

Sept. 22, 1931.

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1,824,121

OPEN BOTTOM FURNACE ORGANIZATION

Filed July 22, 1930

2 Sheets-Sheet 1

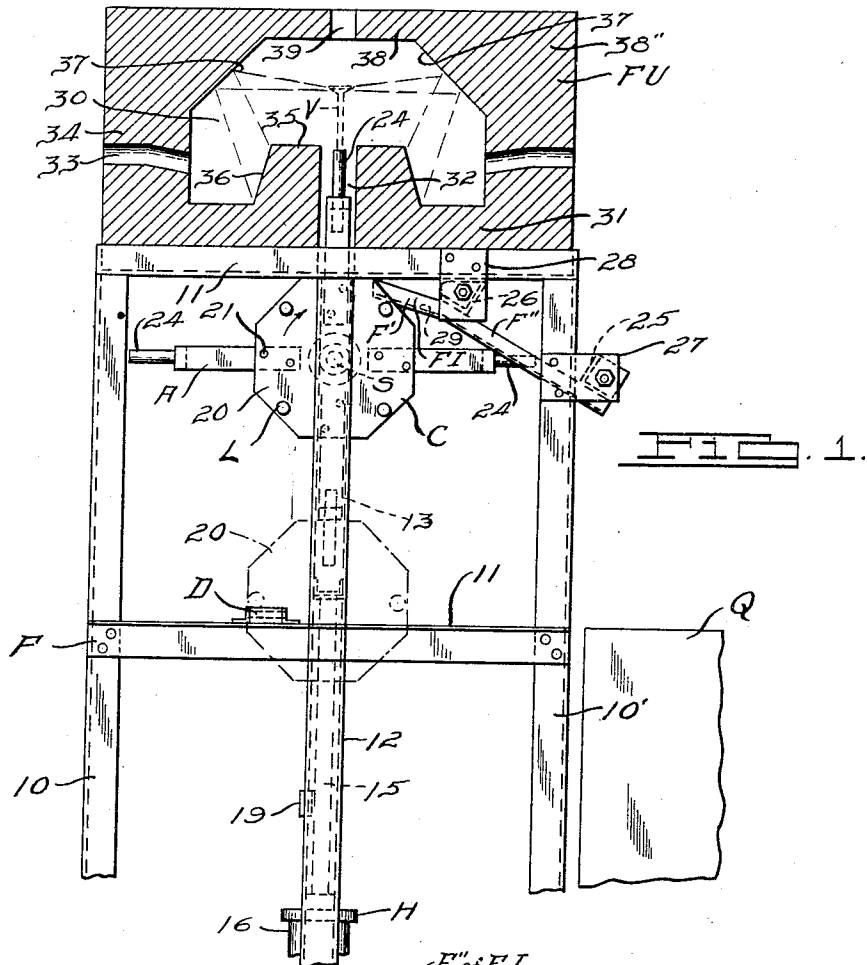


FIG. 1.

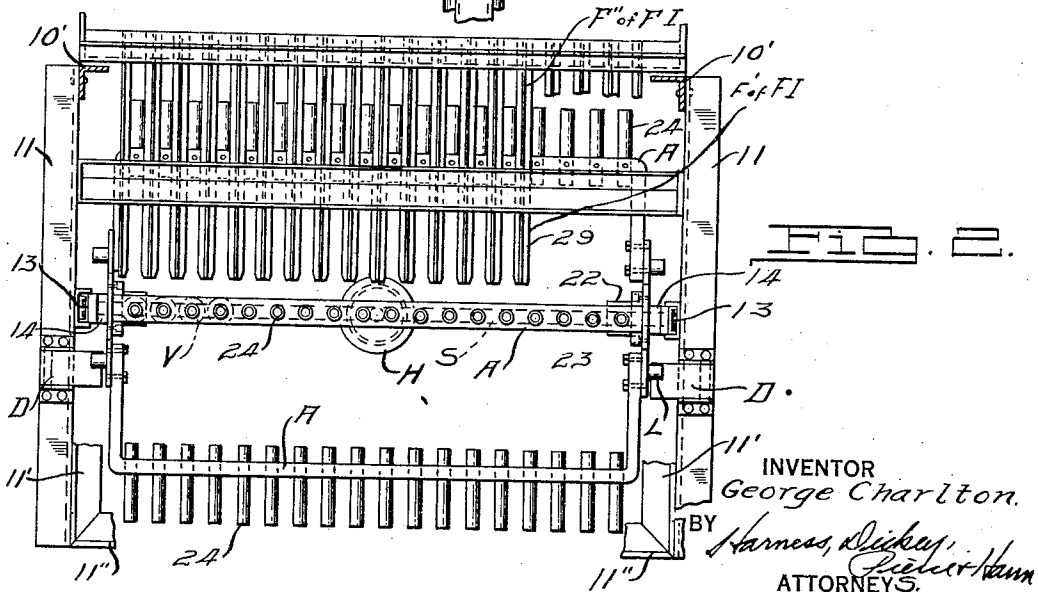


FIG. 2.

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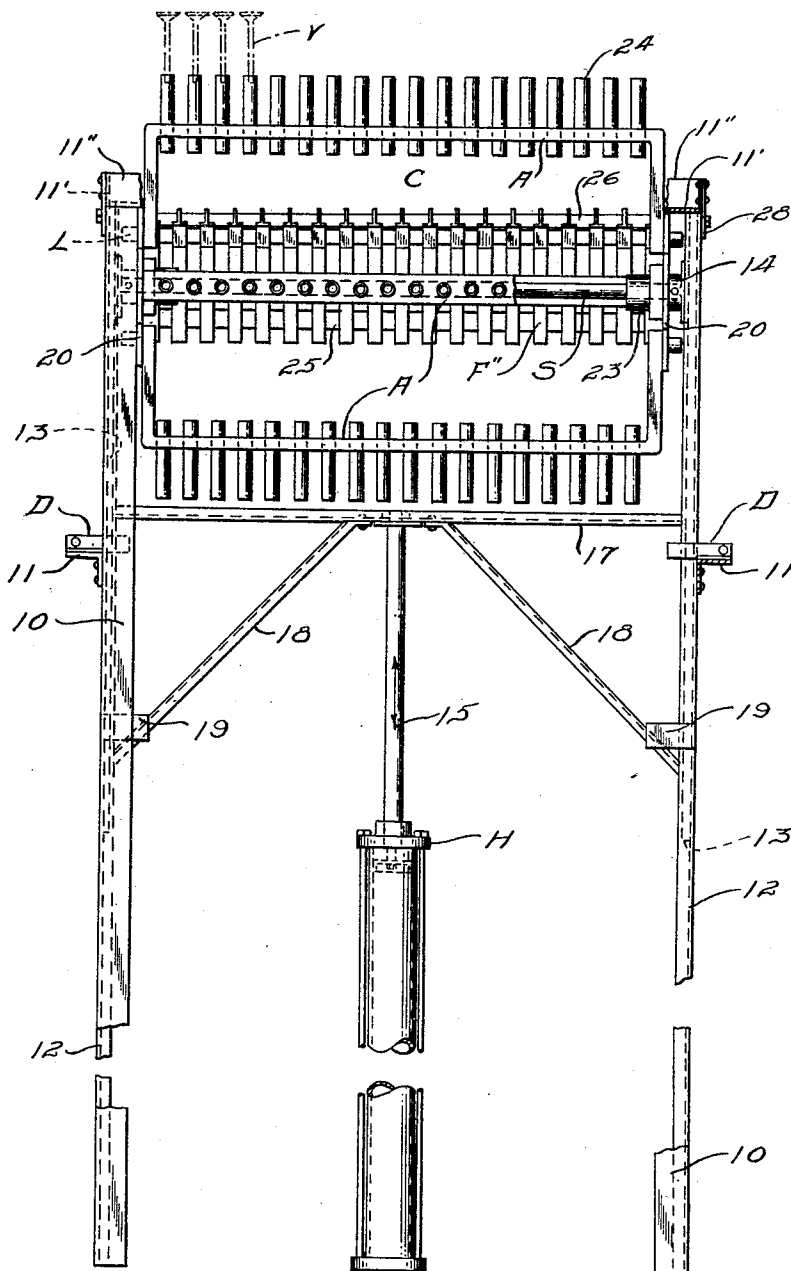


FIG. 3.

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UNITED STATES PATENT OFFICE

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OPEN-BOTTOM FURNACE ORGANIZATION

Application filed July 22, 1930. Serial No. 469,878.

Although designed with particular reference to the heating of units such as valves, of so-called "poppet" type, the principles of construction and operation of the furnace of the present invention render the same applicable to the heating of corresponding enlarged or other portions of series or batches of similar units; and the invention should be understood to include when designed for a "batch" process, not only a novel furnace, provided with a longitudinal work-passing opening in the bottom thereof, but also a work-handling device comprising a special carrier provided with means for the support of a plurality of the mentioned valves, or like work units, not only during a heating or an analagous treatment but during relative movements of insertion and withdrawal between said units and said furnace.

It is an object of the present invention to provide a furnace having not only the mentioned work-passing opening in the bottom thereof, through which at least one row of valves or the like, may be vertically inserted and withdrawn, but also, in opposite side walls, symmetrically disposed rows of additional openings through which burners or flame jets may be inwardly projected; and, in preferred embodiments of the invention, in which the heating chamber is substantially arrow-shaped in cross section and said additional openings are downwardly inclined at the inner ends thereof, the interior of said chamber may be provided not only with parallel and longitudinally extending upwardly-radiating baffles opposite said additional openings but with inclined surfaces in the upper portion thereof, shaped favorably to a convergent radiation of heat therefrom into a uniform-temperature central region and toward the heads of said units; and said baffles may accordingly have the character of upwardly extending partial partitions carried by the bottom wall of said furnace adjacent the edges of the mentioned work-passing opening therein, small openings being optionally provided in the top of said furnace for exit of combustion gases in a natural manner.

The mentioned furnace construction has

been devised with special reference to a combination of the advantages of the muffle or semi-muffle type of furnace with the advantages of the so-called over-fired type of furnace, while eliminating the disadvantages of the mentioned known type. The muffle type and the semi-muffle type are recognized as having the advantage of providing a substantially uniform temperature zone which is protected from direct influence of the burning fuel; but these types suffer the disadvantage of a high fuel consumption, required to produce the desired high and uniform temperature at a point remote from the zone of actual combustion, the resultant deterioration of furnace parts being also undesirably rapid. On the other hand, the over-fired type of furnace, although it has notable advantages in high fuel economy and in slow rate of deterioration of parts, has involved the objectionable feature of a direct impingement of the flame upon work, creating a non-uniformity in heating effect; and its use has disclosed other disadvantages due to a cold hearth, to local inadequacy or excess of heating effects and/or to the impact of excessively hot oxidizing or reducing gases, or the like.

As compared with the foregoing, the new furnace is designed to produce a high uniformity of heat throughout the work-heating zone, permitting the products of combustion to rise naturally and to give to the work the full benefit of the burning fuel without undue local exposure thereto. The new construction affords protection against undesirable "hot spots" in that portion of the furnace chamber which receives the work, any unavoidable "hot spots" being produced upon the mentioned baffles and these being permitted to radiate toward reflecting walls in such manner as to produce a high convergence of heat rays longitudinally of the center of the furnace chamber; and the novel construction is also favorable not only to the use of an advantageous type of work handler therewith, but also to the prompt and easy delivery of successive batches of valves, or the like, after they have been heated to the desired temperature for an appropriate time,

into an adjacent quenching tank such as may be conveniently provided at a lower level.

It is a further object of this invention to provide, for use in connection with a furnace of the general type referred to, or for use in conjunction with any equivalent downwardly opening treating organization, a special handling device for successive batches of units such as valves; and preferred embodiments of this work-handling device or organization may include a special work carrier comprising a plurality of radially disposed arms and provided not only with means for its bodily reciprocation, in a vertical plane, to advance and retract a batch of valves relatively to the mentioned furnace, or its equivalent, but also with means for effecting a partial rotation of said carrier incidentally to each vertical reciprocation thereof and in a manner favorable to the loading and the automatic unloading of said arms, as hereinafter described.

Other objects of the present invention, in which the mentioned vertical reciprocation may be effected by hydraulic means and the mentioned rotation may be effected by successive engagements of spaced lugs, if provided upon the mentioned carrier, with dogs pivotally secured to a supporting frame, and in which fixed stripping fingers may be employed to receive and to guide each batch of valves, delivering the same directly into the mentioned quenching tank, or the like, may be best appreciated from the following description of an illustrative embodiment of the invention, taken in connection with the appended claim and the accompanying drawings.

Fig. 1 is an end elevational view in which a furnace is diagrammatically shown in transverse vertical section, an outline of a work unit in the form of a poppet valve being indicated in dotted lines and parts being broken away.

Fig. 2 is a top plan view omitting furnace, etc.

Fig. 3 is a side elevational view, with parts broken away, also omitting furnace, etc.

Referring first to the more general features of the present invention, a frame F is shown as supporting a rotatable carrier C comprising four radially disposed arms A, each provided with means slidably to receive a plurality of valves V, or the like; and said carrier is not only vertically reciprocable relatively to a furnace FU, as by a suitable hydraulic means H, but is rotatable upon a shaft S, as it approaches its lowermost position, by engagement of cam lugs L, upon said carrier, with dogs D, pivoted upon the frame F, the mentioned rotation having not only the effect of delivering a heated or otherwise treated batch of valves V, or the like, to a set of stripping fingers FI but the incidental effect of presenting an empty arm

of said carrier favorably to the mechanical or manual insertion of an additional batch of valves therein, to undergo heat treatment, in turn, upon the next rotation of said carrier and the upward advance of said arm toward said furnace. The fingers FI may guide the work units directly into a quenching tank Q.

Coming now to preferred details of construction, a main frame comprising uprights 10 and horizontal elements 11 is shown as including also channel-section vertical guides 12 adapted to cooperate in slidably receiving a pair of elongated shoe elements 13, carrying bearing sockets 14 for the respective ends of the shaft S; and lower portions of said shoes may be interconnected and secured to a plunger rod 15 (shown as extending vertically from the hydraulic device H, comprising a cylinder 16) by means including a horizontal element 17 and diagonal braces 18, optional local reinforcements for the latter being shown at 19.

The radially disposed arms A are shown as secured to end plates 20 by means of threaded elements 21; and said plates are shown as mounted upon the shaft S by means of hubs 22, including flanges 23, the mentioned rotation-imparting lugs L being secured to the plates 20 in symmetrical relationship to the arms A and said arms being preferably each provided with a series of tubular receptacular elements 24, or with other means for the reception of longitudinally extending rows or batches of valves, or the like.

It will be understood that the use of four radial arms A, in preference to a smaller or larger number of said arms, has the advantage of disposing one of said arms in a horizontal position when another of said arms occupies a vertical position favorable to the heating of a batch of valves. This permits one arm to be conveniently loaded during the heating of a preceding batch of valves. It also permits the employment of means, such as the mentioned set of stripping fingers FI, in the removal of a batch of valves incidentally to the complete lowering of the carrier C; and it will be seen that the configuration and inclination of the fingers FI shown as supported by angle elements 25 and 26 which are terminally connected with frame elements 10' and 11' by plates 27 and 28, is favorable to a reception of the stems of valves V between cooperating pairs of the mentioned fingers, the heads of said valves being, in the illustrated instance, engaged by laterally extending flanges 29 of said fingers until such time as said heads, cammed outward across slightly-inclined portions F' of said fingers incidentally to the rotation of the mentioned arm, reach steeply inclined outer portions F'' of said fingers, and are thereby guided,

under the action of gravity, into a suitably disposed quenching tank Q, or its equivalent.

Any horizontal or other frame element 11" employed for the support of the furnace FU may obviously be structurally united with the vertical elements 10, 10', of the main frame F of the handling organization; and, however supported, said furnace preferably provides the mentioned substantially arrow-shaped chamber 30. This is shown as supported from a bottom wall 31 having a longitudinally extending work-passing opening 32 provided in the center of the bottom thereof; and it preferably has symmetrically disposed and downwardly inclined flame-admitting openings 33 in its lateral walls 34. Extending longitudinally of the furnace adjacent the edges of the opening 32 are shown baffles 35, in the form of partial partitions, having upwardly convergent outer faces 36. The latter are so disposed that the heat radiated from any "hot spots" thereon may be inwardly reflected by upwardly convergent surfaces 37 provided at the edges of the top 38, combustion gases being permitted to escape through an opening or openings 39 therein. The general manner in which heat waves may be radiated and convergently reflected for an equalizing and conserving effect is diagrammatically suggested by dotted lines in Fig. 1.

The general mode of operation of this furnace organization having been indicated in connection with the various parts thereof, it will be understood that, after the heads of a given batch of valves have been heated to a desired temperature for a period suitable to the desired effect, the lowering of the vertically reciprocable carrier C is continued without rotative effect until a pair of lugs L thereon engages the pair of dogs D (assuming lugs and dogs to be provided at both ends of said carriage) and that by the time of such engagement the position of the uppermost arm A will be such as to enable the same to clear the inner ends of cam portions F' of the fingers FI although the heads of the valves carried by said arm will be engaged and cammed outward incidentally to the rotative advance of the carrier and its cylindrical or other holding elements 24 until by the time they are completely separated from said holding elements, said valves reach the more steeply inclined portion F'' of said fingers, down which, with their stems dangling, said valves may slide into the tank Q, or its equivalent.

The described withdrawal movements of the carrier C will be seen to have incidentally brought a loaded arm A to an uppermost position, ready for insertion in the furnace FU. A horizontally extending arm A being then loaded (whether manually or auto-

matically) with an additional batch of valves, an upward movement of the carriage C, to insert the previously-loaded arm or the batch of valves carried thereby into the furnace FU, will be understood to be without rotative effect, in view of the manner in which the dogs are pivotally supported for free upward movement. However, the breadth of the dogs D will be seen to be such as to assure the indicated camming action, relatively to the lugs L, during descent of the carrier; and it will be obvious that vertical reciprocation of the carrier C, to effect insertion and withdrawal of successive batches of valve heads, may be effected by either manual or automatic means, or by manual control of the hydraulic device H by means not shown.

Although the foregoing description has included complete details of but one embodiment of the present invention, it will be understood not only that various features thereof might be independently employed but also that numerous modifications, additional to any suggested herein, might easily be devised by skilled workers, if informed of the foregoing, without involving departure from the scope of the present invention, as the latter is indicated above and in the following claim.

What I claim is:

For use in a treating organization as described, a device comprising: a frame; and a rotatable carrier provided with substantially radial work-receiving arms and slidably mounted in said frame for substantial vertical reciprocation relatively to an open-bottom furnace thereabove, said carrier being provided with means for effecting its partial rotation incidentally to a reciprocatory movement thereof; and means for stripping work units from said arms incidentally to such rotation.

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