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METHOD OF AND MOLD FOR MAKING CASTINGS.

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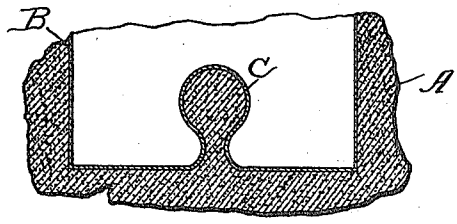

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UNITED STATES PATENT OFFICE.

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METHOD OF AND MOLD FOR MAKING CASTINGS.

1,153,231. Specification of Letters Patent. Patented Sept. 14, 1915.

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To all whom it may concern:

Be it known that I, CHARLES B. JACOBS, a citizen of the United States, and a resident of Port Chester, Westchester county, State of New York, have invented certain new and useful Improvements in Methods of and Molds for Making Castings, of which the following is a specification.

This invention has for an object to provide a method of producing metal castings with protective layers or with surface portions or facings having properties or characteristics different from those of the metal forming the body portions, said protective layers or surface portions, whether interior or exterior, being of any desired form and dimensions.

The invention also has for an object to provide molds whereby such castings may be reliably and cheaply produced.

These and other objects of the invention will be in part obvious and in part more fully explained in the following description.

The invention consists in the novel methods, molds, and improvements herein set forth.

According to one feature of the invention, a protective layer or facing having the desired characteristics is produced upon a casting by coating the corresponding surface in the mold in which the casting is to be formed, with a material having or adapted to produce the desired characteristics, said material being in a more or less finely divided or comminuted condition, and securing this coating to the mold surface by a cement which is adapted to act as a flux for the molten metal introduced into the mold to form the main body of the casting.

While the invention may be applied to the manufacture of castings adapted for a great variety of purposes and comprising many different metals, it is particularly useful as applied to the production of castings comprised in the main of iron or steel or so-called "semi-steel" and allied metals, which may be termed generally the "ferrous metals", because by the practice of this invention the inherent advantages of these metals as to strength, rigidity, cheapness, etc., may be realized without the presence of their inherent disadvantages, such as liability to corrosion, erosion, disintegration or distortion by heat, etc. By means of this invention the castings may be provided with protective layers or facings adapted to protect the body portions from any or all of the above-indicated and other destructive influences, and the protective layers or facings may be provided within or at any desired part of or throughout the entire surface of the casting, irrespective of the form, location, or dimensions of such surfaces, or, if desired, protective layers or facings of different characters may be provided at different parts of a single casting.

The protective layer or facing may be formed of any material having the desired characteristics and which will not interfere with the casting process or be destroyed or dissipated by the heat of the metal which is to compose the main body of the casting when said metal is in a molten state. This material may be a refractory mineral, natural or artificial, such as corundum, alundum, carborundum, and the like, which will not be fused or disintegrated by the heat of the molten metal and which is very hard and resistant to the action of acids and other corroding or eroding influences and a non-conductor of heat and electricity; or a material may be employed which is fusible by the heat of the molten metal to form a substantially continuous or unbroken layer or facing. As a protective layer or facing for ferrous metal castings, for example, another metal or alloy, such as copper, tin, lead, aluminum, bronze, and the like, may be used, or a fusible mineral or a mixture of minerals or metallic salts, such as are used for enameling purposes may be used.

A hard refractory material is well adapted to resist the erosive action of abrading materials, penetration by cutting tools, the slipping of contacting surfaces as in the case of a tread, the disintegration or deformation by heat, etc., and while such material is also effective to resist corrosion by acids and the like in some cases, this purpose may often be better subserved by a fusible material of a mineral or metallic character according to circumstances. Moreover, a metal will be in some cases better adapted for mechanical purposes or to enhance the appearance of a facing, while a fusible mineral will be better adapted to act as a non-conductor of heat or electricity. Where a protective layer or facing having the char-

acteristics of both classes of materials is desired, a mixture of the materials may be employed. Whatever may be the nature of the material employed for the protective layer or facing, it is preferably used in a more or less finely divided or comminuted condition in order that it may be readily applied in the form of a coating of the desired thickness to a surface in the mold irrespective of the form or position of that surface. In the case of a refractory material, moreover, a more or less finely divided condition thereof will tend to prevent the material from being disintegrated or injured by the heat of the molten metal during the casting operation and will enable the particles to protect more thoroughly the metal of the casting in which they are embedded, and in the case of a fusible material the finely divided condition will facilitate the prompt and thorough fusing of the particles to unite them to each other or to the casting metal and produce a substantially continuous or unbroken protective layer or facing.

The degree of fineness of the coating material may be varied according to the nature of its substance, the thickness of the protective layer or facing to be produced, the shape or nature of the surface which is to receive the coating, and the character of metal of which the main body of the coating is to consist. Ordinarily, the material is in a sufficiently fine state of division to pass through a screen of from eight to thirty mesh, but it may be considerably coarser than this or in a powdered condition to meet the circumstances of particular cases.

The comminuted material is applied as a coating or layer to a surface in the mold, the layer being of such thickness that it may be penetrated by the molten metal and the particles forming it being secured in such manner that they will not be displaced by the molten metal. The manner of securing the particles forms an important feature of the present invention. The particles must be secured by means which will effectively prevent displacement by the washing action of the molten metal while filling the mold and also the tendency to float of particles having a lower specific gravity than that of the casting metal, and yet the securing means must be such as will not interfere with the casting operation or prevent the casting metal from thoroughly penetrating the coating and coming in intimate contact with the particles thereof and such also as may be applied irrespective of the contour or position of the surface to which the coating is applied.

In accordance with this invention the coating is secured by a cement which will resist the heat of the casting metal until the latter has become quiescent in the mold and sufficiently firm to prevent the displacement of the particles forming the coating and which will nevertheless be destroyed or replaced by the molten metal and not form a gas or leave a deposit on the comminuted material which will repel the molten metal or prevent the latter from penetrating or uniting with the coating or becoming incorporated therewith. In other words, the cement after performing its functions as a securing means should act as a flux, allowing the casting metal to enter the interstices of the coating and keep the surfaces of both the casting metal and the particles forming its coating free from oxids or deposits which would prevent an effective union between the body of the casting and the protective layer or facing when the casting has cooled and set.

For making a casting from a ferrous metal in sand molds, what is herein termed a "soluble glass" has been found to give the best results as a cement for the coating. Such a cement may be formed by combining the oxids of certain elements of groups three and four of the periodic table with the oxygen salts of the alkaline metals. For example, oxids of silicon or boron combined with the hydrate, carbonate or sulfate of potassium in various proportions will produce suitable cements, instances of those containing oxid of silicon being the substances commonly known as "water glass." An instance of such a cement containing oxid of boron is what may be termed a "soluble boric acid glass." This may be formed, for example, by digesting with an equivalent quantity of water, three to four molecular equivalents of boric anhydrid with one molecular equivalent of sodium hydrate or one molecular equivalent of potassium hydrate. As an instance, take 65 to 85 parts (by weight) of boric anhydrid, 40 parts of caustic soda, and 105 to 125 parts of water, and digest these with heat. The result will be a viscous liquid soluble in water and similar in many of its properties to ordinary water glass.

The strength of such a "soluble glass," whatever its specific composition, may be varied to meet different conditions or to produce different results. Usually, the best results will be obtained by diluting the ordinary or full strength solution with from one to four parts of water, the solution being made stronger when used in connection with relatively coarse materials.

The coating may be applied and secured to a surface in the mold in various ways. Where the coating is to form a facing on the casting, the coating will be applied directly to one of the mold surfaces. Where the coating is to form a protective layer within the body of the casting, it may be

applied to a surface supported within the mold cavity in any suitable way. For example, it may be applied to a support secured in the mold in the manner that cores are usually secured, the support being of a character adapted to become incorporated within the body of the casting without unduly weakening the same. As an instance, the coating may be applied and secured to a piece of sheet metal or wire mesh suitably positioned and held in the mold, the support being of such material and strength as will enable it to retain the coating in the desired position until the casting metal has become firm enough to prevent its displacement and yet not so refractory or massive as to prevent it from becoming integrally united with the casting metal as by being fused or partly fused by the heat of the molten metal so as to amalgamate therewith.

In either case the coating may be first applied to the surface and then secured by applying the cement thereto as by means of the so-called "spray can" or the "mold swab" used by molders, the cement then being hardened or solidified by allowing it to dry or by applying heat thereto either in an oven or by a flame such as that of a skin-drying torch frequently used by molders. If desired, the surface which is to receive the coating may be first moistened with the cement and then after the coating has been applied the moistening operation may be repeated before the drying operation is performed. Where an extra thick coating is required, one or more additional layers of the comminuted material may be applied to the first layer and secured to the first layer by the cement in the same manner that the first layer was secured to its supporting surface, the additional layer or layers being usually of a coarser or of successively coarser materials.

Where the surface to receive the coating is of such form or so located that the coating materials will not rest thereon in the desired position by gravity or cannot be made to temporarily adhere thereto by first moistening the surface with the cement, a paste may be formed by mixing with some of the cement a suitable material in a finely divided or powdered condition. Some of the coating material may be used for this purpose or in some cases a different material adapted to be destroyed by the heat of the molten casting metal may be used, such as rye flour, for instance. A layer of this paste having been applied to the surface in any suitable way, as by a brush, the coating material may be caused to adhere thereto, as by dipping or rolling the pasty surface in a mass of the comminuted material or by applying the comminuted material in bulk to the pasty surface allowing what will to stick thereto. Where the surface which is to receive the coating is too delicate to receive the paste treatment without danger of injury, as in the case of a green sand mold, such surface may be first hardened or toughened by moistening it with the cement and then drying it in accordance with the method set forth in a companion application.

Advantages of the application other than those above set forth or suggested will be obvious to those skilled in the art, and it is to be understood that the invention in its broader aspects is not limited to the particular mode of procedure nor to the employment of the specific materials herein described, as many variations in both the materials and the treatment of them may be resorted to without departing from the main principles of the invention and without sacrificing its chief advantages.

Since the above described improvements are partly capable of illustration a drawing is annexed hereto forming the part of this specification in which the single figure of the drawings represents diagrammatically a general cross section of a mold of convenient form, and embodying or adapted to illustrate the present improvements.

In the drawings the body of the mold is indicated at A, the walls of the mold inclosing the space B within which the metal is to be cast. The special material to be incorporated in or near the surface of the casting, together with its carrier, is indicated diagrammatically at C, it being understood that this may consist of any of the alternates referred to in the preceding description. This portion C may consist of a coating, layer or facing which is a mixture of comminuted material with a fluxing cement, or a suitable paste containing the comminuted material and, on the other hand, it also represents a fabric or wire mesh applied within the mold and employed as a carrier for the material. The complete nature and details of the illustrated mold are already made clear in the specification as well as the mode in which the same is utilized in fully carrying out the principles of the present invention.

Claims:

1. The method of producing a metal casting with a protective layer, which method consists in coating a surface in the mold in which the casting is to be formed with a suitable material in a finely divided condition, spraying the coating with a liquid cement, drying the cement, and then introducing into the mold the metal in a molten state.

2. The method of producing a metal casting with a protective layer, which method consists in coating a surface in the mold in which the casting is to be formed with a suitable material in a finely divided condi-

tion, spraying the coating with a soluble glass, drying the coating, and then introducing into the mold the metal in a molten state.

3. The method of producing a metal casting with a protective layer, which method consists in coating a surface in the mold in which the casting is to be formed with a metal different from that of which the body of the casting is to consist and adapted to be fused by the heat of the body metal when in a molten state, said coating metal being in a finely divided condition, spraying the coating with a soluble glass, drying the coating, and then introducing into the mold the body metal in a molten state.

4. The method of producing a ferrous metal casting with a facing having properties different from those of the ferrous metal, which method consists in preparing a green sand mold for the casting, coating a surface of the mold with a suitable material in a finely divided condition, spraying the coating with a soluble glass, drying the coating, and then introducing into the mold the ferrous metal in a molten state.

5. The method of producing a ferrous metal casting with a facing having properties different from those of the ferrous metal, which method consists in preparing a green sand mold for the casting, coating a surface of the mold with a material adapted to be fused by the heat of the ferrous metal when in a molten state, said material being in a finely divided condition, spraying the coating with a soluble glass, drying the coating, and then introducing into the mold the ferrous metal in a molten state.

6. The method of producing a ferrous metal casting with a facing having properties different from those of the ferrous metal, which method consists in preparing a green sand mold for the casting, coating a surface of the mold with a non-ferrous metal adapted to be fused by the heat of the ferrous metal when in a molten state, said non-ferrous metal being in a finely divided condition, spraying the coating with a soluble glass, drying the coating, and then introducing into the mold the ferrous metal in a molten state.

7. The method of producing a ferrous metal casting with a facing having properties different from those of the ferrous metal, which method consists in preparing a sand mold for the casting, coating a surface of the mold with a paste composed of a soluble glass and a suitable material in a powdered condition, applying to this coating a layer of a suitable material in a finely divided condition, drying the coating, and then introducing into the mold the ferrous metal in a molten state.

8. The method of producing a ferrous metal casting with a facing having properties different from those of the ferrous metal, which method consists in preparing a sand mold for the casting, coating a surface of the mold with a paste composed of a soluble glass and a suitable material in a powdered condition, applying to this coating a layer of a material adapted to be fused by the heat of the ferrous metal when in a molten state, said material being in a finely divided condition, drying the coating, and then introducing into the mold the ferrous metal in a molten state.

9. The method of producing a ferrous metal casting with a facing having properties different from those of the ferrous metal, which method consists in preparing a sand mold for the casting, coating a surface of the mold with a paste composed of a soluble glass and a suitable material in a powdered condition, applying to this coating a layer of a non-ferrous metal adapted to be fused by the heat of the ferrous metal when in a molten state, said non-ferrous metal being in a finely divided condition, drying the coating, and then introducing into the mold the ferrous metal in a molten state.

10. The method of producing a ferrous metal casting with a facing having properties different from those of the ferrous metal, which method consists in preparing a green sand mold for the casting, treating a mold surface with a soluble glass and heat to harden said surface, coating the hardened surface with a paste composed of a soluble glass and a suitable material in a powdered condition, applying to this coating a layer of a suitable material in a finely divided condition, drying the coating, and then introducing into the mold the ferrous metal in a molten state.

11. The method of producing a ferrous metal casting with a facing having properties different from those of the ferrous metal, which method consists in preparing a green sand mold for the casting, treating a mold surface with a soluble glass and heat to harden said surface, coating the hardened surface with a paste composed of a soluble glass and a suitable material in a powdered condition, applying to this coating a layer of a material adapted to be fused by the heat of the ferrous metal when in a molten state, said material being in a finely divided condition, drying the coating, and then introducing into the mold the ferrous metal in a molten state.

12. The method of producing a ferrous metal casting with a facing having properties different from those of the ferrous metal, which method consists in preparing a green sand mold for the casting, treating a mold surface with a soluble glass and heat to harden said surface, coating the hardened surface with a paste composed of a soluble glass and a suitable material in a powdered

condition, applying to this coating a layer of a non-ferrous metal adapted to be fused by the heat of the ferrous metal when in a molten state, said non-ferrous metal being in a finely divided condition, drying the coating, and then introducing into the mold the ferrous metal in a molten state.

13. The method of producing a metal casting with a protective surface, which method consists in first procuring a mold therefor, then providing a dryable non-volatile cement-flux of a character adapted to cement a coating material and also to act as a flux for the molten metal to be introduced into the mold, and by means of such cement-flux securing at the surface of the mold a finely divided material of a character adapted to be taken into the casting surface and convert or harden the same, and then introducing into the coated mold in a molten state the metal to be cast.

14. The method of producing a metal casting with a protective layer, which method consists in coating a surface in the mold in which the casting is to be formed with a material adapted to convert the casting's surface, such material being in a finely divided condition, securing the coating to the surface by a material adapted to dry out before casting, such material constituting both a cement for the coating and a flux for the metal of which the body of the casting is to consist, and then introducing into the mold the metal in a molten state.

15. The method of producing a metal casting with a protective layer, which method consists in coating a surface in the mold in which the casting is to be formed with a material adapted to be fused by the heat of and taken into the metal of which the body of the casting is to consist when said metal is in a molten state, securing the coating to the surface by a material adapted to dry out before casting, such material constituting both a cement for the coating and a flux for the metal, and then introducing into the mold the metal in a molten state.

16. The method of producing a metal casting with a protective layer, which method consists in coating a surface in the mold in which the casting is to be formed with a metal different from that of which the body of the casting is to consist and adapted to be fused by the heat of and taken into the body metal when in a molten state, said coating metal being in a finely divided condition, securing the coating to the surface by a material adapted to dry out before casting, such material constituting both a cement for the coating and a flux for the body metal, and then introducing into the mold the body metal in a molten state.

17. The method of producing a metal casting with a protective layer, which method consists in coating a surface in the mold in which the casting is to be formed with a material adapted to convert the casting's surface, such material being in a finely divided condition, securing the coating to the surface by a cement-flux consisting of soluble glass adapted to cement the coating material on the mold surface and to act as a flux for the casting metal, and then introducing into the mold the metal in a molten state.

18. The method of producing a metal casting with a protective layer, which method consists in coating a surface in the mold in which the casting is to be formed with a material adapted to be fused by the heat of and taken into the metal of which the body of the casting is to consist when said metal is in a molten state, securing the coating to the surface by a cement-flux consisting of soluble glass adapted to cement the coating material on the mold surface and to act as a flux for the casting metal, and then introducing into the mold the metal in a molten state.

19. The method of producing a metal casting with a protective layer, which method consists in coating a surface in the mold in which the casting is to be formed with a metal different from that of which the body of the casting is to consist and adapted to be fused by the heat of and taken into the body metal when in a molten state, said coating metal being in a finely divided condition, securing the coating to the surface by a cement-flux consisting of soluble glass adapted to cement the coating material on the mold surface and to act as a flux for the casting metal, and then introducing into the mold the body metal in a molten state.

20. The method of producing a metal casting with a protective layer, which method consists in coating a surface in the mold in which the casting is to be formed with a material adapted to convert the casting's surface, such material being in a finely divided condition, securing the coating to the surface by a cement-flux consisting of water glass adapted to cement the coating material on the mold surface and to act as a flux for the casting metal, and then introducing into the mold the metal in a molten state.

21. The method of producing a metal casting with a protective layer, which method consists in coating a surface in the mold in which the casting is to be formed with a metal different from that of which the body of the casting is to consist and adapted to be fused by the heat of and taken into the body metal when in a molten state, said coating metal being in a finely divided condition, securing the coating to the surface by a cement-flux consisting of water glass adapted to cement the coating material on the mold surface and to act as a flux for

the casting metal, and then introducing into the mold the body metal in a molten state.

22. The method of producing a ferrous metal casting with a facing having properties different from those of the ferrous metal, which method consists in preparing a green sand mold for the casting, coating a surface of the mold with a material adapted to convert the casting's surface, such material being in a finely divided condition, securing the coating to the mold surface by a material adapted to dry out before casting, such material constituting both a cement for the coating and a flux for the ferrous metal, and then introducing into the mold the ferrous metal in a molten state.

23. The method of producing a ferrous metal casting with a facing having properties different from those of the ferrous metal, which method consists in preparing a green sand mold for the casting, coating a surface of the mold with a converting material adapted to be fused by the heat of and taken into the ferrous metal when in a molten state, said material being in a finely divided condition, securing the coating to the mold surface by a material adapted to dry out before casting, such material constituting both a cement for the coating and a flux for the ferrous metal, and then introducing into the mold the ferrous metal in a molten state.

24. The method of producing a ferrous metal casting with a facing having properties different from those of the ferrous metal, which method consists in preparing a green sand mold for the casting, coating a surface of the mold with a nonferrous metal adapted to be fused by the heat of and taken into the ferrous metal when in a molten state, said non-ferrous metal being in a finely divided condition, securing the coating to the mold surface by a material adapted to dry out before casting, such material constituting both a cement for the coating and a flux for the ferrous metal, and then introducing into the mold the ferrous metal in a molten state.

25. A mold adapted to produce metal casting having a protective layer, said mold having a surface therein coated with a material adapted to form said protective layer, said coating material being in a finely divided condition and secured in a dry condition to the said surface by a material which constitutes both a cement for the coating material and a flux for the casting metal when introduced into the mold in a molten state.

26. A mold adapted to produce metal castings having a protective layer, said mold having a surface therein coated with a converting material adapted to be fused by the heat of the casting metal when said metal is in a molten state, said coating material being in a finely divided condition and secured in a dry condition to the said surface by a material which constitutes both a cement for the coating material and a flux for the molten casting metal.

27. A mold adapted to produce metal castings having a protective layer, said mold having a surface therein coated with a metal different from that of which the body of the casting is to consist and adapted to be fused by the heat of the casting metal when in a molten state, said coating metal being in a finely divided condition and secured in a dry condition to the said surface by a material which constitutes both a cement for the coating material and a flux for the molten casting metal.

28. A mold adapted to produce ferrous metal castings with a facing having properties different from those of the ferrous metal, said mold being formed of green sand and having a surface thereof coated with a material adapted to form said facing, said coating material being in a finely divided condition and secured in dry condition to the mold surface by a solidified soluble glass, which constitutes both a cement for the coating material and a flux for the casting metal.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

CHARLES B. JACOBS.

Witnesses:
R. R. MURPHY,
WM. J. DOLAN.