Nov. 29, 1932. C. R. JOHNSON 1,889,665

ELECTRIC FURNACE

Filed Sept. 9, 1931

FIG. 3

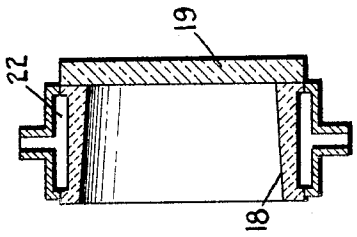
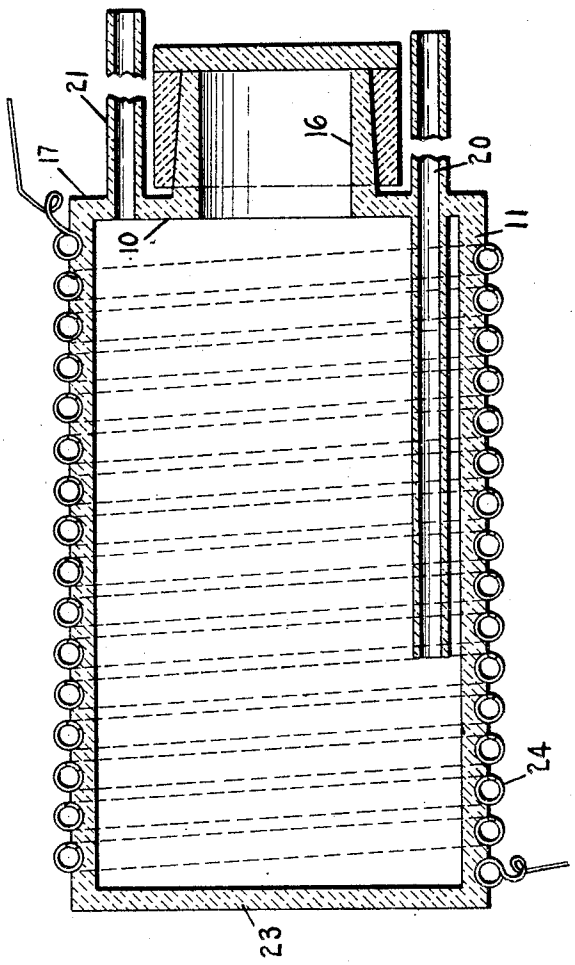


FIG. 1



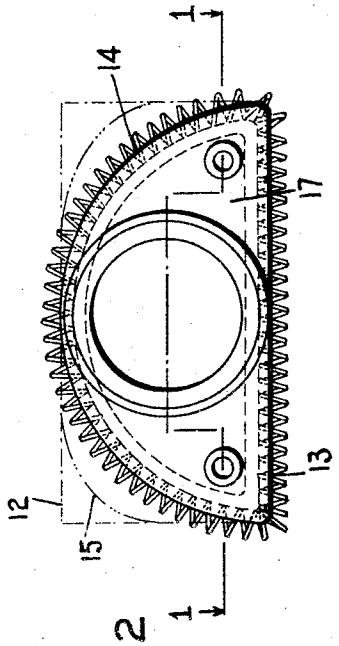


FIG. 2

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INVENTOR

BY his ATTORNEY C. R. Jorgenson

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UNITED STATES PATENT OFFICE

CLYDE R. JOHNSON, OF PRINCETON, NEW JERSEY, ASSIGNOR TO AMERSIL COMPANY, INC., OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

ELECTRIC FURNACE

Application filed September 9, 1931. Serial No. 561,828.

This invention relates to electric furnaces and it particularly relates to electric furnaces which are heated by the thermal effect of an electric current passing through a coil of resistance wire arranged on the outer surface of a chamber, constructed of electrically non-conductive material capable of withstanding the influence of a temperature of at least 1000° C. prevailing for a considerable length of time within said chamber.

It is one of the objects of the invention to create an electric furnace as a means to fuse substances, such as metals, and to have a considerable amount of flat surface for a bed for the fused materials.

It is another object of my invention to create an electric furnace as a means to treat therein substances, for instance such as metals at an elevated temperature, including for instance temperatures at which the metals would fuse, and to have a clear vision of the inside of the furnace at all stages of the fusion or of any other action on the substance treated therein.

It is also an object of my invention to create an electric furnace as a means for fusing a number of different kinds of material in an atmosphere of various pure gases, corrosive (though not to the material of the chamber), or otherwise.

It is, furthermore, an object of my invention to create an electric furnace as a means for treating substances at an elevated temperature within a confined space, such as a chamber, having an unlubricated, but fairly tight, joint permitting operations within aforesaid confined space at a moderate pressure above or below that of the atmosphere and permitting easy access to the interior of the furnace.

It is thus obvious that my new electric furnace overcomes various shortcomings of the well known muffle furnace now universally used in chemical laboratories and factories. It is a long felt want that the muffles of these furnaces, which are used from the smallest to very often considerable sizes, cannot be suitably closed so as to make them gas tight and to allow an easy access to its contents. These muffle furnaces are furthermore, always used at very high temperatures and usually a door made of a cementitious material, is arranged in front of the muffle opening to close the muffle, and the gap between the muffle and door is closed by some cement putty or other suitable material, but up to now no relief has been found from this situation which was cumbersome and unpleasant owing to the high temperatures applied.

With these and other objects in view, which will be more apparent from the following description of my new invention, reference is had to the accompanying drawing, which illustrates by way of example one of the forms in which I may embody my new invention.

In said drawing:

Figure 1 is a horizontal sectional view through the electric furnace on the line 1—1 of Figure 2.

Figure 2 is a side elevation of the electric furnace, and

Figure 3 is a detail view of the cap closing the electric furnace.

In said drawing the numeral 10 denotes the chamber of the furnace which consists of a body 11 and is made of fused silica. The form of this body 11 may vary within certain limits, for instance from that of a rectangular prism, as indicated in Figure 2 by the dashed line 12 and the bottom line 13, to that of a semi-cylinder, as indicated by the bottom line 13 and the curved line 14, which is the usual form of the well known muffle referred to above. In Figure 2 the dashed-dotted line 15 indicates another very suitable form of body for the chamber 10, which in its lower part is prismatic and is rounded at its ceiling, thus assuming the shape of a loaf of bread.

A neck 16 is secured to and preferably centrally arranged in the front side 17 of the body 11 so as to allow access to the inside of the same. This neck has preferably the form of a truncated cone so that the cap 18, which conforms with its inside shape to the outside shape of the neck 16 and which is ground in upon the same, closes the chamber 10 air-tight. While the mantle of the cap 18 is made of fused silica and therefore is opaque, the front side 19 is made of fused

transparent quartz so as to serve as a window.

A tube 20 is introduced into the inside of the chamber 10; it may be of any length, so as to terminate at any given point and preferably it is arranged close to the edge formed by the bottom 13 and the curved ceiling 14 of the chamber 10. At the point where the tube 20 penetrates the front side 17, a gas tight point is made by welding the aforesaid front side 17 together with the peripheral circumference of the tube 20. On the other side, opposite to the tube 20, a tubular neck 21 is welded to the front side 17 around an aperture so that this neck 21 may also communicate with the inside space of chamber 10. Both tube 20 and the tubular neck 21 are of the same diameter and as they are provided, respectively, for the purpose of introducing gases into and conducting them out of the chamber 10, their outer ends may be bent sidewardly to allow a more convenient connection with other passageways of tubular or other form.

It will be noticed from an inspection of Figure 2 that the outside diameter of the rim of the neck 16 is practically identical with the height of the body 11.

Though, in view of the negligible size of the coefficient of expansion of fused silica, there is no danger that the ground joint between the neck 16 and the cap 18 will leak in case a moderate pressure is maintained within the chamber 10, an annular cooling channel 22 may be arranged around the cap 18 so that, in case very high temperatures are applied, water may flow through said channel 22 to absorb any heat which might contribute to a slight expansion so as to cause a leak of said joint.

As the body 11 may be made of a rectangular prismatic shape, the front side 17 is of considerable surface and in such case more than one neck 16 with cap 18 may be arranged on the front side 17 just as the situation may require.

The body 11 is, furthermore, provided with a helical groove 23 in which a coil 24 of resistance wire is arranged, which at its ends is connected with the bus-bars (not shown) of a source of electric energy.

In case the body 11 is for instance 14 cm. long, 8 cm. wide and 4 cm. high, and has walls 3–4 mm. thick, the coil 24 is for instance made of 8 meters of #16 (B. & S. gauge) Chromel A wire, wrapped on an iron rod of 5 mm. and stretched to a length of 150 cm. whereupon it is made to encircle the body 11 for a length of about 12 cm. The heating unit is intended for use on 110–120 volt A. C. circuits, in series with an 8 ohm, 8 ampere rheostat. The coils (only shown at both ends) are carefully spaced and tied in position with asbestos. The body 11, with the open end exposed, is packed in a one gallon crock lined with magnesia, which is held in place by a layer of pressed asbestos. After drying the furnace at a low temperature, it can be heated quite rapidly to temperatures in the neighborhood of 1000° C. As the mounting, of the essential parts of the electric furnace in asbestos insulation, etc., is within the knowledge of the art, illustration of these features is dispensed with.

It is of course understood that I am not restricted to the one transparent window 19 arranged in the cap 18, as I may arrange such windows at any other suitable part of the body 11, for instance in the side 23 opposite to front side 17.

The operation of the furnace is self explanatory from the details given above; as one of the operations, for which the furnace was found to give a highly satisfactory service, I cite the treatment of silver, arranged within the furnace on a suitable support, with pure hydrogen gas. In the absence of rubber gaskets, or metallic stoppers there is no possibility of contaminating the silver owing to the effect by the hot corrosive gases liberated during the fusion.

What I claim is:

In an electric furnace, the combination comprising a heating chamber made wholly of fused silica and terminating at one side into a tapered neck, a cap, of fused silica and having a top of transparent quartz, ground in on aforesaid neck so as to hermetically close aforesaid chamber, passageways for conducting a gas into and withdrawing same from aforesaid chamber, and an electrically conductive resistance wire operatively arranged around the body of aforesaid chamber.

In witness whereof I hereunto set my hand.

CLYDE R. JOHNSON.