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METALLOGRAPHY PROBE LOCKING DEVICE FOR FINISHING OPERATION

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Abstract: The paper presents a locking device to fasten a metallographic probe in order to finish its plane surface on a probe finishing machine. This device guarantees the contact of the probe with the grinding paper and maintains a constant pushing force which with the probe is pushed against the grinding paper of the disc.

1. INTRODUCTION

Phases that exists in an alloy at a certain moment at room temperature, can be observed using optical microscopy analysis. This kind of approach uses the metallographic microscope, which is an optical microscope operating on the basis of light reflection from the surface of previously prepared metallographic probes.

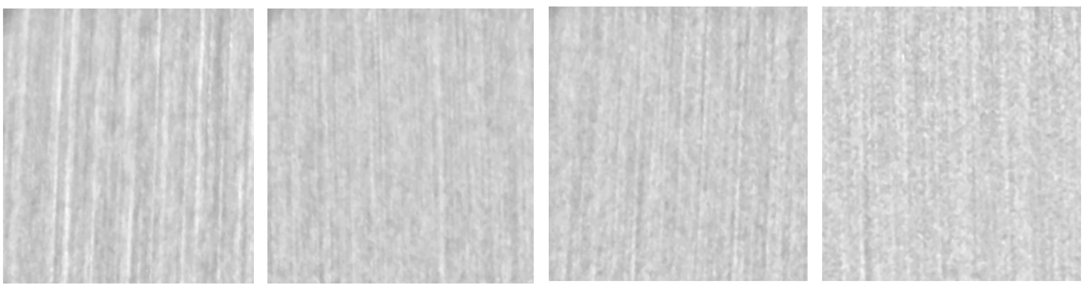
Reparation of metallographic probes assume the accomplishment of the following operations:

a) *Cutting out of the metallographic probes* from the analyzed material, which must not produce structure modifications of the material. So there must not be used cutting procedures that are producing cold deformation and also which are rising the temperature of the material during the cutting process, massive cooling cutting procedures and electric erosion procedures being preferred.

b) *Obtainment of plane surfaces*, which is done to achieve two parallel plane surfaces: one to correctly lay the probe on the microscope table and the other to reflect the microscope light. This operation is done by: milling or grinding. It is desired that the probes dimensions would be either 15x15x10 mm or Φ15x10 mm. In case that the probes dimension are smaller (wires, sheets and so on) the probe will be positioned in a metal holding filled up with synthetic resin, so that the assembly will allow the achievement of the described plane and parallel surfaces of the metallographic probe.

c) Polishing of a plane surface (figure 1), which comprises the following phases:

- *raw polishing*: is made on a grinding machine, using grinding wheels with 25..16 grades (STAS 1753-76);
- *intermediate polishing*: is made on a metallographic probe polishing machine, using grinding paper with increasing grades, starting with 20 (ex. Figure 1);



a) b) c) d)

Fig.1 Probe code : a) np10x25; b) np11x25; c) np12x25; d) np13x25.

- *final polishing*: is made on a metallographic probe polishing machine, using grinding paper with increasing grades, starting with 8;

d) *Finishing of the plane surface*: is made on a metallographic probe polishing machine, using fabric wheels impregnated with abrasive paste (Al oxide or Mg oxide or diamond powder) of a suitable grade, according to the probe's hardness.

e) *Cleaning of probes*: the finished probe will be washed and dried;

f) *Etching of probes with metallographic reactive*: the finished surface of the probe will be etched with the metallographic reactive which will enhance the outlines of different microstructures. This can be done by submersing the probe in the reactive liquid, or by gently touching the probes surface with a fabric impregnated with the reactive substance.

The analysis and reasoning of the obtained metallographic structures is done using the optical microscope at scales of 100x, 200x, and 1000x depending on the analysis goal, as it is given in the following standards: STAS 5000-97, SR ISO 3887-94, STAS 5500-74, STAS 7626-79.

2. CONSIDERATIONS OF DEVICE DESIGN AND MANUFACTURING

The device will have to achieve the following objectives: the polishing and finishing operation of a plane surface, of metallographic probes, using the probe polishing machine, knowing that without the device, the probe fastening had been done manually. In order to achieve this operation in optimal conditions, the device conception will have to deal with the following considerations:

- the device will be fixed on the body of the probe polishing machine disc (figure 2) ow the simultaneous polishing of two probes;

a) b)

Fig. 2 Metallographic probe finishing machine

- the surface of the polished probe will have mirror quality without any scratches;
- the plane surface of the probe will be maintained in contact with the plane surface of the grinding disc by a fine pushing;
- the wear of grinding paper has to be as uniform as possible.

In order to achieve the above mentioned objectives, an adapted planetary mechanism is considered having the possibility to fasten two probes simultaneously and to ensure the pushing force on the grinding disc.

3. DESCRIPTION OF THE MECHANISM

The mechanism which is moving the metallographic probes is a planetary type mechanism formed by the cinematic elements (figure 3) : 0, S – satellite support arm, D_p – planetary wheel and D_s – satellite wheel. The metallographic probes (2) which are usually of dimensions Φ15x10 mm, are fixed on the satellite wheel and pushed on the grinding disc (1) with the spring (3) fastened by he screw (4). Due to the grinding disc's rotation, the probes will be under the action of friction forces, which has a perpendicular direction on O_1O_3 and O_1O_4, so that torques will be born which will rotate the satellite wheel (D_s) according to point M, making this wheel to rotate on the planetary wheel (D_p). In these conditions, the probes will describe epytrochoid trajectories of equation:

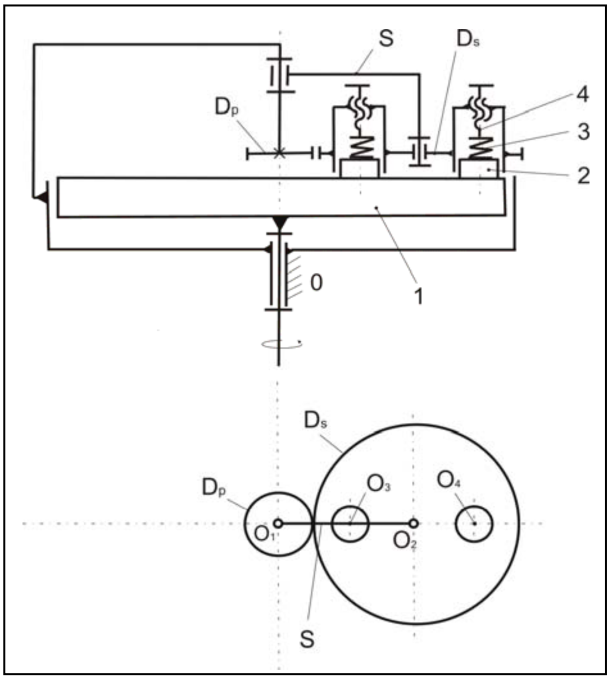


Fig. 3 Planetary mechanism device

$$\begin{cases} x(\theta) = r(k+1)\cos\theta - p\cdot r\cos(k+1)\theta \\ y(\theta) = r(k+1)\sin\theta - p\cdot r\sin(k+1)\theta \end{cases} \tag{1}$$

Where : r is the radius of the rotating circle;
R - is the radius of the fixed circle in which center's is placed the origin of the coordinate system;
k – is the ratio between the two circle radius : R= k·r
p – is the ratio between the distance r_x (O_2O_3) of point O_3 which describes the curve and the radius r of the rotating circle : r_x = p·r

In real conditions : r= 60 mm. R= 15mm, r_x = 40. k= 1/4 şi p= 2/3, the described curves by a point of the circle which rotates on the fix circle, are shown in figure 4: for ө=

360° (a complete rotation) the curve is given in figure 4a), and for 4 complete rotations, the curve is given in figure 4b).

Because the grinding disc is also in rotational movement, practically, the probes will describe a relative motion of approaching and departure to the center of the disc, filling the disc's whole area.

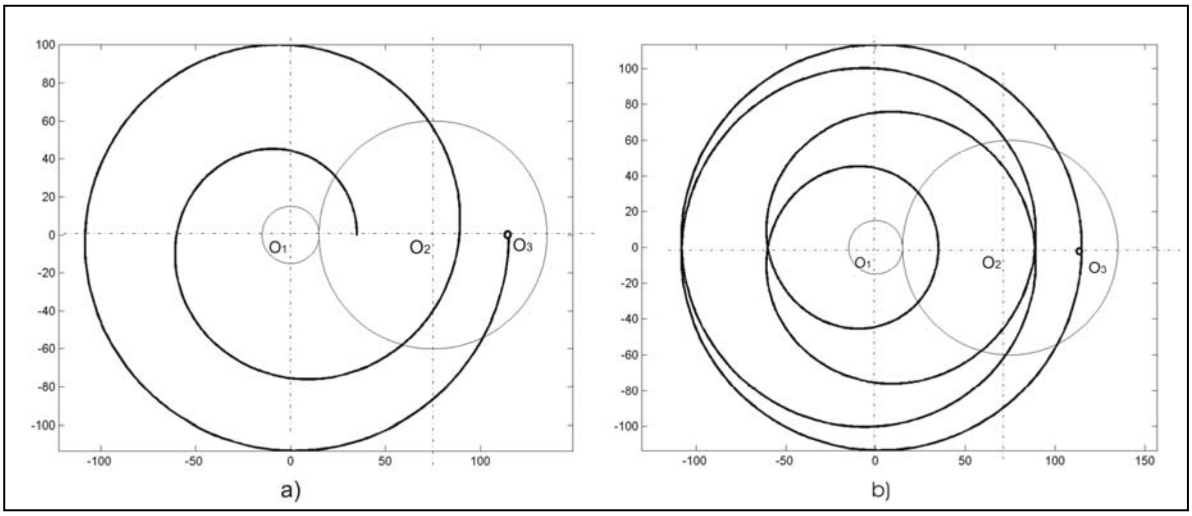


Fig.4 Trajectories of metallographic probes in the rotation plane : a) 2 rolls on the fixed circle; b) 4 rolls on the fixed circle.

4. CONCLUSIONS

The designed device allow the simultaneous polishing and finishing of two metallographic probes up to the dimensions of Φ25x25. So a plane surface is obtained, with the desired mirror type quality, which is needed for the study of the metallographic probe's microstructure with the optical microscope. This device also allows an optimal usage of the grinding paper guaranteeing a uniform wear and eliminates a difficult manual operation which requires the maintain of contact between the grinding disc and the probe.

5. REFERENCES

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