

UNITED STATES PATENT OFFICE

2,490,327

EXOTHERMICALLY REACTIVE
MOLD INSERT

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No Drawing. Application October 14, 1947,
Serial No. 779,831

3 Claims. (Cl. 22—134)

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This invention relates to exothermic compounds for use in the casting of metals, and the present application is a continuation-in-part of an application serially numbered 595,824, filed May 25, 1945, now abandoned. In the aforementioned application I have disclosed a method of casting metal bodies employing exothermically reactive materials for prolonging the fluidity of the metal in the sinkhead or feeder to obtain sound ingots or castings free of piping and fissures, and the present invention is for an exothermic compound which is particularly adapted in the casting of low melting point metals, such as aluminum and magnesium and other metals.

The need for an exothermic material for aiding in the casting of aluminum, magnesium, zinc and other white metals has long existed, but due to the low pouring temperature of such metals no exothermic material has heretofore been proposed which would ignite at such low temperatures and produce sufficient heat to be of value in maintaining the fluidity of the metal while feeding to the main body of the casting.

In accordance with the present invention, an exothermic material or compound which will ignite at or above temperatures of 300° F. and which will react within itself exothermically to produce a temperature up to 3000° F. or more, is employed as a liquefier or heating source for either melting metals or metal ores or maintaining a controlled fluidity of molten metals while being cast.

As in the former application Serial No. 595,824, referred to above, the exothermically reactive material may be compounded with a binder and shaped as rings, the center of which constitutes a feed passage from a riser to a casting, or the composition may be formed in the shape of fillets or thin slabs for insertion in sand flasks or permanent molds in selected regions of the matrix portion thereof to control the solidification of the metal at such points. The binder may be silicate of soda, or a cereal or other binder, such as dextrines, resins, plastics, molasses or foundry core binders. The shaped rings or inserts form a refractory insulator after the reaction and retain their shape and size, thereby differing from Thermit now in common use. Also the composition of the exothermically reac-

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tive material hereinafter described may be applied on the heads and risers of castings in a dry powdery form and will exothermically react to raise the temperature of the feeding metal to cause it to remain liquid beyond the point where the metal in the main body of the casting has solidified. After burning out the material forms a soft powdery refractory and insulating material which acts as a thermal insulator and reduces loss of heat from the metal through radiation.

Still another adaptation of the exothermically reactive composition is that when bonded it may be molded into crucibles or other containers which, when filled with metals or ores and ignited, will melt the metal and ores.

One of the primary objects of the invention is the provision of an exothermically reactive composition for uses hereinbefore described in which the exothermic chemical reaction occurs in the material independently of the metal with which it contacts and in which neither the material nor any product of the reaction will contaminate or alter the chemical composition of the metal which it is employed to heat.

A suitable exothermically reactive material for use in casting the low melting point metals may be of the following composition and proportions:

	Per cent
30 Al_2O_3 -----	27.79
SiO_2 -----	0.41
CaF_2 -----	10.70
C -----	7.10
CaCO_3 -----	0.12
35 Fe_2O_3 -----	5.19
TiO_2 -----	0.41
Na_2O -----	0.33
MgCO_3 -----	0.12
NaNO_3 -----	5.54
40 AlN -----	0.63
KNO_3 -----	2.85
Al_2C_3 -----	1.29
KClO_3 -----	2.85
Al -----	28.98
45 K_2CO_3 -----	0.12
Mg -----	4.57
$\text{H}_2\text{Mg}_3(\text{SiO}_3)_4$ -----	1.00

The foregoing is the preferred composition, but the ingredients may be varied to produce suitable

exothermic reactions in the following proportions:

	Per cent
Al ₂ O ₃ -----	20 - 90
SiO ₂ -----	0.10-10
CaF ₂ -----	0.10-11
C -----	3 - 10
CaCO ₃ -----	0.05- 0.25
Fe ₂ O ₃ -----	2 - 6
TiO ₂ -----	0.10-10
Na ₂ O -----	0.10-10
MgCO ₃ -----	0.05- 0.25
NaNO ₂ -----	1.5 - 6
AlN -----	0.0 - 1
KNO ₃ -----	1 - 4
Al ₄ C ₃ -----	1 - 3
KClO ₃ -----	1.5 - 6
Al -----	0.5 - 50
K ₂ CO ₃ -----	0.05- 0.25
Mg -----	0.10-10
H ₂ Mg ₃ (SiO ₃) ₄ -----	0.0 - 2

If used with a binder to provide preformed rings or inserts for use as cores or sections under risers or in mold cavities and when molded into crucibles or other containers, a cereal binder, such as dextrans, or a resin, plastic or other binder such as common molasses, may be employed.

As noted from the composition, carbon is employed which acts a fuse for low melting point metals when the composition is used at low temperature. The degree of sensitivity to heat is accomplished through the interaction of the carbon with a chemical or chemicals which readily give up oxygen, such as sodium nitrate or other nitrates, potassium chlorate or other chlorates, etc. The carbon may be omitted without impairing the exothermically reactive characteristics of the composition, but the ignition point will be higher.

Also, in casting aluminum or magnesium and other non-ferrous metals, excess amounts of aluminum or magnesium may be employed in the composition beyond the amount needed to react chemically in the exothermic function of the composition, and such excess will result in a supply of molten aluminum, magnesium or other non-ferrous metal to supplement the cast metal for the purpose of feeding the casting. Such use obviously requires but very small heads or risers for feeding the casting of such metals.

Also, a mixture of the composition containing excess aluminum or magnesium may be placed upon the heads or risers or upon the cast metal to itself constitute a feeder for the casting. The composition of the exothermically reactive material herein disclosed is also suitable for use in methods of casting ferrous and non-ferrous metals of high melting point.

The exothermically reactive materials herein disclosed differ from common exothermic materials, such as coke, coal, carbon and wood, in that oxygen from the atmosphere or other outside source is not needed for combustion. The herein disclosed compound contains its own oxygen. Also, the compound of the present invention generates a greater degree of heat than is possible from such common exothermic materials.

Although the invention has been herein illustrated and described in particular uses and certain composition and ranges, it will be evident to those skilled in the art that modifications may be made in the compounding and proportioning of the materials and in the substitution of other materials of like characteristics without departing from the principles herein set forth.

I claim:

1. A fluidizer for maintaining localized fluidity of molten metal comprising an exothermically reactive composition of aluminum and magnesium compounded with other materials in the following proportions by weight:

	Per cent
Aluminum oxide -----	20 - 90
Silicon dioxide -----	0.10-10
Calcium fluoride -----	0.10-11
Carbon -----	3 - 10
Calcium carbonate -----	0.05- .25
Ferric oxide -----	2 - 6
Titanium dioxide -----	0.10-10
Sodium oxide -----	0.10-10
Magnesium carbonate -----	.05- .25
Sodium nitrate -----	1.5 - 6
Aluminum nitride -----	.0 - 1
Potassium nitrate -----	1 - 4
Aluminum carbide -----	1 - 3
Potassium chlorate -----	1.5 - 6
Aluminum -----	.5 - 50
Potassium carbonate -----	.05- .25
Magnesium -----	0.10-10
Hydrated magnesium silicate -----	.0 - 2

2. A fluidizer for maintaining localized fluidity of molten metal comprising a preformed body of exothermically reactive materials and a binder, said materials being composed of aluminum and magnesium compounded with other materials in the following proportions by weight:

	Per cent
Aluminum oxide -----	20 - 90
Silicon dioxide -----	0.10-10
Calcium fluoride -----	0.10-11
Carbon -----	3 - 10
Calcium carbonate -----	0.05- .25
Ferric oxide -----	2 - 6
Titanium dioxide -----	0.10-10
Sodium oxide -----	0.10-10
Magnesium carbonate -----	.05- .25
Sodium nitrate -----	1.5 - 6
Aluminum nitride -----	.0 - 1
Potassium nitrate -----	1 - 4
Aluminum carbide -----	1 - 3
Potassium chlorate -----	1.5 - 6
Aluminum -----	.5 - 50
Potassium carbonate -----	.05- .25
Magnesium -----	0.10-10
Hydrated magnesium silicate -----	.0 - 2

3. An exothermically reactive material for use as an insert in a casting mold for prolonging the fluidity of sections of the cast metal comprising a preformed body of exothermically reactive material containing aluminum oxide, silicon dioxide, calcium fluoride, carbon, calcium carbonate, ferric oxide, titanium dioxide, sodium oxide, magnesium carbonate, sodium nitrate, aluminum nitride, potassium nitrate, aluminum carbide, potassium chlorate, aluminum, potassium carbonate, magnesium, hydrated magnesium silicate and a binder in the following proportions:

	Per cent
Aluminum oxide -----	27.79
Silicon dioxide -----	0.41
Calcium fluoride -----	10.70
Carbon -----	7.10
Calcium carbonate -----	0.12
Ferric oxide -----	5.19
Titanium dioxide -----	0.41
Sodium oxide -----	0.33
Magnesium carbonate -----	0.12
Sodium nitrate -----	5.54

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Aluminum nitride -----	0.63
Potassium nitrate -----	2.85
Aluminum carbide -----	1.29
Potassium chlorate -----	2.85
Aluminum -----	28.98
Potassium carbonate -----	0.12
Magnesium -----	4.57
Hydrated magnesium silicate -----	1.00

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