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EXOTHERMIC INSULATING COMPOUND

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My invention consists of a new and improved compound for preventing or reducing to a minimum piping in the production of ingots and other castings.

My novel compound is applied to the top of the poured molten metal where it forms a thin uniformly distributed layer which acts as an insulating blanket to retard the escape of heat from the metal and which becomes exothermic to aid in such retardation.

In the present practice in common use in the art such insulating materials as lime, sand and clay; and sometimes such combustible substances as straw, cork, coke and the like, have been employed for this purpose, but the results have not been entirely satisfactory because objectionable piping and cavitation of the ingot or casting still occurs, necessitating the cropping off of an excessive percentage of the cast product to eliminate defects.

The object which I have in view is the provision of a new and improved compound which, when applied to the surface of the molten metal in the "hot top" of the mold will blanket the molten metal and retard the escape of heat and will also by its exothermic action retain the metal in the hot top in such a fluid state that it will readily flow into the cavity formed by shrinkage and thus prevent or reduce piping to a minimum, thereby limiting the metal which must be cropped from the ingot to that portion thereof which is retained in the hot top after the ingot hardens.

My improved compound is a mixture of a non-combustible insulating material and a fuel, both in ground or granular form. For the insulating material I use either granulated blast furnace slag or exfoliated vermiculite material, while for the combustible content of the compound I use ground coke or coke breeze, or gas-producer flue dust.

Thus I have used in the commercial casting of steel ingots the insulating compound as follows, the percentages being given by weight.

Example No. 1

	Percent
Ground coke or coke breeze	60
Granulated blast furnace slag	40

Example No. 2

	Percent
Ground coke or coke breeze	85
Exfoliated vermiculite granules	15

Example No. 3

	Percent
Ground coke	25 to 40
Flue dust	30 to 25
Granulated blast furnace slag	45 to 35

Example No. 4

	Percent
Flue dust	50
Granulated blast furnace slag	50

The granulated slag above referred to is produced by directing a high pressure stream of water into the molten slag as it flowed from the runner of the blast furnace.

The amount of compound used is determined by practice. Usually from ½ to 1½ pounds of the compound per ton of molten metal is sufficient.

The above compound may be varied in accordance with the materials available but in case the carbon content of the insulating mixture material is reduced below 30% a small quantity of ferro-silicon or some other deoxidizing agent should be added to the compound to compensate for the deficiency in carbon.

To realize the full advantages of my improved compound a close check must be made of the raw materials. First, they must be free from excessive moisture, and after the materials are intermixed to form the compound, they must be stored in a closed container until used, if the maximum insulating value is to be obtained. The correct amount of the compound should be employed and it should be applied to the top surface of the molten metal in the mold immediately after the ingot or casting is teened and the stream of molten metal is shut off.

Due to the lightness of my improved compound it spreads easily over the surface of the molten metal in a uniform layer.

When applied by the above procedure there is no "bridging" of the material of the compound above the steel in the hot top of the mold, and the steel as it hardens will drop parallel with the walls of the hot top. This is especially true where the steel is from .25 to .40 carbon with .75 to 1.40 manganese. In the case of the lower carbon steel the drop is not so pronounced.

In the case of a big-end-down ingot mold having cross sectional dimensions of 24"x24" fitted with a hot top, with the use of my compound, approximately 750 cubic inches or 192 pounds of molten metal may be displaced from the hot top in from twenty to thirty minutes in the case of .25 to .40 carbon steel.

Due to the formation of a slag which floats on the top of the metal there is no pick-up of carbon from the molten metal.

This remarkable displacement of the metal is due to the fact that with the use of my compound the metal from the hot top flows downwardly into the mold and fills up any cavitation which may be produced by the outward shrinkage of the metal in cooling. With the use

of my material, piping or cavitation caused by shrinkage of the molten metal in cooling is practically eliminated, and the metal which must be cropped from the ingot before the same is rolled is limited to that which remains in the hot top after the solidification of the metal is completed. Thus a very substantial saving in metal is realized.

Also owing to the fact that there is no tendency of the compound to bridge or form a self-sustaining layer over the top of the metal in the compound, there is no formation of a cavity in the metal in the hot top or in the upper end of the ingot as is characteristic of ingots cast with the use of sand or lime as an insulating material.

Another advantage of my invention is the low cost of the material compared to the cost of other compounds hitherto used for this same purpose.

As the carbonaceous material I prefer to use coke breeze or flue dust. The last named is a carbonaceous material which is deposited in the flues of a gas-producer and which is composed largely of carbon.

The analysis of these materials is approximately as follows, the amounts being given by weight:

	Volatile matter	Fixed carbon	Ash
Coke breeze	2.30	88	13.15
Ground coke	2.90	84.35	8
Flue dust	.85	84.25	14.90

The blast furnace slag which I may use in ground form is the incombustible material which may be basic furnace slag or Bessemer blast furnace slag, and the analysis of these by weight is approximately as follows:

	SiO_2	Al_2O_3	CaO	MgO
Basic furnace slag	36	10	48	3
Bessemer blast furnace slag	38	9	47	5

I claim:

1. A loose exothermic insulating compound to be spread over the surface of molten cast steel for preventing piping and cavitation in the formation of ingots and other castings, which comprises an intimate admixture of from 30% to 65% by weight of a finely divided carbon combustible and the balance finely divided blast furnace slag composition consisting essentially of the oxides of silicon, aluminum, calcium and magnesium.

2. A loose exothermic insulating compound to be spread over the surface of molten cast steel for preventing piping and cavitation in the formation of ingots and other castings, which comprises an intimate admixture by weight of approximately 60% of a finely divided carbon combustible and 40% of finely divided blast furnace slag.

3. A loose exothermic insulating compound to be spread over the surface of molten cast steel for preventing piping and cavitation in the formation of ingots and other castings, which comprises an intimate admixture by weight of approximately from 55% to 65% of a finely divided carbon combustible and of from 45% to 35% of finely divided blast furnace slag composition consisting essentially of the oxides of silicon, aluminum, calcium and magnesium.

4. A loose exothermic insulating compound to be spread over the surface of molten cast steel for preventing piping and cavitation in the formation of ingots and other castings, which comprises an intimate admixture by weight of approximately 85% of a finely divided carbon combustible and 15% of exfoliated vermiculite granules.

5. A loose exothermic insulating compound to be spread over the surface of molten cast steel for preventing piping and cavitation in the formation of ingots and other castings, which comprises an intimate admixture of from 30% to 85% by weight of a finely divided carbon combustible and the balance at least one insulating material of a group consisting of a finely divided blast furnace slag and exfoliated vermiculite granules.

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