TRANSLATION

ON THE FEASIBILITY OF THE ANODE-JET METHOD
OF PROCESSING METALLIC SURFACES

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In analyzing the structural formulas of the jet liquid-abrasive processing of metallic surfaces there was revealed a new method of conducting the process. Its essence consists in the constant formation on the surface of the part being processed of an anode film and products of anode solution and their removal by a jet of abrasive electrolyte (1). Meanwhile it was noted that such a unique anode-mechanical processing can be accomplished by various arrangements: 1) V-EA-EA, 2) EA-EA-EA, 3) EA-V-V, etc. [V = air; E = electrolyte; A = abrasive].

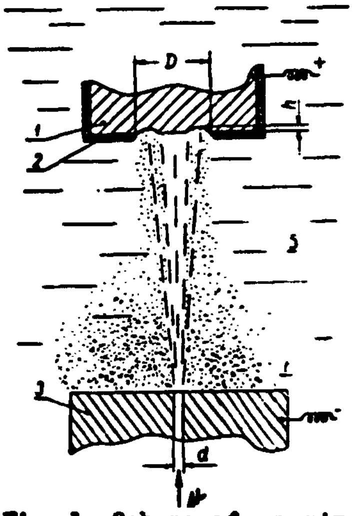

Fig. 1. Scheme of experiment 1--specimen; 2--electrical insulation film; 3--cathode with jet apparatus; 4--air; 5--cutting electrolyte; 6--precipitate of abrasive.

In this paper we explain the results on an experimental check of the anode-jet method of processing for the purpose of determining the feasibility of its accomplishment.

The experiments were conducted by the arrangement EA-V-V (Fig. 1) on specimens of steel 9KhS tempered to a hardness R_c = 58—62. Before submerging in the abrasive electrolyte each specimen is subjected to electrical insulation by means of the application of a thin layer of celluloid on its surfaces, which in the electrolytic bath are in contact with the electrolyte. At the initial moment of the process the protective coating was locally broken by the action of a cutting jet of electrolyte, and the electrical field being formed took on high uniformity.

The pressure of the air brought to the jet apparatus in all the experiments amounted to 4.5 excess atm and the length of the jet was 20 mm. The diameter of the output opening of the nozzle-cathode was 0.8 mm. Such a dimension of the opening made it possible with sufficient intensity to take off the anode film without cutting the basic metal, which was established experimentally by cutting out the source of the electrical current.

As an abrasive material there was used the powder of electrically produced corundum of varying granularity: 60, 100, 220, M28 and M7. The volumetric concentration of the abrasive in the electrolytes, independently of the kind of experiment, amounted to about 50%. The duration of the experiment was 5 min.

The compositions of the electrolytes used are given in Table 1. In selecting their concentration consideration was given to the condition of least electrical resistance, assuring, as is known high productivity of solution (2).

The process of the experiment was accompanied by the formation on the surface of the specimen being tested of a ring-shaped craterlet, by the greatest depth of which the effectiveness of the process was evaluated. The density of the current was calculated by dividing the strength of the current I by the area of the craterlet free from the celluloid film.

The results of the experimental researches are presented in Table 1. Part of the most essential material in evaluated form is shown in the form of graphics in Fig. 2. By analyzing these experimental data one can come

T a b l e 1

Наименование электролита, его концентрация в г на 1 л воды (1)	Электрические параметры (2): I, a	Электрические параметры (2): V, в	Глубина лунки, мк (3) — зернистость абразива (4): 60	100	220	M28	M7
$NaH_2PO_4+KNO_3$ (фосфорнокислый натрий и азотнокислый калий), 31 и 16 (5)	0.5	20	42	42	39	30	15
	1.0	30	51	48	45	39	30
	3.0	40	69	60	57	45	38
	6.0	75	127	123	117	66	56
NaCl (хлористый натрий), 11 (6)	0.5	15	27	24	23	22	18
	1.0	30	42	39	30	30	27
	3.0	50	57	45	42	36	33
	6.0	65	96	87	84	51	38
NaS (сернистый натрий), 16 (7)	0.5	50	37	18	16	11	9
	1.0	75	39	27	21	20	18
Na_2SiO_3 (жидкое стекло), уд. вес 1,24 г/см³ (8)	0.5	55	38	36	33	24*	Образование электрофореза (9)
	1.0	80	84	52	45	27**	

*Area of craterlet 0.14 cm^2. **Area of craterlet 0.29 cm^2. In the remaining cases 0.28 cm^2.

Key: (1) name of electrolyte, its concentration in w for 1 liter of water; (2) electrical parameters; (3) depth of craterlet, microns; (4) granularity of abrasive; (5) (sodium phosphate and calcium nitrate), 31 and 16; (6) (sodium chloride), 11; (7) (sodium sulfide), 16; (8) (water glass), Spec. Wt. 1.24 g/cm^3; (9) electrophoresis.

to the following conclusions.

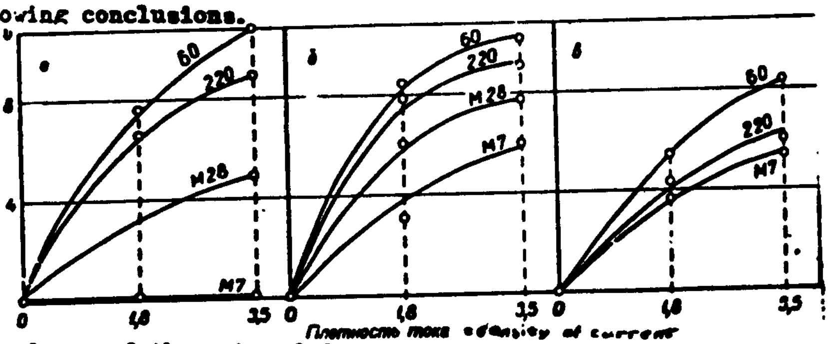

Fig. 2. Dependence of the rate of formation of the craterlet (micron/min) on the density of the current (amp/cm^2) and the granularity of the abrasive or electrolyte: a—Na_2SiO_3; b—$NaH_2PO_4 + KNO_3$; c—NaCl

The processing of metallic surfaces by means of combining an anode solution with the mechanical action of a cutting electrolyte represents a feasible process, which can be made the basis of machining the parts of machines and instruments.

The proposed process in its essence represents the sum of electrical, chemical, and mechanical phenomena. It has been shown that the rate of formation and the removal of the products of anode solution depends on the kind of electrolyte used, the density of the current, and the granularity of the abrasive. By means of change in the listed factors it is possible to regulate the productivity and quality of the processing. With a density of the current up to 2 amp/cm^2 the amount of metal removed, as compared with anode-mechanical working, is less by a factor of two or three, and less by a factor of ten as compared with the hydro-abrasive jet process. With a density of the current above 6 amp/cm^2 the productivity exceeds the two compared methods of working.

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Literature Cited

1. S. A. Dovnar, DAN BSSR (reports of the Academy of Sciences of the Belorussian SSR, No. 4, 19 61.

2. B. I. Kan and I. G. Kosmachev, Anode-mechanical Polishing Process, Mashgiz (state scientific and technical publishing office of literature on machinery), 1952.

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