United States Patent Office

2,876,511

Patented Mar. 10, 1959

1

2,876,511

FOUNDRY MOLD COMPOSITION AND METHOD OF PREPARING AND MAINTAINING THE SAME FOR REPEATED USE

Jesse Leroy Baugh, Springfield, Ill., assignor to Mold-Rite Corporation, Springfield, Ill., a corporation of Illinois

No Drawing. Application February 23, 1952
Serial No. 273,138

9 Claims. (Cl. 22—193)

This invention relates to foundry mold compositions and to the art and method of preparing such compositions and maintaining them in foundry use.

One of the objects of the invention is to produce a foundry mold composition for making molds having both a very high green strength and a very high hot strength, and which will also peel off and separate from the casting cleanly, with very little, if any, sand adhering to the casting, and with a minimum of burn-on or sand penetration of the surface of the casting.

Another object of this invention is to produce a mold composition that will flow readily and freely in separate granules, and which yet will maintain very high jolting, ramming, and squeezing characteristics conducive to a high green strength mold.

Yet another object of the invention is to produce a mold composition which will improve the finish of castings, and permit a wide range of castings, with respect to weight and metal sections, being made in the same sand, without the use of special facing sand and without sacrifice of satisfactory permeability.

Still another object of my invention is to eliminate from the mold composition sea coal or pitch in heaps and systems, and to reduce the amount, ordinarily required, of bonding clays such as bentonite and the like.

It is still another object of my invention to produce a mold composition which will readily shake out with a high degree of disintegration when castings are drawn and which composition can be repeatedly re-used with very little re-conditioning treatment, and without the necessity of adding any great amount of new material.

Other objects and advantages of my invention will become apparent to those skilled in foundry practice from the detailed description of my invention and discovery as hereinafter set forth.

I am well aware of the many difficulties inherent in casting, in green sand molds, such high melting point metals as grey iron, steel and ferrous metals, and also many non-ferrous metals and alloys. The burn-on of sand to the metals, dirt inclusive and imperfections in the castings, and the tendency of molds to swell or to wash results in large percentages of scrap and rejected castings, and require prolonged and expensive cleaning procedures including sand-blasting, wire-brushing and tumbling operations.

To avoid such large percentages of defective castings and expensive cleaning operations in foundries numerous efforts have been made to produce synthetic molding compounds, and special facing sands made of a wide variety of materials. Many of such materials are not readily available or are again so expensive as to counteract savings which might otherwise have been effected. It has been suggested that various pitches and hydrocarbons be mixed with molding sand, both for the purpose of increasing the green strength of the molds and to cause substantial sooting of the mold to facilitate separation of the casting from the mold. However in

2

such compositions it has been found necessary to use in addition relatively large amounts of bonding clays, such as bentonite, in an effort to prevent adherence of sand particles to one another, forming objectionable lumps, and in an effort to slow down excessive and rapid burn-out of the pitches and hydrocarbons in the mold material. Since it is essential in such compositions that bonding clay or bentonite be deposited on the sand particles externally of the pitch coating, re-use of such molding sands or facing sands in very difficult without extensive re-conditioning steps. This is particularly true when the burn-out of the pitch has been substantial, with a resulting high percentage of fixed carbon in the used sand.

In the foundry mold composition of my invention I have found that the sooting occurs at the face of the casting resulting in superior shake-out and separation characteristics, and yet with such shallow burn-out of the mold composition, with resulting low percentage of fixed carbon, as to permit its re-use indefinitely with very little re-conditioning necessary. I have also found from experience with the composition of my invention that I can obtain superior and cleaner castings, with considerable reductions in scrap loss, and at the same time with considerable saving in bonding material.

I describe a preferred example of the composition which I have invented, and of the method of making and maintaining the same, as follows:

An emulsion is first made comprised of 55% to 65%, by weight, of petroleum asphalt having a medium melting point, emulsified with about 4% of tall oil and 0.5% of hydrated lime, the remaining amount of 100% being water.

The tall oil and lime may be mixed into the petroleum asphalt in any convenient manner, but it should be a thorough mixture and I accomplish it with the use of steam pressure. I have found that sodium hydroxide may be used instead of hydrated lime, with equally satisfactory results.

Other fatty-acid soaps and resin soaps may be substituted for the tall oil and hydrated lime ingredients, for the purpose of emulsifying the petroleum asphalt, with fairly satisfactory results, but I believe the tall oil and lime to be preferable.

When I am about ready to make up a sand composition I mix equal parts of the asphalt emulsion and cold water, the resultant product being what I will refer to as the "foundry emulsion."

To make up my mold composition I deposit in a mulling chamber 1600 pounds of clean silica sand, one and a half pints of bentonite, one quart of wood flour and one quart of finely divided vegetable fibre such as "Carbo," which is a residue of hulls, and the like, from the manufacture of oat meal, to which a small amount of asphalt coating has beein added. To this material I gradually add eight quarts of the foundry emulsion mixing the ingredients thoroughly but briefly, for about forty seconds in the muller. In this step water is added to bring the moisture content of the composition up to slightly above 3.50% by weight. The resultant product is taken from the muller by an overhead conveyor and deposited by gravity flow into hoppers, whence it is taken to the molds. Aeration occurs in this movement of the material, with some loss of moisture content, and therefore the moisture content in the muller or mixer may be varied in accordance with the particular conditions present in the plant where it is used. I have found a moisture content of 3% to 3.25% at the time of molding to be most satisfactory. I have found it desirable however to provide a greater moisture content at the time of mixing, not only to compensate for loss of moisture prior to use,

but also to improve the coating of the sand particles during mixture.

When the sand composition of my process reaches the hoppers it will be observed that the sand particles are thoroughly coated and will flow smoothly and easily without lumps, in separate granules, similar in flow characteristics to small dry grain. Close inspection of the coated sand particles will disclose numerous sharp and flat surfaces with a minimum of rounded or convex surfaces, of which many were present in the untreated sand.

In making up molds from the composition it will be found to have exceptionally high jolting, ramming and squeezing characteristics, resulting in molds of exceptionally high green strength without sacrifice of satisfactory permeability.

When the molten metal is poured into molds made of this composition, the bitumen in the composition melts, spreading to substantially every particle of sand and bonding the sand together into a firm non-swelling mold which has an exceptionally high hot strength resulting in more accurate castings and substantially reducing the percentage of resulting scrap.

The clay, wood flour, and grain hull ingredients in my composition seem to absorb the foundry emulsion permitting such large quantities thereof to be used, without balling of the sand, as to fill substantially the spaces between the particles when the molten metal is poured into the mold.

When the molten metal is poured into a mold made of my composition there is a partial decomposition of the organic matter in the mold at and near the face of the casting, liberally sooting the mold and the casting at their parting faces, thus enabling the mold to be peeled and stripped cleanly from the casting without leaving particles of the mold burnt-on or adhering to the casting at the time of shake-out. The resultant castings need very little, if any, cleaning operations. The soot does not, however, penetrate the mold to any substantial extent and there is a minimum of fixed carbon in the mold after a casting operation.

After the molding composition has been used it is returned to the muller to be prepared for re-use. When the composition is new I add eight quarts of foundry emulsion, one quart of silica sand, one-half pint of bentonite, and one pint each of wood flour and Carbo to each 1600 pounds of the returned molding composition, and water to bring up the moisture content to the desired percentage. I continue this practice until the composition has gone through three casting cycles. Thereafter I add the same ingredients in the mixing chamber on each cycle but I reduce the foundry emulsion to seven quarts for three casting cycles. At that time the foundry emulsion added is reduced to six quarts for each of the three following casting cycles; then to five quarts for each of three casting cycles; then to four quarts for each of three casting cycles; then to three quarts for each of three casting cycles.

The molding composition may then be said to be fully loaded, and thereafter I add to each 1600 pounds of the used composition, on each cycle, two quarts of foundry emulsion, one quart of silica sand, one-half pint of bentonite and one quart each of wood flour and vegetable hull compound. On each cycle, of course, water is added to bring the water content up to approximately 3.50%, or slightly more, at the mixer.

I have found that the molding composition which I have described, prepared and maintained as I have stated, may be used and re-used indefinitely to accomplish the purposes and objects which I have above set forth, with great benefits and advantages economically and in the quality of castings produced.

Obviously, variations in quantities, substitutions of materials, and alteration in method steps may be made from the specific preferred materials, quantities, and steps

which I have described, without departing from the spirit of my invention as expressed in the following claims:

I claim:

1. A foundry composition for forming molds for metal casting essentially consisting in approximate proportions of 1600 pounds of silica sand, eight quarts of petroleum asphalt emulsion, one and one-half pints of bonding clay, one quart of wood flour and one quart of finely divided vegetable fibre, said composition having a moisture content of approximately 3% to 3.5% by weight.

2. A foundry composition as defined in claim 1 in which said petroleum asphalt emulsion consists essentially of 30% of petroleum asphalt having a medium melting point, 2½% of an emulsifying soap having a tall oil base, and 67½% of water.

3. A foundry composition as defined in claim 1 in which said petroleum asphalt emulsion consists essentially of 55% to 65% of petroleum asphalt having a medium melting point, 4% of tall oil, 0.5% of hydrated lime, and water to total 100%, said emulsion being diluted with an equal volume of water.

4. The method of preparing a foundry composition, for use to form molds for metal castings, consisting of the steps of emulsifying petroleum asphalt by mixing therewith water and an emulsifying soap having a tall oil base, thoroughly and rapidly admixing said emulsion with silica sand in the proportion of eight quarts of emulsion to 1600 pounds of sand, having added to said sand approximately one and one-half pints of clay, one quart of wood fibre and one quart of vegetable fibre, adding water prior to or while mixing to raise the moisture content of said mixture to above 3.5% by weight, and aerating said mixture to reduce the moisture content to not less than 3% by weight.

5. The method of preparing a foundry composition, for use to form molds for metal castings, consisting of the steps of emulsifying petroleum asphalt by mixing therewith water and an emulsifying soap, rapidly and thoroughly mixing said emulsion with silica sand in a mixing chamber in the proportion of one pint of emulsion to one hundred pounds of sand, there previously having been added to said sand a small quantity of smulsion absorbent clay and finely divided vegetable fibre, and water slightly in excess of 3.5% by weight of said sand, then drying said mixture to a moisture content of not less than 3%, and flowing said mixture by gravity flow to a receiving bin.

6. The method of loading and maintaining a foundry composition for repeated use in making molds for metal castings comprising the steps of making a foundry composition as defined in claim 5, using said composition in a mold for a casting operation, separating said composition from the casting and returning it to the mixing chamber, adding to said composition an additional quantity of said petroleum asphalt emulsion reduced after each two or three casting cycles by one-eighth of the amount of such emulsion first used in making said composition, until the amount of such emulsion added has been reduced to one-quarter of a pint to each one hundred pounds of foundry composition, and thereafter, after each casting operation, re-cycling the used composition to said mixing chamber, and adding thereto and rapidly and thoroughly admixing therewith, for each one hundred pounds of the used composition, one-quarter of a pint of said emulsion, a small quantity of sand, clay, and finely divided vegetable flour, totaling about one-half of a pint, and water sufficient to raise the moisture content to approximately 3.5% by weight.

7. The method of reconditioning a foundry composition as defined in claim 1 for re-use to form molds for metal castings, comprising the steps of removing said composition from castings and returning it to a mixing chamber after a casting operation, adding to 1600 pounds of said composition, or proportionally thereto, substantially

one quart of silica sand, two quarts of petroleum asphalt emulsion, one pint of bentonite clay, one pint of finely divided vegetable fibre and sufficient water to raise the moisture content above 3.5% by weight, rapidly and thoroughly admixing said ingredients, drying said mixture to a moisture content of about 3.25%, and flowing said mixture by gravity flow to a receiving bin.

8. A foundry composition for forming molds for metal casting essentially consisting in approximate proportions of 1600 lbs. of silica sand, 8 quarts of a water-petroleum asphalt emulsion containing about 30% petroleum asphalt and about 3 quarts of primarily vegetable emulsion absorbent material, said composition having moisture content of approximately 3.0 to 3.5% by weight.

9. A foundry composition for forming molds for metal casting essentially consisting in approximate proportions of 1600 lbs. of silica sand, 8 quarts of a water-petroleum asphalt emulsion containing about 30% of a medium melting point petroleum asphalt, 1½ pints of bonding clay and about two quarts of vegetable matter, said composition having a moisture content of approximately 3 to 3.5% by weight.

References Cited in the file of this patent

UNITED STATES PATENTS

1,561,956	Thomas	Nov. 17, 1925
2,159,952	Jones	May 23, 1939
2,508,857	Chamberlin	May 23, 1950
2,525,175	Keyser	Oct. 10, 1950