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SYNTHETIC MOLD COMPOSITION AND METHOD OF MAKING SAME

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1

This invention relates to the casting in green sand molds of difficultly oxidizable metals of high melting-point, as grey iron, steel, bronze, refractory non-ferrous metals and alloys thereof but more especially to ferrous metals.

Among the principal objects of the invention are the provisions of a novel synthetic molding medium, composed principally of sand, which, when tempered with water and formed into molds, in the manner customary when employing ordinary molding sand, imparts to such molds highly desirable characteristics and more especially the capability of producing castings of the aforesaid metals from which the molding sand can be readily stripped without resorting to expensive prolonged tumbling, wire-brushing, sand blasting and like finishing operations, whereby remarkably smooth and pattern-true castings, essentially free from burnt-on-sand grains, can be obtained. Other objects of the invention are hereinafter set forth.

Heretofore, as I am well aware, special facing sands have been employed in foundries for facing the molds used in casting metals, such as aforesaid, which were composed principally of either naturally or artificially bonded molding sand with which was intimately incorporated a modicum of high melting-point pitch, commonly in a ratio of 90 of sand to 1 of pitch, in an effort to minimize the so-called burn-on of the sand grains to the casting due to the normal tendency of the molten metal to fuse the bonding material of the molding sand both to the metal and to the sand grains in the mold-metal interface. Such facing sands were applied next to the pattern as a facing layer of substantial thickness, usually from about ¼" to an inch or more, and when the molten metal entered the mold cavity, faced with such special sands, the volatile hydrocarbons in the pitch component thereof, were rapidly volatilized by the hot metal and the evolved vapors ignited to produce a sooty flame due to the limited supply of unconsumed oxygen present in the mold. As a result of such incomplete combustion, the sand particles at the mold-metal interface became coated with soot which acts to separate the sand nuclei of such coated particles from the hot metal and thus materially aids in the stripping of the sand layer at such interface from the finished casting.

Among the disadvantages attendant upon the use of pitch in such facing sands was the tendency of the same to melt at a relatively low temperature varying from about 300° F. to 400° F., and upon so melting to run freely around and en-

2

velop the bonded particles of the molding sand in the facing layer. Such action tends to objectionably waterproof either the naturally or artificially bonded sand particles, so enveloped, to such an extent that eventually the entire molding sand heap can no longer absorb sufficient water to be capable of being properly tempered, so to speak, when it was attempted to form fresh molds therefrom.

My investigations have led to the discovery of a special facing sand, containing pitch or pitch-like substances as an active soot-producing ingredient thereof, which are entirely free from the objectionable feature ordinarily imparted thereto by pitch, the same being prepared in accordance with the procedure set forth in the following detailed description thereof.

In carrying out my invention is it preferable to proceed as follows:

200 parts by weight of sharp or unbonded silica sand of the desired grain sizes are intimately admixed, in a suitable mixer equipped with paddles, with 10 parts, by weight, of powdered coal tar pitch, preferably normally solid pitch of a melting-point of 400° to 500° F., the mixture being heated, preferably by the application of direct heat, until the pitch is thoroughly melted and the same being continually stirred in order to thoroughly distribute the melted pitch so that the sand grains will become enveloped by a layer of the hot sticky pitch or other hydrocarbons, such as gilsonite, elaterite, asphalt, petroleum still-bottom residues, capable of forming voluminous quantities of soot on burning in a limited supply of air which may, if desired, be satisfactorily substituted for such pitch. When the sand grains have become thoroughly coated, 20 parts of powdered carbon, essentially free from volatiles, desirably 72 hr. metallurgical coke, petroleum coke or retort carbon are added and thereupon the heating is discontinued while the stirring is continued until the previously coated sticky sand particles are in turn homogeneously coated with a layer of the high refractory carbon powder. The agitation of the mass is continued until the temperature thereof normally drops until it becomes cold or at least drops below the melting point of the particular hydrocarbon used. Upon so cooling, the pitch component of the mass again solidifies and anchors the coke carbon layer fast to the silica grains. The resultant mass is dumped from the mixer, screened to remove any lumps and the separated lumps are then ground, re-screened and added to the other finished material.

In order to prepare the molding medium for use

in making green sand molds from such finished material it is merely necessary to incorporate therewith in the well known manner, either at the plant where manufactured or at the foundry where the same is to be used, a sufficient quantity of the common bonding agents, as bentonite or other bonding clays, with or without cereal binders, until the desired green bond and green shear strengths are developed in the molding medium, dependent upon the particular class of work for which it is intended to be used.

Another important advantage such novel molding medium, is the fact that it lends itself to the production of baked cores for use in casting the aforesaid metals in green sand molds, it being merely necessary to form cores of the desired size and shape from such medium after suitably bonding the same with appropriate bonding agents and binders and then to bake such cores, in the manner now customary, to impart thereto the requisite hot strength.

In lieu of employing hydrocarbons, such as aforesaid, as the sticking agent, appropriate amounts of various carbohydrates, as molasses, dextrine, sulphite waste liquors or sticky residues obtained as by-products from alcohol distillation, may be substituted therefor, but in such an event the mass in the mixer must be heated sufficiently to char the carbohydrate and render it insoluble and such charring action functions of itself to anchor the subsequently added carbon fast to the silica grains substantially as effectively as do the hydrocarbons as aforesaid.

The successive heating-and-cooling pre-treatment of the hydrocarbon and sand mix, on the one hand, or the carbohydrate and sand mix, on the other hand, not only fixes the hydro-carbon or the carbohydrate so that it will not flow during the casting operation but drives off such of the volatiles of these compounds as would tend to cause mapping, gas marks, or rounded edges on the casting surfaces and insures against any possibility of the explosion of the mold when the same is broken up such as sometimes occurs when external air comes in contact with volatiles evolved from the prior pitch-treated facing sands. The coating of the sticky sand particles with the powdered carbon which desirably is from about 200 to 325 mesh or even finer, insures of the deposit of an insulating layer of refractory material on the sand particles that is far more effective in preventing the burn-on of sand to the casting than it is possible to accomplish when employing ordinary pitch-treated facing sand.

Castings produced from molds prepared from my improved molding medium can be readily stripped from the sand layer at the mold-metal interface and remarkably smooth pattern-true castings obtained without necessitating prolonged and expensive mechanical cleaning operations thereon. So also can the cores prepared from such molding medium, as aforesaid, be readily stripped from castings formed therewith and such cores contribute to the production of remarkably pattern-true holes in such castings whose surfaces are unusually smooth.

The amount of pitch to be incorporated with any given amount of sharp silica sand that is employed will vary directly with the grain size of such sand or like refractory material, since the finer the grain size, the greater will be the surface presented and therefore the greater the quantity of pitch that will be required. Desirably between 3% to 17% of the pitch by weight of the sand-pitch mixture is employed.

Various modifications of the procedure and proportions above specified may be resorted to when making my improved molding composition without departing from the spirit of my invention as embraced within the scope of the appended claims.

Having thus described my invention I claim:

1. An intermediate composition for use in making a mold composition consisting essentially of sharp silica sand grains externally coated with pitch having a melting point of at least about 400° F. and in which are embedded particles of refractory powdered carbon, the amount of such refractory carbon being sufficient to prevent burn-on of the silica sand grains to a metal casting during the forming thereof in a mold formed with such intermediate composition.

2. A mold composition for metal-casting purposes consisting essentially of sharp silica sand grains externally coated with pitch having a melting point between about 400° F. and 500° F. having a layer of refractory powdered carbon deposited thereon and a modicum of a clay-like bond incorporated with said mold composition, the particles of said bond being out of direct contact with said unbonded sand grains and the amount of such refractory carbon present in the mold composition being sufficient to prevent the burn-on of the silica sand grains to a metal casting during the forming thereof in a mold formed with such mold composition.

3. A mold composition for metal-casting purposes consisting essentially of sharp silica sand grains which are individually externally coated with high melting-point pitch that is essentially free from volatiles and in which pitch coatings are embedded particles of refractory powdered carbon, the said mold composition containing a modicum of a clay-like bond, the particles of which are out of direct contact with said sharp silica grains and the amount of such refractory carbon present in the mold composition being sufficient to prevent the burn-on of the silica sand grains to a metal casting during the forming thereof in a mold formed with such mold composition.

4. A mold composition for metal-casting purposes, consisting essentially of sharp silica sand grains the particles of which are individually coated with a film of pitch having externally embedded therein fine particles of refractory carbon, said mold composition containing a modicum of a clay-like bond the particles of which are out of contact with the sharp silica sand grains and the amount of such refractory carbon present in the mold composition being sufficient to prevent the burn-on of the silica sand grains to a metal casting during the forming thereof in a mold formed with such mold composition.

5. In the method of making a mold composition for metal-casting purposes, the steps which comprise intimately admixing particles of sharp silica sand of selected grain sizes with pitch, heating the mixture with constant stirring to a sufficient temperature to melt the pitch and effect the substantial coating of the sand grains, then admixing powdered refractory carbon with the resultant mass while the pitch therein is still in a tacky condition so as to effect the anchoring of the carbon powder to the coated sand particles, the amount of such refractory carbon employed being sufficient to prevent the burn-on of the silica sand grains to a metal casting during the forming thereof in a mold formed with such mold composition so obtained.

6. In the method of making a mold composition for metal-casting purposes, the steps which comprise effecting the individual coating of sharp silica sand grains with a film of hot pitch, then while the films are still hot and in a tacky condition dusting into the mass finely powdered refractory carbon while continually stirring the mass and thereby effecting the anchoring of the particles of powdered carbon in said films of pitch, the amount of such refractory carbon employed being sufficient to prevent the burn-on of the silica sand grains to a metal casting during the forming thereof in a mold formed with such mold composition so obtained.

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