

## Stamping Equipment Selection and Mold Structure Design

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*Abstract: The mechanical presses commonly used in stamping processing belong to the category of forging machinery. The mechanical presses are divided into several series according to their structural forms and objects of use, and each series is divided into several groups. The type and specifications of the stamping equipment should be selected to meet the requirements of the designed mold and production. The choice of stamping equipment is an important part of process design and mold design. Reasonable use of equipment has a major impact on the quality of the workpiece, the improvement of productivity, the safety of the operation, and the convenience of the design of the mold. The choice of stamping equipment mainly determines its type and specifications.*

*Keywords: Die structure; Compensation technology; Forging machinery.*

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### 1. INTRODUCTION

The crank press is a crank-driven forging machine that can perform various stamping processes such as punching, bending, drawing, bulging, extrusion and die forging. It is the main equipment of the stamping workshop.

The main technical parameters of the crank press:

- 1) Nominal pressure the nominal pressure of a crank press is the maximum force allowed on the slider when the slider is at a certain distance from the bottom dead center or when the crank is rotated to a certain angle before the bottom dead center. For example, the nominal pressure of the J31-315 press is 3150KN, which refers to the maximum force allowed on the slider before the slider is 10.5mm from the bottom dead center or before the crank rotates to the bottom dead center. Nominal pressure is a major parameter of the press.
- 2) Slider stroke it refers to the distance the slider passes from top dead center to bottom dead center. The size varies with the process application and the nominal pressure. For example, the crank press for punching has a small stroke, and the stroke for drawing is large.
- 3) Number of strokes it is the number of times the slider reciprocates from the top dead center to the bottom dead center every minute and then back to the top dead center. . Generally, small presses and presses for punching have a large number of strokes, and large presses and presses for deep drawing have a small number of strokes.
- 4) Closing height it refers to the distance from the lower plane of the slider to the plane on the table when the slider is at the bottom dead center. When the closing height adjustment device adjusts the

slider to the uppermost position, the closing height is the largest, which is called the maximum closing height; when the slider is adjusted to the lowest position, the closing height is the smallest, which is called the minimum closing height. The range in which the closing height can be adjusted from the maximum to the minimum is called the closing height adjustment amount.

5) Mounting height when the working surface is equipped with a working pad and the slider is at the bottom dead center, the distance from the lower plane of the slider to the plane of the pad is the clamping height. The height of the mold at the maximum closed height state is the maximum mold height, and the mold height at the minimum closed height state is the minimum mold height. The difference between the height of the mold and the height of the closure is the thickness of the backing plate.

## **2. DRAWING DEFORMATION CHARACTERISTICS**

(1) Drawing and its process

(2) Drawing is a process for pressing metal sheets into various rotating or hollow parts. Drawing is also known as drawing, calendaring and stretching. The drawing process is as follows: the die and the bead ring first press around the wool, then the punch bears against the intermediate wool, and the annular pressing material is pulled into the concave mold cavity in whole or in part to form a cylindrical vertical wall.

(3) Characteristics of drawing mechanics

(4) From the drawing process, the annular pressing zone is the deformation zone, and the deformation zone must be a weak zone. The material of the punch top and the gradually forming sidewall are the force transmission zone. It can be said that the drawing process is the process of deformation caused by the force in the deformation zone, and the stress and strain characteristics of the deformation zone are the main basis for determining the deformation property.

(5) Professor Li Shuoben believes that although there are many methods for sheet deformation, there are only two kinds of methods, namely, elongation type deformation and compression type deformation. Due to the drawing deformation, when the annular pressing material of the deformation zone flows into the cavity, the tangential shrinkage becomes short and the radial elongation is long. The maximum principal stress is the tangential compressive stress, and the maximum principal strain is also the tangential compressive strain. So drawing is a compression class deformation.

(6) If the maximum principal stress of the deformation zone is tensile stress, then the deformation belongs to the elongation type deformation, such as the turning hole, the pull type and the concave curve flange, etc., which belong to this category.

## **3. DRAWING DIE STRUCTURE**

(1) Single action drawing die

The single-action drawing die, also known as the flip-chip drawing die, uses a single-action press with the punch and the presser ring at the bottom, the die at the top, and the punch directly on the lower table. The lifting power source of the presser ring is the ejector cylinder below the press is used to obtain the blanking force through the ejector. Figure 2 is the basic structural form. The mold has only three major parts: punch, die and presser ring. Between the punch and the binder ring, it is guided by a wear-resistant plate with oil-containing graphite, commonly known as the inner guide; the die and the die the beading ring is guided by the guiding leg, commonly known as the outer guide.

Fig. 1 is a drawing die guided by a plug-in guide plate, which has a simple structure and a low cost, and is suitable for forming a shallow drawing piece, and is widely used in the production of a small-sized modified car. The top plate No. 2 in the figure is only used for parts without a draft angle, and is usually integrally cast with a die.

Figure 2 is a simple drawing die with a chamfered corner. It is drawn with a square block. The corner scrap is too large, which affects the forming. The mold cuts the corner scrap and saves a set of blanking die. Since the trimming gap is small, the mold needs to adopt a double guiding structure of the guiding leg and the guiding pillar guide sleeve to improve the guiding precision of the mold

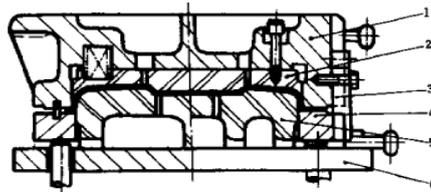


Fig 1

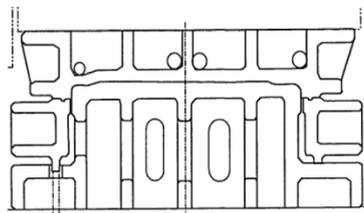


Fig 2

#### (2) Double acting drawing die

The double-action drawing die, also known as the dressing drawing die, uses a double-action press with the punch and the presser ring on the upper side, the die is on the lower side, the presser ring is mounted on the outer slide of the machine tool, and the punch is mounted inside the slide. On the block, when forming, the outer slider drives the presser ring to descend first, and the wool is pressed tightly on the concave die surface, and then the inner slider drives the punch to descend, and the wool is extended into the cavity of the cavity, and the wool is in the convex die and the concave. Under the action of the die and the crimping ring, the large plastic deformation is completed. Figure 5 is the basic structural form. The mold consists of five major parts: punch, die, presser ring, punch pad and presser ring. The structure is more complicated. The profile of the crimping ring is large. It looks like a big brim, and it is more difficult to install and debug the mold. Figure 6 shows the inner guide of the punch and the binder ring, and Figure 7 shows the outer guide of the binder ring and the die. The pressing edge does not rely on the elastic member to apply force, but relies on the machine tool slider to transport the work to ensure the gap between the upper and lower molds to prevent smashing.

In the early assembly of the press line, the first machine used a double-action press for draw forming. Now that the single-action press has been used, the single-action press has a large pressure at the ejector cylinder and can provide sufficient pressing force.

#### 4. RESONANCE COMPENSATION TECHNOLOGY

The blanking ring is the structural member with the worst rigidity and the maximum force of the drawing die. In the past, the size of the design was very random and there was no specification. This paper suggests focusing on the height  $H$  and the width of the hole width  $W$ , see Figure 17 and Figure 18, to determine the method:

$$H \geq 0.15L \quad \min H = 200,$$

$$W \geq 0.75H \quad \min W = 150,$$

Among them: L----type hole maximum length mm.

The above dimensions are suitable for the case where the drawing height is about 50 to 80 mm. When the drawing height is increased, it should be properly adjusted, that is, 50% to 75% of the value of the drawing height is added to the height of the bead ring, and W is increased according to the height. 75% of the calculation.

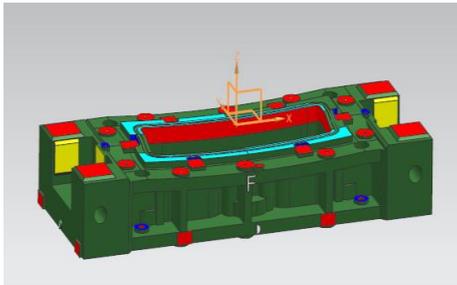


Fig. 3 Blanking circle plane

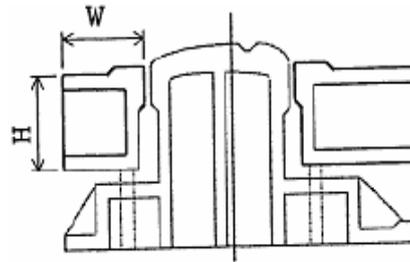


Fig. 4 Section

## 5. CONCLUSION

The die life of the workpiece is at the same level in the same product, the workpiece DC-04 is easy to obtain, the comprehensive performance is good, the price is cheap, the processing performance is good, and the workpiece can meet the requirements easily, and the workpiece can be easily produced. The cost is also low, and there is a large profit margin, so this design meets the requirements in terms of economy.

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