

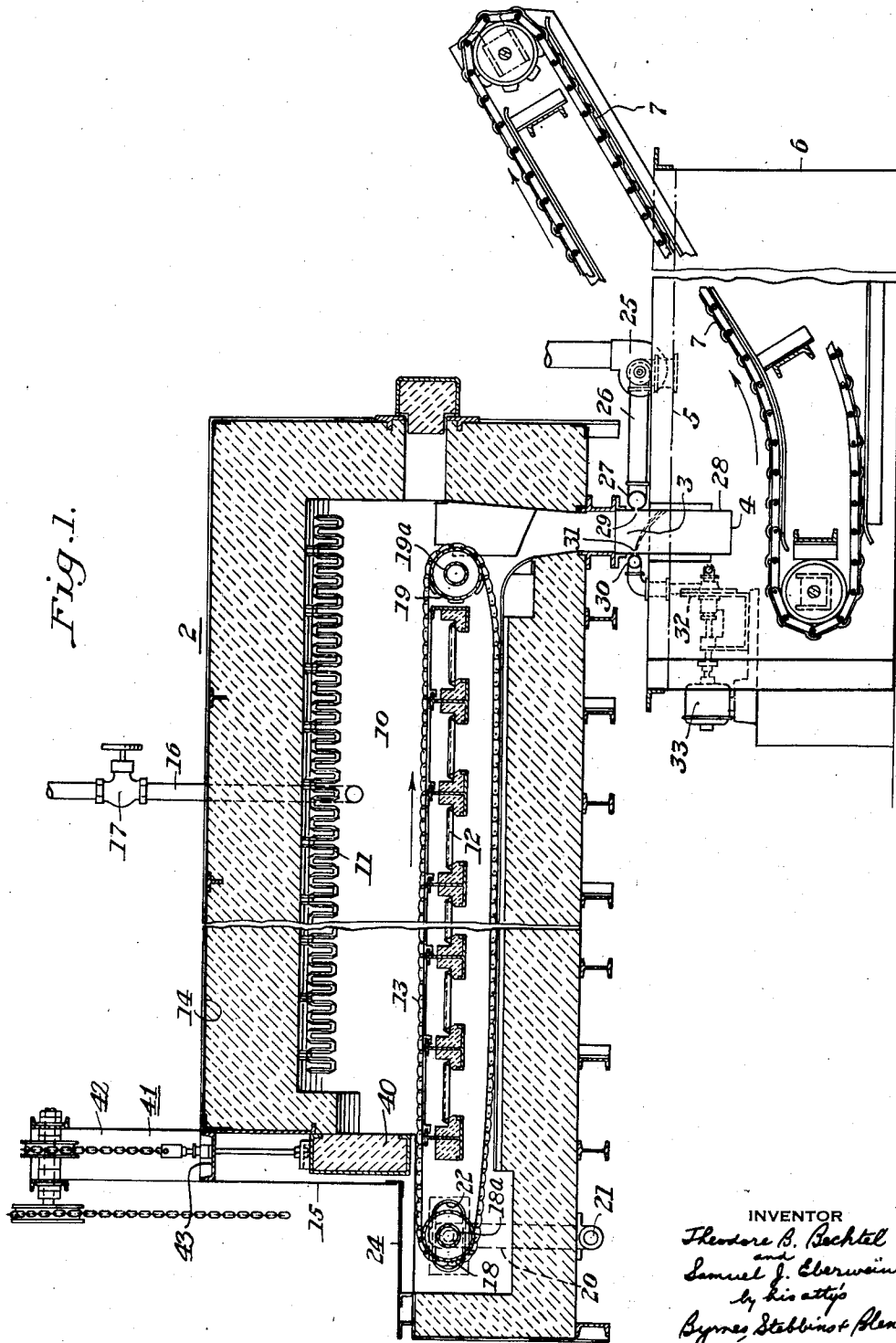
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HEAT TREATING

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HEAT TREATING

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This invention relates generally to heat treating, and more particularly to apparatus and method for hardening steel or other articles.

In the accompanying drawing, which illustrates a present preferred embodiment of our invention,

The figure is a longitudinal section through a heat treating furnace, the figure also showing a quenching bath and associated apparatus.

In the type of heat treating to which the present invention relates, the articles to be heat treated are heated in a furnace and then discharged into a quenching bath, such, for example, as oil or water, the articles being discharged from the furnace through a discharge passage having its exit end extending below the surface of the quenching bath. We have found that when heated articles fall into the quenching bath, some of the fluid is likely to splash upon the walls of the discharge passage. These surfaces are unavoidably at a high temperature, which results in the vaporization of the fluid. Furthermore, considerable radiant heat reaches the surface of the quenching bath through the discharge passage, which produces considerable vaporization of the portion of the bath which is within the discharge passage. If the quenching bath is water or a solution or emulsion containing water, much steam will reach the interior of the furnace chamber and come in contact with the heated work. If this is permitted, the work will be damaged even in the presence of a protective atmosphere in the furnace. If an oil bath is used as the quenching medium, the oil vapors coming into contact with the heated brickwork deposit solid carbon which may quickly accumulate in injurious quantities, thereby causing damage to the brickwork or short-circuiting the electric resistance heating elements used for heating the work.

In accordance with the present invention, the disadvantages caused by splashing of the quenching medium onto the walls of the discharge passage of the furnace, or the vaporizing of the quenching medium and the entrance of the vapors into the furnace are eliminated or diminished by providing means communicating with the discharge passage for preventing the vapors from entering the furnace. This may be accomplished, for example, by providing means for exhausting from the discharge passage at a point intermediate the quenching bath and the furnace. Preferably some of the protective gas which is supplied to the heating furnace is caused to flow downwardly through a

portion of the discharge passage so as to oppose the upward flow of vapors from the quenching bath, and the protective gas together with any vapors from the quenching bath are exhausted from the discharge passage. Another method of preventing the vapors from the quenching bath entering the furnace is to project a curtain or sheet of quenching fluid across the discharge passage so as to form a barrier which prevents the entrance of the vapors from the quenching bath into the furnace. If desired, a curtain of quenching fluid may be employed in conjunction with the means for exhausting the protective gas and vapors from the quenching bath from the discharge passage.

Referring now more particularly to the accompanying drawing, the articles to be heat-treated are conveyed through a furnace indicated generally by the reference numeral 2 and are then discharged through a discharge passage 3, the lower end 4 of which extends below the surface 5 of a quenching bath contained in a quenching tank 6. The articles fall onto a conveyor 7 which removes them from the quenching bath and deposits them on the floor or into a receptacle, not shown.

The furnace 2 is provided with a heating chamber 10 heated by electrical resistance heating elements 11 located adjacent to the top of the chamber, and by electrical resistance heating elements 12 located between the upper end and lower strands of a chain conveyor 13 which carries the articles through the furnace. The entire furnace is provided with an outer sheet metal casing 14 which encloses the furnace and includes a door housing 15, the casing preventing the escape of protective gas supplied to the chamber 10 through a pipe 16 having a control valve 17. A sufficient quantity of gas is admitted to maintain an outward flow through the charging opening 24 so as to prevent the entrance of air at this point. The protective gas used is commonly of a combustible character and in such cases it burns as it escapes. The chain conveyor 13 passes around an idler drum 18 and a driving drum 19 supported, respectively, by shafts 18a and 19a. The drum 18 is mounted so that it may be adjusted to vary the tension on the conveyor chain. The shaft 18a is mounted on two arms 20 pivoted as indicated by the reference numeral 21 so that the shaft and drum may be moved toward or away from the front end of the furnace. The shaft 18a extends through slots 22 formed in the sides of the furnace and is provided with sliding seal plates

which effect substantially complete closure of the slots regardless of the position of the shaft.

The articles to be heat treated are charged into the furnace through a charging opening 24 and are deposited on the chain conveyor 13 at a point adjacent the drum 18. They are carried by the conveyor in the direction indicated by the arrow until they reach the drum 19, at which time they fall off the conveyor and are discharged through the discharge passage 3 into the quenching bath, from which they are removed by the conveyor 7 as previously described. An adjustable door 40 is located within a housing adjacent the front end of the furnace. The housing, indicated generally by the reference numeral 41, consists of two upright channel shaped columns 42, a horizontal channel 43 extending between the two columns 42, and a front plate 15 which is removably connected to the upright and horizontal channels. The door 40 is normally kept open just enough to clear the work which is loaded onto the conveyor through the charging opening 24. Since the height of the work may vary, the position of the door 40 is made adjustable so as to prevent loss of excessive amounts of heat and protective gas from the furnace. Also, if at any time it is necessary to get into the furnace to make repairs, the plate 15 can be removed and the door 40 raised to admit a workman.

In order to prevent vapors arising directly from the quenching bath, or vapors due to vaporization of quenching liquid which may splash onto the walls of the discharge passage 3 from entering the furnace, we provide an exhaust fan 25 connected by a pipe 26 to a pipe 27 which is welded to the outside of a chute 28, forming a part of the discharge passage 3. The pipe 27 is provided with a slot 29, as is also the chute 28, so as to place the interior of the discharge passage 3 in communication with the exhaust fan 25. A portion of the protective gas admitted into the furnace through the pipe 16 flows downwardly into the discharge passage 3 and is exhausted through the opening 29 by the fan. In its downward passage through a portion of the discharge passage 3, the protective gas opposes the upward flow of vapors from the quenching bath above the point 29 where the fan communicates with the discharge passage. This effectually prevents entrance of the vapors from the quenching bath into the furnace.

In addition to the exhaust fan, we may also provide the discharge passage with means for projecting a fluid curtain across the discharge passage, which further aids in preventing vapors from the quenching bath entering the furnace. In the embodiment shown, a pipe 30 provided with a slot 31 cooperating with a corresponding slot in the wall of the discharge passage is connected to a pump 32 with its intake

connected to the quenching bath. The pump is driven by a motor 33 so as to force quenching liquid from the quenching bath through the opening 31 in the form of a sheet or curtain which extends across the discharge passage 3. This curtain of quenching liquid further seals the discharge passage and, in addition, cools it so as to materially decrease the amount of vaporization of the quenching bath.

Instead of providing a fan for exhausting the vapors from the discharge passage, a stack of sufficient height may be employed. The quenching fluid used to form a curtain across the discharge passage may, if desired, be obtained from a source separate from the quenching bath itself. Thus, if water is used as the quenching medium, it may be supplied from a water main to the pipe 30 instead of being pumped from the quenching bath. Where oil is employed as the quenching medium, it may be supplied to the pipe 30 from a cooling system through which the heated oil flows from the quenching bath. The gases may be exhausted from the discharge passage or a fluid curtain may be employed, or both of these means may be used in conjunction with each other.

The invention is applicable irrespective of the particular type of furnace or quenching tank. It has been applied, for example, to pusher type furnaces for carburizing and hardening articles, and to continuous furnaces of the strand conveyor type for heat treating non-ferrous metal in coils, and for other purposes.

We have illustrated and described the present preferred embodiment of our invention. It is to be understood, however, that the invention may be otherwise embodied or practiced within the scope of the following claims.

We claim:

1. Apparatus for heat treating, comprising a quenching bath, a furnace having a discharge passage through which the articles heated in the furnace are discharged into the quenching bath, the discharge passage extending below the surface of the bath, means for supplying protective gas to the furnace, means for exhausting vapors from the discharge passage, and means for projecting a fluid curtain across the discharge passage.

2. In the method of heat treating wherein the articles are heated in a furnace in the presence of protective gas and delivered through a discharge passage extending below the surface of a quenching bath, the steps comprising exhausting vapors from said passage and projecting a fluid curtain across the discharge passage, thereby preventing the entrance of vapors from the quenching bath into the furnace.

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