Feb. 18, 1930. T. S. CURTIS 1,747,756

ELECTRIC TORCH FURNACE

Filed July 30, 1928 3 Sheets-Sheet 1

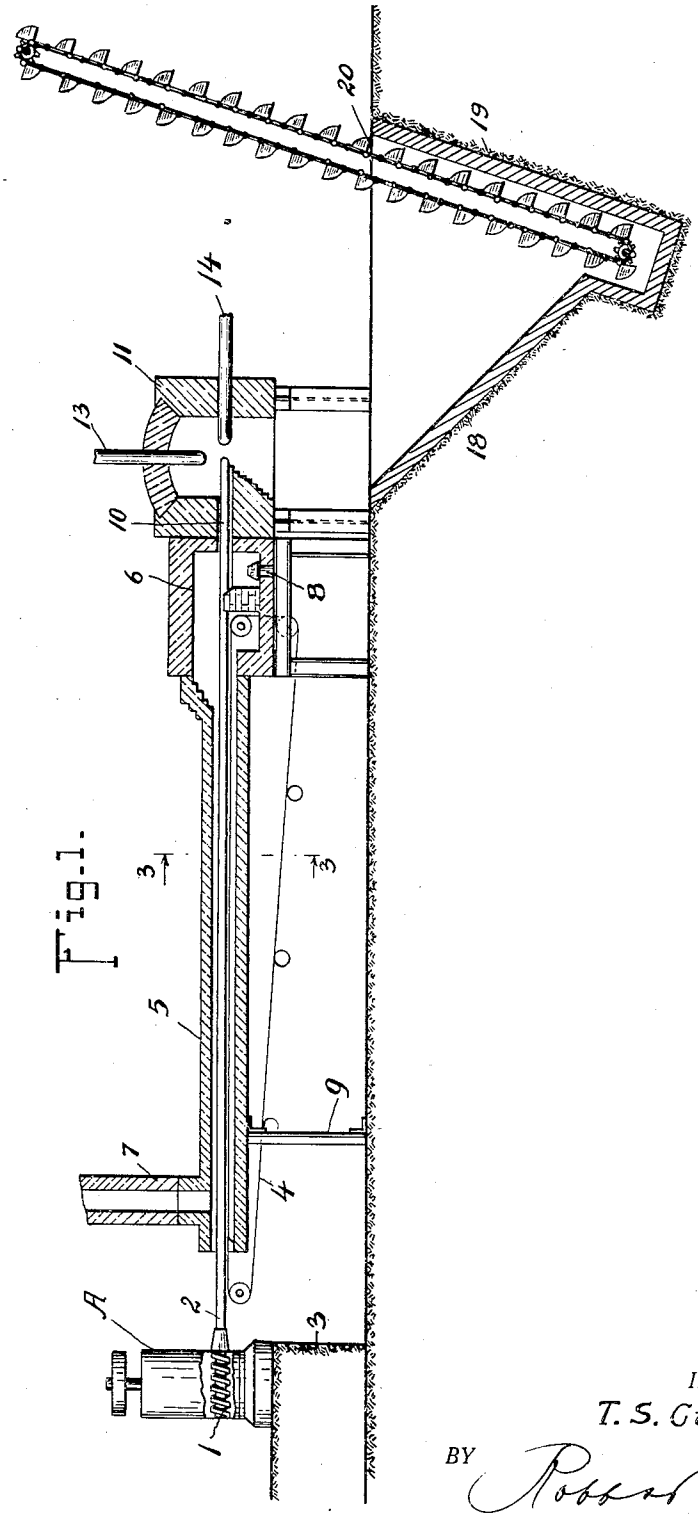


Fig. 1.

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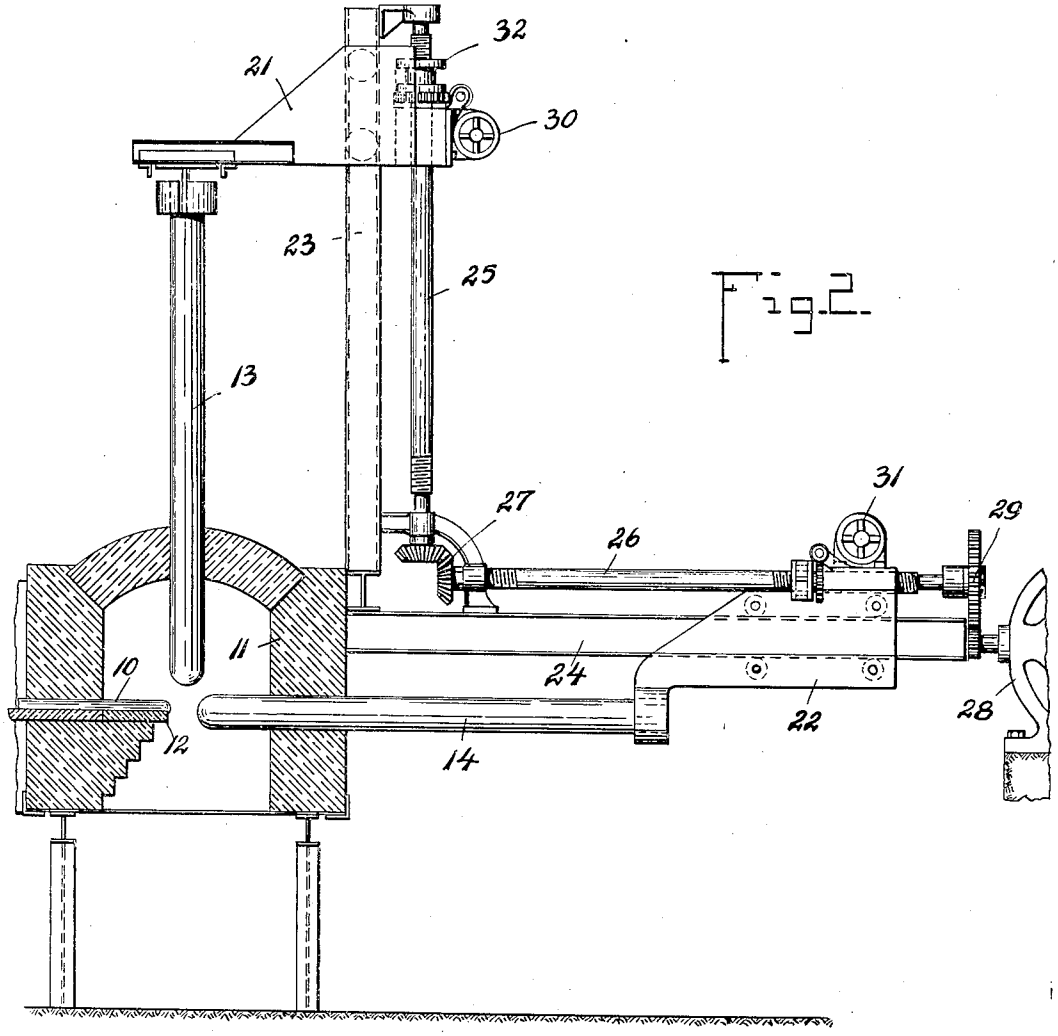


Fig. 2.

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Fig. 3.

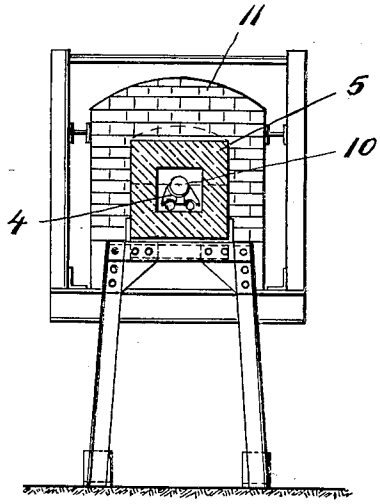


Fig. 5.

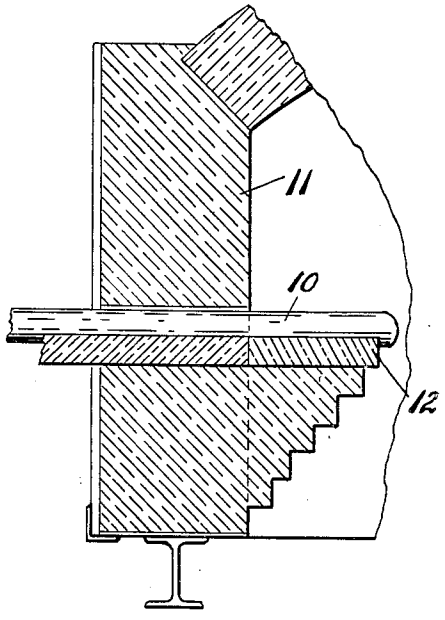
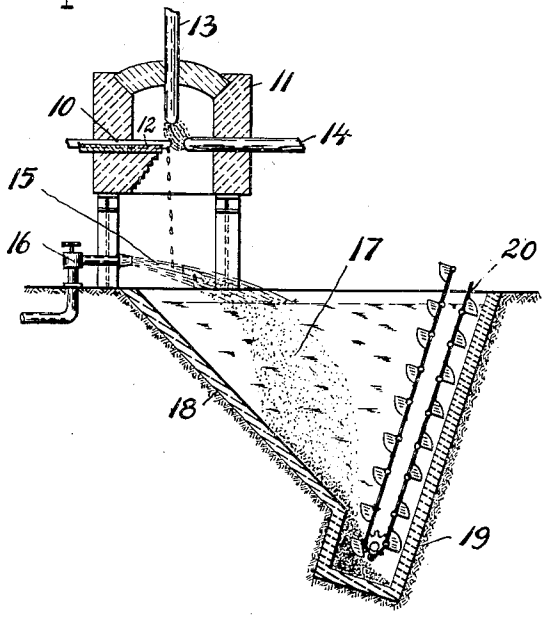


Fig. 4.



INVENTOR.

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Patented Feb. 18, 1930

1,747,756

UNITED STATES PATENT OFFICE

THOMAS STANLEY CURTIS, OF HUNTINGTON PARK, CALIFORNIA, ASSIGNOR TO THE VITREFRAX CORPORATION, OF HUNTINGTON PARK, CALIFORNIA

ELECTRIC TORCH FURNACE

Application filed July 30, 1928. Serial No. 296,405.

The principal object of this invention is to provide an electric furnace which is designed primarily for fusing or melting products of the ceramic class, and specifically mullite. To the end of carrying out the process of fusing mullite so as to obtain the substance in its amorphous form, this furnace has been designed to easily be adapted for use with other materials.

In designing an electric furnace for the objects noted, I avail of an electric arc between carbon electrodes which are arranged at right angles with one another so that the arc generated thereby is a 90 degree arc. Raw material in the form of a bar is fed into the arc in substantially the same line as one of the electrodes and the end is melted away by the heat effect of the arc thereon. To the end of always maintaining the electrodes in proper position, suitable instrumentalities are provided which feed the electrodes toward each other at a constant, even rate, and should one of the carbon electrodes be consumed more rapidly than the other, due to defects or other circumstances, I provide supplemental instrumentalities for individually actuating either or both of these electrodes.

A suitable mixture of alumina and silica is fed into a pug mill which extrudes the mass in the form of a continuous bar or cake which is passed on to a conveyer of the endless type. This conveyer carries the mass through an elongated heating chamber wherein its temperature is gradually raised. A particularly noteworthy feature of the invention lies in the means provided for synchronizing the rate of speed of operation of the pug mill and conveyer. Obviously, it would not be desirable or practical to have the conveyer operate at a speed sufficient to disintegrate the bar. I therefore avail of any suitable instrumentalities for establishing the proper relationship between the operations of these parts. With the end in view of providing a furnace which will carry out the commercial process noted, as cheaply as possible, I avail of gas or other carbonaceous fuel for preheating the bar being treated, and in carrying out this idea, I employ an elongated heating chamber which encloses the conveyer. This heating chamber functions to gradually raise the bar in temperature as it moves comparatively inwardly so that by the time it reaches the electrodes, it is at substantially a red or white heat, thereby rendering more effective and efficient the action of the electric arc thereon.

In order to obtain the amorphous form of the substance being treated, it is essential that it be quickly cooled or quenched and to this end I avail of a stream of water which is positioned beneath the electrodes so that material fused by the latter elements will fall into the stream and be quickly cooled thereby. Furthermore, this stream functions to break the globules or balls of fused material into many particles with a shattering effect thereby rendering more effective the cooling action. The water coming from the stream and the particles of mullite cooled thereby pass into a receptacle of pyramidical construction which has at the bottom a throat in which the material collects.

For the purpose of removing the material from the throat of the receptacle, elevating means preferably in the form of an endless bucket chain is employed which raises the material out of the liquid whereupon subsequent operations may take place thereon.

Various other more detailed objects and advantages will in part become apparent and in part be hereinafter stated as the description of the invention proceeds.

For a full and more complete understanding of the invention, reference may be had to the following description and accompanying drawings, in which

Figure 1 is a side view partly in section and partly in elevation of an electric torch furnace made in accordance with this invention.

Figure 2 is an enlarged detailed view partly in section and partly in elevation bringing out the arrangement of electrodes employed and the operating instrumentalities therefor.

Figure 3 is a section taken about on the line 3—3 of Figure 1.

Figure 4 is a detailed view showing in section bringing out particularly the action of water on the molten mullite.

Figure 5 is a detailed illustration showing

the manner in which the bar of raw material is supported just before insertion in the electric arc.

While a preferred embodiment of the invention is herein set forth, it is to be understood that I am not to be limited to the exact constructions illustrated and described, because various modifications of these details may be provided in putting the invention into practice within the purview of the appended claims.

From my copending process application Serial No. 296,404 filed July 30th, 1928, it is readily ascertainable that I wish the raw material to be subjected only to the action of carbon in vapor form. Any other form of the carbon has a very deteriorating effect.

A pug mill is indicated somewhat diagrammatically at A and includes a worm 1 which extrudes raw mix in bar form as indicated by the reference character 2. The mill 1 may be mounted on any suitable support such as at 3. As the mill A extrudes the bar 2, it passes on to a conveyer 4 which is preferably of the endless link type and should be made of some good refractory metal, any of the well known metals of this character being satisfactory. The conveyer 4 carrying the bar 2 is surrounded by a heating chamber designated 5 that includes at one end an enlarged combustion chamber 6 while at the other end is a flume exhaust or chimney construction 7. A gas burner 8 is located in the combustion chamber. It is readily appreciable that the combustion of fuel supplied by the burner 8 in the chamber 6 causes a high temperature therein and the passage of heat along the elongated chamber 5 and finally out through the exhaust at 7 provides for the gradual heating of the chamber 5 which has a minimum heat adjacent to the exhaust 7 with a maximum in the chamber 6. The conveyer 4 and heating chamber just described may be supported in any preferred manner such as by supports indicated at 9. The bar having been heated by its passage through the chambers 5 and 6, passes through an opening 10 in the wall of a furnace chamber 11 wherein it is supported by a graphite siloxicon supporting member 12. Inside the electric furnace 11 are located two electrodes 13 and 14, the ends of which are mounted at a constant distance by instrumentalities to be hereinafter described. The end of the bar is fed in by the conveyer at a suitable rate so that its end is constantly melted by the arc passing between electrodes 13 and 14. This fused material falls due to gravity action, into a stream of water 15 flowing from a hydrant indicated generally at 16. This stream of water is under sufficient pressure to cause a shattering of the molten globules of the mullite so as to break the latter up into small particles which are shown somewhat diagrammatically at 17. A chamber 18 of somewhat pyramidical formation receives the water 15 and also the particles 17 which last named material passes into a throat portion 19 of the receptacle wherein is located an elevator 20 in the form of an endless bucket chain. This elevator raises the material 17 out of the water in the chamber 18 and passes it on to a point whereupon subsequent operations may take place thereon.

The electrodes 13 and 14 are carried by slides 21 and 22 which are arranged for movement on suitable supporting members indicated at 23 and 24. A worm drive arrangement between the slides 21 and 22 and driving members 25 and 26 which are simultaneously operable due to the presence of the bevelled gear construction at 27, causes feeding movement of the electrodes. Driving members 25 and 26 are driven by any suitable power source such as an electric motor indicated at 28 which drives the member 26 through gear shown at 29.

In case one of the electrodes should be defective and therefore be consumed at a faster rate than the other, I provide for the individual movement of either one of the electrodes without entailing a corresponding movement of the other. To this end the electric motors 30 and 31 are carried by the slides 21 and 22 and which motors function to operate worm drive means shown at 32 to cause movement of its associated slide.

It is thought that the operation of the furnace is apparent from the foregoing, and it might be again mentioned that this furnace is particularly useful for commercial use inasmuch as it provides for the carrying out of the desired process with the smallest possible consumption of fuel and power.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent in the United States, is

1. An electric torch furnace of the class described, comprising, in combination, electrodes arranged in right angular relationship, quenching means beneath the meeting ends of the electrodes, and means to feed a quantity of ceramic material to one of the electrodes substantially in line with but from a direction opposite the same.

2. An electric torch furnace of the class described, comprising, in combination, means for forming a bar of material to be treated, instrumentalities for preheating said bar, and electric means for heating such bar to the point of fusion.

3. In an electric torch furnace of the class described, the combination with electric means for fusing material to be treated, of a stream of water under pressure arranged to receive material fused by the action of the electric means thereon and which stream of water functions to shatter and cool said fused material.

4. In an electric torch furnace of the class

described, the combination with electric means for fusing ceramic material, of instrumentalities for feeding the ceramic material to the electric heating means, means for quenching said fused material, a tank for receiving and cooling the quenched material, and elevating means for removing the material from the tank.

5. An electric torch furnace of the class described, comprising, in combination, a pug mill for forming raw ceramic material into a continuous bar, an endless conveyer for receiving said bar and passing it into the furnace, and means for preheating the bar prior to its being placed under the action of superheating means.

6. An electric torch furnace of the class described, comprising, in combination, a conveyer, a heating chamber enclosing said conveyer, carbon electrodes constituting an electric furnace, said furnace being arranged with respect to the heating chamber so that it will receive fuel heated thereby at its maximum temperature.

7. An electric torch furnace of the class described, comprising, in combination, an elongated heating chamber having a combustion chamber at one end, instrumentalities for passing a bar of ceramic material to be treated to said heating chamber, said heating chamber and combustion chamber functioning to gradually heat the bar of material to a high degree, and an electric furnace located adjacent to the combustion chamber so that it acts on the material just as it has reached the maximum heat caused by the heating and combustion chambers.

8. A torch furnace of the class described, comprising, in combination, an endless conveyer partially enclosed by an elongated heating chamber, means for supplying plastic ceramic material to the conveyer which carries it into the heating chamber, an electric furnace including electrodes arranged so that they form an arc which acts on the material coming from the heating chamber to fuse the latter, and cooling means located beneath the meeting point of the electrodes so that material fused thereby falls directly into the cooling means.

9. In a furnace of the class described, the combination, with means for fusing material to be treated, means for feeding a ceramic material to the fusing means, and means for substantially instantaneously cooling the material fused as it is fused.

10. In a furnace of the class described, the combination, with means for fusing material to be treated, means for feeding a ceramic material to the fusing means, and means for directing cooling water against the material as it is fused to shatter and cool it.

11. In a furnace for the production of amorphous mullite, in combination, a fusing chamber, means for feeding the ceramic material into the fusing chamber and subjecting the material to fusing operation, and means for directing a blast of cooling water against the material as it is fused to quench the material and shatter the same.

12. In an apparatus for making amorphous mullite, in combination, a fusing chamber having fusing means therein, means for forming ceramic material into a plastic bar and feeding said bar to the fusing means in said chamber, and means for directing a cooling blast of water against the material as it is fused to quench and shatter the latter substantially as set forth.

13. Apparatus for making a ceramic product in amorphous form, comprising electrodes to provide a fusing electric arc, a heating chamber for bringing the raw material fed to said arc to a high heat, a conveyer to carry the raw material in the heater and supply it to the electrodes for fusing action, and means to quickly cool the material after it is fused at the electrodes.

14. Apparatus for making a ceramic product in amorphous form, comprising fusing electrodes arranged at an angle to one another, means for feeding ceramic material to said electrodes so as to be acted upon by the electric arc provided in the operation of the electrodes, the feeding means being disposed so that the material does not contact with the electrodes as said material is supplied to and acted upon by the electric arc.

15. Apparatus for making a ceramic product in amorphous form, comprising electric fusing means, a preheating compartment for the ceramic material, means for feeding the ceramic material through said preheating compartment and increasing the heating of said material gradually from the entering to the delivering end of the compartment so that when the material reaches the arc of the electric fusing means, it is in a highly heated condition, and quenching means for the ceramic material operating thereon substantially as it is fused.

16. In apparatus for making a ceramic product in amorphous form, fusing means, means to form raw ceramic materials into a plastic bar, means for gradually heating said plastic bar thereby hardening the same, means for advancing the plastic bar through the heating means to the fusing means so that when the bar reaches the fusing means the bar is in highly heated condition, and means for suddenly cooling the materials of the bar after fusion.

In testimony whereof I affix my signature.

THOMAS STANLEY CURTIS.