April 28, 1931. J. D. MORGAN 1,803,282

HIGH TEMPERATURE ELECTRIC HEATING FURNACE

Filed Oct. 15, 1928

Fig. 1.

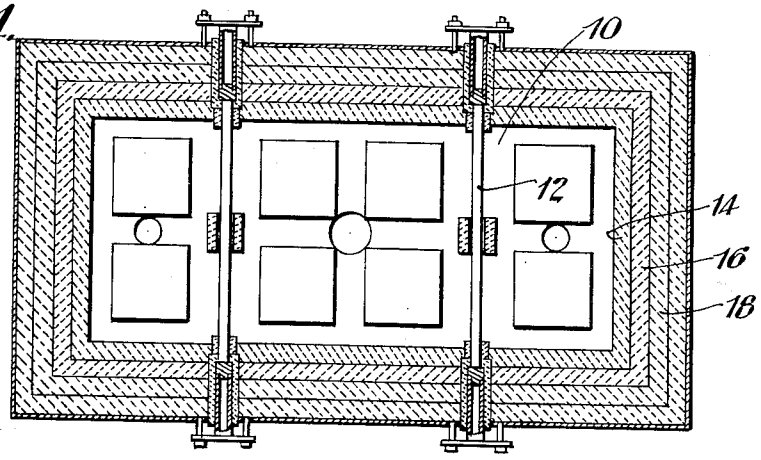


Fig. 2.

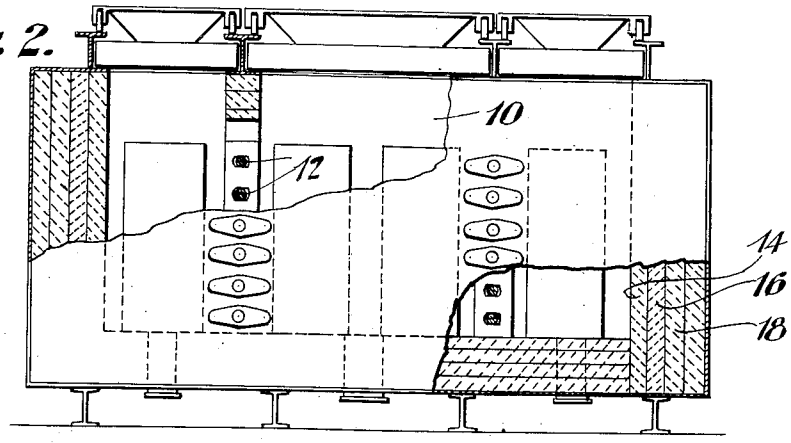
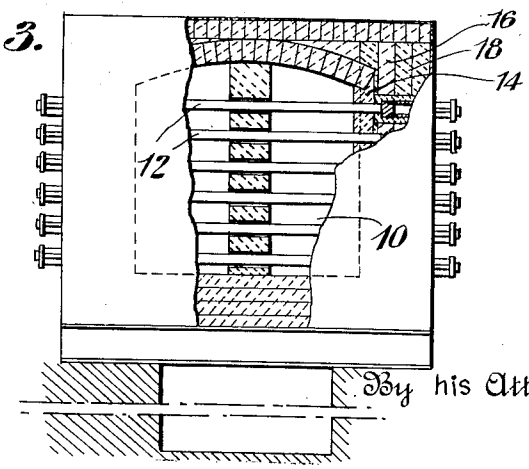


Fig. 3.



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UNITED STATES PATENT OFFICE

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HIGH-TEMPERATURE ELECTRIC HEATING FURNACE

Application filed October 15, 1928. Serial No. 312,575.

It is common practice to line furnace chambers with refractory such as firebrick and place a layer of heat insulating material such as infusorial earth, silocel brick or the like outside the refractory layer. With a furnace lined in this manner the time required for raising the temperature of a billet or like therein has often been very long with consequent high consumption of electric current or fuel. A relatively long period of heating is especially undesirable in an electric furnace on account of the usual high cost of the current.

The primary object of the present invention is to provide a furnace chamber adapted to heat up quickly.

It has been found that the time required to raise a billet or like object through a given temperature rise depends, in considerable measure upon the character of the refractory lining of the heating chamber. The present invention is based on the discovery that the heating efficiency and time efficiency of a soaking pit is improved by increasing the conductivity of the inner lining of the furnace chamber.

In accordance with the present invention, it is preferred to use the inner lining or facing of the furnace chamber a composition of silicon and zircon disclosed in my prior joint application, filed June 11, 1928, Serial No. 284,668 for heat conducting high temperature resistant refractory. The composition of silicon and zircon just mentioned contains in its preferred form, approximately equal parts of ground silicon or high grade ferro-silicon, and ground zircon (zirconium silicate) bonded with ortho-phosphoric acid. The preferred composition has a thermal conductivity at temperatures above 2000° F. of the order of cast iron and has a limiting strength under compression of 650 pounds per square inch at 2500° F. This material is moreover quite dark in color and therefore a very efficient absorber of radiant heat.

In the accompanying drawing:

Fig. 1 is a horizontal section of a furnace in accordance with the present invention;

Fig. 2 is an elevational view of the furnace illustrated in Fig. 1, parts being broken away and parts being shown in section for purposes of illustration;

Fig. 3 is an end view of the furnace shown in Figs. 1 and 2, parts being broken away and parts being shown in section for purposes of illustration.

In the drawing, 10 is a furnace chamber, soaking pit or the like, preferably arranged to receive billets which are to be heated to rolling temperature. The furnace chamber 10 may be heated by any suitable means. In the arrangement illustrated, chamber 10 is heated by radiating type heating means comprising resistors 12 connected into an electric circuit, not shown. The side walls, bottom and roof of chamber 10 are of composite structure. The inner layer 14 of material in said walls of chamber 10 is of heat conducting material, but of a substance capable of withstanding high temperatures without deterioration. As illustrated, the layer 14 is in the form of bricks, but the invention is not limited to this. As above indicated, the layer 14 is preferably of a silicon-refractory composition. It withstands high temperatures under atmospheric conditions, and conducts the heat along the wall of chamber 10 so that all portions of the wall are of substantially the same temperature and a billet or like article is heated to the desired temperature and to the desired uniformity in a minimum of time for a given maximum temperature in the chamber 10.

The advantages of a heat conducting layer 14 are plain from the foregoing. However, unless surrounded by a heat insulating layer, the inner conducting layer 14 would cause a large heat loss to the atmosphere. The furnace in accordance with the present invention therefore includes heat insulation surrounding the layer 14. In the arrangement illustrated, the heat insulation for chamber 10 is in two layers. Immediately adjacent but outside of layer 14 is a heat insulating layer 16 of highly refractory material. The preferred material for layer 16 is zircon treated to form cellular blocks disclosed in my prior application filed June 20, 1928, Serial No. 286,831, for "High temperature insulating product and process of mak-

ing the same." This material has shown a limiting strength under compression of 15 pounds per square inch at 2850° F., and, further, is light in color which mitigates against its being a good absorber of radiant heat. Such material is not only a good insulator against loss of heat, but is highly refractory and cannot be damaged by any temperature which is tolerable to the heat conducting layer 14. The advantage of utilizing these two preferred materials is best illustrated by the fact that the high heat conductivity material has a heat conductivity of 226 B. t. u. per square foot per inch thickness per degree Fahrenheit per hour, whereas the high temperature insulating product material has a heat conductivity of 2.9 B. t. u. per square foot per inch thickness per degree Fahrenheit per hour. Surrounding layer 16 is additional heat insulating material in the form of layer 18. Layer 18 is preferably of "silocel" brick, or other form of bonded diatomaceous earth. Such material cannot withstand as high temperatures as the zircon of layer 16, but is less expensive. If the furnace is not intended for very high temperatures all the heat insulation may be of cheaper material than zircon.

Surrounding the heat insulating material is preferably a steel shell.

Although there has been herein described a specific embodiment of the invention it will be obvious to those skilled in the art that various modifications may be made in the details of construction and in the proportion of the several cooperating materials without departing from the principles herein set forth.

Having thus described my invention, what I claim as new is:

1. A heating chamber having walls, including an inner layer of a heat conducting refractory mixture containing silicon and zircon and having a heat conductivity at least twice that of fireclay at temperatures of 2000° F., and a refractory heat insulating layer containing zircon having a high percentage of voids surrounding said conducting layer.

2. A heating chamber having walls including an inner layer of heat-conducting refractory containing silicon and zircon.

3. In a heating chamber an inner wall of heat-conducting refractory material containing silicon and zircon and a refractory heat-insulating layer surrounding said conducting layer.

In testimony whereof I affix my signature.

JOHN D. MORGAN.