April 2, 1935. E. F. KENNEY 1,996,295

FURNACE AND PROCESS OF HEATING

Filed Feb. 12, 1932 2 Sheets-Sheet 1

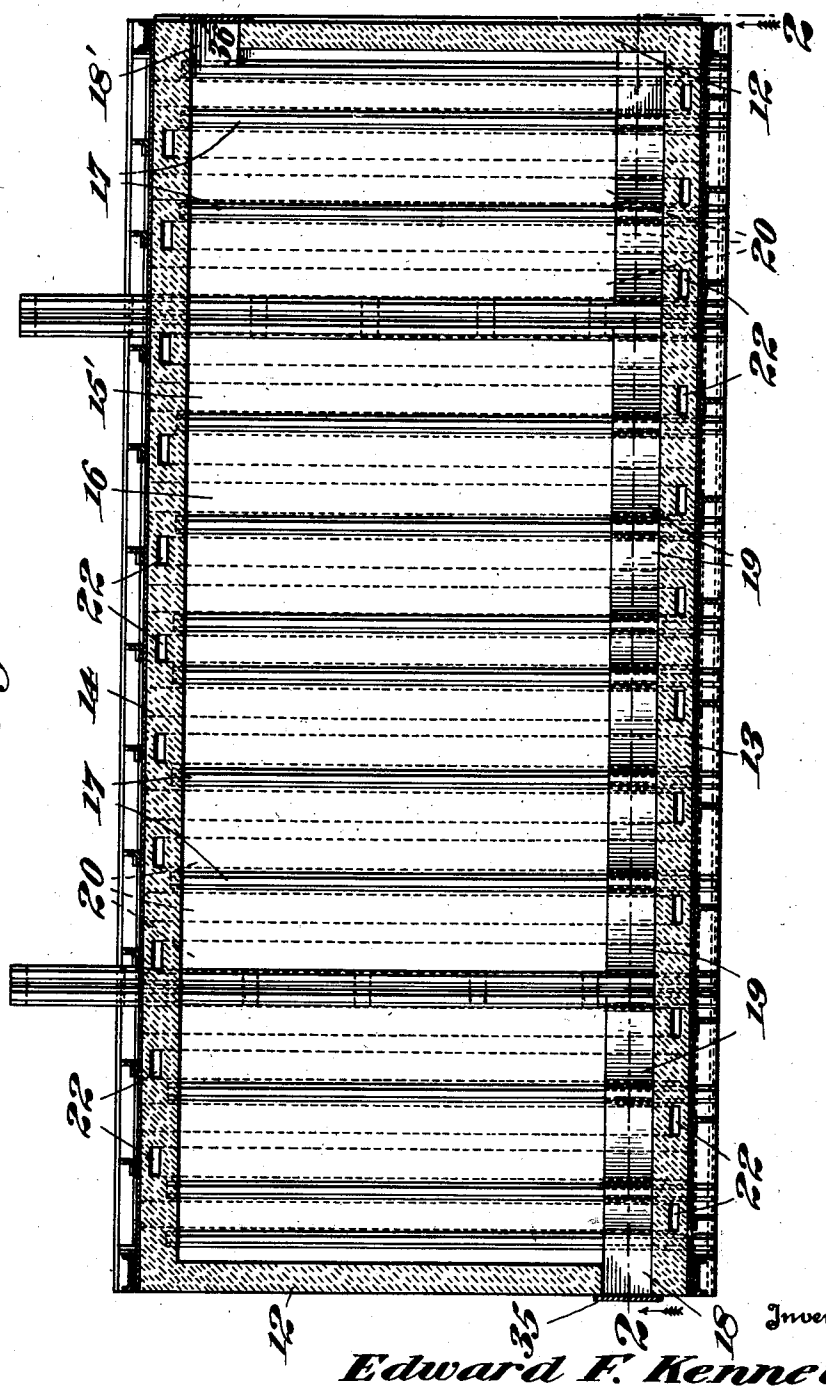

Fig. 1.

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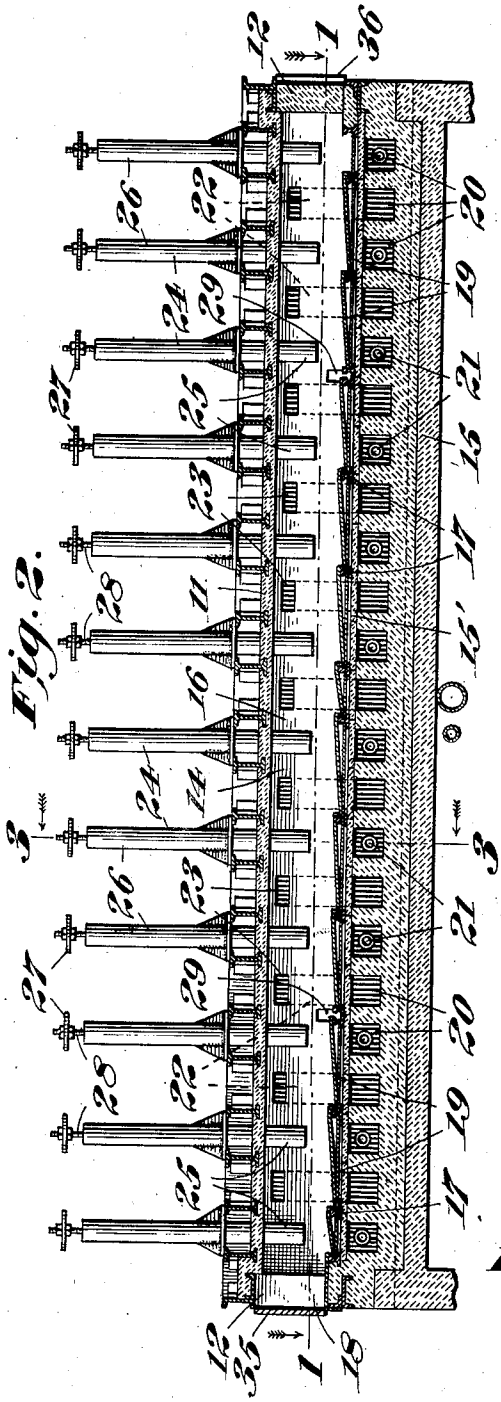

Fig. 2.

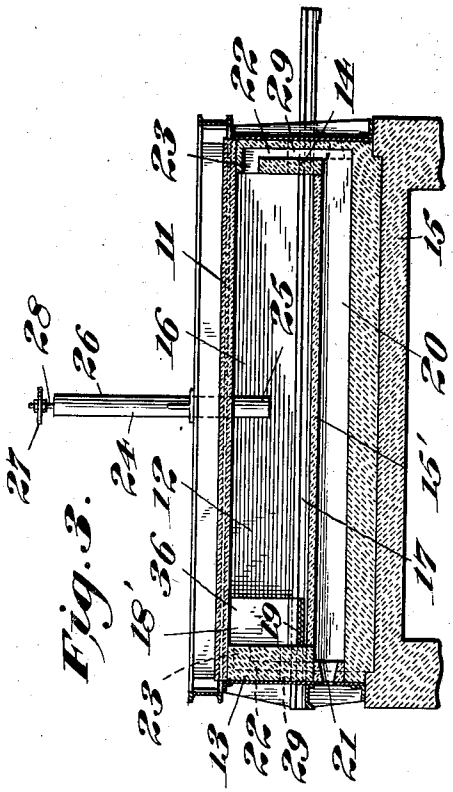

Fig. 3.

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FURNACE AND PROCESS OF HEATING

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5 Claims. (Cl. 263—6)

My invention relates to furnaces and processes of heating. Particularly it relates to furnaces and processes for the heating of rails.

In the treatment of metal bodies it is common practice to subject them to various heating processes for a variety of purposes, annealing for example. Elsewhere I have set forth processes for the heat treatment of rails in which the rails while still above the critical range are quenched in water or other medium and then subjected to an equalizing treatment in a lead bath or in furnaces. In such processes the rails, following such equalization are kept subjected for a more or less protracted period at a somewhat elevated temperature to remove any possible stresses or strains that may be present. If a furnace is used for the equalizing or "annealing" operations it is important that the rails be kept at a very uniform temperature. Consequently it is very important that the furnace chamber be maintained in such a state as to give the greatest possible uniformity of heating effect.

The invention of this present disclosure is primarily concerned with equipment and processes for securing uniform temperatures of metal bodies which are being subjected to heat treatments of one kind or another.

My furnace and heating process involve heating the articles conductively and radiatively from the bottom of the furnace and the introduction of heating gases into the furnace chamber to heat them from above.

To secure the conductive and radiative heating from the bottom of the furnace chamber I pass a multiplicity of streams of heated gases beneath the floor of the furnace chamber, alternate streams being in opposite directions. The heated gases from these streams after heating the bottom are introduced into the furnace chamber at a multiplicity of points alternately on opposite sides of the furnace and the waste gases are then removed from the furnace chamber at a multiplicity of points uniformly distributed along the median line of the furnace. The inventions can be better understood after a more or less specific description of a particular embodiment has been given. Accordingly, referring to the accompanying drawings:

Fig. 1 is a horizontal section through the side and end walls of the furnace giving a plan view of the floor of the furnace chamber and taken on lines 1—1 of Fig. 2;

Fig. 2 is a vertical longitudinal section taken on the lines 2—2 of Fig. 1; and

Fig. 3 is a vertical cross section taken on the lines 3—3 of Fig. 2, at right angles to the showing of Fig. 2.

The furnace is a rectangular structure and comprises masonry roof 11, end walls 12, front and back walls 13 and 14, and base 15 enclosing the furnace chamber 16.

Disposed transversely of the furnace, on the chamber floor 15' are skid rails 17 upon which the rails to be treated are adapted to rest, the rails being disposed longitudinally of the furnace and therefore extending transversely relatively to the skid rails. Openings 18 and 18', having closures 35 and 36, are disposed in the ends of the furnace through which rails are adapted to be charged and through which they are to be removed upon the completion of their furnace treatment. Plates 19 are disposed at one side of the furnace chamber opposite the opening 18, one end of each plate resting upon a skid and the other upon the chamber bottom 15', the plates thus being somewhat inclined from the horizontal in a direction away from the charging opening 18. These plates serve the function of protecting the skids during charging of the furnace and also facilitate the easy entrance and disposal of the rails on the skids during charging.

Disposed in the bottom of the furnace are a multiplicity of ducts or channels 20, extending substantially the full width of the furnace and provided for substantially the entire length thereof. These conduits are relatively close together and are separated from the furnace chamber by masonry of relative thinness, say a single brick thickness. Each of these conduits is provided at one end with a burner opening 21 and at the other end communicates with a vertical duct 22 in the side of the furnace, which in turn communicates with the interior of the furnace by passageway 23. The burner ends of channels 20 are disposed alternately on opposite sides 13 and 14 of the furnace, ducts 22 and passageway 23 likewise being disposed alternately on opposite sides. As a result the heated gases from the burner in each channel and ducts 20 and 22 respectively, travel in opposite direction from the gases in the adjacent channels and ducts. Thus the floor of the furnace chamber is heated conductively from beneath by a multiplicity of streams of gas flowing alternately in opposite directions and the rails in the furnace are heated above by the hot gases which are introduced into the furnace at a multiplicity of points alternately on opposite sides of the furnace chamber.

Uniformly distributed along the median line of the furnace roof is a multiplicity of waste gas

pipes or conduits **24** the lower portions **25** of which project into the interior of the furnace chamber and the outer portions **26** extend above the furnace structure. Each of pipes **24** is provided with a damper plate **27** adjustably mounted by screw thread arrangement on rods **28** mounted at the upper ends of pipes **24**.

Openings **29** are provided in the masonry of the side walls **13** and **14** through which tools may be inserted for moving the rails laterally of the furnace chamber to progress such rails transversely from the region adjacent side **13** where the rails are charged toward side **14** where the rails are removed through an opening **18'** which is provided with a closure **36**.

A brief outline will now be given of the method of application of our inventions to the treatment of rails. In describing this operation reference will be made to a process for the heat treatment of rails in which the rails from the mill are first quenched through the critical range by immersing the rails in water for a limited period of time and then while still hot but with the temperature of the metal below the critical range are immersed in a bath of molten lead to quickly equalize the temperature, this lead bath treatment taking but a limited period of time. The rails thus equalized are introduced into the furnace shown, being charged longitudinally through opening or door **18**, such charging of course occurring at intervals depending upon the time required for the previous operations. As fast as the rails are charged into the furnace they are moved transversely of the furnace chamber being pushed laterally by means of tools inserted through openings **29** in the side wall **13**. From time to time rails are removed from the furnace through the door or opening **18'** from the side of the furnace adjacent wall **14**. The capacity of the furnace and the rate of introduction of the rails are such that the rails remain within the furnace chamber the desired period of time to effect the desired changes in the conditions of the rail metal such as the relief of strains.

By the arrangement disclosed it is possible to subject the rails to very uniform heat conditions. Because of the ducts or channels **20** in the floor of the furnace chamber their distribution for substantially the entire length of the furnace chamber, their closeness together, and the fact that the streams of heating gases flow alternately in opposite directions effect a very uniform heating of the chamber floor. The rails being supported adjacent the floor are very uniformly heated conductively and radiatively therefrom. Likewise very uniform temperature conditions are secured as the result of the mode of distribution of the heating gases in the furnace chamber. The introduction of the heating gases from the sides of the furnace at a multiplicity of uniformly distributed points substantially along the entire length of the furnace, and alternately in opposite directions contribute to this effect. A further feature that is of considerable importance in the uniform heating of the furnace is the removal of the waste gases from the furnace chamber at a multiplicity of points along the median line of the furnace. A point worthy of note in this connection is the fact that the inlet ends of the waste gas pipe **24** extend a substantial distance within the furnace chamber, portions **25**, the inlet ends in fact being sufficiently low in the furnace chamber so that they are in proximity to the rails being treated. All of these conditions result in a very uniform distribution of the heating gases in the furnace chamber with resulting uniformity of temperature conditions.

Obviously it is not intended that the invention shall be limited to the treatment of rails following a quenching and equalizing operation. The furnace itself may be employed for the equalizing step, omitting the lead bath or equivalent treatment. The furnace, in fact, may be used for any type of operation where it is desired to heat objects, whether rails or otherwise.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a process for the treatment of rails, the steps of charging the rails progressively in a chamber, moving the rails progressively transversely of their length, heating the rails radiatively from the bottom of the chamber substantially uniformly along their lengths, passing a multiplicity of streams of hot gases in proximity to each other within the chamber transversely of the length of the rails from opposite directions substantially along the entire length of the rails, and removing the rails progressively from the chamber.

2. In a heat treatment furnace, a bottom adapted to support the bodies to be treated, a multiplicity of gas conducting channels adjacent to each other in the bottom of the furnace communicating at their ends with the interior of the furnace at alternate sides of the furnace, said channels being distributed substantially the entire length of the furnace and adapted to heat the bottom to substantially uniform temperatures, and a multiplicity of waste gas conduits uniformly distributed along the length of the furnace in the upper part of the furnace chamber, the gas entry ends of the conduits being located at positions intermediate the roof and the bottom of the furnace chamber.

3. In a heat treating furnace having a furnace chamber adapted to receive the articles to be treated, a multiplicity of gas conducting channels adjacent each other at the bottom of the furnace extending crosswise of the furnace and distributed along substantially the entire length thereof, a multiplicity of ducts in the sides of the furnace opening into the interior of the furnace chamber at their upper ends and communicating at their lower ends with ends of said channels, said ducts being disposed alternately at opposite sides of the furnace, and a multiplicity of regularly spaced discharge flues disposed substantially along the median line of the furnace chamber, said flues projecting into the furnace chamber so that their inlet openings are disposed between the roof and the bottom of the furnace chamber.

4. In a process for the treating of metal articles having a great length relative to their other dimensions, the steps of charging the articles in a chamber, supporting the articles in proximity to the bottom of the chamber, heating the bottom of the chamber from beneath substantially uniformly along the lengths of the articles to heat them radiatively from the bottom, introducing a multiplicity of streams of heating gases into the chamber from both sides thereof transversely of and substantially uniformly along the entire length of said articles, and removing gases from the chamber at points spaced at frequent intervals along the lengths of the articles and in proximity thereto.

5. In a furnace having a furnace chamber pro-

vided with a bottom adapted to support articles having a great length with respect to their cross sectional dimensions, means for introducing a multiplicity of separate streams of heating gases through inlet openings distributed along opposite sides of the furnace chamber for substantially the full length thereof, a multiplicity of gas exit flues disposed at frequent intervals along substantially the median line of the furnace chamber, said flues projecting into the furnace chamber and having their inlet openings disposed in a plane below the plane of said inlet openings.

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