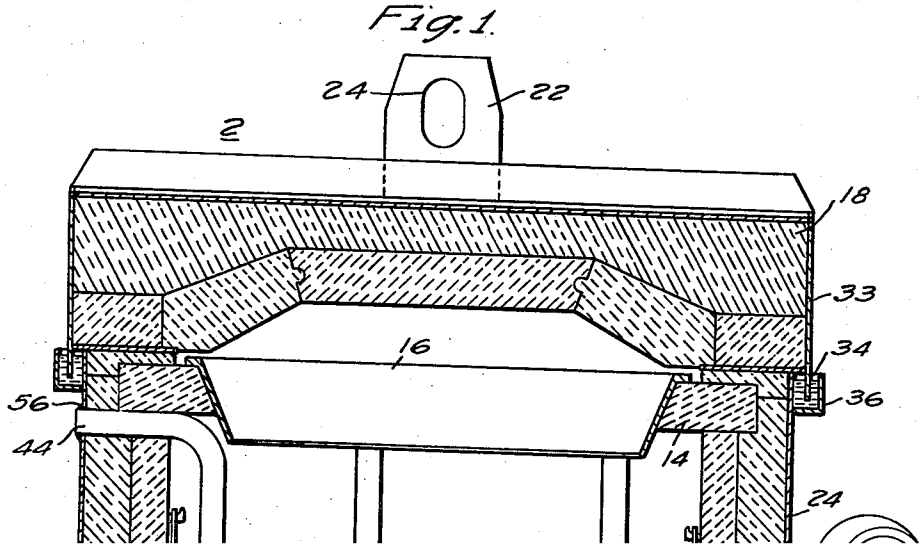
Sept. 17, 1940. J. H. GERMANY 2,215,322

PIT FURNACE

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Fig. 1.



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PIT FURNACE

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Fig. 2.

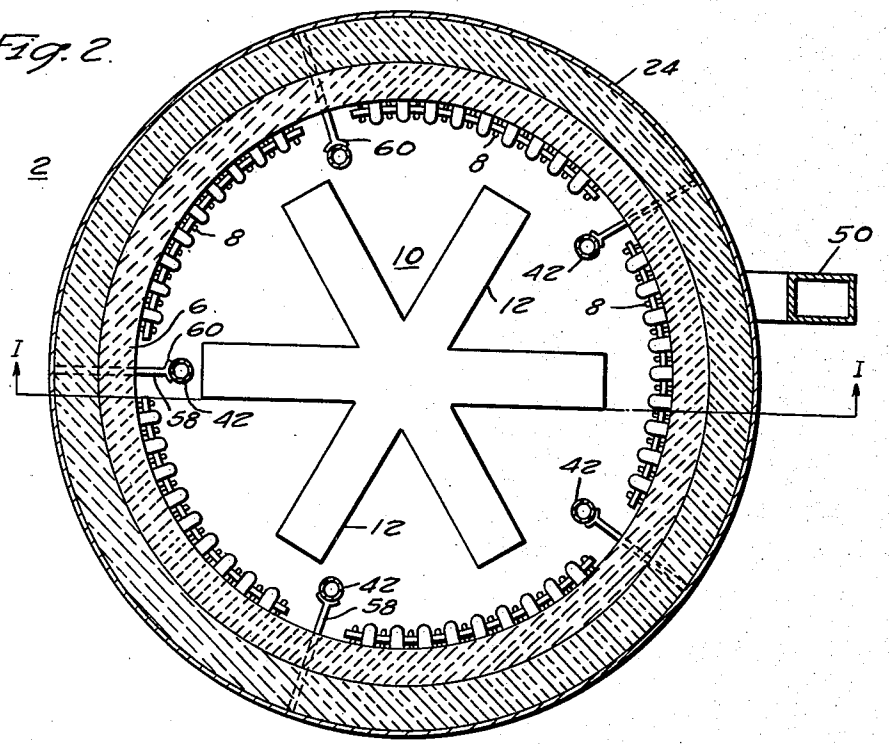
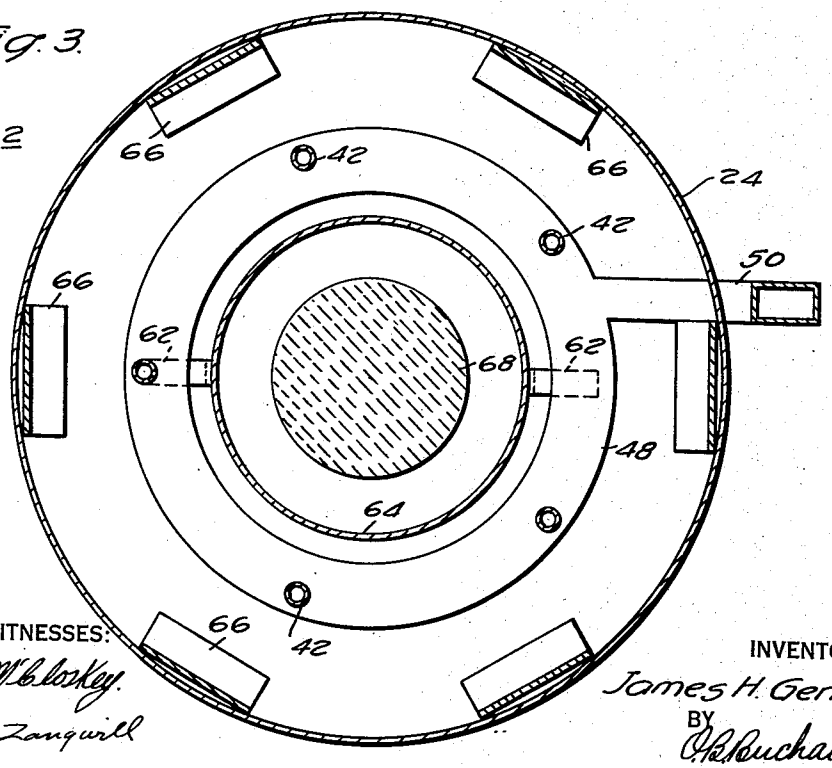


Fig. 3.



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Fig. 4.

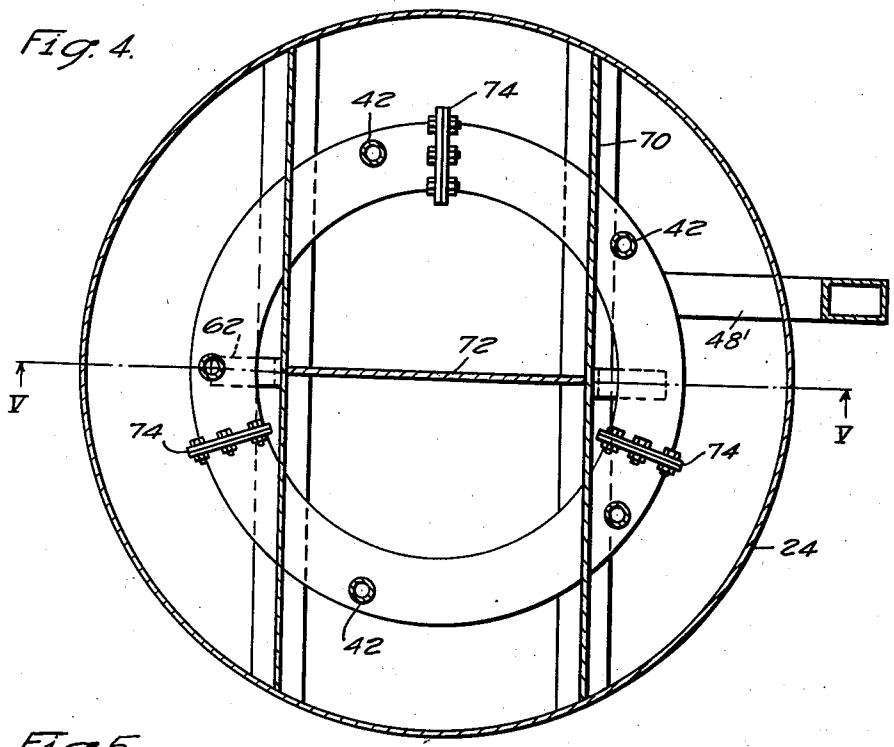


Fig. 5.

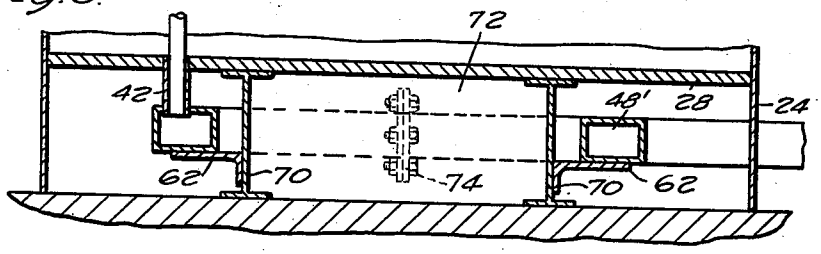
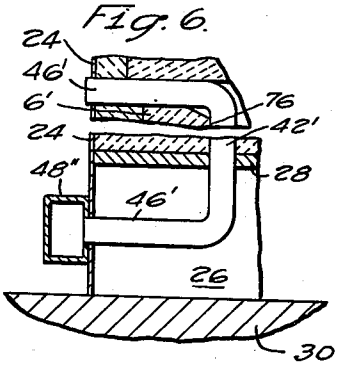


Fig. 6.



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2,215,322

PIT FURNACE

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Application April 18, 1939, Serial No. 268,558

5 Claims. (Cl. 263—44)

This invention relates especially to a pit-type furnace adapted primarily for short-cycle heat-treatment, as, for example, a furnace wherein a pre-heated charge may be rapidly cooled to the proximity of the predetermined soaking temperature, and then maintained thereat for a fixed time. I desire it to be distinctly understood, however, that my invention is not limited to such a furnace or to a particular heat-treating cycle, and that my invention is generally useful in vertical furnaces.

Furnaces of the type referred to generally have a heating chamber with an open top covered by an insulated, removable cover. The cover has an eye-bolt or the equivalent so that it can be moved by any appropriate means to enable a charge to be lowered into or raised out of the furnace. A protective grill or guides are usually secured to the side walls of the furnace to protect the heating elements against damage, or even destruction, while the charge is being lowered or raised, as the case may be. Where rapid cooling is desired, some sort of cooling means is also employed frequently in the form of a direct blast of cooling air blown into the furnace and exhausted through suitable openings. The heating as well as the cooling in the heating chamber of the furnace may be controlled to effect any desired heat-treating cycle, under the supervision, if desirable or necessary, of any suitable temperature-responsive control means.

In accordance with my invention I combine the function of the cooling means and protective guiding means into single units in the form of vertical conduits interspersed amongst the heating elements or heating means and so supported that they protrude inwardly further than do the heating elements. I prefer to make the conduits through which the cooling medium is conveyed in the form of pipes, which, as is well known, have considerable resistance to bending stresses. With my novel construction, therefore, the conduits not only serve to protect the heating elements, but also can serve as heat exchange units for withdrawing heat from out of the furnace.

It is, accordingly, an object of my invention to provide a furnace with an efficient cooling system economically built into it.

A more particular object of my invention is to provide a furnace of the pit-type having heating elements disposed at its sides, the furnace incorporating cooling means that serve not only for cooling but also as guiding means for the charge during the movement of the last into and out of the furnace.

It is another object of my invention to provide a furnace of the pit-type having heating elements disposed at its sides, with cooling means that additionally serve to protect the heating elements against damage during insertion and removal of the charge.

My invention contemplates a furnace in which the charge is heat-treated either in a protective atmosphere, or while enveloped only by a small amount of air so that excessive scale on the surface of the charge or other deleterious effects are minimized. To accomplish this the air inlets and outlets to the cooling pipes are outside the furnace, and the heat in the furnace is conveyed out by indirect heat exchange through the pipes to the cooling medium flowing through them. Accordingly, the furnace can be built substantially gas-tight, and if desired a protective atmosphere supplied to its heating chamber, or the charge heated in the presence of whatever air is in the furnace, the amount being insufficient to cause serious oxidation.

In addition to the foregoing objects and specific features of my invention, other objects, features and combinations of structures will be apparent from the following description thereof, taken in conjunction with the drawings in which like reference numerals designate like parts, and in which:

Figure 1 is a vertical sectional view of one form of a furnace embodying my invention, and taken on the line I—I of Fig. 2;

Figs. 2 and 3 are horizontal cross-sectional views taken on the lines II—II and III—III, respectively, of Fig. 1;

Fig. 4 is a horizontal cross-sectional view, similar to Fig. 3, of a modified bottom structure for a furnace embodying my invention;

Fig. 5 is a sectional view of the lower part of a furnace on the line V—V of Fig. 4; and

Fig. 6 is a fragmentary vertical sectional view of a detail of a modified form of furnace.

Referring more particularly to the form of my invention shown in Figs. 1, 2 and 3, the furnace indicated in its entirety by the reference character 2 is representative of a pit-type furnace and comprises a bottom wall 4 integral with side walls 6, the walls being constructed of refractory brick and fire brick in any customary manner, with the side walls having any ordinary provisions for supporting electric heating elements 8. The furnace is here shown as being circular in cross-section, but my invention is not limited to a cylindrical furnace. By the term "side walls," I, therefore, intend to embrace

either a continuous or curved or cylindrical vertical interior, or an interior formed with any number of angular edges, that is, a furnace partly or wholly polygonal in section.

The top wall is so formed as to provide an opening through the center thereof through which the charge may be lowered or raised upon a hearth 10 resting on the bottom wall 4, the hearth 10 comprising, in this case, a plurality of radially projecting supporting piers 12, as shown more particularly in Fig. 2.

The upper ends of the side walls 6 are formed by refractory tile or brick 14 having inner surfaces that taper toward the bottom of the furnace so that a guide casting 16, preferably of heat-resisting metal alloy, can be suitably supported thereon. An insulated, removable top 18, which can be raised or lowered by any suitable means, sits on the top of the side walls and in closed position defines, in conjunction with the side walls 6 and the bottom wall 4, a heating chamber 20 in which any appropriate heat-treating cycle may be carried out. To facilitate the raising and lowering of the top 18, it is provided with an eye bolt 22 having an aperture 24.

The entire wall structure of the furnace is preferably encased in a metallic shell which comprises a cylindrical tube 24 encasing the outside of the furnace, except for the top, and preferably extending below the bottom wall 4 to provide a space 26 between a metallic base plate 28 encasing the bottom wall of the furnace and a suitable bottom 30 of a pit 31 in the floor 32. The exposed sides and wearing surfaces of the top 18 are also encased in a metallic shell identified in the drawings by the reference numeral 33. This metallic shell may be provided with a downwardly projecting flange 34 fitting into a channel seal 36 secured in a gas-tight manner to the upper outside edge of the shell 24. It is obvious, therefore, that the metallic casings for the different parts of the furnace render it substantially impervious to any leakage of gas or air into or out of the furnace.

It may be observed that the lower edge or periphery of the guide casting 16 defines an inner circle of somewhat lesser diameter than the inner circumference of the side walls 6, and also of lesser radius than the distance of the innermost points of the heating elements 8 or their supporting pins 40 to the axis of the furnace, so that during the lowering of the charge the guide casting tends to center it with respect to the heating elements to avoid contact therewith. However, as the charge is lowered below the guide casting, there may be sufficient swinging or other movement which ordinarily might cause the charge to strike the heating elements and perhaps damage or short them. Accordingly, it has been the custom to provide vertical guides of substantially the full height of the chamber 20 for guiding the charge onto its supporting hearth without contacting the heating elements, and also directing the charge, when raised, through the guide casting 16. In accordance with the design of my invention, there guiding functions are performed by a plurality of horizontally-spaced vertically-disposed conduits 42, preferably in the form of pipes.

The vertical conduits 42 have their upper ends 44 turned to extend horizontally through the side walls 6 and out of the furnace, these horizontal portions preferably forming discharge ends or outlets for any cooling fluid that may be passed through the conduits, while the bottom ends 46 of the conduits 42 pass through the bottom wall 4 and base plate 28 into a toroidal supply header 48 connected by means of a conduit 50 to a blower 52 or other suitable air-propelling means for forcing cooling air through the pipes 42, the blower being mounted on a side of the furnace or any other suitable place. The number and size of the conduits disposed in the furnace is obviously a matter of design, but should be such as to accomplish the cooling functions aforesaid. In the particular embodiment of Figs. 1–3, I show five such conduits equally spaced circumferentially inside the furnace. The supply header 48 is, of course, of sufficient size to assure a proper distribution of air to the conduits 42.

The conduits 42 preferably take the form of circular pipes and may be made of a heat-resistant alloy if exceptionally high temperatures are to be present in the heating chamber 20, and of less expensive metal, such, for example, as a high grade steel, if the temperatures to be encountered are sufficiently low to permit this material to be employed. Whatever the pipes 42 are made of, I prefer to brace them against movement or disturbance in the event that a charge strikes them with considerable force. To this end, the bottoms of the pipes, where they pass through the base plate 28, are securely welded to the latter, as shown diagrammatically by the welds 54, and it may be observed here that these welds 54 also close any possible leaks about the pipe. Manifestly, the lower ends of the pipes 42 are held against horizontal movement by the bottom plate 28 through which they extend and the upper ends 44 may likewise be secured to the casing 24 by welds 56 to prevent movement of the upper parts of the conduits. In exceptionally high furnaces I may also provide metallic braces 58 resting in suitable holes in the side walls 6 with one of their ends abutting the case 24 and the other end having a curved head 60 fitting the pipe 42 which it engages.

The header 48 may rest directly on the foundation 30 or, as shown in Fig. 1, may rest upon suitable angle clips 62 secured to a tubular metallic member 64 properly positioned underneath the base 28 and in the space 26. The furnace itself can, in some instances, be supported solely by the outer casing 24 made of exceptionally heavy plate for the purpose, but in order to economize on this outer shell and also to provide a better support for the furnace, I prefer to place a plurality of channels 66 circumferentially in the space 26 and upon which the side walls 6 of the furnace are supported. Additionally, I may provide a brick pier 68 centrally located in the space 26 for adding rigidity to the base wall 4 in order that any charge in the furnace may be suitably supported by vertically-directed reaction forces.

In Figs. 4 and 5 I show a slightly modified form for the bottom support of the furnace. In this form of my invention, the central supporting means comprises a plurality of I-beams 70 extending a full width of the furnace and connected at their centers by a reinforcing cross beam 72. Suitable openings are, of course, cut into the I-beams to permit the supply header 48′ to be assembled in position, which, in this instance, is formed of three sections bolted together as at 74.

In Fig. 6 I disclose a slightly modified form of conduit in which the bottom portion is bent to form a horizontal inlet end 46′ which extends outward of the casing 24 into a supply header 48″ located on the outside and bottom of the casing 24. The supply header 48″ may completely circumvent the furnace or may also partially cir-

cumvent it, but in any event I prefer to have the single header supply all of the pipes 42' with cooling medium or with air.

Fig. 6 also depicts a further modification in which the pipes abut the interior surface 76 of the side wall 6' so that the necessity for braces 52 is eliminated. It is obvious, of course, that in the event a space 26 is not desired beneath the furnace itself, the cooling pipes may have their inlet portions 46' as shown in Fig. 6, but instead of passing below the base plate 28 these inlet portions may pass out of the furnace through the bottom portion of the side wall 6' slightly above or directly in contact with the upper edge of the base plate 28.

The principal advantages of my invention are, of course, obvious from the foregoing description. Briefly and generally stated, my invention combines the cooling means with the guiding means and thereby not only effects economy in manufacture, but also provides a furnace capable of accurate and quick control of a heating cycle. The furnace can be applied to any suitable heat-treating processes as, for example, short-cycle malleableizing, annealing, or normalizing, and although I have not shown any temperature control means, such elements are common in the art and may readily be applied to the furnace described.

While I have shown and described my invention in certain forms which I believe to be the best mode of application, it is obvious that many modifications may be made of the features I have described. For example, the electric heating means might be replaced by gas-fired radiant tubes, or the equivalent, with the cooling means properly disposed to protect such heating elements. Accordingly, I desire that the appended claims be given their broadest interpretation and limited only by the prior art.

I claim as my invention:

1. A pit-type furnace comprising walls defining a heating chamber having an opening in the top thereof for the insertion and removal of a charge, heating means on the sides of said chamber, charge-guiding and cooling means in the form of conduits along the sides of said chamber and extending inwardly of said heating means, a truncated guide casting defining said opening, said casting being downwardly tapered with its lowest surface slightly inward of the last said means, and a cover removably placeable over said opening.

2. A pit-type furnace comprising a charge-supporting base and vertical side walls defining a heating chamber having an opening in the top thereof for the insertion and removal of a charge, heating means on said side walls, a plurality of horizontally-spaced, vertical conduits along said side walls extending inwardly of said heating means, bracing means for said conduits, said conduits being fixed in said furnace with turned upper air-discharge ends extending out of said furnace and lower air-inlet ends extending out of said furnace, and means to supply cooling air to said lower ends.

3. A device of the class described, comprising a furnace with a substantially vertical axis, having a charge entrance opening along said axis, said furnace comprising substantially vertical side walls defining a heating chamber aligned with said opening, a removable closing means for said opening, heating means along said side walls, cooling means comprising a plurality of spaced, hollow conduits fixed in said furnace, said conduits being distributed along said walls and protruding inwardly beyond said heating means, whereby to protect said heating means while a charge is being inserted or removed through said opening.

4. A pit-type furnace comprising a charge-supporting base, and substantially vertical side walls about said base, said furnace having a top opening through which a charge can be passed into or out of the furnace, heating means along said side walls, cooling means comprising a plurality of spaced, hollow conduits distributed along said side walls, said conduits being fixed in said furnace and protruding inwardly beyond said heating means whereby to guide a charge to or from said base while the charge is being inserted or removed through said top opening, said cooling means including means for forcing cooling fluid through said conduits.

5. A pit-type furnace comprising a charge-supporting base, side walls, and a removable top, electric heating means mounted on said side walls, spaced cooling conduits fixed in said furnace during use, along the said side walls and protruding inwardly of said heating means, whereby to guide a charge during its movement into and out of said furnace through a top opening exposed when said removable top is removed, means external to the furnace for forcing cooling air through said conduits, said conduits having air-outlet means extending outside of the furnace, and a truncated guide casting defining said opening, said casting being downwardly tapered with its lower edge slightly inward of said conduits.

JAMES H. GERMANY.