ANNALS of the ORADEA UNIVERSITY.

Fascicle of Management and Technological Engineering, Volume VII (XVII), 2008

MODULAR DEVICE FOR MAKING SPLINE HUBS BY MEANS OF MASSIVE ELECTRODE ELECTRICAL DISCHARGE MACHINING

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Keywords: electrical discharge machining, spline hub, massive electrode

Abstract: This paper presents an electrical discharge machining modular device, designed and made by the author in order to work spline hubs of hard and extra-hard materials. The device can work splines of different angles, width and depths, according to the piece to be made, by means of a special modular bushing with grooves in which copper lamellae are mounted; such a special bushing and the afferent copper lamellae play the role of an interchangeable element within this device.

1. INTRODUCTION

The dictionary says that "*the device is an auxiliary component of a technological system that constitutes a unit from the functional point of view, made of solid elements, with connections that allow them a limited mobility and which stay in relative stand-still during service*".

The device is a group of mechanisms that helps us to perform faster, more exact and more accurate executions of required pieces, so that this piece must not any longer be specially prepared for this purpose. So, from this definition results that the devices must be placed among different technical systems which are, within the technological processes of machine making: working, control, and assembling.

Usually, the role of devices is to permit the acceleration of work, without any decrease in accuracy, but with increased work precision to equally all processed pieces. Shortly, we may state that the use of devices guarantees a higher productivity and ensures the product quality and the uniformity of work.

The device building domain is very wide and, as techniques develop, requires the solving of more and more issues. We must emphasize that nowadays the device building may be considered as a distinct branch in the machine building domain. It was observed that the problems of special working can be very easily solved by adapting devices to existent machines, thus eliminating the necessity to purchase a new, sophisticated and expensive tool-machine.

The presence of devices in the technological processes within the machine building has a positive influence upon some technical and economical parameters. The work productivity increase and, implicitly, the price decrease will be achieved mainly by: partial or total elimination of the marking operations, which are expensive because of the requirements for highly-qualified work; the reduction of the time necessary for orienting and checking the positions of the surfaces to be worked; time cutback by simultaneously fixing more work-pieces in the same device.

As for quality increase and its maintaining in time, special care must be taken about the overall concept of the device, to eliminate the subjective errors that go with marking and orientation checking of the surfaces to be worked.

Under the aspect of work conditions improvement, the devices lead to the elimination of the efforts concerning the verifications of the surfaces in regard to the tools trajectories and the muscular efforts cutback due to the centralization of clamping and release of the pieces to be worked.

The presence of devices in the working operations and not only, makes possible the widening of the machine using possibilities, they create conditions for fabrication assimilation of new products with minimal investment expenses and positively influence the accuracy, rigidity and efficiency of used machines.

2. DEVICE DESCRIPTION

The electrical discharge surface working accuracy is directly influenced by how the tool-electrode and tool-workpiece settings are done. The setting operation for both electrodes consists of clamping, centering and reciprocal positioning.

According to the shape and dimensions of the wokpiece-electrode and to the operation to be executed, the workpiece may be set and clamped directly on the machine table, in universal devices, on prisms, cases or custom-designed devices. For clamping and centering of the tool-electrodes, the clamping devices of the machine and, if necessary, several special devices can be used.

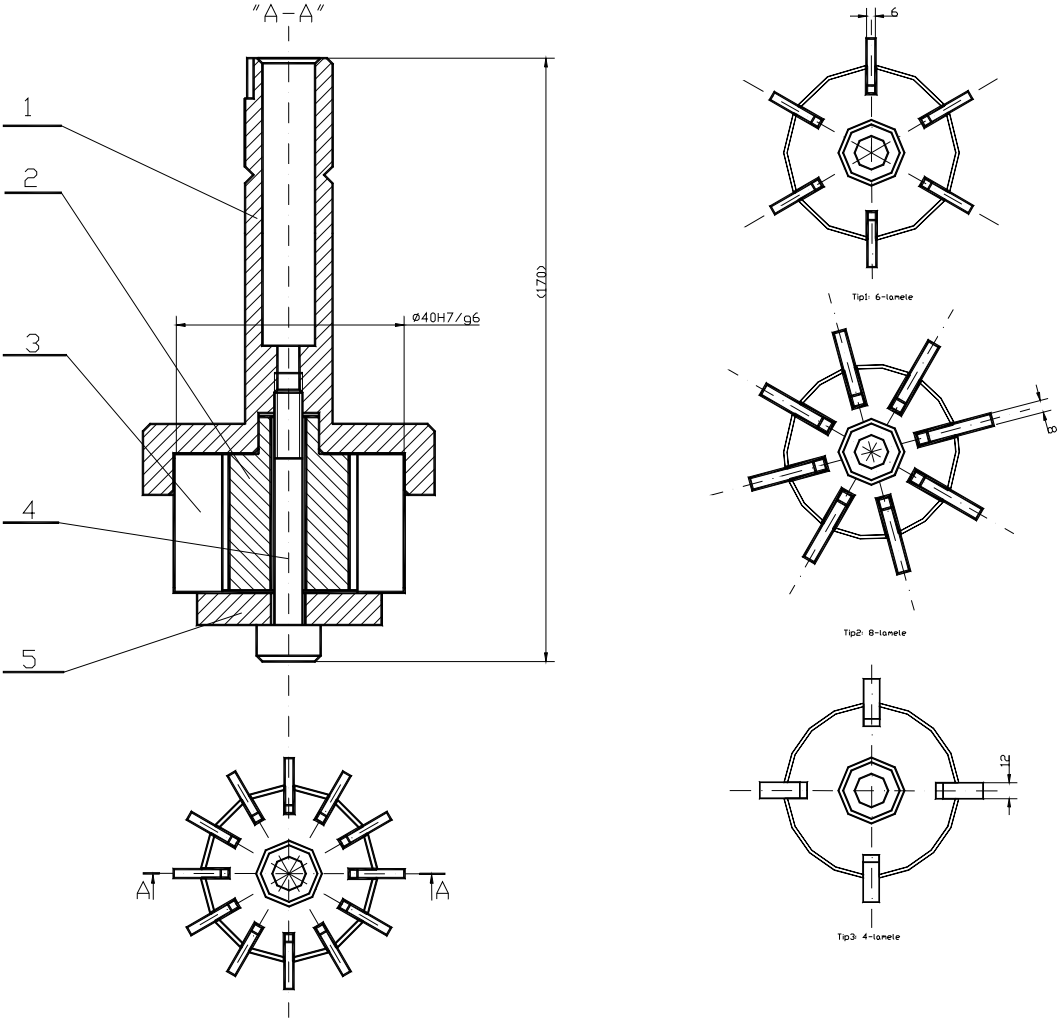

Fig.1. *Device for working internal splines (left) and several types of bushings with copper lamellae (right).*

The device shown in fig.1, with interchangeable bushings and copper lamellae, was designed and executed in order to machine internal splines in hard and extra-hard materials. This device features the possibility to use several spline divisions (4, 6, 8, 10, 12) and several thickness values, according to requirements. Also, key slots of different widths and depths can be machined by using a single copper lamella.

This device can replace the rapid steel broaches when performing the reconditioning of toothed wheels with spline hubs; because these wheels are reconditioned by welding, the hub hardness is increased and it would be necessary to make special thermal treatments in order to make the splines by broaching.

By using this device, designed and made by the author, the working costs are much reduced compared to the use of rapid steel broaches, which are much more expensive than it. Also, making broaches requires special techniques of shaping, thermal treating and sharpening.

This device was designed to be included in the rigging of the electrical discharge working machine ELER-01-GEP-50-F, and has the following components:

1. *sustaining body*, which ensures the clamping in the main machine shaft;
2. *spline bushing*, which can be changed according to the division and lamellae thickness;
3. *copper lamellae*, which are made of copper at various thickness (2, 4, 6, 8 mm), according to the splines of the bushing 2;
4. *clamping screw*, which clamps the spline bushing 2 and the copper lamellae 3 to the sustaining body 1;
5. *washer*, which clamps and sustains the lamellae.

Fig.2 shows the realized device, and fig.3 shows the device in working position and the worked piece.

Fig.2. *Modular device for making spline hubs.*

Fig.3. *The device in working position, monted on the ELER machine, and the worked piece.*

3. CONCLUSIONS

The research that has been carried out pointed out that this device can be used for making different splines of various widths and divisions, interior working of key slots and coupling, by simply changing the spline bushing and copper lamellae, which are the modular elements of the device.

This device can be used for working operations than cannot be carried out by means of the classic methods (slotting, broaching etc). It is easy to be made and is centered in the machine vertical shaft, achieving accuracies of 0.02 ÷ 0.03 mm. The productivity is increased because all splines are worked at a single passing. By means of this device, the reconditioning after welding of toothed wheels with spline hubs can be performed.

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