Die casting

The die casting or pressure die casting may be *defined as that casting which uses the permanent mould and used pressure to molten metal is introduced into it.* The casting produced by die casting method require very little machining. The dies are usually made in two parts which must be locked securely before molten metal is forced into then under high pressures of 7 to 700 MPa. The pressure may be obtained by the application of compressed air or by hydraulically operated piston. The ferrous alloys are not yet commercially die-casted because of their high pouring temperature.

Typical parts made through die casting are motors, appliance components, hand tools, and toys. *There are two types of die casting machines; hot chamber and cold chamber.*

1. Hot Chamber

The hot chamber die casting machine of the submerged type is shown in Fig 23. The molten metal is forced in the die cavity at pressures from 7 to 14 MPa. The pressure may be obtained by the application of compressed air or by a hydraulically operated plunger.

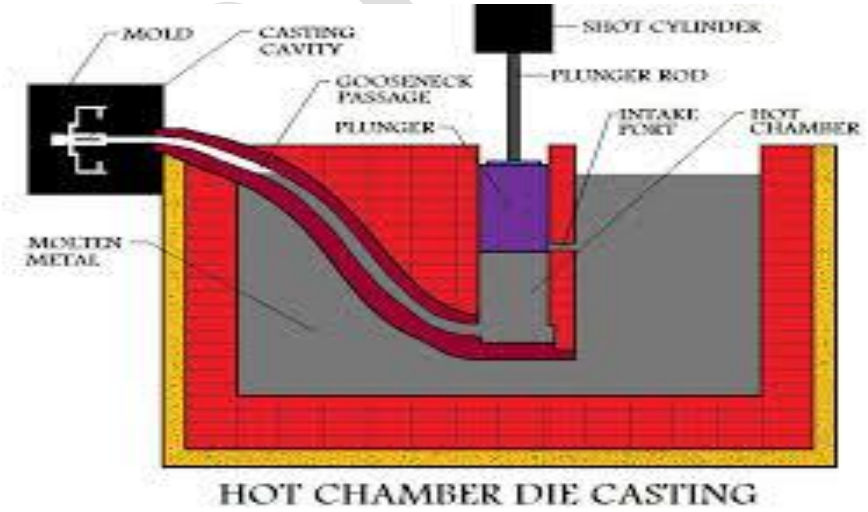

Fig.23 Hot Chamber of Die Casting (hydraulically plunger)

In the first method, the goose neck is lowered to filling of the molten metal. It is then raised and connected to the die neck. A suitable mechanism is provided to raise and lower the goose neck. The compressed air at a pressure of about 2.5 to 5 MPa is now injected into the goose neck to force the molten metal into the die. In the second

method, the plunger acts inside a cylinder formed at the end of the goose neck, which is immersed in a pot of molten metal. A port is provided near the top of the cylinder to allow the entry of the molten metal. The downward stroke of the plunger pushes the molten metal through the goose neck into the die. The hot chamber die casting machine is used for casting zinc, tin, lead and other low melting alloys.

2. Cold Chamber

In cold chamber die casting machine, the melting unit is usually separate and molten metal is transferred to injection mechanism by ladle. The pressure on the casting metal in cold chamber die casting machine may vary from 21 to 210MPa and in some cases may reach 700MPa. The greater pressures are required for semi-molten alloys to compensate for reduced fluidity resulting from low pouring temperatures. This process is used for casting aluminum, magnesium, copper base alloys and other high melting alloys. The cold chamber die-casting machine, as shown in Fig. 24 consists of

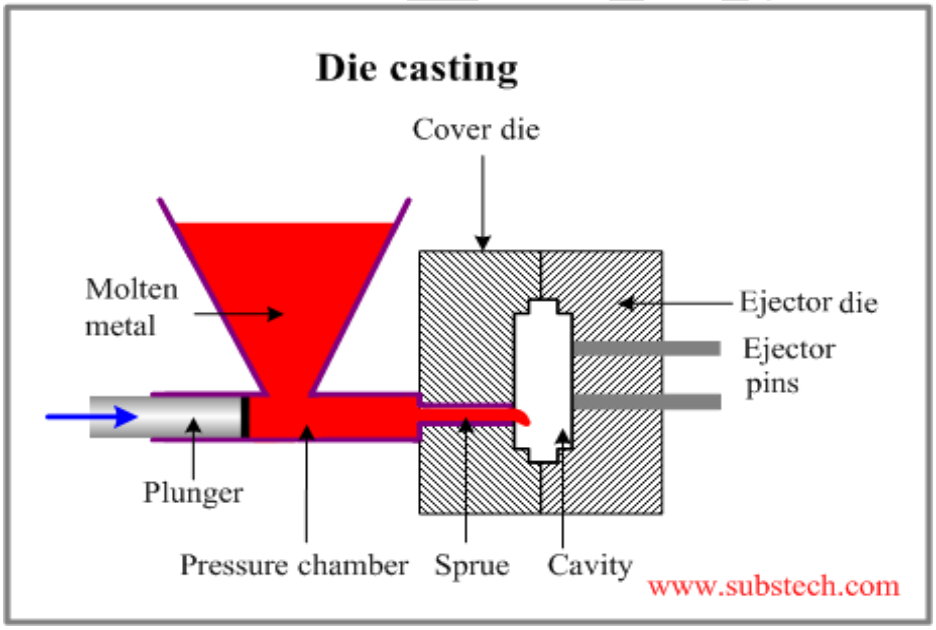

Fig.24 Cold Chamber of Die Casting

a pressure chamber of cylindrical shape fitted with a piston that is usually operated by hydraulic pressure. A measured quantity of molten metal is brought in a ladle form the melting pot to a chamber and forced into the closed die sections by applying hydraulic pressure upon the piston. The cycle is completed in the following four steps:

1. The metal is loaded in the chamber.

2. The plunger forces the metal into the die cavity.

3. After the metal solidifies, the die is opened.

4. The casting, together with the slag of the excess metal is ejected- form the die.

Advantages

1. The rapid and economical production of large quantities of identical parts can be achieved.

2. The parts having smooth surfaces and close dimensional tolerances may be produced, very little machining is required.

3. The parts having thin and complex shapes can be casted accurately and easily.

4. The die casting requires less floor area than is required by other casting processes.

5. The castings produced by die-casting process are less defective.

6. The rapid cooling rate produced high strength and quality in many alloys.

7. The die is used more than once and life for longer periods. For example, the life of a die for zinc base casting is up to one million castings, for copper base alloys up to 75,000 castings, and for aluminum base alloys up to 50,000 castings.

Disadvantages

1. The cost of equipment and die is high.

2. There is a limited range of non-ferrous alloys which can be used for die castings.

3. The die castings are limited in size.

4. It requires special skill in maintenance.

Centrifugal casting

In centrifugal casting process, the molten metal poured at the centre of a rotating mold or die. Because of the centrifugal force, the lighter impurities are crowded towards the centre of the mold. For producing a hollow part, the axis of rotation is placed at the centre of the desired casting. The speed of rotation is maintained high so as to produce a centripetal acceleration of the order of 60g to 75g. The centrifuge action segregates the less dense non-metallic inclusions near to the centre of rotation that can be removed by machining a thin layer. No cores are therefore required in casting of hollow parts although solid parts can also be cast by this process.

The centrifugal casting is very suitable for axisymmetric parts. Very high strength of the casting can be obtained. Since the molten metal is fed by the centrifugal action, the feeding is simple. Both horizontal and vertical centrifugal castings are widely used in the industry. *Figure 25* schematically shows a set-up for horizontal centrifugal casting process. *Figure 25* typically shows large pipes that are made using centrifugal casting process.

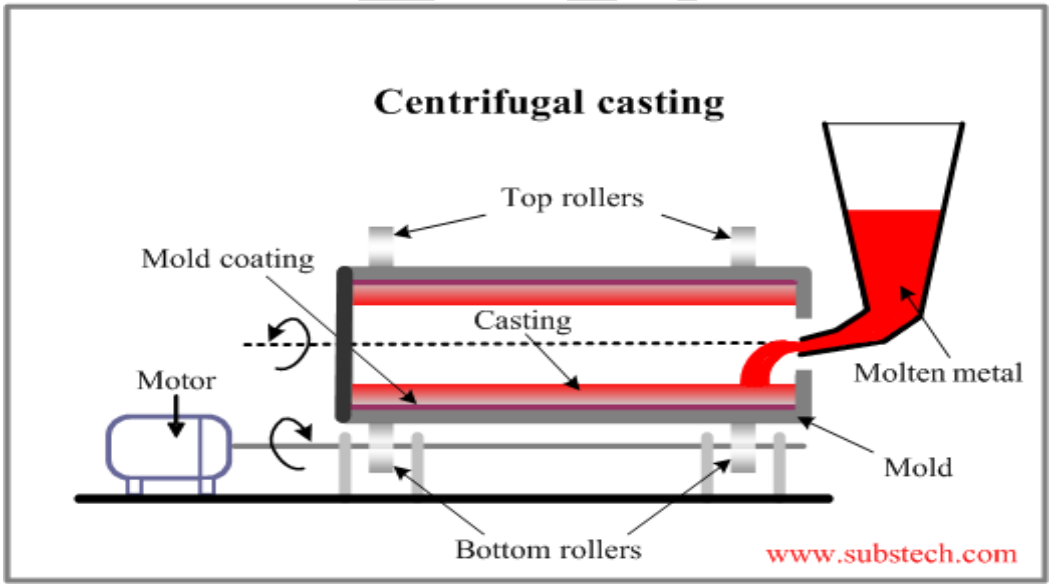

Figure 25 Centrifugal casting process

Features of centrifugal casting

- Castings can be made in almost any length, thickness and diameter.
- Different wall thicknesses can be produced from the same size of mold.
- No need for cores.
- Resistant to atmospheric corrosion, a typical situation with pipes.
- Mechanical properties of centrifugal castings are excellent.
- Only cylindrical shapes can be produced with this process.
- Size limits are up to 3 m diameter and 15 m length.
- Wall thickness range from 2.5 mm to 125 mm.
- Tolerance limit: on the OD can be 2.5 mm on the ID can be 3.8 mm (0.15 in).
- Surface finish ranges from 2.5 mm to 12.5 mm.