

TECHNOLOGICAL PERSPECTIVES REGARDING THE APPLICATION OF THE CONTACT BREAKING ELECTRICAL DISCHARGE MACHINING PROCESS USING AS ELECTRODE-TOOL - METAL BAND IN THE MACHINE MANUFACTURING INDUSTRY

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Rezumat. *Lucrarea științifică prezintă cele mai importante aspecte de natură teoretică și practică cu privire la posibilitățile de prelucrare a materialelor metalice utilizând procedeul de prelucrare prin eroziune electrică cu rupere de contact cu obiect de transfer bandă metalică. Cercetarea expusă are la bază experiența dobândită de-a lungul anilor de o echipă de cercetători și profesori universitari români care au reușit să breveteze o instalație de debitare a materialelor metalice utilizând procedeul de prelucrare prin eroziune electrică cu rupere de contact cu obiect de transfer bandă metalică. Lucrarea științifică prezintă o radiografie a unor studii și cercetări desfășurate de-a lungul anilor în domeniul anterior prezentat.*

Abstract. *The scientific paper presents the most important aspects of theoretical and practical nature regarding the possibilities of processing metallic materials using the contact breaking electrical discharge machining with transfer object-metal band. The exposed research is based on the experience gained over the years by a team of Romanian researchers and university professors who managed to patent a metal material cutting plant using the process of contact breaking electrical discharge machining with transfer object-metal band. The scientific paper presents a radiography of some studies and research carried out over the years in the previous field presented.*

Keywords: contact breaking electrical discharge machining; cutting steel; metal band

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1. Introduction

Dimensional processing by electrical discharge machining is one of the most widespread nonconventional processing processes in the world. Contact breaking

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electrical discharge machining is a process widely used today for cutting metallic materials using primarily a disk-type transfer object. The authors of this scientific paper contributed by completing the range of possibilities currently available, using a metal band as a transfer object for processing through contact breaking electrical discharge machining.

Contact breaking electrical discharge machining processing using as electrode-tool - metal band - is one of the modern technological procedures for nonconventional processing of high-alloy steels (hard and extra hard), in economic conditions of optimal efficiency [1, 2].

In the research carried out in order to carry out this scientific paper on the mentioned cutting process, the specific technological aspects of cutting (semi-finished products of high steel alloy) through Contact breaking electrical discharge machining using as Transfer Object - metal strip were addressed.

This Transfer Object - the metal band is found in the structure of the installation prepared for the steel cutting process through contact breaking electrical discharge machining. This constructive solution is often subject to specific size restrictions and a large size of semi-finished products [3, 4].

The fact that the metal disc was replaced with the metal strip as a Transfer Object in order to perform the cutting operations, leads to the fundamental modification of the constructive solutions that have been applied until now. This leads to completely new forms of construction for the new installations.

Due to this replacement, the range of phenomenological constraints is influenced, but also of the constructive and technological ones. This leads to the limitation of the possibilities of using the metal disc, as a tool (determined by the range of semi-finished products) especially in the processes specific to the metallurgical industry.

In the research conducted there are a multitude of applied research options that led to the identification of optimized values of the construction elements of the metal strip (length, width, thickness), as well as for the ends of the connection, to form a closed, strong and durable contour.

2. Aspects regarding the behavior of the transfer object - metal band during the contact breaking electrical discharge machining

The first aspect worth mentioning is that the current research on Contact breaking electrical discharge machining - the transfer object - metal band has replaced the metal disk. In this sense, there is research that has debated this topic and its relevance, and at the same time presents its behavior with the dynamic demands existing during the debiting process [5, 6].

At the time of processing by Contact breaking electrical discharge machining, among the main factors that show a direct influence on the object of transfer is the diameter of the working wheels, within the experimental system of drive of the stand (figure 1). This factor and not only determines the geometric dimensions of the metal band.

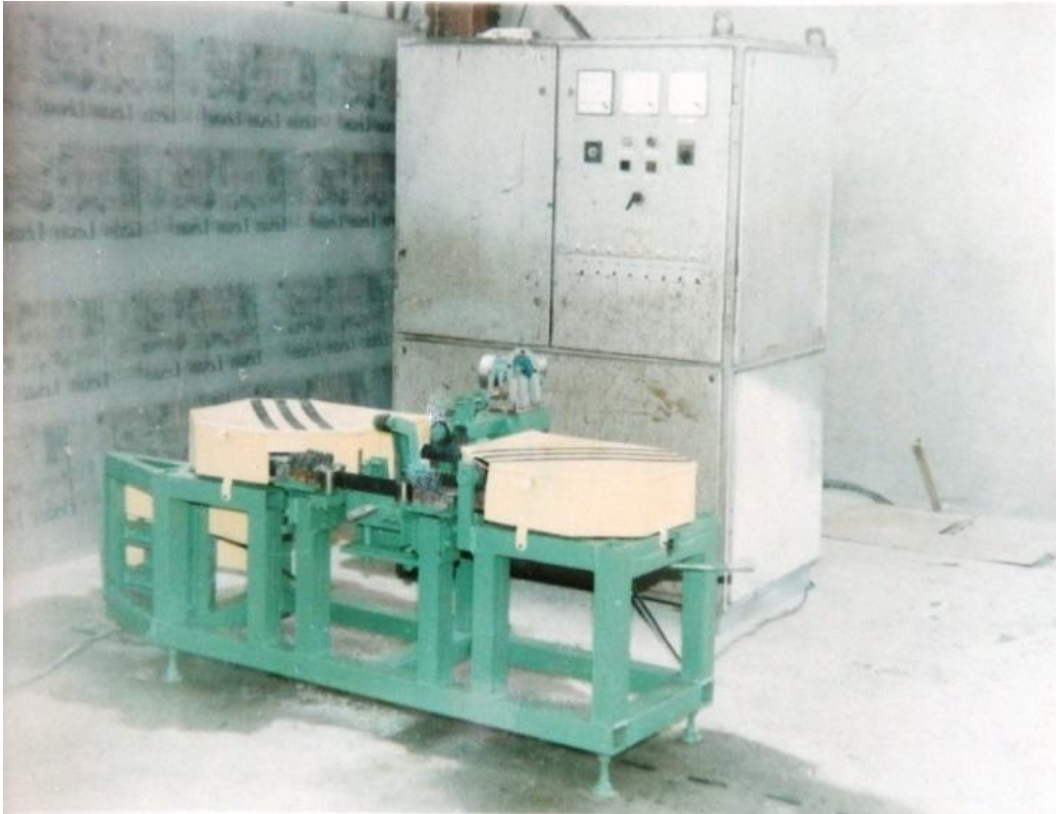


Fig.1. Experimental installation for the study of the processing by contact breaking electrical discharge machining with transfer object - metal band

Regarding the behavior of the metal band during the cutting process, when mechanical stresses and fatigue stresses occur, it was taken into account the choice of types of materials that are compatible with the construction (design, construction, and assembly) and especially the operation stand. This is about technological conditions along with the construction project that was adopted, as well as the working conditions and last but not least the physical and mechanical properties of the material. The latter being determined by the chemical composition and the type of processing [7, 8].

3. Advantages of using metal band as object transfer

The use of metal disks in the contact breaking electrical discharge machining processing type raises a number of issues. Of these, the most relevant and noteworthy are presented below.

The first aspect is the high consumption of electricity - this is due to the discharges generated during the processing, in the form of the "wrong arc". It takes place between the side surfaces of the metal disk - called the transfer object, and the part to be processed - also called the processing object;

Another relevant aspect involves energy losses in the form of the "wrong arc". These losses lead to additional energy consumption which is very necessary in the process of working.

Increasing discharges in the form of a "wrong arc", in other words "energy losses", leads to a decrease in productivity - and this is again to the detriment of metal disks.

When it comes to the individual sections of the processing object, in these situations, the cutting process is no longer possible due to the very large "energy losses". The reason is that the value of these "losses" increases in direct proportion to the increase in the object of processing [9].

In this context, based on the disadvantages of the metal disk, presented above, and due to the existence of restrictions induced by the use of the transfer object - the metal disk, the authors found that the use as a transfer object - of the metal strip involves many advantages. These involve the aspects presented below [10].

The side contact surfaces that generate a "wrong spring" are significantly smaller which leads to reduced energy loss.

Another key advantage is that it is possible to use technological parameters whose values may be lower, considering that the side contact surfaces also have lower values of. As a result, low electricity consumption results [11, 12].

Last but not least, the advantage of the possibility of ensuring a better probability of the working process, compared to the use as a transfer object of the metal disk is also mentioned.

4. Physical mechanism of the processing method

To ensure the stability of the contact breaking electrical discharge machining process, the necessary conditions are necessary, the most important of which are:

- Direct introduction of electricity into the transfer object: the contact area of the treatment object and the fulfillment of the conditions required for the start of disposal;
- Continuous and temporary electrical impulses in the interaction zone between transmission objects - processing objects;
- Ensure the polarization properties of electrical impulse emissions, which will result in the discrimination of both processing objects and transmission objects;
- Continuous recovery of the initial condition in the erosion area and continuous changes in the position of the transfer object to the treatment object, which allows periodic recurrence;
- Effective removal of corrosive products.

The primary forms of erosion of technological interest are presented in figure 2.

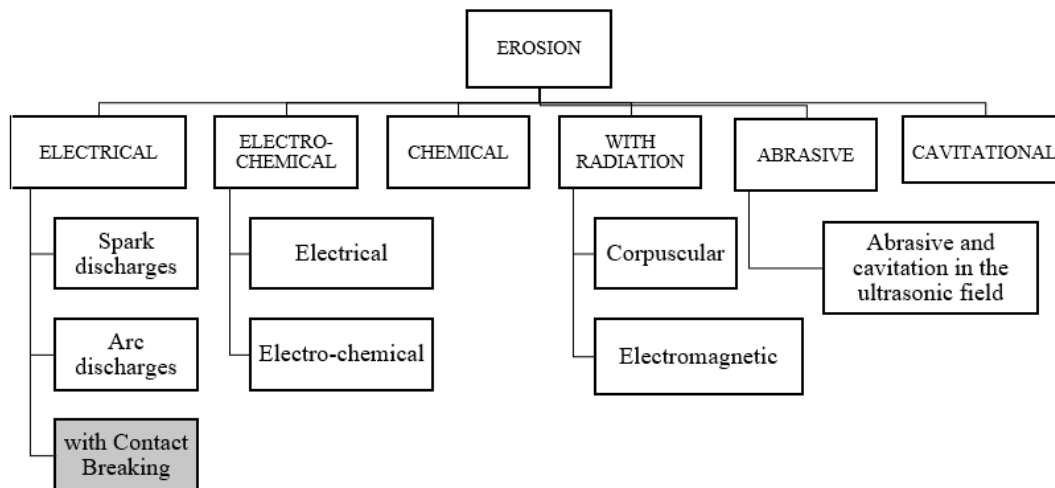


Fig. 2. The primary forms of erosion of technological interest

5. The principle of processing

The erosion is the part of the process which is based on the action of material decomposition (underlined by several experts in the field, according to the literature mentioned in the dissertation).

Electrical corrosion by the contact separation process is based on the release of non-static suction springs by the separation of the electrical current-carrying contact, which is temporarily made between the transmission object and the processing object, each connected to the pole of the electric generator.

În figure 3 it is presented the schematic diagram of contact breaking electrical discharge machining process with metal band as the transfer object. In this figure, the number position represent:

- 1 – metal band (transfer object);
- 2 – the processed object;
- 3 – cooling/working environment (w.e.);
- 4 – power source (P.S.);
- 5 – Power receptors;
- F – pushing force;
- c – contact pressure;
- S – feed movement of the transfer object

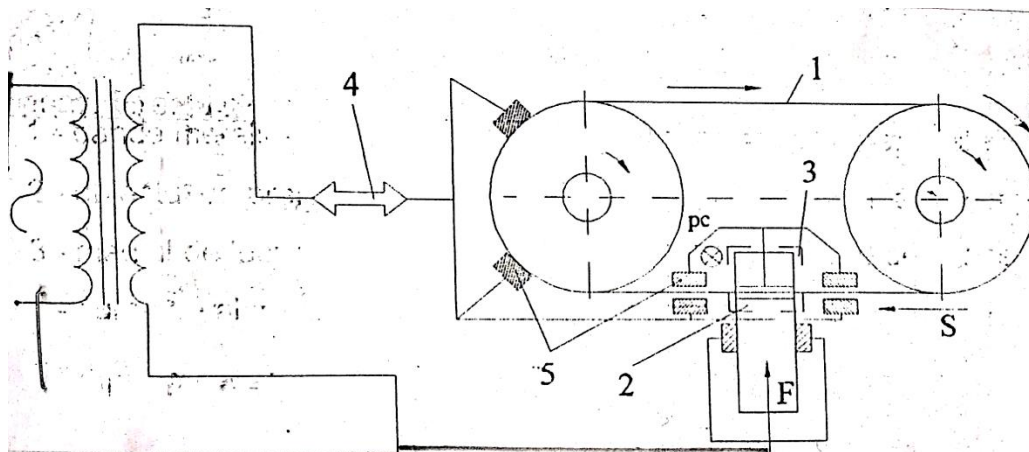


Fig. 3. Schematic diagram of the contact breaking electrical discharge machining process with metal band transfer object

6. Fields of application

The contact breaking electrical discharge machining process has a wide range of applications in industries for mechanical or metallurgical engineering.

The main important applications for contact breaking electrical discharge machining process are given in Table 1.

Table 1) Fields of application

<i>No.</i>	<i>Name of the operation</i>	<i>The shape of the object transfer</i>	<i>Quality of the material</i>
1	Dump-cleaning	Circular Disc	OL, OLC
2	Drilling	Cylindrical	OL, OLC, Cu
3	Surface treatment	Radial brushes	OL, Am, Cu
4	Cutting	Circular Disc	OL, OLC
		Metal band	OL

The main areas of applicability can be found in:

- cutting difficult-to-process steel parts;
- unmasking of cast parts;
- surface processing (flat, cylindrical, frontal, etc.);
- sharpening cutting tools;
- smoothing / rectifying the processed surfaces;
- drilling, perforating plates, profiles, etc.

Conclusions

Budget efficiency is an important factor in enabling state-of-the-art technology that is highly economically viable, especially by increasing energy / efficiency stress.

The results of the experiment show the economic results obtained by cutting the final products directly with contact breaking electrical discharge machining process from alloy steel, using the metal band.

After the tests performed and the results obtained, a new alloy steel cutting technique can be used and can successfully replace the current technique characteristic of traditional fields (cutting, arc, energy heat, etc.).

Features of the new surgical technique developed by the contact breaking electrical discharge machining process:

- Promoting the impact of social work, recovery of social work;
- Improving the quality of cut parts;
- Improve performance and change its performance.

This scientific article is a broad approach to the problems associated with contact breaking electrical discharge machining process using metal band as a transfer object and showed that it is one of the modern techniques that with sufficient

technical and technical and technical and in terms of economic efficiency. Analysis and research conducted during the preparation of this scientific paper in the field of nonconventional (contact breaking electrical discharge machining process) highlighted the performance and benefits of this process. The conducted research activities led to the highlighting of technological and management aspects related to the cutting of certain alloy steel materials, the use of metal strip as metal strip and the completion of established research guidelines enabled important original contributions to be made.

There may be more research and elucidation in this field, the authors express the belief that research institutes have new concepts and solutions, seeing benefit presented in good design and good results, but future and clear why which has been used commercially, will directly address the elimination of natural problems of technology that is still in use today, as well as unresolved decisions and solutions.

The arguments based on the above claim to calculate the best design, financial accounting industry that only develops contact breaking electrical discharge machining process with transfer object-metal band. All these cases provide additional information in the research.

We can conclude that the contact breaking electrical discharge machining process is one of the modern technologies which can solve some of the problems associated with processing of highly steel alloys.

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