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APPLICATION OF DIE CASTING: A REVIEW PAPER

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ABSTRACT

The basic purpose of this paper is to cover all the aspects and techniques regarding Die casting process that is being used to cast so many object that are used in our daily life. In this article all the scientific techniques associated with die casting will be covered and further the advantages and disadvantages of die casting will also be covered in this paper. Die casting and its application is very wide so in this paper the future supplication and challenges of die casting will also be covered so that the die casting process can be understood with deep knowledge. This paper also consists of machine that is required to perform die casting process and also sub process related to die casting. Further the future scope of die casting process is also covered in later section so that reader have clear cut concept that what kind of improvement does die casting need.

KEY WORDS

Brief about die casting process, die casting machines, different process related to die casting, die casting dies, advantages, limitation, future scope.

INTRODUCTION

Die casting involve casting of different intricate products by injecting molten metal with high pressure in metal dies that are reusable after the solidification of molten metal by spraying water or by another method(note: water is not directly sprayed on the molten metal so as to avoid any type of casting defect) casted product is ejected out from dies. After little machining or no machining the casted product is ready for use with bearing high strength and another enhanced mechanical properties. The most important advantages of die casting are that one die can be used to produce large number of casting products and there is also time saving because preparation of pattern for each and every single casting is not needed. Dies are arranged in such a manner so that with the pressure of molten metal it can adjust its shape according to requirement.

Die casting is termed as permanent mould casting because die casting process use reusable metallic dies. In die casting as the molten metal injected into die at very high pressure as the pressure compared to permanent molding, die casting is also termed as pressure die casting.

With the help of die casting process any intricate shape, narrow shape and any other complex shapes can be casted with high accuracy without any casting defects, so die casting process is far

better than conventional casting process which involves casting defects and consume more time and they are also not suitable for mass production.

HISTORY OF DIE CASTING

High pressure die casting(HPDC) was invented in year 1964 in Japan by Japan society for die casting, later on this casting process was claimed with different name as united states says it is casting for die casting, casting for die was claimed by British as pressure die casting but basic principle associated with pressure die casting remains the same.

HOW DIE CASTING IS PERFORMED?

Die casting setup consist of two parts. One part is called stationary half or covered die which is basically fabricated with die casting machine. On the other hand another or second part or die is called moving half or ejector die, that is capable of performing motion and used for extraction of casted products. The cycle of casting starts when two die are apart from each other and lubricant is pumped into die either by manual process or by automatic or semi automatic process so that casting cannot stick to die.

Required amount of molten metal is pumped into metallic die and after the solidification of molten metal the casting is extracted out from die and the product is ready for other manufacturing operation. The die casting setup also consists of cooling chamber that is used to transfer or extract heat from molten metal so that the solidification time can reduced and casting can be performed at higher rate.

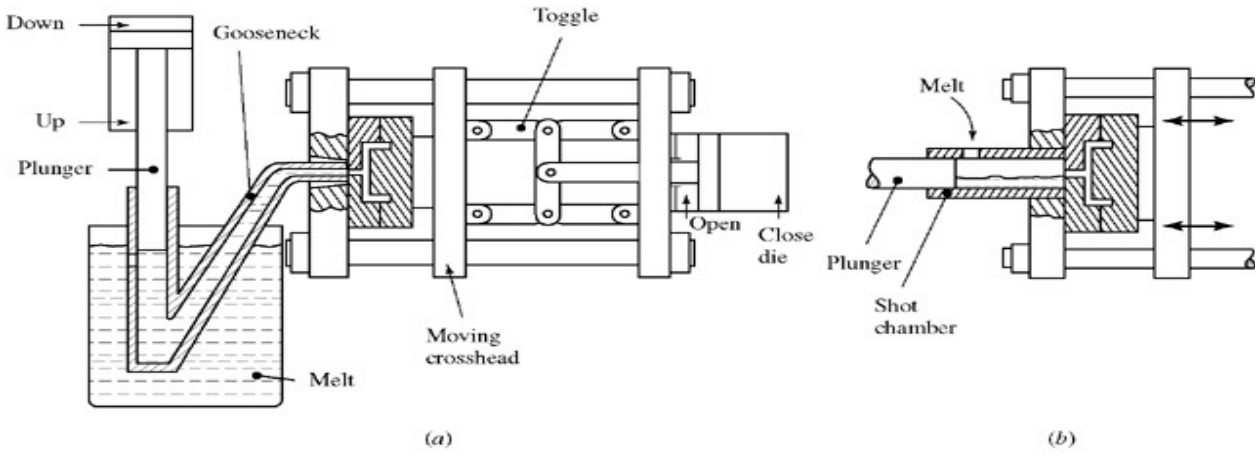
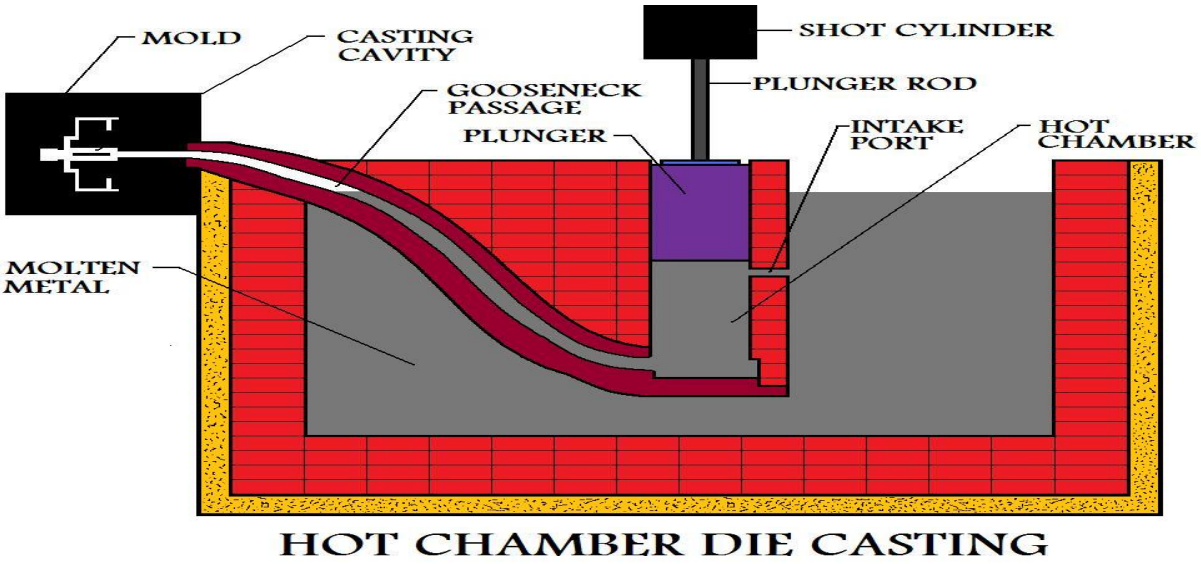


Fig.1.Die casting process setup

The die casting machines is of two types:

1. Hot chamber die casting machine,
2. Cold chamber die casting machine.

Taking about difference between these two die casting machine the in hot chamber die casting machine the chamber which hold the molten metal is integrated with die casting machine but in cold chamber die casting machine the scenario is quite different , in cold chamber metal is



melted into separate furnace and then poured into metallic die at high pressure.

Fig.2. Hot chamber die casting process

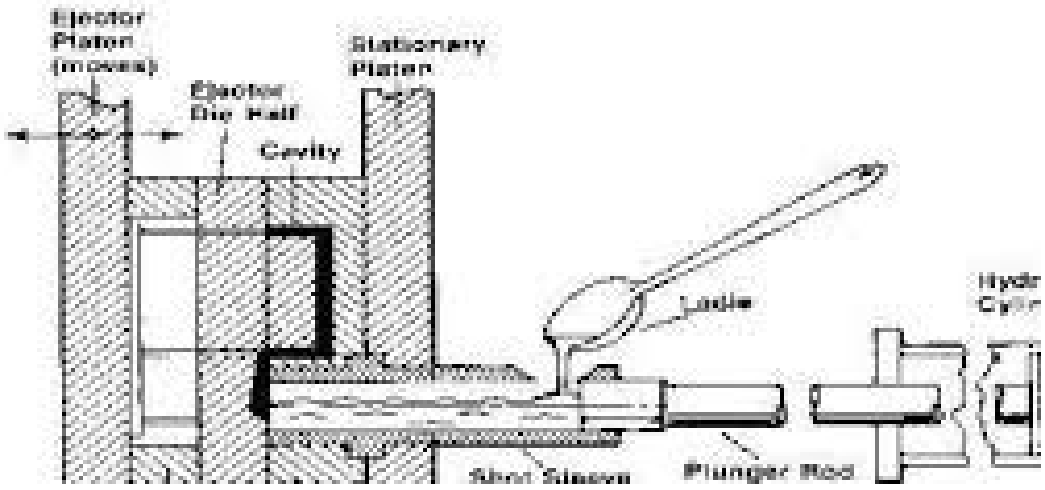


Fig.3.Cold chamber casting process

DIE-CASTING DIES

The die consist of two parts, first one is stationary or cover die which produce no motion and second one is ejector die which is basically fixed to moving platen of die casting setup.cover die consist of sprue which is also called biscuit,runner or gates. It is in contact with the gooseneckas it was shown in fig.1,or in the case of hot chamber die casting process and it is in contact with shot chamber as we can see in cold chamber process.

Movement of ejector pin with movement of die allow the casting to free from ejector pin and producing final casting. Taking about the number of ejector pin then it should be sufficient so that the casted product can be ejected from die without any type of defect or distortion. The ejector pin placed in the that position so that pin mark left on the casting side.

Types of cores used in die casting are made up of metal and it is classified into two types and they are as follows:

1. Fixed cores : which are fixed to die half. These cores are parallel to the movement of dies.
2. Moving cores: they are removed before casting product is led out of die. These cores are not parallel to the die movement.

It is necessary to provide the overflow in the parting plane for the entering or first metal which is normally at low temperature or cold, as by entering the die cavity it solidifies. The overflow is opulence and it must be avoided in the design of die casting, overflow is limited with small component and it purpose is to provide enough heat input to die, so that there is no any defect like cold shuts as it happen in other casting process. Overflow can be used in another way to positioned the ejector pin so that the impression of ejector pin on casted surface can not be occur and desired shape of casting can be produced.

The time required to produce casting from die casting method is very small(cycle time). Temperature of dies rises and it happen in the vulnerable section such as sprues or the heavy section of casting. This temperature is too high so as to maintain precise temperature suitable for casting, water and other coolant is circulated in the vulnerable section.

Dies materials

1. For zinc alloys: AISI P20 for low volume and H13 for high volume.
2. For aluminium and magnesium: H13 and H11 are commonly used.
3. For copper alloys:H20,H21 and H22 are common die materials.

ADVANTAGES

1. Due to movabable dies it is quite easy to produce intricate shape as in case of permanent mould casting.
2. Very less or no chances of defect like misrun because molten metal is injected at very high pressure inside dies.
3. It is used for mass production(250 pieces per hour).
4. Very good surface finish can be obtained of order of 1.1 micron can be achieved.
5. Precise tolerance like +0.07 mm can be obtained as compared to other conventional casting process.

DISADVANTAGES

1. Casting can not be performed for all sizes or maximum size of casting is limited. The normal size is from 3.5 kg to maximum 14.5 because the limitation of setup.
2. Die casting is not suitable for every material and thus performed for limited materials like, zinc, aluminium, magnesium, copper alloys etc.
3. Due to air trapped inside the die cavity and thus some casting defect occurs.
4. The installation cost is quite high than other casting process. Economical only when it is set up for large production.

APPLICATIONS

The application of pressure die casting is very wide like:

1. Carburetors
2. Crank cases
3. Megnetos
4. Handle bar housings
5. Some parts of scooters, mopeds, motorcycles, headlamp bezels.

FUTURE SCOPE

Future of high pressure die casting is seems to be better than the other casting process because of its mass production rate and can be used to produce complex shape with less casting defects, but there is research needed regarding this die casting process so as to enhance its productivity and to install additional features so that its efficiencies can be improved more. It is also necessary to make the die casting process economical and to reduce its installation cost.

CONCLUSION

In this paper the basic concept as well as advanced concept regarding high pressure die Casting (HPDC) is explained so that reader must know what the pressure casting actually mean and what is working principle of pressure die casting. Further in this paper the advantages of pressure die casting is explained over conventional casting and limitation is also explained so that this limitation can be removed in future to make this casting process more precise and make it useful for large applications. Application of die casting is in different fields like automobile, household, and thus due to this versatility high pressure die casting (HPDC) is preferred over other casting process.

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