J. FITZPATRICK AND L. T. STEPHENS.

ELECTRIC FURNACE.

APPLICATION FILED MAR. 21, 1919.

1,313,985. Patented Aug. 26, 1919.

Fig. 1.

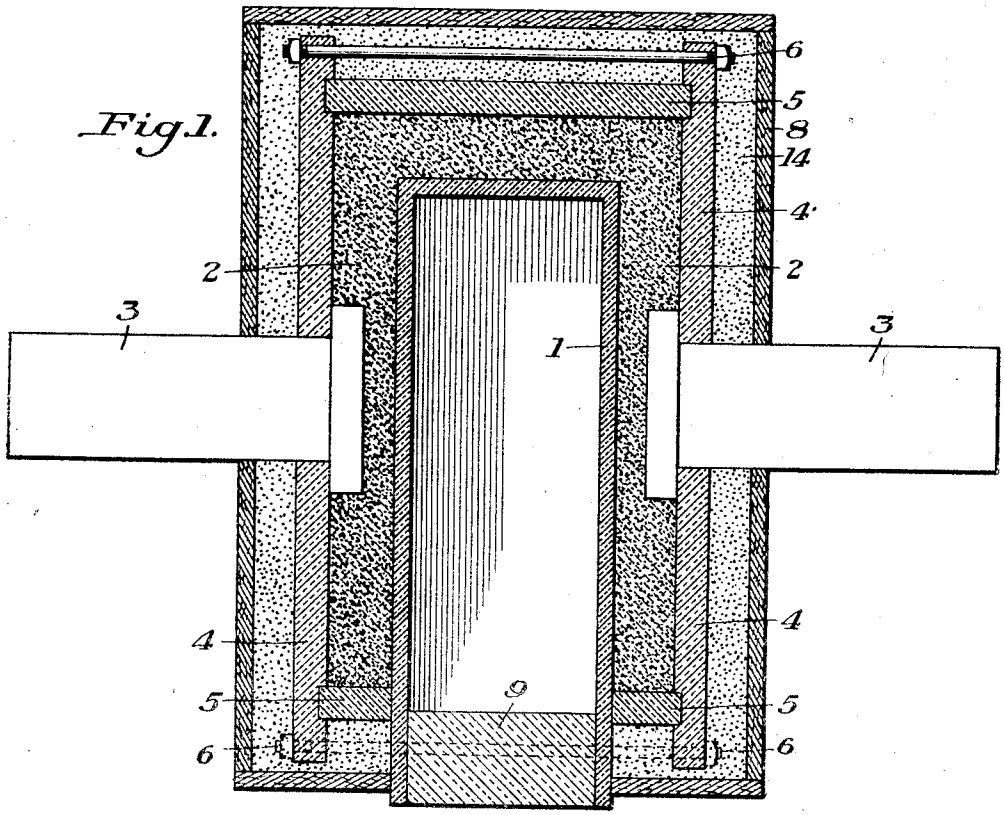
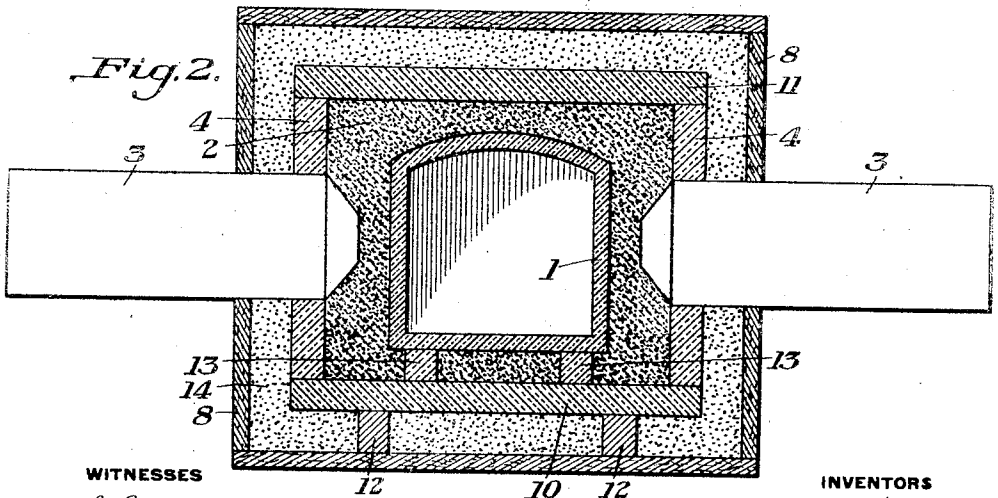


Fig. 2.



WITNESSES

R. A. Balderson

F. Tsainor

INVENTORS

John Fitzpatrick
and
Levi T. Stephens
by their attorneys
Bakewell, Byrnes & Parmelee.

UNITED STATES PATENT OFFICE.

JOHN FITZPATRICK AND LEVI THURSTON STEPHENS, OF NIAGARA FALLS, NEW YORK, ASSIGNORS TO THE CARBORUNDUM COMPANY, OF NIAGARA FALLS, NEW YORK, A CORPORATION OF PENNSYLVANIA.

ELECTRIC FURNACE.

1,313,985. Specification of Letters Patent. Patented Aug. 26, 1919.

Application filed March 21, 1919. Serial No. 284,023.

To all whom it may concern:

Be it known that we, JOHN FITZPATRICK and LEVI THURSTON STEPHENS, both citizens of the United States, and both residing at Niagara Falls, Niagara county, New York, have invented a new and useful Improvement in Electric Furnaces, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a horizontal cross section through the furnace, and

Fig. 2 is a vertical cross section.

The invention relates to electric furnaces and more particularly to electric resistance furnaces suitable for the heating, hardening and tempering of small metal parts and for other purposes requiring a close regulation of temperature in a neutral or reducing atmosphere.

The object of the invention is to provide a furnace of the character herein described in which a high temperature is obtainable without rapid deterioration of the furnace. With this object in view, the present invention consists in the electric furnace hereinafter described and particularly pointed out in the claims.

Referring to the illustrated embodiment of the invention:—The furnace comprises a muffle 1 composed of silicon carbid open at one end and constituting the furnace chamber in which are placed the objects to be heated. Silicon carbid is particularly adapted for this purpose on account of its refractoriness, its resistance to oxidation and its high heat conductivity. Several forms of silicon carbid may be used but we prefer to use a muffle composed of a material commercially known as silfrax, the muffle being molded from silicon carbid grains or powder and heated in a silicon atmosphere in an electric furnace so that the grains are welded together in a solid mass of silicon carbid without any other bonding material. The walls of the muffle are preferably about one-half inch in thickness. Silicon carbid is formed at a temperature of about 1800° C. and is decomposed at 2200° C. It is therefore far more refractory than any of the ordinary muffles made of fire clay. It has a thermal conductivity of about eight times that of fire clay and this is of prime importance in a refractory such as a muffle which is used for the transmission of heat.

A mass of resistance material 2, preferably composed of granular carbon, graphite or coke, surrounds the muffle on all sides except at one end where the muffle is open and is carried through the outside casing of the furnace. The resistance material is in direct contact with the muffle.

Graphite electrodes 3, 3 are connected at their outer ends outside of the casing to suitable sources of electrical energy, and extend inward and make contact with the resistance material 2 so that when power is put on the furnace, the current enters the furnace through one electrode, traverses the resistance material around the muffle and passes out through the other electrode, heating the muffle up to the desired temperature depending on the power employed.

Protection slabs of silicon carbid indicated by reference numerals 4, 4, 5, 5, 10 and 11 entirely surround the resistance material. Their function is to form a closed, solid receptacle which keeps the resistance material in a fixed position. These slabs are preferably about one inch thick. We use for this purpose a form of silicon carbid refractory commonly known as carbofrax consisting of silicon carbid grains bound together by a binder of clay and fired in the manner of fire brick. The end slabs 4, 4 holding the electrodes, are recessed as shown and the side slabs 5, 5 are fitted into the recesses. Iron bolts 6, 6 are provided to hold the two end slabs together, thus firmly binding the slabs together. These bolts are placed close to the outside casing of the furnace so that they are not subjected to any considerable temperature. The bottom slab 10 is supported by means of refractory blocks 12 resting on the bottom member of the outside casing of the furnace. The muffle 1 is supported on the slab 10 by means of the refractory blocks 13. The electrodes pass through the end slabs and are provided on their inner ends with flanges which set up against the inside of the slab thus preventing the electrode from moving away from the resistance material. In some cases we find it of advantage to cut the muffle into two parts, the plane of the section being within and parallel to the side protection

slab through which the muffle passes. This cuts down the conduction of heat from the working chamber to the outside and thus improves the thermal efficiency.

A mass of heat insulating material 14, such as silocel, diatomaceous earth, or the like, is packed in around the protection slabs, this insulating material filling the entire space between the receptacle holding the resistance material and the outside casing 8 of the furnace. The outside case 8 is constructed preferably of asbestos board or a similar material in the form of a rectangular box. The muffle being open at one end is provided with a fire clay block 9 closely fitting the inside of the muffle and forming a door which can be removed to gain access to the interior of the muffle. In operating a small furnace of this type having a muffle measuring 6 inches by 6 inches by 18 inches in length, we have used a layer of resistance material around the muffle one inch in thickness. To attain a temperature of 1500° C., the power consumed was approximately nine kilowatts at twenty volts.

The advantages of this furnace over other types of muffle furnaces heated by oil gas or electricity for use for similar purposes are durability, close regulation of temperature and the high temperature range obtainable without rapid deterioration from excessive heating. The granular carbon resistor is an ideal material for resistance purposes in an electric furnace on account of its cheapness and its uniformity of resistance and uniform heating effect. In furnaces where a carbon resistance material comes in contact with a fire clay muffle, or other refractory contaminating clay in considerable amount, the upper temperature limit is very definitely fixed because the carbon will react with the constituents of the clay if the temperature is too high, and as a practical matter it is found that a range of working temperature inside the muffle up to 1500° C. is not possible with this construction, because this means a much higher temperature on the side of the muffle in contact with the carbon. When carbon is brought in contact with a silicon carbid muffle, all these difficulties disappear and not only is there no re-action between the two substances, but silicon carbid is capable of transmitting the heat most efficiently and having a very low co-efficient of expansion, it does not crack and deteriorate with alternate heating and cooling such as is necessary in opening and closing the furnace. A carbon resistance material must of course be kept isolated from the air to prevent oxidation and this is effectively accomplished by the protection slabs 4, 4 which are closely fitted together and surrounded by the insulating material, thus making access from the outside air substantially impossible. We have found that the resistance material does not need to be renewed oftener than once every month or two and this can be readily done by removing the top of the casing and then removing the top protection slab 11. This furnace has a neutral or reducing atmosphere. This is a great advantage in heating steel parts which do not undergo any surface oxidation.

While the preferred embodiment of the present invention has been specifically illustrated and described, it is to be understood that the present invention is not limited to the illustrated details of construction but may be otherwise embodied within the scope of the following claims.

We claim:

1. An electric resistance furnace comprising a silicon carbid muffle and current conducting resistance material around the muffle; substantially as described.

2. An electric resistance furnace comprising a silicon carbid muffle, current conducting resistance materials around the muffle, and a closed refractory receptacle surrounding the material for keeping it from contact with the air; substantially as described.

3. An electric resistance furnace comprising a silicon carbid muffle, a current conducting resistance material around the muffle, and a closed silicon carbid-refractory receptacle surrounding the resistance material for keeping it from contact with the air; substantially as described.

4. An electric resistance furnace comprising a silicon carbid muffle, a current conducting resistance material around the muffle, a closed silicon carbid refractory receptacle surrounding the resistance material for keeping it from contact with the air, and a heat-insulating casing surrounding the said receptacle; substantially as described.

In testimony whereof, we have hereunto set our hands.

JOHN FITZPATRICK.
LEVI THURSTON STEPHENS.