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SYNTHETIC FOUNDRY SANDS

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This invention relates to the production of so-called synthetic molding and facing sands.

The principal objects of the invention comprise the expeditious and economical production of products of the aforesaid character, all of which are adapted to effectively prevent the fusion of sand particles in the surfaces of molds containing such products with the metal that contacts with such surfaces during a metal casting operation. Other objects of the invention are hereinafter set forth.

As I am well aware, it has been proposed in Patent No. 2,348,155 to produce mold-facing sand by mixing together in the cold, sharp or unbonded sand, bentonite, pitch and sea-coal, preferably in the proportions of approximately 80% sand, 12% bentonite, 12% pitch and 4% sea-coal. In such a mixture since the bentonite is directly admixed with the sand, as distinguished from being completely isolated therefrom by a heat-insulating layer of fine sooty carbon such as is the case with my improved facing sand, as herein-after described, the usual objectionable fusion would occur between the sand particles in the forming surfaces of a mold containing such mixture and the metal in the surface of a casting produced by such mold since the directly admixed bond will promote such fusion.

My investigations have led to the discovery that it is not essential that the carbon particles in sands such as aforesaid shall be of solid carbon throughout, but that the same may consist of nuclei of unbonded or sharp refractory particles coated with a fine layer or film of hydrocarbons containing a pre-determined amount of soot-producing substances which upon contact with molten metal substantially completely decompose to a fine soot composed of colloidal carbon that serves to smoke those parts of the mold which would ordinarily be inaccessible to facing materials.

I am well aware that it is common practice to admix sea-coal with molding sand in order to accomplish the aforesaid purpose, namely, the production of gaseous hydrocarbons which on decomposition when exposed to the heat of the molten metal produce an atmosphere of soot in the mold, but due to the fact that such sea-coal is mechanically admixed with the molding sand and also has been applied as a thick layer over the pattern during the formation of the mold, a considerable portion of the sea-coal is wasted since only the portions thereof on the surface of the mold will be decomposed by the molten metal on contact therewith and the balance of the sea-coal

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embedded in the mold, which constitutes the major portion thereof, will be wasted.

At the present time foundry sands, such as aforesaid, whether the same be natural or artificial, usually consist of sand particles surrounded by a thin coating or layer of a colloidal clay-like substance which serves as a bond, i. e., it causes the sand particles to adhere to each other and thereby form a suitable molding medium. When molten metal, heated to temperatures ranging from about 1445° C. to 1750° C., strikes such particles, the clay bond surrounding each particle acts as a flux and tends to lower the normal melting point of the silica, about 1700° C., with the result that both the silica particle and the bond fuse to the metal, resulting in a badly burnt-in casting. The higher the temperature of the metal the greater the degree of fusion which occurs and consequently the worse the resultant burnt-in sand condition. This will be more readily appreciated by a consideration of the results obtained in casting various metals in sand molds. For example, when aluminum and magnesium are cast, due to the relatively low temperatures at which they are poured, ranging from about 700° C., there will be substantially no burnt-in sand condition observable. In the case of various brasses, poured at 1200° C., some burnt-in sand condition will occur. In the case of both iron, poured at 1445° C. to 1535° C., and steel, poured at 1650° C. to 1750° C. the burnt-in condition is very pronounced and decidedly objectionable and the higher the temperature above these ranges the worse such burnt-in condition becomes, due to the more extensive nature of such fusion of the clay or other bonding material to the metal and the sand particles. This burnt-in condition can, I have discovered, be substantially prevented if the bonding material be separated from the sand or silica particles by some combustible carbonaceous material, in which event although the incoming metal will fuse the clay bond nevertheless, due to the simultaneous combustion of the carbonaceous material lying beneath the clay bond, the latter will be temporarily separated by a gaseous or sooty envelope both from the silica particle and from the metal. Hence the silica, being separated from the flux or bond, will not fuse and by the time the combustible separating layer is completely consumed so much heat will have been dissipated from the metal in the mold that it will have solidified and consequently will be no longer capable of picking up the fused clay. The resultant casting will, therefore, be substantially free from burnt-in sand or clay.

As a preferred example of the method of making my improved molding, facing or core sands, I preferably proceed as follows:

200 parts of sharp sand free from any bond, desirably of about 70 mesh, are introduced into a suitable mixing chamber, such as that of a batch mixer or a continuous tubular mill. Powdered coal tar, urea or like combustible hydrocarbon is then introduced into said mixing chamber desirably in the ratio of one part thereof to twenty of the sharp sand or silica employed. The actual amount of the combustible material employed depends upon the fineness of the silica base, as the finer the base the greater will be the surface area to be coated and consequently the more combustible material that will be required. Following the charging of the combustible material into the mixing chamber, the charge is heated sufficiently to melt the pitch or like combustible employed while continually stirring or agitating said charge. Then the mass is allowed to cool and is then pulverized to any desired degree of fineness, desirably about 70 mesh. It is then in condition to be shipped to foundries which are accustomed to bond their own sand, but before shipping elsewhere it is desirably bonded to the requisite extent, depending on the character of the work to be performed therewith by intimately incorporating bentonite therewith, desirably bentonite of 250 to 350 mesh fineness.

Other refractory bases which may advantageously be employed in addition to those above set forth, are zircon sand, kaolin, fly ash and stack dust. In fact almost any refractory base fusing above about 650° C. is suitable, provided it is not objectionably chemically active.

For the carbon-producing or soot-yielding component of my improved synthetic molding sand products, I preferably use coal tar pitch as above stated, but other substances such as asphalt, gilsonite, rosin-pitch, anthracene oil and naphthalene are excellent substitutes therefor since all of them readily decompose and yield voluminous sooty fumes when contacting molten metal heated about 650° C.

As set forth in the technical work by Herbert Abraham entitled Asphalt and Allied Substances, fifth edition, 1945, vol. 1, published by D. Van Ostrand, Inc., the fusion point of coal-tar pitch ranges from about 80° F. to 300° F. or even higher, that of asphalt, both natural and residual petroleum asphalts, between 80° F. and 225° F. (see pages 405 and 496 respectively), that of gilsonite between about 270° F. and 400° F. and that of rosin pitch between about 100° F. and 200° F. (see pages 251 and 329, respectively).

Various changes in and modifications of the foregoing procedures and products, within the scope of the appended claims, may be made without departing from the spirit of my invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A synthetic foundry sand, comprising principally finely divided sand nuclei, which nuclei are free from bonding material, evenly coated with a heavy hydrocarbon belonging to a mem-

ber of the group consisting of a solid, a semi-solid and a normally non-volatile liquid and capable of yielding voluminous soot-like fumes on contact with molten metal during a casting operation and clay-like bonding material externally deposited on said coated nuclei.

2. A foundry sand comprising principally silica nuclei, free from bonding material, evenly coated with asphaltic material and capable of yielding voluminous sooty fumes on contact with molten metal during a metal casting operation and clay-like bonding material externally deposited on said coated nuclei.

3. A sand for use in molding operations in foundries, comprising principally silica nuclei, free from bonding material, evenly coated with a pitch-like hydrocarbon capable of yielding voluminous sooty fumes on contact with molten metal during a casting operation; and bentonite externally deposited on said coated nuclei.

4. In the method of making a sand for molding operations in foundries the steps comprising evenly coating finely divided refractory material which is infusible below about 650° C. and which is free from bonding material with a heavy hydrocarbon belonging to a member of the group consisting of a solid, a semi-solid and a normally non-volatile liquid and capable of yielding voluminous sooty fumes on contact with molten metal during a casting operation and then finely comminuting the resultant product and admixing therewith a minor proportion of bentonite.

5. In the method of making a molding sand, the steps which comprise evenly applying to particles of sharp molding sand a coating of a heavy hydrocarbon belonging to a member of the group consisting of a solid, a semi-solid and a normally non-volatile liquid and capable of yielding voluminous sooty fumes on contact with molten metal during a casting operation and then finely comminuting the resultant product and adding a minor proportion of bentonite thereto for bonding the same.

6. A molding sand comprising principally sharp sand whose individual particles are evenly coated with pitch-like material and which coated particles are surrounded by bentonite particles externally deposited thereon.

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