

Feb. 26, 1929.

1,703,658

H. L. COLES ET AL

APPARATUS FOR MELTING AND CASTING

Original Filed Nov. 6, 1922

Fig. 1.

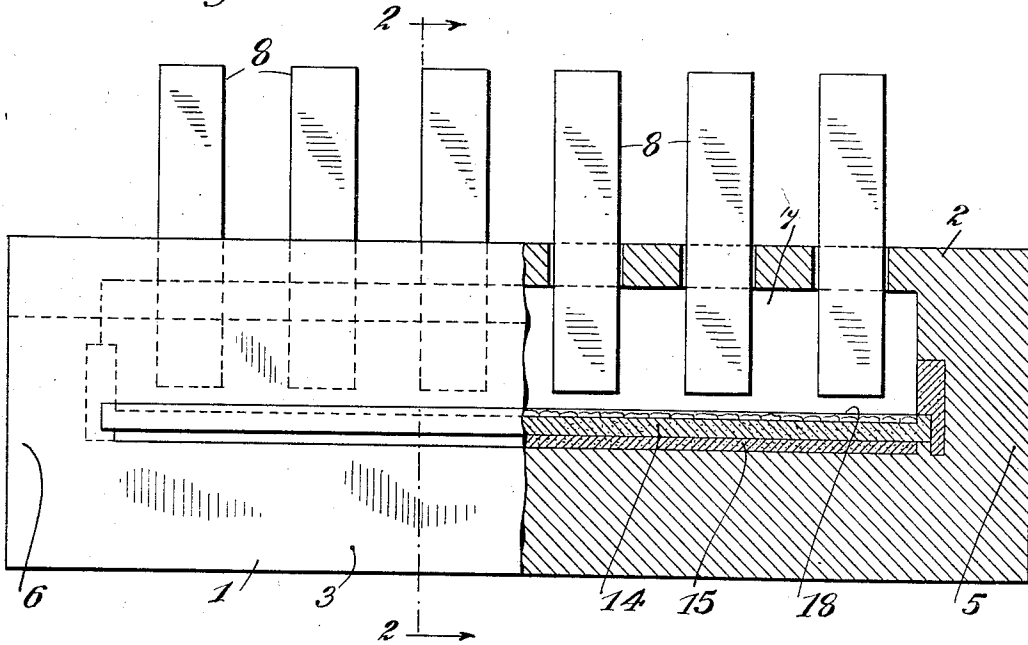
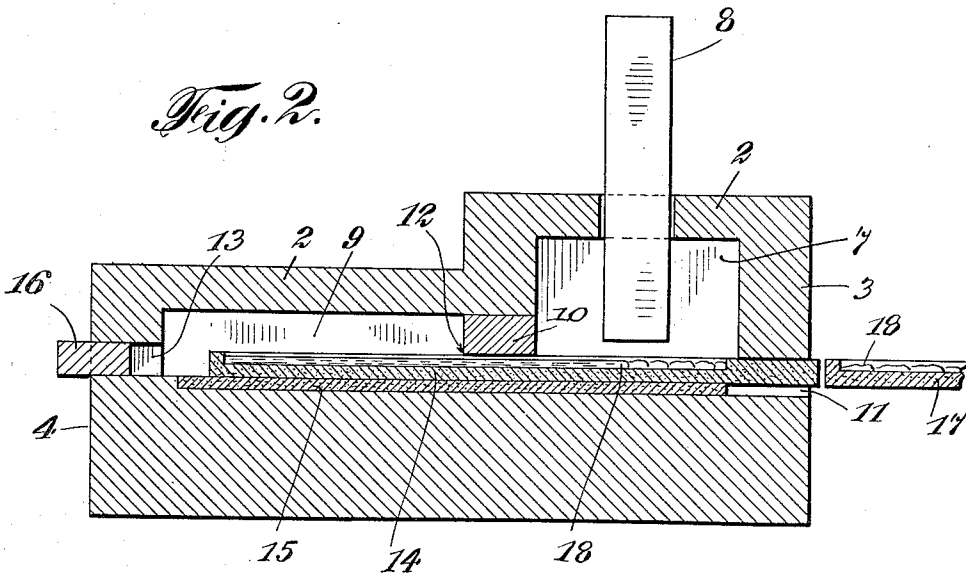


Fig. 2.



INVENTORS.
Henry L. Coles and
Joseph A. Donaldson
BY
J. W. Edwards
their ATTORNEY

Patented Feb. 26, 1929.

1,703,658

UNITED STATES PATENT OFFICE.

HENRY L. COLES AND JOSEPH G. DONALDSON, OF HAMILTON, OHIO, ASSIGNORS TO
GUARDIAN METALS COMPANY, OF HAMILTON, OHIO, A CORPORATION OF
DELAWARE.

APPARATUS FOR MELTING AND CASTING.

Original application filed November 6, 1922, Serial No. 599,199. Divided and this application filed
July 3, 1926. Serial No. 120,292.

This invention relates to methods of and apparatus for melting and casting, and more particularly to a method of melting and casting highly refractory materials and to an electric furnace for carrying out such method.

In electric furnaces, when the material becomes molten it separates into two parts, viz, the metal and the slag, due to their different specific gravities. It has been customary to pour off this slag through a slag hole in the furnace and then pour the metal out of the furnace into a suitable mold for casting. Some materials, for instance zirconia, are so highly refractory as not to permit pouring and are so hard as not to permit subsequent rolling or forging. These methods and furnaces fail when it is desired to produce integral lengths of highly refractory material, such as zirconia or compositions thereof. Applicants are unaware of any method of or apparatus for producing integral lengths, either cast, rolled or forged, of such materials prior to this invention.

The principal object of this invention is to provide a method of and apparatus for melting and casting highly refractory materials. A further object of this invention is to provide a method of continuously melting and casting highly refractory material by means of an electric furnace requiring a very small amount of current considering the quantity of material melted and cast. Another object of this invention is to provide an electric furnace which takes care of increased quantities of material in a given time, by facilitating the rapid feeding and discharge of charges of material, and by facilitating the removal of slag and similar material formed during the treatment of the material therein. Other objects will be in part obvious and in part pointed out hereinafter.

In accordance with the method of this invention, fragmentary material is progressively subjected to the action of heat to fuse the material progressively, the material being allowed to set in a mold to produce the integral length desired. The material may be carried in a trough or tray which is moved progressively past a heating agent so as to progressively subject the material carried by the trough to the heating agent to cause the desired fusing of the material. The trough may comprise a mold, in which the fused material, upon cooling, will be formed to the desired

shape. The cooling also may be progressive, and may take place on one part of the trough while material on another part is being fused. Thus the material may be melted and cast at the same time. By feeding molds in close succession the melting and casting operations may be maintained practically continuous. To carry out this method a furnace may be provided, having a heating chamber and means for progressively moving charges of material through said chamber to cause each charge to be progressively acted upon by the heat in said chamber. The material moving through the furnace is treated progressively, instead of as a whole, as has been customary heretofore, with the result that the size of the heating area in the chamber may be considerably reduced. The material is preferably passed through the furnace on troughs or molds which are movable along passageways provided therefor. The progressive action of the heating means upon fragmentary material in molds permits of the production of longer integral length than has heretofore been possible in furnaces having the same heating area. For instance, plates, strips or rods of great length may be made in an electric furnace adapted for the practice of this method, and which has only a single transverse line of electrodes, instead of the larger number of electrodes which would be required to heat simultaneously the entire area of the plate, rod or strip to be produced. In a furnace adapted to our method the size of the heating chamber may be correspondingly reduced.

By continuously withdrawing the slag and similar materials from the furnace by means of the troughs or molds, the necessity of periodically stopping the operation of the furnace to clean out the slag is eliminated. The slag is prevented also from interfering with the formation of additional metal.

In order that a clearer understanding of our invention may be had, attention is hereby directed to the accompanying drawings, forming a part of this application and illustrating one possible embodiment of my invention. Referring to the drawings, Fig. 1 is a diagrammatic view, partly in elevation and partly in section, of an electric furnace embodying our invention; and Fig. 2 is a diagrammatical, vertical sectional view taken on the line 2—2 of Fig. 1. Similar reference char-

acters refer to similar parts throughout both views of the drawings.

The drawings illustrate an electric furnace 1, adapted for use in practicing the new and useful method of producing alloys or compositions, and more particularly adapted for use in producing plates, rods or strips of highly refractory material. The furnace comprises bottom 1, top 2, rear 3, front 4, and sides 5 and 6, the construction being preferably of brick. The construction is arranged to provide within the furnace a heating chamber 7 into which extend, in the usual manner, electrodes 8, arranged as a single transverse heat-creating battery, which is adapted to direct the desired degree of heat to material within heating chamber 7. The method of and apparatus for creating heat in a heating chamber of an electric furnace is so well known in general that more specific description or instruction is believed unnecessary in this regard. The furnace construction is also arranged to provide one or more cooling chambers, such as 9, which is separated from heating chamber 7 by a wall 10, preferably of graphite or similar non-fusible material. The rear wall 3, front wall 4, and intermediate wall 10 are provided with aligned openings, respectively shown at 11, 12 and 13, shaped as to length and height to permit a trough or tray 14 to be slid into the heating chamber 7 of the furnace from the rear and to be moved through the heating chamber 7, so as to subject material on the tray progressively to the action of heat created at the electrodes 8, and then to be moved through wall 10, cooling chamber 9 and out of the furnace at the front. Preferably a bottom lining 15, of graphite or similar material, upon which the trough or tray slides, is provided in chambers 7 and 9 and below wall 10. If desired, a removable closure member 16, of brick or other suitable material, may be provided for opening 13. Preferably a plurality of trays or troughs for carrying the material through the furnace are provided so that subsequent trays, such as 17, may be employed to push the preceding tray or trays, such as 14, through the furnace.

In practicing the method by means of the furnace described, the material 18 to be subjected to the action of the heat to form the desired alloy or composition is placed on a tray 14, which is in effect a mold designed to form the material to the desired shape when allowed to cool therein after being fused or melted in the furnace. The tray is then slid into the rear of the furnace, through heating chamber 7 and cooling chamber 9 and out of the furnace at 13. The tray is moved continuously at a regulated rate of speed which will cause the material on the tray to be sub-

jected progressively to the action of the heating means for a sufficient length of time to effect the desired fusing of the material on the tray. The material so treated in the heating chamber is then carried by the tray through one or more cooling chambers and then out of the furnace. A continuous operation of the furnace may be had by feeding therethrough one tray of material right after another. Obviously all slag, and similar material formed during the treatment, is carried out of the furnace, where it may be removed by methods which are well known.

The method and apparatus above described is particularly well adapted for the making of cores or plates of highly refractory material, such as zirconia, in fragmentary form, either used alone or in combination with other materials, although obviously the method and apparatus applies to other material as well.

As many changes could be made in the method and apparatus above described, and as many different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings be interpreted as illustrative and not in a limiting sense, the scope of the invention being defined in the accompanying claims.

What we claim is:—

1. In a furnace of the character described, a heating chamber, a passageway through said chamber for material-conveying troughs, a plurality of material-conveying troughs adapted for continuous progressive movement through said passageway in close succession to each other, and a single series of arc electrodes extending across said heating chamber for at least the width of the material carried in said troughs and being positioned to melt simultaneously all of the material extending across the particular trough under said electrodes and perpendicular to the line of travel of said troughs.

2. In a furnace, in combination, a heating chamber, a cooling chamber, a passageway connecting said chambers, a stationary wall of refractory material substantially separating said chambers except at said passageway, said passageway adapted to have material-conveying troughs continuously and progressively moved therethrough, and a single series of electrodes mounted in said heating chamber across said chamber in positions to fuse said material as it passes under said electrodes.

This specification signed this 29 day of June, 1926.

HENRY L. COLES.
JOSEPH G. DONALDSON.