TRANSFER OBJECTS USED IN THE PROCESSING OF COMPLEX EROSION

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Abstract: *The construction and form of the transfer object depend on process parameters and influence the technological parameters and the state parameters of the process. The most frequently used form of transfer object is the disk form. In accordance with the type of operation we may use electrodes under the form of band and sometimes, very seldom, under the form of wire. The paper presents a transfer object under the form of stratified disk that allows the introduction of the working fluid through it..*

Keywords: transfer object, processing objects, working space, working fluid, complex erosion

1. THE MATERIAL OF THE TRANSFER OBJECT

Almost always the choice of the material of which the OT transfer object is made is done from reasons of cost. Most often, OT is made of steel (high productivity at an optimum price), without the state parameters be maximum.

For the special technological characteristics, steel is not the most adequate and copper, brass, cast iron are preferred, but the additional price does not always justify the performances.

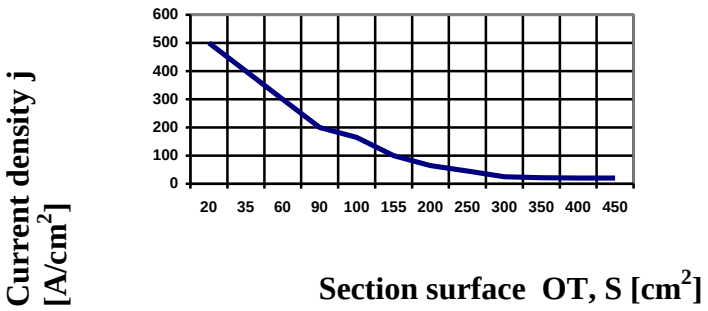


Fig 1: The dependence of the current density of the surface of the OT section

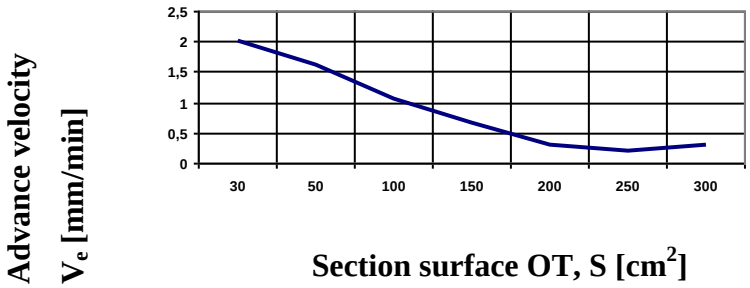


Fig 2: The dependence of the advance velocity of the OT section surface

2. THE FORM OF THE TRANSFER OBJECT

- Disk (the most frequent), for cutting (figure 3) slots of any type, hard to process materials, special alloys, metallic carbides; it has numerous advantages: the OT disk exploitation ruggedness; the constructive simplicity of the processing device; the possibility to carry different operations with small changes at the processing device;

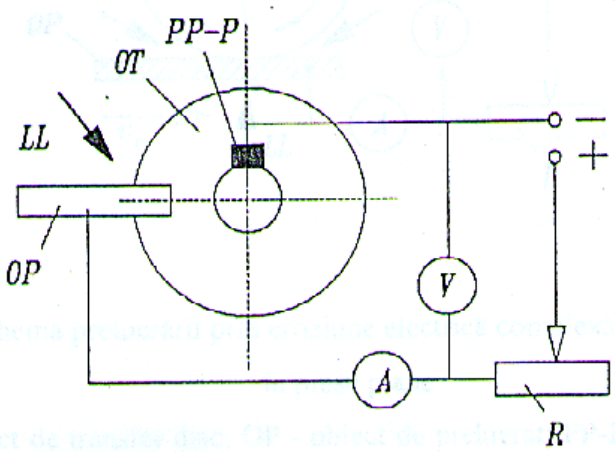


Fig. 3: The OT disk processing scheme

- Band (figure 4), for cutting, lateral slots, metallic carbides, refractory steels, hardened steel; it has the advantages: the constant maintenance of the relative velocity v_r, during the cutting; low cost of the OT; very high use coefficient of the OT material.

Among the disadvantages we mention:

- The use of the band is made difficult by the relatively big size of the band (0,5 – 2 mm) which may break when being passed through the guidance mechanisms;
- The difficulty to put together the ends of the band where high stress appears;
- The need to permanently clean the band and guidance of the particles from the working fluid LL;

- The impossibility to cut materials with a bigger width than the free space between the guidance rolls;

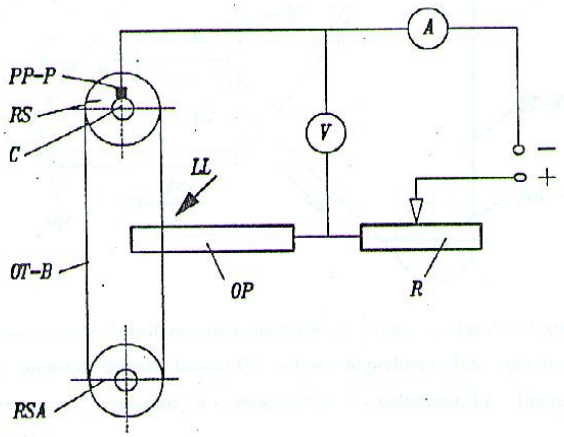


Fig. 4: *The scheme of band OT processing*

- Wire (very rarely, having among others the inconvenient that it requires a starting hole), for cutting, but especially for lateral slots, especially for extrusion materials (figure 5).

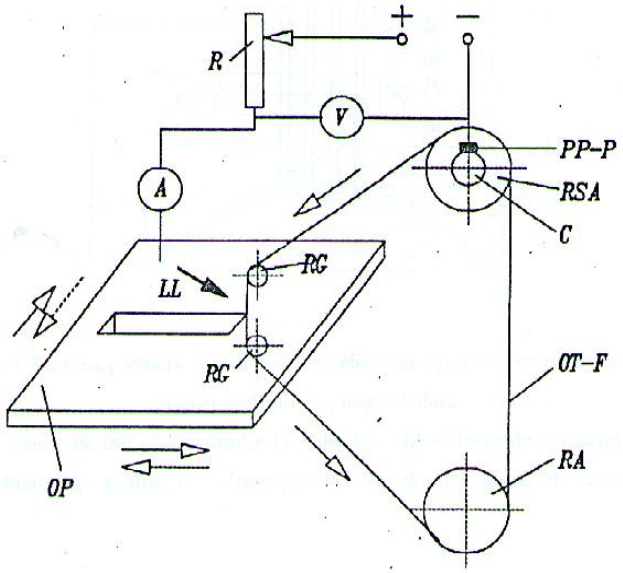


Fig. 5: The scheme of wire OT processing

3. THE WASHING WAY OF THE WORKING BY THE WORKING FLUID

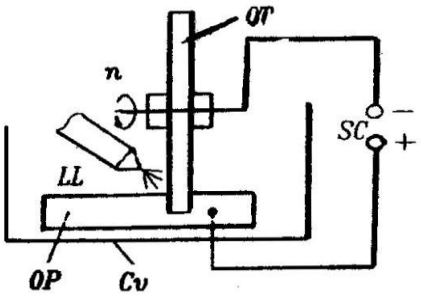
When we presented the influence of the I intensity on the Q_{OP} processing productivity and the quality of the surfaces obtained, we showed that the results depend on the way in which the working space SL is washed by the LL working fluid namely:

- Through jet, when the OT-OP contact area is poured with LL working fluid (figure 6); it has advantages (+) and disadvantages (-):

+ small quantity of LL in most of the processing cases;
+ the lack of SL working space sealing systems;
+ the use of a small power flow pump;
-In some cases the LL access into SL is difficult to achieve;
-When processing big surfaces the amount of LL is big also;
-The need of a ventilation system for evacuating aerosols;

- Through immersion, when the OP processing object and part of the OT transfer object are sunk into a bath (container) containing LL (fig 7); the advantages (+) and disadvantages (-) of the method are:

+ higher quality of the processing parameters;
+ simple working site;
+higher stability of the erosive process;
-The need for two pumps for LL, one for filling the container and one for recycling LL;
-Complicated construction and sealing system of the container if OP has a high weight or complex forms;
-High volume of LL and suitable container.



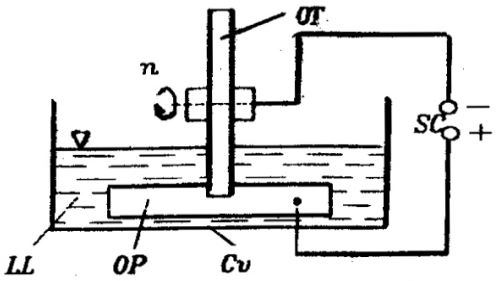


Fig. 6: Supplying with jet electrolyt *Fig. 7: Supplying with electrolytes through immersion*

Between two working possibilities there are differences both from the point of view of size, sealing and SL volume (and thus LL volume) and the necessary related devices.

The method of immersion processing can be advantageous from the point of view of the system for the working environment ML and ventilation systems. In this case, the big amount of LL existent in SL needs powerful pumps for filling the container and recirculation of the LL; the high volume of LL requires high capacity reservoirs and adequate sealing systems for the SL size with the advantage of lacking the emanations of aerosols. When cutting, the method leads to the decrease of the cutting time almost to half, dimensional precision and the quality of the surface are improved; it decreases the energetic consumption and thus the costs of the operation.

If using the jet processing, LL is brought to interstitium to values of the pressures p on 1-2 daN/cm^2.

Both systems require the cleaning of the electrolyte and the limitation of the maximum temperatures to values that would not overcome 70^0C.

Introducing the working fluid (LL) through the object of transfer (OT) disk is a solution proposed in this paper. The advantages are the improvement of the surface and an important increase of the productivity when OT disk cutting.

For experiments, stratified disk transfer objects have been built allowing the introduction of the working fluid through them (figure 8).

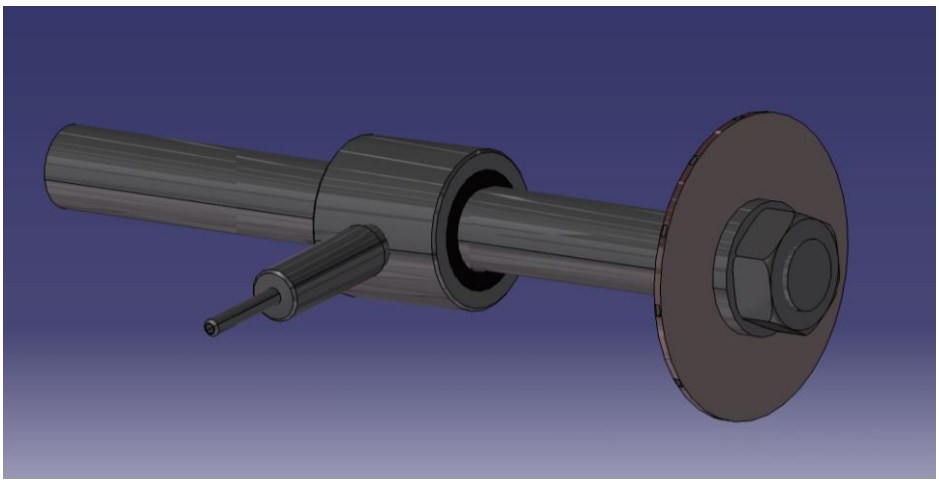


Fig. 8: Stratified disk assembly, shaft, connecting sleeve for introducing the working fluid through the OT

The number and size of the slots is calculated in accordance with the necessary flow of the working fluid into the processing interstitium.

A detail of the stratified disk is presented in figure 9.

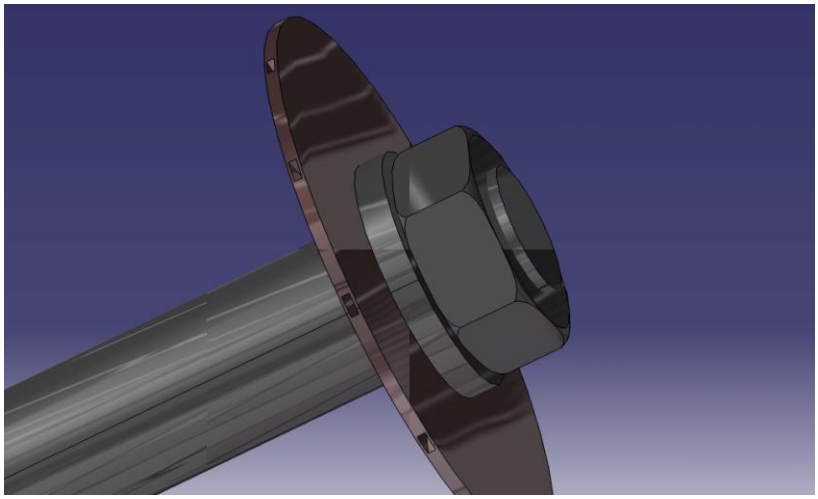


Fig. 9: Fixing the stratified disk on the tubular shaft of the cutting machine through EEC.

One of the constructive solutions chosen for achieving the disk electrode was the achievement of an intermediary piece where slots are practiced of the size and configuration established through computation or experimental determinations (figure 10). It follows the application of two disks that shall represent the exterior faces, where the intermediary disk is fixed and their processing as a whole for opening the slots that shall allow the movement of the working fluid on radial direction, from the centre of the disk towards the extremities.

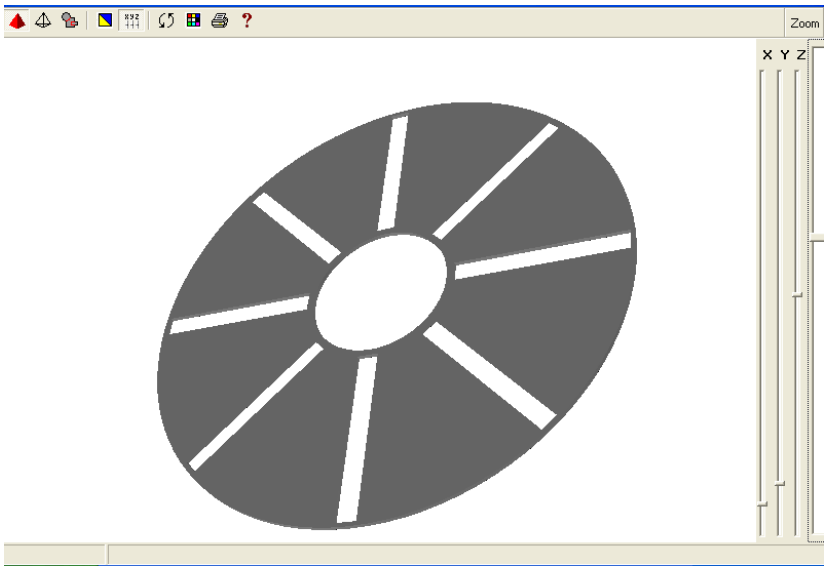


Fig. 10: Processing stage of the intermediary disk

By spinning the disk with slots we create a variation of the pressure similar to the situation of the rotor of a centrifuge pump (figure 11).

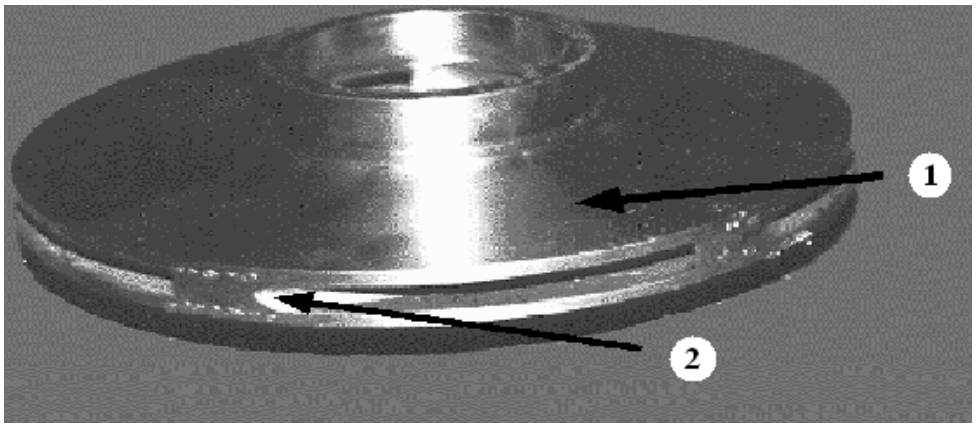


Fig. 11: Big sizes and spiral form slots disk:
1 – exterior disk; 2 – intermediary piece

4. CONCLUSIONS:

Researches made so far in the field of cutting metallic materials through complex erosion using the disk type classical transfer object, the electrolyte being brought in the working area through jet, or through immersion have revealed an entire series of disadvantages that appear in the two cases of washing the working space. When cutting materials using transfer objects of different forms one mainly seeks for this operation to be optimum from the economic point of view, but at the same time some conditions be met from the technical point of view.

REFERENCES

[1] **Gavrilaş, I**. ş.a. - *Prelucrări neconvenţionale în construcţia de maşini* -Editura Tehnică, Bucureşti, 1991.
[2] **Nagîţ, Gh**., - *Tehnologii neconvenţionale,* Universitatea Tehnică „Gh. Asachi", Iaşi, 1998.
[3] **Herman, R.I.E**. - *Prelucrarea prin eroziune electrică complexă*, Editura Augusta, Timişoara, 1998.
[4] **Herman, R.I.E**., ş.a. – *Prelucrarea prin eroziune complexă electrică- electrochimică*, Editura Augusta, Timişoara, 2004.
[5] **Nioaţă, A**., *Cercetări teoretice şi experimentale privind optimizarea unor parametri ai prelucrării prin eroziune complexă*, Teză de doctorat, Sibiu, iulie, 2007