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BINDERS FOR BAKED SAND CORES AND DRY SAND MOLDS FOR USE IN CASTING METALS

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This invention relates to the treatment of pitch, more especially coal tar pitch and oxidized asphaltic pitches and other pyrogenous pitches to render the same peculiarly suitable for use as a binder in making sand cores and dry sand molds intended for metal-casting purposes.

Among the principal objects of the invention are the production of such pitch binder, in powder form, which has the following characteristics, viz.,

(1) An extremely high binding strength by comparison with that possessed by untreated coal tar pitch.

(2) The pitch particles of such binder are non-tacky and therefore do not tend to coalesce or clump together when packed in bags under the high pressures developed, when the same are piled one on another in tall stacks, during shipment or storage.

My investigations have led to a discovery that certain glycol compounds in which said pitches are entirely insoluble, more especially diethylene glycol ($HO.CH_2.CH_2.O.CH_2.CH_2OH$), are capable of imparting to baked sand cores and dry sand molds, when employed as the binder thereof, an increase in strength, some 100% or even more, of the strength imparted to such cores and molds by ordinary coal tar pitch or by the other pitches aforesaid, when so employed as the binder therein and prior to the fortifying treatment thereof in the manner hereinafter described.

In the production of the aforesaid fortified coal tar pitch in accordance with the invention, it is preferable to proceed as follows:

98 parts of finely pulverized coal tar pitch, desirably of 200 mesh and with a "ring and ball" softening point of between 270° F. and 330° F. is thoroughly mulled in a suitable mixer with 2 parts, by weight, of diethylene glycol and 5 parts, by weight of water which latter serves to facilitate the distribution of the glycol over the pitch particles. Since the coal tar pitch is wholly insoluble in glycol compounds, whether ethylene or propylene glycols, there is as hereinbefore specified no tendency for the treated pitch particles to clump together when packed in bags and stacked, under the high pressures developed during shipment or storage thereof.

In order to obtain baked sand cores, having the resultant fortified pitch as the binder element thereof, ninety-seven parts of sharp silica sand or like refractory of an American Foundrymen's Society grain fineness number of 50 to 60, and three parts of such pitch together with seven parts of water are thoroughly mulled together

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and then rammed up into cores of the desired shape and size. These cores are baked at a temperature of 260° C. for about three hours and then allowed to cool. The resultant cores, as above stated, when tested against cores similarly prepared, except that the coal tar pitch commonly employed in foundries as a binder has been substituted for the above specified fortified pitch, show a strength of some 200 lbs. per square inch as against but about 100 lbs. per square inch for the cores containing the untreated coal tar pitch as the binder element thereof.

In making dry sand molds with the aforesaid fortified pitch, a mold composition is prepared by mulling together 97 parts of clay-bonded sand, 2 parts of fortified pitch and 7 parts of water. This composition is employed in making molds of the desired size and shape and these molds are then baked at about 260° C. for three hours after which they are allowed to cool, whereupon they are ready for use in metal casting operations. Such molds are prepared from clay-bonded sand as distinguished from the sharp or unbonded sand which is admixed with the fortified pitch when making cores and consequently while such molds possess remarkable strength it is somewhat less than that of the cores, due to the fact that such binder is required to spread over a considerably greater surface area in the case of the clay-bonded particles of the dry mold.

Desirably the sharp sand employed in making cores with the fortified pitch is of a grain fineness number of from about 20 to 60, as defined by the foundry sand grading classification of the American Foundrymen's Society. The clay-bonded sand employed in making dry sand molds with said fortified pitch binder is, on the other hand, desirably of a grain fineness number of between 10 and 100 on the same scale.

Other glycols and especially monoethylene glycol, triethylene glycol as well as the propylene glycols may be substituted for diethylene glycol in preparing the fortified pitch but diethylene glycol is especially preferred because its boiling point is between about 244° C. and 250° C., which closely approximates the maximum temperature of some 260° C. to which the cores and molds are heated during the 3 hour heating cycle, with the consequence that the diethylene glycol tends to linger in the cores or molds, where it is most needed, throughout the cycle.

The aforesaid fortifying characteristics of glycols when employed in pitchy and resinous binders only come into play if the amount of the glycol, based on the weight of the pitchy mixture

of glycol and pitch, is held between certain critical limits, namely between about 1½% and 3%. Below 1½% the effect of the glycol as a fortifying agent in a binder is scarcely noticeable whereas above 3% its fortifying action tends to actually decrease as the amount of glycol used increases above that limit.

Heretofore it has been proposed, as set forth in Patent No. 2,250,287, granted July 22, 1941, to render carbonaceous fuels such as coal, coke and briquettes substantially dustless by spraying or otherwise applying thereto some 3 to 4 gallons per ton of fuel of a water dispersion of bentonite containing some 12% of ethylene glycol which represents about ½% of glycol per ton of fuel treated. In this patent it states that bentonite may be distinguished from common clay by its "extreme stickiness when wet" (see page 1, col. 1, lines 37–39). While bentonite, because of this characteristic, may be desirable in association with a hygroscopic agent such as ethylene glycol for rendering carbonaceous fuel dustless, such characteristic renders bentonite highly objectionable for use as an ingredient of a fortifying agent for pitches containing a glycol, as the finely divided pitchy particles with which such fortifying agent is admixed would, when bagged, tend to clump together into cakes and be rendered valueless for use in foundries to which the treated pitches might be shipped as a binder for baked cores and dry sand molds. Since, as above stated, the patented dust-proofed composition contains but a small fraction, about one-third, of the minimum amount of glycol required for accomplishing the effective fortifying of the particular pitch specified herein as suitable for treatment by applicant's novel method, it will be apparent that even were the carbonaceous fuels specified in said patent suitable for serving as binders in baked sand cores and dry sand molds, which they certainly are not, nevertheless such dust-proofed composition would not posses a binding strength differing substantially from that of the untreated carbonaceous fuel.

Various modifications and changes in the compositions and methods of making the same as described herein, within the scope of the appended claims, may be made without departing from the spirit of the invention.

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

1. A fortified binder for baked sand cores and dry sand molds consisting essentially of a pyrogenous hydrocarbon selected from the group consisting of coal tar pitch and oxidized asphaltic pitches, the same being intimately admixed with from one and one-half to three per cent, by weight of the mixture of a glycol compound.

2. A fortified binder for baked sand cores and dry sand molds, consisting essentially of finely comminuted coal tar pitch intimately admixed with from one and one half to three per cent by weight of the mixture of diethylene glycol.

3. Fortified binder for baked sand cores and dry sand molds consisting essentially of a finely comminuted pyrogenous hydrocarbon selected from the group consisting of coal tar pitch and oxidized asphaltic pitches which is intimately admixed with from one and one-half to three per cent by weight of the mixture of a glycol compound, said binder, when three parts thereof are intimately mulled with seven parts of water and ninety seven parts of sharp silica sand of an A. F. S. grain fineness number from 50 to 60 and then rammed up into specimen testing cylinders that are two inches both in height and diameter which are then baked for three hours at 260° C., serving to impart to such specimens a binding strength equal to at least 150 pounds per square inch.

4. A molding sand composition for use in casting metals consisting essentially of molding sand the particles of which are coated with a fortified binder belonging to the group consisting of coal tar pitch and oxidized asphalt pitches which contains from one and one-half to three per cent of a glycol.

5. A molding sand composition for use in casting metals, consisting essentially of sharp molding sand the particles of which are coated with a fortified binder belonging to the group consisting of coal tar pitch and oxidized asphalt pitches which contains from one and one-half to three per cent of diethelene glycol.

6. A molding sand composition for use in making baked sand cores and dry sand molds for metal-casting purposes, consisting essentially of molding sand the particles of which are coated with a fortified binder consisting essentially of coal tar pitch containing from one and one-half to three per cent of diethelene glycol by weight of the pitch and glycol mixture.

7. A fortified binder as specified in claim 3 wherein the pyrogenous hydrocarbon consists of coal tar pitch and the glycol compound consists of diethylene glycol and the strength imparted to the test specimens is at least 175 pounds per square inch.

8. A molding sand composition for use in casting metals consisting essentially of molding sand the particles of which are coated with a fortified binder consisting of coal tar pitch intimately admixed with from one and three-quarters to two and one-half per cent, by weight of the mixture of sand and pitch, of ethylene glycol.

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