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3,157,924

## METHOD OF CASTING

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No Drawing. Continuation of application Ser. No. 101,687, Apr. 10, 1961. This application Feb. 12, 1964, Ser. No. 344,190

10 Claims. (Cl. 22—196)

This invention relates to the making of castings and more particularly to a method of preparing molds and producing castings therein.

This is a continuation of applicant's copending application Serial No. 101,687 filed April 10, 1961, now abandoned.

A molding technique wherein patterns of expanded polystyrene or the like shaped to the exact configuration desired, allowing, of course, for shrinkage of the material being cast, are used in the preparation of a mold of the cavityless type is well-known in the art. The mold is prepared in accordance with well-known molding practices using conventional molding sand and flask equipment. U.S. Patent No. 2,830,343 issued April 15, 1958, to Harold F. Shroyer is illustrative of the state of the art wherein castings are made in a mold having an expandable combustible pattern therein of the shape of the intended casting made by the use of conventional founding techniques. This conventional founding technique includes the placing of the pattern within the confines of the drag portion of a flask and filling said drag with molding sand rammed by hand or by power operation, turning over the drag, placing a conventional cope on top of the drag, and filling the superimposed cope with molding sand rammed therein. Suitable gates, risers, runners and a multiplicity of vents are incorporated in the completed mold. In conventional practice, the molding sand used is dense and includes various binders to assist in the retention of the shape of the pattern in the molding sand. This dense, bonded molding sand also effectively restricts the passage of air and vapors therethrough and, therefore, substantial venting by forming passageways in the mold is necessary in the cavityless type of molding technique illustrated by the aforementioned prior art patent to release the gases formed upon combustion of the pattern.

It is an object of this invention to further simplify the cavityless type of founding technique.

It is a further object to simplify the removal of the sand from cavities and recesses found in many castings. It is a further object to eliminate the necessity of providing a multiplicity of vents used in conventional founding practice.

It is yet a further object of this invention to substantially eliminate the necessity of extensive compacting or tamping of the mold. Further objects and advantages of this invention will become evident as the description proceeds.

Generally described, the instant invention contemplates a method of casting wherein a cavityless-type mold is used having a combustible pattern of expanded polystyrene or the like imbedded in clean, unbonded sand. The molten casting material is poured into the mold using gates, runners and risers as necessary formed also of combustible material such as expanded polystyrene or preformed of a non-combustible material.

In the technique forming the basis for the instant invention, it has been found that the use of clean, unbonded sand in the preparation of a mold of the cavityless type effectively provides sufficient venting area through the interstices of the sand to permit the vapors formed upon contact of the combustible pattern with the molten cast-

ing material to flow therethrough. It appears that upon contact with the cooler sand that the evaporated polystyrene or other comparable pattern material will condense and in so doing retain the sand in position a sufficient length of time to support the entering molten casting material. It has been found that cavities and holes in the pattern filled with clean, unbonded sand produce sound castings faithfully reproducing the contours of the pattern. The casting is simply removed from the mold, and cavities or recesses in the casting are readily cleaned by simply pouring the free-running, unbonded sand therefrom.

By the instant invention, it is possible to greatly simplify conventional molding practices. A simple container having bottom and side walls of a size sufficient to receive the combustible pattern plus a sufficient volume of sand in accordance with current practices is found adequate. The conventional and often complicated flask equipment is not necessary. The desired combustible pattern is inserted in a suitable container with clean, unbonded sand poured thereabout and into all recesses and cavities of the pattern. It should be noted that the combustible pattern may include suitable risers and gates with the gates including a splash basin and a runner all of a design and dimension in accordance with conventional molding practice. It should also be noted that the above contemplates the gates, risers and runners being of the same combustible material as the pattern, although preformed gates, risers and runners may also be used made of a non-combustible material and attached to the pattern in a suitable manner without departure from the spirit of the instant invention.

Molten casting material poured into a cavityless mold made in accordance with the above description using clean, unbonded sand vaporizes the pattern immediately before it as it rises in the mold. The cavities of the pattern may be filled with clean, unbonded sand without conventional core supports being required in most cases. It has been found desirable to place the runner supplying molten casting material to the pattern area at a low point in the pattern so that the molten casting material may rise uniformly upwardly through the cavity formed upon vaporization of the pattern immediately before the flow of the molten casting material.

It has been found that the technique outlined above using an expanded plastic such as polystyrene for the pattern material in clean, dry, unbonded sand greatly simplifies the molding operation, effecting marked reduction in cost, and producing sound castings. The cost of cleaning the castings and removal of sand from cavities is greatly reduced.

In the foregoing description, the mold bodies have been described as being formed by clean, unbonded sand; and it should be pointed out that the sand should be free of organic combustible materials and bonding and setting agents which may prevent the free flow of the sand and plug the interstices of the sand, thus preventing proper venting of the pattern vapors during the casting operation.

In the specification, there has been set forth a preferred embodiment of the invention; and, although specific terms are employed, these are used in a generic and descriptive sense only and not for purposes of limitation. Changes in form or proportion of parts, as well as a substitution of equivalents are contemplated, as circumstances may suggest or render expedient, without departing from the spirit and/or scope of this invention as further defined in the following claims.

I claim:

1. A method of casting comprising the steps of imbedding in a mold body of clean, free-flowing, dry and substantially unbonded sand a form combustible substan-

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tially without residue on subjection to a molten casting charge and shaped for exact reproduction as a casting; forming in said mold body a gate leading to said imbedded form and pouring into said gate a molten casting charge for burning and vaporizing said imbedded form in said mold body.

2. A method of casting, comprising the steps of imbedding in a mold body of free-flowing, clean and substantially unbonded sand a form combustible substantially without residue on subjection to a molten casting charge and shaped for exact reproduction as a casting, providing in said mold body a passage for a molten casting charge to said imbedded form, and pouring into said passage a molten casting charge for burning and vaporizing said imbedded form in said mold body.

3. A method of casting, comprising the steps of imbedding in a mold body of clean, free-flowing and substantially unbonded sand a form combustible substantially without residue on subjection to a molten casting charge and shaped for exact reproduction as a casting and including a gate leading to a lower portion of said form, and pouring into said gate a molten casting charge for burning and vaporizing said imbedded form in said body of clean sand.

4. A method of casting comprising the steps of imbedding in a mold body of clean, free-flowing and substantially unbonded sand a form combustible substantially without residue on subjection to a molten casting charge and shaped for exact reproduction as a casting, forming in said mold body a gate leading to said imbedded form and pouring into said gate a molten casting charge for burning and vaporizing said imbedded form in said mold body.

5. A method of casting, comprising the steps of wholly imbedding a form having a recess and being substantially without residue on subject to a molten casting charge and shaped for exact reproduction as a casting including said recess therein, in a body of free-flowing, clean and substantially unbonded sand; said recess being also filled with said free-flowing, clean and substantially unbonded sand; forming in said body of sand a gate leading to said form; and pouring into said gate a molten casting charge for burning and vaporizing said imbedded form.

6. A method of casting comprising the steps of imbedding in a mold body of clean, free-flowing, dry and substantially unbonded sand a form being substantially without residue on subjection to a molten casting charge and shaped for exact reproduction as a casting; forming

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in said mold body a gate leading to said imbedded form and pouring into said gate a molten casting charge for substantially vaporizing said imbedded form in said mold body.

7. A method of casting, comprising the steps of imbedding in a mold body of free-flowing, clean and substantially unbonded sand a form vaporizable substantially without residue on subjection to a molten casting charge and shaped for exact reproduction as a casting, providing in said mold body a passage for a molten casting charge to said imbedded form, and pouring into said passage a molten casting charge for substantially vaporizing said imbedded form in said mold body.

8. A method of casting, comprising the steps of imbedding in a mold body of clean, free-flowing and substantially unbonded sand a form vaporizable substantially without residue on subjection to a molten casting charge and shaped for exact reproduction as a casting and including a gate leading to a lower portion of said form, and pouring into said gate a molten casting charge for substantially vaporizing said imbedded form in said body of clean sand.

9. A method of casting comprising the steps of imbedding in a mold body of clean, free-flowing and substantially unbonded sand a form being substantially without residue on subjection to a molten casting charge and shaped for exact reproduction as a casting, forming in said mold body a gate leading to said imbedded form and pouring into said gate a molten casting charge for substantially vaporizing said imbedded form in said mold body.

10. A method of casting, comprising the steps of wholly imbedding a form having a recess and being substantially without residue on subjection to a molten casting charge and shaped for exact reproduction as a casting including said recess therein, in a body of free-flowing, clean and substantially unbonded sand; said recess being also filled with said free-flowing, clean and substantially unbonded sand; forming in said body of sand a gate leading to said form; and pouring into said gate a molten casting charge for vaporizing said imbedded form.

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