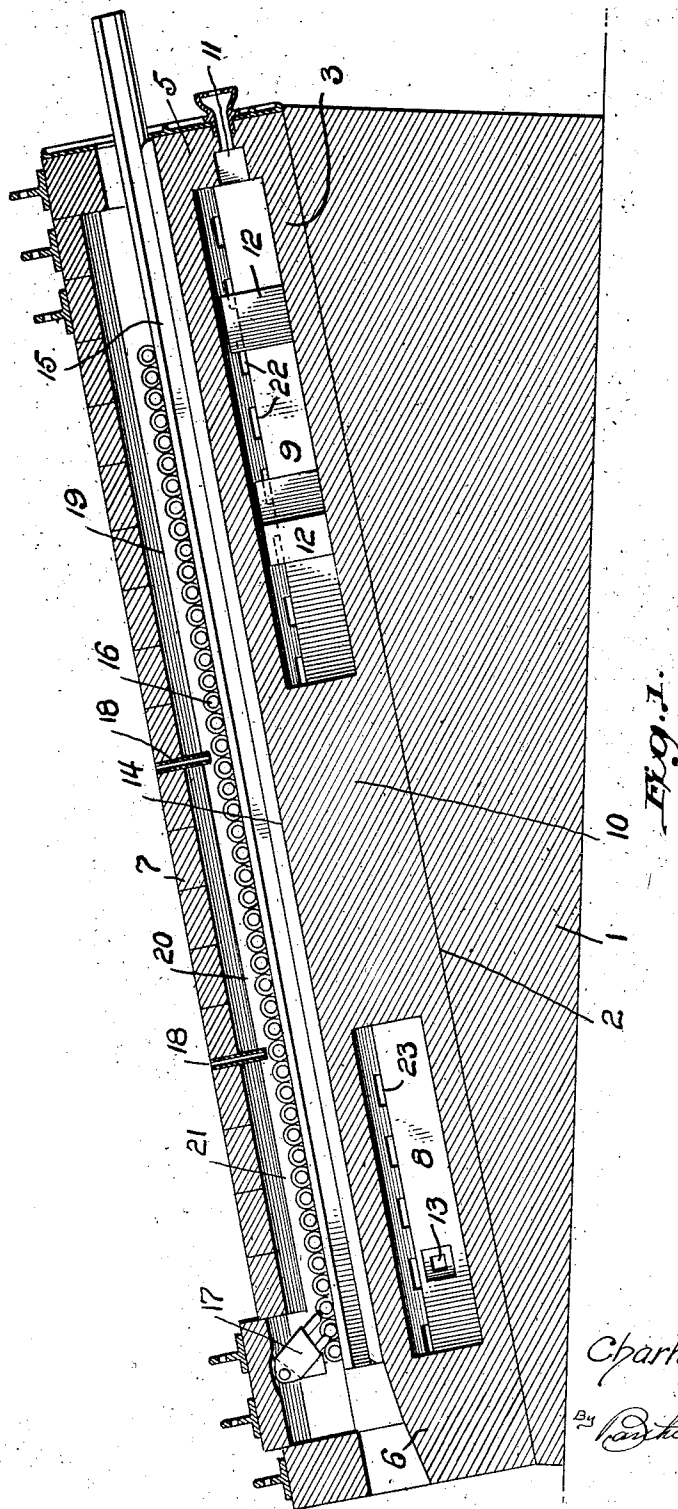


1,406,424.

C. E. SORENSEN.
ANNEALING FURNACE.
APPLICATION FILED OCT. 17, 1919.

Patented Feb. 14, 1922.
2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

Fig. 2.

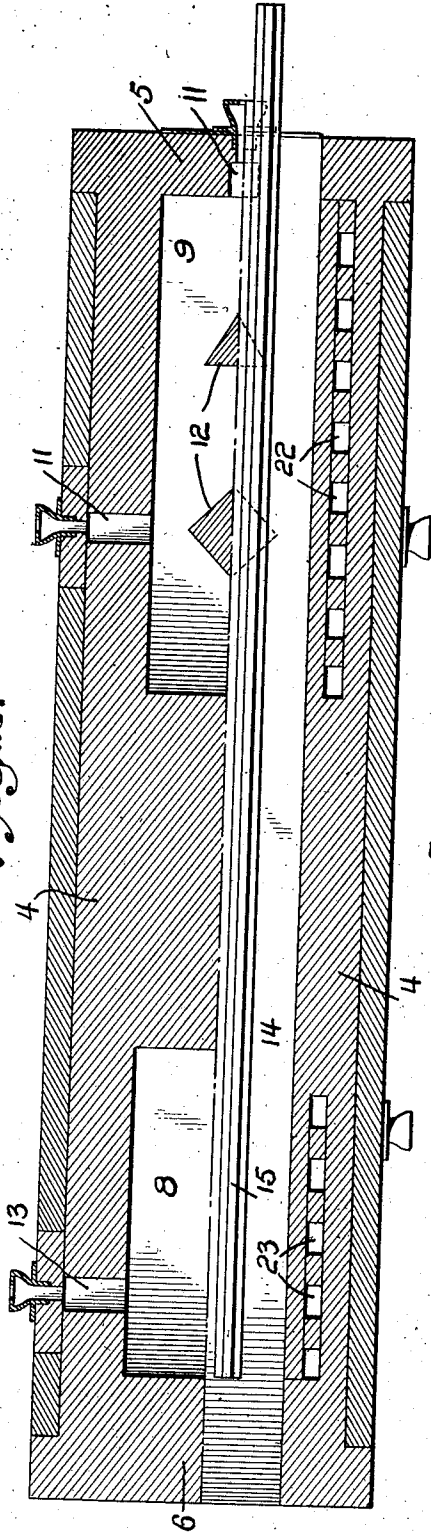
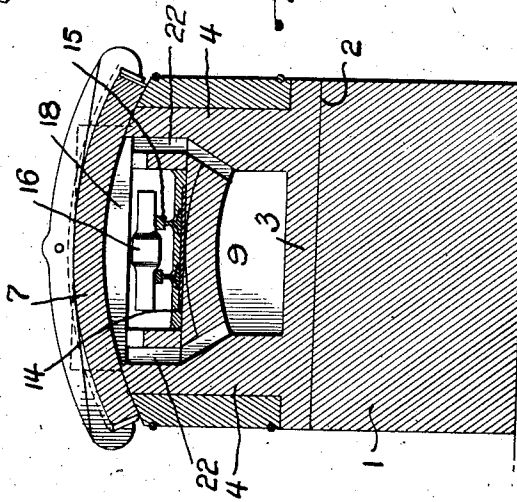


Fig. 3.



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ANNEALING FURNACE.

1,406,424.

Specification of Letters Patent. Patented Feb. 14, 1922.

Application filed October 17, 1919. Serial No. 331,335.

To all whom it may concern:

Be it known that I, CHARLES E. SORENSEN, a citizen of the United States of America, residing at Dearborn, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Annealing Furnaces, of which the following is a specification, reference being had therein to the accompanying drawings.

10 This invention relates to an annealing furnace, and the primary object of my invention is to furnish a furnace of the above type with a plurality of chambers, one or more of which serve as cooling chambers for reducing the temperature of stock from above critical points or stages to a temperature below the critical points or stages, thus insuring uniform annealing of all stock placed in or passing through the furnace.

20 Another object of my invention is to provide a furnace wherein a speedy drop in temperature may be obtained from an initial heat to a second heat, and provision is made for automatically conducting stock or pieces of work through the furnace and in a manner that the heat treatment may assure uniformity and at the same time permit of operations being economically and expeditiously carried on.

30 The above and other objects are attained by a furnace structure of novel design in many particulars, and these will be best understood by first considering the drawings and then the detail description thereof, but when reviewing the matter, it is to be understood that the preferred form of furnace has been illustrated, since it is in use, and that the same principle may be involved in a many chambered furnace of greater capacity or size.

40 Reference will now be had to the drawings, wherein

Figure 1 is a longitudinal sectional view of the annealing furnace;

15 Fig. 2 is a horizontal sectional view of the same, showing two different planes on which the section is taken, and

Fig. 3 is a vertical cross sectional view of the furnace.

50 In the drawings, the reference numeral 1 denotes a suitable foundation having an upper inclined surface 2 and erected thereon is an oblong furnace structure comprising a base 3, side walls 4, front wall 5 and a rear

wall 6, said side wall supporting an arched roof 7 and the entire structure tied and bound so as to withstand the heat to which it is subjected. The furnace base 3 and the foundation 1 may be a homogeneous mass to preclude any danger of the furnace being displaced or shifting relative to its foundation and with the furnace parallel with the upper surface of the foundation it is necessarily at an inclination placing the receiving end of the furnace at a greater elevation than the discharge end thereof so that pieces of work or stock may pass through the furnace by gravity.

The hearth of the furnace includes two chambers 8 and 9 separated by a solid partition or structure 10 and the chamber 9 slightly greater in area than the chamber 8. The chamber 9 is served by three or more burners placed at openings 11 in the side walls of the chamber 9 and in the front wall 5 of the furnace proper. The burners may be of a conventional form of oil or gas burning type and within the chamber 9 are flame baffles 12 which also serve as supports for the roof of the chamber 9 and the bottom of the furnace proper.

The chamber 8 is somewhat similar to the chamber 9 with the exception that it is simply served by two burners placed at openings 13 in the side walls of the chamber, and the distinction between these two chambers will be hereinafter referred to.

The base 3 of the furnace provides a furnace floor 14 serving as a hearth throughout the length of said furnace. Extending longitudinally of the floor 14 are rails 15 which have the forward or upper ends thereof protruding out of the front wall 5 of the furnace so that pieces of work or stock 16 may be placed thereon to descend by gravity and be discharged at the rear wall 6 of the furnace. The passage of the stock through the furnace is controlled by a conventional form of escapement device 17 adapted to be intermittently actuated to feed stock out of the furnace after a predetermined heat treatment within the furnace.

The roof 7 of the furnace is provided with transverse air cooled partitions or baffle members 18 extending towards the rails 15 and just providing clearance for the stock 16 on said rails. The location of the partitions 18 is such as to divide the furnace

proper into three compartments or chambers 19, 20 and 21. The compartment 19 is at the forward or upper end of the furnace above the chamber 9 and heat from said chamber is conducted to the compartment 19 by a plurality of flues or conduits 22 in the side walls 4 of the furnace, the heat being admitted to the compartment 19 adjacent the roof 7 so as to be deflected directly on the stock passing through said compartment. The compartment may be considered the annealing compartment as the temperature therein is maintained much higher than the compartments 20 and 21, and with the rails 5 protruding from the front end of the compartment 19, the stock placed on the upper ends of the rails will receive the benefit of any heat from the front open end of said compartment. The stock placed in position to pass by gravity into the furnace will absorb such waste heat, and when the furnace is built for the purpose of annealing one class of stock, the entrance opening to the compartment 19 may be shaped so that stock therein practically closes the front end of said compartment.

The compartment 20 is intermediate the ends of the furnace and directly above the solid partition between the chambers 8 and 9, and this intermediate compartment may be considered a cooling compartment and its temperature will be considerably below that of the annealing compartment 19.

The compartment 21 is above the chamber 8, and heat from said chamber is conducted to the compartment 21 by a plurality of flues or conduits 23 in the side walls of the furnace, and since the chamber 8 is of less area than the chamber 9 and served by fewer burners, it is obvious that the temperature in the compartment 21 will be lower than the annealing compartment 19, but higher than the cooling compartment 20.

As will be understood from the above disclosure, I have provided an annealing furnace wherein the stock is movable therethrough to permit treatment thereby, and in which the stock is subjected to zones of heat which vary as to temperature values with an intermediate zone of less temperature value than the zones adjacent thereto, this result being obtained by the use of a succession of compartments arranged in such manner that while two spaced apartments are each positively heated to produce definite temperature values, the intermediate compartment is not heated, and, in the disclosure, is arranged over a portion of the hearth of the furnace so arranged as to tend to reduce the temperature conditions of the compartment above it, the length of this unheated portion—shown as of solid formation—being such as to practically prevent material heat conduction to such intermediate compartment. As a result, such intermediate compartment forms

a zone in which the temperature value is less than that of either of the compartments at the opposite ends of such zone, it being understood, of course, that such intermediate zone will necessarily have a temperature value above that of the atmosphere, since it is unobstructed by doors from adjacent compartments, and the heated stock from compartment 19 is delivered therinto, so that this compartment may be considered as one for subjecting the stock to heat.

As a result, the temperature drop desired in succession to the primary annealing treatment, may be had without subjecting the stock to the variations in atmospheric conditions in immediate succession to the actual annealing action, and yet permitting the stock to pass from the furnace in a heated condition, by subjecting the stock to the action of compartment 21 after leaving the compartment of lowest heating value. Hence, it will be understood that the arrangement sets up conditions of setting the stock following the annealing temperature application, and then preparing it for discharge from the furnace.

Since the compartment 20 is at the lower or discharge end of the furnace, the stock after leaving the cooling compartment 20 is raised to a temperature which insures absolute uniformity in the stock before it is discharged from the furnace, consequently there can be not variations in the heat treatment of the stock due to climatic conditions at the discharge end of the furnace. In other words, instead of immediately discharging the annealed stock to the atmosphere that may hourly vary in temperature, the stock is uniformly cooled in the chamber 20 thus insuring the proper degree of hardness after the annealing treatment. The interposed compartment 21 therefore prevents the atmosphere from interfering with the cooling in the compartment 20, where the stock may be properly set for a desired degree of hardness, and I attach considerable importance to the location of this cooling compartment, particularly the fact that it obviates the necessity of a cessation in the operation of the furnace, as is the usual practice when the furnace is to be unloaded or stock obtained. With my furnace the operation of annealing can be continuously carried on and the degree of heat treatment depends on the nature of the hearth and the time the stock is retained within the furnace, both of which may be varied for different kinds of stock.

As shown in the drawings, the rails 15 permit of rollable stock passing through the furnace by gravity, and with such stock that cannot roll it is possible to place the furnace at a desired inclination so that the stock may slide therethrough. Then again, it is possible to substitute a conveyor which may be

continuously or intermittently actuated to conduct various kinds of stock through the annealing furnace.

What I claim is:—

5 1. An annealing furnace comprising a hearth, compartments above said hearth, and heating means for end portions of said hearth so that the middle portion of said hearth and the compartment above it are
10 relatively cool.

2. A furnace as characterized in claim 1 wherein the compartments are devoid of doors and disposed in a plane so that stock may pass therethrough by gravity.

15 3. An annealing furnace comprising heated compartments, a cooling compartment between said heated compartments, and stock supporting means extending through all of said compartments.

20 4. An annealing furnace comprising an inclined structure having an annealing compartment at its upper end, a discharge compartment at its lower end, and a cooling compartment intermediate its ends, and heating
25 means for said annealing and discharge compartments.

5. An annealing furnace having a hearth on which stock may roll from end of the hearth to the opposite end thereof, and holding
30 partitions depending from the roof of said furnace and providing just sufficient clearance for stock to pass thereunder, so that said partition will afford compartments in said furnace which may be maintained at
35 different temperatures.

6. An annealing furnace comprising an inclined structure adapted to receive stock at its upper end and discharge stock at its lower end, means extending in proximity to
40 the bottom of said structure partitioning said structure into compartments, separate heating means for some of said compartments, and means adapted to regulate the passage of stock through the compartments of said
45 structure.

7. A furnace of the type described comprising chambers in a common plane with a

non-heat conducting partition therebetween, heating means for said chambers, compartments above said chambers adapted to be
50 heated therefrom, and a cooling compartment above said partition.

8. A furnace as characterized in claim 7 wherein additional means is adapted to
55 cause stock to pass from one compartment to another.

9. In an annealing furnace having a travel path for the passage of stock therethrough, means operative on the stock during its pas-
60 sage for subjecting it to zones of heat varying as to temperature values, with an intermediate zone of less temperature value than the temperature values of the zones adjacent thereto.

10. In an annealing furnace wherein the
65 stock is passed through a succession of compartments, means operative to subject the stock to zones of heat treatment during its passage with the temperature values of the
70 several zones such that the stock is subjected to a zone of setting temperature in succession to the action of the zone of annealing temperature and then subjected to a zone of
75 temperature preliminary to discharge from the furnace, with the latter zone having its temperature value higher than that of the setting zone and less than that of the annealing zone.

11. A furnace as in claim 10 characterized in that the zones are equal in number to the
80 number of compartments.

12. A furnace as in claim 9 characterized by a succession of compartments wherein the heat is applied, with the adjacent compartments having positive heating means and the
85 intermediate compartment free from such means.

In testimony whereof I affix my signature in the presence of two witnesses.

CHARLES E. SORENSSEN.

Witnesses:

HARRY V. FISHER,
J. RUSSELL GNAU.