Patented June 30, 1936 2,045,913

UNITED STATES PATENT OFFICE

2,045,913

CASTING LIGHT METAL

John E. Hoy and Leslie Brown, Midland, Mich., assignors to The Dow Chemical Company, Midland, Mich., a corporation of Michigan

No Drawing. Application August 28, 1933, Serial No. 687,162

3 Claims. (Cl. 22—192)

The invention relates to procedures for casting light metals, e. g. magnesium, aluminum and alloys thereof, in temporary molds, that is, a mold or mold part, such as a core, comprising conventional pulverulent molding materials, such as foundry sand, pulverized carbon, cinders and the like, which are used but once for each casting. Such molds may be made up with water-tempered materials, or they may be dried or baked.

Owing to their relatively low specific gravity and heat capacity, light metals do not flow readily in nor fill completely mold cavities of narrow section, but instead chill promptly therein, thus giving rise to cold-shuts and mis-runs. Moreover, the heavier sections remain molten for a longer time than the thinner sections, so that shrinks, draws, and cracks may form between them. One of the objects of our invention is to facilitate the flow of light metals in the mold cavity, especially in the relatively narrow sections thereof, whereby the aforementioned difficulties may be overcome.

Heretofore the methods employed to minimize these difficulties were: (1) pouring the molten metal at temperatures considerably above the melting point of the metal, whereby its fluidity is increased but at the risk of excessive oxidation; (2) using numerous gates at the thin sections and risers on the heavy ones, which requires excessively large amounts of metal to trim off the casting, thereby increasing the cost of the latter; (3) increasing the thickness or decreasing the area of the thin sections. Such difficulties preclude the successful production of many forms of light metal castings in temporary molds, thus limiting the usefulness of these valuable light metals.

We have now found that we may pour light metal castings having a relatively thin section employing fewer gates and risers at lower temperatures generally than heretofore and thereby avoid excessive oxidation, with reduced risk of mis-runs and cold-shuts, if to the surfaces of the mold cavity and core when desired, if such is therein, we apply a lubricant dissolved in a liquid halogenated hydrocarbon, together with a finely divided solid material substantially inert to the molten light metal.

The invention, then, consists of the method hereinafter fully described and particularly pointed out in the claims, the following description illustrating, however, but several of the various ways in which the principle of the invention may be realized.

In carrying our invention into effect we may proceed in various ways. For example, the lubricant, such as an oil or wax, may be dissolved in, or mixed with, the liquid halogenated hydrocarbon and the mixture applied to the mold cavity, following which the finely divided inert solid may be dusted thereon. However, it is preferable to form a solution of oil or wax in the halogenated hydrocarbon and to suspend therein the inert solid and to apply the so prepared mixture to the mold cavity surfaces. The light metals may then be poured into the mold in the usual manner, in doing which lower pouring temperatures generally may be employed than in conventional practice.

Of particular importance in carrying out such procedure is the nature of the liquid medium or vehicle by use of which the lubricant and finely divided solid material may be applied to the mold cavity surfaces. Ordinary liquid hydrocarbons, such as gasoline and the like, do not produce the desired results. We prefer to use a chlorinated hydrocarbon, such as carbon tetrachloride, although any halogenated hydrocarbon, preferably of the aliphatic series, may be employed that is a liquid at ordinary temperatures and has a boiling point in excess of about 40° C. Other examples of a chlorinated hydrocarbon are: ethylene chloride, propylene chloride, tri-chloroethylene, tetra-chloroethylene, and chloroform.

In the preparation of the coating we can use any of the common waxes, such as paraffin, bayberry, carnauba, ceresin, beeswax, etc., or a mineral lubricating oil or any animal or vegetable oil, such as lard, whale, tallow, cocoanut, olive, palm, castor oil, etc., as well as mixtures of such oils and waxes, which may be dissolved in, or diluted with, the halogenated hydrocarbon.

While an oil particularly of animal or vegetable origin or a wax applied to the mold cavity with the aid of a halogenated hydrocarbon of the type described facilitates to a certain extent the flow of molten metal in the mold, a materially greater improvement occurs when we employ in conjunction therewith a finely divided or powdered solid substance that is substantially inert to, or unaffected by, the metal at the casting temperature. Examples of solids which are suitable for the purpose are talc, silica flour, precipitated silica, kieselguhr, kaolin, magnesium oxide, limestone, and fuller's earth. The solid may be ground to a relatively fine powder so that it will pass through a screen having about 100 meshes or more per inch, in which condition it may be suspended readily in the mixture of

wax or oil and halogenated hydrocarbon, or dusted on the mold surfaces treated with the mixture of oil or wax in the halogenated hydrocarbon.

In pouring magnesium castings in molds formed from green, i. e. water-bound, sand containing an oxidation inhibitor of the type commonly used for such castings, e. g. ammonium salts, boric acid, sulphur, volatile fluorine compounds, etc., we have observed that the beneficial action of the inhibitor is not affected by applying our coating agents to the surface of the mold cavity. If desired, an oxidation inhibitor may also be included with our mold coating agents.

The relative proportions of the ingredients of the coating composition may be varied over a wide range. For example, we may employ in one gallon of halogenated hydrocarbon from 0.5 to 4 pounds of oil or wax, and from 0.5 to 4 pounds of inert solid material, although other proportions may be used if desired. It is convenient to apply the mixture to the mold by means of a spray gun or atomizer, in amount sufficient to coat the surface of the mold cavity.

To demonstrate the effectiveness of the invention we have made flow tests in a mold cavity for a thin spiral casting having a triangular cross section of approximately ¼ square inch. The tests showed that the metal flowed much further, in some cases as much as double the distance, when poured at a temperature of 1225°–1275° F. into the mold cavity previously sprayed with a composition made up in the following proportions: one gallon of carbon tetrachloride, one pound of paraffin wax, and two pounds of powdered talc.

Among the advantages of our invention are: (1) we can pour thin section light metal castings with fewer gates and risers than is otherwise possible, thus saving considerably in the amount of metal used; (2) we can pour the metal at a lower temperature than is otherwise possible, and still avoid mis-runs and cold-shuts; (3) by pouring the metal at a lower temperature we substantially avoid draws and shrinks between the heavy and thin sections of the castings which ordinarily occur in castings poured at high temperatures; (4) sand pits are avoided, since the sand is held in place by the coating and does not fall from the cope into the drag.

In the disclosure and appended claims the term "light metals" means magnesium, or aluminum, or alloys thereof wherein either the magnesium or aluminum content predominates; the term "lubricant" means a wax or a mineral lubricating oil or an animal or vegetable oil.

This application is a continuation in part of our prior application Serial No. 608,845, filed May 2, 1932.

Other modes of applying the principle of our invention may be employed instead of those explained, change being made as regards the process herein disclosed, provided the step or steps stated by any of the following claims or the equivalent of such stated step or steps be employed.

We therefore particularly point out and distinctly claim as our invention:—

1. In casting magnesium in molds of sand and the like, the step which consists in applying to the surfaces within the mold cavity a mixture containing paraffin wax, talc, and carbon tetrachloride.

2. In casting magnesium in molds of sand and the like, the step which consists in applying to the surfaces within the mold cavity a mixture containing from 0.5 to 4 pounds of paraffin wax, from 0.5 to 4 pounds of talc in one gallon of carbon tetrachloride.

3. In casting magnesium in sand molds and the like, the step which consists in applying to the surfaces within the mold cavity a mixture containing a wax, a liquid chlorinated aliphatic hydrocarbon and a finely divided substantially inert solid material selected from the group consisting of talc, silica, kieselguhr, kaolin, magnesium oxide, limestone, fuller's earth.

JOHN E. HOY.
LESLIE BROWN.