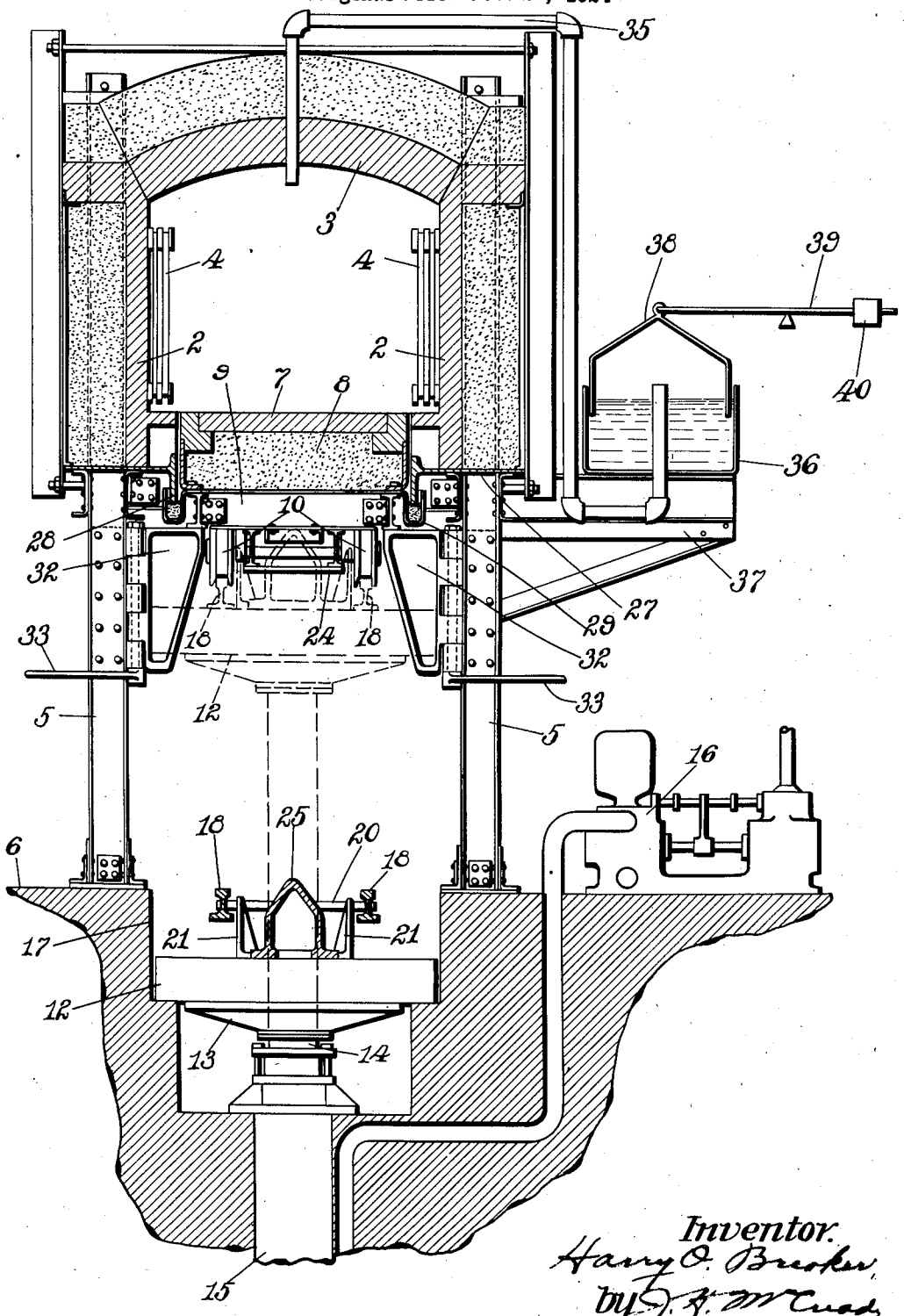
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HEAT TREATING FURNACE

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HEAT-TREATING FURNACE.

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This invention relates to furnaces for heat treating metal parts, and more especially to electric furnaces designed for this purpose. The invention is particularly concerned with the control of the atmosphere within the furnace.

It is frequently desirable to heat treat metal parts in an inert or non-oxidizing atmosphere for the purpose of preventing the scaling of the parts. This is particularly true when the parts under treatment have been partially or wholly machined since it permits the passing of the parts on to the next operation in a clean condition and eliminates any necessity for removing the scale. In some cases, also, it is necessary to carry on the heat treatment in an atmosphere of reducing gas or in a gas of some special composition.

The present invention deals with the problems presented by these conditions, and it aims to devise a furnace construction in which the gas within the furnace can be readily controlled, and in which the interchange of the gas in the furnace with the surrounding atmosphere shall be reduced to a minimum. It is also an object of the invention to devise an apparatus of this character which can be manufactured economically, will be convenient to use, and will have a high thermal efficiency.

In a prior application I have disclosed a furnace in which these objects are realized to a very satisfactory degree, and it is a further object of this invention to improve and perfect the furnace shown in my earlier application, with a view particularly to controlling even more accurately the atmosphere which comes in contact with the metal parts during their treatment.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawing, and the novel features will be particularly pointed out in the appended claims.

The single figure of the accompanying drawing is a vertical, cross sectional view of a furnace structure embodying the present invention, some of the parts appearing in elevation and some being indicated diagrammatically.

The construction shown comprises an electric furnace having side walls 2 and a top 3, these parts being made of any suitable materials and supported in a structural steel shell in the usual manner. It will be understood that these parts usually comprise a lining of vitreous brick, or other fire resistant material, backed by suitable heat insulating materials. In constructing this portion of the furnace the standard practice may be followed except that no openings are made other than those that may be required for observation purposes, and these are normally closed. Also, the walls and shell of the furnace should be made as gas tight as possible. Metallic resistors, indicated at 4, are secured to the side walls 2 and are connected with suitable sources of current to supply the necessary degree of heat to the furnace. The furnace is supported in an elevated position by means of structural steel members, indicated in general at 5, which rest on a suitable floor 6.

The hearth 7 of the furnace is mounted on, or forms part of, a bottom 8 which, in the present instance, is supported on a car, the frame or body of which is shown at 9, the wheels being indicated at 10. For the purpose of raising the bottom 8 of the furnace and the hearth 7 into their operative positions, as shown in the drawings, and lowering them out of said positions again to facilitate loading and unloading, these parts are mounted on the platform 12 of an elevator. Preferably the elevator is of the hydraulic type, including a plunger 13 and piston 14. The piston works in a cylinder 15 to which water or other fluid under pressure is supplied, as desired, by the pump 16. A pit 17 is formed in the floor 6 to receive the platform 12. In order to lock the car in its elevated position and permit the platform to be lowered, four stops are provided, two of which are shown at 32—32, these stops being pivoted to the upright frame pieces 5—5 and having handles 33—33 by means of which they may be swung into or out of their operative positions.

The fixed part of the furnace has a bottom plate 27 which is provided with a depending flange 28 that surrounds the opening normally closed by the bottom 8. As the furnace bottom 8 is moved into its cooperative relationship to the other parts of the furnace, this flange 28 is entered in a trough 29 which is secured to and surrounds the margin or outer edge of the bottom 8. This trough contains sand or some other sealing material into which the edge of the plate 28 is forced; so that as the furnace bottom is moved into its

operative position, the space between the bottom 8 and the side walls 2 is automatically sealed. The furnace thus forms an enclosure adapted to confine an atmosphere or body of gas and to substantially prevent interchange of this atmosphere with the surrounding atmosphere.

Located closely adjacent to the furnace is a gas holder comprising a tank 36 and a bell 38 telescoping within the tank. This holder is supported on a bracket 37 and it is connected with the upper part of the furnace by a pipe 35. The lower edge of the bell is sealed by a suitable liquid, such as a heavy mineral oil. A lever 39 connected to the bell and having a weight 40 adjustable thereon almost counter balances the bell so that it exerts only a slight pressure on the gas stored therein.

In using this furnace the oxygen contained in the air within the furnace becomes burned out very quickly and the gases remaining are inert, or at least, non-oxidizing. When the bottom of the furnace is lowered for the unloading and loading operations, the hot air or gas in the furnace remains pocketed therein due to the fact that the only opening in the furnace is at its bottom. Consequently, there is practically no tendency for this heated, burned out atmosphere to interchange with the surrounding atmosphere. Any such tendency further is reduced by the use of the gas holder. That is, when the bottom of the furnace is lifted into its operative position to introduce a new charge into the furnace and current is turned on to the resistors, the resulting increase in temperature expands the atmosphere within the furnace and part of this atmosphere is forced into the bell 38. After the heat treating operation has been completed and the current is turned off to allow the charge to cool, the gas pressure within the furnace falls and the gas previously forced out of the furnace is returned to the furnace again by the bell 38. Substantially the same atmosphere, therefore, is retained in the furnace and the gas holder almost indefinitely so that when the oxygen has once been burned out of this atmosphere, the remaining gases are held within the furnace and the gas holder substantially without change during the treatment of successive charges.

This is a very important practical advantage in preventing the scaling of metal parts during the heat treatment. It is of further advantage, also, in improving the thermal efficiency of the furnace since the walls of the furnace cannot give up their heat to the surrounding atmosphere as they do in furnaces of the ordinary construction where a free circulation of cold air is permitted through the furnace whenever it is opened. This arrangement, also, is of advantage when a gas or gases other than the atmospheric gases, are introduced into the furnace in connection with the heat treating processes.

The arrangement provided by this invention is of particular advantage where some special means is employed to expedite the cooling of the charge within the furnace after the heat treating operation has been completed. For example, provision may be made for circulating the atmosphere within the furnace through some cooling means and returning this atmosphere to the furnace again, this circulation being continued until the temperature of the charge has been lowered below the scaling point. The circulating operation is then stopped and the furnace opened and the charge removed. When such an arrangement is employed, the gas bell automatically supplies inert gas to the furnace as the cooling operation progresses.

While I have herein shown and described the best embodiment of my invention that I have so far devised, it will be appreciated that the invention may be embodied in other forms without departing from the spirit or scope thereof.

Having thus described my invention, what I desire to claim as new is:

1. An apparatus of the character described, comprising, in combination, an electric furnace including fixed top and side walls and a removable bottom, an elevator for raising said bottom into its cooperative relationship to the other parts of the furnace and for lowering it out of said relationship, and means connected with said furnace for receiving gas displaced from the furnace and for subsequently returning said gas again to the furnace.

2. An apparatus of the character described, comprising, in combination, an electric furnace including fixed top and side walls and a removable bottom, an elevator for raising said bottom into its cooperative relationship to the other parts of the furnace and for lowering it out of said relationship, and a gas holder communicating with said furnace, said holder and furnace cooperating to form an enclosure for retaining a given body of gas substantially without interchange with the surrounding atmosphere.

3. An apparatus of the character described, comprising, in combination, an electric furnace including fixed top and side walls and a removable bottom, an elevator for raising said bottom into its cooperative relationship to the other parts of the furnace and for lowering it out of said relationship, an expansible gas holder, and a pipe connecting the interior of said furnace with said gas holder, whereby gas forced out of the furnace upon an increase in pressure therein will subsequently be returned to the furnace automatically when the gas pressure in the furnace is reduced.

4. An apparatus of the character described,

comprising, in combination, an electric furnace including fixed top and side walls and a removable bottom, an elevator for raising said bottom into its cooperative relationship to the other parts of the furnace and for lowering it out of said relationship, a gas bell, a tank in which said bell is mounted, a sealing liquid in said tank, a counter balance for said bell, and pipe connections between said bell and the upper part of said furnace permitting a free flow of gas in either direction between said bell and furnace.

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