Dec. 27, 1932. C. A. HERBST 1,891,981

HEAT TREATING OVEN

Filed Feb. 18, 1931

Fig. 1.

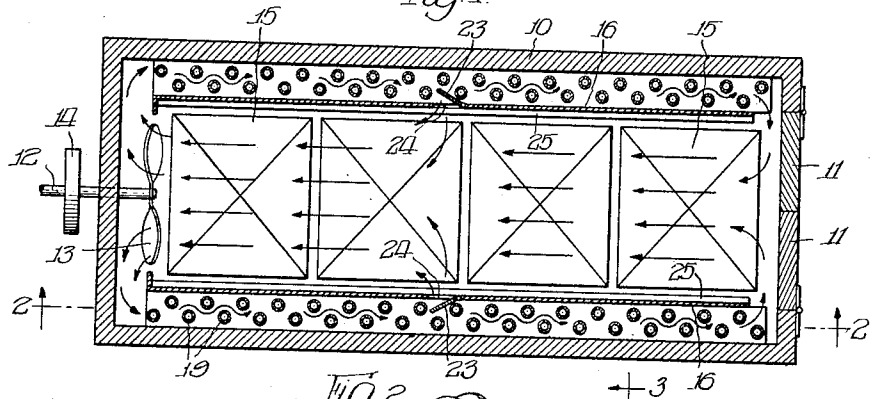


Fig. 2.

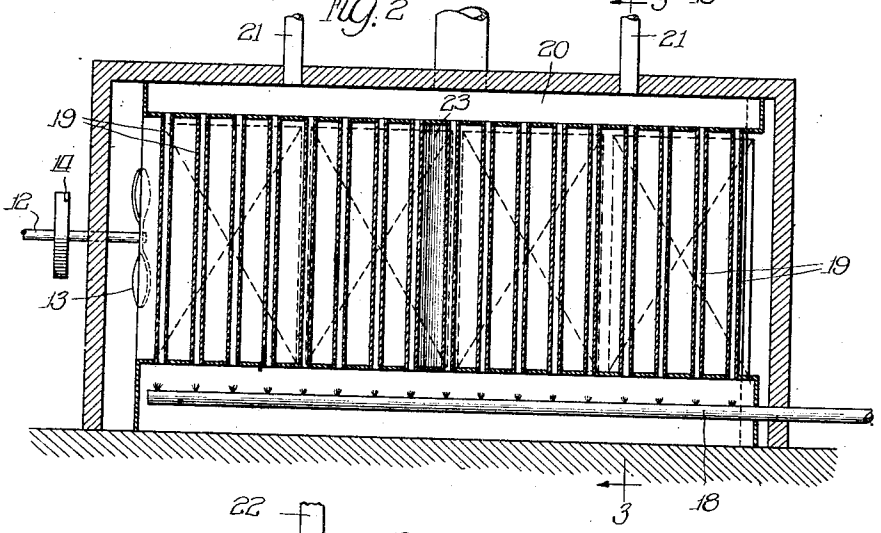
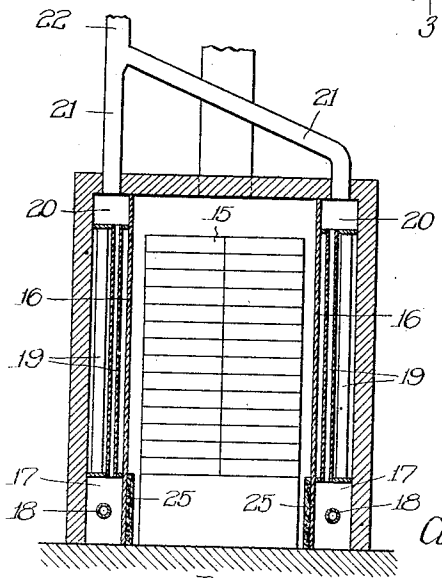


Fig. 3.



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UNITED STATES PATENT OFFICE

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HEAT TREATING OVEN

Application filed February 18, 1931. Serial No. 516,666.

This invention relates to improvements in a heat-treating oven which is especially applicable for heat treating cold-molded products.

It is an object of the invention to provide an oven which may be heated by combustion, such as by gas burners and into which material may be charged on trays and racks and to provide means for circulating the heated air within the oven and to so design the apparatus that substantially uniform temperature conditions may be maintained for all the material being heat-treated.

It is further an object of the invention to provide a series of radiator tubes on each side of the oven which is separated from the trays and racks of material by heat-radiating shields and to use a fan at one end of the oven which produces a circulation of the air so as to draw the air past the material being treated and direct the air to flow between the walls of the oven and the shields thereby passing over the radiator tubes and to additionally provide for uniform temperature conditions throughout the length of the oven by admitting a portion or portions of the heated air from the space between the shields and the walls to the interior of the oven in contact with the material treated while the remainder of heated air passes to the extreme end of the oven.

Further objects and advantages of the invention will be more readily apparent from the description taken in connection with the attached drawing, in which

Figure 1 is a horizontal section taken through the oven illustrating the racks and trays diagrammatically;

Figure 2 is a vertical longitudinal section of the oven taken on the plane indicated 2—2 in Figure 1, and

Figure 3 is a vertical transverse section of the oven showing the burners and flue connections.

The oven itself, indicated 10, is formed in the usual manner, such as by magnesia block covered with galvanized sheet metal. 11—11 are a pair of doors at one end of the oven through which the material may be charged into the oven. A shaft 12 at the opposite end of the oven protrudes thereinto and carries a circulating fan 13 while the shaft is driven by an exterior pulley 14. A plurality of racks 15, which carry a plurality of trays, for the material treated may be charged into the oven as indicated in Figures 1 and 3 where there are shown four racks extending throughout the length of the oven. Heat radiating shields 16—16 extend from top to bottom of the oven but the ends thereof are spaced from the ends of the oven. A closed combustion chamber 17 is provided at each side of the bottom of the oven into which extend a pair of burner tubes 18—18. The gases burned in the combustion chambers are directed to flow through a series of radiator tubes 19 which extend vertically between the lower combustion chambers and a pair of closed headers 20—20 at the upper portion of the oven. The consumed gases are directed through flues 21—21 to a stack 22.

It will, therefore, be understood that all the air within the oven which comes in contact with the material treated is heated by radiation from the radiator tubes. The fan 13 is driven in such direction that the air within the oven is drawn from the end of the oven which carries the doors towards the fan, and the air which passes the fan is directed laterally to flow forward towards the doors of the oven in the conduits formed between the walls and the shields thereby coming in contact with the heated radiator tubes. The arrows in Figure 1 illustrate the flow of air.

An oven of the type disclosed herein is especially adaptable for use in heat-treating cold-molded products. Such products are molded to the proper shape and then charged into the oven and heat is applied with a

gradually rising temperature for a period of several hours, during which the cold-molded products are absorbing heat. When the critical temperature is reached, a reaction occurs and the material is transformed into a hard and infusible product. During the reaction heat is being given out from the material since the reaction is exothermic. It is, therefore, highly desirable that all of the material be brought to the critical temperature at substantially the same time.

It will be obvious that if a single fan is used to draw the air from one end of the oven to the other end and then pass over the radiator tubes back to the first end of the oven that the last rack, which is charged into the oven, will be subjected to a greater temperature than the first rack which is closest to the fan since the temperature will diminish towards the fan, due to the absorption of heat. It is, therefore, necessary to add additional heat units at successive points along the oven so that the material which is nearest the fan will receive the same amount of heat as the material nearest the doors.

One manner of obtaining this desirable result is illustrated in Figure 1 in which I have shown a pair of baffles 23—23 adjacent openings 24—24 in the shields at the middle portion of the oven. The baffles are so arranged that a portion of the air flowing towards the front end of the oven is caused to flow through the openings 24 and join the current of air flowing towards the fan. The additional air which flows through the openings will provide sufficient heat units to maintain a more uniform temperature at the opposite ends of the oven.

It is also desirable to have the combustion chamber insulated at the bottom of the oven, such as by insulating material, indicated 25 in Figure 3, so that the lower trays of material will not receive a greater proportion of heat than the upper trays due to direct radiation from the combustion chamber through the shields.

My invention is particularly adapted to be used in connection with an oven in which the dimension in the direction of the current of circulating air is substantially greater than the dimension across the current of air, but various changes and modifications may be resorted to without departing from the spirit of the invention as expressed in the appended claims.

The important feature of the invention is that in an oven of the type mentioned, I provide for uniform temperature conditions throughout the oven by the design of the radiating shields and openings at certain points so that additional heat units are added as the air flows towards the fan through the length of the oven to compensate for the heat absorbed by the first material which the air passes over.

I claim:

1. A heat treating oven comprising a closed chamber, a pair of heat radiating shields at the sides of the chamber spaced from the walls thereof, means for circulating the air within the chamber longitudinally between the shields in one direction and longitudinally between the shields and the walls of the chamber in the opposite direction, means for heating the air as it flows between the shields and the walls of the chamber and means for adding heat units to the air as it flows longitudinally between the shields to compensate for the absorption of heat by the material treated.

2. A heat treating oven comprising a closed chamber, a pair of conduits for the circulation of air on the opposite sides of the chamber, means for circulating the air within the chamber by drawing the air from one end of the chamber to the other between the side conduits during which the air passes over the material treated and then forcing the air to flow longitudinally in the opposite direction through said conduits, means for heating the air as it flows through the side conduits and means for admitting portions of the heated air from the conduits into the space therebetween at points intermediate the ends of the oven.

3. A heat treating oven comprising a closed chamber, a pair of heat radiating shields at the sides of the chamber spaced from the walls to define circulating conduits for the air within the chamber, a fan within the chamber at one end thereof operative to draw the air towards the fan from the opposite end of the chamber between the shields and to direct the air to flow back towards the opposite end of the oven by flowing through the circulating conduits and means for heating the air as it flows through the circulating conduits, said conduits having openings at points intermediate the ends of the chamber whereby some of the air is drawn into the central portion of the chamber before it reaches the end of the chamber toward which it is flowing.

4. A heat treating oven comprising a closed chamber having side and end walls, a pair of longitudinal combustion chambers along the sides of the chamber adjacent the bottom thereof, a pair of longitudinal headers at the upper portion of the oven, radiator tubes joining the combustion chambers to the headers, a pair of heat radiating shields within the chamber on the inner side of the radiator tubes, means for circulating the air in the chamber by drawing the air towards the end of the chamber between the shields and directing the air to flow back towards the first end of the chamber in contact with the radiator tubes, said shields having openings intermediate the ends of the chamber and baffles adjacent said openings for di-

recting some of the air back to the central portion of the chamber before it reaches the end of the chamber toward which it is flowing.

5. A heat-treating oven comprising a closed air chamber having a doorway at one end thereof, racks for the material to be heat-treated adapted to be moved into said chamber through said doorway, means for closing said doorway, a pair of air circulating passageways extending along the opposite sides of the chamber within the interior thereof open at their ends for communication through the central portion of the chamber, an air circulating fan centrally positioned adjacent the end of the chamber opposite the doorway, said fan being adapted to draw the air longitudinally of the chamber past the material to be heat-treated and to force the air to flow longitudinally in the opposite direction through said passageways, means for heating the air substantially throughout the entire length of said passageways as the air flows therethrough, the inner walls of said passageways having vertical slotted openings extending substantially throughout the entire height thereof, placing the passageways in communication with the central portion of the chamber at points intermediate the ends of the chamber and vertical baffles extending from the edges of said slots farthest from the fan and directed inwardly with respect to said air passageways whereby predetermined portions of air flowing through said passageways are caused to be directed into the central portion of said chamber to maintain a more even temperature condition of the air flowing past the material to be heat-treated.

6. A heat-treating oven comprising a closed air chamber having a length materially greater than the width thereof, a doorway at one end of said chamber, a plurality of racks for supporting the material to be heat-treated adapted to be moved into said chamber through said doorway and to remain stationary within said chamber while the material is being heat-treated, means for closing said doorway, a pair of air circulating passageways extending along the inner side walls of said chamber substantially throughout the entire length thereof, said passageways being open at their opposite ends for communication through the central portion of said chamber adjacent the ends thereof, an air circulating fan centrally positioned adjacent the end of said chamber opposite said doorway adapted to draw the air longitudinally of said chamber past the material to be heat-treated and to direct the air to flow longitudinally in the opposite direction through said passageways along the side of said chamber, means for progressively heating the air as it flows through each of said passageways substantially throughout the entire length thereof, the inner walls of said passageways having vertical slotted openings at predetermined points intermediate the ends thereof and baffles adjacent said slotted openings extending partially across said passageways to deflect predetermined portions of air flowing through said passageways into the central portion of said chamber.

Signed at Chicago, Illinois, this 13th day of February, 1931.

CLARENCE A. HERBST.