DEVICE FOR SPIRAL PROFILES PROCESSING BY ELECTRIC DISCHARGE MACHINING

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ABSTRACT.
The widespread use of metals and alloys with higher physico-mechanical and physico-chemical properties has arising many problems regarding their machinability. Processing high-strength metals and alloys (refractory steel, stainless steel, anti-corrosive, metalo-carbide, et.al.) conducted to the introduction of non-conventional machining processes, called Electrotechnologies. By Electrotechnologies could be solved a wide range of technological problems: dimensional and shape accuracy, surface quality, et.al. The paper presents a device designed to process the spiral cam by electric erosion with massive electrode.

KEYWORDS electric erosion, cam processing

1. INTRODUCTION

Electrical erosion processing is a method based on material removal by the action of electrical discharges that occur between electrode tool and the object to be processed, separated by a dielectric liquid

Electric discharge machining is applied to process metallic materials with high hardness to obtain a form of surfaces that cannot be achieved easily and accurately by conventional cutting processes.

The processed metal is exposed to erosion by electrical discharges between metal and a copper electrode-tool in a dielectric liquid. During processing, the electrical discharges erode also the tool electrode, which changes its dimensions.

Corrosion effect is caused by energy released by an erosive agent that develops in a working environment, positioned on the surface of the work part.

In this way, will be copied the shape of the tool electrode on the work piece, under certain conditions the precision of form, dimensions and surface roughness quality.

In other words, there is a "dip" of the processing tool electrode into the work piece, forming a cavity in with similar shape of the electrode due to the melting material of work piece by a lot of sparks that occur between the areas of the tool electrode and the object of processing.

The material corrosion is done only if there is a heat source temperature sufficiently high to cause local changes of the object to be processed, destroying its integrity, crater formation and removal of eroded particles from the processing.

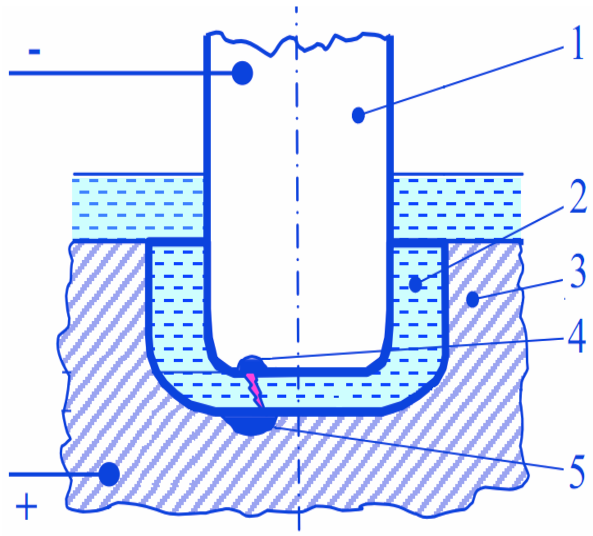

Figure 1

The Electrode-tool and the work piece will be made from electrically conductive material order to be possible dimensional processing by electrical erosion, they must meet the following physical conditions

– the electrode tool and the work piece must be connected to a power source

in order to obtain the energy to the surface of the work piece.
- the electrode-tool and the work piece will be made from electrically conductive material;
- continuously restoration of the original state in the erosion gap, so the discharge may occur repeatedly in identical conditions;
- to achieve a maximum corrosion of the material being processed and a minimum electrode-tool wear, they will provide a polarizing nature of the electric discharge from impulse.

By electrical impulse, you understand the state evolution of an electromagnetic system in which at least one of the characteristic elements (voltage, current, etc.) deviate suddenly from a constant value and which can return after a certain period of time.

Although at the erosion discharge machining can be used electrode-tool of any material or semiconductor good conductor of electricity and good thermal conductivity, the quality of the material is very important as well.

The tool electrodes can be made by:
- Copper;
- Brass
- Aluminum alloy
- Wolfram
- Graphite

Graphite and copper electrodes present obvious advantages compared to the rest of the material in terms of their operation. For these reasons, they are the most-used materials for making electrodes for processing by electrical erosion.

A key factor which influences the processing by EDM is the method of producing electro dimensional electrodes.

The choice of the electrode-making process tool, we must have regard to the processing cost, the nature of electrode material, the necessary precision, and the productivity process. Electrodes can be made by casting, plating, extrusion, die cast or cutting.

For the removal of material to be possible the dielectric must be able to remove particles from the field work. The most common dielectric is air, but it oxidizes the two electrode surfaces and forming an oxidant film, so the discharges are no longer possible. For this reason, it is used liquid oil or deionized water.

Generating surfaces can be processed by copying the electrode profile, which is gradually introduced in the work piece after a certain direction, by moving the electrode to the work piece or moving piece to the electrode.

2. CONSTRUCTION OF THE DEVICE

The device for processing the spiral cam by electrical erosion is shown in Figure 1. It consists of a housing 1 composed of several plates in which are mounted radial angular bearings with tapered roller. On the input shaft 3 is mounted worm 4 which engages with worm gear 5.

On the worm gear it is found the plate 6 where is installed the work piece to be machined.

The worm 4 is not axially fixed on the input shaft 3, so that it can slide along its, rotation motion and torque are transmitted through the longitudinal key fixed on the input shaft by screws.

From the input shaft 3 the motion is transmitted to the spur gears consisting of gears 7, 8 and 9 and then the drive screw 10, which give to the slide 11 a motion along guides 12.

As a result, the movement of the plate 6 will be composed by a rotating motion gave by the worm gearing components, and a translation movement obtained from the screw nut mechanism.

That means that a point of the work piece to be machined will describe a spiral trajectory. Their pitch can be adjusted by changeable gear wheels. The clearance due to wear guides dovetail-shaped can be eliminated by tightening the screws for adjustment.

The motion is received from a cylinder-worm motor gearbox. The device together with the motor gearbox is mounted on the EDM machine table.

The device is used to the processing spiral channels in flat disks or of spiral channels or their periphery, as well as spiral cams.

Massive electrode EDM machines reproduce the geometric shape of the electrode tool.

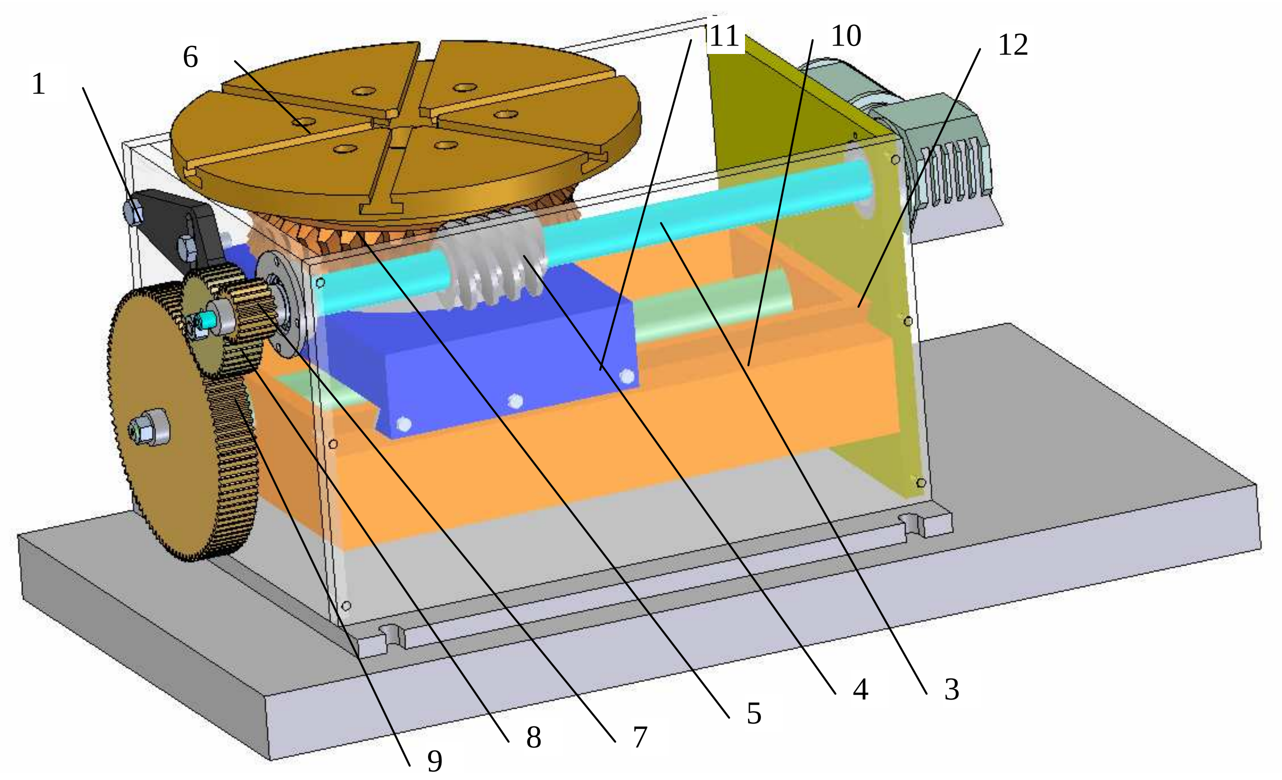

Figure 2

Cam mechanisms are found in various construction machinery in many fields of industry, for example, automatic machine construction for textile, printing, food industries, automatic lathes control, in construction of some electrical equipments, et.al.

Compared to other mechanisms with inferior kinematic couplings, the mechanisms with cams present the following advantages:

- can realised the exactely synthesis, so it can be reproduced any imposed law;
- there is a low number of elements, that conclude to unsignificant erors;
- have a low gauge;
- allow to stop the movement of the led element; in the meantime the movement of the leader element can continue;
- by replacing the cam is also replaced the motion law as following the requirements.

The cam mechanisms present a few disadvantages.

It wears fast both the cam and the cam followers, because the contact between them is a line or a point, so they are taken high specific pressures, which means the need of using resistant materials with applied thermical and chemical treatments;

Within the cam mechanism components has always been included a superior kinematic coupling useful to transmit the motion from the entrance element, cam, to the output element, cam followers.

Cam mechanisms can be done by several criterias: by structural point of view (mechanisms with plane and spatial cams), by cam motion (mechanisms with rotative cam, oscillating, with cam in translational motion), by cam followers motion and its position related to the cam (with cam followers in translational motion, in oscillating motion).

Spiral is an open flat curve that arises by rotating a mobile point around a fixed point used as the center, which is always away. Spiral elements are: spira that corresponds to spiral portion of a complete rotation, the spiral step that is the distance between two consecutive spiras and origin of spiral. There are spirals with two or more centers formed by connected arcs, which are the developed perimeters of regular polygons with the same number of sides.

Among the classic spirals, the Archimedes spiral is applied to draw cams.

A few pieces obtained by using the projected device are shown in figures 3…5.

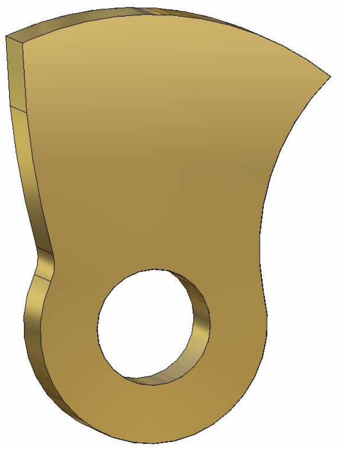

Figure 3.

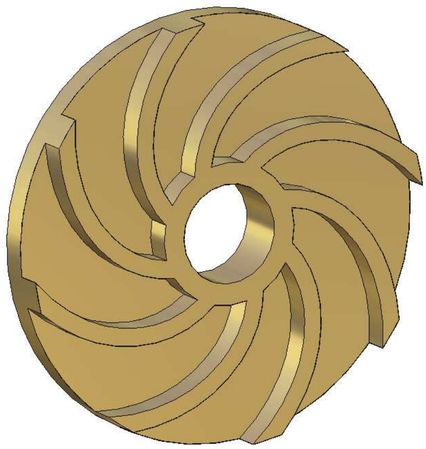

Figure 4

Figure 5

CONCLUSIONS

The designed device is useful in the machining process of spiral pins and plane threads by electrical erosion.

The movement of the plane table where is fixed the work piece on is obtained by combining a rotation and a translation motion.

Adjusting the spiral step is made by using wheels which realize a transmission to a screw driver.

The device can be mounted on the table where is performed the electric erosion of the work piece without any constructive change of it.

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