

UNITED STATES PATENT OFFICE.

HARRY M. WILLIAMS, OF DAYTON, OHIO, ASSIGNOR TO GENERAL MOTORS RESEARCH CORPORATION, OF DAYTON, OHIO, A CORPORATION OF DELAWARE.

PROCESS OF COATING MOLDS AND PRODUCT THEREOF.

No Drawing.

Application filed January 10, 1925. Serial No. 1,580.

This invention relates to the art of casting metal in permanent molds. It appertains specifically to the preparation of metallic molds to receive molten metal of relatively high melting point.

Its object is to protect the mold surface from injury during the casting and setting period; to avoid the necessity of renewing the coating with every pour; and to perfect the quality of the resultant casting.

The invention consists in a process of treating the mold in preparing it for receiving molten metal by applying, in the manner hereinafter described, a high heat resistant material of relatively indestructible character.

In the practice of casting metals of relatively high melting points in so-called permanent molds, in distinction from the more usual sand molds, metallic molds are used which are frequently of the same material as the metal to be cast, and therefore of substantially the same melting point. Metallic molds for this purpose may be also of metal having lower melting point than that of the metal to be cast. In making castings of iron, steel, brass and other relatively high melting point metals, in metal molds, to avoid fusing, washing or dissolving of the interior surface of the mold, or sticking of the casting to the mold, it is necessary to treat the mold in some way; otherwise both mold and casting are likely to be ruined. Hence it is usual to coat the interior of the molds with some material that will prevent said sticking of the cast metal and said melting, dissolving or washing away of the mold surface to the damage of the casting and ruin of the mold. Difficulty has been experienced hitherto with the coating of metallic molds used for casting relatively high melting point metals because the coatings have not preserved an intact film separating effectively the casting from the mold in such manner as to avoid the difficulties named.

In the process constituting the subject of this application, the interiors of metal molds are coated with a high heat resistant and durable substance of extremely fine texture

and smooth surface. By this process molds may be coated with refractories without the use of any binder, whereby full advantage of the high melting point of the refractory accrues since its melting point is not lowered by the presence of a binder nor is the coating rendered crumbly or scaly by the volatilization, melting or burning of a binder.

In practicing the invention a refractory material may be ground into a granular state sufficiently fine that the granules or particles can pass through a 100 mesh sieve. The material ground to this degree of fineness may then be introduced with water and a deflocculating agent into a ball or pebble mill and then ground again for a period of from six to twelve hours or more, until the refractory substance is reduced to exceedingly fine, impalpable particles, in whole or in part.

Among refractory materials that have given good results are magnesite, zirconia, silica, alumina and thoria; and among the deflocculating agents used successfully are the alkaline substances, caustic soda, soda ash, and borax and such acid substances as tannic acid.

The refractory material produced in the manner described is of extremely fine and smooth texture. A large part of it, if not all, will be an impalpable powder. This material in the described state of extremely fine, impalpable powder, may be diluted to a thin slurry with water or other suitable liquid vehicle and sprayed by an air brush, or otherwise applied to the molding surface of molds to be prepared for receiving molten metal. No binder whatever is used.

The deflocculating agent functions solely to promote the reduction of the material during the final grinding. It acts in no sense as a binder for the refractory coating. The quantity of deflocculating agent required to achieve satisfactory reduction of the refractory substance to an impalpable powder may be about one half of one per cent ($\frac{1}{2}\%$) by weight compared with the quantity of refractory material being treated.

Metal molds to be prepared for casting are first heated, then the molding surfaces are covered in any suitable manner with coating of the described refractory, prepared in the manner explained, of any desired thickness. The best mode of applying the coating thus far known is to spray the slurry or apply it in an "atomized" condition onto the hot mold by means of an air brush. The moisture in the coating quickly evaporates, owing to the heat of the mold and thus continuously dries so that the coating is always in condition for receiving continuously additional quantities of the slurry being sprayed. In consequence, a coating may be quickly built up to any desired thickness.

After the coating applied to a mold as described has attained the desired degree of thickness the coated mold should be placed in a furnace or oven and heated to a temperature of about 1100° F. until the particles of the impalpable powder in the coating have been caused by the heat to sinter or aggregate into a coherent mass. Should there be any coarser particles in the coating which will not cohere each to the other or to the extremely fine particles, the sintered mass will bind them inextricably in place.

By the process described a refractory coating may be obtained on permanent metal molds, which is fusible only at the fusing temperature of the refractory used, as no binder is included. The inclusion of binders in mold coatings reduces the melting point of the coating as a whole, or the binder may burn out or volatilize and render the coating friable or scaly, exposing the metallic molding surface to direct contact with the molten metal which has been poured into them, with the result of possible injury to both mold and casting and the probable necessity of renewing the coating for every cast or at very frequent intervals.

A principle involved in this invention is the capacity of particles of refractories, reduced to extremely fine state or to an impalpable powder, to cohere or aggregate into an integral mass when subjected to a certain temperature that is lower than the melting point of the refractory.

Among the many refractories and deflocculating agents used in mold coating by the process described, calcined magnesite and caustic soda have yielded very satisfactory results over extended periods of test and manufacturing production. The fusing point of calcined magnesite is about 5000° F., while that of cast iron and steel are respectively about 2250° F. and not over 2800° F.

The coating material produced and applied as described forms a smooth heat resisting and heat insulating, relatively permanent mold lining, making possible the production of a large number of excellent

castings from a single mold without renewal of the coating.

Still more improved results may be achieved by covering the relatively permanent lining with a temporary or renewable coating, such as soot or other suitable form of finely divided carbon. The temporary coating preferred is a mixture of finely divided graphite with shellac dissolved in alcohol, which may be brushed or sprayed upon the refractory lining. It is obvious that mold surfaces thus coated may be smoked before each pour, as is customary in preparing permanent or other molds. The use of the refractory coating described with a temporary, renewable covering of a graphitic nature is extremely useful for protecting metallic molds which are of the same or lower melting point than that of the metal to be cast in them, or which are intended to receive molten metal of a kind that tends to dissolve or set up a reaction with the mold surfaces.

The use of the refractory coating prepared and applied in accordance with this invention, either with or without the additional fugitive and renewable coating, renders it practicable to make excellent castings of iron and other high melting point metals, in high heat conducting molds composed of metals of lower melting point, which it has hitherto been deemed could not be used as mold materials for this purpose.

While the best methods of practicing the process of this invention and the best embodiment of the product of said process have been explained and described in detail as required by the patent laws, it is to be understood that the scope of the invention is not limited to the detail described but only by the definitions of the appended claims. What is claimed and desired to be secured by Letters Patent is:

1. A process of preparing metallic molds for receiving molten metal which consists in applying to the molding surface a coating of finely divided refractory material comprising a substantial proportion of the refractory reduced to an impalpable powder, and then heating the coated mold at a temperature and for a period of time sufficient to effect aggregation of the impalpable particles into a coherent mass.

2. A process such as is defined in claim 1 in which the mold is heated before applying the coating, and the refractory material is suspended in a liquid vehicle while being applied.

3. A process such as is defined in claim 1 in which the mold is heated before applying the coating and the refractory material is suspended in water, while being applied.

4. A process such as defined in claim 1 in which the mold is heated before applying the coating and the refractory material, sus-

pended in a liquid vehicle, is applied to the mold surface in an atomized condition.

5 5. A process such as defined in claim 1 in which the refractory, reduced to a granular state, is then ground with water and a deflocculating agent until a substantial portion, at least, is reduced to an impalpable powder.

6. A process such as is defined in claim 1 in which the refractory is reduced to an im- 10 palpable powder by grinding in the presence of a liquid and a deflocculating agent.

In testimony whereof I hereto affix my signature.

HARRY M. WILLIAMS.