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MOLDING IRON AND STEEL

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This invention relates to the molding of iron and steel, and has for its general object to reduce to a minimum the losses which result from the piping of the metal in the tops of the molds.

As is well known to those skilled in the art to which our invention relates, it has been the practice to provide ingot molds with removable refractory extensions, known as sink heads, which tend to delay the chilling and freezing of the molten metal therein to an extent to enable it to flow into the cavity which tends to be formed in the portion of the ingot which is in the top of a mold by the freezing and contraction of the metal therebeneath. To the extent that the molten metal in the sink head can flow down and maintain contact with the top of the solidifying ingot therebelow, the formation of shrinkage cavities or secondary pipe can be prevented. But, even where these sink heads are used, there is a considerable loss of metal, as that which remains in the sink heads must be cropped off and put through the melting and refining operations in order to render it fit for re-use.

In order to reduce the quantity of metal remaining in the sink heads after the molding operation, various insulating covers or blankets for the metal therein have been proposed. But none of the materials heretofore employed for blanketing and insulating purposes possesses all of the following desirable qualities:

Avoidance of introduction of carbon or other impurities into the metal.

Ability to keep the metal hot for a sufficient length of time to prevent the formation of shrinkage cavities.

Ability to be spread readily over the whole upper surface of the molten metal. This is of importance because of the difficulty of efficiently applying blanketing material, lacking this ability, to the top of the metal because of the extreme heat in this region.

Freedom from the production and liberation of fumes or smoke, the presence of which will interfere with the operation of the crane by which the ingots are transported.

Freedom from fire hazard.

Cheapness of production.

The material which we employ for blanketing and insulating purposes and which will now be described possesses all of the foregoing desirable qualities. Where a material possessing no outstanding exothermic properties is desired we prepare our material as follows:

We grind carbon, preferably in the form of coke breeze, with a substantially equal quantity by weight of argillaceous material, preferably fire clay; moisten the mixture with water, and pass the same through a pug mill, after which the pugged mixture is heated to a temperature of approximately 2500° F., preferably under reducing conditions, until all of the volatiles have been driven off. The resultant product is then ground to a fine powder, wherein every particle of the coke breeze carbon is coated with clay so that the said product possesses all of the qualities which are desirable in a blanketing material of the pure insulator type. Due to its finely divided condition, it can be conveniently applied to the surface of the molten metal in the sink head, since it will spread over the same in a manner similar to the action of a liquid poured upon a surface. Experiment has shown that the carbon of the mixture can be slowly oxidized, with the evolution of heat and that, due to the extent of the heating of the mixture subsequent to the pugging operation, the coke breeze carbon constituent of said mixture will not enter into combination with the molten metal, thereby to increase the carbon content of the latter, and cause segregation at the top of the ingot or casting.

Still further, because our powdered mixture contains no ingredient which can be sintered, it will remain in contact with the top of the molten metal as the metal sinks in the sink head or hot top.

Where it is desired to increase the ability of the above mixture to delay the solidification or freezing of the metal in the sink heads, we have found that this result can be accomplished by mixing with the same a quantity of a material possessing a high heat of combustion (such as aluminum, magnesium and silicon), powdered so finely that it will burn in air. As a source of aluminum, we preferably utilize the waste product which collects in the form of a powder on the surface of the molten aluminum in the course of recovering secondary aluminum. This waste product contains from 5% to 50% of finely divided readily combustible aluminum. The balance of this product consists of aluminum oxide, iron oxide, silica, etc.

We have found that when this finely divided waste product is mixed with from 5% to 95% of the fired ground coke clay mixture in a proportion such that the final mixture will contain from 1% to 40% of aluminum, a corresponding series of blanketing materials are formed which are suitable for application to sink heads of various sizes. The proportion of aluminum varies

with the length of time the metal thereunder is to be kept molten. The aluminum present burns in the air, not suddenly, as is the case in a thermite mixture, but slowly, over a considerable period of time. This keeps the metal in the sink head molten and prevents the formation of shrinkage cavities. This mixture remains in the powdered form, as there is nothing present therein to sinter, and it therefore stays in contact with the molten metal as the latter sinks in the head.

Being a finely divided powder, the material containing this waste product also spreads readily over the molten metal and, as everything present has already been highly fired, it liberates no smoke or fumes.

In place of aluminum, we may, as pointed out hereinbefore, use finely powdered magnesium or silicon. The aluminum, magnesium or silicon may be used either alone or each in admixture with one or both of the other ingredients. Where either or both magnesium and silicon are used, the proportion of the same when used alone (or of the mixture of which each forms a part) to the fired coke-clay mixture will be approximately the same as the proportion of powdered aluminum thereto as set forth hereinbefore. The magnesium may be obtained from what is also considered as waste material, for example; the borings and filings of magnesium copper alloys.

Our invention is also applicable for use in connection with the risers of iron and steel castings, the said risers and the sink heads constituting reservoirs for our blanketing and insulating materials.

It will be noted that, when made from the ingredients which we preferably employ, our insulating and blanketing material is extremely economical of production, since the carbon and the aluminum and/or magnesium which may be employed therein can be obtained from materials which are usually regarded as waste products.

Having thus described our invention, what we claim is:

1. A composition of matter suitable for insulating and blanketing molten metal in reservoirs for molds, the same comprising a finely divided mixture of carbon and argillaceous material, from which mixture substantially all volatile products have been expelled and wherein the particles of carbon are enclosed by argillaceous material, said mixtures having admixed therewith finely divided material possessing a high heat of combustion in the proportion of approximately from 1% to 40% by weight of said material to the weight of the final mixture.

2. A composition of matter suitable for insulating and blanketing molten metal in reservoirs for molds and applicable directly to the top of the molten metal, the said composition comprising a finely divided mixture of carbon and argillaceous material from which substantially all volatile products have been expelled and which mixture will not sinter, whereby it will remain in contact with the top of the molten metal as the metal sinks in its reservoir.

3. A composition of matter suitable for insulating and blanketing molten metal in reservoirs for molds and applicable directly to the top of the molten metal, the said composition comprising a finely divided mixture of carbon and argillaceous material from which substantially all volatile products have been expelled and wherein the particles of carbon are enclosed by argillaceous material, said mixture being sinter-resistant and capable of remaining in contact with the top of the molten metal as the metal sinks in its reservoir.

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