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Elements Specifically to Pressurization (Sealing/ Tightening) in Hydrostatic Extrusion Processes

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Abstract

In the paper are presented some particular elements related with the tightening as a part of the hydrostatic extrusion equipment. These elements are responsible of the high pressure of the hydraulically agent in the extrusion process. The tightening is also an important problem to be solved when the hydrostatic extrusion process has to be applied to carry out the real parts.
***Keywords**: extrusion, hydrostatic, tightening.*

Theoretical aspects

One of the most important issues in high pressure equipments manufacturing is related to the pressurization / tightening elements, to be selected depending on certain acknowledged criteria such as those connected to the material dimensional character and substance and processing cycle's number at the industrial level or to the working scheme. Considering the case of classical hydrostatic extrusion (simple hydro pressing) , the high pressure precinct is fitted with a fixed sealing system to its bottom side, at the active plate level and a gliding (sliding) sealing system the need for which is imposed by the relative movement between the die and the stencil, figure 1. Where: a - sealing on the die; b - sealing on the stencil.

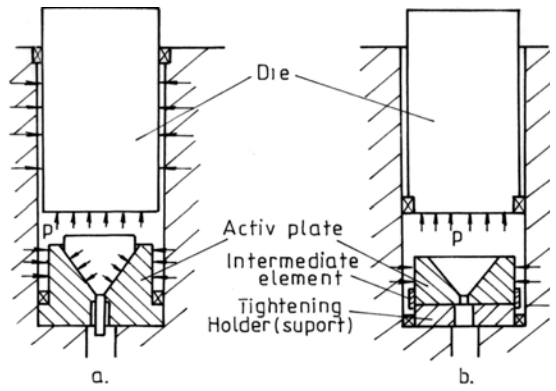

Fig. 1

The first one of the variants shown in figure 1 a, displays advantages of a functional nature. Half-finished products supplying, filling and dosage of hydraulic agent are relatively simple operations, as they can be automated. Given their high complexity, the sealing systems are interlocked with the die.

One of the frequently used variants of such packing glands fitted on the die is shown in figure 2.

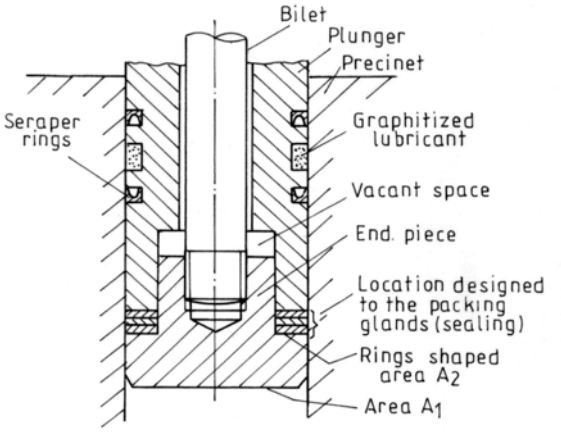

Fig. 2

By providing a sufficient retightening, the composite material packing glands, placed in A_2 bear an axial compression, resulting in their radial deformation. Given deformation ensures a certain magnitude contact pressure at the level of the high pressure precinct surface, which in its turn will provide the tightening. The gripping danger is removed by securing the greasing by means of a graphitized lubricant, placed into the radial groove between the two O-rings. O-rings simplicity and efficiency secure their being effectively used to provide post-sealing. Yet they are supposed to be used only in complete with antiextrusion collars. Usual pressures they are able to secure amount to 10

Kbar, some of the designed variants providing higher pressures, but not more than 15 Kbar. Given type systems are likely to be used only with a limited number of cycles. The common drawback of such pattern systems is the fact that, during operation, caused by the high pressures, the clearance between the die and precinct increases which bring about all the difficulties related to the possibility of loosing the sealing.

One of the procedures meant to secure the mentioned clearance compensation, is using an antiextrusion collar (ring) with a special geometry, which is able to distorn itself radically, concomitantly with the precinct walls, under the effect of the working pressure; see figure 3.

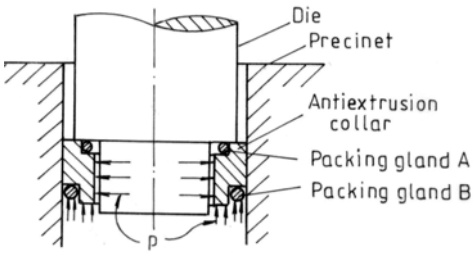

Fig. 3

The working pressure acting on its lower surface, provides the frontal contact between the collar and the die, the extrusion of packing gland A being excluded; same pressure operating on the inside surface of the ring, is forcing it to radically deform itself and by diminishing the clearance against the precinct walls prevents the extrusion of collar B.

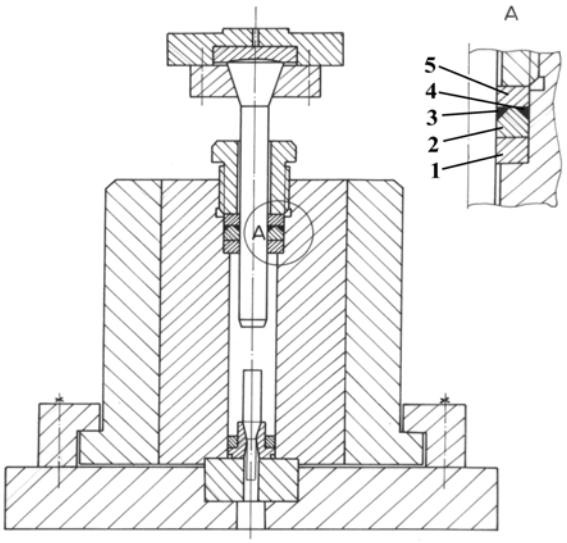

Fig. 4

The second sealing varinat, figure 1b, has the advantage of high reliability with extrusion pressure exceeding 20 Kbar. It is also much more simplified in relation to the die designing shape. On the other hand, the billets supplying is difficult.

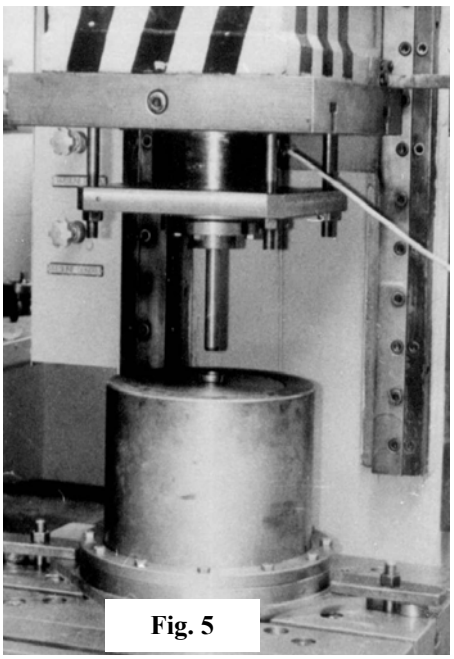

Fig. 5

At the University "Dunarea de Jos" of Galatzi, at the Cold Plastic Forming Lab, within Mechanical Engineering Technology Department, they have produced a hydrostatic extrusion stencil in its classical paten, figure 4. The precinct of the shrunk fit stencil has been sized to bear a maximum pressure of 25 Kbar, when the die diameter is 30 mm.

The sliding sealing system, also the a.m.department own concept, is made of five rings:

1 - treated alloy steel, $\frac{H_7}{s_6}$ fit for the outside surface (pressed hydrostatic extrusion or hydropressing with backpressure), they are commonly used for against the bore into the stencil body), $\frac{H_7}{f_6}$ fit for interior surface (with a minor clearance to the exterior surface of the die);

2 - graphitized bronze ring, $\frac{H_7}{p_6}$ fit for the exterior surface (moderate squeezing against the bore into the die body), $\frac{H_7}{d_6}$ fit (sliding down against the exterior surface of the die);

3,4 - polytetrafluoroethylene rings;

5 - steel ring , $\frac{H_7}{r6}$ fit for the exterior surface (slightly pressed against the bore into the stencil body), $\frac{H_{11}}{d_{11}}$ fit for inside surface (with a clearance against the exterior surface of the die). Retightening is secured by means of a special nut with direct tapping into the extrusion stencil body.

By means of given stencil, assembled on a 100 ft hydraulic press of 100, figure 5, direct

hydraulic extrusions have been made on billets (half-finished) of different metallic materials and for different distortion degrees , pressures exceeding 22 Kbar, under the condition of properly providing the high pressure precinct sealing. Analysis and measurements performed on its elements after aproximatively 10^3 cycles did not emphasize any damage or wear thereof.

Conclusions

High pressures under which hydrostatic extrusion is carried out imply certain peculiarities for the high pressure precinct sealing systems. Except for the processing exceptional accuracy, such features need to be adjusted also to the process characteristics or those of the adopted hydrostatic extrusion procedure variant. As already noted, despite their several defficiencies, the sealing systems interlocked with the plunger are recommended for industrial use, as for average working pressures. Those fitted on the stencil are more reliable and provide better tightening, under high pressure conditions. Yet, given their relatively limited application field (classical experimental hydrostatic deformations and lab trials.

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Elemente specifice etanşărilor în procesele De extrudare hidrostatică

Rezumat

În lucrare sunt prezentate câteva dintre elementele specifice etanşărilor care sunt parte componentă a echipamentelor de extrudare hidrostatică. Aceste elemente sunt responsabile de asigurarea presiunii înalte a agentului hidraulic. Realizarea etanşeității este un problemă dificilă mai ales în procesele de extrudare hidrostatică industrială

Les éléments spécifiques pour l´étanchéité dans le processus D´extrusion hydrostatique

Résumé

L'article présents quelques éléments particulières concernant l'étanchéité comme un part component de l'équipement du l'extrusion hydrostatique. Ces éléments sont responsables d'assurer la haute pression de l'agent hydraulique. L'étanchéité est un problème qui on doit résolu dans le processus d'extrusion industrielle.