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Ikeda et al.

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[54] **PROCESS FOR FORMING A CASTING WITH A SLIDING SURFACE BY HIGH PRESSURE CASTING**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **164/97**

[51] **Int. Cl.** **B22d 19/08**

[58] **Field of Search** 164/97

[56] **References Cited**

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[57] **ABSTRACT**

A process for forming a sliding surface of a casting by a high pressure casting operation in which particles of any material suitable for improving the lubricating property, wear resisting property or the like of the sliding surface are adhered, in the form of a layer, by a binding agent of synthetic resin to a surface of a casting mold that is to form the sliding surface of the cast product. The casting material is supplied under high pressure into the casting mold to effect casting and to transfer the particles from the mold to the cast product. The resin binding agent is burned by the casting material and serves as a release agent.

9 Claims, 3 Drawing Figures

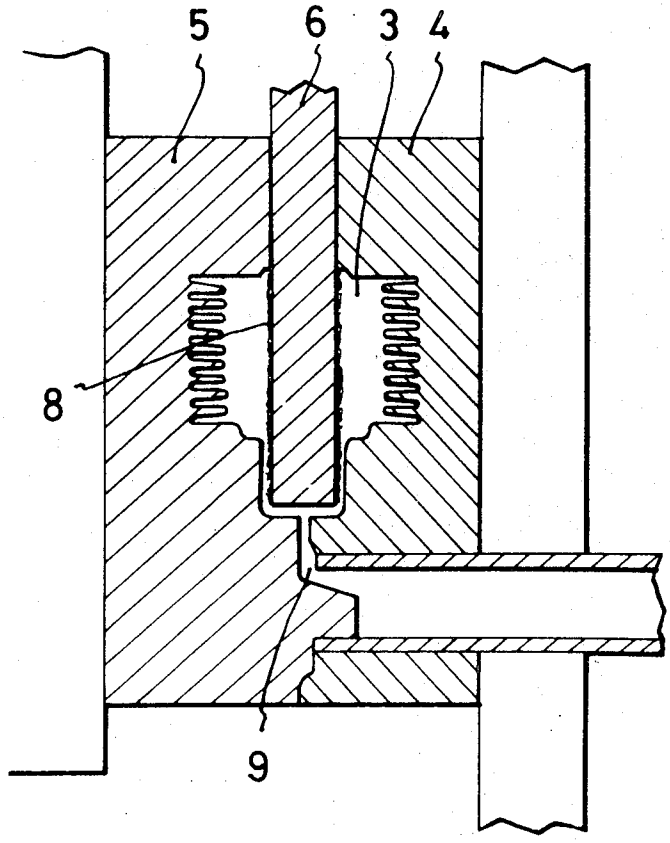


FIG. 1

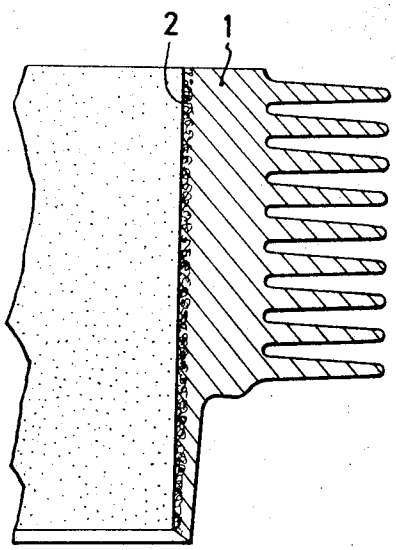


FIG. 2

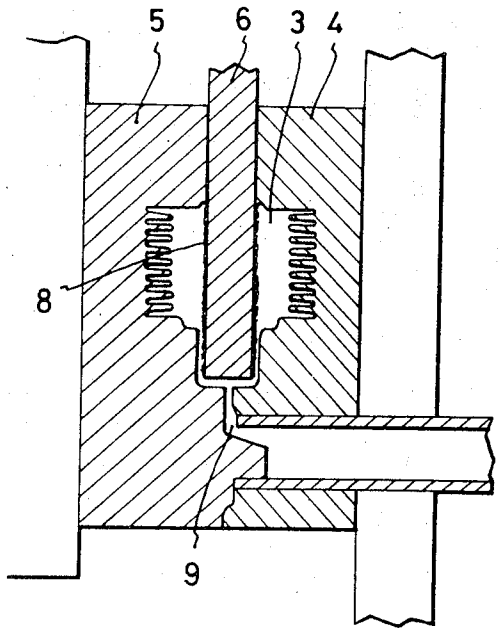
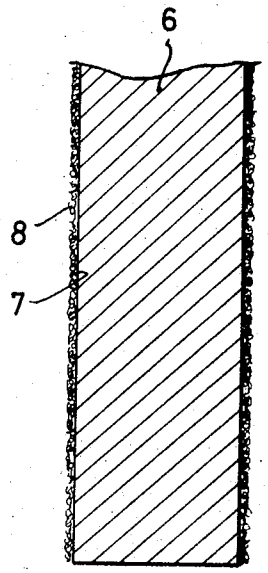


FIG. 3



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PROCESS FOR FORMING A CASTING WITH A SLIDING SURFACE BY HIGH PRESSURE CASTING

SUMMARY OF THE INVENTION

The invention relates to a process whereby a cast surface such as a sliding surface of a cyinder bore of a light alloy engine cylinder, a valve bore of a zinc slide valve type carburetor or the like is formed, in the casting thereof, with a sliding surface of lubricating property and/or wear resisting property or the like.

The invention is characterized in that particles of material for improving the lubricating property, wear resisting property or the like are adhered in a layer form by a binding agent of synthetic resin to a surface portion of a mold to form the sliding surface portion of a cast product, and the material to be cast is supplied under high pressure into the mold.

It has been attempted to use an aluminum alloy for producing the cylinders of an internal combustion engine, but cylinders of this kind are poor in lubricating property and have a strong tendency to cause such disadvantages as biting, seizing, etc. in the course of sliding movement of an aluminum alloy piston therein. For removing those disadvantages, it has been attempted to apply a hard chromeplating, iron plating or the like onto the sliding surface.

According to this invention, simultaneously with casting a product by high pressure casting such as die casting, a layer of particles of a material excellent in lubricating property or wear resisting property or the like, for example, graphite, iron, molybdenum or the like is formed on a sliding surface of the product.

BRIED DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmental sectional side view of a cylinder having a sliding surface according to this invention;

FIG. 2 is a sectional side view of a die casting apparatus for casting the product of FIG. 1; and

FIG. 3 is a enlarged sectional side view of a portion of the core metallic mold of the apparatus.

DETAILED DESCRIPTION

Referring to the accompanying drawing therein is shown in FIG. 1 a lubricating and/or wear-resisting layer 2 formed on the inner peripheral surface of a cylinder 1. In order to form layer 2, a metallic core mold 6 is arranged in a casting mold 3 comprising a stationary metallic mold 4 and a movable metallic mold 5 of a die casting apparatus, and particles 8 of graphite, iron, molybdenum or the like are adhered to the outer surface of core mold 6 by a layer of binding agent 7 chiefly composed of synthetic resin so that a layer of the particles is formed thereon. The binding agent may be, for example, a thermosetting resin such as a phenol resin, an epoxy resin or the like dissolved in a solvent such as alcohol or the like, and the binding agent is applied to the outer surface of the core mold 6 by means of soaking, painting, spraying or the like, whereafter the particles 8 are adhered thereto. The particles 8 are 0.3 to 1.5 mms in size, and the binding agent layer 7 having the particles 8 adhered thereto is then heated to, for example, about 200° C for curing thereof.

After the core mold 6 thus prepared is placed in the casting mold 3, molten aluminum alloy is injected under high pressure into the mold 3 through a runner 9, whereupon the casting product 1 as shown in FIG. 1 is obtained in which the particles 8 are embedded in the surface thereof which comes in contact with the core metallic mold 6. It is essential to this invention that the casting be a high pressure casting such as die casting. If the casting is an ordinary shell mold or metallic mold casting, when molten metal has entered the casting mold, the binding agent is decomposed by the heat to generate gas and there takes place a so-called "blowing" and a firm attachment of the particles with the casting product cannot be obtained. If, however, the casting is a high pressure casting such as die casting, the molten metal fills the casting mold instantly and penetrates, owing to its high pressure, among the particles combined together by the binding agent so that the particles are transferred to the metal, and the molten metal is then solidified rapidly, and accordingly there is not caused "blowing" by the thermal decomposed gas. Thus, the binding agent layer 7 is firmly embedded in the metal surface and is burned.

It has been well known that metal particles can be applied by metal spraying to a metallic core mold after which casting is effected. But in this process, the sprayed metal particles are fused and combined together to form a metal layer, so that the metal layer is cast in the casting metal. This process has the disadvantage that the core mold is limited to use of a breakable material such as a sand mold so as to be removable after the casting operation, so that the same is not suitable for a casting operation requiring accuracy in size such as die casting.

In this invention, the core mold and the particles are combined together through the binding agent and this binding agent is burned, so that the binding agent serves as a mold releasing agent and the core can be easily removed. Additionally, since the particles are combined with the core through the binding agent, the particles may be metallic or non-metallic.

For improving the wear resisting property, there are used metallic particles such as molybdenum, cobalt, iron, manganese, silicon etc.; metallic oxide particles such as aluminum oxide, zirconium oxide etc.; nitride particles such as boron nitride etc.; and carbide particles such as silicon carbide etc. For improving the lubricating property, there can be used graphite, mica, steatite, molybdenum dioxide, lead, bismuth, lead sulfide, lead oxide, tin oxide, and fluorite.

Thus, according to this invention, particles of any desired material excellent in lubricating property or wear resisting property or the like are adhered in the form of a layer through a binding agent of synthetic resin to such a portion of a casting mold that is to form a sliding surface of a cast product, and the particle layer is then firmly combined with the metal surface of the casting by high pressure casting, whereby the casting product can be easily provided with a sliding surface having excellent lubricating property, and/or wear resisting property or the like. Additionally, since synthetic resin is used as the binding agent, any desired particles, regardless of whether metallic or non-metallic, can be used for forming the particle layer, and the binding agent is burned to serve as a mold releasing agent for facilitating the mold releasing operation. Thus, an excellent casting process for forming a sliding surface having lubricating property and/or wear resisting property or the like can be provided.

What is claimed is:

1. A process for forming a cast surface which is to be slidable with respect to another surface, said process

comprising providing a casting mold having a surface against which the casting material is to come into contact to form said cast surface, adhering particles onto the surface of the casting mold by a binding agent of synthetic resin and effecting die casting by injecting the casting material under pressure into the mold (a) to transfer said particles from the surface of the casting mold onto the cast surface and (b) to burn said binding agent and cause the latter to remain as a release agent enabling separation of the cast product from the mold.

2. A process as claimed in claim **1** wherein said particles have lubricating property.

3. A process as claimed in claim **2** wherein said particles are graphite, stealite, mica, molybdenum dioxide, lead, bismuth, lead sulfide, lead oxide, tin oxide or fluorite.

4. A process as claimed in claim **1** wherein said particles have wear resistant properties.

5. A process as claimed in claim **4** wherein said particles are a metal, a metal oxide, a metal nitride or a metal carbide.

6. A process as claimed in claim **1** wherein said particles are metallic.

7. A process as claimed in claim **1** wherein said particles are non-metallic.

8. A process as claimed in claim **1** wherein said binding agent is an epoxy or phenol resin.

9. A process as claimed in claim **1** wherein said particles are formed of a size between 0.3 and 1.5 mm.

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