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Die Structural Design Features Based On the AD

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***Abstract:** User demands for the die is the function. Actually, a user to buy the mold is the function of mold rather than the mold itself. Then, it needs to be abstract the functional requirements and transform into actual mold structure. With the help of AD to solve the problem of functional decomposition and structure solution, and an example for the carriage dies structure design.*

Keywords: AD, stamping die, the functional of the structure, design.

1. AD in the "s" word map

Axiomatic design MIT, a design decision method, was proposed by professor Suh in the middle of 1970s. Axiomatic design is different from other design methods, it needs to take full account of the relationship between the two domains, and then complete the final product design.

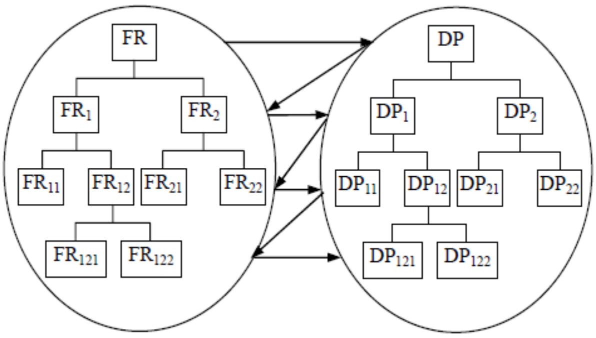

Figure 1: word die structure design of the mapping structure diagram

2. Die Functional Decomposition

2.1 Functional Decomposition Tree

To achieve the conversion of functional structure, first of all, functional decomposition is need to be done. Analysis of the demand to obtain total functionality of the system. Under normal circumstances, you need to devised function into multiple simple, relatively easy to achieve sub-functions, from sub-functions start to achieve sub-function principle structure, then combination it reasonable and orderly, you can get the final structure of die system design. A functional decomposition product always begins with function, with the help of total functional decomposition tree to division it into the sub-function or functional elements. The results of the decomposition as shown in Figure 2.

2.2 Based on TRIZ law of completeness of the functional

Decomposition of the die structure design is the actual form of moulds, and demand function is the abstraction of user needs, so in the design of die structure needs will take the user demand as constraint, with the analysis of general user demand, expressed as Cs, and structural DPS demands with the functional requirements of FRS and constraints requirements CS to express. According to the function decomposition of die structure, the stamping die function has the same six functions in the decomposition, so the law of completeness in the TRIZ technology system evolution law is adopted, According to the requirement of function (FRs), the user demands can be abstracted by the stamping die structure as the functional requirement(FR_0): A variety of molding functions, and its decomposition, Decomposition into process forming function(FR_1),FR_2 Forming function for auxiliary. According to TRIZ theory, a complete technical system has to include four functions: power device, transmission device, actuator and control device. And for stamping die can be a variety of molding functions in accordance with the law of the completeness of FR_1, FR_2 to make further decomposition to decompose, constitute a complete mold system. Take these two functions into FR_{11} as work function, FR_{12} as the function orientation and FR_{13} for loading and unloading material ejection function decomposition, FR_{21} as guiding function and FR_{22} as support clip to function, FR_{23} as fastening function, and continue down decomposition, the decomposition until not so far. The decomposition process is shown in figure3.

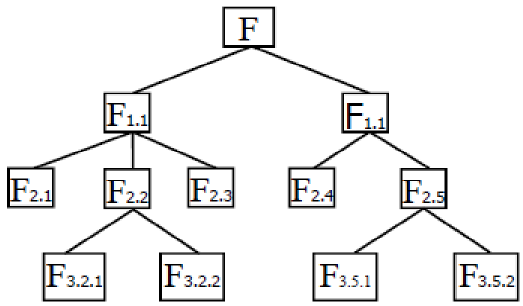

Figure 2: Functional decomposition

3. Function structure design of stamping die

3.1 Decomposition of stamping die structure

Based on AD theory, in order to realize the transformation from function to structure the structures corresponding to function are expressed. So it is necessary to structure of the stamping die is decomposed as shown in figure 3-1. For stamping die, according to their different functions in general can be divided into the following several parts: molding parts, positioning parts unloading pushing parts, guiding parts, bearing and fixed components. Mold of the main for molding parts and positioning parts and unloading unloading components, we generally referred to process components;

and other components is only an auxiliary mold to complete the work, so called auxiliary components, and each component specific decomposition as a functional element corresponding to the structure element, concrete structure decomposition is shown in Figure4.

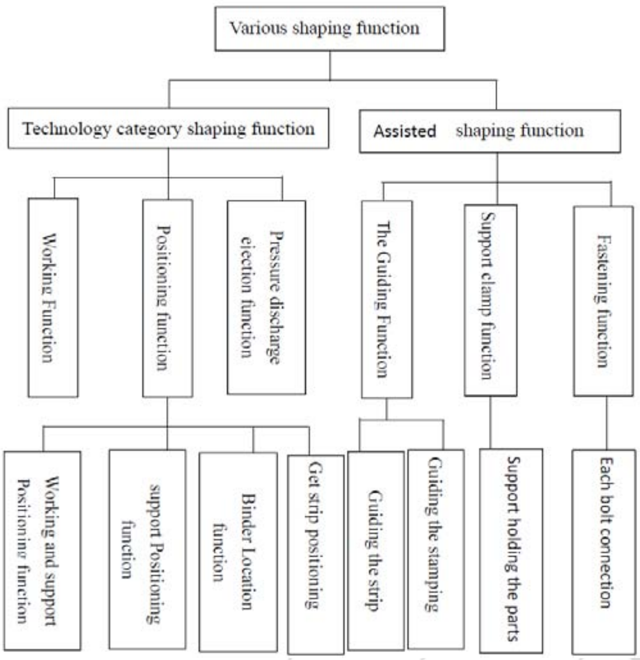

Figure 3: Stamping die completeness of functional decomposition tree

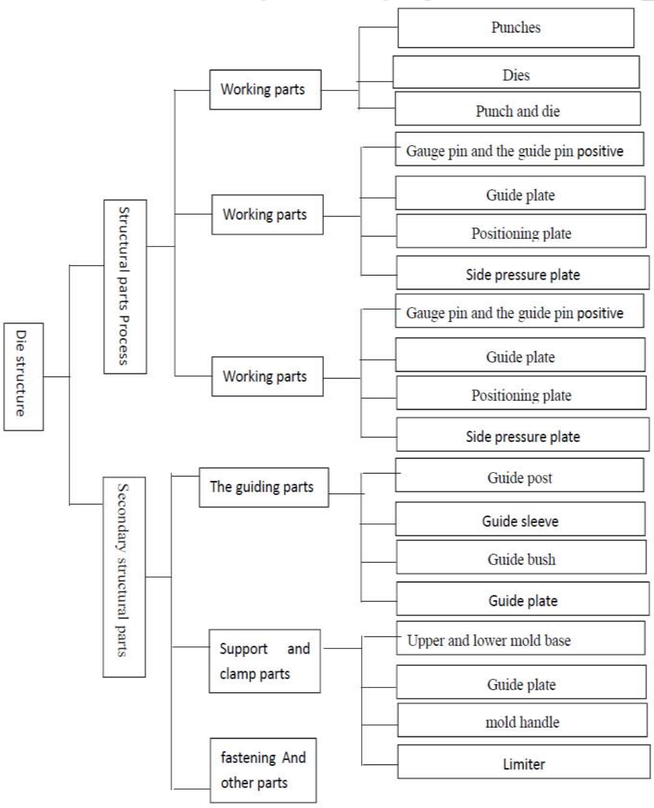

Figure 4: Die Breakdown Structure

3.2 Structure Selection

According to the requirement of Cs: The die structure design of User demand partial constraint or Constraint between systems conduct as the boundary of the design. combined with the characteristics of die structure, The structure may be one or more of the structural elements of the last one, which is determined by the demand. Therefore, at this stage can be lead into Mold user requirements Cs, As a design parameter DPs selection of the basic constraints, which can be decomposed as follows: C_1, good reliability, C_2 simple structure, C_3 high efficiency, C_4 low cost, C_5 good operability, C_6 convenient disassembly and maintenance. But the selection of the die structure is determined by features of product parts. Outstanding demand as a function of the key parts of constraints, here mainly refers to the precision requirement: C_7 no precision and C_8 accuracy requirements. According to the word mapping, there is a mapping relationship between design parameters DPs and function FRs, which will be affected by the constraints of the Cs, So the parameters can be designed to be more reasonable and meet the needs of users.

According to the structural characteristics of the stamping die, for the function of FR, provided by a number of design parameters DP, and under the influence of the constraint conditions Cs, selected the reasonable design parameters. Its DP according to FRs and Cs select the appropriate DPs method as shown:

1 The choice of the assembly structure

(1) no accuracy requirement

Function （FRs）	constraint （Cs）	structure（DPs）
FR_1 the function of molding technology	C_1 Good reliability C_2 Simple structure C_3 High efficiency C_4 low cost C_5 Good maneuverability C_6 Disassembly easy maintenance	DP_{11} Working parts DP_{12} Positioning parts DP_{13} Pressure, discharge, pushing parts
FR_2 Assisted molding function		DP_{22} Support, clamping parts DP_{23} Fastening parts

(2) Accuracy Requirements

（FRs）	Cs	DPs
FR_1 the function of molding technology	C_1 Good reliability C_2 Simple structure C_3 High efficiency C_4 low cost C_5 Good maneuverability	DP_{11} Working part DP_{12} Positioning parts DP_{13} Pressure, discharge, pushing parts
the function of Assistting molding	C_6 Disassembly easy maintenance	DP_{22} Support, clamping parts DP_{23} Fastening parts DP_{21} Guiding parts

(2)The choice of components

1) The choice of Design parameters DP_{12}

（FRs）	Cs	DPs
1) the positioning function of punch-die 2) the positioning function of Punch and the mold base 3) the positioning function of Die and mold base 4) the positioning function of Discharging	C_1 Good reliability C_2 Simple structure C_3 High efficiency C_4 low cost C_5 Good maneuverability C_6 Disassembly easy maintenance	1 fixed plate of punch-die 2 Cylindrical pin 3 Cylindrical pin 4 Discharge screw

2) The choice of Design parameters DP_{13}

	FRs	Cs	DPs
1	Guide function of imported materials	C_1 Good reliability C_2 Simple structure C_3 High efficiency C_4 low cost C_5 Good maneuverability C_6 Disassembly easy maintenance	stop pin
2	Guide function of pressing		model set

4. Conclusion

AD by means of the word mapping process in user demand constraint functions to achieve a die structure design, using this method can achieve faster structural design features die.

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