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METHOD OF CASTING

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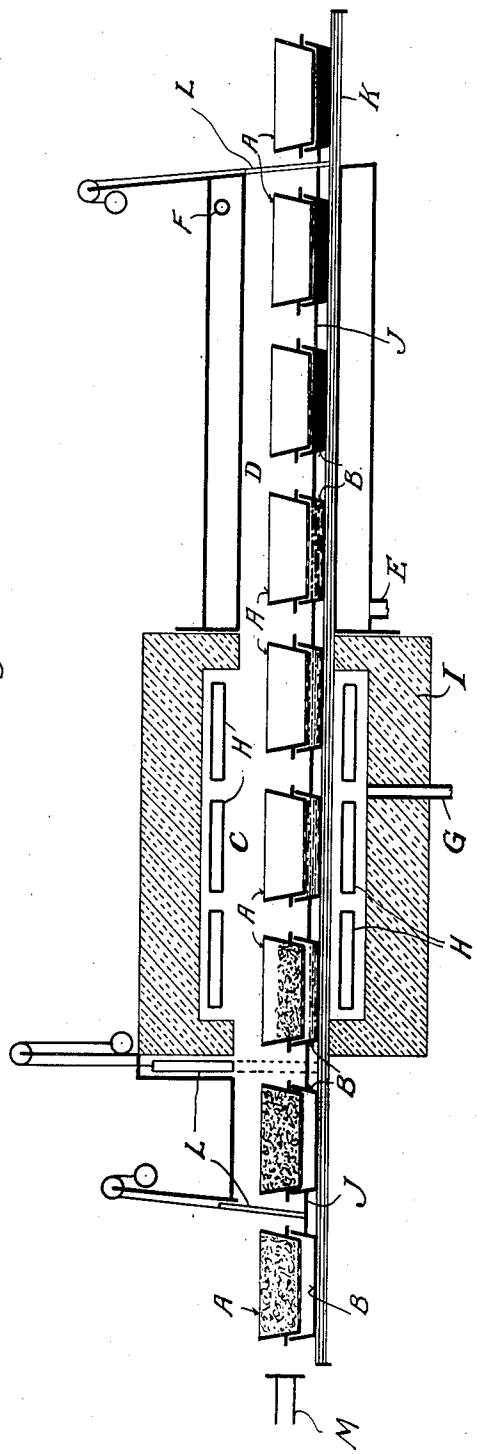


Fig. 1.

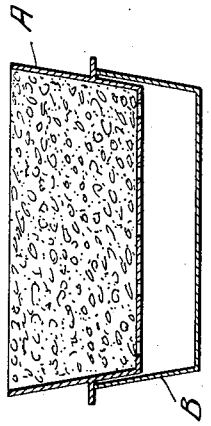


Fig. 2.

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METHOD OF CASTING

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6 Claims. (Cl. 22—200)

In the production of ingots and other castings, the usual procedure is to charge the metal into a receptacle that is built into or installed in a melting furnace and to pour the molten metal from the said receptacle into open moulds. In the working of this method, however, it is extremely difficult, or even impossible, to avoid oxidizing contact between the metal and atmospheric air during the melting, pouring and cooling operations, so that oxygen or oxides become included in the castings, with consequent deterioration of their physical properties.

The present invention purposes to eliminate the disadvantages that attend the ordinary methods of melting and casting, and to provide for the metal and casting of metal in mobile containers whilst the latter are passing successively and at a uniform speed through a furnace from which atmospheric air is excluded.

According to the said invention, it is proposed to charge the metal to be melted and cast into a container which is fitted to and above the top of a mould and to pass the combined container-and-mould unit through a heating chamber and a cooling chamber of a furnace of the continuous type, the metal being melted whilst the combined unit is in the heating chamber so that it can percolate into the mould in which it is solidified into ingot or other form whilst the unit is passing through the cooling chamber.

Referring to the drawing herewith submitted, and which illustrates diagrammatically apparatus in accordance with the invention:—

Figure 1 is a sectional elevation of a furnace and

Figure 2 is a sectional elevation of a combined container-and-mould unit, the container being shown charged with metal.

In the said drawing, the metal is charged into a container or crucible A which is socketed into the mouth of a mould B to form a mobile container-and-mould unit, the container being provided with a perforated floor, or otherwise so constructed that, as the metal melts, it may percolate or pass freely from the said container into the said mould. A plurality of charged units are mechanically conveyed in succession into and through the heating chamber C of a continuous type furnace by means of a pusher mechanism M or by placing them upon a conveyor belt, and as each unit emerges from the said heating chamber C it passes directly into and through the cooling chamber D. Each of the units is passed through the furnace in a definite controlled time period and the rate of travel is such that the whole of the charge in each container A is melted and run into the complementary mould B before the unit is discharged from the heating chamber C, whereas the molten metal is cooled to below its oxidizing temperature before the unit is discharged from the cooling chamber D.

The cooling chamber D is surrounded by a jacket through which water, air, or other cooling media flows from an inlet E to an outlet F, although, if desired, the jacket may be disposed on the underside only of the said chamber. Hence, as each unit passes into the cooling chamber, the mould is cooled by direct contact with the cooled floor of the chamber and the cooling of the molten metal takes place mainly from the bottom of the mould to the top so that the resulting casting is of uniform metallurgical structure and the possibility of gas being trapped therein is reduced to a minimum.

After each container-and-mould is discharged from the cooling chamber, the mould is disconnected from the container to enable removal of the casting.

The furnace is illustrated as a resistance type electric furnace having resistance units H suitably connected to a source of electrical energy, but any appropriate type of furnace may be used, as will be clear to those skilled in the art. In order to facilitate the movement through the furnace of the units, separated by spacers J, rails K may be provided which extend from a position in advance of the charging opening into the furnace and beyond a discharge opening at the end of the cooling chamber D. The melting and cooling being preferably carried out with the exclusion of atmospheric air, doors L are provided for closing the charging and discharging openings except when inserting or removing one of the units. Two doors may be provided, as shown at the charging end of the furnace in Figure 1, at a distance from each other slightly in excess of the length of a unit so as to form an air lock, and prevent appreciable influx of air into or efflux of gas from the heating chamber C during a charging operation. The same arrangement may be used at the discharge end. Any desired gaseous atmosphere may be obtained by flowing the necessary ingredients into the heating chamber C through a conduit G in the insulated wall I of the furnace from any suitable source of supply.

Preferably the heating chamber of the furnace is maintained at a temperature above the melting point of the metal so that after the container charge has been melted and run into the matrix of the mould, the casting is maintained in a molten condition up to the time of its conveyance into the cooling chamber. Or, if required, the casting may be subjected to super-heating by passing the same through a zone of the furnace wherein the temperature is higher than that required to melt the metal, or to maintain the casting in a molten condition.

By thus performing the melting, casting and cooling operations, in a continuous-type furnace,

it becomes a comparatively simple matter to exclude air from the molten metal and thus protect the casting from oxidation, as for example, by maintaining an appropriate gaseous atmosphere in the heating and cooling chambers. Where it is desired to prevent such oxidation, the atmosphere gas may be of a deoxidizing or inert character. Or the gas may contain a reducing constituent which acts as a deoxidizer for reducing any oxide that may be present in the metal to be cast, but it is preferable that the atmosphere gas should be insoluble in the molten metal so that it does not produce blow-holes or other unsoundness in the finished casting.

Alternatively, in cases where the prevention of oxidation is not essential, and/or where it is desired to impart special characteristics to the metal during the melting and/or casting operations, the said operations may be conducted in a furnace which is charged with a gas which will react with the molten metal and impart the desired characteristics thereto.

Having described my invention, what I claim and desire to secure by Letters Patent is:

1. A method or process of melting and casting metals in which metal is charged into a container fitted to and above the top of a mould to form a combined container-and-mould unit, the said unit is passed through a heating chamber of a furnace where the whole of the metal to be cast is melted and passes into said mould, and said unit is then passed directly into and through a cooling chamber of said furnace where the metal is solidified; the heating and cooling operations being carried out with the exclusion of atmospheric air.

2. A method or process of melting and casting metals according to claim 1, in which the heating and cooling operations are carried out in a reducing gas and the cast metal is cooled to below its oxidizing temperature before it is discharged from the cooling chamber.

3. A method of melting and casting metals in a combined unit having a container with a perforated bottom cooperatively mounted on a mould and proportioned to hold about sufficient metal to fill the mould entirely throughout its cross section and up to a region just below the perforated bottom of said container which comprises placing a charge of metal to be melted on the perforated bottom of the container of the aforesaid combined unit, subjecting said charged unit to a temperature higher than the melting point of the metal in the container, maintaining said charged unit at a temperature higher than the melting point of said metal for a period of time sufficient to melt all of the aforesaid metal in the container and to cause said melted metal to flow into the mould thereby filling the latter throughout its cross section and up to a region just below the perforated bottom of said container, and cooling the molten metal in said mould to solidify it whereby a sound casting can be produced uniformly and successively.

4. A method of melting and casting metals in a plurality of combined units adapted to move in succession through an environment comprising a heating region and a cooling region, each unit having a container with a perforated bottom cooperatively mounted on a mould and proportioned to hold about sufficient metal to fill the mould entirely throughout its cross section and up to a region just below the perforated bottom of said container which comprises placing a charge of metal to be melted on the perforated bottom of each container of the aforesaid combined units, successively moving the charged units through a heating region while subjecting them to a temperature higher than the melting point of the metal in the containers, maintaining said charged units at a temperature higher than the melting point of said metal for a period of time sufficient to melt all of the aforesaid metal in the containers and to cause said metal to flow into the complementary moulds, maintaining the metal which flows into said moulds in a molten condition until the whole of the metal to be cast has flowed into said moulds thereby filling each of the latter throughout its cross section and up to a region just below the perforated bottom of said container, successively moving said units through a cooling region while cooling the metal in said moulds to solidify it whereby sound castings can be produced uniformly and successively.

5. A method of melting and casting metals in a combined unit having a container with a perforated bottom cooperatively mounted on a mould and proportioned to hold about sufficient metal to fill the mould entirely throughout its cross section and up to a region just below the perforated bottom of said container which comprises placing a charge of metal to be melted on the perforated bottom of the container of the aforesaid combined unit, subjecting said charged unit to a temperature higher than the melting point of the metal in the container while excluding atmospheric air, maintaining said charged unit while excluding atmospheric air at a temperature higher than the melting point of said metal for a period of time sufficient to melt all of the aforesaid metal in the container and to cause said melted metal to flow into the mould thereby filling the latter throughout its cross section and up to a region just below the perforated bottom of said container, and cooling the molten metal in said mould while excluding atmospheric air to solidify it whereby a casting substantially free from oxidation can be produced uniformly and successively.

6. A method of melting and casting metals in a combined unit having a container with a perforated bottom cooperatively mounted on a mould and proportioned to hold about sufficient metal to fill the mould entirely throughout its cross section and up to a region just below the perforated bottom of said container which comprises placing a charge of metal to be melted on the perforated bottom of the container of the aforesaid combined unit, subjecting said charged unit in the presence of a reducing gas to a temperature higher than the melting point of the metal in the container, maintaining said charged unit in the presence of a reducing gas at a temperature higher than the melting point of said metal for a period of time sufficient to melt all of the aforesaid metal in the container and to cause said melted metal to flow into the mould thereby filling the latter throughout its cross section and up to a region just below the perforated bottom of said container, cooling the molten metal in said mould in the presence of a reducing gas to solidify it, and maintaining the cast metal in a reducing atmosphere until it has cooled below its oxidizing temperature whereby castings free from oxides can be produced uniformly and successively.

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