Nov. 21, 1950 J. B. BRENNAN 2,530,853

METHOD OF CASTING

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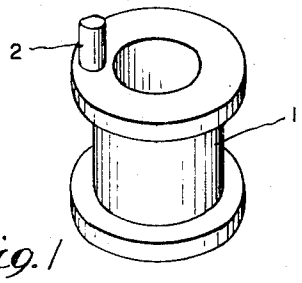


Fig. 1

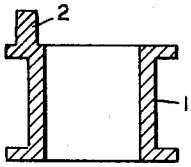


Fig. 2

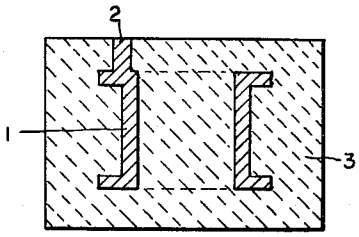


Fig. 3

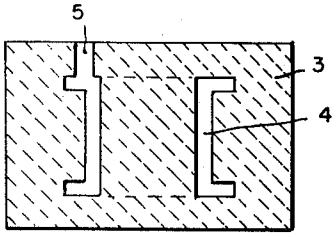


Fig. 4

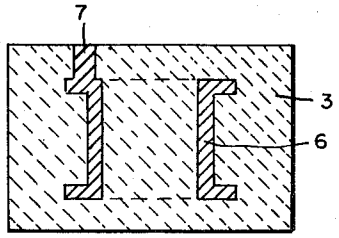


Fig. 5

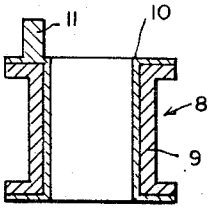


Fig. 6

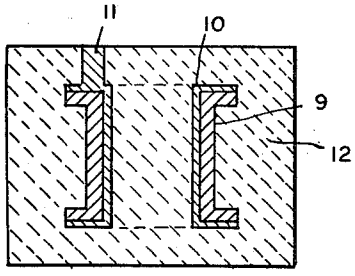


Fig. 7

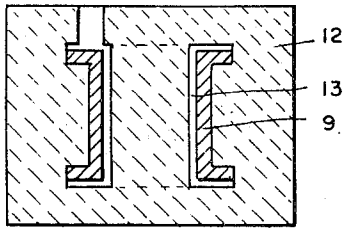


Fig. 8

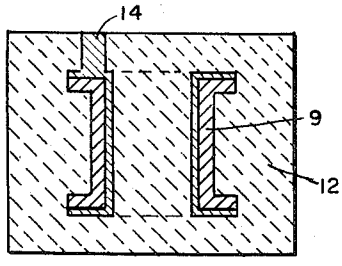


Fig. 9

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METHOD OF CASTING

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2 Claims. (Cl. 22—203)

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This invention relates as indicated to molding or casting and relates more specifically to an improved process for the production of molded or cast parts preferably formed of metal and in which the finished part, in its as cast condition, is held to extremely close tolerances and without any surface imperfections such as are usually attributable to the parting line of conventional sectional molds.

In the more specific embodiment of my invention, the process is especially adapted to the manufacture of composite metallic structures, which, in their finished form, have the same desirable properties as those enumerated above.

It is a principal object of my invention to provide a process having the advantages above enumerated.

Other objects of the invention will appear as the description proceeds.

To the accomplishment of the foregoing and related ends, said invention then comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawing setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principle of the invention may be employed.

In said annexed drawing:

Fig. 1 is a perspective view of a model used in carrying out the process of my invention in one of its forms;

Fig. 2 is a transverse sectional view of the model illustrated in Fig. 1;

Figs. 3, 4, and 5 are views of a mold constructed in accordance with the principles of my invention and showing various steps in my improved process;

Fig. 6 is a view similar to Fig. 2 but showing a modified form of model used in carrying out one of the preferred modes of operation of the process comprising my invention; and

Figs. 7, 8, and 9 are illustrations of sequential steps in such last named process.

Broadly stated, this invention is concerned with an improved method of casting which comprises providing a die-cast model of a low melting point metal with a projection on such model, encasing said model in a compacted mold body of finely divided carbon, with said projection extending to the outer surface of said mold body, heating said mold sufficiently to melt said model, draining the melted model from the mold body through the opening provided by said projection, and then filling said mold with the metal from

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which the desired article is to be made, said mold being supported in a space of reduced atmospheric pressure during said last named step.

In the preferred embodiment of my invention, the same is concerned with the method of forming a composite metallic structure which comprises providing one of the components of the desired structure, incorporating said component in a die-cast model, the remainder of which is formed of a low melting point metal provided with a projection thereon, encasing said model in a compacted mold body of finely divided carbon, with said projection extending to the outer surface of said mold body, heating said mold sufficiently to melt said low melting point metal, draining the melted portion of said model from the mold body through the opening provided by said projection, and then filling said mold with the metal from which the second component of the desired article is to be made, said mold being supported in a space of reduced atmospheric pressure during said last named step.

The precise manner in which my invention as above defined may be carried out will be more readily understood by having reference to the drawing in which Fig. 1 shows a model generally indicated at 1 formed of a die-casting of conventional low melting point die-cast metal. The model is accurately dimensioned in accordance with the dimensions of the desired article to be produced. The only differences between the dimensions of the model and the desired finished article are those resulting from the shrinkage of the metal from which the final product is cast. The usual and well-known procedure for determining the degree of shrinkage of the desired cast product is followed in determining the dimensions of the die-cast model 1.

The die-cast model 1 is provided with a projection 2 extending therefrom at an appropriate point for the reasons hereinafter more particularly explained.

After the die-cast model is provided and the surface thereof freed from any burs or other imperfections as for example the ridge or line left by the parting line of the die-casting molds, it is then imbedded in a briquette 3 of compacted finely divided carbon as most clearly illustrated in Fig. 3. The formation of the briquette 3 can be accomplished in any suitable press or briquetting machine of which a number are available on the market at the present time. The finely divided carbon is compacted sufficiently under the pressure of the briquetting operation so as to be retained in a substantially rigid and coherent

mass with the projection 2 of the model extending to the outer surface of the briquette or mold.

The carbon from which the briquette is made is preferably granular in form so that even in the compacted state, the body of the mold is porous to a degree such that air and other heated gases therein may readily escape through the pores thereof. The pressures available in conventional briquetting machines are generally sufficient to so compact the finely divided carbon sufficiently to provide a self-sustaining briquette without the use of any binders, although if desired a binder may be employed to insure the production of a briquette body of sufficient strength.

After the model has thus been imbedded in the mold or briquette, the latter is heated to a temperature sufficient to melt the metal from which the model is made. The melted model is then drained out of the briquette by up ending the same, leaving therein a cavity 4 of the exact size and configuration of the model. A sprue opening 5 extends from the cavity 4 to the outer surface of the briquette or mold at the place formerly occupied by the projection 2.

After the mold has thus been prepared, i. e. as illustrated in Fig. 4, the cavity 4 is filled with the metal from which the desired product is to be formed. The casting metal is introduced through the opening 5 until the mold cavity 4 is completely filled, thus providing the body 6 of the desired casting.

The casting step just described is preferably performed by placing the briquette mold 3 in a space in which a reduced atmospheric pressure is maintained viz. a partial vacuum. The porous and thus gas pervious nature of the mold body provided by the utilization of granular carbon will insure that all air will be removed from the space 4 in which the desired article is to be cast, thus insuring that the finished article will be full in all of its dimensions.

After the casting operation just described, the mold may be placed in a soaking pit to properly anneal the casting, after which the briquette is destroyed by breaking it up to remove the cast object therefrom. The slug 7 in the sprue opening is then removed in any conventional manner and the resultant article will be found to require little machining or finishing in order to reduce the same to the close dimensions of the desired size and shape of the finished article.

As previously indicated, my invention is especially adapted to the production of composite metallic articles, as for example a sleeve bearing having an outer reinforcing and supporting part of steel and an inner layer of cast bearing metal adhering to and supported by the steel body.

When carrying out this preferred modification of my invention, the pattern generally indicated at 8 in Fig. 6 will consist of the component 9 which is also a component of the desired finished article. The model generally indicated at 8 is provided by incorporating the component 9 in a die-casting, the remainder of which is formed of low melting point die-cast metal 10 with a projection 11 extending therefrom.

The model as thus provided and as illustrated in Fig. 6 is imbedded in a briquette mold 12 formed in the manner previously indicated, after which the mold is heated sufficiently to melt away and to permit draining from the mold of the die-cast metal, leaving a cavity generally indicated at 13 in the mold adjacent to the component 9.

The mold is then filled, as indicated in Fig. 9, with the metal from which the second component

of the composite article is to be formed, after which the annealing step, if desired, will follow as previously indicated. Then the briquette is broken up to remove the cast article therefrom and finally the slug 14 is removed and the article finished to the desired close dimensions.

The process of my invention is particularly adapted to the manufacture of bearings wherein a supporting shell of steel is to be provided with a bearing or wearing surface of soft metal such as silver or silver alloys.

In certain instances, especially when the mold is to be subjected to high temperatures, it will be preferable to support the same in a neutral or reducing atmosphere in order to prevent oxidation of the mold body.

In addition to carbon in granular form which has been indicated as the preferred material from which the briquette mold may be made, other refractory materials may be employed. Examples of such other materials are gypsum, powdered mica, finely divided aluminum oxide, and other similar substances.

When forming a composite article in accordance with the method illustrated for example in Figs. 6 to 9, and when component 9 is a ferrous alloy, and the other component is silver or a silver alloy, it will be found desirable, in certain instances at least, to provide means whereby an improved bond between component 9 and the other component is assured. One expedient which has been found highly successful for this purpose is to deposit a fired coat of nickel on the surface of component 9 to which the silver or silver alloy component is to be adhered. A convenient way of accomplishing this is to place on component 9 a dusting of nickel powder and then fixing the same thereto by firing that is heating to a degree sufficient to cause adhering of the nickel to the component 9 whereby to form a thin layer of nickel on the latter. Electrodeposition of nickel for this purpose is not satisfactory.

After the thin coating of nickel is thus fired on component 9, it will be utilized in the preparation of the die-cast model in precisely the manner previously explained, and the thin coating of nickel will be found to adhere to the surface of component 9 after the die-cast metal has been melted and drained from the briquette mold.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims or the equivalent of such be employed.

I, therefore, particularly point out and distinctly claim as my invention:

1. The method of forming a composite metallic structure which comprises providing a model consisting of a low melting point metal and a higher melting point metal with a thin third metal coating adhered to the latter and disposed between the two first-named metals, encasing said model in a compacted but porous, gas pervious mold body of a finely divided refractory material, heating said mold sufficiently to melt said low melting point metal, draining the melted metal from the mold body, and then filling said mold with a fourth metal to replace said low melting point metal and to adhere to said thin coating, heated gas within said mold body escaping through the pores of said mold body.

2. The method of forming a silver bearing having a steel supporting shell which comprises providing a model consisting of a steel shell having

a nickel coating adhered thereonto, and a low melting point metal against the coating on said shell, encasing said model in a compacted but porous, gas pervious mold body of finely divided carbon in granular form, heating said mold body sufficiently to melt said low melting point metal, draining the melted metal from the mold body to expose the coating on said shell, and then filling said mold with silver to replace said low melting point metal and to cause the silver to adhere to the nickel coating and thereby bond together the silver and the steel, heated gas within said mold body escaping through the pores of said mold body.

JOSEPH B. BRENNAN.

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