

106-84

CROSS REFERENCE

EXAMINER

Patented Nov. 29, 1932

1,889,007

UNITED STATES PATENT OFFICE

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SAND CORE FOR CASTING METAL AND METHOD OF MAKING SAME

No Drawing. Application filed February 24, 1931. Serial No. 518,500.

This invention relates to the manufacture of sand cores for use in the casting of metal in sand or metal molds and has for its particular objects the expeditious and economical production of a sand core that is self-sustaining during the casting operation under the action of the molten metal, is substantially free from organic ingredients that will generate a voluminous acrid smoke or objectionable gases during the casting of the metal, and furthermore, such cores will not adhere to the castings when the latter solidify, but on the contrary, can be expeditiously and easily disintegrated by simply tapping or tumbling the castings when cool and the resultant disintegrated cores can then be readily removed through usual openings formed in such casting. Various other advantages of my improved cores and the core binder employed in the production thereof are hereinafter set forth.

Heretofore, as I am well aware, attempts have been made to produce sand cores from ordinary sodium silicate solution (water glass) by the admixture of moist sand therewith or if dry sand was employed, the same was first moistened with water to insure the thorough wetting of the sand by the silicate solution. However, such attempts have been invariably unsuccessful as either the sand particles were not effectively bonded together by the silicate solution and as a consequence, the core would break down under the erosive action of the molten metal in the pouring of the mold or else if the core was made stronger by increasing the ratio of the binder to the sand employed so as to resist the action of the molten metal thereon, the core would solidify in the casting when cool and tenaciously adhere to the inner walls thereof so that its removal from the casting was extremely difficult and often impossible. As a consequence, the employment of sodium silicate solutions, as a core binder, has been universally regarded as wholly impracticable for foundry purposes.

My investigations have led to the discovery that entirely satisfactory sand cores can be produced with sodium silicate as the essential bond thereof in lieu of organic bonds as

linseed oil, pitches, dextrine, etc., which are now commonly employed, provided certain conditions of operation are carefully observed during such manufacture. For example, the sodium silicate vehicle or binder employed should preferably be highly alkaline as compared with the so-called ordinary standard sodium silicate in which latter the proportions of SiO_2 to Na_2O approximate 3.25 to 1 as thereby, owing to the increased adhesiveness or bonding properties of the silicate, a smaller quantity suffices to cement or bond the sand particles of the core together and any tendency for the core to adhere to the interior of the casting when the latter has cooled and thus interfere with the removal of the core therefrom is eliminated. Furthermore, the amount of silicate bond employed should not be so excessive as to cement the sand particles so firmly together that the core will not readily disintegrate when the casting is subjected to the usual tumbling or like tapping operation.

On the other hand, the bond between the sand particles of the core should be sufficiently strong to withstand the action of the hot molten metal while leaving a high percentage of voids in the core to permit of the proper venting of same during the casting operation. My improved product not only possesses these advantages of being readily disintegratable when the casting, after cooling, is subjected to the usual tumbling operation, whereby the substantially complete removal of the entire sand particles comprising the core can be accomplished without any objectionable adhesion of the surface portions of the core to the casting, but, owing to the unusual cementitious properties possessed by my binder, the cores made therewith are more indestructible during the casting operation than those produced with the aforesaid usual organic binders at present employed and as a consequence rodding and vent wiring of the cores is either rendered unnecessary or is reduced to a minimum. Furthermore, the elimination of the acrid fumes in the foundry serves to very substantially increase the efficiency and morale of the molders.

In carrying out my invention, I preferably proceed as follows:—

Standard sodium silicate of a specific gravity of about 41° to 42° Bé. and having the aforesaid ratio of about 3.25 to 1 (commonly known as water glass) is boiled with about 10% of its weight of solid caustic soda (NaOH) until a clear white solution results. A small amount of solid sodium carbonate (Na₂CO₃), about 2.5% by weight is then added to gelatinize the mass and the mixture is held at a boil until the desired viscosity, say about 52° to 54° Bé. while hot, is attained. The resultant viscous mass when cooled to room temperature will flow quite freely and in this form is particularly adapted for shipment to and handling in the foundry where the sand cores are to be made. In order to prepare the sand cores utilizing the aforesaid silicate binder, the molder first thins the same with about 80% of water and mixes the solution in a muller, or other suitable sand mixing machine, with about 20 to 60 parts of sand to each part of such thinned silicate binder, the quantity of sand varying with the character of the casting and the kind of core desired. The molder shapes the core desired from resultant sand-and-binder mixture so obtained and subjects the core to a preliminary baking at a temperature of say 220° C. to 260° C. in the manner now customary in the production of cores containing organic binders and obtains the desired self-sustaining core which is then introduced into the mold and utilized in the well known manner in the casting operation.

As above explained, the complete removal of the core from the cooled casting can be easily accomplished merely by tapping the casting and if necessary, poking the core with rods introduced through the openings in the casting that are customarily provided for the removal of the cores.

The castings obtained through the employment of my improved core which is, of course, adapted to be superficially coated with a usual core wash containing graphite, or other suitable carbonaceous ingredients and a binder, are peculiarly perfect, being especially free from blow holes which frequently result from the large amount of fumes generated from other cores containing organic binders, and also owing to the small amount of volatiles generated from my improved cores, as well as on account of their remarkable porosity, the blowing of the casting during the pouring of the mold due to incomplete venting of the gases and fumes generated from the core, is eliminated.

Owing to the unusual adhesiveness of the binder employed in the production of my improved core, a very small quantity suffices to produce the necessary bond and as a consequence there is no tendency for the molded

core to adhere to the walls of the core box such as would be the case were it attempted to employ ordinary water glass alone as such bonding agent.

While I preferably employ a highly alkaline sodium silicate in which the proportions of SiO₂ to Na₂O therein are not in excess of about 1.58 to 1 because of its peculiar adhesiveness, nevertheless without departing from the spirit of my invention as embraced within certain of the appended claims, sodium silicate of a lower alkalinity, say 2 to 1 or even 2.75 to 1, may be employed with or without small amounts of other bonding agents suitable for the purpose provided the adhesiveness thereof is sufficient to insure that the sand cores formed therefrom, owing to the small amount and character of the silicate bond, will not adhere to the core box and can be readily disintegrated and removed from the cooled casting while at the same time such cores will effectively resist the erosive action of the molten metal during the pouring of the mold. However, the adhesiveness of the bond employed, whether consisting solely of a sodium silicate compound or admixtures thereof with small amounts of other suitable adhesive bonding agents should be at least as great as that of sodium silicate of an alkalinity corresponding to that of a 2.35 to 1 sodium silicate solution.

It is, of course, not essential that the silicate binder should be first prepared with a high viscosity of say 52° to 54° Bé. but, to avoid the expense in the shipping of such binder from the manufacturer thereof to the foundry in which the cores are to be prepared, a solution of the above degrees of viscosity is highly desirable, especially since owing to its fluidity, the same can be poured from the shipping container without necessitating the destruction of such container to remove its contents.

While I preferably prepare my improved binder from ordinary sodium silicate because of its availability, of course the same can be prepared directly from sand or other quartz-like raw material by fusion with the requisite quantity of alkali necessary to produce such abnormally alkaline sodium silicate and the fused mass is then digested with water to produce such binder of the desired concentration.

It is especially desirable that bank sand or thoroughly washed sea sand be utilized in the production of sand cores in accordance with my invention, since even the very small amounts of chlorides as sodium or calcium chlorides, such as are commonly present in beach sands or sea sands interfere with the production of such cores and impart objectionable properties thereto.

Various other changes within the scope of the appended claims may also be made

without departing from the spirit of my invention.

Having thus described my invention, what I claim and desire to obtain by United States Letters Patent is:—

1. The method of making sand cores for metal casting which comprises increasing the alkalinity of sodium silicate until the ratio of SiO_2 to Na_2O thereof is less than 2 to 1, but above that point at which the adhesiveness of such silicate is substantially impaired by reacting upon the same with caustic soda and effecting the gelatinization of the mass by the action of a soluble salt having an alkaline reaction and then mixing sand gelatinized silicate with sand in the presence of water, the amount of sand employed being in excess of 90% of the mixture, then desiccating said sand mixture to evaporate the moisture therefrom and form a self-sustaining core without effecting the decomposition of such silicate.

2. A smokeless sand core for casting metal, comprising a major percentage of sand particles bound together by a very small percentage of abnormally alkaline sodium silicate, said core being free from ingredients capable of generating voluminous smoke fumes, being capable of resisting disintegration by molten metal during the pouring of the mold, being free from any tendency to stick to the core box during formation of same and being capable of being readily disintegrated and removed through small openings in the cooled casting.

3. The method of making sand cores for use in casting metal, which comprises mixing sand with a highly alkaline sodium silicate solution, the alkalinity of which solution is greater than the ratio of 2.75 parts of SiO_2 to 1 part of Na_2O but not sufficient to seriously impair the adhesiveness of such silicate, shaping the core and desiccating the same to obtain a self-sustaining mass of the form desired without effecting the decomposition of such silicate.

4. The method of making sand cores for use in casting metal, which comprises mixing sand with a highly alkaline sodium silicate solution, the alkalinity of which solution is greater than the ratio of 2.40 parts of SiO_2 to 1 part of Na_2O but not sufficient to seriously impair the adhesiveness of such silicate, shaping the core and desiccating the same to obtain a self-sustaining mass of the form desired without effecting the decomposition of such silicate.

5. The method of making sand cores for use in casting metal, which comprises mixing sand with a highly alkaline sodium silicate solution, the alkalinity of which solution is greater than the ratio of 2 parts of SiO_2 to 1 part of Na_2O but not sufficient to seriously impair the adhesiveness of such silicate, shaping the core and desiccating the same to

form a self-sustaining mass of the form desired without effecting the decomposition of such silicate.

6. The method of making sand cores for use in casting metal, which comprises reducing to a gelatinized mass a solution of sodium silicate of an alkalinity substantially greater than the ratio of 2.75 parts of SiO_2 to 1 part of Na_2O but not sufficient to seriously impair the adhesiveness of such silicate, and mixing said gelatinized silicate with water and sand, the amount of sand employed being in excess of 90% of solid content of the mixture, then desiccating said mixture to evaporate the excess moisture therefrom and form a self-sustaining core without affecting the decomposition of such silicate.

7. A substantially smokeless sand core for use in casting metal, comprising in excess of 90% of sand and a small percentage of a highly alkaline sodium silicate bonding agent, the alkalinity of said sodium silicate being in excess of the amount corresponding to a ratio of 2.75 parts of SiO_2 to 1 part of Na_2O but not sufficient to seriously impair the adhesiveness of such silicate, said sand core being capable of resisting disintegration by the molten metal during the pouring of the mold, being substantially free from any objectionable tendency to stick to the core box during the forming of the core and being capable of being readily disintegrated and removed through openings in such castings upon the completion and cooling of such casting.

8. A sand core for use in casting metal, containing highly alkaline sodium silicate as the principal bonding material, said core being capable of resisting disintegration by the molten metal during the pouring of the mold, being substantially smokeless and substantially free from ingredients yielding acid fumes, being free from any objectionable tendency to stick to the core box during the forming of the core and being capable of being readily disintegrated to a powder upon the cooling of the casting whereby its expeditious and effective removal from the casting can be accomplished.

9. The method of making sand cores for use in casting metals, which comprises subjecting sodium silicate of a specific gravity of about 40 to 43° Bé. and containing approximately from 3 to 3.35 parts of SiO_2 to 1 part of Na_2O to the action of a small amount of solid caustic soda and approximately 5 to 15% by weight thereof and at a temperature approximating the boiling point of the solution, then gelatinizing the mass by the addition of a small percentage of an alkali metal carbonate, the specific gravity of the resultant product being in excess of 48° Bé. when hot, then thinning the mass with water and mixing the same with a large percentage of sand and in excess of 90%

by weight of the mixture, shaping the core and heating the same to a high temperature to volatilize the moisture without effecting the decomposition of adhesive qualities of such silicate.

10. A sand core for casting metal, containing a small percentage of sodium silicate as the principal bond thereof, said core being free from any objectionable tendency to stick to the core box when formed, being substantially smokeless and substantially free from ingredients which evolve acrid fumes when such cores are employed in metal casting operations and said core being highly resistant to disintegration or erosion by molten metal during such casting operation while being readily disintegratable to a powder and easily removable through small openings provided in a casting when a casting formed therewith has cooled.

11. A sand core for casting metal being characterized by its freedom from any objectionable tendency to stick to the core box when formed, being substantially smokeless and substantially free from ingredients which evolve acrid fumes when such cores are employed in metal casting operations and said core being highly resistant to disintegration or erosion by molten metal during such casting operation while being readily disintegratable to a powder and easily removable through small openings provided in a casting when a casting formed therewith has cooled.

- Signed at New York, in the city, county and State of New York, this 30th day of January, 1931.

BENJAMIN F. WALLACE.

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