PROCESSING OF THE GROOVES THROUGH SURFACE PLASTIC DEFORMATION

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Abstract:*The processing of the grooves for a putting gaskets in the hydraulic holes is embarrassed because the high requirements for their precision and roughness. In this case like a method for finish processing it is suitable using surface plastic deformation. This method ensures as the quality of the machining surface as higher productivity.*
Key words:*surface plastic deformation, roughness, tool for grooves.*

INTRODUCTION

The processing of the grooves for a putting gaskets in the hydraulic holes is embarrassed because the high requirements for their precision and roughness.

The using of the grinding like a method for machining of the groove cylindrical surface leads to the necessity of special shaping of the grinder and made more expensive the technological process. The execution of this operation is embarrassed or impossible through machining of cast iron, non-ferrous metals and other.

In this case the using of the surface plastic deformation (SPD) like a method for finish processing is suitable. SPD as the quality of the machining surface and its exploitation features as higher productivity [1,2].

There are known one-roll tools for SPD which have a simple construction but their application is limited because some failings [3,5]:

- over the technological system machine - appliance – tool – detail (MATD) there are applied one-way deformation force, which creates deformation circumstances in MATD. In its turn this is a cause for appearance of processing mistakes [3,4];
- availability compulsory two movements (axis and radial) through start and end work of the tool.

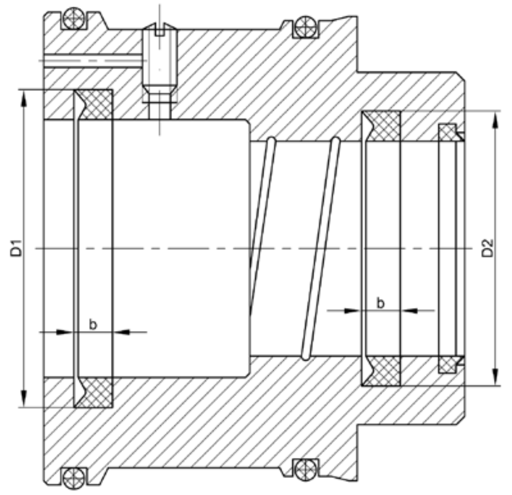

Fig.1. Detail set

In the production program of a company "Hydraulic Elements and Systems" – Yambol there are details from type „Obturator" (Fig.1). To the grooves of this type details laid down requirements of precision and roughness.

EXPOSE

The suggested tool is designed for grooves machining of details from GS20. These grooves are intended for putting rubber packs, which must ensure hermetical with wide range fluid pressures. It follows that comparatively high requirements for the roughness of the cylindrical surface of the groove, which are impossibly to be reach by using of the extant technological process - double turning, this can't ensure the demanded roughness from plan Ra = 1,25μm.

For removing mention shortcomings of the one-roll tools for SPD it is developed a tool which is shown on fig.2 in start position. It is two-rolls, without separator, with hard action, adjusted and it has following main parts: body 4, in which are assembled the carriers 23, with fitted in deformation rolls 20, by the stems pivots 22 and the insertions 21, bearing cotter 13, pegs 15 and 18, thrust bearing 19, cup 1, stop 2, nuts 7 and 9, stopper 5, washer 6, springs 17 and 25, insertions 10 and 12, screw special 24, cup 14, tail-end 16, screws 3, 8 and 11.

This tool hasn't mentioned disadvantages and it can use with a different machines. Through its design the following requirements are took account of: possibilities for exploration as in horizontal as and vertical position; technological of the design; possibilities for hand applying of the deformation force; possibilities works like immovable and turning tool.

The reciprocal corner location of the body 4 and the cup 14 toward the bearing cotter (it is cut through because the peg 18) is fixed with the cylindrical pegs 18 and 15. The carriers look like prismatic devices with possibility for radial moving in corresponding guides of the body 4 and they are constantly pressed to the bearing cotter 13 through springs 25 and the special screws 24. They support the cylindrical deformation rolls 20, which bear over the bronze insertions 21, they are immovable toward pivots 22. The distance between the detail joint to the groove is adjusted by the nut 7, which with the thrust bearing 19 determines the axis location of the stopper 5. The work adjusting dimension of the tool (the radial position of the rolls) is determined from the position of a nut 9, which is fixed with a screw. For protecting from contamination there are ensure the cup 1 and insertions 10 and 12.

The two-roll tool works in the following sequence.

In a non-work position under the action of the spring 17, the cup 14 and the bearing cotter 13 hold right end position toward the body 4, and the carriers 23 are located over most narrow part of the cotter. It is realized a turning moving of the spindle and through axis feed the tool is free get in the cylindrical hole of the detail. In the moment when the joint of the stopper 5 touches the detail joint the stopper 5 stops its turning because the availability of the thrust bearing 19 and the deformation rolls are locates opposite the groove, which has to machining. With continuous feed moving the bearing cotter is moved toward the body 4 while the cup 14, bending the spring 17, reaches to the nut 9. Besides the rolls are moved radially till to adjusting dimension of the tool and they are pressed to the bottom of the groove and in this way the rolls machine the groove. The deformation forces are got mainly on account of the elastic deformations, which are due to the difference of the groove diameter and adjusting dimension (tightness).

The going out of the tool is made in opposite turn, as under the action of the springs 17 and 25, the bearing cotter 13 is moved and the rolls 20 are took into the body 4. In this way it is accomplished the machining on the vertical position with the work on the scheme „immovable detail – turning tool", through the tool settle down with its tail end 16 into the machine spindle.

When it is worked in a horizontal position the scheme is „movable detail – immovable tool". Through this scheme the detail is made only the turning movement and the tool only axis feeding movement.

The groove parameters are: diameters D_1 = 70mm and D_2 = 60mm; a width b = 10 mm. The dimensions limits are respectively $T_{D_1} = T_{D_2}$ =0,190mm and T_b =0,2mm.

For checking the technological possibilities of the tool and determination of the work regime with the tool is held the appropriate experiment. 30 pieces patterns put to the examination. They are received from the factory-producer with cut through grooves. Because of this that the groove dimensions don't allow directly controlled of the machining precision and roughness, the patterns are separated in two groups by 15 pieces. The patterns of the one of the groups are made additional cut through and in this way it is ensured free access to the cylindrical surface of the groove.

For controlling the mention parameters are used two measurement devices – universal length-measures and profilometer – profilograph „TALYSURF-6".

In this way it is accomplished the measuring of the receiving in the factory-producer roughness respectively Ra = 2,2 ÷ 3,4μm and fringing field of the diameter ω_D=0,153mm.

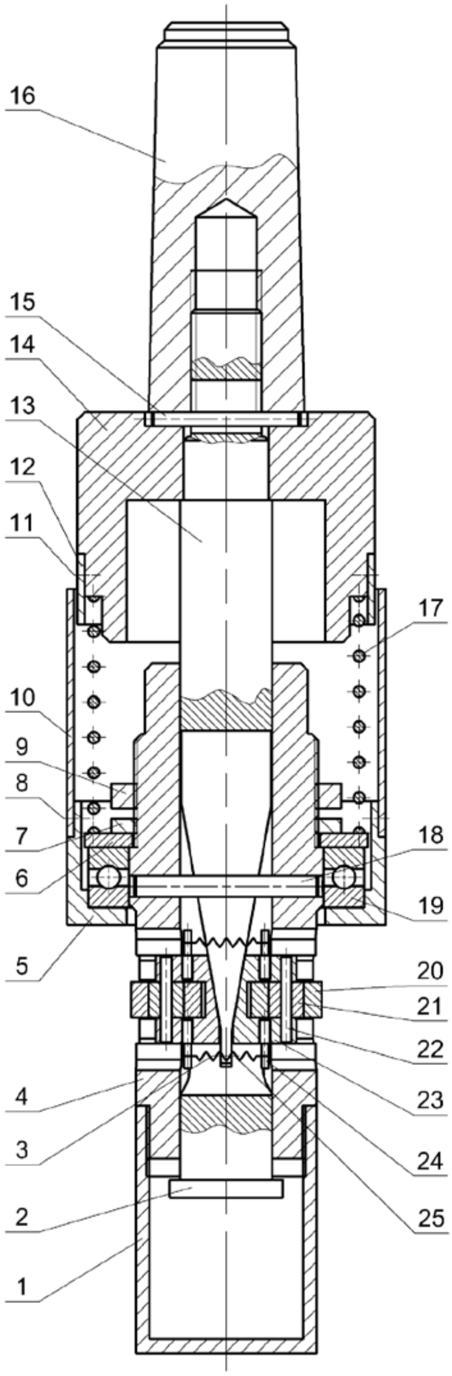

Fig.2. Two-roll tool for groove machining

The patterns from the second group are machined through SPD with the help of a vertical drilling machine BK-32. The adjusting dimension is ensured through hand pressing with the flywheel of the drilling machine, of the putted into the spindle tool toward to the detail joint. As lubricant is used a combination from engine oils M10D, LT-2T and naphtha in proportion 1:1:5. It is feed through the cooling system of the drilling machine and at the same time helps as for taking out the chipa as for lubrication of the deformation rolls and the machining surface. The measuring of the machining surfaces after cut through of the patterns shows that the fringing field of the diameter ω_D don't change materially and it has a value ω_D = 0,142mm. The roughness is decreased to Ra = 0,64÷0,85µm depending on the magnitude of the adjusting dimension (tightness) and numbers of passages (numbers turning of the tool m).

It is determined that the minimum roughness is received with maximum tightness C = 0,16mm) and numbers turning m = 5. The increasing of the numbers turning m over five don't influence materially on the roughness.

With advisable regime: tightness C = 0,1 – 0,16mm, numbers turning of the tool m = 5 and frequency of turning n=180min^{-1}, the single time for machining is 0,2min.

The hydraulic tests, which are took over the product with build-in details and machining with the described tool, are get very good results in relation of the hermetically of the observed compounds.

CONCLUSIONS

From the accomplished experimental examination it can do following conclusions:

- the accomplished technological research proves the working capacity of the creating tool.
- the roughness measuring on the parameter Ra is decreased approximately 1,5 parts in comparison with the advisable at the plan.
- the dispersing of the roughness parameter Ra after SPD is due to as the fluctuation of the deformation force (because of the sizable limit of the diameter) and the hard action of the tool as the dispersion of the initial roughness.

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