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CONTINUOUS HEAT TREATING APPARATUS.
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1,234,257.

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2 SHEETS-SHEET
Continuous Heat-Treating Apparatus.

1,234,257.

To all whom it may concern:

Be it known that we, THADDEUS F. BAILY and FRANK T. COPE, of Alliance, Ohio, assignors to the ELECTRIC FURNACE COMPANY, of Alliance, Ohio, a corporation of Ohio, have invented a new and useful Continuous Heat-Treating Apparatus, of which the following is a specification.

Our invention relates to improvements in heat treating furnaces and has more especial reference to a hardening furnace arranged in combination with an annealing furnace and quenching device arranged to receive the charge from the hardening furnace and carry the charge to the annealing furnace. The object of our invention is to provide a heat treating furnace in which billets or the like are fed automatically through a hardening furnace and discharged therefrom into a quenching device from which they are carried to an annealing furnace and fed automatically therethrough.

Another object is to provide a device of this character in which the mechanism for automatically feeding and discharging the billets is operated by electrical devices controlled by the temperature of the furnace.

With these objects in view the invention consists in the novel construction and arrangement of parts hereinafter described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, being understood that various changes in the form, proportions, size and minor details of construction may be made within the scope of the appended claims without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawings:

Figure 1 is a diagrammatic view of a heat treating furnace constructed in accordance with our invention.

Figure 2 is an enlarged view of one of the furnaces showing the operating mechanism in detail.

Similar numerals of reference indicate corresponding parts throughout the several figures of the drawing.

Repeating more especially to the construction illustrated in the accompanying drawings, the numeral 1 indicates generally the hardening furnace provided with the entrance and exit openings 2 and 3 respectively, said openings being normally closed by means of the sliding doors 4 and 5 respectively. A suitable billet support 6 extends through the heating chamber 7 of the furnace, the extremities of said support being extended through the entrance and exit openings 2 and 3 forming stops for the doors 4 and 5 as indicated at 8 and 9, the extremity designated by the numeral 8, which extends out through the entrance opening, being preferably of suitable length to form a receiving table upon which the billets may be placed preparatory to being passed into the heating chamber, the inclined extremity designated by the numeral 9, which extends out and through the exit opening, being arranged to carry the treated or hardened billets from the hardening furnace to the quenching trough. Resister troughs 20 may be provided for electrically heating the furnace or any other heating device may be employed to keep the temperature of the heating chamber at the desired degree.

A thermo-couple 10 of any usual and well known type is located in the heating chamber adjacent the exit opening 3 and is connected by wires 11 with a pyrometer 12 of any suitable construction. The pyrometer 12 is provided with an arm 13 connected to a wire 14 upon which wire is located a battery or other suitable source of current 15, said wire being connected to a relay 16, which relay is connected by means of a wire 17 with a contact point 18 upon the pyrometer.

The armature 19 of the relay 16 is connected by means of a wire 20 with the solenoid 21, a wire 22 connecting said solenoid with the contact point 23 adapted to be engaged by the armature 19, a battery 24 being interposed upon said wire 22. The contact plate 25 is adapted to be engaged by the pivoted arm 26, said contact plate being connected by means of a wire 27 with the solenoid 28, a battery 29 being interposed on said wire 27.

The armatures 30 and 31 of the solenoids 31 and 28 respectively are pivotally connected to a rock arm 32 which controls the three-way valve 33. A water supply line 34 and a water discharge line 35 are connected to said valve and are adapted to be connected, as desired, by means of the valve, with the pipe 36, which supplies the pusher cylinder 37 and the door operating cylinder 100.
28. A branch pipe 39 connects the pipe 36 with the upper end of the pusher cylinder 37. A piston 40 is mounted within the cylinder 37 and the rod 41 thereof is pivotally connected to the arm 42 of a bell crank lever, which is pivoted at 43, the arm 44 of said bell crank lever being pivotally attached to the pusher arm 45. A counterweight 46 is mounted upon a cable 47, which passes over the pulley 48, said cable being connected to the upper extremity of the arm 44, the counterweight normally holding the bell crank lever in the position shown in the drawings. A finger 49 is provided upon the bell crank lever and adapted to move the pivoted arm 26 into contact with the plate 25. The extremity of the pipe 36 is connected to the lower end of the door lifting cylinder 38 within which cylinder is mounted a piston 50 to the rod 51 of which are connected the cables 52 and 53, said cables passing over suitable pulleys 54 and 55 respectively, carrying the doors 4 and 5 respectively.

The inclined portion 9 of the billet support extends into the quenching tank 30, said tank containing a quantity of water for the purpose of quenching the billets as they are received from the hardening furnace. Located within the tank 30 and extending to the entrance of the annealing furnace 57 is an endless conveyor 58 provided at intervals with lugs 59 adapted to carry the billets, as they are received from the inclined support 9, through the quenching tank and to the entrance of the annealing furnace where they are deposited upon the billet support of the annealing furnace in a position to be pushed into the annealing furnace when the entrance door thereof is raised and the pusher mechanism connected thereto is operated. The endless conveyor chain 58 passes over the pulleys 60 and 61 located within the tank and adjacent the entrance of the annealing furnace respectively and said conveyor is continually operated in the direction of the arrow shown thereon by any suitable power applied to either of the pulleys.

The annealing furnace 57 is of substantially the same construction as the hardening furnace 1 and is provided with the same mechanism for carrying the material therethrough and it is therefore not thought necessary to further describe the annealing furnace in detail as the description of the hardening furnace is also a description of the annealing furnace. It will of course be understood that any other mechanical means than the fluid operated cylinders shown in the drawings may be used to operate the doors and pusher mechanism and that any other suitable electrical mechanism controlled by the temperature of the furnace may be used to control the operation of the mechanical mechanism, the showing disclosed and described being merely to illustrate the invention.

The hardening furnace is arranged to be operated at a temperature of 1600° F. and the annealing furnace 57 is arranged to operate at 900° F. It will, of course, be understood that if desired these furnaces may be arranged to operate at different temperatures than the above. Both of the furnaces may be arranged to operate from one temperature measuring instrument if desired, no claim being made to the specific construction of the electrical and mechanical mechanism for operating the furnaces, this mechanism being claimed specifically in a copending application, Serial Number 27,795, filed May 13, 1918.

The billets indicated by the letter A are placed one at a time upon the extension 85 of the billet support of the hardening furnace 1, the several movable parts of the device being then in the normal position as shown in the drawings. As the temperature in the rear end of the heating chamber 70 adjacent the thermo-couple 10 reaches the proper degree the thermo-couple causes the pyrometer 13 to operate, moving the arm 13 into engagement with the contact plate 18 closing the circuit from the battery 15 through the relay 16 and drawing the armature 19 of the relay into engagement with the contact plate 23, thus closing the circuit from the battery 24, through the solenoid 21. After the armature 30 of the solenoid 21 operates the arm 32 is drawn toward said solenoid, connecting the pipe 36 with the water supply 34.

The water passing through the pipe 36 and through the branch pipe 39 operates the pistons 40 and 50 in the cylinders 37 and 38, opening the doors 4 and 5, of the furnace 1, and pushing the billet which has been placed upon the outside of the door 4 into the heating chamber against the other billets located in the heating chamber, moving all of said billets upon the support 6. The billet adjacent the door 5, being heated to the proper degree, is pushed from the furnace, through the door 5 and down the inclined chute 9 into the quenching trough where it is properly quenched and picked up by the continuously operating endless carrier 68 which carries said billet upwardly and deposits it upon the pipe 38 of the annealing furnace 57, from where said billet is carried through the annealing furnace in the same manner as has been moved through the hardening furnace, the mechanism connected with the annealing furnace operating in the same manner as the above described mechanism with the exception, as above stated, that the annealing furnace operates at a lower temperature than the hardening furnace.
As the finger 49 comes into contact with the pivoted arm 26, it moves said arm into contact with the contact plate 25, closing the circuit from the battery 29 through the solenoid 28. The temperature within the heating chamber of the furnace, will, by this time, have been lowered sufficiently to cause the arm 13 of the pyrometer to move into contact with the contact point 18, thus breaking the circuit to the relay 16, allowing the armature 19 thereof to drop out of contact with the plate 23, breaking the circuit from the battery 24 to the solenoid 21.

The armature 31 of the solenoid 38 will then be operated, moving the arm 32 back into the position shown in the drawings, operating the valve 33, connecting the pipe 36 with the discharge pipe 35. The weight of the doors 4 and 5 will then cause them to close and the counterweight 46 will bring the pusher back to the normal position, shown in the drawings, rocking the bell crank lever and moving the finger 49 away from the pivotal arm 26 allowing said arm to move out of contact with the plate 28, thus de-energizing the solenoid 28.

By the construction above described and illustrated in the accompanying drawings it will be seen that the operation of the furnace is entirely automatic, depending upon the temperature at the discharge end of the heating chamber being raised to the proper degree to operate the pyrometer which controls all of the mechanism. It will be understood that the apparatus diagrammatically shown in the drawings, is merely one of many different forms of apparatus which may be used to carry out the operation of the furnace without departing from the spirit of the invention.

We claim:

1. A continuous heat treating apparatus comprising a heating furnace, a quenching bath, a reheating furnace, means for moving material under treatment through said heating furnace and into said quenching bath, independent means for moving separate or distinct articles of the material from said quenching bath to said reheating furnace, means for moving the material through said reheating furnace, a thermally controlled device controlled by the temperature of each furnace and electrical controlling means forming an operative connection between said thermally controlled device, and said means for moving the material through the furnaces.

4. A continuous heat treating apparatus comprising a heating furnace, a quenching bath, a reheating furnace, electrically controlled means for moving material under treatment through said heating furnace and into said quenching bath, independent means for moving separate or distinct articles of the material from said quenching bath to said reheating furnace, electrically controlled means for moving the material through said reheating furnace, a temperature measuring device adapted to measure the temperature of the material contained in each furnace and electrical controlling means forming an operative connection between said temperature measuring devices and said electrically controlled means for moving the material through the furnaces.

5. A continuous heat treating apparatus comprising a heating furnace, a quenching bath, a reheating furnace, means for moving the material to be treated through said heating furnace and into said quenching bath, independent means for moving separate or distinct articles of the material from said quenching bath to said reheating furnace, means for moving the material through the reheating furnace, an electrically operated device controlling the operation of said means for moving the material through the reheating furnace, the furnaces, an electric circuit connected to each of said electrically operated devices, a temperature measuring device arranged to measure the temperature of the material in each of said furnaces and electrical controlling means forming an operative connection between said temperature measuring devices and said electrically operated devices.

6. A continuous heat treating apparatus comprising a heating furnace, a quenching bath, a reheating furnace, a pusher for moving material under treatment through said heating furnace, and into said quenching bath, independent means for moving separate or distinct articles of the material from the quenching device to the reheating furnace, a pusher for moving the material through the reheating furnace, means for operating said pushers, temperature measuring means for controlling the operation of the furnace.
uring means for measuring the temperature of the heating chambers of said furnaces, and electrical controlling means forming an operative connection between the temperature measuring means and said means for operating the pushers.

7. A continuous heat treating apparatus comprising a heating furnace, a quenching bath, a reheating furnace, a heating chamber in each of said furnaces, temperature measuring means connected to each of said heating chambers, mechanical means for passing material under treatment through each of said heating chambers, electrical controlling means forming an operative connection between said temperature measuring means and said mechanical means and independent means for moving separate or distinct articles of the material through said quenching bath to said reheating furnace.

8. A continuous heat treating apparatus comprising a heating furnace, a quenching bath, a reheating furnace, a heating chamber provided in each of said furnaces and having an entrance end and an exit end, means for applying heat to said chambers, said heat being at a maximum near the exit ends, a temperature measuring device near each exit end, means for forcing material to be treated from the entrance end toward the exit end of each heating chamber, said means being controlled by the temperature measuring device and independent means for carrying separate or distinct articles of the material through the quenching trough to the reheating furnace.

In testimony that we claim the above, we have hereunto subscribed our names.

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