July 7, 1959 F. EISERMANN 2,893,084

CASTING MOLD AND METHOD OF CASTING CARBON-CONTAINING ALLOYS

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Fig. 1.

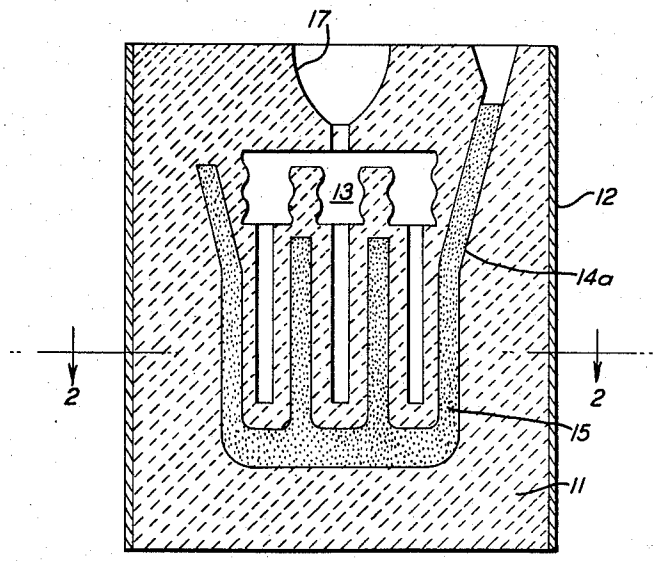
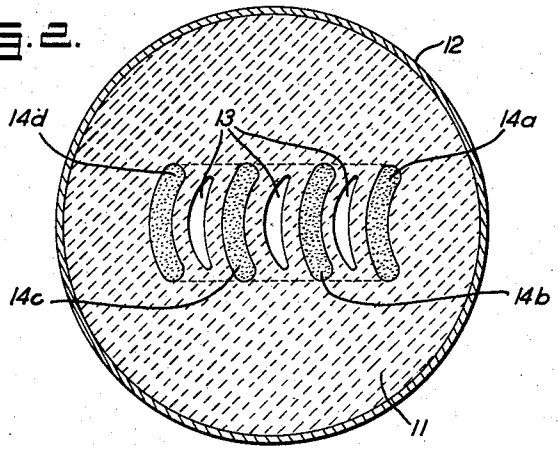


Fig. 2.



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CASTING MOLD AND METHOD OF CASTING CARBON-CONTAINING ALLOYS

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14 Claims. (Cl. 22—214)

This invention relates to casting molds and a method for the casting of metallic alloys containing carbon.

In the casting of metallic alloys having a carbon content decarbonization frequently occurs at the exposed portions of the casting due to said exposed portions coming into contact with oxygen during the cooling and solidification of the casting in the mold. While decarbonization is encountered in all methods of casting such alloys, it is particularly pronounced in castings produced by the destructible-pattern precision-casting method. In precision-casting the molds are usually already hot when filled with molten metal which presents more heat to be dissipated and, therefore, causes a delay in the cooling of the casting and an increased opportunity for decarbonization to occur. It is possible to use a carbonization treatment of the casting by adding additional carbon to the casting. However, it is impossible to obtain a homogeneous casting composition by using this method, as the finished casting will have a concentration of carbon which is high at the surface and decreases towards the center of the casting. Because of this it is not satisfactory to use a carbonization treatment in precision casting. Quite apart from these difficulties, the carbonization treatment is an additional operation which takes up time and increases the cost of production.

My invention provides a new method of casting which eliminates the problem of decarbonization in the casting. It comprises forming a casting mold that has a casting cavity and an additional cavity substantially encircling the whole surface of the casting cavity and being separated therefrom by a relatively thin wall of the refractory mold material. A protective substance is then placed in the additional cavity and the casting cavity is filled with molten metal. The heat of the mold and the molten metal will cause the protective substance in the additional cavity to generate a reducing gas to blanket the cooling casting and prevent the carbon in the exposed portions of the cooling casting from oxidizing. The protective substance may be placed in the mold before or after the molten metal is poured therein. My invention also provides a mold made in accordance with the described method.

The invention is illustrated in the accompanying drawing, in which:

Fig. 1 shows a vertical cross-section through a refractory casting mold ready for casting, and,

Fig. 2 shows a cross-sectional view along lines 1—1 of Fig. 1.

In the drawings the flask **12** encloses a fired refractory mold material **11**, the casting cavity **13** and the additional cavities **14***a*, **14***b*, **14***c* and **14***d*. The casting cavities and also the additional cavities can be advantageously produced according to the lost wax process using destructible patterns having the same external configuration as the finished castings to be cast. The additional cavities are so positioned that the casting cavity **13** and the additional cavities are separated by only a thin wall of the refractory mold material and the additional cavities substantially encircle the whole surface of the casting cavities or the casting being produced. The additional cavities contain a protective substance **15**. The cavities **14***b* and **14***c* are blanked off by means of the plug **16** made of ceramic material. The plugs prevent the protective substance from falling out while the mold is reversed into the casting position shown in Fig. 1. The molten metal is poured through the ingate **17** to form the casting.

The method of my invention may be used, by way of example, in the destructible-pattern method of precision casting of high carbon steel as follows:

A destructible wax pattern is formed having two parts. One part has the same external configuration of the finished casting to be cast and the other is in the shape of the desired additional cavity. The two parts are associated together so the two cavities formed by them will be separated from one another in the finished mold and, preferably so positioned that when the casting cavity is filled with molten metal the two cavities will be separated by only a thin wall of refractory substance so that heat will be readily transmitted from the casting cavity to the additional cavity. A rod-like projection may be placed upon the pattern segment forming the additional cavity so that a channel will be formed in the wall of the finished mold through which the protective substance may be placed in the additional cavity. The channel is advantageously made as small as possible so the reducing gas generated therein will not escape to the outside air too readily but will instead enter the casting cavity to blanket the cooling casting. After firing, the casting cavity of the mold is filled with molten metal. A protective substance is introduced into the additional cavity, either before or after the molten metal is poured into the casting cavity. However, if the protective substance is introduced into the mold after the casting cavity is filled through the channel provided therefor, it should be done immediately thereafter so that the generation of reducing gases and the resulting blanketing of the molten metal begins early in the cooling process to avoid any unnecessary decarbonization. Any material which will produce carbon monoxide in incomplete combustion may be used as the protective substance. I have found that petroleum coke, coke, pitch, heavy oils, as well as pure natural substances such as brown coal, or sawdust are satisfactory for use. I have also found that organic substances such as oxalic acid, which form carbon monoxide on heating may be advantageously used. Liquid material may be poured drop by drop into the additional space, while solids may be introduced either as a powder, pellet or piece of an appropriate size.

The castings made according to the described method show a complete absence of any decarbonization and a uniform carbon content throughout the entire finished casting.

While the described method may be used in destructible-pattern precision casting with great advantage, it is not limited to that type of casting, but may be used with advantage in ordinary steel casting with cold molds to prevent decarbonization.

I claim:

1. A method of making castings from carbon containing metals which comprises forming a gas-permeable refractory casting mold having a casting cavity and at least one additional cavity, said additional cavity being so positioned that when the casting cavity is filled with the molten metal, the casting cavity will be separated from said adjacent cavity by a thin wall of gas-permeable refractory mold material, inserting into said additional cavity a protective substance which produces a reducing gas during the cooling of the casting in the mold to

prevent surface decarbonization of the casting, and filling the casting cavity with a molten metal containing carbon.

2. A method of making castings from carbon containing metals which comprises forming a gas-permeable refractory casting mold having a casting cavity and an additional cavity, said additional cavity being so positioned that when the casting cavity is filled with the molten metal, the casting cavity will be separated from said adjacent cavity by a thin wall of gas-permeable refractory mold material, filling the casting cavity with a molten metal containing carbon, and inserting into said additional cavity a protective substance which produces a reducing gas during the cooling of the casting in the mold to prevent surface decarbonization of the casting before the molten metal solidifies.

3. The method of claim 1 in which the protective substance is petroleum coke.

4. The method of claim 1 in which the protective substance is oxalic acid.

5. The method of claim 1 in which the protective substance is pitch.

6. The method of claim 1 in which the protective substance is brown coal.

7. The method of claim 1 in which the protective substance is sawdust.

8. The method of claim 2 in which the protective substance is petroleum coke.

9. The method of claim 2 in which the protective substance is oxalic acid.

10. The method of claim 2 in which the protective substance is pitch.

11. The method of claim 2 in which the protective substance is brown coal.

12. The method of claim 2 in which the protective substance is sawdust.

13. A refractory casting mold for the production of castings from carbon containing metals comprising a gas-permeable refractory casting mold having a casting cavity and an additional cavity being so positioned that when the casting cavity is filled with the molten metal, the casting cavity will be separated from said adjacent cavity by a thin wall of gas-permeable refractory mold material.

14. The refractory casting mold of claim 13 which includes a passage leading from the outside of the mold to the additional cavity through which the protective substance can be introduced into the additional cavity.

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