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Karmalita A.K., candidate of technical sciences
Yakymchuk D.M., post-graduate student

Khmelnitsky national university, c. Khmelnitsky, Ukraine

INVESTIGATION OF ENERGETIC PARAMETERS OF ELECTRO-HYDRAULIC PRESS EQUIPMENT

The basic methods of improving of electro-hydraulic press equipment are proposed.
Experimental equipment for research energetic indexes of electro-hydraulic presses are developed.
Influence of the indicated indexes on the dynamics of work of presses is determined.

Introduction

Present state of industry is characterized by fast development of its different branches. Such every branch has its own differences and peculiarities. One of such branches is light industry.

The energy factor occupies one of the most important places in the development not only light industry, but the whole state in general. The producers of the equipment work at the effective improvement existing examples as well as at developing new, more economic and technological ones. This in its turn brings to a new turn of high-quality development of all industry branches.

Electro-hydraulic press equipment in light industry is used for carving out the components from artificial and natural leather by means of submerging the cutter into carving plate. Nowadays the enterprises of light industry of Ukraine use a number of carving presses of Soviet production, and the amount of new modern presses isn't enough for satisfying the needs of industry. Such situation is extremely tense under the development of crisis in the world economy. That is why, the improvement of such equipment and its technical-economic activities are a very actual task. This is the purpose of present abstract.

The exposition of main material

The most widespread carving presses of Soviet production, which are used on Ukrainian enterprises of light industry, are the presses PVG-8-2-0, PVG-18, PKP-10 and PKP-16. Most of them have the console construction, which has recommended itself very well. However, such equipment goes out of date physically and morally, and needs being modernized. The most popular is the press PVG-8-2-0. That is why we chose such press equipment as basic for increasing the work effectiveness.

For the complex improvement of technical-economic activities of the press PVG-8-2-0 we need to do such innovations:

1 – substituting the electric engines of hydro pump drive for more economical;

2 – excluding from the press hydro drive the mechanism of turning the striker and substituting it for manual control;

3 – substituting the relay schemes of control of press electric equipment for micro controller;

4 – reduction of mass and overall size if possible;

5 – tuning in the optimal conditions of installed equipment work.

The primary task of the press PVG-8-2-0 modernization was to investigate its energy parameters. It is known from the practice, that electro-hydraulic press equipment has a number of drawbacks, which are characterized by specific conditions of its work.

The electric system of guidance plays the important role in the quality work of press hydro apparatus [1]. As a result of a delay in snapping into action of the electric and hydraulic apparatus, the carving out of each detail in the end of the process is accompanied by considerable pressure increase in the hydro system, which produces the press overload and results in a fast wearing out of cutting instrument and carving out slabs, hydro system details breakage, heating oil, and exceeding the capacity, which is consumed.

In the abstract [2] the researchers investigate the size of pressure reflux in press equipment. They determine that after finishing carving out the material a delay in snapping into action of the electric and hydraulic apparatus is observed. They result in the overload and stopping working of the hydraulic elements and this in its turn leads to the press energy consumes increase in general. Such delay makes the value Δt=0,03 – 0,04c., and the pressure reflux make the average Δp=5,8 MPa.

For determining the value of pressure reflux in the abstract [3] as a basis such formula is taken:

$$\Delta V = Q \cdot \Delta t \cdot \eta, \tag{1}$$

where: ΔV – liquid quantity, which comes into a hydro system during the period of overload;

Q – pump production;

Δt – hydro system overload in general;

η – volume hydro system coefficient of efficiency, which considers liquid flow out in the pump, spreader, cylinders, etc.

On a basis of made calculations the authors ascertain that for the improving of the work of the carving out press hydro system and improving of its energy indices, also for the decrease of overloads, it is needed to introduce into hydraulic systems flexible chains- wares with air bag or spring pump (accumulators), short sections of tubes with elastic walls.

Given above research was made on that time equipment, which wasn't precise enough. Experimental data was taken from electric devices and oscillographs, and the average value of received quantities was presented on a graphs. Nowadays equipment allows to research necessary parameters of equipment with higher accuracy.

The authors did not also investigate the use of press equipment capacity, and the results were presented only in calculated form.

For the investigation the energy parameters of carving out press PVG-8-2-0 we developed the experimental stand (fig.1).

The basic task of measuring devices was the task of investigating the transitional processes in electric equipment taking into account the energy parameters. The most important index, which influence such processes, is capacity, which is consumed P (W). Optimization (decreasing) of this parameter is top-priority task.

For getting the precise measuring we developed the experimental stand. The main elements of measuring device are: 1 – measuring block; 2 – block of galvanic outcome; 3 – analog-to-digital converter (ADC); 4 – personal computer.

The block of measuring device consists of: 1 – power supply; 2 – shunts; 3 – control elements; 4 – without contact starter.

Measuring device works on a principle of analog-to-digital converter of current signal, which is consumed by electric press equipment, with the help of shunts of high accuracy and ADC with further depicting of experimental data on a screen of personal computer.

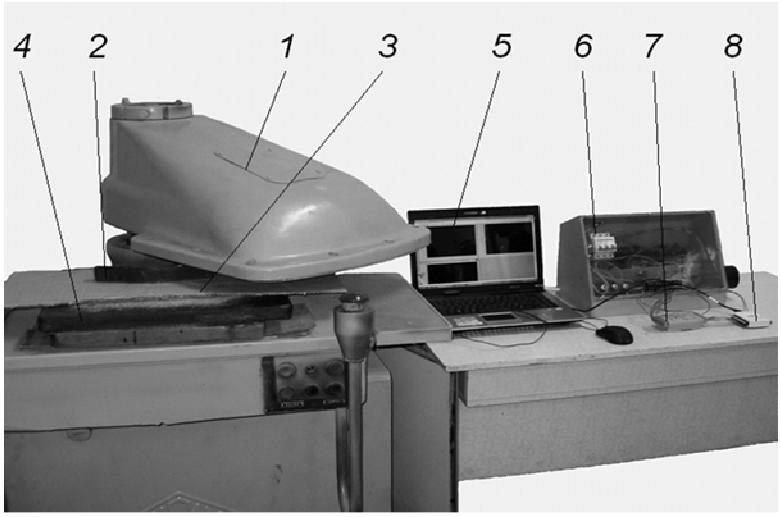

Fig.1. Scheme of measuring device: 1 – striker; 2 – cutter; 3 – material (carton); 4 – carving outplate; 5 – personal computer; 6 – measuring block; 7 – block of galvanic outcome; 8 – analog- to-digital converter

For performing the research we built a program for receiving the basic indices of electric hydraulic equipment. Given program is done in LabView. It allows not only to describe precisely the electric processes with the use of virtual devices, but also to watch the transitional processes. The worked out program consists of exterior panel (fig.2) and block-diagram (fig.3). In the block-diagram the transitional processes of electric part are described. On the exterior panel there are the graphs of true values of voltage *U*, current *I*, and consumed capacity *P*.

Experimental researches were performed on two material models-natural leather and carton.

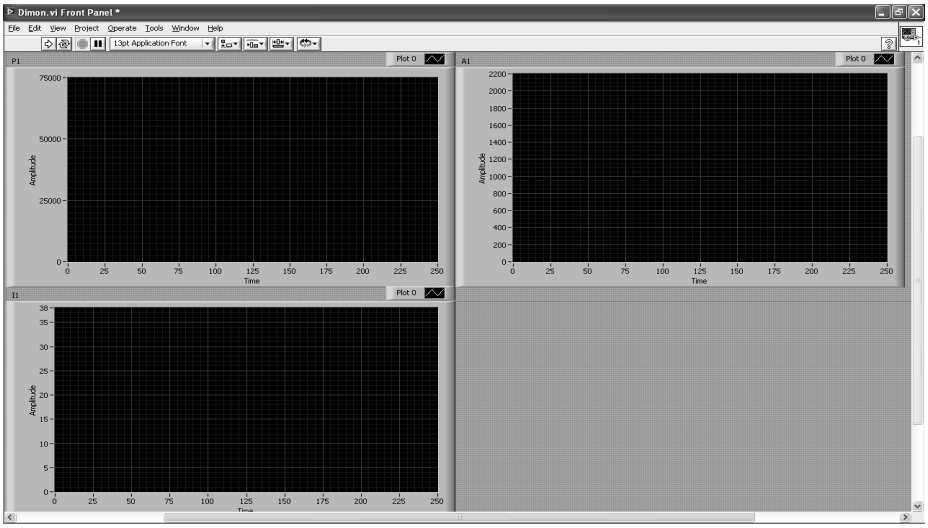

Fig.2. Exterior panel of the program for measuring energy parameters of press equipment

From the results of performed researches we received qualitative characteristics of voltage value U, current value I, and consumed capacity P. We determined that consumed capacity of starting the press comprises in average *P*=3–5 *kW*. Such rise happens in the time interval t=0,04 second. The next rise of capacity happens under doing the technological operation of carving out. After returning the striker into the working position its further movement down to the cutter contact happens. After cutter carving out of the material to the contact with carved

out plate we watch the tension in press equipment and big rise of capacity under the duration of the process of carving out t=0,02 second.

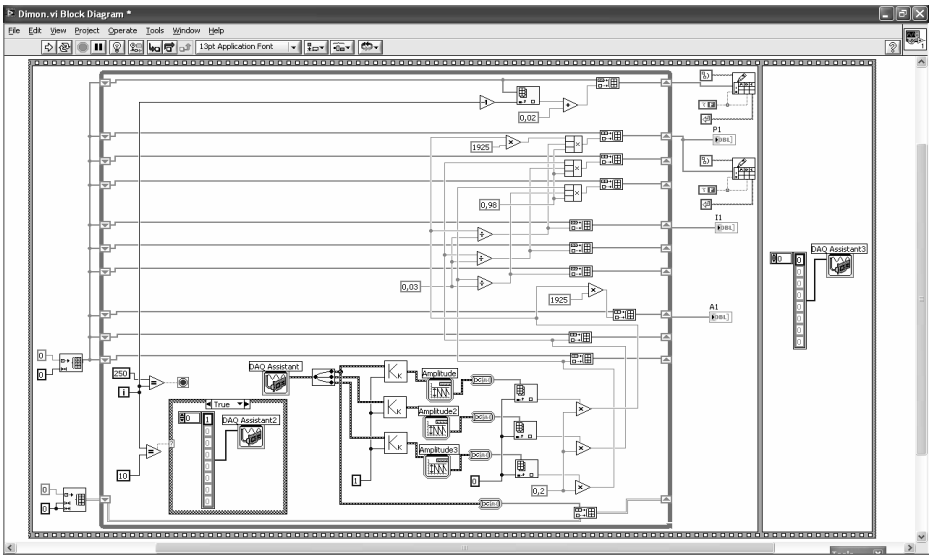

Fig.3. Block-diagram of the program for measuring energy parameters of press equipment

On a fig.4 we can see the graphs of dependence of capacity P of electric hydraulic press of console type PVG-8-2-0 from time t for leather and carton. Section AB for leather and AB_1 for carton correspond with the process of press starting, under which we watch the tenfold rise of consuming the electric energy. It is explained by big starting current of electric engine. Further the process of consuming energy stabilize – the press is on an idling stage.

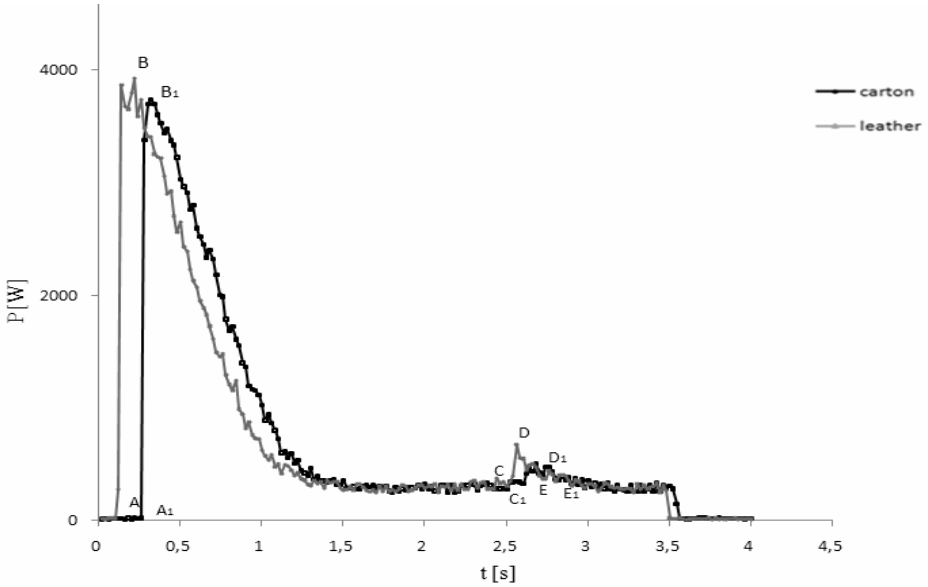

Fig.4. Graphs of dependence of capacity P of electro-hydraulic press of console type PVG-8-2-0 from time t for leather and carton

While pressing the buttons there happens the implementation of the process of carving out and we watch the high picks of tension (section CD for leather and CD_1 for carton). As we see from the graph the maximum rise of capacity for leather during the time of performing craving out is almost two times higher than for the carton. It is explained by the fibrous leather structure, for carving out of which we need much more efforts to overcome the strengths of

interaction of fibrous intermolecular ties. The carton doesn't have such complex structure, that's why the process of carving out is performed with less electric energy consumption.

Sections DE and DE1 correspond with finishing the process of carving out from the moment of working technological press contact.

For the reduction of such rises of capacity it is needed to perform described above press modernization. Such actions will contribute to reducing the press overstrain, which will result in prolongation of exploitation of such equipment.

Introduction

Performed researches on the electro-hydraulic press equipment gave the opportunity to estimate its basic energy characteristics. The experiments showed that the most capacity consumption occurs during the time of performing the technological operation of carving out in the time interval t=0,02–0,04 seconds. Taking into consideration the results of the research we propose the variants of possible improvement of press equipment.

Literature

1. Bakanov N.I. Reduction of overload of hydraulic carving our press, which occur after the carving out / Bakanov N.I., Pudov V.A., Amirhanov D.R., Piskorskiy G.A. // Technology of light industry. – 1972. – №5. – P. 148 – 151.
2. Sivchenko N.A. About the reasons of overloading the presses for carving out the details of footwear upper part / Sivchenko N.A., Sidorets L.V., Panasyuk I.V., Trubchaninova I.A. // Technology of light industry. – 1984. – №1. – P. 129 – 131.
3. Sivchenko N.A. The calculation of reflux size of pressure in the presses for carving out the details of footwear upper part / Sivchenko N.A., Sidorets L.V., Panasyuk I.V. // Technology of light industry. – 1984. – №2. – P. 104 – 107.