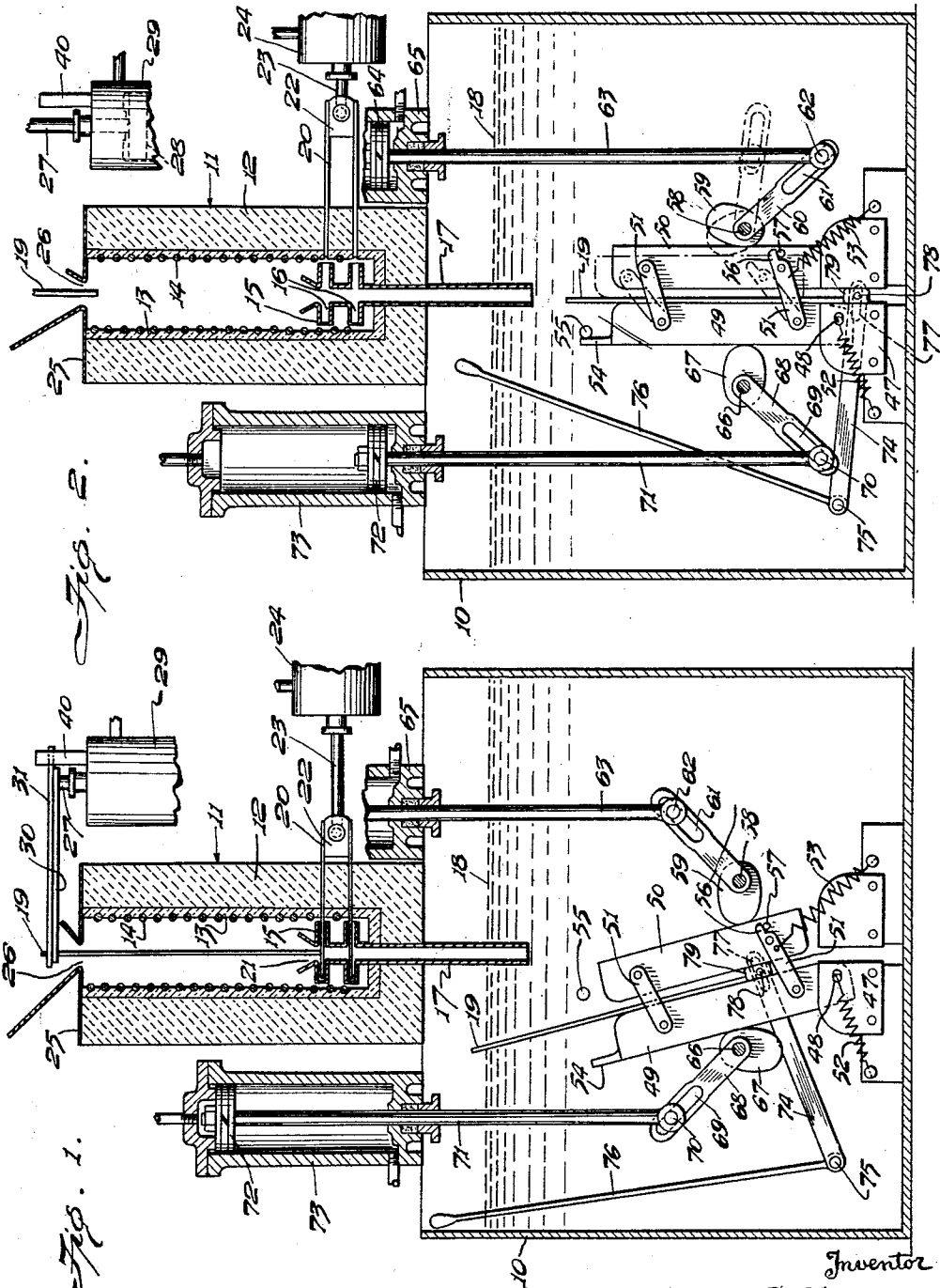


Fig. 1.

Fig. 2.

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Inventor
Morroe S. Clawson
John Milton Jester
Attorney

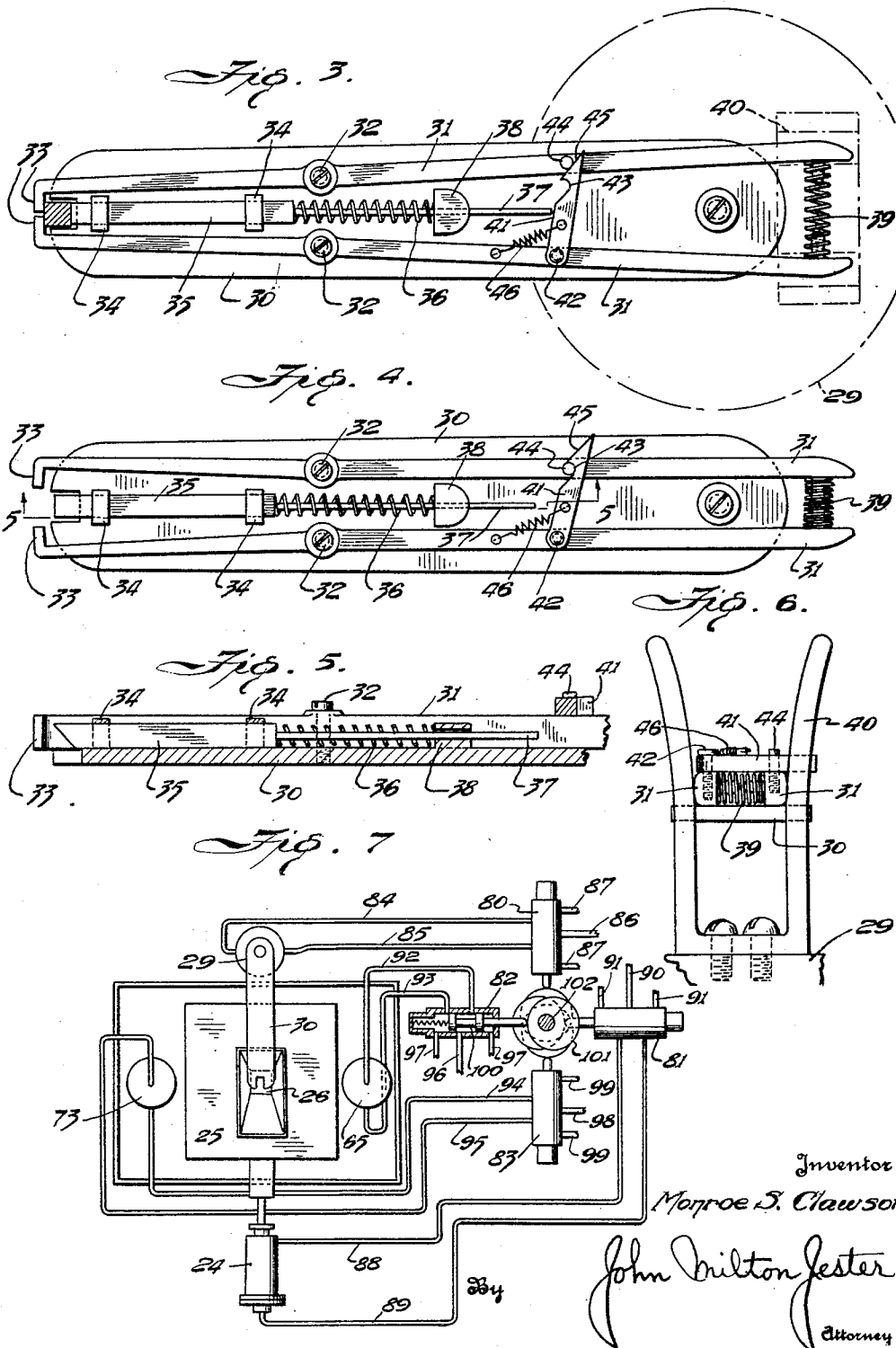
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UNITED STATES PATENT OFFICE

MONROE S. CLAWSON, OF UPPER MONTCLAIR, NEW JERSEY

TEMPERING APPARATUS

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The invention relates broadly to metal treatment and has special reference to apparatus for tempering files, saw blades and in fact probably many other elongated objects formed of steel or the like.

It is well known that in some forms of heat treatment of metal it is a common practice to heat the metal to a predetermined degree and then plunge it into a liquid, oil, water or some solution, for the purpose of effecting hardening or tempering. It is also known that if the heated metal be exposed to the air prior to its quenching or plunging into a liquid it becomes oxidized to a greater or less extent, necessitating a subsequent operation of cleaning by a chemical or mechanical means. In addition to the foregoing information it is known that when tempering files and the like by quenching them there is a great tendency for them to warp and be consequently unfit for accurate service.

It is with the above facts in view that I have devised the present invention which has for its general object the provision of an apparatus by means of which any desired number of files or other elongated metallic pieces capable of being hardened may be tempered in a very rapid manner, the apparatus being susceptible of construction as multiple units so that a large number of the pieces may be treated at one time.

An important object of the invention is to provide an apparatus of this character having means whereby the heated metal strip will be prevented from any prolonged exposure to the air prior to plunging in a liquid so that oxidation will be avoided.

Another important object is to provide an apparatus of this type embodying means for applying pressure to the files or other metallic pieces at the critical moment so as to prevent warping or other distortion.

Still another object is to provide an apparatus of this character in which there is means for preventing any prolonged communication between the heating chamber and the plunging or quenching chamber.

A further object is to provide an automatically operating means for gripping and then

releasing the files or other objects at the proper time.

In addition to the foregoing features the invention contemplates the provision of a control means for the central station from which all of the successive operations are controlled mechanically and in the proper timed relation so that the work will be done expeditiously and accurately and the cost of production thereby reduced.

To the attainment of the foregoing and other objects and advantages, the invention preferably consists in the details of construction and the arrangement and combination of parts to be hereinafter more fully described and claimed, and illustrated in the accompanying drawings in which:

Figure 1 is a vertical cross sectional view through the device or one unit thereof, showing the parts in position to release a tempered file and to quench the next one,

Figure 2 is a similar view with the parts in the position assumed by them when a file is plunged,

Figure 3 is a plan view of the file holding and releasing means showing it in closed position,

Figure 4 is a similar view showing the parts in file releasing position,

Figure 5 is a fragmentary longitudinal section taken on substantially the line 5—5 of Figure 4,

Figure 6 is a rear end elevation, and

Figure 7 is a diagrammatic plan view, with parts in section, illustrating the control means.

Referring more particularly to the drawings I have shown the device as comprising a tank or vat 10 above which is mounted in any suitable manner a heater 11 here disclosed as comprising a body 12 of refractory material having a lining 13 upon which is mounted or within which may be partially embedded a resistance coil 14 which may be supplied with current from any suitable source. The exact construction of this electric furnace may of course be varied within considerable limits. At the lower part of the furnace is a heat and air obstructing mechanism for the purpose of preventing any excess quantity of vapor

or gas passing from the tank into the furnace. This obstructing device is shown as comprising a casing 15 having intermediate pockets 16 and provided at its bottom with an outlet tube 17 which projects through the bottom of the furnace and which is intended to be partially submerged in the oil or other liquid 18 in the tank. The files 19, or other equivalent elements, to be tempered are of course heated within the furnace and for this purpose are supported therein by means to be described. A special type of suspension means is provided for holding the upper end of the file while the lower end thereof rests upon the upper one of a pair of plates or strips 20 slidable through the side of the furnace body and received within the pockets 16. It is preferable that the top of the casing 15 have a flaring entrance opening 21 to facilitate entrance of the file, this opening being in alignment with the tube 17 as will be apparent. After a file has been mounted and is to be dropped into the liquid it is necessary that the slides 20 be withdrawn and it is for this reason that they are shown as mounted on a cross head or the like 22 carried by a piston rod 23 entering a cylinder 24 and provided therein with a suitable piston. Means for operating this mechanism by fluid pressure will be discussed hereinafter.

To prevent waste of heat the top of the furnace may be partially closed by a cover plate 25 having an opening 26 therein for the insertion of the files. Above this cover plate is located the mechanism for clamping and lowering the tool to be tempered, this clamping device being carried by a piston rod 27 carrying a piston 28 operating within a cylinder 29 so that the clamping device may be raised and lowered by fluid pressure. This clamping device comprises a supporting plate 30 directly attached to the piston rod and carrying a pair of jaws 31 pivoted intermediate their ends as shown at 32 and having angular ends 33 directed toward each other and adapted to receive the file or other tool 19 between them. On the plate 30 are guides 34 within which is slidable a bar 35 urged into clamping relation to the file or tool by means of a coil spring 36 which encircles a reduced stem 37 on the bar 35 and which abuts against one end of the latter and against an additional guide 38. It will be noted that the angular ends 33 of the jaws engage against the far side of the file or tool while the bar 35 engages against the opposite or near side. The jaws 31 have their angular ends 33 urged toward each other by a coil spring 39 located between their rear ends.

As mentioned above, this clamping device is moved up and down by air or steam pressure within the cylinder 29 and means is provided for automatically opening the clamp when this entire device reaches the lower limit of its movement. This means is here

shown as comprising an upstanding fork 40 mounted on the cylinder 29 and having diverging arms between which the rear ends of the jaws are received, the divergence being such that the jaws will have their rear ends pressed together against the resistance of the spring 39 so that their active ends will disengage the file or other tool 19. There may also be provided a latch 41 pivoted at 42 on one jaw and having a notch 43 in one edge adapted to engage a keeper 44 on the other jaw member, an inclined surface 45 leading to the notch for guiding the latch. A coil spring 46 attached at one end to one jaw member and at its other end to the latch operates to urge the latch into cooperative relation to the keeper. The function of the latch is to hold the jaw members 31 in open position, as shown in Figure 4, when a file or other tool is to be placed in position ready to be lowered into the furnace.

The file or other tool is of course to be heated within the furnace to the desired extent and is then to be plunged or quenched in the oil or other liquid 18. However, it is well known that there is a tendency for the file or other device to warp or become otherwise distorted when it is quenched. To take care of this I provide an automatically acting clamping device within the tank 10 for receiving the file and applying pressure thereto at the critical moment. This mechanism is here disclosed as comprising a suitable support 47 upon which is pivoted at 48 a clamping member 49 with which cooperates a second clamping member 50 normally spaced somewhat therefrom so that the file will be received between them. To effect a proper clamping action these members 49 and 50 must be maintained in parallel relation and this is easily effected by connecting them by means of links 51 so arranged as to keep the members parallel while permitting movement thereof toward or from each other, a certain amount of relative longitudinal movement being of course necessary. Springs 52 and 53 are preferably provided for the purpose of normally holding these clamping members in upright position with the space between them alining with the tube 17, overthrow of the parts being prevented by the engagement of a stop lug 54 on the member 49 with a pin or the like 55 in the tank. To prevent the spring 53 from moving the member 50 to an undesired extent the lower link 51 may be provided with a stop lug 56 cooperating with a stop pin 57. Of course any equivalent means may be provided to take care of these detailed conditions but what is disclosed is efficient and satisfactory for the purpose.

For moving the members 49 and 50 into clamping relation to a file entering between them, I provide a cam mechanism here represented as comprising a shaft 58 carrying a

cam 59 and a crank arm 60 having a slot and pin connection 61 and 62 with a piston rod 63 carrying a piston 64 operating within a cylinder 65. This mechanism is located at one side of the clamping device, and located at the opposite side is a shaft 66 carrying a cam 67 engaging the member 49. The shaft 66 is provided with a crank arm 68 having a slot and pin connection 69 and 70 with a piston rod 71 carrying a piston 72 operating within another cylinder 73. By referring to Figure 2 it will be seen that when the two pistons 64 and 72 are at the lower limit of their movements the clamping members 49 and 50 are in upright position and in spaced relation, and that when the piston 64 moves upwardly the cam 59 will force the member 50 toward the member 49 and clamp the file so that it cannot warp. At such time the cam 67 serves as an abutment for the member 49.

After the file has been quenched as above mentioned it becomes necessary to remove it from the liquid so that the cycle of operations may be repeated. To effect this I provide an arm 74 pivoted at 75 within the tank and equipped with a lever 76. The arm 74 has a slot and pin connection 77 and 78 with an abutment element 79 slidable between the members 49 and 50 and constituting a support for the lower end of the file. When the pistons 64 and 72 are at the upper limits of their movements the rotation of the shafts 58 and 66 and hence the cams 59 and 67 will move the clamping devices 49 and 50 into the inclined position shown in Figure 1, the spring 53 operating to move the member 50 away from the member 49. By then grasping and pulling upon the lever 76 the abutment element 79 is moved upwardly, projecting the file upwardly so that it may be conveniently grasped and removed from the tank. When the lever 76 is then moved to the right and the pistons 64 and 72 returned to their lowered positions the clamping device comprising the members 49 and 50 will be restored to its initial position ready for the next operation.

The timing of the various operations is naturally of great importance and it therefore becomes necessary to provide some sort of control means for effecting movement of the various pistons in the proper relation. In Figure 7 I have disclosed a mechanism capable of accomplishing the desired result by the mere turning of a handle. This means is represented as including a plurality of valves 80, 81, 82 and 83, all of which may be similar and only one of which is therefore shown in section. The purpose of the valve 80 is to control the supply of fluid pressure to the cylinder 29 within which is the piston carrying the file holding and lowering clamp, two pipes 84 and 85 connecting the opposite ends of the cylinder 29 with the valve 80, and the valve 80 having a fluid pressure sup-

ply pipe 86 and a pair of exhaust pipes 87. The valve 81 controls the operation of the cylinder within which is the piston for operating the cut-off slides or obstructing device between the furnace and the tank. Two pipes 88 and 89 connect with the opposite ends of the cylinder 24 and with the valve 81, this valve having a fluid pressure supply pipe 90 and a pair of exhaust pipes 91. The valves 82 and 83 control the supply of pressure to the cylinders 65 and 73 respectively. Connected with the valve 82 are pipes 92 and 93 leading to opposite ends of the cylinder 65, and similarly there are two pipes 94 and 95 leading from the valve 83 to the opposite ends of the cylinder 73. The valve 82 has a supply pipe 96 and exhaust pipes 97 while the valve 83 has a supply pipe 98 and exhaust pipes 99.

The valves 80, 81, 82 and 83 are simple in construction and each may include a longitudinally movable member 100 urged in one direction as by a spring and adapted to be moved in the other direction as for instance by means of a cam 101 on a shaft 102, the cam engaging against a stem on the movable member. The shaft 102 may be turned by means of a crank handle and in the present instance it is shown as carrying four cams for operating the four respective valves. It is conceivable that a different operating means might be provided but that disclosed will perform the necessary operation. It will be apparent from an inspection of Figure 7 that the admission of fluid pressure to the various cylinders at either side of the pistons therein may be readily effected.

In the operation of the device, it is of course to be understood that the first step is to admit air pressure within the bore of the cylinder 29 so as to raise the gripping or clamping device comprising the plate 30 with the jaws thereon. The file or other tool to be tempered is then engaged within the angular ends 33 of the jaws and by the bar 35. Pressure is then admitted to the top of the cylinder 29 so that this clamping device carrying the file will move downwardly, the file passing through the entrance opening 26 and into the furnace with its lower end disposed within the flaring entrance 21 to the casing 15 and resting upon the uppermost stop slide 20. When the clamping device reaches its lowermost position the rear ends of the jaws engage within the fork 40 which operates to swing the jaws into released position so that the file is no longer gripped though it is maintained in upright position. Heat is of course generated by the passage of current through the resistance coil. After the file has been heated to the desired extent fluid pressure is admitted to the forward end of the cylinder 24 so that the piston therein will move away from the furnace, thus withdrawing the

slides 20 and permitting the file to drop down into the liquid in the tank. Immediately the slides are returned into their normal position obstructing passage of air and heat between the furnace and the tank. The normal position of the anti-warping mechanism comprising the members 49 and 50 and their associated parts has already been mentioned. When the file drops into the tank it enters between the members 49 and 50 and rests on the stop element 79. The instant that the file reaches this position fluid pressure is admitted to the bottom of the cylinder 65 for moving the piston 64 upwardly. The consequent movement of the arm 60 and cam 59 will cause the member 50 to be forced toward the member 49, thus gripping the file and holding it straight so that it cannot warp. As the piston 64 continues its upward movement fluid pressure is admitted to the bottom of the cylinder 73 whereupon the resultant movement of the arm 68 and shaft 66 will swing the cam 67 away from the member 49 so that the cam 59 in completing its movement will force the two members 49 and 50, with the file between them, into the inclined position shown in Figure 1. The operator then pulls the lever 76 for ejecting the file. This completes the cycle of operations and the parts are then restored to their original position ready for the next operation. By providing a time controlled means for rotating the shaft 102 which carries the cams for operating the valves 80 to 83 the mechanism can be operated not only practically automatically but also with the utmost accuracy.

From the foregoing description and a study of the drawings it will be apparent that I have thus provided a very reliable device for tempering or hardening files, other tools or metal strips or bars. It will also be noted that any desired number of multiples of the units shown may be provided so that a very large output can be had. It is thought that the construction, operation and advantages should be readily apparent to one skilled in the art without further explanation.

While I have shown and described the preferred embodiment of the invention, it should be understood that the disclosure is merely an exemplification of the principles involved as the right is reserved to make all such changes in the details of construction as will widen the field of utility and increase the adaptability of the device provided such changes constitute no departure from the spirit of the invention or the scope of the claims hereunto appended.

Having thus described the invention, I claim:

1. A tempering apparatus comprising a tank for liquid, a furnace thereabove, means for supporting an object within the furnace,

means for releasing said means, and a clamping device within the tank for receiving and applying pressure upon the object, said device embodying relatively movable members and means for forcing them together.

2. In a tempering apparatus, a tank for liquid, a furnace located thereabove, means for lowering an object into the furnace, means for supporting the object within the furnace during heating, means for releasing said supporting means, and a movably mounted clamping device within the tank adapted to receive and apply pressure to the object for preventing warping thereof, said device embodying relatively movable elements and means for forcing them together.

3. In a tempering apparatus, a tank for liquid, a furnace located thereabove, means for lowering an object into the furnace, means for supporting the object within the furnace during heating, means for releasing said supporting means, and clamping means within the tank adapted to receive and apply pressure to the object for preventing warping thereof, said clamping means comprising a pair of relatively movable members and cam means for moving the same relatively toward each other.

4. In a tempering apparatus, a tank for liquid, a furnace located thereabove, means for lowering an object into the furnace, means for supporting the object within the furnace during heating, means for releasing said supporting means, clamping means within the tank adapted to receive and apply pressure to the object for preventing warping thereof, said last named means comprising a pair of relatively movable members normally spaced apart, means connecting the same for maintaining parallelism, and cam means for moving said members relatively into clamping relation to the object.

5. In a tempering apparatus, a tank for liquid, a furnace located thereabove, means for lowering an object into the furnace, means for supporting the object within the furnace during heating, means for releasing said supporting means, a clamping means within the tank adapted to receive and apply pressure to the object for preventing warping thereof, and means connected with said clamping means for ejecting the object from between the same.

6. In a tempering apparatus, a tank for liquid, a furnace located thereabove, means for lowering an object into the furnace, means for supporting the object within the furnace during heating, means for releasing said supporting means, clamping means within the tank adapted to receive and apply pressure to the object for preventing warping thereof, and fluid pressure means for operating all of said means.

7. A tempering apparatus comprising a tank, a furnace, means for inserting an ob-

ject within the furnace, means for supporting the object within the furnace during heating, clamping means within the tank, and means for discharging the object from the furnace into said clamping means, and means for controlling operation of all of said means in sequence.

8. A tempering apparatus comprising a tank, a furnace, means for inserting an object within the furnace, means for supporting the object within the furnace during heating, clamping means within the tank, means for discharging the object from the furnace into said clamping means, and fluid pressure means for operating all of said means sequentially.

9. In a material treating apparatus, a tank for liquid, heating means mounted thereabove, means for temporarily retaining an object to be heated within the heating means, means for releasing said retaining means to permit the article to drop into the tank, clamping means within the tank normally positioned to receive the article when it drops, and means for moving said clamping means bodily to permit extraction of the article therefrom.

10. In a material treating apparatus, a tank for liquid, heating means mounted thereabove, means for temporarily retaining an object to be heated within the heating means, means for releasing said retaining means to permit the article to drop into the tank, clamping means within the tank normally positioned to receive the article when it drops, and means for moving said clamping means bodily to permit extraction of the article therefrom, the clamping means comprising relatively movable members and cam means for forcing them together.

11. In a material treating apparatus, a tank for liquid, heating means mounted thereabove, means for temporarily retaining an object to be heated within the heating means, means for releasing said retaining means to permit the article to drop into the tank, clamping means within the tank normally positioned to receive the article when it drops, means for moving said clamping means bodily to permit extraction of the article therefrom, the clamping means comprising relatively movable members and cam means for forcing them together, and fluid pressure operated means for operating all of said means in sequence.

12. In a material treating apparatus, a tank for liquid, heating means mounted thereabove, means for temporarily retaining an object to be heated within the heating means, means for releasing said retaining means to permit the article to drop into the tank, clamping means within the tank normally positioned to receive the article when it drops, means for moving said clamping means bodily to permit extraction of the ar-

ticle therefrom, the clamping means comprising relatively movable members and cam means for forcing them together, fluid pressure operated means for operating each of said means, and means connected with all of said fluid pressure operated means for effecting actuation thereof in a predetermined order.

13. In an apparatus of the character described, a tank, a heater located thereabove and having an outlet communicating with the tank, laterally movable cut-off means obstructing said outlet, means above the heater for suspending therein an article to be heated, means for moving said cut-off means, and other means for releasing said suspension means.

14. In an apparatus of the character described, a tank, a heater located thereabove and having an outlet communicating with the tank, laterally movable cut-off means obstructing said outlet, means above the heater for suspending therein an article to be heated, means for moving said cut-off means, and other means for releasing said suspension means, both of said last named means being fluid pressure operated.

15. In an apparatus of the character described, the combination of a tank for liquid, a heater thereabove, releasable means for holding an object to be heated within said heater, clamping means located within the tank and comprising normally spaced relatively movable elements adapted to receive the object between them, cam means for forcing said elements together into clamping relation to the object, and means for moving the clamping means bodily to facilitate removal of the object.

16. In an apparatus of the character described, a tank for liquid, a heater thereabove, releasable means for supporting within the heater an object to be heated, clamping means within the tank comprising connected relatively movable elements, spring means normally holding said elements separated to receive the object, means for urging said elements together into clamping engagement with the object, said clamping means being pivotally mounted within the tank, and means for swinging the clamping means as a whole to facilitate removal of the object therefrom.

In testimony whereof I affix my signature.

MONROE S. CLAWSON.