NON CONVENTIONAL MANUFACTURING IN THE CRYOGEN MEDIUM

Ing. Ionel DEJEU, Florica PLOP

Abstract: This paper presents non conventional works in the presence of the cryogenic environment. In the industry of machines construction the frozen is used to cool the tools or the pieces. In the processing working in the presence of frozen, the physics proprieties are very important because the electric strength lows the line. It is also presented the fluctuation of the physics proprieties of the materials due to the lower temperature or the modular structure of the cryogen installation.

Keywords: Cryogenic, temperature, high pressure, frozen

1. GENERALITIES

In the last century the technique of frozen finds many aptitudes in the construction of some specialize installation with many uses in processing of some special material.

Regarding the temperature which develops the processing in the presence of the frozen, there are two specific fields of using:

a) the field of temperature between a 0….-30°C, named the industrial frozen with many applications in the food industry, chemical and extractive industry.
b) the field of temperature between -30… -200°C, named the depth frozen (cryogenie) with many applications in the electronique technique and the machines construction.

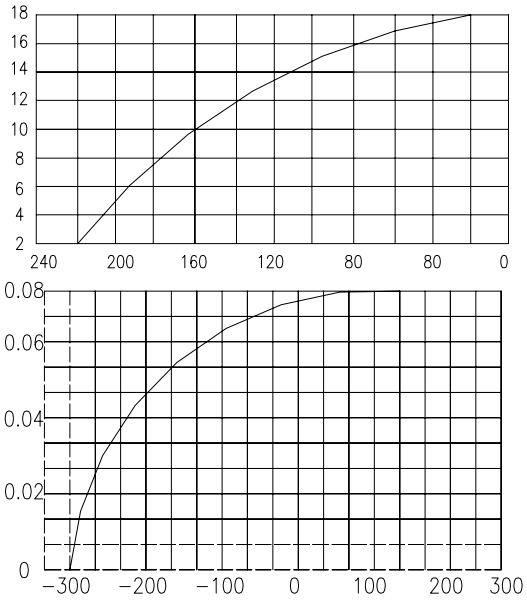

Fig. 1 The variation of the physics proprieties at the iron and steel because of the lower temperature

In the machines construction, the frozen was used to the coldness of the tools or the pieces that were manufacturing. It is also obtained a quickly manufacturing because of the easy process of making cuttings, especially in the case of manufacturing steel .If only the tool is submitted to the frozen process, the productivity of the manufacturing can increase with 15-20%.

By the frozen process of the manufacturing tool is increased the brittleness of the cutting metal, the quality of the surface increases because of the decrease of the roughness and the parameters of the tool are maintain.

The special results were obtained at the grind of the tools quench of the steel, when by establishing the time of maintaining in the frozen rooms, are obtained a few distortions in the process of the heating to the grinding.

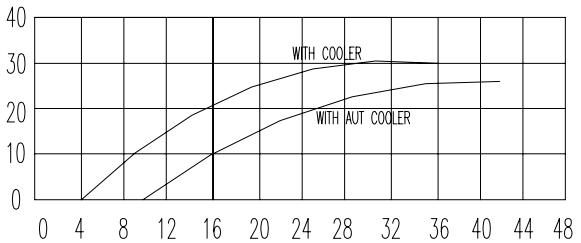

Fig. 2 The influence of the volumetric relative wear

The technique of frozen has many applications in the case of non conventional technologies, to the cutting or the electrochemical, in case of electroerosive manufacturing, when the decrease is made independentely for the drilling electrode and the tool electrode.

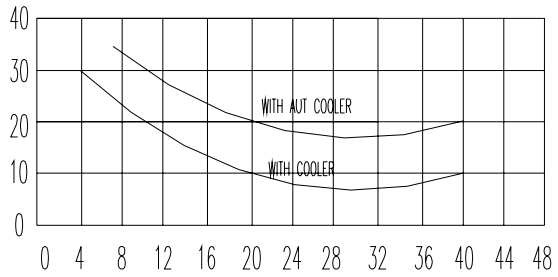

Fig. 3 The influence of the productivity

2. PHYSICS PHENOMEN AT THE SUPRACOOL MANUFACTURING

By overheating the tool electrode the materials become better electricity conductor so they can be used to the manufacturing of the electrodes and other materials. Types of producing installations of frozen:

a) the vaporize- where the frozen agent is vaporized by switching the heat with the air from outside.
b) the compressor- of cold vaporize obtained by the heating of the agent in the vaporize.
c) the liquid separator- realizes the saturated dry estate of the vapors at the entrance in the compressor.
d) the condenser- has the role of assuring the switch of the heat
e) The supercooler of condenser- is introduced in the installation when the temperature θ_a of the water is lower then the temperature θ_c of the condensing water.

The manufacturing by electric erosion with electrodes cooled with nitrogen liquid. The process permits the chill out of the tool electrodes until the temperature of 160-180°C. The model presented there is the block of the installation with nitrogen liquid formed by a few modules.

The model of the installation of cooler:

-MS zone- the stocking module and trapping of the nitrogen liquid, which has the role to create a pressure in the stocking room.

-MA zone- the mode of charging which assures the transfer of the nitrogen liquid from the stocking room;

–MP zone- the pressurization mode which assures the transfer of the nitrogen liquid.

-MR zone- the setting mode of the nitrogen liquid debit, corresponding to the imposed temperature in the working zone.

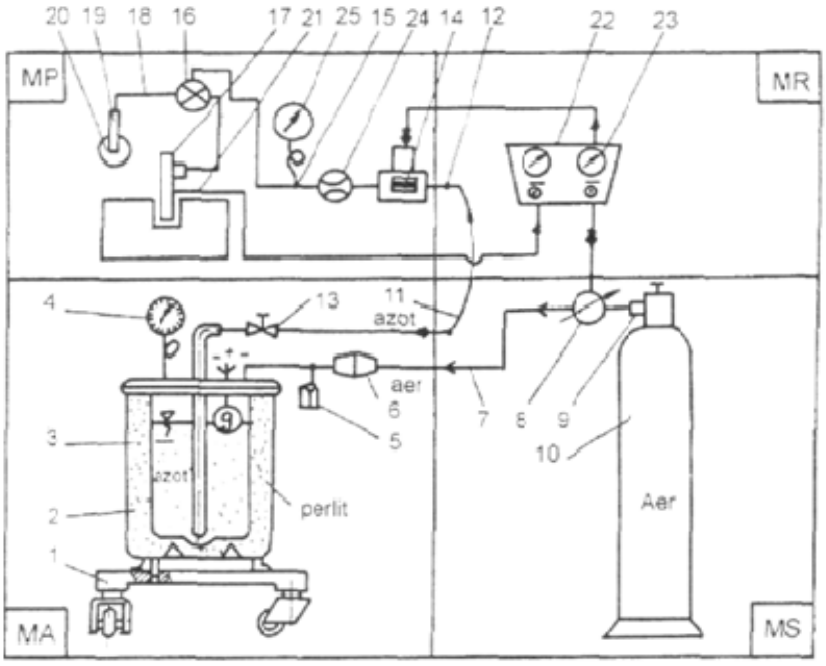

Fig.4 The modular structure at the frozen installation.

The components of the installation are:

- the transporting carrier of the installation;
- the stocking vase of the nitrogen liquid, having a capacity;
- levelmeter;
- pressure gage;
- pipe valve;

- air filter;
- the transfer tube of the air;
- top pressure;
- step down gear;
- air cylinder.

The module of the alimentation is formed by:

- o the flexible pipe of transfer with special thermical isolation;
- o the rigid pipe of transfer, from copper;
- o top manual for flow control;
- o electroventil for flow control;
- o coupling connection.

The pressurization module is formed by:

- distributor;
- tool electrode;
- the jet with two channels of alimentation;
- the relative adaptor;
- the nozzle for pressure.

The adjustement module has:

- heat translators;
- heat comparator;
- heat controller;
- volumeter for measuring the pressure of nitrogen liquid;

3. THE RUNNING OF THE INSTALLATION

The air for creating suprapressure is produced by the 10th cylinder, by the reductor of the pressure 8, the transfer tube 7 and the filter 6 in stocking vase 2. Because of the pressure realized by introducing the comprimed air, the nitrogen liquid from the vase is transmitted through the flexible pipe 11, the transfer rigid pipe 12, top manual 13 and the electroventil 14 to the three horses distributor16.The heat translator 23, because of the temperature in the working zone, commands the opening-closing of the electroventil 14, realizing the control of the debit. At the shapping is recommended circular nozzles, at which the splashing orifice are disposed having the amplacement angle between 15-20 towards the piece.

The installation presents a few advantages:

- ✓ it is simple to make it and it is easy to explore
- ✓ the nitrogen fluid debit can be modified by the connecting realized by the electroventil
- ✓ the cryogenic cool can be realized in all three versions only the piece,only the tool, or the piece and the tool by the three horses distributor at which the handle of action has three work position:0, 45, 90.

The disadvantage of the installation:

- ❖ it is not assured a fine flow of the nitrogen liquid but only after a time necessarily for the stabilization of the pressure in circuit.
- ❖ at stocking and transforming the nitrogen liquid the energy losses are big because it can not be assured a perfect thermic isolation

4. APPLIANCE FOR ELECTRODE FIXATION

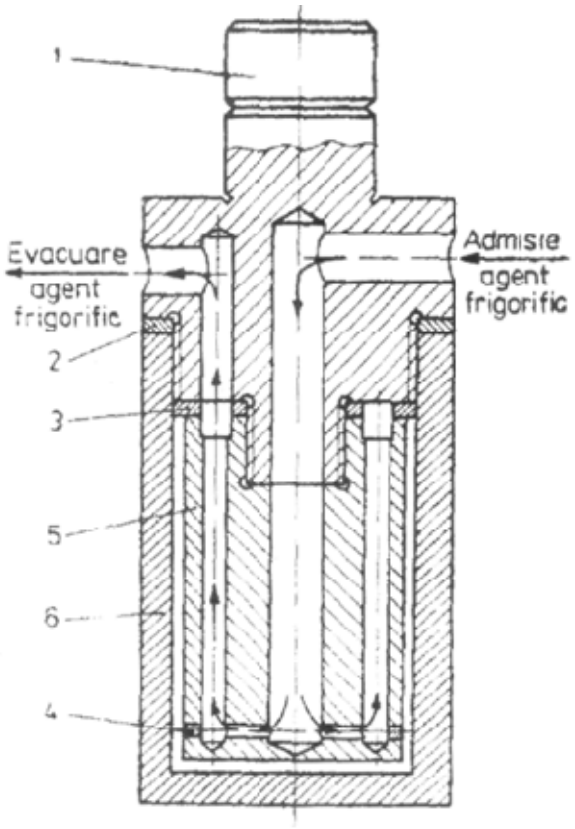

Fig. 5 The appliance for the clamping special electrode tool; 1 - element of fixation in the portelectrode; 2, 3, 4 - armatures of closing; 5 - transfer element of the cooler agent; 6 - the electrode tool.

5. CONCLUSIONS

The advantages of using these types of appliances are:

- the production increases with 30-40%
- the tool wear is lower with almost 40-45%

- the quality of the surface increases with 15-25%
- the depth of the work surfaces is lower
- the coating with thermical influence has a depth of 3…5 lower

REFERENCES

[1] BAILA, N.A., High Technology in the Machines Construction-University Pitesti 1994;
[2] GAVRILAS, I., MARINESCU N.I., Non Conventional Manufacturing in the Machines Construction – Technique Publishing Bucuresti 1993;
[3] MIHAILA I., The Technology of Machines Construction IIS Oradea 1983;
[4] MIHAILA I., The Materials Technology, Publishing Oradea 1995;
[5] NICHICI A., Manufacturing By Erosion in The Machines Construction –Publishing Facla 1993;
[6] R. Barron, "Cryogenic treatment of metals to improve wear resistance" Butterworth & Co. Ltd.(1992)
[7] www.cern.ch