United States Patent [19]

Sprinkle et al.

[11] **3,769,046**

[45] **Oct. 30, 1973**

[54] **HOT TOPPING**

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[22] Filed: **Apr. 5, 1972**

[21] Appl. No.: **241,403**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 40,395, May 25, 1970, abandoned.

[52] **U.S. Cl.**..... **106/38.22,** 106/38.23, 106/38.27, 249/197, 249/202

[51] **Int. Cl.**..... **B28b 7/36**

[58] **Field of Search**..... 106/38.9, 38.22, 106/38.27, 38.3, 38.35, 38.23; 164/53, 54; 249/197, 202

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[57] **ABSTRACT**

In the casting of metals, the use of compatible exothermic hot topping material in compressed agglomerated form, having an ignition time greater than five minutes, reduces air pollution and safety hazards and permits reuse of the riser material.

2 Claims, No Drawings

HOT TOPPING

This application is a continuation-in-part of our copending application Ser. No. 40,395 filed May 25, 1970, now abandoned, and assigned to the present assignee.This invention relates to the casting of metals. More particularly, it relates to the preparation of large metal castings wherein hot topping is resorted to in order to maintain s supply of molten metal to compensate for shrinkage of the solidifying metal.

The practice of hot topping in the preparation of relatively large metal castings is well known. Generally speaking, in hot topping, an exothermic material is placed on the surface of the riser metal to maintain the riser metal in a molten or liquid condition so that it may readily flow into the main parts of the casting to compensate for any shrinkage experienced during the solidification of the metal being cast. It has been customary to add such exothermic material in the form of a finely divided powder which will be readily ignited by the riser metal in performing its heating function. It is customary also to use as the exothermic hot topping material one which is compatible with or innocuous to the metal being cast so that the riser material may be reused in future castings. This is particularly important because the riser may constitute up to 50 percent or more of the weight of the casting proper, riser weights of 100,000 pounds and upward not being unusual in the manufacture of large metal castings.

The use of finely divided or powdered hot topping materials is fraught with many hazards. The hot topping material used in relatively large quantities for large castings, for example from about 40–50 pounds for a 12-inch diameter riser, creates a safety hazard in that the powder, even though added in containers such as paper bags, ignites very rapidly at the metal contact surface ejecting large quantities of hot gases and finely divided material from the riser surface, making necessary the use of protective clothing by persons carrying out the hot topping and evacuation of the general area due to the explosive nature of the reaction and the ejection of material. More importantly, the ejection of large quantities of finely divided material creates a serious air pollution hazard.

From the above it will be quite evident that there is a need for hot topping material which can be used with relative safety and with the evolution of little or no air pollutants.

It has been found that when the hot topping material or composition is provided in the form of briquettes or agglomerates, pressed under relatively high pressures, normally greater than 2,000 pounds per square inch, having a volume of at least about one cubic centimeter, the hot topping material can be applied with relative safety, is ignited in a period of time, greater than five minutes, which allows withdrawal of persons with safety from the immediate vicinity of the mold, and drastically reduces the air pollution hazard. The materials of the invention are selected, and they are used in proportions, which permit agglomeration at pressures ranging from slightly over 2,000 psi for 1 cubic centimeter briquettes to 5,000 psi for 20 cubic centimeter briquettes. Many of the usual thermite materials would be agglomerated at these pressures only at great hazard — and many would ignite upon agglomeration at these pressures.Those features of the invention which are believed to be patentable are set forth with particularity in the claims appended hereto. The invention will, however, be better understood and further objects and advantages thereof appreciated from a consideration of the following description.

Any of a number of exothermic hot topping materials can be used in conjunction with the present invention. It is preferable that the exothermic material be either innocuous to the metal composition or compatible therewith so that the solidified riser material may be used in further casting operations. In addition, they must be capable of agglomeration at pressures over 2,000 psi. A typical composition which has been found useful in the present connection is one consisting of, by weight, powdered, from 59 percent to 69 percent and preferably 64 percent black iron oxide, from 10 percent to 16 percent and preferably 13 percent aluminum, from 2 percent to 6 percent and preferably 4 percent silicon, from 2 percent to 6 percent and preferably 4 percent manganese dioxide and from 12 percent to 18 percent and preferably 15 percent wollastonite. The term "binder" is used herein in accordance with its well known meaning in the briquetting industry as an adhesive material capable of giving green strength to the compressed agglomerate. Any of a number of adhesive or binding materials can be used with the present invention, the only dictate being that it not contain materials which will contaminate the riser metal. Thus, generally speaking, unless carbon is deliberately desired to be added to the metal composition, organic or carbon-containing or producing binders which do not volatilize should be avoided. Among the binders which have been found useful are the usual foundry type binders such as clay, and celluslosic materials such as wood sugars, cornstarch or those having a dextrin base, among others. The material specifically used had a hydrolyzed wood sugar base and is sold as KG201 by Komarek-Greaves and Company. The binder should also be inert in the sense that it does not react deleteriously with any of the metal constituents or with the binder constituents proper. Typically, the binder is less than 10 percent of the weight of the remaining ingredients, and usually from about 0.5 percent to 5 percent, although it can be varied within these limits with different binders and hot topping materials. A solvent, typically water, may be present in amounts of 0.5 percent to 4 percent, based again upon the 100 percent granular base.

In preparing the agglomerated hot topping materials of the present invention, various shapes and sizes can be used. Generally speaking, briquettes similar in shape to charcoal barbecue briquettes or pillows but having a volume of about from 5 to 10 cubic centimeters are preferred. Such shapes and sizes can, of course, be varied as desired, but preferred from the viewpoint of ease of manufacture and use are briquettes ranging in overall dimension from about 1¼ inch × ⅝ inch × 1¼ inch to 1 inch × 1 inch × ⅜ inch. In making the briquettes, the binder is simply mixed thoroughly with the powdered material and pressed and dried in any desired manner. It has been found that briquettes substantially over 25 cubic centimeters in volume may present problems in use in that they are difficult to dry thoroughly, resulting in the possibility of an explosion hazard when any remaining solvent or liquid is suddenly expanded upon exposure to the riser metal.

As opposed to the use of bags of powdered exothermic material which must be placed on the riser surface by persons dressed in protective clothing, the present

briquetted exothermic hot topping material can simply be dropped into the riser opening in any manner desired since at riser surface temperatures of from about 2,600°F to 2,800°F at which the material is usually applied, the briquettes will usually ignite only after a period of from about 5 to 15 minutes after exposure to the molten metal in the riser. This is an unusually long ignition time for a thermite material. Thus, personnel can be evacuated readily from the immediate vicinity of the mold and they need not be attired in protective clothing. Generally speaking, the briquettes are placed on the riser surface when by usual probing methods it has been found that the riser metal is about one-half frozen or solidified. The amount of material applied varies with the surface area of the riser, a good rule of thumb being that the pounds of material added is equal to about four-tenths the area of the riser surface in square inches. Of prime importance is the reduction of air pollution when the present invention is used. When the exothermic hot topping material is used in the form of powder, as pointed out above, the air pollution is intensive due to the creation of dust which itself may be explosive in nature and in any case requires the evacuation of the building housing the mold for times up to an hour or more until the pollutants are abated. The explosive force of the reaction also wastes the topping material in that quantities of it are ejected along with any heat insulating material which may have been added to the riser surface. When the above described materials are used in the present briquetted form as opposed to the powdered form in the same amount and for the same application, the production of dust and other air pollutants is reduced by a factor of about nine to ten so that production even in the immediate vicinity of the mold being treated need not be interrupted. The lower particulate emission rate results from the slower burn rate and fewer thermal currents. In a typical application of the present invention, there was added to the 12-inch diameter riser of a melt when it was about one-half frozen with a surface temperature of about 2,650°F, 45 pounds of briquettes of the above composition with 10 percent KG201 binder, each briquette having a volume of about one cubic centimeter. The briquettes were added to the riser simply by pouring from a container and did not ignite for a period of eight to 10 minutes. Tests carried out on the air pollution created by such typical use of briquettes showed that the air pollution was 0.006 pound of particulate matter per pound of exothermic material as compared to an air pollution of 0.053 pound of particulate matter per pound of exothermic material when added in the powdered form.

There is provided by the present invention exothermic hot topping material in compressed agglomerated form which is readily and without hazard added to mold risers with the production of substantially little or no air pollution. While the agglomerated form of the material has been described herein in a preferred briquette form which is used both from the point of view of ease of manufacture and use, it will be realized that departures in the shape and size of the agglomerate may be made without departing from the sense and spirit of this invention. Thus, for many purposes the agglomerated form may be in the shape of spheres or pellets or pill shaped or in relatively thick wafer shape, it being realized that as the thickness of the shape is lessened, the ignition time and safety time factors will be reduced. Likewise, the size of the agglomerates may be reduced so long as the decreased safety factor and risk of increased air pollution can be tolerated.

We Claim:

1. An exothermic hot topping material in the shape of pressed formed agglomerates containing, by weight, from 59 to 69 percent black iron oxide, from 10 to 16 percent aluminum, from 2 to 6 percent silicon, from 2 to 6 percent manganese dioxide, from 12 to 18 percent wollastonite and from 0.5 to 10 percent binder, said agglomerates being pressed at a pressure greater than 2,000 psi and having a volume in the pressed form of from about 1 cubic centimeter to about 25 cubic centimeters and an ignition time greater than five minutes.

2. A material as in claim 1 which is in the shape of briquettes or pillows.

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