SOME ASPECTS OF PRELIMINARY DESIGN OF EDM MACHINE

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ABSTRACT: The process of electrical erosion is extremely complex and depends on a number of parameters to obtain the required surface using specialized equipment to carry out a series of relative movements of the tool and work piece. These movements occur during erosion and during displacements into space (withdrawals or advances for subassemblies fast positioning). Promptness and accuracy in taking all these are largely determined by the quality of the equipment with which executes the processing
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DESIGN OF TECHNOLOGY SYSTEMS

1. Generalities

Construction technological-system processing with massive electrode in electrical erosion includes:

- electrode (tool) subsystem - object to be processed
- device processing subsystem.

This paper deals with a part of the processing subsystem comprising:

- mechanical block (machining centre itself)
- Pulse generator
- aggregate of dielectric fluid
- cars performance within this subsystem is equipped with:
- processing order management process,
- the control,
- adaptive control,
- Computer (control and optimization system).

Buildings of blocks of the device functions, which are in active interdependence, are shown schematically in Fig. 1.

Action processing technology electrical erosion takes place within a technological system that has the following main functions:

- generation and maintenance of erosive agent on the surface to be treated,
- waste discharge gap and work out a balance dynamic between erosion and outlet.
- moving spatial coordinates erosion to generate the desired surface.

These functions are fulfilled by electrical erosion processing machines, which despite the diversity of technological operations have a structure identical principles.

The block diagram of one of the most widely used electrical erosion machined solid electrode which operates on the principle of copying the shape and profile is illustrated in FIG. 1 and includes five basic subsystems (listed above).

Mechanical block has a similar construction to that of the machine - the classical tools has added specific elements to erosion processing power: the processing tank required for connecting devices and

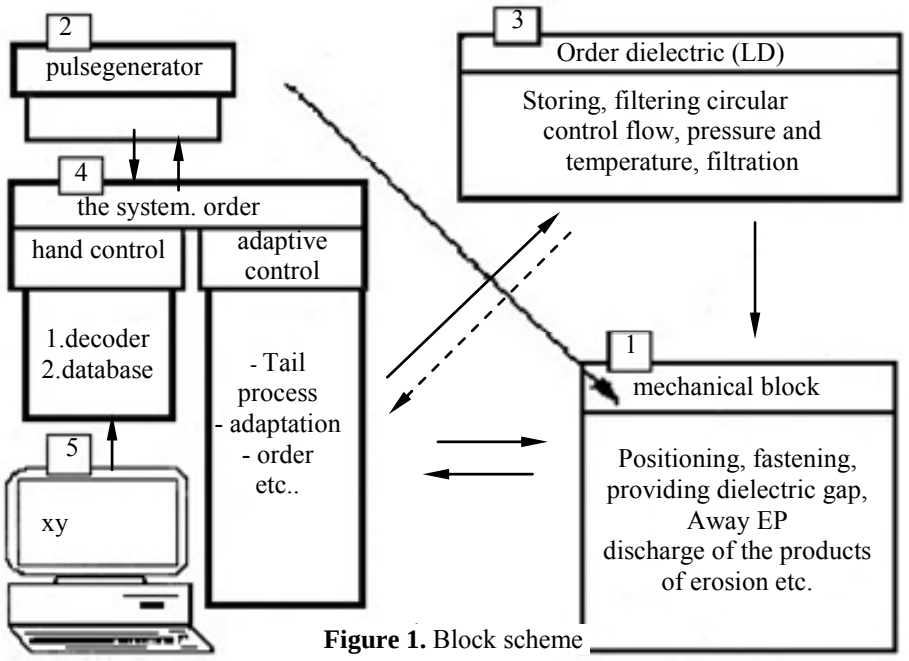

Figure 1. Block scheme

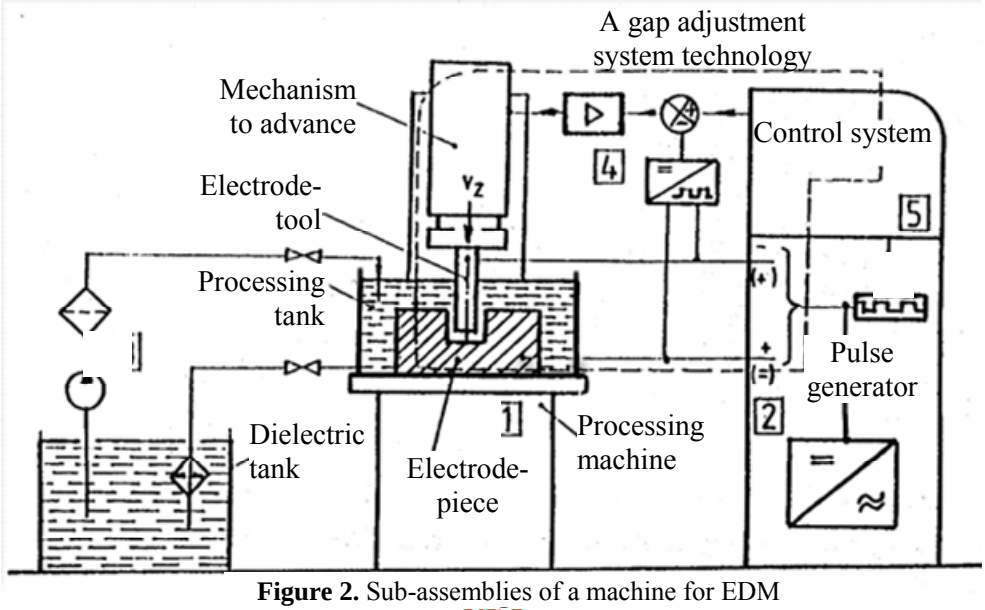

Figure 2. Sub-assemblies of a machine for EDM

electrical isolation (related to electricity supply to technological gap).

The main functions of mechanical block are (Fig.2):

- electrode support tool, work-piece and dielectric fluid tank,
- voltage pulse generator developed electrode - the tool and the object to be processed,
- kinematics ensuring regulation of the generation gap and working surfaces
- Security operation of the equipment.

The pulse generator provides erosive agent - voltage pulses - whose form, energy and frequency are appropriate for initiation and maintenance of erosive action on the work piece surface.

Currently there is a great variety of design solutions for the impulse, but their operation is based on two principles:

- relaxation energy stored in a capacitor, generating relaxation (dependent) pulses (Fig. 3)

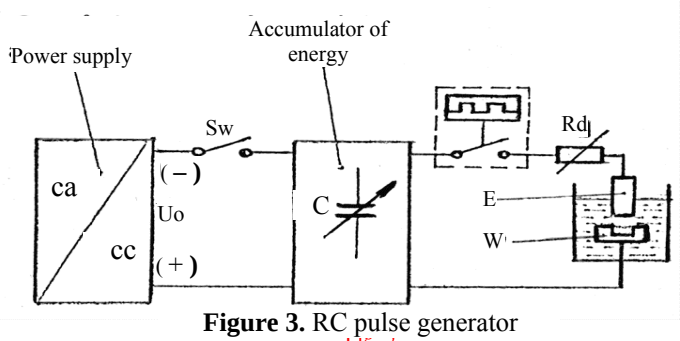

Figure 3. RC pulse generator

- Switching DC voltages (generating independent pulses) so-called chopper.

Relaxation generators are currently used only for finishing as addition of sub-generators pulses like generator driven.

Being able of precise dosage of energy pulses at high idle voltage, these types of generators can achieve higher quality surfaces.

Independent generators operate at constant frequency pulse (iso-frequency) or constant power pulse (iso-energy).

Table 1 presents the main characteristics of pulse generators.

When applying successive pulses according to regime mostly in the concrete conditions of work, a series of phenomena arise and influence each other, having in turn a specific influence on EDM process in general on processing characteristics.

The dielectric fluid has the main role to ensure the proper discharge priming and maintaining of erosive process in the technological gap.

From the point of view of the solid electrode pair location - in relation to the object to be processed with the working fluid, the processing can be submerged and / or with forced circulation of the dielectric fluid in the working gap by one of the following schemes:

- Injection asymmetric

Table 1. General characteristics of the pulses generators

Pulse generators		Idle voltage V	Current intensity A	Pulse duration µs	Pause duration µs	Pulse frequency kHz	Filling factor k	Power kVA
Commanded	with transistors	80-100	25-800	2-3200	3-1600	0.1-300	0.001-0.99	1.5 -100
Relaxation	RC	100-3000	0.01-20	0.5-200	-	1-100	0.01- 0.6	0.3 -1.5

- Injection symmetric
- Injection - extraction.

In the electrical erosion machine tools, one of the most important roles has the technological gap adjustment system.

It maintained throughout the processing of an optimal distance between the two electrodes so that it delivers pulses with a maximum frequency, to avoid short circuits or unwanted conductive bridges and erosion products to be easily discharged.

Advance of electrode-tool (or object processing) is performed by a specific mechanism for advance, integral part of the automatic adjustment of the technological gap machine.

The tractor is embodied as a rule, by a servo element acting as a control loop adaptive implementation shown in regardless of the mode of operation; it is necessary to continuously vary the rate of erosion, in which case manual adjustment is not possible, or using advance boxes.

2. INSTEAD OF CONCLUSIONS

At the end of this paper we propose, given the importance of electrical erosion, to restore some of the most significant moments of its development.

Lightning effect using was initiated before the end of World War II, specifically in 1937, by Lazarenkos at Electrical Research Institute in Moscow. The research was interrupted by the war and after 1950 were undertaken by other researchers in Switzerland this time, which also proposed to construct machines in the early 50 (Fig. 4). Technological aspects were in place but in several countries already were built machines: Switzerland, Russia, Czechoslovakia, Hungary, Germany, and later Romania, and Spain. In some countries, the construction of machines was exceeded, and research and techno-logical phenomena, were vital in order to conquer the markets.

Figure 4. AGIE 1950

Research, both in terms of technology and physics aspects began immediately after the war, carried on by many researchers that became sounding names in the field. In Russia may be appointed Lazarenkos, Mandelstom and Rajski, Zingerman, Livs in Germany Hinnuber, Opitz, Konnig, Schierholt, Kracht, Kurr, Barz in Israel, Wertheim in England Divers etc. In our country are mentioned Nanu, Nichici, Isarie, Gavrilaş, Marinescu, Visan and the team of MU Department of Polytechnic Institute from Brasov.

High speed spreading process is attested by the large number of companies producing electric cars erosion growth rate d beings than 10 times higher than conventional cars.

Figure 5. AGIE 1969

The first machines of this kind were made in Switzerland by Agie firm in Geneva. They were equipped with relaxation generators and use modest parameters. They were followed by Csepel from Budapest (Erozimat U), Nassovia-Krupp, AEG and Siemens from Germania, VJK in Czech, ONA in Spain, JAPAX in Japan etc.

Since 60's all companies manufactured machines equipped with generators performing commanded pulses. Development of various manufactured models allowed the appearance of the first NC machine in 1969, first machine -AGIECUT presented in fig. 5.

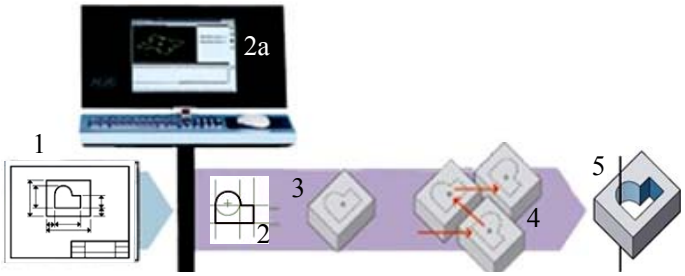

Figure 6. Processing with wire electrode

Succession of process design with NC, initiated by the company AGIE (Fig. 6) involves a sequence from parts design (1) through various phases of machining specific to wire cutting (5).

In 1955, the company Charmilles from Geneva produced machines for wire EDM. Robofil model

Figure 7. Charmilles

(Fig. 7) was built by the union of the two companies AGIE (in Losone) and Charmilles (in Geneva).

Figure 8. AGIE

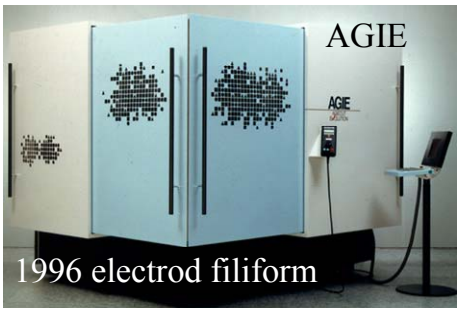

Figure 9. AGIE

Figure10.

Figure11.
Sodick

1996 was a year of change in the design of machinery products; an interesting one is presented under the AGIE brand (fig. 8 and 9).
Compaction allows firstly access and maintenance simpler, easier maintenance and a pleasing aspect too. A German company produces accessories for electrical erosion and sells machined from company Yokohama Kanagawa - Japan. Figures 10 and 11 are two of the products mentioned above that is a wire machine (Fig. 10 AQ750) and the second one with massive electrode (Fig. 11 AG40).
The high diversity of construction is determined by the results of the research phenomenon, technology and the economy of specialists.
Variety machines offer extremely high electrical erosion, mostly near about same opportunities. It remains therefore that the choice of one or other of the products to be made, often for economic reasons.

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