United States Patent [19]

Howells

[11] **3,770,465**

[45] **Nov. 6, 1973**

[54] **MOLD WASH COMPOSITION**

[75] Inventor: **Norman C. Howells,** Conneaut, Ohio

[73] Assignee: **Exomet, Incorporated,** Conneaut, Ohio

[22] Filed: **July 19, 1971**

[21] Appl. No.: **164,030**

[52] **U.S. Cl.**..... **106/38.23,** 106/38.24, 106/38.25, 106/214, 106/237, 106/238, 106/241, 106/253, 117/5.2, 117/5.3, 260/29.3, 260/38

[51] **Int. Cl.**..... **B28b 7/38**

[58] **Field of Search**..... 106/38.22, 38.23, 106/38.24, 38.27, 38.5 R, 38.5 D, 38.25, 214, 237, 238, 241, 253; 117/5.1, 5.2, 5.3; 260/29.3, 38

[56] **References Cited**

UNITED STATES PATENTS

1,725,039	8/1929	Williams	106/38.27
2,652,312	8/1953	Fink	106/38.5 D
3,081,177	3/1963	Garay et al.	106/38.5 D
3,212,145	10/1965	Green	106/38.22
3,275,460	9/1966	Jeanneret	106/38.22

Primary Examiner—Lorenzo B. Hayes

Attorney—Ronald B. Sherer et al.

[57] **ABSTRACT**

A mold wash consisting of a vehicle wherein there is held in suspension a mixture of a refractory base, a suspension agent, a binder and a readily volatilized constituent selected from the group consisting of metals and complex metal flourides. The wash is characterized in that the readily volatilized constituent reacts to form a refractory. A preferred constituent is potassium zirconium flouride.

5 Claims, No Drawings

MOLD WASH COMPOSITION

BACKGROUND OF THE INVENTION

This invention pertains to the art of metal founding. In the foundry and the steel mill, it is common practice to coat the interior surfaces of the mold with a wash to prevent intrusion of the molten metal into pores, cracks and the like on the surfaces of the mold cavity that will contact molten metal. Mold washes, as the coatings are commonly called, are applied to sand mold cavities for making castings of a specific shape as well as to the interior of iron ingot molds used in the steel mill.

Prior art mold washes, such as disclosed in U. S. Pat. Nos. 3,121,269 and 3,211,560, are painted or sprayed on the mold cavity surface and dried to form a continuous refractory surface over the sand or metal. These washes can be mechanically cracked prior to casting of the metal with the result that the molten metal enters cavities in the refractory to contact the sand or metal mold surfaces. In the sand molds, iron, steel or other high melting point metal produces a dense, very adherent mixture of metal and entrapped sand on the surface of the casting which is difficult and expensive to remove. In the case of cast iron or steel molds, the ingots become difficult to strip and generally contain surface defects. These defects require extensive salvaging operations such as chipping, grinding, burning or machining, thereby decreasing production and increasing cost of the castings or ingots poured.

BRIEF DESCRIPTION OF THE INVENTION

In order to avoid the above described problems and produce an improved mold wash, it has been discovered that when a readily volatilized metal or metal compound component, that reacts under heat to form a refractory oxide, is added to a basic mixture of a refractory base, binder, and suspension and the dry mix suspended in a suitable vehicle is applied to the mold surfaces, high melting point metals can be successfully cast relatively free of gross surfaces defects. The wash reacts under heat liberated by the metal entering the mold to prevent intrusion of metal into discontinuities in the mold cavity surface by forming a refractory oxide.

Therefore, it is the primary object of this invention to provide an improved mold wash.

It is another object of this invention to provide a mold wash useful for casting metals having high melting points.

It is a further object of this invention to provide a mold wash for use in mold cavities of sand or iron used for the casting of ferrous metals.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The mold washes of the present invention are unique in that the volatile additive reacts under the heat of the molten metal to form a continuous refractory surface on the mold cavity.

In order for mold washes of the present invention to succeed, they must contain a readily volatile ingredient that will react to form a refractory oxide to adhere to mold cavity surfaces or react with the mold cavity surface to form the refractory oxide.

The broad compositional ranges of the present invention are:

	% by weight
Suspension agent	0–6
Binder	0.2–30
Volatile Constituent	0.25–95
Base	0–98

The above compositional ranges are for the dry ingredients which are normally suspended in a vehicle such as water, isopropyl alcohol, ethyl alcohol, methyl alcohol, naphtha, or mixtures thereof.

The preferred suspension agent is one that exhibits thixotropic properties so that settling is inhibited and the wash can easily be applied. A seaweed extract called carrageenen is particularly effective as a suspension agent. Sodium alginates and bentonite clays have also been effective. Colloidal silica and fly-ash from a coal fired electrical generating station are satisfactory suspension agents.

A preferred binder is phenol formaldehyde (phenolic resin). Shellac flakes (in alcohol vehicle), drying oils known in the trade as core oils, dextrine, polyvinylpyrolidone and mixtures thereof and with the phenolic resin are also very effective binders.

Refractory bases include zircon flour, chromium ore, silica flour, graphite, aluminum oxide, and mixtures thereof.

The preferred volatile constituent is a complex metal flouride having the general formula AxMFy wherein A represents an alkali metal such as sodium or potassium; M represents a metal such as aluminum, chromium, titanium and zirconium; and F represents flourine. Successful washes have been formulated with potassium aluminum flouride, sodium aluminum flouride, potassium chromium flouride, and the preferred potassium zirconium flouride. It is also possible to use a metal such as magnesium that is readily volatilized and forms a refractory oxide on the mold cavity surface.

A series of mold washes were formulated and tested in a mold using molten gray iron. The wash is placed on a core made from a mixture of:

3% Phenolic resin
3% Dextrose with amonia salt
1% Gelatinized corn flour
5% Water
88% Sand The cores in the form of sticks were baked and the wash applied in a wet coating about 1/32 inch thick. After coating, the cores were rammed in place at the bottom of a mold cavity about 7 inches in diameter and about 30 inches high, the cavity being bottom gated. Molded exothermic riser sleeves were used in the cavity to lengthen the time that the 15 to 30-inch high column of metal would be molten. The longer contact time for the molten metal to the core provides a more rigourous test than normally used in the foundry.

Table I sets forth a series of washes that were used in the foregoing core test and showed no penetration of the metal into the core surface, e.g., the solidified casting surface in contact with the core was flat and relatively smooth.

Constituent	Wash No. (percent by weight)										
	1	2	3	4	5	6	7	8	9	10	11
Carrageenen	0.24	0.24	0.25	0.25	0.25		0.25				
Colloidal silica									0.25		
Fly ash											5.0
Phenolic resin	1.4	1.4	1.4	1.4	1.4	5	1.4			1.9	
Dextrine								2.0			
Shellac									19.3		
Core oil							4.5				
Polyvinyl-pyrolidone										0.5	0.5
K_2ZrF_6	1.4	0.2	5	1.4		95	1.4	1.4	1.0	1.4	1.4
K_3AlF_6				3.6							
Na_3AlF_6											
K_2CrF_5					1.4						
K_3CrF_6											
Zircon flour	Bal.	Bal.	Bal.	Bal.	Bal.		Bal.		Bal.	Bal.	Bal.
Chrome ore								Bal.			

The washes of Table I were formulated and numbers 1 through 8 were dispersed in water as a vehicle whereas numbers 9 and 10 were dispersed in an ethyl alcohol vehicle. The ratio of dry ingredients to vehicle should range from 1 ½ / 3 ½to 1 by volume depending upon the method of application, a good spray mixture being 2 ½: 1 respectively. In wash No. 9, silica flour can be substituted for zircon flour in the ration of 1 part silica flour for 2 parts zircon flour, serving as both a refractory and a suspension agent.

In Table I washes 1–5 were also effective when tested on the interior surface of a cast iron ingot mold into which a ferrous melt was poured.

It has also been shown that in wash No. 9, hydrated aluminum chloride can be used alone or in combination with the phenolic-polyvinylpyrolidone system as a binder agent.

In all of the washes the key is the volatile constituent that reacts to form a refractory oxide. The balance of the composition provides the medium as needed for this reaction to take place.

Other volatile flourides, such as sodium zirconium flouride, can be used.

Having thus described my invention, the following is desired to be secured by Letters Patent of the United States.

I claim:

1. Dry ingredient mixture for a mold wash for use in preventing intrusion of molten metal into surface openings on a foundry core or ingot mold consisting essentially of 0.25 to 95 percent potassium zirconium flouride; 0.2 to 20 percent of a binder selected from the group consisting of phenolic resin, dextrine, shellac, drying oil, and polyvinylpyrolidone; balance zircon flour.

2. A mold wash containing the dry mix according to claim **1** dissolved in a vehicle selected from the group consisting of water, ethyl alcohol, isopropyl alcohol, methyl alcohol and mixtures thereof.

3. A mold wash according to claim **1** wherein silica flour is substituted for zircon flour on a 1 to 2 ratio respectively.

4. A mold wash according to claim **2** wherein the 1 1/2 to 3 1/2 parts dry ingredients are mixed with 1 part vehicle.

5. A mold wash consisting of 2 to 10 percent by weight binder selected from the group consisting of phenolic resin, dextrine, shellac, drying oil, and polyvinyl pyrolidene and 98 to 90 percent by weight potassium zirconium flouride.

* * * * *