March 31, 1936. L. JACOBSMEYER 2,035,890

HEAT TREATING MACHINE

Filed Feb. 11, 1935 2 Sheets-Sheet 1

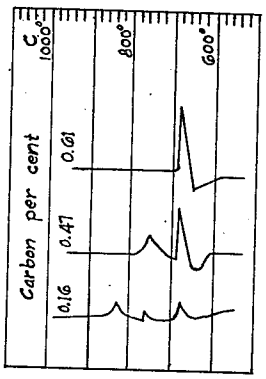


Fig. 2

Fig. 1

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Fig. 3

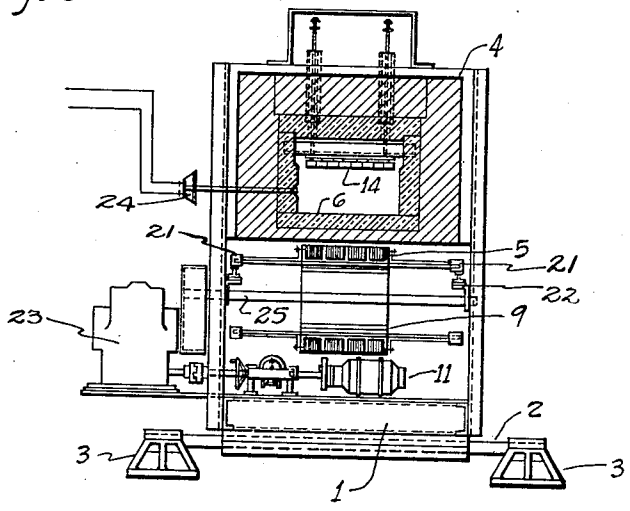
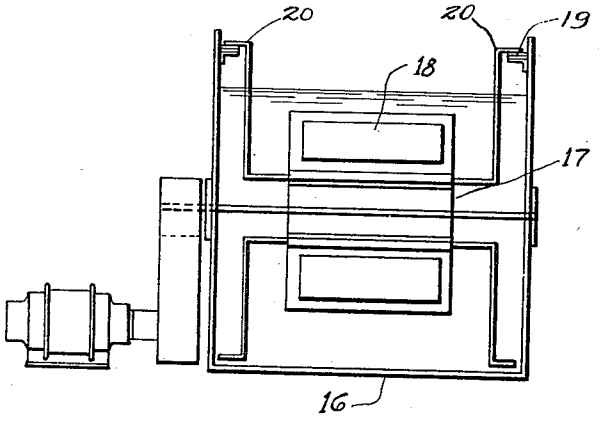


Fig. 4



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UNITED STATES PATENT OFFICE

2,035,890

HEAT-TREATING MACHINE

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Application February 11, 1935, Serial No. 5,997

4 Claims. (Cl. 266—4)

This invention relates to a machine for heating and then quenching or chilling articles of steel and operates automatically to perform the quenching operation when the articles are definitely at the required temperatures.

Changes in magnetic responsiveness of the articles according to temperature are made use of in controlling the delivery of such articles to the quenching bath.

The objects of the invention are to provide improvements in heating and quenching machines, enabling exact and uniform treatment of the articles operated upon; and to provide an improved magnetic conveyor system for steel articles which is operative to release such articles for quenching to a quenching machine at such temperatures where the articles under treatment lose magnetic qualities.

The purposes of the invention are accomplished by means of a construction as illustrated in the drawings wherein:

Figure 1 is a longitudinal sectional view of the machine.

Fig. 2 is a chart illustrative of the demagnetizing points of steels of different carbon content, such points of demagnetization taking place at critical temperatures indicated on the chart in degrees C.

Fig. 3 is a transverse sectional view as indicated by the line 3—3 on Fig. 1, and

Fig. 4 is a sectional detail as indicated by the line 4—4 on Fig. 1.

The construction illustrated and method of operation thereof are arranged to utilize the magnetic qualities of steel as changed by the temperatures thereof, for precise timing in quenching.

The principal parts of the new construction are an electric heating oven arranged over an inclined support for articles of steel which are caused to travel along the inclined support during the period at which the temperature of the articles is raised to the desired quenching point; a magnetic means for retarding movement of the articles along the inclined support and preventing their release therefrom except at the required temperature; and a quenching machine for receiving the articles as released.

Steel responds to magnetic influence according to its temperature, and there is a pronounced loss of magnetic qualities at critical temperatures. It is resirable for certain qualities of the product, particularly the hardness thereof, to perform the quenching operation at such critical temperatures. With the machine herein disclosed, use is made of that characteristic of steel for effecting its release to a quenching bath from a magnetic conveyor. It is possible by use of such machine to avoid variation in the product due to time and temperature errors in quenching.

Reference is here made to the book "The Metallography and Heat Treatment of Iron and Steel", by Albert Sauveur, Chapter X and following chapters for a description of various steels with reference to their critical temperatures and a corresponding change in the magnetic characteristics thereof. The present machine is arranged to release the articles for quenching precisely at or definitely as near as desired to the critical temperature points, and is, therefore, made adjustable to advance or retard the delivery of articles under treatment to the quenching bath so that quenching may take place precisely when the desired temperatures have been attained.

As shown in the drawings the frame structure 1 pivots on the shaft 2 on a fixed base 3. This frame structure carries an electric heating oven 4 and a magnetic conveyor system 5. The floor 6 of the oven extends parallel with and over the conveyor 5. The inclination of frame structure 1 and parts carried thereby is regulated by a handwheel 7 and which controls the adjustment of jacks 8. The conveyor 5 consists of a belt 9 and a series of magnets 10 carried thereby. The belt is driven by motor 11. The magnets 10 act through the ceramic floors 6 of the oven to hold back and time the movement of articles along this floor to the lower end thereof. The articles which are to be hardened may for example be ball bearings and are delivered to this floor at a regular rate through the receiving chute 12, and are delivered from the floor to the quenching bath through the delivery chute 13.

The conveyor 9 is arranged to operate according to the rate of heat delivery to the articles under treatment from the heating elements 14 so that such articles will pass from end to end of floor 6 in the time required to raise the temperature of the articles or material under treatment to approximately 700 degrees C.

This is the critical temperature made use of for freeing the articles from the influence of magnets 10 and occurs at point 15 on floor 6 where the inclination of the floor is increased adjacent to the receiving point of delivery duct 13.

The quenching tank 16 is located beneath the duct 13. Within the tank 16 is a conveyor system

17 including clamping members 18 for receiving each article as it is delivered through the chute 13 and carrying such article through the bath.

The clamping means shown in the drawings is electromagnetic and receives the operating current from one of the rails 19. Brushes 20 connect the magnets with the rails only when the magnets should become effective for clamping. It is used for flat articles, such as gears but the machine is complete for many purposes without the conveyor system 17.

The magnets 10 of the conveyor 5 for controlling the rate of travel along the oven floor 6, of articles which are to be hardened, are also energized only when passing along the bottom surface of floor 6, when the current carrying brushes 21 therefor are in contact with the conducting rails 22, as shown in Fig. 3. This figure also shows a speed-reducing means 23 between motor 11 and drive shaft 25 for the conveyor system 5. This view also shows a heat indicating means 24 located at the side of the oven.

In the operation of the machine, and assuming that it is desired to perform continuously on a series of like steel articles which are delivered to the machine through chute 12 at a regular rate, the inclination of the heating section of the machine is, through the operation of hand-wheel 7, made to conform to the weight of the product and time required for the heating elements 14 to bring the product up to the desired temperature. This temperature occurs slightly below the 700 mark as indicated by the chart, Fig. 2. This is the point of recalescence for the carbon steels indicated thereon.

Below the point of recalescence the magnets 10 are effective for regulating the rate of travel of the product along the floor 6, but at the point of recalescence the magnetic effect is lost and the product slides along the surface 15 into the chute 13. By making use of this magnetic characteristic of steel it may be seen that the time of quenching with reference to temperature can be so precisely performed as to insure against error and bring about uniformity in the product.

The reading of pyrometers or the attention to color is not required during continuous running of the machine because the operation is automatic and based upon the magnetic characteristics of the product at a certain temperature.

I claim:

1. An electric oven having an inclined floor, a series of magnets supported beneath said inclined floor and means for continuously causing said magnets to travel along the bottom of said floor, an article delivery chute communicating with the lower end of said floor and a quenching tank arranged for receiving articles from said delivery chute.

2. In a machine of the class described, an electric oven, a support for the oven, said support having mounted thereon a continuously driven magnetic conveyor located outside of the oven, a quenching tank positioned to receive articles from one end of said oven, means for tilting said support whereby the oven and magnetic conveyor may be inclined variably in an upward direction from said quenching tank.

3. In a machine of the class described, an electric oven, a magnetic conveyor located outside of said oven, a support for the oven and the conveyor, means for driving said conveyor in a direction for causing it to draw articles of magnetic material from end to end of the oven, means for tilting said support for the purpose of inclining the oven and the conveyor downwardly in the direction of action of the conveyor, a quenching tank in position to receive articles from the end of the oven, said quenching tank in position to receive articles from the end of the oven, said quenching tank having mounted therein a conveyor having a plurality of electromagnetic clamps for clamping and carrying articles received from the oven, and means for driving both conveyors in synchronism.

4. In a machine of the class described, an oven, a quenching tank located beneath one end of the oven, a support for the oven, means for adjusting said support for the purpose of inclining the oven variable extents upwardly from said quenching tank, a continuously moving conveyor located outside of said oven and comprising a series of electromagnets, and contact rails mounted on said support in position to energize said magnets only as the latter pass along said oven.

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