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METHOD AND MEANS FOR FOUNDRY PRACTICE

No Drawing.

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My invention relates to a new and useful method of making molds and cores for metal castings.

Previously in this art the hot metal coming in contact with the mold and core surfaces causes the sand in contact to burn into the adjacent surfaces of the metal and produces castings of rough exterior and interior surfaces, which surfaces are formed of an integral film of mixed metal and sand. This, as well as the removal of the cores and the cleaning of the un-integral sand from the casting, has heretofore been an expensive, laborious and dusty task frequently requiring the use of pneumatic chisels and other tools, while in the machining of such castings the integral film of sand and metal is difficult to machine unless the tool in its first cut penetrates beyond the depth of such film.

In the prior art many cracked castings have been produced due to hard cores and molds which do not crush readily as the metal casting cools, contracts and solidifies, and such castings are a constant source of substantial loss in all foundries but more especially in aluminum and kindred metal castings.

A further constant source of substantial loss in the prior art of metal casting has resulted from mold and core blows due to the low permeability of the sand forming such molds and cores.

In the past many endeavors have been made to overcome these very objectionable conditions and losses. Some of these attempts have been to form the molds and cores of green sand, which is the ordinary molding sand of commerce, but the liability of such molds and cores to be washed in part into the molten flowing metal being cast prevents, or renders hazardous, their use in many cases.

To provide molds and cores of more strength than possessed by green sand molds and cores, it heretofore has been common practice to embody a binder in the sand of, either or all, clay, molasses and water, flour and water, and oil, and to indurate such molds and cores by baking. Such molds and

cores have all the aforesaid defects except the tendency to wash into the flowing molten metal, while the thus formed harder molds and cores increase the cracking liability of the castings as well as tend to increase the liability of the castings to blow due to the lesser porosity of such molds and cores.

Heretofore volatile substances have been employed in and about the foundry in the molding and core rooms, for instance in applying the same to the mold or core as a whole or to the surfaces thereof and then ignited to dry the mold sufficiently before the molten metal was cast therein or thereabout; but such a practice adds a very substantial fire hazard and explosion hazard. Furthermore, such volatiles become impregnated in the air, breathed by the operatives, which tend to harmfully affect the operatives physically and in their efficiency.

My present invention relates to an improved method and means for foundry practice. Its object is to overcome the aforesaid conditions, to cheaply and readily produce a mold or core of as great, and even greater, strength, durability and permeability than normal strength, to produce a mold or core which may be used advantageously at very later periods of time than is possible with molds or cores of the prior art.

To attain these and other objects, and in accordance with the general features of this unitary invention of related and interdependent components, my improved method contemplates the employment of latex. This substance is the natural rubber substantially as it comes from the plant, usually with the addition of a preservative, and which normally contains a substantial water content. In some rubber growing regions the water content of the latex is reduced substantially by evaporation, in the presence of a protective colloid, in order to avoid the substantial shipping cost of the water content.

The latex may be mixed directly with the dry sand which is to be made into a mold or core, but such mixing is an extremely difficult operation to bring it into an intimate mixture due, among other conditions, to what may be properly termed as the "thirstiness"

of the sand which substantially segregated the latex solids and requires their being mechanically divided and intimately commingled in the sand in the mixing process. In the more advantageous and economic practice of my method, I prefer to moisten the sand more nearly to the moisture content required for proper molding consistency and then mixing the latex into such free moistened sand. This enables the more ready attainment of an intimate mixture of the latex and the sand.

A still more efficient intimate mixture of the sand and the latex may be attained more readily and inexpensively by adding to the water with which the dry sand is mixed a suitable protective colloid such as gelatin, agar agar, glue, sodium and ammonia soaps, extract of quince seed, or the like, water soluble substances. Such substances added to such water reduces the surface tension of the sands and lubricates the surface of the sand grains, as well as the surface of the solid particles in the latex and at the same time saturating with water the sand and any clay content without tending to solidify the solids contained in the latex, thereby avoiding aggregation and facilitating the intimate mixture of the solids of the latex throughout the sand grains of the mold. This enables the molding sand to be tempered to the proper consistency with a substantially less water content. It is optional with those desiring to practice my method in the manner last stated by mixing with the latex any one or more of the aforesaid or other suitable protective colloids and water to the extent required to give the sand its proper molding consistency; or the water instead of being added to the latex and colloid mixture may be, if desired, first mixed with the sand. With the natural water content of the latex, I have found it unnecessary to add water, either to the sand, or to the latex, and colloid mixture, but in cases where the latex is partially dehydrated, a suitable addition of water content may be added either to the sand or to the latex colloid mixture to give the molding sand its proper molding consistency.

Preferably, the next step of my method contemplates the making of the requisite molds and/or cores.

It is further contemplated that the latex mixture above stated may be employed with or without the addition of any of the well-known vulcanizing ingredients. When such vulcanizing ingredients are added, they may be either of the atmospheric or the artificial air curing or heat curing variety. Where the air curing variety may be applied, the mold or core is subjected to atmospheric conditions for a sufficient period to vulcanize the sand, and where the heat curing vulcanizing agent is employed, the mold or core is

subjected to the requisite elevated temperature to cure the same to the degree of strength required by each particular mold or core or class thereof.

During such vulcanizing period, or during the period between the making and the using of the unvulcanized molds or cores, the surfaces thereof have their moisture contents reduced by evaporation.

The mold or core thus produced is then used in the making of a casting, most usually by having the molten metal poured thereon or thereabout. Where molten metal is poured into or about the mold or core, its heat coming in contact with the surfaces of the molds and/or cores causes a gas to be formed which permeates the cavity in the mold to be occupied by the molten metal. This gas is in direct contact with the surfaces of the metal in the mold and through which gas the metal is being poured or is otherwise maintained in intimate contact with said gas. As the metal is poured into the molds this gas attains a pressure in the mold cavity, but such pressure is higher between the molten metal and the surface or surfaces of the mold covered thereby. This gas pressure causes the mold or core to become more or less permeated by said gas. This permeation tends to filter or condense, either or both, from the gas the constituents thereof and to deposit the same upon the walls of the mold or core. This gas and/or said filtration or condensation product prevent the sand or other earthy constituents of the mold or core from becoming embedded into or adhering to the surfaces of the casting when made with a mold or core in the practice of my method.

This result is also contributed to by the fact that the heat of the molten metal applied to the surfaces of the mold and/or core tends to decompose some or all of the said materials added to the sand and/or other earthy content of the mold or core. This decomposition in whole or in part tends to form a protective, insulating or other coating or medium intermediate the juxtaposed surfaces of the molten metal and the mold and/or core which substantially tends or contributes to the prevention of the normal tendency of the earthy particles of the mold and/or core from being embedded into or adhering to the surfaces of the casting.

My method also substantially reduces or practically eliminates the tendency toward oxidization of the surfaces of the cast metal.

My method further substantially decreases the normal tendency of the metal surfaces of the casting in contact with the mold, particularly iron castings and the like, from peeling or hardening and thus making thin castings more brittle and all castings' surfaces more difficult to machine than heretofore.

The aforesaid steps may also be said to be included in, or to comprise the method of,

slowing up the cooling rate of the castings made in or about such mold or cores and which substantially contributes to the avoidance of said brittleness of thin iron castings and the machining difficulties of other iron castings, and which also substantially contributes to the prevention of the earthy particles of the mold or core from being embedded into or adhering to the surfaces of the casting. This latter result is contributed to by the formation of an insulated gas film between the juxtaposed surfaces of the casting and the mold or core and/or the decomposition in whole or in part upon the surfaces of the mold or core of some one or more of the aforesaid ingredients mixed with the earthy particles forming the main body of the mold or core.

Castings of all kinds, and more especially of molten metal, made in the practice of my method may be cleaned at a fraction of the cleaning cost required by the practices of the prior art.

To demonstrate the practical utility of my said method, I employ a mold and/or core constructed in accordance with my said method and have made and caused to be made many kinds of castings in such molds and/or cores of many different kinds of metals and their alloys and other cast substances.

Instead of the employment of latex as above described the practice of my method may be advantageously accomplished by the employment of latex embodying the particles or a rubber solution that had been vulcanized to the desired degree or the employment of artificial latex and/or rubber or rubber-like dispersions and/or the product or products of latex, rubber, or rubber-like substances in dispersion or otherwise, including such substances or the rubber base thereof, as may have been treated by another substance such, for instance, as a sulphonic acid, a halogen, or a substance which may have modified some of the properties which ordinarily characterize rubber or rubber-like substances. The amount of the latex rubber or rubber-like substance or the derivative thereof employed in the practice of my method depends upon the degree of strength required in the mold and/or core required for the efficient production of a casting of given characteristics. For instance, molds and/or cores having relatively thin areas which are more liable to crumble or be broken off in normal handling or production, or to wash into the fluid material being cast should have greater strength. Such greater strength may be obtained at will by the employment of a greater percentage of a more concentrated solution, a variation of the ingredients of the mixture, including the possible increment of the amount of accelerant of vulcanization, or the increment of the period or rate of the curing or vulcanization of the mold and/or

core, which those having skill in the art may readily determine from the characteristics of the desired casting and/or the characteristics of the metal, alloy or substance to be cast.

In the attainment or molds and/or cores of greater strength, where the aforesaid substance or substances employed therefor may in any case result in the constituents of the mold or core becoming too moist for advantageous construction of the mold or core therefrom, which condition is readily recognizable by those skilled in the art, the excess moisture may be readily removed therefrom by any of the practices employed in the art, including the prolonged tempering and aeration of the material and/or its being subjected to normal atmospheric or an elevated temperature.

In this specification and its appended claims where the term, hydrated rubber, is employed it is also intended to include rubber either as latex, coagulated rubber, rubber dispersions, artificial latex, or sap from trees such as *Hevea brasiliensis*, or from vines or shrubs, as well as from other kindred vegetation such as guayule containing more or less rubber hydrocarbon. The rubber may be unvulcanized or consist of vulcanized soft rubber, and may have been previously subjected to an elevated temperature.

It may also include any rubber or scrap rubber, either or both, that has been subjected to an elevated temperature alone or in the presence of sulphuric acid or a sulphonic acid or a sulphonyl halide or it may also include a substance such as is an article of commerce under the name "Thermoprene". It may also include dispersions of one or more of said substances.

In the development of my present invention I have made or caused to be made many molds and/or cores for different types of castings of different metals, compositions, or materials, and have employed therein, separately and in combination, the various materials hereinbefore stated, and have attained satisfactory results in substantially all respects therewith.

In this art, binders for the constituents of cores and molds long have been recognized compositions of commerce used in the production of molds and cores for the making of castings of hot metal.

The molds and/or cores made in accordance with my invention are not required, as in the prior art, to be used soon after their production nor are they required to be handled with the care of such production of the prior art, and that the molds and/or cores produced in accordance with my method possess substantially greater strength and equal or superior permeability and may be used in forming a casting at a remote period after their production.

The material with which they are mixed tends to prevent the absorption of moisture by the molds and/or cores and hence does not require the care with respect to moisture proof storage nor as to the humidity of their surrounding atmosphere as do molds and/or cores of the prior art.

While the ingredients which I employ in mixing with the sand or other body portion of the molds and/or cores are higher in cost than the mold and/or core binders of the prior art, yet the percentage of such materials added to the mold and/or core material is relatively small even with castings requiring the greatest strength of mold and/or core. The difference in the cost of my binding materials is very much less than the saving which their use entails even in the one item of the cleaning cost of the castings. This renders the use of my method and means profitable even in the one item of casting cleaning costs while its numerous other advantages constitute additional gains and savings ordinarily and usually occurring from the practice of my said method.

In the production of molds and/or cores of relatively large areas a further saving may be obtained by the construction of the surfaces of the mold and/or core to a desired thickness by the molding sand mixed with my said binder and then backing the same up with the molding sand of the prior art.

This invention is in furtherance and continuance of, and an improvement upon, the invention set forth in my pending application to likewise entitled and bearing Serial No. 332,225.

The invention herein described may be manufactured and used by or for the Government of the United States for governmental purposes without the payment to me of any royalty thereon or therefor.

Having now so fully described my invention that others skilled in the art may therefrom make and use the same, what I claim and desire to secure by Letters Patent is

1. The method of producing molds or cores comprising selecting the molding sand or components, tempering the same with a hydrated rubber mixture, making the mold or core by employing said tempered components, and dehydrating the mold or core to the desired extent.

2. The method of producing molds or cores including the step of applying to constituents of the mold or core a hydrated rubber mixture.

3. The method of producing molds or cores comprising selecting the molding sand or components, tempering the same with a hydrated rubber mixture containing an added colloid, making the mold or core by employing said tempered components, and dehydrating the mold or core to the desired extent.

4. The method of producing molds or cores

comprising selecting the molding sand or components, tempering the same with a hydrated rubber mixture containing an added colloid to the desired consistency, and making the mold or core by employing said tempered components.

5. The method of producing molds or cores including the step of applying a liquid containing a colloid to constituents of the mold or core, and applying to constituents thereof a hydrated rubber mixture.

6. As a new article of manufacture, a mold or core containing a hydrated rubber.

7. As a new article of manufacture, a mold or core containing small particles and hydrated rubber substantially intimately mixed therein.

8. The method of making castings including the steps of forming a mold or core from material of small particles bound together in whole or in substantial part by a hydrated rubber material, and forming the casting in contact with said mold or core.

9. The method of making castings including the steps of forming a mold or core from material of small particles bound together in whole or in substantial part by a hydrated rubber material, dehydrating the said mold or core material to the desired consistency, and forming the casting in contact with said mold or core.

10. A binder for the constituents of molds or cores in the production of a mold or core for the making of castings of molten steel, iron, brass, aluminum and the like high melting point metals, said binder containing hydrated rubber.

11. A binder for the constituents of molds or cores in the production of a mold or core for the making of castings of molten steel, iron, brass, aluminum and the like high melting point metals, which binder contains rubber and an added colloid.

12. The method of decreasing the surface tension of a core binder in the production of a mold or core for the making of castings of molten steel, iron, brass, aluminum and the like high melting point metals, said binder including a hydrated rubber solution, consisting of adding a colloid to said hydrated solution.

13. A mold or core formed of refractory particles at least some of which are bound together by a liquid containing particles of a binder selected from the class comprising rubber and rubber derivatives, said liquid also containing a protective colloid in quantity sufficient to keep said particles suspended in said liquid, said bound granules being located within an area of the mold or core subjected to, and at least some of the binder in said area being adapted to be volatilized by the heat of the cast metal in contact with said mold or core.

14. A mold or core having refractory par-

5 ticles at least some of which are bound together by a liquid containing particles of a binder selected from the class of rubber and rubber derivatives, and said liquid also containing a colloid selected from the class comprising gelatin, agar agar, glue, sodium and ammonia soaps, and extract of quince seed.
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