

Nov. 2, 1943.

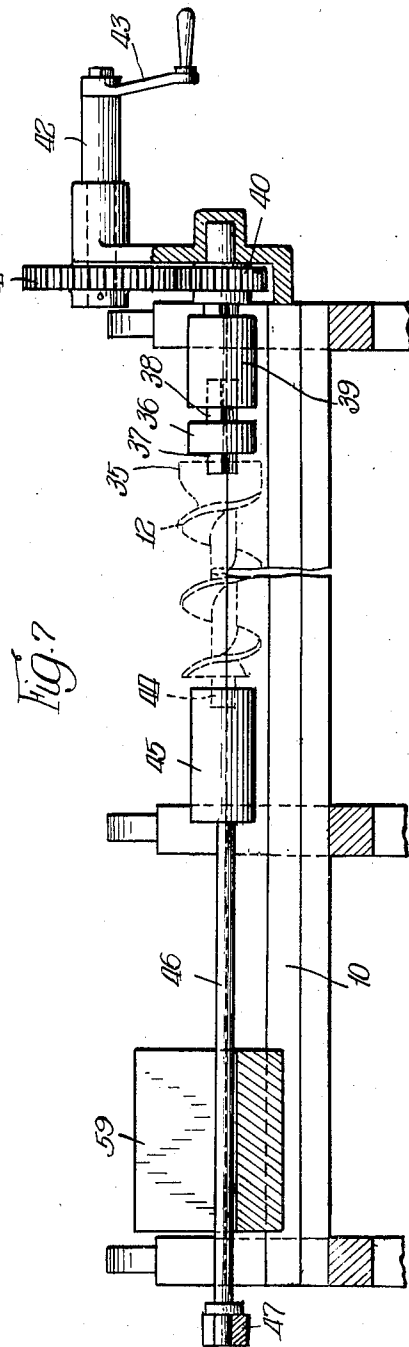
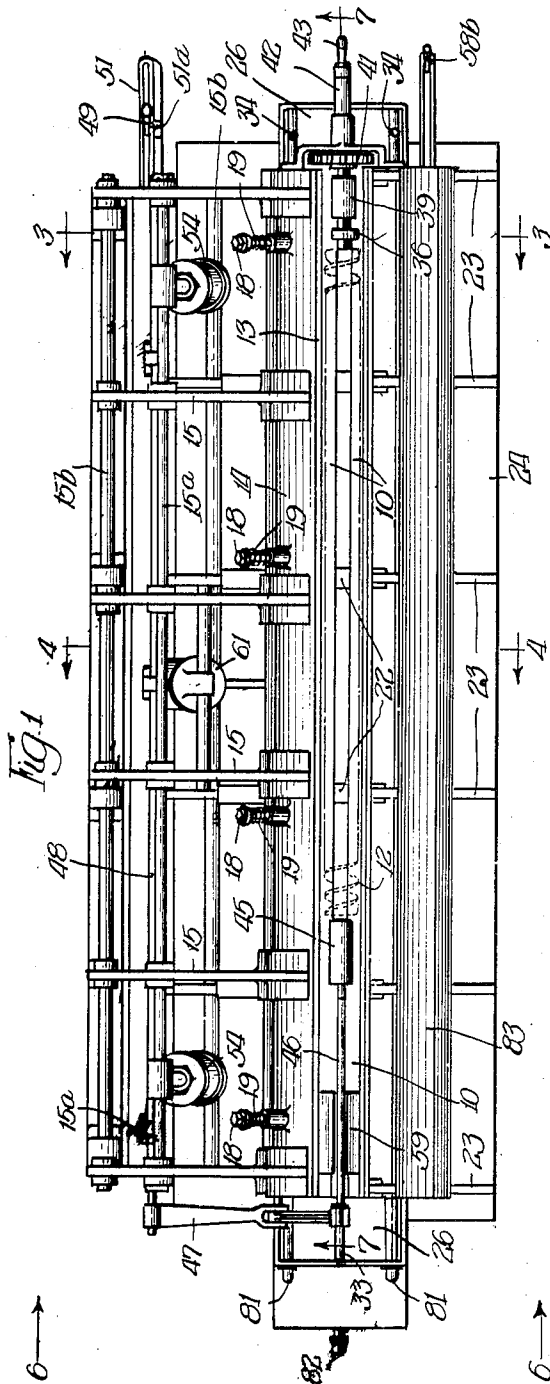
W. P. SMITH ET AL

2,333,344

HEAT TREATING MEANS

Filed June 7, 1941

5 Sheets-Sheet 1



INVENTORS
Walter P. Smith,
C Edward Westover,
BY
William H. Hays, Byron & Knight
attys

Nov. 2, 1943.

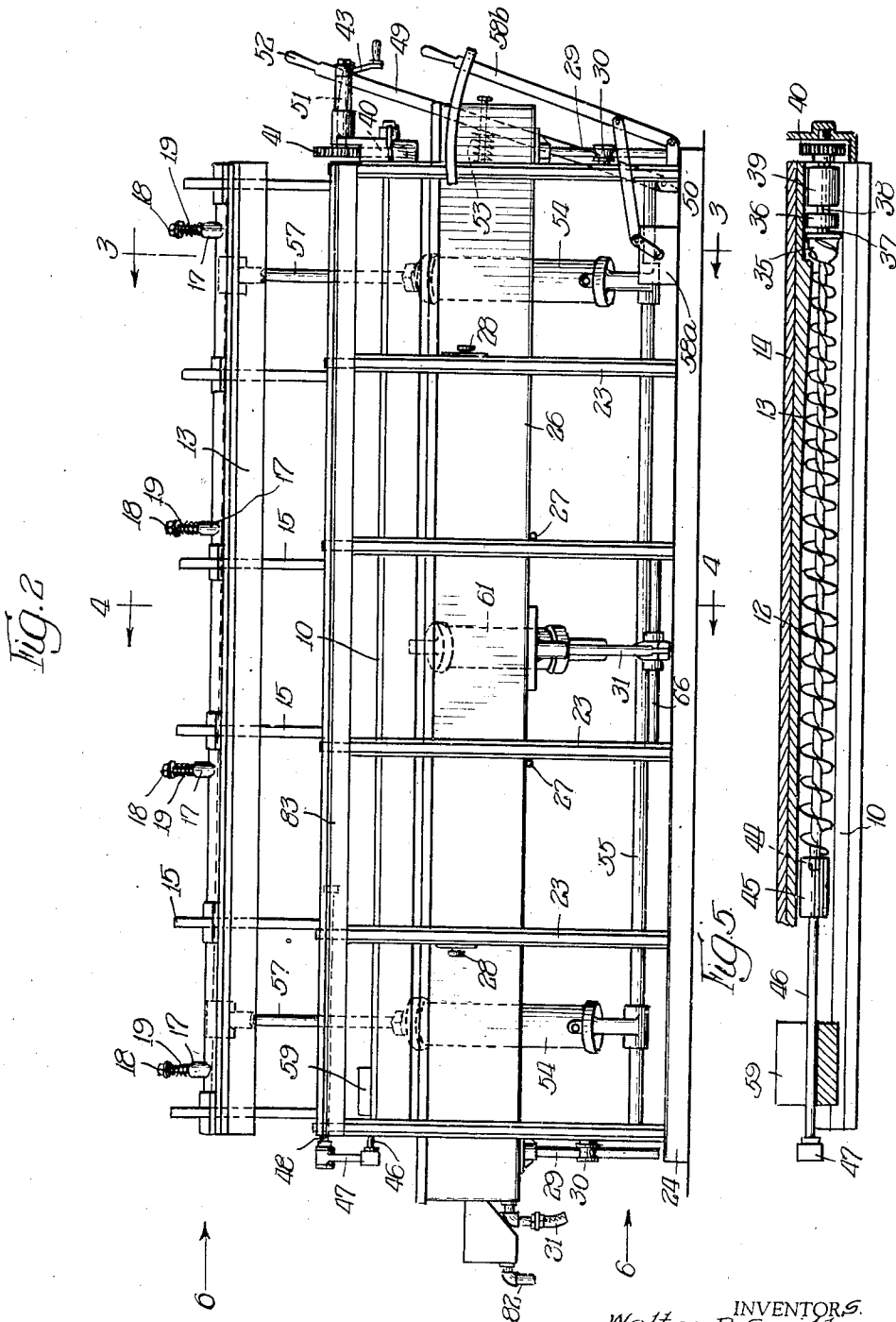
W. P. SMITH ET AL

2,333,344

HEAT TREATING MEANS

Filed June 7, 1941

5 Sheets-Sheet 2



INVENTORS
Walter P. Smith
C. Edward Westover
BY
William H. Hargrave, Byron Knight
attys

Nov. 2, 1943.

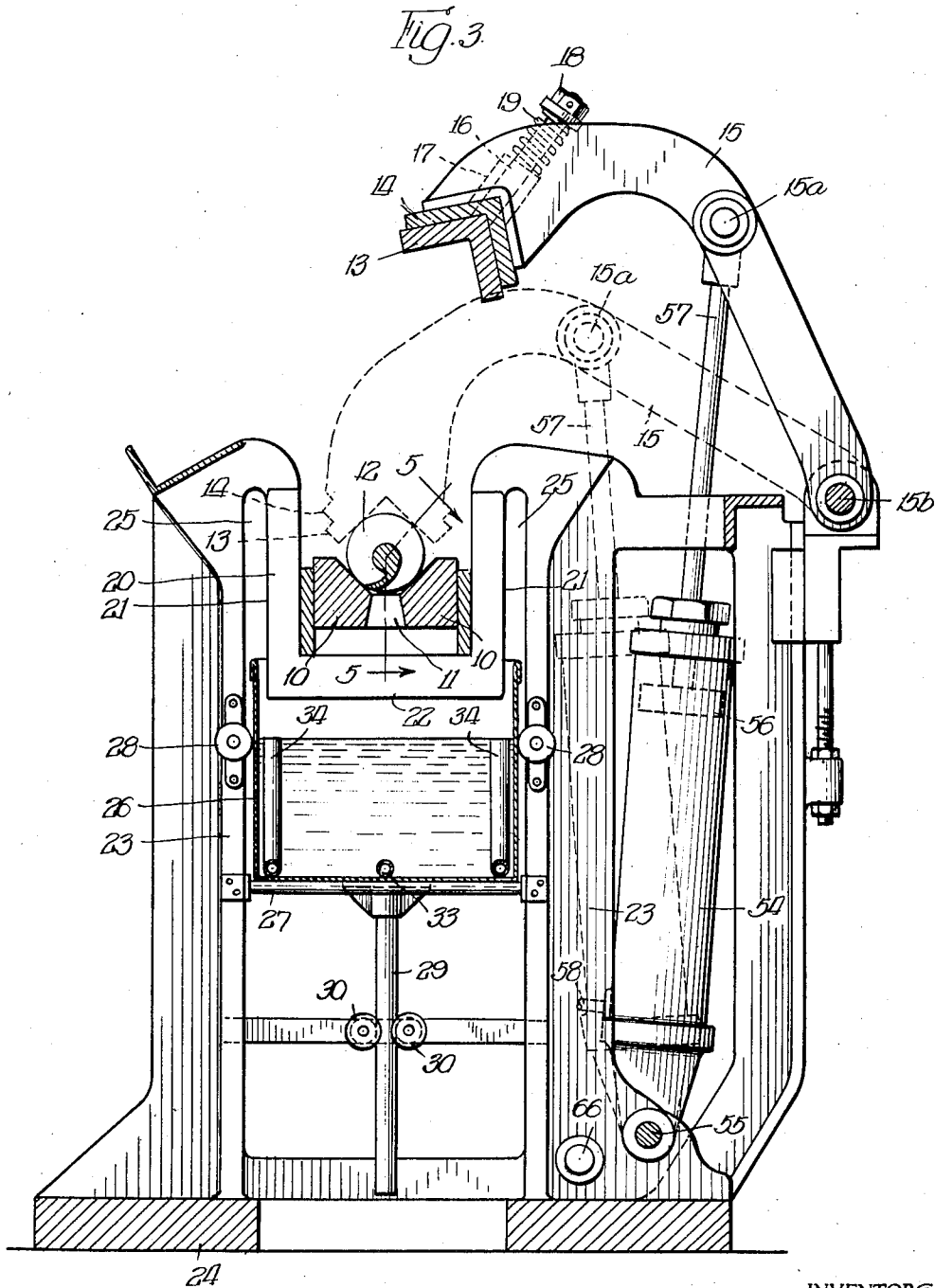
W. P. SMITH ET AL

2,333,344

HEAT TREATING MEANS

Filed June 7, 1941

5 Sheets-Sheet 3



INVENTORS
Walter P. Smith,
BY Edward Westoper,
William H. Hargreaves, Byron & Knight,
Attys.

Nov. 2, 1943.

W. P. SMITH ET AL

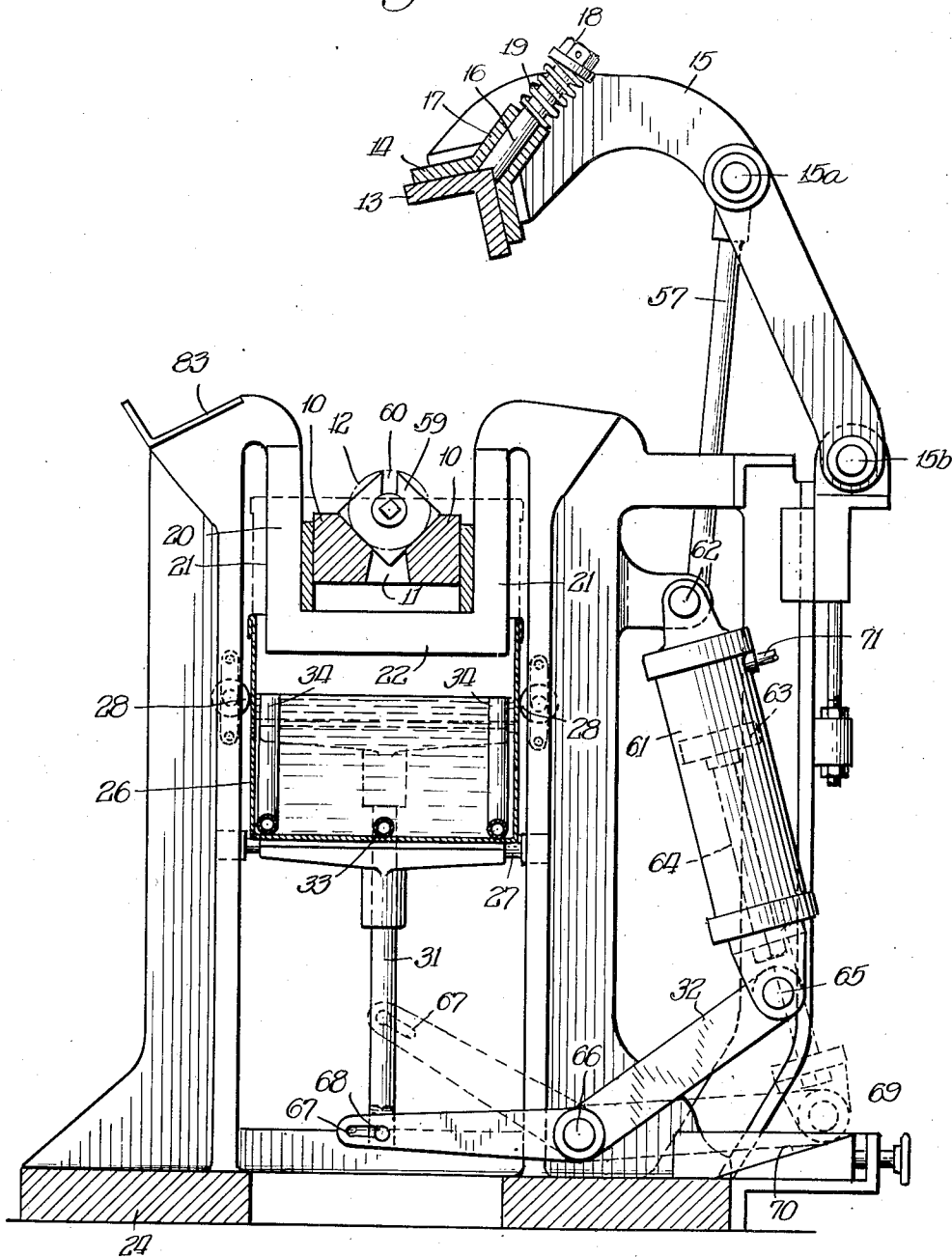
2,333,344

HEAT TREATING MEANS

Filed June 7, 1941

5 Sheets-Sheet 4

Fig. 4



INVENTORS
Walter P. Smith,
C. Edward Westover,
BY
Wilkinson, Hargrey, Byrnes & Wright
attys.

Nov. 2, 1943.

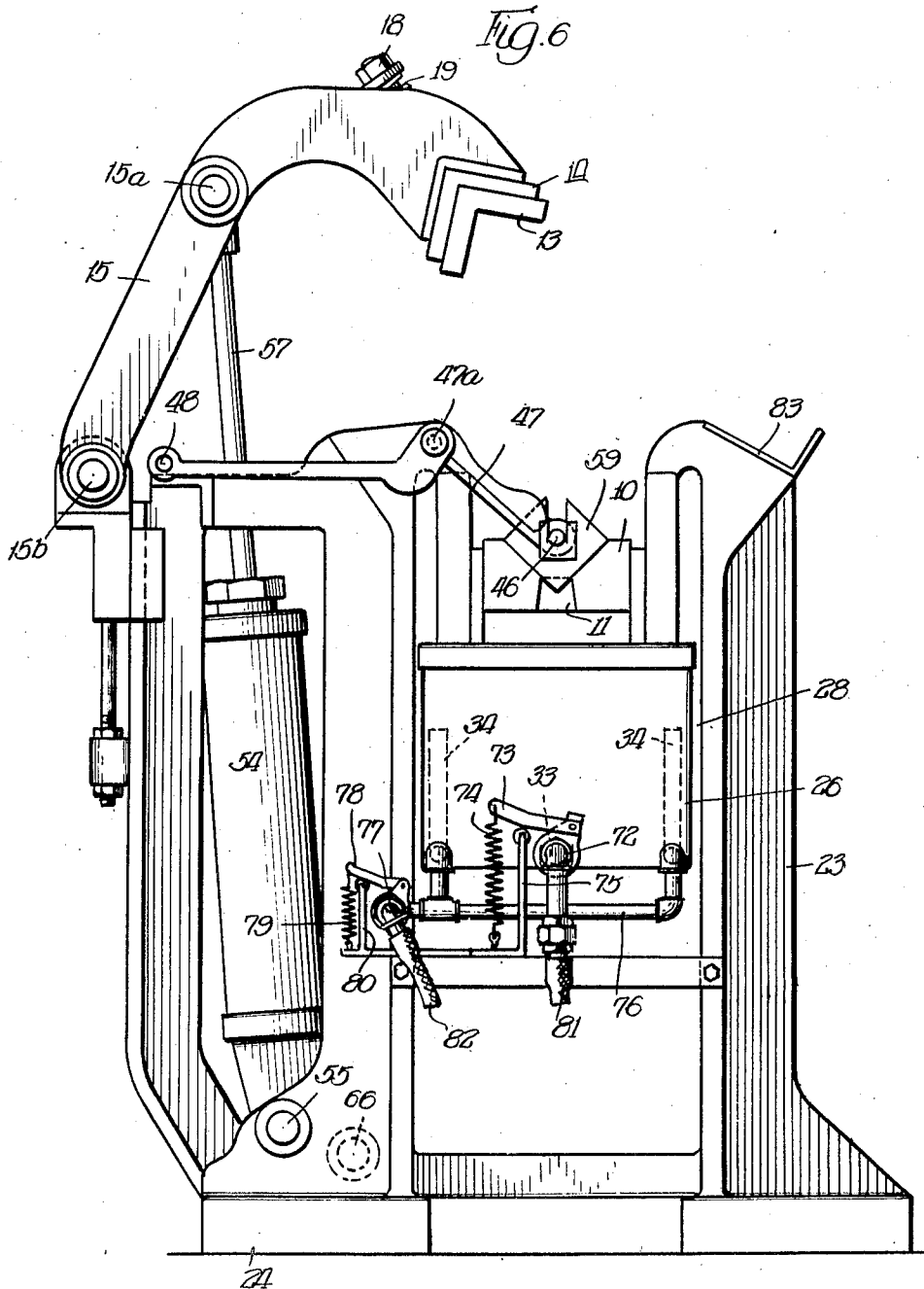
W. P. SMITH ET AL

2,333,344

HEAT TREATING MEANS

Filed June 7, 1941

5 Sheets-Sheet 5



INVENTORS
Walter P. Smith,
C. Edward Westover,
BY
Wilkinson, Humphrey, Bryant & Wright
attys.

UNITED STATES PATENT OFFICE

2,333,344

HEAT TREATING MEANS

Walter P. Smith and C Edward Westover, Chicago, Ill., assignors to Burnside Steel Foundry Company, Chicago, Ill., a corporation of Illinois

Application June 7, 1941, Serial No. 397,146

10 Claims. (Cl. 266—6)

The present invention relates to improvements in straightening and heat treating means.

The present invention will be described in connection with means for straightening and heat treating elongated members such as conveyer screws of the type used in stokers. Such screws are commonly manufactured by a casting operation and after being taken from the molds must be straightened and heat treated.

An object of the present invention is to provide means for heat treating elongated members with a minimum of handling.

A further object is to provide improved heat treating means in cooperation with improved straightening means whereby uniform heat treating operations may be expeditiously performed.

A further object is to provide straightening and heat treating means well adapted to meet the needs of commercial operation.

Further objects will appear as the description proceeds.

Referring to the drawings—

Figure 1 is a top plan view of one embodiment of the present invention;

Figure 2 is a front elevation of the structure illustrated in Figure 1;

Figure 3 is a sectional view taken along the plane indicated by the arrows 3—3 of Figure 1 and Figure 2;

Figure 4 is a sectional view taken along the plane indicated by the arrows 4—4 in Figure 1 and Figure 2;

Figure 5 is a sectional view taken along the planes indicated by the arrows 5—5 of Figure 3 showing the hammering member in contacting relationship with a conveyer screw;

Figure 6 is an end view of the structure illustrated in Figures 1 and 2, the view being taken in the direction of the arrows 6—6; and

Figure 7 is a view on an enlarged scale taken along the plane indicated by the arrows 7—7 of Figure 1.

The description of the mechanism may be prefaced by a brief preliminary discussion thereof.

Referring to the straightening and heat treating of conveyer screws, which structures have been chosen for illustration, such screws, after having been cast, are placed in a heating furnace. After having been subjected to a heating operation the screws are taken from the heating furnace and placed upon straightening mechanism which according to the present invention in-

cludes a horizontal V-shaped die, open at its bottom. A conveyer screw is commonly provided at one of its ends with a socket of non-round conformation, and into this socket a projection is fitted whereby turning movement may be communicated to the screw to be straightened. A spring-pressed abutment is moved up against the opposite end of the screw so that said screw is resiliently held against endwise movement while it has been rotated. A cooperating V-shaped die is adapted to be brought down with hammer blows against the top side of the screw as it is being rotated. Inasmuch as the screw, when it comes from the heating furnace, will ordinarily be warped, the socket referred to, in one end of the screw, may be out of line with the lengthwise dimension of the screw. For this reason the projection fitting within the non-round aperture in the socket portion of said screw should have a more or less universal movement.

Conveyer screws are commonly manufactured of varying diameters intermediate of their ends, certain portions of the length of a screw being tapered. In order to take care of the tapered portions of a screw, or of the portions of less diameter than the largest portion of the screw, the upper die may be provided with a shoe shaped to conform to the shape of the straightened screw. This shoe need be located only upon the upper die.

Below the lower die is an elongated tank with overflow pipes extending to near the top thereof. This tank may be moved bodily up and down. Cold water may be admitted to the bottom of the tank at all times except when the tank is in or approaching its uppermost, that is—quenching, operation. The level of the water is maintained by means of said overflow pipes when the tank is in its lowered position. When said tank is raised, inflow of water is automatically stopped and the outflow of water is also automatically stopped. The level of the water in the tank is sufficient to submerge a predetermined radial dimension of the large diameter of the screw (if it is a tapered screw). By reason of the submerging of the outer portion of the screw in the water, this outer portion is hardened. The operator, during the quenching operation, will continually turn the screw so that the entire outer edge of the screw is quenched. It is possible that the outer edge of the part of the screw of less diameter may not be submerged, but this is satisfactory because the portions of the screw close to the axis should be left ductile. Moreover, the

large diameter of the screw is the part subjected to the heaviest duty and should be the hardest part. This is due to the fact that the linear speed of the outermost portion of the screw is greater than the linear speed of the part of the screw of smaller diameter. By reason of the fact that the bottom of the lower die is open, the water in the tank will have ready access to the screw when the tank is raised.

By reason of the fact that the inflow of water to the tank and the outflow of water from the tank are stopped automatically when the tank is in raised position, a sufficient submersion of the screw in the water is insured. When the tank is in its lowered position, water is always flowing in at the bottom and out at the top. It is thereby insured that the tank is filled with cold water when quenching is to be done.

Reference may first be had to Figures 3 and 4 to understand the operation of the die members and the tank above referred to. The stationary die member is indicated by the numeral 10. Said die member is V-shaped and is open at its bottom, as indicated by the numeral 11, to permit the free access of water. Resting upon the die member 10 is an elongated screw member 12 which is to be straightened. The numeral 13 indicates a shoe adapted to be brought down with hammer blows upon the upper surface of the screw 12. Said shoe 13 is V-shaped in cross section on its hammering surface and, longitudinally, should conform in general to the corresponding surface of the screw member 12 throughout the length of said screw member 12 as said surface should appear after it has been straightened. Said shoe is mounted upon a bearing 14 extending longitudinally in parallel relationship with the die 10. Said bearing 14 is carried by a plurality of rocker arms 15 connected together by the rod 15a and mounted to swing about the fulcrum 15b, adapted to be operated by mechanism which will be described presently. Said shoe 13 is resiliently carried by the bearing 14, and for this purpose the shoe 13 may be provided with a plurality of pins 16 adapted to ride in bosses 17 carried by the bearing 14. The pins 16 may be screw-threaded at their outer extremities for the reception of nuts 18. Coil springs 19 may be positioned to exert pressure between the bosses 17 and the nuts 18.

As shown in Figures 3 and 4, the die 10 is carried by a depending U-shaped member 20 having the side members 21—21 and the bottom members 22. Said bottom members 22 will permit access of water to the aperture 11 in the die 10. Said U-shaped member 21 is supported from above by the standards 23—23 carried by the base member 24. The side members 21—21 of the U-shaped depending member 20 are spaced from the corresponding standards 23—23 to provide spaces 25—25 to permit the raising of the tank 26.

Said tank 26 is shown in its lowered position in Figures 3 and 4 and is supported in said lowered position by means of the cross bars 27 carried by the standards 23—23. Said tank 26 is guided in its vertical movement by means of the rollers 28—28. The bottom of said tank is provided with a plurality of downwardly extending rods 29. Rollers 30—30 supported by the standards 23—23 are adapted to engage said rods 29—29, whereby to assist the rollers 28—28 in guiding the tank 26 in its vertical movement.

As illustrated in Figure 4, the tank 26 is provided with a downwardly extending operating

rod 31 adapted to be moved by means of a rocker arm 32, to be described more in detail presently.

The tank 26 is provided with the water inlet pipe 33 and the water outlet pipes 34—34. Said outlet pipes 34 are open at a predetermined level below the top of the tank 26. Said level is so chosen that when the tank 26 is in its uppermost or quenching position the level of the water will be such as to submerge a portion of the periphery of the screw being heat treated. The level reached by the water in the tank 26 will be controlled by the extent of lifting of said tank 26 in a manner which will appear as the description proceeds. As indicated hereinabove, the inflow of water to the pipe 33 and the outflow of water from the tank to the pipes 34—34 will be stopped automatically when the tank 26 is in its raised or quenching position. The inflow of water to the pipe 33 and outflow of water from the tank to the pipes 34—34 will be permitted automatically when the tank 26 is in its lowered position, as will appear more in detail presently.

Resiliently controlled means are provided for holding the screw 12 in predetermined position relative to the length of the die 10. As indicated hereinabove, one extremity of the screw will ordinarily be provided with a socket portion 35 having a non-round opening. As shown more in detail in Figure 7, a floating member or drive center 36 is provided having a projection 37 adapted to fit within the non-round aperture in the socket portion 35 of the screw 12. Said floating member, or drive center, 36 is provided at its other extremity with the non-round projection 38 adapted to fit within the corresponding aperture in the socket 39. Said socket 39 is mounted to turn in suitable bearings and is connected to be driven by a gear 40 adapted to cooperate with the gear 41, which gear 41 in turn is provided with the shaft 42 adapted to be turned by means of the crank 43. The oppositely extending projections 37 and 38 of the floating member or drive center 36 may have relatively loose connections respectively with the socket portion 35 of the screw 12 and with the socket 39, whereby to have a more or less universal movement, to the end that it will cooperate with a screw 12 which has its socket portion 35 warped out of proper relationship with the lengthwise dimension of the screw 12.

The particular screw 12 chosen for illustration is provided with a cylindrical extremity 44 adapted to be disposed within and to turn relatively to the socket 45. Said socket 45 is mounted at the end of a longitudinally movable rod 46, which rod 46 is mounted upon the extremity of an arm 47 extending at right angles to the axis of said rod 46. Said socket 45 will have sufficient play in a direction at right angles to the length of the rod 46 to engage the extremity 44 of the screw 12 even though said screw 12 is in warped condition.

The arm 47 with the rod 46 is adapted to be moved longitudinally of the machine, and for this purpose has fixed thereto the rod 47a adapted to slide longitudinally of the machine in bearings carried by the frame of the machine. Said arm 47 is adapted to be moved longitudinally of the machine by the rod 48. Said rod 48 is connected to the lever 49 which swings about the fulcrum 50. Said lever 49 is disposed within the guide loop 51 and is provided with the handle 52 (Figs. 1 and 2). A spring 53 is disposed in position to urge the lever 49 toward the right as the parts are viewed in Figure 2, whereby to re-

silently hold the arm 47 and consequently the socket 45 toward the right as the parts are viewed in Figures 1, 2 and 7. By this action the screw 12 will be resiliently held against longitudinal movement. When it is desired to change screws the lever 49 will be moved toward the left as the parts are viewed in Figure 2 to release the socket 45 from the extremity of the screw 12. The loop 51 may be provided with catch means, indicated generally by the numeral 51a, for releasably holding the lever 49 toward the left as the parts are viewed in Figures 1 and 2 while one screw 12 is being removed from the machine and another screw 12 is being disposed thereon.

The means for operating the top die are illustrated in Figures 1, 2, 3 and 6. The numerals 54—54 indicate cylinders mounted for swinging movement about the fulcrum 55. Disposed within each of said cylinders 54 is a piston 56, to which is connected a corresponding piston rod 57. The piston rods 57—57 are fulcrumed to the rod 15a which connects the rocker arms 15—15. The lower extremity of each of the cylinders 54 is provided with the air conduit 58, through which air may be admitted under pressure to said cylinder or may be discharged from said cylinder. Valve means for controlling the admission of air to and the withdrawal of air from the cylinders 54 need not be illustrated in detail. The numeral 58a indicates generally a valve for this purpose, which valve is adapted to be controlled by the lever 58b. It will be sufficient to state that when air under pressure is admitted to the cylinders 54 and pistons 56 thereof will be raised whereby to lift the rocker arms 15—15 and the shoe 13. When air is allowed to discharge from the cylinder 54 the shoe 13 will descend and will strike the screw 12 with a hammer blow. Mechanism which is readily available to those skilled in the art may be employed in connection with the valve 58a to control the admission of air to and the withdrawal of air from the cylinders 54, whereby the shoe 13 may be raised and dropped in a rapid succession of movements. The numeral 59 indicates a stop mounted upon the die member 10 adjacent to the left-hand end thereof as the parts are viewed in Figures 1, 2 and 7. Said stop 59 will limit the movement of the shoe 13 in its hammer blows. As shown in Figure 4, said stop 59 is provided with the upwardly opening slot 60 for receiving and permitting longitudinal movement of the rod 46.

As stated hereinabove, the operator, by means of the handle 43 operating through the gears 41 and 40, will communicate a turning movement to the screw 12 while the hammer blows are being delivered to said screw 12 by the shoe 13.

The mechanism for operating the quenching tank 26 is illustrated in Figures 1, 2 and 4. The numeral 61 indicates an air cylinder mounted to swing about the fulcrum 62. Disposed within said cylinder 61 is the piston 63 having connected thereto the piston rod 64. The outer extremity of the piston rod 64 is fulcrumed about the pin 65 at one extremity of the rocker arm 32 mounted for swinging movement about the fulcrum 66. The other extremity of the rocker arm 32 is slotted, as indicated by the numeral 67, for cooperation with a pin 68 projecting from the operating rod 31 for moving the tank 26. An adjustable stop 69 is provided having the inclined face 70 for limiting movement in a clockwise direction of the rocker arm 32 as the parts are viewed in Figure 4.

The upper extremity of the air cylinder 61 is provided with the conduit 71, through which air

under pressure may be admitted to the cylinder 61 or discharged therefrom. Means for controlling the admission of air to the cylinder 61 or the withdrawal of air from said cylinder will be readily available to those skilled in the art, and no illustration thereof is necessary. It will be sufficient to state that when air under pressure is admitted to the top portion of the cylinder 61 the rocker arm 32 will be swung in a clockwise direction as the parts are viewed in Figure 4, communicating a lifting movement to the tank 26, whereby the level of water (marked by the upper extremities of the pipes 34—34) will be brought up to a sufficient height to submerge a portion of the screw 12 being heat treated. During the time that the screw 12 is being heat treated, said screw will be rotated, such rotation being accomplished by operation of the crank 43.

Cooling water will preferably be admitted to the tank 26 and discharged therefrom continuously while said tank is in its lowered position. By reference to Figure 6 it will be noted that the pipe 33 for delivering water to the tank 26 is provided with the valve 72 adapted to be operated by the lever 73. Said lever 73 is biased by the spring 74 to hold valve 72 in closed position. When the tank 26 is in its lowermost position, said lever 73 will be abutted by the stop 75, whereby to hold the valve 72 in open position.

The pipes 34—34 for discharging water from the tank 26 are connected to the pipe 76 provided with the valve 77. Said valve 77 is adapted to be controlled by the lever 78, which is biased by the spring 79 to hold the valve 77 in open position. When the tank 26 is in its lowermost position the lever 78 will be abutted by the stop 80, whereby to hold the valve 77 in open position.

When the tank 26 is raised a short distance above its lowermost position the levers 73 and 78 will be freed from their corresponding stops 75 and 80, and by reason of the springs 74 and 79 respectively will be moved in a counterclockwise direction as the parts are viewed in Figure 6 to close the corresponding valves 72 and 77, whereby both inflow of water to and discharge of water from the tank 26 will be stopped and whereby a predetermined level of water will be maintained within the tank 26 to submerge a predetermined portion of the screw 12 being treated.

As illustrated, a conduit 81 is provided for admitting water to the valve 72 for delivery to the bottom of the tank 26. A discharge conduit, indicated by the numeral 82, is connected to the discharge valve 77. When the tank 26 is in its lowered position, water is always flowing in at the bottom of the tank and out at the top. It is thereby assured that the tank is filled with cold water when quenching is to be done.

The numeral 83 indicates a trough extending longitudinally of the machine for convenience in handling a screw 12 before and after it has been straightened and heat treated.

By reason of the construction illustrated and described, the functions set forth in the prefatory remarks appearing hereinabove will be accomplished. By reason of the blows applied by the shoe 13 while the screw is hot and being turned, said screw will be straightened, the action being decidedly better than a pressing action upon the hot screw. Experience has shown that a screw which has been straightened by pressing will often resume its warped shape upon being subjected to a blow such as caused for example by dropping upon a hard floor.

Though a preferred embodiment of the present invention has been described in detail, many modifications will occur to those skilled in the art. It is intended to cover all such modifications that fall within the scope of the appended claims.

What is claimed is—

1. Means for heat treating a member including means for holding said member, means for rotating said member, a vertically reciprocable quenching tank, means for delivering cooling medium to and withdrawing cooling medium from said tank to maintain a predetermined level of cooling medium in said tank when said tank is in lowered position, said delivering and withdrawing means being provided with means responsive to vertical movement of said tank for stopping flow of cooling medium into and out of said tank when said tank is removed from its lowermost position, and means for controlling the raising and lowering of said quenching tank whereby the level of water in said tank may be raised to a predetermined level to submerge a predetermined portion of said member.

2. Means for heat treating a member including means for holding said member, means for rotating said member, a quenching tank, means for maintaining a predetermined level of water within said tank, means for raising said tank into quenching relationship with said member, and means responsive to the position of said tank for stopping inflow of water to and outflow of water from said tank when said tank is removed from its lowermost position.

3. Means for heat treating a member including means for holding said member, means for rotating said member, a quenching tank, means for maintaining a predetermined level of water within said tank, means for raising said tank into quenching relationship with said member, means responsive to the position of said tank for stopping inflow of water to and outflow of water from said tank when said tank is removed from its lowermost position, and adjustable means for limiting the lifting movement of said tank whereby to limit the level of water in said tank with respect to said member.

4. Means for heat treating a member including means for holding said member, means for rotating said member, a quenching tank, means for maintaining a predetermined level of water within said tank, means for raising said tank into quenching relationship with said member, means for insuring a supply of flowing cool water to said quenching tank while said tank is in non-quenching position, and means responsive to the position of said tank for shutting off the supply of water to and the outflow of water from said tank when said tank is in quenching position.

5. In combination, means for holding a member to be heat treated, means for rotating said member, a quenching tank adapted to be raised and lowered, means for maintaining a predetermined level of flowing water within said tank when said tank is in lowered position, means for raising said tank whereby the water in said tank

is brought into quenching relationship with said member, and means responsive to the position of said tank for shutting off the inflow of water to and the outflow of water from said tank when said tank is in quenching position.

6. Means for heat treating a member including means for holding said member, a vertically reciprocable quenching tank, means for delivering cooling medium to and withdrawing cooling medium from said tank, said delivering and withdrawing means being provided with means responsive to movement of said tank for stopping flow of cooling medium into and out of said tank when said tank is removed from its lowermost position, and means for controlling the raising and lowering of said quenching tank whereby the level of water in said tank may be raised to a predetermined level to submerge a predetermined portion of said member.

7. Means for heat treating a member including means for holding said member, a quenching tank, means for maintaining a predetermined level of water within said tank, means for raising said tank into quenching relationship with said member, and means responsive to the position of said tank for stopping inflow of water to and outflow of water from said tank when said tank is removed from its lowermost position.

8. Means for heat treating a member including means for holding said member, a quenching tank, means for maintaining a predetermined level of water within said tank, means for raising said tank into quenching relationship with said member, means responsive to the position of said tank for stopping inflow of water to and outflow of water from said tank when said tank is removed from its lowermost position, and adjustable means for limiting the lifting movement of said tank whereby to limit the level of water in said tank with respect to said member.

9. Means for heat treating a member including means for holding said member, a quenching tank, means for maintaining a predetermined level of water within said tank, means for raising said tank into quenching relationship with said member, means for insuring a supply of flowing cool water to said quenching tank while said tank is in non-quenching position, and means responsive to the position of said tank for shutting off the supply of water to and the outflow of water from said tank when said tank is in quenching position.

10. In combination, means for holding a member to be heat treated, a quenching tank adapted to be raised and lowered, means for maintaining a predetermined level of flowing water within said tank when said tank is in lowered position, means for raising said tank whereby the water in said tank is brought into quenching relationship with said member, and means responsive to the position of said tank for shutting off the inflow of water to and the outflow of water from said tank when said tank is in quenching position.

WALTER P. SMITH.
C EDWARD WESTOVER.

CERTIFICATE OF CORRECTION.

Patent No. 2,333,344.

November 2, 1943.

WALTER P. SMITH, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, first column, line 2, for "righgt" read --right--; line 34, for "and" read --the--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 14th day of December, A. D. 1943.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.