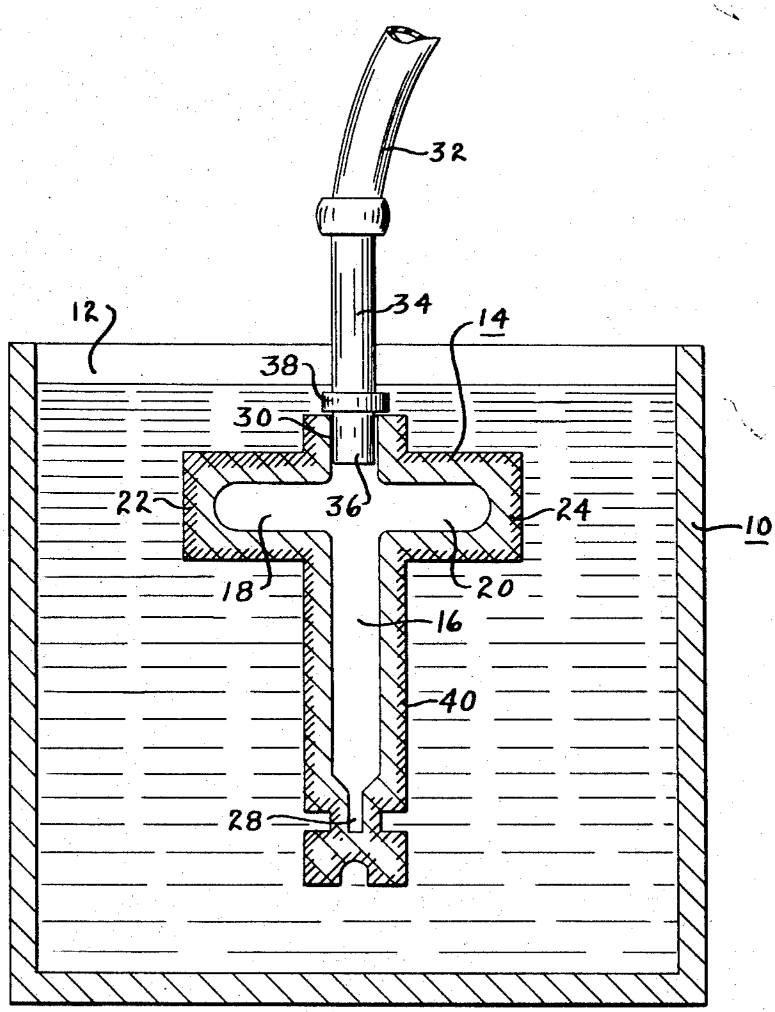
Sept. 10, 1968 D. A. BEHNKE 3,400,751

METHOD OF TREATING CORES

Filed May 9, 1966



INVENTOR.
DONALD A. BEHNKE
BY M. A. Hobbs
ATTORNEY

United States Patent Office

3,400,751
Patented Sept. 10, 1968

1

3,400,751

METHOD OF TREATING CORES

Donald A. Behnke, South Bend, Ind., assignor to Sibley Machine and Foundry Corp., South Bend, Ind., a corporation of Indiana

Filed May 9, 1966, Ser. No. 548,631
9 Claims. (Cl. 164—7)

ABSTRACT OF THE DISCLOSURE

A method of making cores, molds and similar structures which includes the steps of forming with sand and a binder a firm porous structure of the desired configuration with an internal passage, then submerging the structure in a core solution and applying vacuum to the passage for drawing the wash solution into the pores of the structure.

The cores used in conventional sand casting operations are usually made of sand molded with a binder, and, when heated after molding, they become rigid and are porous and sufficiently brittle to break readily into small pieces or into granular sand to permit their removal upon completion of the casting operation. Since the cores are often intricate in design, the sand and conventional binder alone do not have sufficient strength to withstand the turbulence of the metal flowing into the mold cavity, and will frequently fracture and/or crumble and become displaced, thus resulting in defective casting, the defects often being of such a nature and magnitude as to require scrapping of the casting. In the past, these cores have usually been treated with a material referred to in the trade as a core wash, which as the name implies, is applied to the surface of the core in liquid form where it solidifies or hardens, giving the surface of the core additional strength and heat resistance to withstand the force and temperature of the molten metal. The core wash usually consists of, for example, graphite and a clay binder material suspended in water or water and/or alcohol, and is applied to the core by dipping the core in the liquid material or by brushing or spraying the material onto the core surface. These methods of applying a core wash in the past, while providing an effective coating over most of the core, resulted in merely a superficial coating effectively covering only the more accessible portions of the core and leaving recessed portions, small fissures and shielded parts of the core untreated with the core wash. This results in a final core structure with weak portions which will likely fail during the casting operation. It is therefore one of the principal objects of the present invention to provide a method of treating cores for use in casting operations which substantially increases the strength of the cores over those made by the conventional practice described above, and which not only produces substantial penetration of the core wash into the body of the core, but also causes the wash to flow into the fissures and other small openings for sealing the core surface and eliminating molten metal penetration during the casting operation and for preventing distortion of the core from pressures while the metal is being poured and thereafter while it is cooling and solidifying.

Another object of the invention is to provide a method of applying a heat resistant and strengthening material to mold cores to obtain optimum strength for casting without sacrificing the required destructibility of the core for removal of the core from the core cavity.

Still another object of the invention is to provide a method of retaining the required core strength, which can readily be applied to cores of a variety of different sizes and shapes, and which can be practiced without elaborate equipment or special care or skill on the part of the operator.

2

A further object is to provide a relatively simple method of applying core wash, which results in deep penetration of the wash into all parts of the core, regardless of its intricacy in structure, and which can be quickly performed without regard for the external configuration of the core.

Other objects and advantages of the present invention will become apparent from the following description and accompanying drawing, wherein is shown a schematic representation of one way of practicing the present method, the figure being a cross sectional view of a container of core wash material and a typical core showing it mounted in position for treatment in the core wash.

The present method of making a core of high strength and heat resistance, and with satisfactory destrucibiliy, consists of molding a porous core structure of the desired configuration as determined by the cavity in the final cast product, and with one or more internal passages having an opening through the outside wall of the core, baking the core structure to make it relatively firm or brittle, applying vacuum to the passage or passages therein through the wall opening, and while maintaining the vacuum in the internal passage or passages, submerging the core structure in a liquid core wash and holding it therein sufficiently long to obtain the desired penetration of the wash in the interstices, fissures and recessed areas in the core structure. After the core structure has been removed from the liquid and the liquid wash permitted to drip therefrom and to dry therein, a further step may consist of heating the final core structure to bake the core wash in the pores of the core. This latter heating step may be combined with the core wash drying operation previously referred to herein.

The length of time the core is held under vacuum in the wash is relatively short, usually only a few seconds; however, the desired degree of penetration may be controlled by varying the submersion time from one to ten seconds, and by varying the degree of vacuum applied to the internal passages of the core. Further, the porosity has an effect on the degree of penetration, but the variation in penetration resulting from variations in porosity can be controlled or compensated for by varying the degree of vacuum and/or the time in which the core is submerged in the core wash while under the vacuum. While uniform penetration of the core wash throughout the core is normally preferred, the porosity may be varied from place to place in the core structure in order to obtain controlled variations and penetrations of the wash from place to place in the structure to obtain the desired strength and heat resistance requirements throughout the core structure.

Referring to the drawing, numeral **10** is a tank or other suitable container for holding core wash solution **12**, and numeral **14** is a vertical cross sectional view through a typical structure, illustrating the manner in which the present method is performed. The core is made of sand held together by a suitable binder for forming a porous structure, and contains internal passage **16** having banches **18** and **20** extending into arms **22** and **24** of the core. In the lower end, where a plurality of recesses are formed in the external surface of the core, a reduced diameter portion **28** of the passage is provided to make close communication with the core material forming those recesses. The passage passes through the external wall of the core at numeral **30**, and a tube **32**, connected to a vacuum pump or other vacuum creating means, is connected to the opening by a nipple **34** having a part **36** extending into the opening, and a gasket or other sealing means **38** around the opening.

In the practice of the present method, the core is formed by a suitable pattern, either by manual or machine operation and baked to give the core a firm structure. The core is connected to nipple **34** of the vacuum line and dipped into a liquid core wash **12** of a suitable composition, such as that previously mentioned herein, consisting of graphite and a clay binder suspended in water or water and/or alcohol. While the core is held immersed in the liquid wash, the vacuum is transmitted through line **32**, nipple end **34** to passage **16**, and thence through the porous structure of the core. The core wash surrounding the core is thereby drawn into the pores, interstices, fissures and recesses in the core in an area such as that illustrated by shaded lines **40**. This impregnation by the wash material may be varied by varying the porosity of the original core structure, the degree of vacuum in passage **16**, and the length of time in which the care remains immersed in the wash material **12**. Further, the impregnation may be varied by varying viscosity, density and surface tension of the core wash material. It is seen that the vacuum created in the pores of the core will draw the wash material inwardly throughout the entire structure, and, if the structure is substantially uniform in porosity, the wash material will be distributed substantially uniformly over the entire external portion of the core. There may be some instances in which strength and heat resistance requirements are higher than in others, and hence for optimum performance, a higher amount of core wash is desirable. This excess core wash can be introduced into the core structure at the desired places by providing greater porosity at those points in the structure and/or by placing passage **16** or the branches thereof in such positions as to channel the concentration of vacuum into those areas while decreasing the degree of vacuum in other areas. Hence, in the structure shown, passage **28** is in a relatively small but intricate section of the core and will provide a higher degree of vacuum around the external surface than branch passages **18** and **20** in the relatively large core sections.

After the core has been held in the core wash material under vacuum for the desired period of time, ranging from one or two to ten seconds, it is removed, the vacuum is shut off, and the excess core material permitted to drain and drip freely from the external surface of the core. The core may then be again baked to complete the final drying of the core material, to harden it, and to give it greater strength and heat resistance properties. In performing the method on large cores, a longer period of time than ten seconds may be required, such as up to thirty seconds, to properly impregnate the heavier sections. The time, however, can be reduced by proper channeling of the vacuum into the various large sections, or making those sections of greater porosity than the smaller sections in the core.

The present method may be used in making cores for casting various types of metals and alloys, and the method may also be used to an advantage in making the mold structure as well as the core structure where intricate sections of the mold are required. The channeling of the vacuum passages to the various areas and the connection of the vacuum to those passages are accomplished in substantially the same manner as described with reference to the cores. When the term "sand" is used herein and in the claims, unless otherwise indicated, it means and includes all types of cores and mold materials of an aggregate type used with a binder suitable for the casting operation. "Vacuum" means that the pressure in the core is less than the pressure on the surface of the liquid wash. While only one embodiment of the present invention has been described in detail herein, various changes and modifications may be made in the method to adapt it to the various types of cores and molds to satisfy requirements.

I claim:

1. A method of making cores, molds and like structures of improved strength and heat resistance, comprising forming with sand and a binder a firm, porous structure of the desired configuration and forming in said structure an internal passage connected to the external surface by an opening, submerging said structure in a core wash solution, and applying vacuum to said passage for drawing said wash solution into the pores of said structure.

2. The method as defined in claim **1**, in which the structure is heated at an elevated temperature between the forming of the porous structure and submerging said structure in the core wash solution.

3. The method as defined in claim **1**, in which the porosity of the sand and binder structure is substantially uniform throughout the structure.

4. The method as defined in claim **1**, in which the structure is submerged in the core wash solution for a period of time ranging from approximately one to thirty seconds.

5. The method as defined in claim **1**, in which the structure is submerged in the core wash solution for a period of time ranging from approximately one to ten seconds.

6. The method as defined in claim **1**, in which the degree of impregnation of the core wash solution is controlled by varying the porosity of the structure.

7. The method as defined in claim **1**, in which the degree of impregnation is controlled by varying the degree of vacuum in said passage.

8. The method as defined in claim **1**, in which the degree of impregnation is controlled by varying the length of time in which the structure is submerged in the core solution while applying vacuum to said passage.

9. The method as defined in claim **1**, in which the structure is heated at an elevated temperature after it has been submerged in the core wash solution.

References Cited

UNITED STATES PATENTS

2,652,609	9/1953	Sudia	164—7
3,038,221	6/1962	Hansberg	164—253
3,284,862	11/1966	Schweikert	117—5.2 X
3,303,933	2/1967	Huff	210—496 X

J. SPENCER OVERHOLSER, *Primary Examiner.*

E. MAR, *Assistant Examiner.*