

POWDROUS LUBRICANTS FOR PLUNGER DEVICE

This invention relates to powdrous lubricants used for being blown onto plunger tips, or onto interior surfaces of bearing sleeves for plungers, as used in diecasting machines.

Diecasting allows continuous manufacture of products at high volume and with high accuracy, so is widely utilized for manufacturing various parts of motor vehicles, electrical apparatus, household goods and building products, etc. In diecasting, molten metal is forced into a die for moulding at high speed by a plunger. So that the plunger tip will slide smoothly in its sleeve, and to reduce wear, a lubricant is required. Lubricants for such plungers are generally classifiable as oily lubricants or water soluble lubricants. A common base includes a mineral oil, a natural fat, a wax, and a synthetic lubricating oil. One or more agents effective to counter extreme-pressure and/or resist abrasion are normally added to oily lubricants, and water and a surface active agent are added to the water soluble lubricants.

In recent years, demands have grown for improving diecasting as to quality of product, decrease in cost, reduction of defective products, reduction in weight, etc, all as part of desired progress of diecasting technology and improvement in alloys used. We believe conventional lubricants militate against satisfying such demands.

Both of oily lubricants and water soluble

lubricants contribute to defects inside products due to generated gas, leading to problems such as a weakening of pressure resistance, loss of mass where needed, and failure to cope with required high working cycles. Water soluble lubricants have particular problems in terms of occurrence of defects inside the products, due to water content, and various costs including capital investment have been required for necessary waste water treatment in order to prevent water pollution effects after use. Oily lubricants have particular problems including in terms of safety due to a high possibility of smoking and flammability, leading to contamination of working environment. Consequently, demand for new types of lubricant for diecasting plungers increases.

This invention results from consideration of the above-mentioned circumstances, and consequent detailed studies and systematic experiments, particularly for a lubricant enabling production of diecast products of high quality without adverse environmental conditions and with good workability.

According to this invention there is provided powdrous lubricant for a plunger device consisting of a powdered or granulated lubricant base material including an inorganic compound as a lubricant in its solid state, and an organic compound giving adhesion capability to the lubricant base material, both compounds having a comminuted or granular form, said organic compound being liquid-form or paste-form compounds consisting of one or more of synthesis esters, natural fats, mineral oils, silicon oil,

polyphenyl ether, polyalkylene glycol, and ethylene-propylene copolymer which are rendered particulate or granular by a cyclodextrin compound.

A powdrous lubricant for plunger mechanisms

positively contributes to reducing occurrence of internal product defects, fire risks, and environmental pollution, as well as enhancing smoothness of plunger sliding.

Specific implementation for this invention is now described, by way of example, including in relation to the accompanying drawing in which the single figure is a sectional view showing lubricant application to a plunger mechanism.

In Fig. 1, plunger device 1 serves for forcing molten metal into dies in diecasting work, and comprises a sleeve 11 shown connecting into a stationary die part 2, and a plunger tip 12 shown sliding in the sleeve 11 to act on molten metal supplied through a feed port 11a, into the die, which is further shown with a moving-side die part 3.

Powdrous lubricant hereof for such a plunger device is used by being sprayed onto a surface of the plunger tip 12 and/or onto an inside face of the sleeve 11 through the filling port 11a by means of any suitable spray system, including an electrostatic spray system. Fig. 1 shows a nozzle 4 for spraying.

Powdrous lubricant hereof with a base material of comminuted or granular ~~for other particulate~~ form is hard to react and generates scarcely any gas even when heated strongly. Blow holes due to gas are thus not produced inside the product. Further, powdrous lubricants hereof comprise inorganic and organic compounds and do not include water or any other substance having a low

molecular weight ~~(and boiling point)~~. Generally, occurrence of defects inside products is substantially avoided and quality of products improved.

Particulate lubricant hereof without water content avoids water contamination after use (as has applied to water soluble lubricants) and avoids contamination of the working environment (as has applied to oily lubricants). Expenses of waste water treatment and environment preservation are thus reduced. Absence of oily substances means there is no risk of smoke and fire, thus reduced safety requirements.

Powdrous lubricants hereof positively separate the plunger tip from its sleeve by at least a space corresponding to grain size of the lubricant base material between surfaces of the plunger tip surface and the sleeve, to which the lubricant adheres. Accordingly, preventing the plunger tip from contacting the sleeve means risks of seizure and abrasion during sliding are reduced, sliding motion is smooth, and workability is improved.

It is found effective to use a containing rate of organic compound to inorganic compound in a weight percent range of 0.1 to 50. Then, there is a sufficient adhesion effect for the inorganic compound relative to the plunger tip surface or the sleeve interior, i.e. for a value not smaller than 0.1 weight percent, and significant internal defects in products from gas generation require a value larger than 50 weight percent.

However, no specific limitations apply to the lubricant base material so long as it is an inorganic compound usable in its solid state. Generally, boron nitride, fluoride, talc, mica, metal oxides, silicon nitride, boron compounds, sulphur compounds and phosphorus compounds have been found satisfactory, and are thus considered satisfactory, even preferred, for the lubricant base material. However, other solid lubricants such as already well-known, for example graphite, molybdenum disulphide, etc. can be used. Such inorganic compounds can be used singly or in combinations of two or more compounds, all in powdered or granular form.

The organic compounds comprises a liquid-form or paste-form compound rendered particulate or granular by a cyclodextrin compound, this liquid-form or paste-form compound consisting of one or more of synthesis esters, natural fats, mineral oils, silicon oil, polyphenyl ether, polyalkylene glycol and ethylene-propylene copolymer.

The organic compound(s) is/are mixed with the lubricant base material, both the lubricant base material and the organic compound being in powdered or granular form. The organic compounds can be used singly or by combining two or more of the above-mentioned compounds.

Powdrous lubricant comprising an admixture of inorganic compound(s) and organic compound(s) is made into a form where the lubricant base material has powdered or granulated form.

Then, occurrence of defects inside diecast products of aluminium alloy or zinc alloy etc. produced by diecasting can be positively avoided so as to improve quality and workability in diecasting, and reduce contamination risks during and after use.

A lubricant that is optimum for use in particular diecasting work can be formulated by combining two or more kinds respectively from among the above-mentioned organic compound and inorganic compound.

A specific example of a powdrous lubricant hereof is now described, by way of example.

The exemplary following lubricants (A) to (C) were prepared, aluminium alloy was cast by the diecasting method using these lubricants, and items tabulated were compared and examined.

In Example (A) of this invention, an organic compound in which natural fat was powdered cyclodextrin compound was used.

Example (A):

Mixture of 20 parts of boron nitride, 60 parts of talc, 5 parts of sodium borate, and 15 parts of powdered natural fat.

Example (B):

Boron nitride only (comparative).

Example (C):

Oily lubricant available commercially and composed of mineral oil, natural oil and wear resisting agent (comparative).

[Table]

	This invention		Example	
		(A)	(B)	(C)
Adhesion ability		○	×	○
Expansion ability		○	—	○
Lubrication ability		○	—	○
Effect for preventing occurrence of defects in product		○	—	△
Effect of preventing environmental pollution in field due to smoking and contamination		○	—	△

— : Unmeasurable

× : Completely nothing

△ : Small

○ : Ordinary

● : Large

CLAIMS

1. Powdrous lubricant for a plunger device consisting of a powdered or granulated lubricant base material including an inorganic compound as a lubricant in its solid state, and an organic compound giving adhesion capability to the lubricant base material, both compounds having a comminuted or granular form, said organic compound being liquid-form or paste-form compounds consisting of one or more of synthesis esters, natural fats, mineral oils, silicon oil, polyphenyl ether, polyalkylene glycol, and ethylene-propylene copolymer which are rendered particulate or granular by a cyclodextrin compound.

2. Powdrous lubricant according to claim 1, wherein the organic compound has a weight percent relative to the inorganic compound in the range 0.1 to 50.

3. Powdrous lubricant according to claim 1 or claim 2, in which the inorganic compound consists of one or more of boron nitride, fluoride, talc, mica, metal oxides, silicon nitride, boron compound, sulphur compounds and phosphorus compounds.

4. Powdrous lubricant substantially as herein described with reference to Example A.



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