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MODULAR DEVICE WITH AXIAL MICROMETRIC ADJUSTMENT FOR MASSIVE ELECTRODE ELECTRIC EROSION WORKING

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Abstract: This paper shows the author's preoccupations concerning the design and realization of a modular device with micrometric adjustment for hard materials working by means of electrical erosion – simple and profiled drilling, slots, axle bearings, grooved wedges etc.

1. INTRODUCTION

The surface electrical erosion working accuracy is directly influenced by the adjustment of the tool-electrodes and of the workpiece-electrode. The adjustment of both electrodes consists of fixing, alignment and reciprocal positioning.

According to the shape and dimensions of the workpiece-electrode and to the operation to be executed, the workpiece can be fixed directly on the machine table, with universal devices, on prisms, on cassettes and in custom-designed devices.

When working series of components by means of electrical erosion, after adjusting the workpiece fixing devices, their positioning versus the port-electrode axis can be carried out by means of the scale rules fitted on the working table support, and special devices can be used in case of high-accuracy operations. In order to ensure the alignment high accuracy between the tool-electrode, fixing device and port-electrode, it is recommended that the tool-electrodes to be worked directly in the fixing device, so that they would be directly mounted in the port-electrode without any further alignment operations. In order to comply with their purpose, the devices must fulfill the following basic requirements:

- to be conceived and made rationally, with adequate degree of mechanization and automation, in order to ensure the production increment versus the same operations without these devices;
- to be resistant and rigid enough in order to allow adequate chipping regimes, with minimal deformations, thus preventing the occurrence of vibrations and maintaining the required accuracy;
- to provide superior working conditions, by reducing the physical effort and ensuring of the working security;
- to have simple construction, easy to execute and to mount on the machines;
- to be made with minimal costs, easy to repair and maintain etc.

The devices must be built in accordance with the calibration system used for control and verification. The same spots, axes or surfaces used for setting the workpiece in the device will be used as check-points for the calibration devices. Also it is essential that as many working and checking operations as possible should be carried out at one workpiece clamping-in. Then, it is advised that the clamping position should remain the same until the completion of all working operations; due to this, the accuracy is increased and the cost of the product is reduced.

The electrical erosion working devices can be classified in several categories:

- electrode clamping devices;
- workpiece clamping devices;
- adjustment and dimensional checking devices;
- special devices.

2. DEVICE DESCRIPTION

The device has been designed and built in order to be fitted to the electrical erosion working machine of the Non-Conventional Laboratory, TCM Department. Through bores and blind-end bores of various shapes (round, squared, rectangular etc) can be made by means of this device, as well as grooved-wedges and couplings on various steel or metal-carbide components.

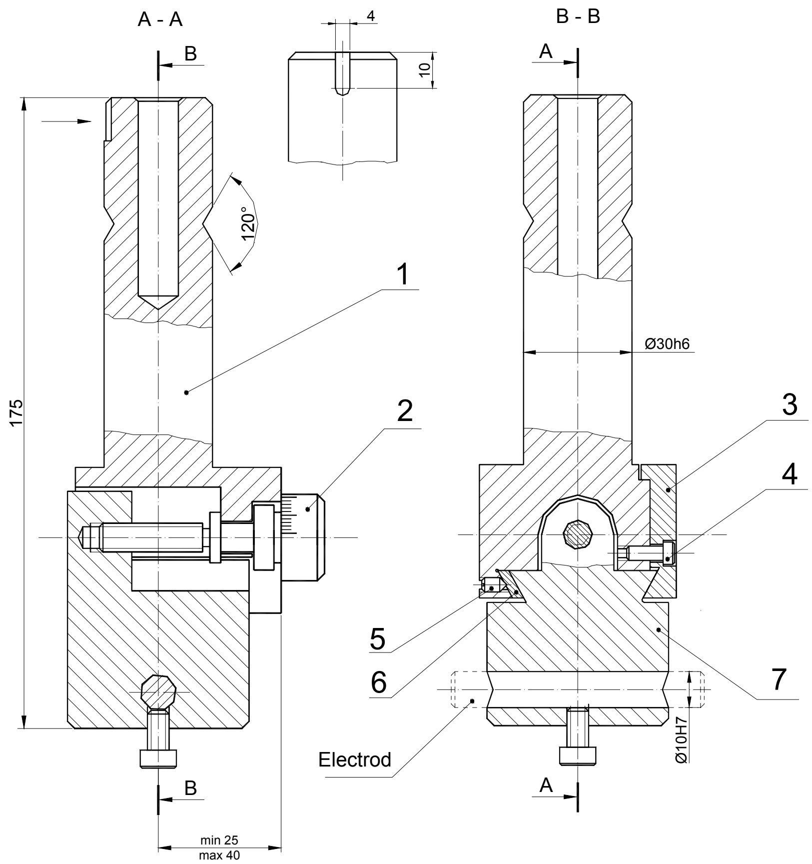

Fig.1. Device with axial micrometric adjustment; 1 – device body; 2 – micrometer screw; 3 – clamping element; 4 – screw M4×12; 5 – screwed pin M3×10; 6 – wedge; 7 – port-electrode head I and II; 8 – screw M6×10.

The device (fig.1) has a simple construction, is made of OLC45 steel and features the following components:

Device body **1**, which has the standardized shape and dimensions, so that it can be mounted in the port-electrode head of the ELER01 GEP 50F electrical erosion working machine. The device clamping tail has a grooved wedge in order to prevent the device rotation in the machine shaft.

Micrometer screw **2**, with 0.5 mm pitch (it advances with 0.5mm when rotated at 360°); the electrode clamped in the port-electrode head 7 is moved by means of this screw, allowing an axial movement of 0 ÷ 15 mm; the screw head is calibrated in hundredths of millimeter, which gives an adequate accuracy by moving the electrode according to the workpiece to be done.

Clamping element **3**, which fixes the device body 1 on the port-electrode head 7 by means of two M4 screws; the device 1 and the clamping device 3 form together a dovetail guide, which is assembled to the port-electrode head 7 that features an identical but negative guide.

Fixing screws **4**, M4×12 type, which fix the device body 1 to the clamping device 3.

Screwed pin **5**, M3×10 type, which moves the wedge 6 on the clamping element body 3, allowing an axial movement of the electrode.

Wedge **6**, which adjusts the clearance between the port-electrode head 7 and the clamping element 3; also, this wedge can block these elements.

Port-electrode head I and II **7**, interchangeable, which clamp the electrode by means of screw 8; according to the operations to be done, several graphite and copper electrode types can be mounted; due to these interchangeable elements, the electrodes can be fixed in both horizontal and vertical position.

Fixing screw **8**, M6×10 type, which fixes the electrode in the port-electrode head 7.

3. DEVICE OPERATION PRINCIPLE

The clamping element 3 is fixed on the device body 1 by means of screws 4; the device 1 is then clamped on one of the port-electrode heads 7. The electrode to be used is fixed in the port-electrode head 7 by means of screw 8. The assembly is mounted in the work head of the ELER01 GEP 50F machine. The electrode axial positioning in 0 ÷ 15 mm range is achieved by means of micrometer screw 2.

Example: several holes of different shapes with 1mm sides are to be made in a hardened steel sheet. After making the first hole, the electrode is moved into the next position by means of the micrometer screw 2 and the next hole can be executed. These operations are repeated until all holes are made. These shapes are used for making drawing dies and producing noodles (fig.2).

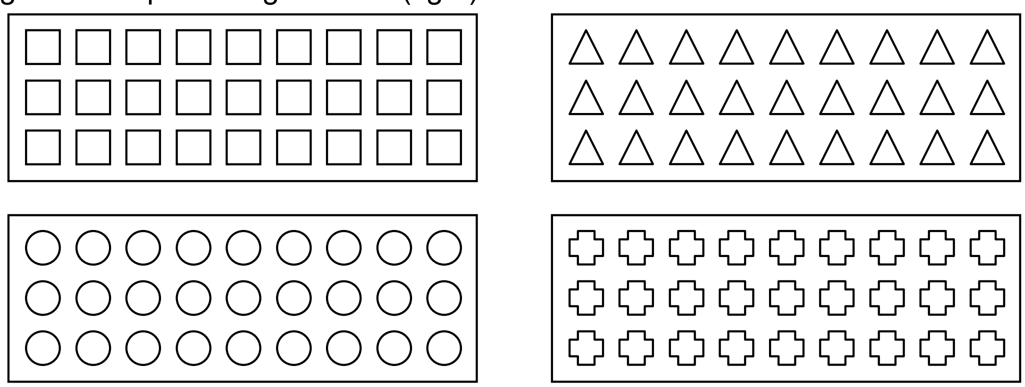

Fig.2. Making of various holes in a Cr120 hardened steel sheet.

Fig.3 shows the device, fitted with two interchangeable elements for working with electrodes in both horizontal and vertical positions. The micrometric axial adjustment device, designed and realized, can be used for electrical erosion working and can be used as accessory of ELER type electrical erosion working machines.

This device has the following advantages:

- ✓ simple construction;
- ✓ indexing accuracy of hundredths of millimeter;
- ✓ interchangeability;
- ✓ relatively low realization cost;
- ✓ can perform a wide range of keyways, wedge grooves, couplings, different sections holes (squared, rectangular, triangular, round etc) in range 0.5 ÷ 50 mm;
- ✓ can perform an accurate axial electrode movement in range 0 ÷ 15 mm by means of the micrometer screw.

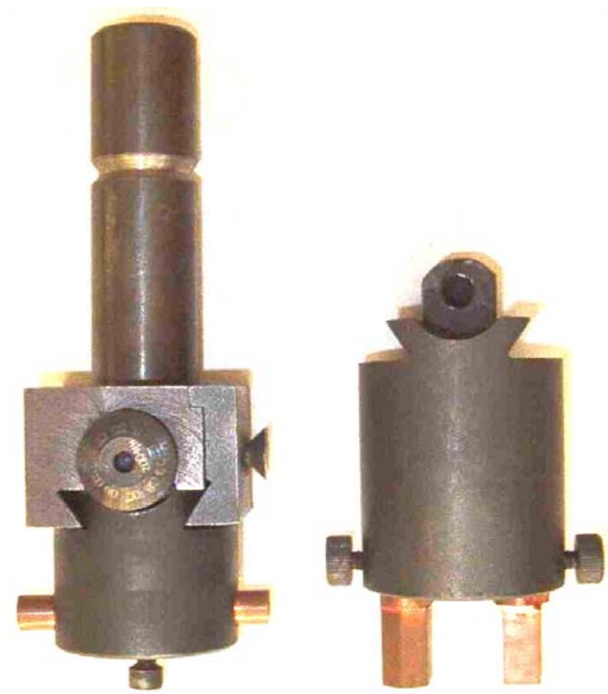

Fig.3. The modular device, designed and realized, fitted with two interchangeable elements (left – horizontal, right – vertical).

4. CONCLUSIONS

The modular device with micrometric axial adjustment contributes to the working accuracy and productivity, and offers the possibility of making a wide variety of holes and keyways. Also, this device ensures the precise alignment between tool-electrode, workpiece-electrode and port-electrode.

By using the interchangeable elements, copper and graphite electrodes can be mounted in vertical and horizontal positions; also, these elements allow the mounting of centering and checking instruments.

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