SCRAP RETENTION BUTTON DIES
—GUIDE—

These products are manufactured and sold exclusively in Japan by MISUMI with the technical tie-up with KRAMSKI

Scrap retention during press operations is caused by product defects or damage to the dies, etc. and can become a serious problem.It is said that scrap retention occurs particularly easily when punching small holes in thin panels or during side cuts when the grinding force with the dies is low.MISUMI has a technical alliance with the German company KRAMSKI, which has patents in each country around the world and abundant experience, and has developed button dies which prevent scrap retention by having special grooves machined in the inner surface of the dies.

■Causes of scrap retention

The causes of scrap retention are said to be adsorption by a vacuum, adhesion to the punch cutting blades, adsorption by oil, punch magnetic force, and its being pushed up by compressed air in the die, etc.

Also, with general clearances, since the dimension P_2 of punching debris is smaller than the diameter of hole P_1, so scrap retention occurs easily.

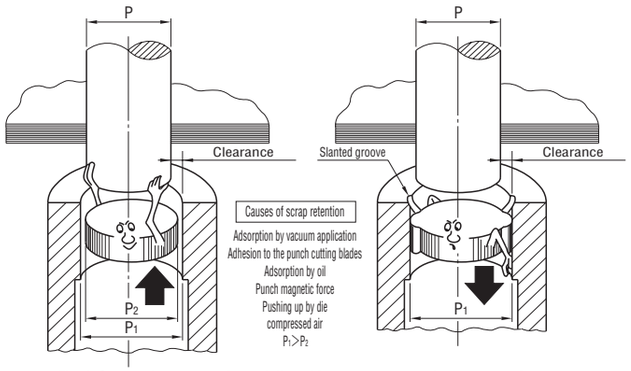

Fig. 1 Causes of scrap retention and dies with countermeasures for scrap retention

■General countermeasures for scrap retention

To prevent scrap retention, if

adsorption force to the punch＜friction force with the die＋weight of punch debris, then the effect is good. Therefore,

1） **Countermeasures with the punch**……Machining of the blade front end（shear angle, projections）, air flow, use of jector punch, etc.

2） **Countermeasures with the die**……Suck the debris out with a vacuum, make the surface of the blade edge rougher or carry out minute chamfering of the cutting blades, etc.

3） **Other countermeasures**……Change the contour shapes, make the clearances smaller, make the penetration depth of the punch and die greater, etc.

All kinds of methods have been used.

Generally, the suction system using a vacuum is used widely, but this requires consideration of the construction from the point when the die is designed and installation operations and adjustments of suction force, etc. are a lot of trouble. In addition, in the case of a jector punch, the jector pins need to be treated during repolishing of the punch and changes in the roughness of the inner surfaces of blade edges require retreatment after repolishing. MISUMI dies with countermeasures for scrap retention are subjected to special groove machining and solve these problems.

Fig. 2 Groove shape of dies with countermeasures for scrap retention

■Theory and features of button dies with countermeasures for scrap retention

1） **Theory of dies with countermeasures for scrap retention**

Two or more slanted grooves are machined in the inside surface of the die in opposite directions when viewed from the center. The scrap punched out initially in the punching process have little projections formed in them corresponding to the slanted grooves in the die. When these are pushed still farther down to the bottom surface by the downward stroke of the punch, these projections are compressed from the die's side surface（ironing effect）and the friction force becomes great, preventing scrap retention. Also, since the slanted grooves are not machined in a spiral pattern but in opposite directions, so there is no rotation of the scrap together with the punch in its upward stroke.

2） **Blade shapes and types of die**

For round and deformed tools which make it easier to produce scrap retention, it is possible and effective to use button dies with countermeasures for scrap retention on cut—out shapes（side cuts）where there is little binding force with the die.

3） **Handling is easy and the total cost is reduced.**

Since results are realized simply by incorporating dies which have undergone countermeasures for scrap retention, it is possible to use them on existing dies and it is unnecessary to undergo all the trouble at repolishing time or reprocessing after repolishing.The cost is slightly higher than previous button dies, but the cost difference from ordinary punches and jector punches make the cost about the same. And if the effects and maintenance costs are considered, we can say that the added value is extremely high.

■Influence on the shape of a sectional surface

Dies with countermeasures for scrap retention deliver their effect by providing slanted grooves in the die inside surface（0.005～0.1mm）. As a result, since the local clearance of those parts corresponding to the parts of the dies where special grooves have been machined is greater, there are slight changes in the sectional surfaces. That is, in comparison to those parts where machining of grooves is not done, the penetration（R）, cross section length（H）, cross section dimensional difference（C）and burr height（B）become greater while the shear section（S）becomes smaller. Accordingly, a lot of shear planes are necessary in shaping work, etc., so please exercise caution in cases where there are problems between the shear plane dimensions.

Run	R1＜R2
Section length	S2＞S2
Break surface length	H1＜H2
Variation of tolerance of break surface	C1＜C2
Burr height	B1＜B2

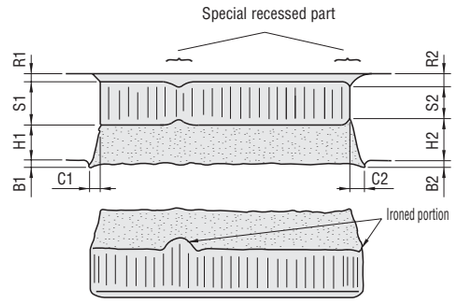

Fig. 3 Shear plane shape due to die with countermeasures for scrap retention

■Available range

1. **Hole diameter ： ϕ 0.8mm～ ϕ 48mm**
   It is said that the smaller the hole diameter, the easier it is for scrap retention to occur, but if the smallest hole diameter is ϕ 0.8mm or larger, it is possible to handle the rising debris.（Only the precision class is compatible with diameters smaller than ϕ 1.0mm.）
2. **Machined material：Materials with a high tensile strength up to 1177N/mm²（120kgf/mm²）**
   It is said that harder the material and the less it can extend, the easier it is for scrap retention to occur. It is possible to use button dies which have undergone countermeasures for scrap retention on practically the whole diverse range of machining materials, and they can be used on materials with a tensile strength of up to 1177N/mm²（120kgf/mm²）.
   In the case of machining materials with a tensile strength that exceeds 1177N/mm²（120kgf/mm²）, the effect may not be realized.
3. **Thickness of machining materials：Handles materials with thickness of 0.1mm of greater.**
   Through adsorption by oil or a vacuum, etc., the thinner the panel thickness gets, the easier it is for scrap retention to occur, and this causes trouble. Button dies with countermeasures for scrap retention are capable of working with materials with thickness of 0.1mm or greater.（For materials with thickness of less than 0.15mm, only precision class dies can be used.）
4. **Die Material：Selection can be made from SKD11, SKH51, powdered high-speed steel, carbide V40 and super corpuscle.**

■Cautions

1. Machining of special grooves is done so as to achieve the best effect and to minimize the effect on the product, but scrap retention gives rise to variations in the effects due to a number of conditions.
2. Punch and die penetration：About 1mm
   To realize the function of button dies with countermeasures for scrap retention sufficiently（to increase the friction force with the die by the ironing effect）, penetration of about 1mm is necessary, so caution is necessary during die design and during repolishing.
3. Amount of repolishing（regrinding）：About 1mm（When BC is used, up to BC—1mm）
   In order to obtain the effect of the button die with countermeasures for scrap retention sufficiently, it is desirable that regrinding up to about 1mm be carried out.（In order to realize the effect, grinding of a minimum of 1mm on the blade straight portion is necessary.）

■Order Method

In order to machine slanted grooves which will achieve the best effect as a countermeasure for scrap retention and minimize the effect on products, in addition to the ordinary button die dimensions, the plate thickness of the machining material and the clearance（one side）values are necessary.

- Worked material thickness MT：0.15mm or more（0.01mm increments）
  Clearance precision MT：0.10mm or more（0.01mm increments）
- Clearance C：0.01mm or more（0.005mm increments）
  Clearance precision C：0.005mm or more（0.001mm increments）

Order

Catalog No.	L	P	W	R(Ronly)	MT	C
SR—MHD13	30	P7.00			MT1.50	C0.105