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FOUNDRY SAND ADDITIVE

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9 Claims. (Cl. 106—38.2)

This invention relates to a foundry sand additive and more particularly to an additive adapted to improve the physical characteristics of the sand and the appearance of the resulting casting.

An object of the present invention is to provide a foundry sand additive which may be more easily distributed throughout the sand and will increase the flowability of the sand in making the molds.

Another object of the invention is to provide a foundry sand additive which will effectively cushion the heat expansion of the sand during casting.

Another object is to provide an additive containing a carbonaceous material which is substantially non-resinous to prevent the formation of resinous lumps in the sand.

Another object is to provide an additive which will not cake or produce ash on flashing, thereby eliminating rough castings and eventual discard of the sand.

A further object is to provide a foundry sand additive which will increase the ram density of the core and mold, thereby preventing metal penetration.

Still another object is to provide an additive which will effectively reduce the oxygen trapped in the mold and prevent the resulting scaling of the casting.

Another object is to provide an additive which will enable the sand to be more easily shaken out after casting.

A further object is to provide a foundry sand additive which will not impair the bond strength of the sand and which, by providing a water repellent coating on the sand grains, enables less moisture to be used in the molding sand.

Another object is to provide an additive which will aid in producing clean smooth surfaced castings.

Other objects and advantages of the invention will appear in the course of the following description.

The present invention is based on the discovery that an incompletely combusted amorphous carbon material when saturated with a petroleum derivative, provides an additive which when added to foundry sand will completely coat each sand grain and improve the physical and casting properties of the sand.

The incompletely combusted carbon used in the additive may take the form of charcoal, lampblack, soot or other carbon materials having a generally non-cellular structure.

The carbon is preferably employed in a powdered form and has a fineness of between about 80 and 200 mesh. It has been found that if the carbon grain size is much greater than 80 mesh, imprints of the coarse grains may be left on the casting. Conversely if the grain size of the carbon is much less than 200 mesh, the surface tension characteristics of the additive will be inadequate due to the fineness of the carbon particles.

The petroleum derivative may be of a paraffin or asphaltic base, and may preferably take the form of a heavy fuel oil.

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The oil serves to soften the carbon material and provides a water repellent covering around each sand grain.

The petroleum derivative or oil should have a thin enough consistency to permit the oil to be readily mixed with the carbon and yet should be viscous enough so that the oil and carbon will not separate or settle out.

In addition, the oil should have a flash point generally within the range of 120° to 180° F. to insure proper combustion or flashing of the oil. A flash point below this range may result in an additive of a dangerous or explosive nature and should be avoided.

It has been found that a No. 4 to No. 6 fuel oil is particularly suitable as the petroleum derivative in the present additive, for it has the aforementioned properties and is readily available and economically practical.

No. 6 fuel oil, as tested according to ASTM D 396-48T, has a flash point of 150° F., a percentage by volume of water and sediment of 2%, a viscosity measured at 122° F. by a Furl viscosity instrument of 30, and a residual ash of .10% by weight.

No. 4 fuel oil has a flash point of 130° F., a percentage by volume of water and sediment of .5%, a viscosity measured at 100° F. by a Universal viscosity instrument of 125, and a residual ash of .10% by weight.

The additive should contain a sufficient amount of oil to saturate the charcoal or other incompletely combusted carbon material. About 25 to 30% by weight of oil in the additive is generally sufficient to saturate the carbon, and thus the proportion of carbon in the additive is about 70% to 75% by weight. It is desirable that the carbon be in a saturated condition in order that the additive will have maximum effectiveness. If a considerable excess of oil is added to the carbon, over that required for saturation of the carbon, the additive will tend to ball, while if insufficient oil is employed so that the carbon is not saturated the additive will contain carbon dust which will reduce the effectiveness of the additive in coating the sand grains.

The additive containing the aforementioned proportions of carbon and oil is mechanically dispersed in the mold sand in the proportions of about 1 to 3% by weight of the sand. Within these ranges the additive will be present in sufficient amount to insure proper combustion and provide sufficient voids in the mold to cushion the expansion of the heated sand, and additionally, the carbon concentration will be sufficient to reduce the oxygen present in the mold and prevent the possibility of scaling of the casting.

The present additive may be employed with equal results in either the molding sand or the core sand. If mixed with the core sand, the additive should preferably comprise from about .5% to 1.5% by weight of the sand.

The present additive has the novel property of being capable of completely coating each sand grain. This is a critical distinction over other additives employing resinous or uncombusted carbonaceous material in combination with a vehicle such as oil. The additive of this invention has exceptional anti-frictional qualities and tends to be readily distributed within the sand grains and cover each grain with a coating of carbon and oil. As each grain of sand is coated, the sand exhibits greater flowability than heretofore obtainable in molding or core sand. In addition, the coating on each sand grain provides the grain with a complete water repellent covering so that the moisture requirements of the sand are lessened.

In contrast to this novel property of coating each grain of sand, the addition of a conventional additive, such as wood flour and oil to sand, does not result in each sand grain being coated with additive, but rather provides a homogeneous mixture of sand grains and oil-impregnated wood flour particles. As the sand grains

themselves are not coated with the additive, as in the present invention, the sand will not flow as readily and cannot be shaken out as easily from the casting as sand containing the present additive.

To illustrate the unique property of coating each sand grain, the present additive, when added to fresh sand even in small amounts of 1% by weight of the sand, will completely discolor the sand, turning the same black. This discoloration shows that each sand grain is completely coated with the black additive. In contrast to this, when an ordinary additive is added to the sand in similar amounts, the color of the sand remains virtually unchanged showing that the additive particles do not coat the sand grains but merely are dispersed throughout the sand, and the sand grains, greatly predominating in number, dominate the mixture so that the color of the mixture appears to be that of the sand.

It is believed that this novel ability of the present additive to coat each sand grain is brought about by the softening action of the oil on the charcoal or other partially combusted carbon which destroys the lignite fibers in the charcoal and reduces the charcoal to a substantially non-cellular state. In this state the charcoal has exceptional anti-frictional qualities, thereby enabling the additive to readily flow around and coat each sand grain.

By employing an incompletely combusted carbon material, such as charcoal, as a source of carbon to reduce the oxygen present in the mold, there will be no coking or ash produced during combustion for the charcoal is substantially all carbon and will be completely combusted. Any residual ash which might tend to produce rough castings is thereby eliminated.

The carbon ingredient of the present additive is substantially free of resinous material. The conventional additives employ carbonaceous materials, such as wood flour, pitch, etc., which contain considerable quantities of resinous matter. After combustion of these carbonaceous materials, the resinous ingredients solidify on cooling and bind the sand particles together in the form of hard lumps. These lumps are undesirable in the sand and an appreciable accumulation of lumps results in the discard of the sand. Thus, additives using wood flour, pitch, etc. as the carbonaceous ingredient seriously impair the quality of the sand in time, and the length of time that the sand is useable in inversely dependent upon the proportion of resinous materials in the additive.

Charcoal is a non-resinous material and the present additive employing charcoal will not develop any hot or dry strength in the molding or core sand and will not produce any resinous lumps which will impair the quality of the sand.

As the additive will not produce resinous lumps or, as previously related, will not cake or produce residual ash, the sand may be re-used for an indefinite period.

The present additive being devoid of resinous material, will not evolve acrid fumes during flashing, yet the charcoal when combusted will provide the necessary reduction in volume to accommodate the heat expansion of the sand.

Because of the exceptional anti-frictional properties of the present additive, the additive acts as a releasing agent and prevents sand from adhering to the core box or the pattern. As the sand, with the addition of the present additive, will not adhere to the pattern on removal of the same from the mold, the surface of the mold will be extremely smooth and the resulting casting will have a correspondingly smooth surface. In addition, the sand when combined with the present additive will not stick or clog in the screen of the core blowing machine.

To prepare the present additive, the oil is added to the charcoal or other amorphous carbon in a suitable mixing vessel until the charcoal is in the saturated state. The oil-saturated charcoal is then passed through a 60 mesh screen to remove any large lumps or particles. The screened mixture or additive is then added to the

molding or core sand in the proper weight ratios and mechanically dispersed therein.

The present invention provides an extremely inexpensive additive and materially reduces cleaning and labor costs in casting. The improved results through use of the additive include, complete reduction of the oxygen in the mold, improved flowability of the sand, better distribution of the additive in the sand, no detrimental effect on the bond strength of the conventional binders normally employed in the sand, unimpaired re-use of the sand, easier shake out of the casting, reduced requirements for moisture in the sand, and clean smooth-surfaced castings.

Various embodiments of the invention may be employed within the scope of the following claims.

I claim:

1. A foundry core sand comprising a mechanical mixture of about 98.5% to 99.5% sand and binder mix and about 0.5% to 1.5% of an additive composition capable of completely coating the individual sand grains, said additive composition comprising about 70% to 75% of powdered charcoal having a particle size in the range of 80 to 200 mesh and about 25% to 30% of fuel oil having a flash point in the range of 120° F. to 180° F.

2. A foundry sand additive consisting essentially of a substantially resin-free, amorphous carbon having a particle size in the range of 80 to 200 mesh, said carbon being saturated with a hydrocarbon oil having a viscosity comparable to fuel oil and having a flash point in the range of 120° F. to 180° F., said oil having the property of softening said carbon to decrease the frictional qualities thereof and enable the saturated carbon to completely coat the individual grains of sand when the additive is mixed with sand.

3. A foundry sand additive consisting essentially of 70 to 75% by weight of a finely divided carbon material selected from the group consisting of charcoal, lamp-black and soot and having a particle size in the range of 80 to 200 mesh, and the balance being substantially a hydrocarbon oil having a flash point in the range of 120° F. to 180° F. and a viscosity permitting the oil to readily mix with said carbon material and to maintain the carbon material in suspension therein.

4. A foundry sand additive consisting essentially of a finely divided, incompletely combusted carbon material selected from the group consisting of charcoal, lamp-black, and soot and having a particle size in the range of 80 to 200 mesh, and a sufficient quantity of a hydrocarbon oil to saturate said carbon material, said hydrocarbon oil having a viscosity comparable to fuel oil and having a flash point in the range of 120° F. to 180° F.

5. A foundry sand additive consisting essentially of 70 to 75% by weight of charcoal having a particle size in the range of 80 to 200 mesh, and the balance being fuel oil having a flash point in the range of 120 to 180° F.

6. A foundry molding sand comprising about 1 to 3% by weight of an additive composition, the balance being substantially all sand, said additive composition consisting essentially of a substantially resin-free, amorphous carbon having a particle size in the range of 80 to 200 mesh saturated with a hydrocarbon oil having a flash point in the range of 120° F. to 180° F. and having a viscosity comparable to fuel oil and capable of softening the carbon and decreasing the frictional qualities thereof to permit the additive to be readily distributed within the sand.

7. A foundry molding sand having increased flowability and capable of being readily shaken from the casting comprising a mixture of about 97 to 99% by weight of a sand and binder mix and about 1 to 3% by weight of an additive composition consisting essentially of finely divided, substantially resin-free, amorphous carbon saturated with a hydrocarbon oil having a viscosity comparable to fuel oil, said carbon having a particle size in

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the range of 80 to 200 mesh and said oil having a flash point in the range of 120 to 180° F.

8. A foundry molding sand as claimed in claim 7 in which said hydrocarbon oil is fuel oil.

9. A foundry core sand comprising between about 0.5 and 1.5% by weight of an additive consisting essentially of finely divided, substantially resin-free, amorphous carbon saturated with a hydrocarbon oil having a viscosity comparable to fuel oil, said carbon having a particle size in the range of 80 to 200 mesh and said oil having a flash point in the range of 120° F. to 180° F.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 15, for "foundy" read -- foundry --; line 20, for "foundary" read -- foundry --; column 4, line 36, for "70 to 75°" read -- 70 to 75% --.

Signed and sealed this 4th day of November 1958.

(SEAL)
Attest:

KARL H. AXLINE

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ROBERT C. WATSON
Commissioner of Patents