United States Patent Office 3,759,724 Patented Sept. 18, 1973

3,759,724

EXOTHERMIC COMPOSITION FOR HOT TOPS

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No Drawing. Filed Sept. 14, 1971, Ser. No. 180,468
Int. Cl. B28b 7/36
U.S. Cl. 106—38.22 4 Claims

ABSTRACT OF THE DISCLOSURE

In an exothermic composition for a hot top on a foundry mold, there are provided from about 5 to 30% by weight of fibers each having a length of about 0.5 to 30 mm., the fibers being evenly dispersed in the exothermic composition to seize the fine particles of the composition and to permit the escape of combustion gas bubbles through numerous cavities formed therein.

BACKGROUND OF THE INVENTION

This invention relates generally to chemical compositions and is more specifically directed to an improved exothermic composition for particular use in retaining heat on the surface of a hot top supplying molten metal to a solidifying casting in a foundry mold in order to compensate for its shrinkage.

Conventional counterparts of such an exothermic composition are mostly mixtures of powdered flammable metal such as aluminum and calcium-silicon alloy, oxidizer, oxidation accelerator, and extender. Being in the form of finely divided particles, the prior art compositions when charged onto the surface of a hot top on a foundry mold in operation are partly blown upward, dust-like, into the air due to the convectional currents produced by the high temperature hot top and to the gases evolving therefrom as a result of the exothermic reaction. The dust-like suspension of the fine particles in air not only lowers the visibility of foundry atmosphere and so hampers the molding operation but is highly undersirable for the hygiene for foundrymen.

SUMMARY OF THE INVENTION

Therefore, it is an object of the present invention to provide an improved exothermic composition for particular use in retaining the heat of a hot top on a foundry mold.

Another object of the invention is to provide an exothermic composition such that substantially no fine particles included therein are released therefrom when the composition is charged onto the surface of a hot top at an elevated temperature.

Another object of the invention is to provide an exothermic composition for a hot top having an improved heat-retaining property.

A further object of the invention is to provide an exothermic composition wherein fibers of substantially any substance, be they organic or inorganic, are employable to obtain the desired results if they are within the specified dimensions.

According to this invention, briefly summarized, there is provided a powdered exothermic composition including a powdered flammable metal, oxidizer, oxidation accelerator and an extender for a hot top on a foundry mold which contains, in addition to its known ingredients, from about 5 to 30% by weight of fibers each having a length of about 0.5 to 30 mm.

The above stated and various other objects, advantages and features of the present invention will become more apparent and understandable from the following detailed description of the invention together with some specific example thereof.

DETAILED DESCRIPTION OF THE INVENTION

The powdered flammable metal, oxidizer, oxidation accelerator and extender to be included in the exothermic composition in accordance with the present invention may be suitably selected from such conventionally known and widely used substances as powdered aluminum, powdered calcium-silicon alloy, iron oxide, manganese dioxide, sodium nitrate, quartz sand and dolomite. The ingredients so selected may be also suitably compounded in accordance with the prior art.

The fibers to be added to the composition according to the novel teachings of this invention may be either of an inorganic substance including such naturally available mineral fibers as asbestos, for example, an amosite and such man-made mineral fibers as glass wool and slag wool, or of an organic substance including such natural fibers as vegetable and animal fibers, regenerated fibers, and synthetic fibers. Additional examples of materials employable for the same objects of the invention include wood and paper scraps, bagasse, brans and numerous other readily obtainable materials irrespective of whether they are originally in the form of fibers or not, the materials originally not in the form of fibers being suitably processed into the desired fibrous dimensions hereinafter set forth. In fact, the fibers of practically any substance are adaptable to the exothermic composition provided that they prevent the fine particles of the composition from being blown away upon contact with a hot top at an elevated temperature and at the same time retain the heat of the hot top.

The temperature at the surface of a hot top on a foundry mold in operation usually ranges between about 1,300 and 1,600° C. so that extremely powerful convection currents are produced thereupon. Heretofore, upon contact with the hot top, the exothermic composition has inevitably had part of its fine particles swept upward by such convection currents. The composition so charged onto the surface of the hot top must be further leveled or flattened into uniformly thick layer, in which case the combustion gases captured temporarily in the composition as a result of the exothermic reaction are instantly blasted up, thereby causing compartively lightweight and finely divided particles of the composition to be swept up and hence to be suspended in the air.

Because of the addition of the aforementioned fibers to the exothermic composition in accordance with the present invention, such fine particles are seized by the thickly interlaced fibers in such a manner that they are not scattered about by any such external forces as the convectional currents or the blasting up of the once-captured combustion gases. Moreover, in the case of fibers of an inorganic substance, the gases produced by the combustion of the exothermic composition are not trapped therein as mentioned above but are made to escape therefrom through numerous cavities formed by the interlaced fibers. Hence there is no possibility of the fine particles being blown upward during the leveling operation.

If, on the other hand, such organic fibers as those listed above are added to the composition, the fibers are naturally burnt into ash thereby to form numerous cavities again in the process of combustion. The resultant porosity of the layer permits ready escape of the combustion gases so that the particles are not blown upward during the leveling operation as in the precedingly considered case of the inorganic fibers. It is also noteworthy that the cavities produced by those fibers in the composition contribute toward formation of an extremely lightweight, porous and soft residual layer on the hot top upon completion of the combustion, the better to retain the heat of the hot top.

At least theoretically, the longer and the greater in amount the fibers are, the better are the fine particles of the composition prevented from being scattered about. Practically, however, excessively long fibers are likely to prevent uniform intermingling of the composition ingredients including themselves. And when added in an overly large amount, the fibers may melt and solidify after being once reduced to ash and thus deteriorate that heat retaining property of the composition.

We have experimentally verified that for the best results, the fibers should each have a length of about 0.5 to 30 mm. and should be added to the desired composition in an amount ranging from about 5 to 30% by weight. Fibers less than about 0.5 mm. in length lead to poor seizure of the fine particles, and those more than about 30 mm. in length make it difficult to mix with the fine particles. A fiber content falling short of the above specified range leads to poor seizure of the particles, and that exceeding the range results in fiber solidification following combustion and hence in a deteriorated heat retaining property. For clearer indication of these findings, reference is made to the following table in which all values of the compositions are in percent by weight.

Sample	I	II	III	IV
Powdered aluminum	15	15	15	15
Aluminum ash	70	60	50	40
Fluorspar	5	5	5	5
Sodium nitrate	3	3	3	3
Iron oxide	7	7	7	7
Asbestos	0	10	20	30
Bulk specific gravity	0.97	0.81	0.65	0.53
Bulk specific gravity after combustion	0.60	0.55	0.50	0.55
Residuum after combustion	Soft	(1)	(1)	Hard

[1] Very soft.

It is apparent that samples II and III are most desirable. If the fiber content is equal to or exceeds 30%, as in sample IV, the bulk specific gravity of the composition increases after combustion, and the residuum is hardened into a pumice-like mass showing the poor heat retaining property.

The nature, utility, and detailed features of this invention are indicated more fully by the following examples of specific practice constituting preferred embodiments of the invention. It should be understood, of course, that these examples are presented as illustrative only, and that they are not intended to limit the scope of the invention.

EXAMPLE 1

Four identical 15-ton flat molds were prepared each with its two longer sides covered with heat-insulating lining frames and were charged with a desired material by pouring to initiate operation. Two slabs of the molds were supplied with 32 kg. each of a conventional exothermic composition, and the other two with 32 kg. each of an exothermic composition containing the following ingredients in the specified proportions in accordance with the present invention:

Powdered aluminum	15
Aluminum ash	50
Fluorspar	5
Sodium nitrate	3
Iron oxide	7
Asbestos (fiber length, about 2 mm.)	10

A considerable amount of fine particles was seen rising from the molds when supplied with the conventional composition, but almost none from the molds supplied with the fiber-containing composition of the invention. During the succeeding process of combustion, the conventional composition produced blowholes that sent the adjacent particles shooting up, obviously a sign of gas entrapment. Also during leveling operation, much particles and white colored smoke due to the exothermic reaction were given off and densely suspended in the air.

No such phenomenon was caused by the exothermic composition of the invention. Its residuum, too, was far softer and thicker layered than that of the sample of the prior art, evidencing its superior heat-retaining property. In contrast to 86.3 and 86.2% yields indicated by the use of the conventional composition, the fiber-containing composition of this invention with its improved heat-retaining property led to the appreciably increased yields of 86.9 and 87.0%.

EXAMPLE 2

Two slabs of the four molds of Example 1 in operation were similarly supplied with 32 kg. each of a conventional exothermic composition, and the remaining two with 32 kg. each of composition containing the following ingredients in accordance with the present invention:

Powdered aluminum	15
Aluminum ash	50
Fluorspar	5
Sodium nitrate	3
Iron oxide	7
Pulp (fiber length, about 5 mm.)	10

While a considerable amount of fine particles was seen rising from the molds when supplied with the conventional exothermic composition as stated already, almost no particles were set up from the molds supplied with this second example of the fiber-containing composition of the invention. The phenomena previously seen with the molds supplied with the conventional composition during combustion and leveling operation were not caused by this second example either. Only the organic fibers when burning gave off red flames that rose barely to a height of about 10 to 20 mm. The residuum of the charged composition was also far softer and thicker layered than that of the conventional composition and thus demonstrated its superior heat retaining property. In comparison with 86.0 and 86.2% yields indicated this time by the use of the conventional composition, the fiber-containing composition of the invention made it possible to secure yields of 86.8 and 86.9%.

EXAMPLE 3

Four identical 11-ton flat molds were prepared each with its all four sides covered with heat-insulating lining-frames and were poured with a desired molten material for operation. Two slabs of the molds were supplied with 30 kg. each of a conventional exothermic composition, and the other two with a composition containing the following ingredients in accordance with the present invention:

Powdered aluminum	15
Aluminum ash	55
Fluorspar	5
Sodium nitrate	3
Iron oxide	7
Amosite (fiber length, about 30 mm.)	5

While a considerable amount of fine particles was also seen rising from the molds when supplied with the conventional composition, substantially no such particles were blown upward from those supplied with the above prepared fiber-containing composition of the invention. The aforedescribed phenomena during combustion and leveling operation were also caused by the conventional composition but not by that of the present invention. As in the foregoing two examples, the residuum of the latter was far softer and thicker layered than that of the former, here again indicating the superior heat-retaining property of the composition of the invention. Compared with 82.6 and 83.2% yields obtained by the use of the conventional composition, the use of the fiber-containing composition of the invention resulted in increased yields of 83.8 and 84.0%.

We claim:

1. In a powdered exothermic hot top composition consisting essentially of a powdered flammable metal, an oxidizer, an oxidation accelerator, and an extender for

particular use in retaining the heat of a hot top on a foundry mold by charging said composition onto the surface of the hot top and then causing said composition charged onto said surface to have combustion, the improvement comprising a fibrous material selected from the group consisting of a natural mineral fiber, an artificial mineral fiber, and a vegetable fiber each having a length of from about 0.5 mm. to about 30 mm. in an amount ranging from about 5% to about 30% by weight of said composition for forming in said composition numerous cavities, thereby retaining the heat of the hot top without trapping gases in said composition produced by said combustion and without releasing the powder in said composition.

2. The composition as claimed in claim **1**, in which said natural mineral fiber is asbestos.

3. The composition as claimed in claim **1**, in which said artificial mineral fiber is selected from the group consisting of glass wool and slag wool.

4. The composition as claimed in claim **1**, in which said vegetable fiber is selected from the group consisting of wood, pulp, paper, baggasse, and brans.

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U.S. Cl. X.R.

106—38.23, 38.27, 39.8, 54; 164—54; 249—197