

UNITED STATES PATENT OFFICE

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ADDITIVE COMPOSITION FOR SAND MOLDS
AND METHOD OF MAKING SAMEBurgess P. Wallace, Brooklyn, N. Y., assignor to
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a corporation of New JerseyNo Drawing. Application July 11, 1950,
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This invention relates to the casting of metals, more especially ferrous metals, bronze and high melting-point metal alloys and has for its principal objects the provision of a composition for use in making "green sand" molds having excellent facing characteristics and a minimum factor of expansion wherein smooth pattern-true castings can be produced that are essentially free from burnt-on sand grains and also from such defects as scabs, rat tails, cracks, buckles and the like that commonly result from objectionable sand expansion and which castings can be readily stripped from adhering sand without resort to prolonged and expensive mechanical finishing operations. Other objects of the invention are the provision of a molding composition having an optimum degree of flowability, gas-permeability and affinity for tempering water and which composition does not tend to cumulatively waterproof the sand heap from which supplies are drawn for the production of subsequent molds. Further objects of the invention are hereinafter set forth.

Heretofore, as I am well aware, it has been proposed to employ in the production of molding sand compositions, cellulosic material such as wood flour, certain types of manure, burned rams' horns and the like. However, none of these materials effected any facing action, whatsoever, on the sand surfaces of the mold and in no instance was colloidal bituminous material in solid form distributed on such wood flour or other cellulosic material in the novel manner employed by me as hereinafter set forth.

The crux of my invention resides in the discovery of a method of combining wood flour and like cellulosic flours with solid colloidal bituminous material in such a manner that the flour employed retains its original powdered form while remaining absorptive of water and yet contains within its pores the bitumen in such a finely divided form that it cannot waterproof or otherwise objectionably affect either the cellulosic flour or molding sand admixed therewith. Such impregnated material acts not only as an ideal facing because of the heavy hydrocarbon vapors given off by the bitumen present during a casting operation, which results in clean casting being obtainable when employing such material, but also acts as a complete preventative of expansion of sand molds formed therewith due principally to the fact that the flour and the bitumen carried thereby burn away leaving practically no ash when molten metal comes in contact therewith, thus affording voids into which the hot sand particles can freely expand.

In carrying out the invention, I preferably proceed as follows:

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1,000 lbs. of wood flour of any good commercial grade is introduced into a mulling machine of the usual type wherein two heavy wheels revolve over a pan. Between 2½% and 10%, by weight of the flour, of a water-soluble starch derivative, such for example as dextrine either in dry pulverulent state or dissolved in 50% of its weight of water, are then distributed in small increments over the wood flour and then, in turn, over this mixture is distributed, also in small increments, 1,000 lbs. of a water dispersion of colloidal discrete, solid bitumen, either native or pyrobitumen artificially produced, of a particle size of from about one to five microns, such dispersion containing about 55% to 60% of such bitumen. Upon the introduction of the bitumen dispersion on the wood flour, the mulling wheels are immediately started and then a very peculiar action occurs, viz., the bitumen dispersion starts to break under the de-hydrolizing action of the wood flour which tends to remove the water from the dispersion. The bitumen used should be hard, i. e. neither sticky nor tacky. In fact, the penetration number of the bitumen so used should range from 10 down to zero at 77° F., 100 grams, 5 seconds and preferably a bitumen having a penetration number of zero is selected. This is extremely important, as the bitumen, if it has any tack or any stickiness at all, will cause the particles of the wood flour to ball up to such an extent that the bitumen cannot be effectively distributed over the individual wood flour particles and driven into the pores thereof.

Under the action of the muller and upon the removal of the water, by absorption, into the pores of the wood flour, the very fine colloidal particles of bitumen in the dispersion will be gradually dispersed and both adsorbed and absorbed on and into the particles of wood flour, which retains its original loose powdered form, thereby resulting in an extremely even distribution of the bitumen in the mass of wood flour to the extent that the total mass will contain 30%, approximately, of bitumen solids. The bitumen does not, however, affect the water-absorbing capability of the wood flour; in fact, the retention of such property is essential to the proper distribution of the colloidal bitumen throughout the wood flour mass. When molding sand is incorporated, as hereafter specified with such a mixture, the wood flour will still retain to an optimum degree its ability to absorb moisture from such molding sand.

The colloidal particles of the bitumen employed by me are so minute that even when they are melted by the heat of the metal they will be so quickly destroyed by such heat that they

will not have an opportunity to waterproof either the wood flour or the sand that has been admixed therewith. Moreover, the wood flour and bitumen on and in proximity to the inner surfaces of the mold are both destroyed on contact with molten metal, leaving practically no ash and consequently the sand grains upon expansion by heat will be afforded voids to move into or, in other words, the space left when the wood flour and bitumen mixture is burned is converted to gas space into which the sand can expand. Somewhat further back in the mold, where the heat has not been sufficient to destroy the wood flour and bitumen, the heat of the sand may still be sufficient to melt the bitumen but the particles thereof will be of such small dimensions that they will be readily absorbed by the wood flour without rendering it completely waterproof and once absorbed by the wood flour particles the bitumen is no longer free to envelop and waterproof any sand grains in proximity thereto.

My improved additive for molding sands may be admixed with molding sand, whether naturally bonded or synthetically bonded, either at the foundry or at the source of the production of the sand. Desirably, the amount of such additive added to the sand is from about $\frac{1}{8}$ % to 5% by weight of the sand. The effective mixing is readily accomplished in an ordinary foundry mulling machine.

When a sand mold, prepared from a molding composition consisting of my improved additive admixed with molding sand, is employed for casting metal, there is no tendency for the heavy hydrocarbon ingredients of such composition to melt and envelop and consequently waterproof either the sand particles or the wood flour particles of the composition. On the other hand, had the additive incorporated with the sand been prepared by grinding the solid bitumen to a fine powder, approximating wood flour in fineness, some 300 mesh, and then mechanically mixing the same while in a dry state with the wood flour, such hydrocarbon ingredient would, due to its relative coarseness, and because of the fact that it would have a relatively low melting point, as do all bitumens, readily melt at the temperature of the molten metal to which it would be subjected and freely run around the particles of wood flour and molding sand, thereby rendering the same waterproof with the result that the sand heap would become unusable.

While it is preferable to incorporate a starch derivative, such as aforesaid, in my improved additive for a molding composition, the presence of the same is not essential and it may therefore be dispensed with, if desired.

The term wood flour as employed herein is intended to include ordinary wood flour as well as flour made from corn cobs, bagasse and like woody vegetable substances.

The term bitumen as employed herein is intended to include native asphalts, pyrogenous artificial asphalts and pitches, Gilsonite and like substances capable of substitution therefor in my improved additive for sand molding compositions.

While I preferably employ dry dextrine other starches or starch derivatives such as corn starch flour in a dry state may be substituted therefor.

The amount of flour or like cellulosic flour

employed should desirably range between about two and ten times that of the bitumen solids in the dispersion that is admixed therewith.

Preferably, I employ a residual petroleum asphalt as the pyrogenous bitumen ingredient of the dispersion having the following characteristics:

1. Penetration number of residual asphalt, after distillation at 77° F., 100 grams 5 seconds 0 to 5.

2. Penetration number of residual asphalt at 115° F., 200 grams 5 seconds 10 to 25.

3. Solubility of asphalt solids in carbon disulphide, 95%.

4. Flash point C. O. C. (Cleveland Open Cup), 525 degrees plus or minus.

5. Specific gravity 1.0 at 77° F.

6. Softening point by ring and ball method, 170° to 210° F.

Having thus described the invention, I claim:

1. A molding sand composition for use in making metal casting molds, consisting essentially of bonded sand having between about $\frac{1}{8}$ % and 5%, by weight of the sand, of an additive product consisting essentially of a cellulosic flour having from 10 % to 50% of particles of non-tacky solid colloidal bitumen of an average particle size between about one and five microns in diameter absorbed therein and adsorbed thereon.

2. A loose powdered product for use as an additive for loose molding sand, consisting essentially of discrete particles of a cellulosic flour containing from about 10% to 50%, by weight thereof, of solid, non-tacky colloidal particles of bitumen of an average particle size between about one and five microns in diameter, said product having an affinity for water at least sufficient to admit of its being tempered there-with when preparing sand molds in which the product is a component part.

3. The method of making a product suitable for use as an additive for loose molding sand, which consists of mulling together a cellulosic flour with a water dispersion containing from about 10% to 50%, by weight of the flour, of a hard, non-tacky colloidal bitumen of a particle size between about one and five microns in diameter, which latter is added in small increments during the said mulling procedure, and continuing said mulling until the dispersion is broken down under the de-hydrolizing action of the cellulosic flour and the bitumen becomes absorbed into and adsorbed on the particles of cellulosic flour.

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