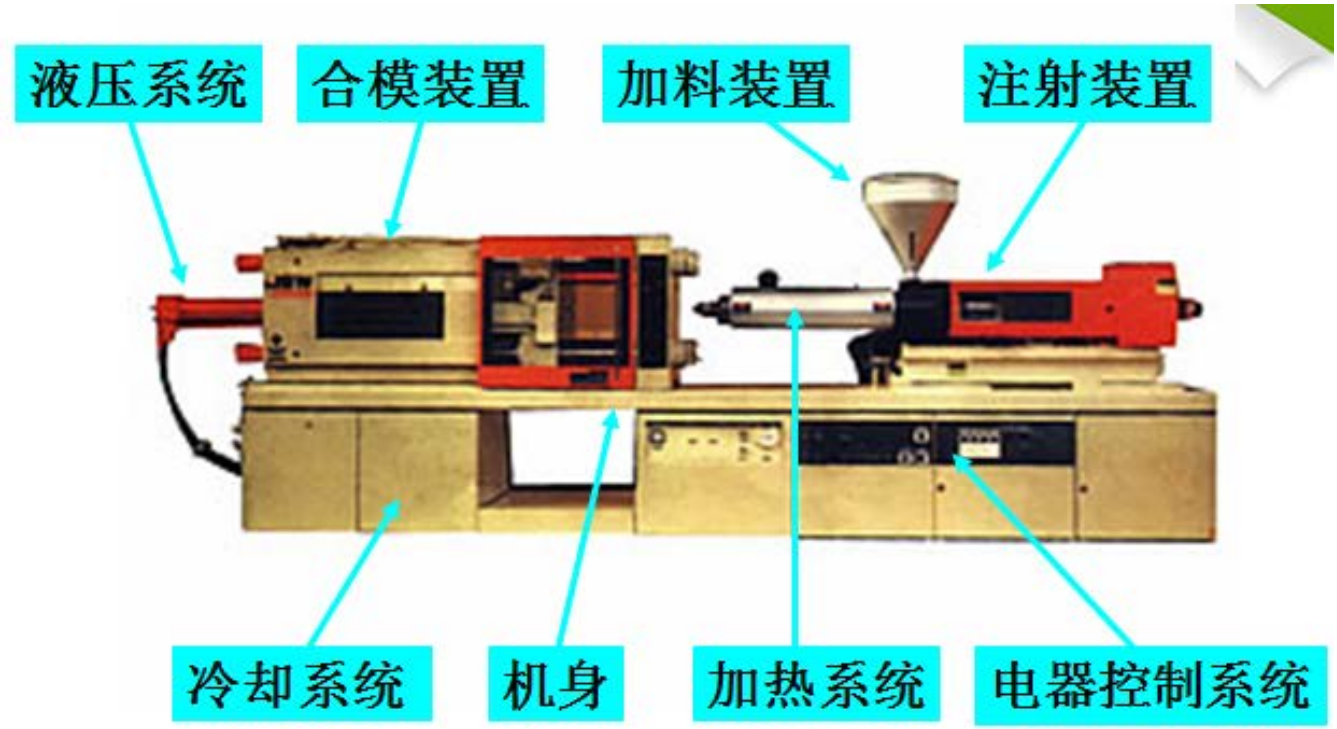
Design and Manufacturing Process of Injection Mold

I. Classification of injection molds

Composition of injection molds

Two major parts:
Movable mold (installed on the movable mold plate of the injection molding machine)
Fixed mold (installed on the fixed mold plate of the injection molding machine)
Prior to injection molding, the movable mold and the fixed mold are closed under the driving of the injection molding machine to form the cavity and the gating system; and the plasticized plastic melt is injected into the cavity by the gating system for cooling solidification, upon cooling solidification, the movable mold and the fixed mold are opened, and plastic parts are ejected by the demolding mechanism.



液压系统	Hydraulic system
合模装置	Mold closing device
加料装置	Clamping unit
注射装置	Injection device
冷却系统	Cooling system
机身	Machine body
加热系统	Heating system
电器控制系统	Electrical apparatus control system

Injection molding principle

Fig. 3-1 shows the principle of the injection molding of the plunger type injection molding machine

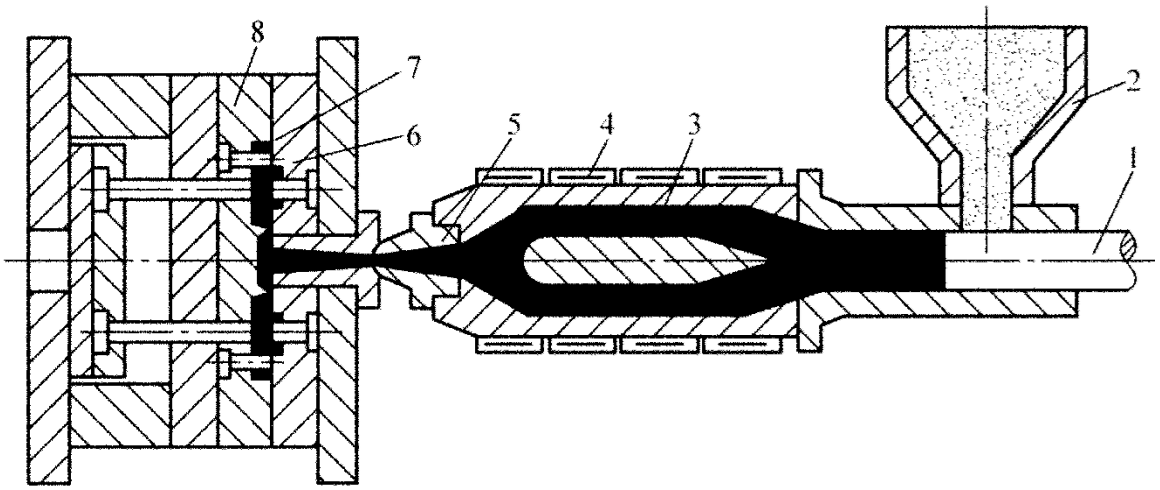


Fig. 3-1 One of injection molding principles

1-Plunger, 2-Hopper, 3-Spreader, 4-Heater,

5-Nozzle, 6-Fixed mold plate, 7-Injection molding part, 8-Movable mold plate

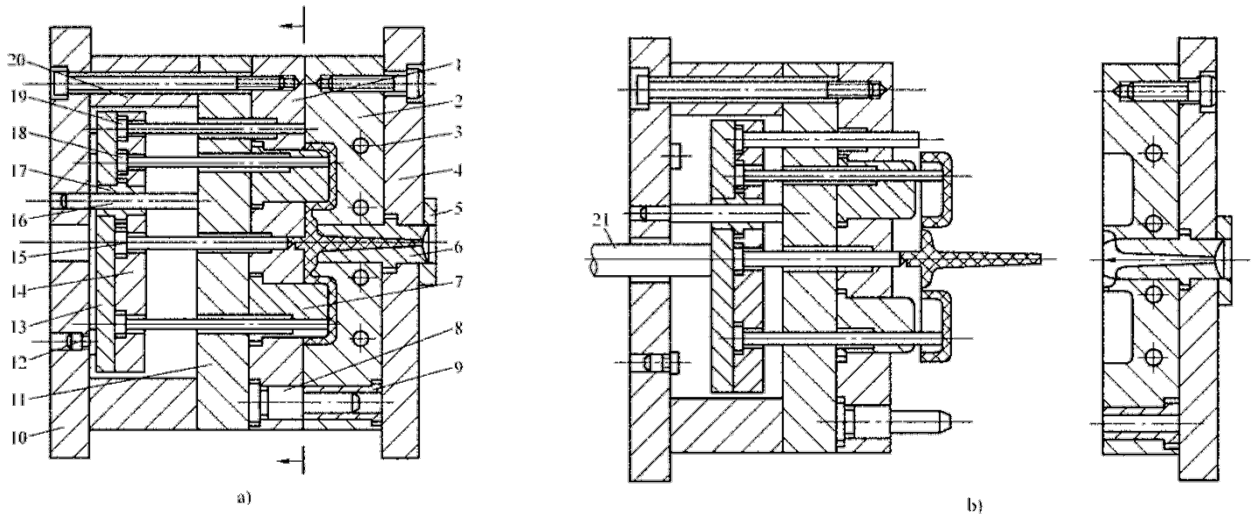


Fig. 4 -1 Structure of injection mold

1-Movable mold plate 2-Fixed mold plate 3-Coolant gallery 4-Fixed clamping plate 5-Locating ring

6-Sprue bush 7-Male mold 8-Guide pillar 9-Guide bushing 10-Moving clamping plate 11-Bearing plate

12-Bearing post 13-Ejector plate 14-Ejector pin retaining plate 15-Sprue puller 16-Ejector guide pillar

17-Ejector guide bush 18-Ejector pin 19-Return pin 20-Cushion block

21-Ejector pin of injection molding machine

1. Formed components and parts Refer to parts or components of the mold, which constitute the cavities of formed products for the mold and come in direct contact with the plastic melt; and after movable and fixed molds are closed, formed parts can determine the internal and external dimensions of injection molding parts.

2. Gating system Refer to the feeding channel from the nozzle of the injection molding machine to the cavity. It is generally composed of main runner, sub-runner, sprue, and cold slug well.

3. Guiding and positioning mechanism Parts that are arranged to achieve accurate guiding and positioning during the closure of movable and fixed molds, such as guide pillar, and guide bushing.

4. Demolding mechanism Refer to a mechanism that ejects plastic parts out of the mold during or upon mold opening. It is generally composed of ejector pin, ejector pin retaining plate, ejector plate, return pin, sprue puller, etc.

5. Side parting and core-pulling mechanism It is used to form plastic parts with side holes or side grooves; and

before plastic parts are ejected out of the mold, it is necessary to implement side parting and pull the lateral core out. The mechanism composed of components and parts that complete the above operation is the side parting and core-pulling mechanism.

6. Temperature adjustment system To meet the requirements of the injection molding process on mold temperature, the mold shall be equipped with the cooling or heating system.

7. Exhaust system To exhaust the original air in the cavity and gas escaped from the plastic melt during injection molding, the exhaust system is arranged in the mold, that is, exhaust is achieved through the air discharge duct arranged on the parting surface, or the fit clearance of ejector pin, and mold insert.

8. Mold base

Classification of injection molds

1. Classified by overall structural characteristics of mold

1) Injection mold with single parting surface

During mold opening, the movable mold is separated from the fixed mold, and plastic parts and the condensates of the gating system are taken out of the single parting surface. It is also called as the double (two)-plate injection mold.

2) Injection mold with double parting surfaces

There are two different parting surfaces, which are used for taking plastic parts and condensates out. A cavity plate (also known as intermediate plate or runner plate) that can make reciprocating motion is arranged additionally between the movable mold plate and the fixed mold plate. It is also called as the three-plate type injection mold

3) Injection mold with side parting and core-pulling mechanism

When there are side grooves or side holes in plastic parts, plastic parts shall be formed with the core or the slider that can make lateral movement.

4) Injection mold with movable formed parts

In terms of the special structures of plastic parts, the mold shall be equipped with movable formed parts; and during mold opening, formed parts can be taken out of the mold together with plastic parts, and then, are separated from plastic parts manually or with the simple tool, which are put back to the mold.

5) Injection mold with maneuverable screw thread unloading

For plastic parts with screw threads, in case of automatic demolding, the rotational threaded core or the mold ring with screw thread can be arranged on the mold, and the actuating device (or special transmission) is arranged through the mold opening of the injection molding machine to drive the threaded core or the mold ring with screw thread to rotate, thereby demolding plastic parts.

6) Injection mold without runner

It means that there are no condensed materials in the runner in the gating system. The injection mold includes the heat insulating runner and hot runner mold for thermoplastic plastics, the warm runner injection mold for thermosetting plastics, and other molds.

2. Classified by capacity of mold cavity

Generally, the injection mold with the capacity of the mold cavity up to 3000cm3 above is called as the large-sized injection mold. The large-sized injection mold is high in difficulty in design and manufacturing, and high in manufacturing costs. It is necessary to deliberately consider the fluidity of the plastic melt, the mechanical properties of the mold, and temperature adjustment system. Customarily, the injection mold with the capacity of the mold cavity of 100cm3 and below is called as the small-sized injection mold. The medium-sized injection mold falls in between them.

II. Typical structure of injection mold

1. Injection mold with single parting surface

2. Injection mold with double parting surfaces

The injection mold with double parting surfaces has two parting surfaces, which is shown as Fig. 4-2

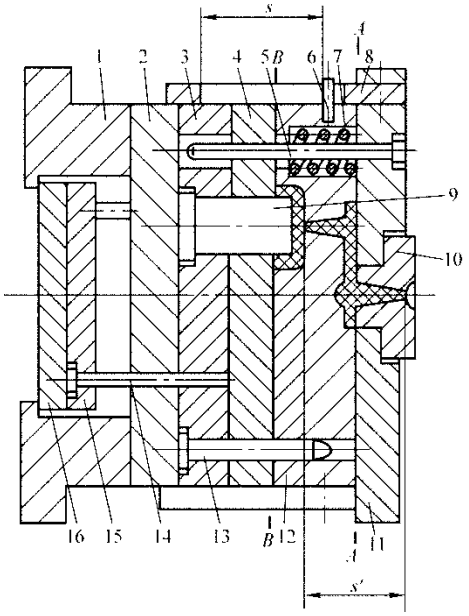


Fig. 4-2 Injection mold with double parting surfaces 1-Mold leg 2-Bearing plate 3-Movable mold plate 4-Stripper plate 5-Guide pillar 6-Spacer pin 7-Spring 8-Puller plate 9-Male mold 10-Sprue bush 11-Fixed mold plate 12-Intermediate plate 13-Guide pillar 14-Ejector pin 15-Ejector pin retaining plate 16-Ejector plate

3. Injection mold with slider angle pin for side parting and core-pulling

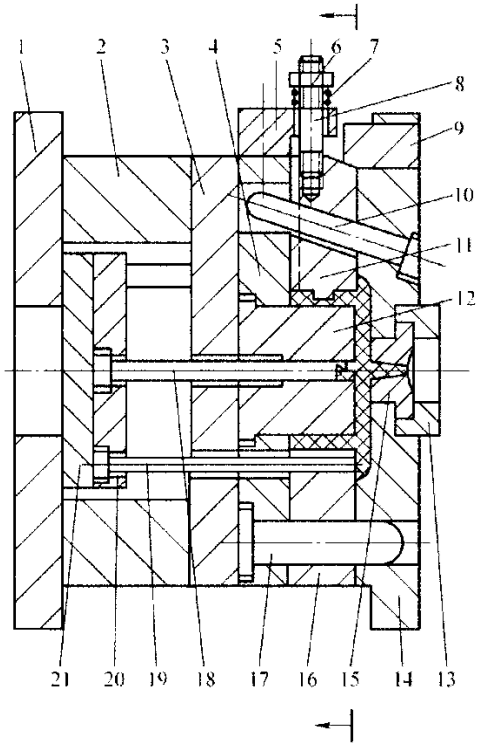


Fig. 4-6 Injection mold with slider angle pin for side core-pulling

1-Moving clamping plate 2-Cushion block 3-Bearing plate 4-Punch-retainer plate 5-Stop dog 6-Nut 7-Spring 8-Slider pull rod 9-Wedge block 10-Slider angle pin 11-Side core slider 12-Male mold 13-Locating ring 14-Fixed mold plate 15-Sprue bush 16-Movable mold plate 17-Guide pillar 18-Sprue puller 19-Ejector pin 20-Ejector pin retaining plate 21-Ejector plate

4. Injection mold with angled-lift splits for side parting and core-pulling

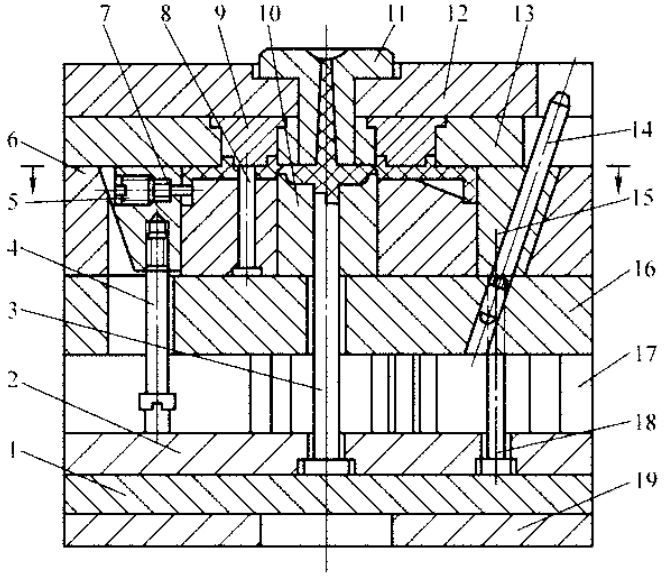


Fig. 4-7 Injection mold with angled-lift splits for side core-pulling

1-Ejector plate 2-Ejector pin retaining plate 3-Sprue puller 4-Limit screw 5-Screw plug 6-Movable mold plate 7-Side core 8-Core 9-Fixed mold insert 10-Movable mold insert 11-Sprue bush 12-Fixed clamping plate 13-Fixed mold plate 14-Sprue puller 15-Angled-lift splits 16-Bearing plate 17-Cushion block 18-Ejector pin 19-Moving clamping plate