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METHOD OF MANUFACTURING POROUS RISER INSULATING SLEEVE

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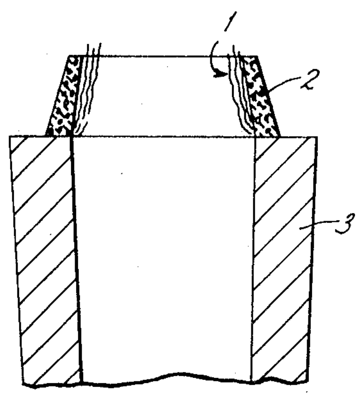

Fig. 1

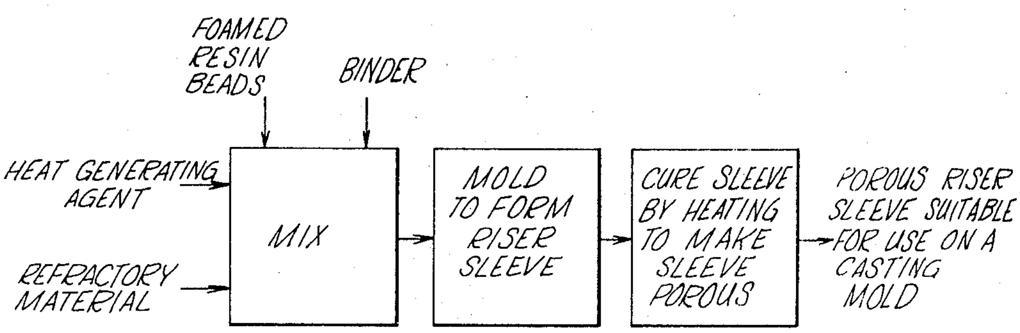

Fig. 2

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METHOD OF MANUFACTURING POROUS RISER INSULATING SLEEVE

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ABSTRACT OF THE DISCLOSURE

A method of manufacturing an insulating porous riser sleeve comprising including beads of foamed resin in the composition for making an insulating riser sleeve, which sleeve is intended for maintaining the temperature of the molten metal by utilizing the heat generated by said riser sleeve upon its contact with the molten metal poured into the casting mold.

The present invention relates to a riser sleeve for being mounted on a mold used in casting molten metal.

Attempts to avoid defective castings due to causes such as the shrinking of the body of molten metal due to solidifying after being cast in a mold or the formation of a shrinkage cavity in the mold have heretofore relied on the following procedure which comprises mounting an exothermic and heat insulating sleeve on the mold, which sleeve is filled up with the feeding head or riser which constitutes a part of the molten metal poured into the mold so that fresh molten metal may be replenished therefrom into the main part of the cast body by virtue of gravity flow of the molten metal located at the feeding head. In order that satisfactory replenishment of molten metal from the riser may be accomplished continuously till the body of the molten metal in the mold solidifies, it is mandatory that the molten metal located at the riser continue to be in a molten state for an extended period of time. To attain this purpose, earlier efforts were directed to increasing the volume of the riser so that the thermal capacity of the riser itself might be increased. Recently, however, attempts have been made to minimize the volume of the riser by employing a sleeve which would be capable of both generating heat and maintaining the temperature of the riser. This concept has lead to the development of a variety of riser sleeves which are intended for accomplishing the foregoing purposes.

The exothermic and heat insulating riser sleeves which have been most commonly used in practice are of the type which utilizes the Thermit reaction of aluminum particles and iron oxide particles as the heat generating source. In view of the nature of the aluminum particles which explosively effect combustion, such exothermic and heat insulating riser sleeves have been manufactured by mixing aluminum particles, iron oxide particles and refractory materials such as silica sand, olivine sand and alumina, thereafter bonding them together with a binder such as water glass, and subjecting the mass to molding. Sleeves of the conventional type wherein refractory materials were employed were intended to suppress the explosive combustion of the aluminum powder component and to obtain a long duration of high temperature of the riser by virtue of the gradual and uninterrupted combustion of the inflammable components of the sleeve and also to retain the configuration of a riser sleeve as long as possible until completion of the entire operation. Other conventional riser sleeves include a porous riser sleeve which is formed by curing a molded mass of a mixture of dolomite grains and combustibles.

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In conventional molded riser sleeves which utilize the Thermit reaction between the aluminum particles and the iron oxide particles, the refractory materials mingled therewith are intensively heat absorptive by nature and therefore, the heat generated by the Thermit reaction is not consumed entirely for the heating of the molten metal located at the feeding head to preserve the temperature thereof. Rather, a considerable portion of the generated heat is consumed for heating the refractory materials per se. When consideration is directed to the fact that the aluminum particles are expensive and that about 80% or more of the cost of riser sleeves of this type is accounted for by this expensive material, one will easily understand that users of the riser sleeves of the conventional type have been obliged to waste money on such risers. In addition, dolomite riser sleeves not only have a great heat capacity but also they are liable to form voids of irregular complicated shape within their body while being cured, and furthermore, they bear a disadvantage that their strength is greatly reduced by the cracks which are formed within the body due to the discharge of an enormous amount of gas which is produced when the combustible components are made to burn.

It is, therefore, the primary object of the present invention to provide a novel method of manufacturing porous riser sleeves for preserving the heat of the riser which are free from the shortcomings of the sleeve risers of the conventional type and which are capable of perfectly preserving the heat of the riser.

Another object of the present invention is to provide a method of manufacturing low-cost and light-weight sleeves for preserving the heat of the riser which will permit a marked reduction in the amount of aluminum used as the heat generating component as well as the amount of the refractory materials used.

Still another object of the present invention is to provide a method of manufacturing sleeves for preserving the heat of the riser which are of a mechanical strength of a considerable magnitude.

Still other objects and advantages of the present invention will become apparent by reading the following detailed description on the method of the present invention which is made on some of the preferred embodiments of the invention which are provided herein by way of example only.

Referring to the drawings:

FIGURE 1 is a central sectional view of a riser sleeve made according to the invention in association with an ingot casting mold.

FIGURE 2 is a flow diagram of the method of the invention.

The inventor, perceiving the fact that air functions as an excellent heat-insulating medium having extremely small heat conductivity, has invented the technique which involves interposing a number of fine pores containing air within the mass of a heat generating agent comprising, for example, a mixture of aluminum particles and iron oxide particles so that the pores containing air may serve as the layer for interrupting the combustion of the heat generating agent and also for insulating the heat generated by the combustion.

In practice, as schematically illustrated in FIGURE 2, the riser sleeve of the present invention is manufactured by the following steps comprising: mixing a small amount of heat generating agents with a small amount of sand or particles of refractory material and also with spherically shaped granules of foamed synthetic resin such as foamed polystyrene; bonding them together with a binder such as water glass; molding the mass into a riser sleeve of the desired shape; and curing the molded mass. During the process of curing, the synthetic resin component decomposes by being subjected to heat, forming a number of fine pores within the molded mass. A heat insulating and combustion insulating sleeve which is light in weight and which is of an excellent heat insulating ability is thus obtained.

Conventional dolomite sleeves discharge an enormous volume of gas when the combustible components are made to burn. In the case of the sleeve of the present invention in which the foamed synthetic resin is contained, the volume of the gas produced by the combustion of the inflammable components is extremely small as compared with the volume of gas produced as a result of combustion of the ordinary resin. This reduced volume of the gas from combustion in the sleeve of the present invention successfully prevents the formation of fine cracks in the body of the sleeve such as have been often encountered when dolomite sleeves were used. The absence of crack formation in the sleeve body, together with the spherically shaped pores formed within the resin component which will be described later, contribute to the enhancement of the mechanical strength of the riser sleeve of the present invention.

Being of an extremely small specific gravity, the foamed polystyrene is easy to handle. The foamed polystyrene beads should be less than about 5 mm. in diameter. In addition, the foamed polystyrene decomposes at a temperature as of low as the order of 150° C., and this is a factor which facilitates the manufacture of the riser sleeve of the present invention. By using globular grains of foamed synthetic resin as one of the components of a riser sleeve, pores with a shape identical to the globular configuration of the resin grains are formed, and the spherically shaped configuration of the pores provides a uniform resistance force against external pressures applied thereto, and this physical property of the pores contributes greatly to the enhancing of the mechanical strength of the produced riser sleeve.

As schematically illustrated in FIGURE 1, in casting, the porous riser sleeve **2** is mounted on the upper end of a casting (ingot) mold **3** of any convenient conventional type. The reference numeral **1** indicates a layer of heat which becomes present during casting and which maintains the metal in the riser sleeve in a molten condition. The riser sleeve **2** serves to protect and insulate the heat layer.

A description will now be made of some of the embodiments of the present invention to demonsrtate the effect of the riser sleeve obtained according to the method of the present invention.

EXAMPLE 1

In the casting of 230 kg. of alloy steel containing 0.4% carbon by weight based on the total weight of the alloy steel, a heat generating sleeve of the under-mentioned composition manufactured according to the conventional technique was used, and shrinkage at the time of solidification of the metal was perfectly checked.

	Percent by weight
Aluminum	30
Alumina	20
Iron oxide	20
Olivine sand or silica sand	30

These components were bonded by water glass.

The above-mentioned sleeve manufactured according to a known method was replaced by a sleeve manufactured by the method of the present invention, as follows:

(1) The olivine sand was replaced by foamed polystyrene beads or grains of 1 mm. in diameter of a volume identical to that of the olivine sand. This means that the quantity of the heat-absorbing refractory materials in the sleeve was reduced by the volume of the olivine sand, and this resulted in the generation of an excessive amount of heat and the sleeve sustained damage from melting due to its being overheated.

(2) The above listed content of aluminum was reduced to 18%, and foamed polystyrene was used in a volume equal to the total of the reduction in the aluminum volume of and the volume of the olivine sand. When the sleeve of this composition was put to use in casting, the same effect as that obtained with the initial sleeve was achieved and the burning (the adherence of sand on castings) of the sleeve, which was encountered when the sleeve formed with olivine sand and silica sand was used, was completely avoided. Thus, the volume of the aluminum component required for the manufacture of a olivine sand-containing sleeve or silica sand-containing sleeve was reduced by approximately one third when the method of the present invention was carried out and when it was desired to obtain the same effect as that obtained by the use of the olivine sand-containing sleeve or silica sand-containing sleeve. This represented a 23% reduction in the cost.

EXAMPLE 2

A similar experiment was conducted on the casting of 6 tons of stainless steel. In the case where the sleeve contained 18% aluminum by weight, excessive heat was generated resulting in burning of the sleeve. The maximum reduction of the aluminum content which was possible was noted when the content was reduced to 9%. When the aluminum content was reduced to this level, the volume of the aluminum required for obtaining the same effect as that obtained from the sleeve of the prior art was noted to be almost one third of the volume of aluminum required for such sleeve of the prior art, and the cost was reduced by approximately 53%.

EXAMPLE 3

In the experiment of Example 1, one half of the olivine sand was substituted by foamed polystyrene of about 2 mm. in diameter. A slightly excessive amount of heat was generated and this caused the sleeve to burn.

In the experiments of Example 1 and Example 2, substantially the same results were obtained in the cases where foamed methyl methacrylate or a copolymer of foamed methyl methacrylate and foamed polystyrene were used in lieu of foamed polystyrene.

As has been clear from the foregoing discussion and examples, according to the method of the present invention, there is provided a riser sleeve which has an excellent heat insulating properties and which is light in weight, great in mechanical strength and which can dispense with expensive heat generating agents to a considerable extent. Thus, the method of the present invention can contribute greatly to the industries concerned.

What is claimed is:

1. A method of manufacturing a porous insulating riser sleeve for use on a mold for casting molten metal, comprising the steps of:

mixing (1) refractory materials selected from the group consisting of alumina, silica sand, olivine sand and mixtures thereof, (2) a heat generating agent comprised of aluminum particles and iron oxide particles, (3) beads of a foamed resin, and (4) a binder, in order to form a mixture;

molding the mixture to form a riser sleeve of the desired shape; and

then heating the mixture to cause the foamed resin beads to decompose whereby pores are formed in the sleeve.

2. A method according to claim **1**, in which the beads are made of foamed synthetic resin selected from the group consisting of polystyrene, methyl methacrylate and copolymers thereof.

3. A method according to claim **1**, in which the binder is water glass.

4. A method according to claim 1, in which the beads are of less than about 5 mm. in diameter.

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