THE BASIC RESULTS RECEIVED AT FRAGILE ENVIRONMENT DESTRUCTION BY PLASTIC SUBSTANCES, THEIR SCIENTIFIC SIGNIFICANCE AND PRACTICAL USE

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The efficiency improvement increase of the mineral resources deposits development is one of the priority directions of the further mining engineering development in the Russian Federation (RF), on the basis of the new methods introduction of the rocks disintegration. So, our country is the most well provided with the natural resources by the state for the extended period, in which the bulk of the domestic product is accounted for the fuel and the energy complex.

Along with this, it is observed the gradual increase in the products consumption from the natural stone, as in the country, well as in the world. So, in the Russian Federation (RF), it is not associated with the further increase in the production and the technological possibilities potential of the domestic enterprises for its mining, and also their processing, and it is, mainly, performed, due to the imported products use.

At present, the industry development level on the natural stone extraction and its further processing is sufficiently high enough in the world. Moreover, more than 70% from the total products consumption from it, it is practically accounted for the construction industry. However, because the complexity, the diversity, and constant mining and geological conditions changes of the further development, it cannot be completely eliminated the labor – intensive methods use of the breaking, some of which are the blast hole ones. So, with their help, at present, it is extracted almost 25% of the natural stone throughout the world. In this regard, their improvement relevance and the actuality are continued to be preserved, for example, through the plastic substances introduction, having increased the mining operations efficiency in the natural stone breaking, under the presence conditions of the natural or the artificial fractures.

So, this already made work's aim has been concluded in the physical and technical bases development for the fields and the deposits of the natural stone directed destruction and their disintegration with the plastic substances and their materials use, thereby it is enabled us to be addressed the challenge of the quality increasing and the cost reduction of the building stone block production, under the natural or the artificial fracturing of the rock mass massif conditions. So, this already made idea's aim has been concluded in the natural stone directed destruction and their disintegration by the injection of the plastic substance and their material into the formed fractures from the blast holes, previously having drilled through the intended spalling, and the hit it by the barbell.

As a result of its implementation, there have been formulated the following basic scientific regulations:

– it has been found, that when hitting the bar on the plastic substance and its material, having found in the blast hole, the longitudinal and the transversal fractures are appeared in the natural stone: the longitudinal ones are directed along its axis, and the cross ones – across, and, thus, with the further increasing its sizes, the both fractures are tended to be moved from the elliptical form to the circular one;

– it has been found the advancement front lag regularity of the injected plastic material and its substance in the longitudinal and the transversal fractures from the front to be promoted the fractures themselves; and this gap is characterized by the hyperbolic dependence: for the longitudinal fractures the advancement front lag of the injected plastic material and its substance is made up 1,11 m at the front of the most advance fracture itself 1,21 m, and at the advancement front lag of the injected plastic material and its substance 1,36 m the fracture advancement front is made up 1,56 m, for the longitudinal fractures the advancement front lag of the injected plastic substance and its material is made up 0,51 m at the front of the most advance fracture itself 0,61 m, and at the at the advancement front lag of the injected plastic substance and its material 0,63 m the front of the most advance fracture itself is made up 0,83 m;

– it has been found the power intensity change regularity of the plastic material and its substance injection into the transversal fracture from the blow energy size to it by the rod; so, this change is characterized by the logarithmic dependence: at the amount the bar hitting energy by the plastic substance and its material 15 J the energy power of its injection into the transversal fracture is made up 71 J/m^2, while the amount the bar hitting energy by the plastic substance and its material 20 J the energy power of its injection into the transversal fracture is made up 24 J/m^2;

– it has been found the ratio increase regularity of the fracture area to the zone area of its filling by the plastic substance and its material from the increase of the hitting energy impact on it by the rod; and this increase is characterized by the logarithmic law;

– it has been found the diameter size increase regularity of the transversal circular fracture from the bar energy impact increasing on the plastic substance and its material, which is in the blast hole; so, this dependence has the logarithmic character: at the value of the bar impact hitting energy on the plastic substance and its material 20 J the transversal circular fracture diameter is made up 87 mm, while the amount of the bar impact hitting energy on the plastic substance and its material 40 J the

transversal circular fracture diameter is made up 120 mm.

Thus, the scientific novelty of the work is laid in the fact, that:

– it has been found the change dependence in the forms of the longitudinal and the transversal fractures on the amount of the plastic substance and its material, required for their further development, at the directed destruction and the disintegration of the stone, which has the natural or the artificial origin;

– it has been found the change dependence of the boundary lag of the plastic substance and its material promotion from the fracture propagation border, having formed by it at the shock injection of the plastic substance and its material into the blast hole in the process of the directed blocks separation of the natural stone;

– it has been found the change dependence of the injection power intensity into the transversal fracture of the plastic substance and its material, having found in the blast hole, from the hitting impact energy on it by the bar at the directed destruction and the disintegration of the stone, which is the natural or the artificial origin;

– it has been found the change dependence of the fracture area ratio to the zone area of its filling by the plastic substance and its material from the hitting energy impact on it by the rod at the directed destruction and the disintegration of the stone, which is the natural or the artificial origin;

– it has been found the change dependence of the transversal fracture diameter size from the impact energy by the rod on the plastic substance and its material, having found in the blast hole, at the directed destruction and the disintegration of the stone, which is the natural or the artificial origin.

The scientific significance of the work is laid in the fact, that for the first time:

– it has been found, that the longitudinal and the transversal fractures form, having obtained at the shock injection into them of the plastic substance and its material from the blast hole, is changed from the elliptical up to the circular one, at the directed destruction and the disintegration of the stone, which is the natural or the artificial origin;

– it has been found the advancement front lag regularity of the injected plastic substance and its material in the fractures from the front to be promoted the fractures themselves, at the directed destruction and the disintegration of the stone, which is the natural or the artificial origin;

– it has been found the power intensity change regularities of the plastic substance and its material injection into the transversal fracture, its diameter size, and also the fracture area ratio to the zone area of its filling by the plastic substance and its material from the blow energy to it by the rod, at the directed destruction and the disintegration of the stone, which is the natural or the artificial origin.

The practical significance of the work is laid in the following:

– in the method and the technical facilities introduction of the directed destruction and the disintegration of the stone of the natural origin, by the shock injection of the plastic substance and its material into the fractures from the blast holes, having drilled through the intended spalling in LLC «Mramor or Marble» (Novosibirsk Region), and the artificial one – in LLC «Prostor» (the city of Novosibirsk);

– in the method and the installation development for the laboratory works carrying out by the directed destruction and the disintegration of the natural and the artificial stone in the Novosibirsk State Architectural and Building University.

Thus, the actual challenge of the physical and technical bases further development for the fields and the deposits of the directed destruction and the disintegration of the natural stone, having carried out by the plastic substance and its material injection into the blast holes, previously having drilled through the intended spalling of the stone blocks, and the hitting on it by the bar, has already been solved in the work. This can be improved the quality and to be reduced the cost of the building stone block production under the rock mass massif the natural or the artificial fracturing conditions.

Thus, the main scientific conclusions and the practical results of the work are laid in the following:

1. It has already been found, that at the directed destruction and the disintegration in the block of stone separation from the massif, by the plastic substance and its material injection into the blast holes, having drilled through the intended spalling, the necessary value of the tensile stresses, having generated, for all this, at the tip of the fracture, especially, for the marble, it is, practically, made up 88 MPa.

2. It has already been found, that the plastic substance and its material, having embedded in the formed fractures, at the directed destruction and the disintegration of the natural stone, is provided the destructive capacity during 2–3 days and nights (e.g. 48–72 hours) just after its injection into the blast holes, through the intended spalling blocks.

3. It has already been found, that for the directed destruction and the disintegration at the block of stone separation from the massif, by the shock injection of the plastic substance and its material into the blast holes, having drilled through the intended spalling, the portable tools are quite preferred with the impact energy up to 100 J, which are able to be formed the circular fractures with the diameters up to 2 m, which is corresponded to the most popular blocks mass size, having supplied to the special plants for the stone sawing.

4. It has already been found, that the method of the natural stone directed destruction and the disintegration with the use of the plastic substances and its materials in their mode of their shock injection from the blast holes into the already formed fractures can be combined used with the well – known

methods of the rock failure at the block of stone separation from the massif; for all this, while the splitting off the planes, in which the blast holes with the plastic substance and its material are practically used, that may be coincided with the planes of other blast holes methods of the breaking.

5. It has already been found, that for the transversal fracture formation at the bottom level of the blast hole at the shock injection of the plastic substance and its material into it, it is practically required the impact energy, than for the longitudinal fracture formation along the entire length of the blast hole, having begun from its mouth.

6. It has already been found, that for the efficiency increase of the directed shock injection of the plastic substance and its material into the blast holes, the drilled through the intended spalling blocks, it is quite necessary to be increased the impact energy and to be reduced their frequency; this is due to the fact, that the internal pressure, that can be bio-accumulated just in the plastic substance and its material, by applying it to the shock, does not have enough time to be relaxed during the time between them.

7. The method and the special technical facilities of the directed destruction and the disintegration of the natural and the artificial stone have already been introduced, by the shock injection of the plastic substance and its material into the fractures from the blast holes, having drilled through the intended spalling, in the mining, and as in the industrial, well as in the civil construction and their building.

8. The method and also the installation for the laboratory works carrying out by the directed destruction and the disintegration of the natural and the artificial stone in the Institutes of higher education of the building structure have already been developed and introduced.

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THE DYNAMICAL PROSESSES ADAPTIVE STABILIZATION IN THE ROBOT ELECTRIC DRIVES CONTROL SYSTEM

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The adaptive regulator application efficiency in the electric drives control system DC of the robot manipulation link has been carried out in the study. The control system dynamics adaptive stabilization has already been implemented, by means of the direct transfer coefficient modifying of the electric drive control regulator. In its turn, this is caused the whole system simplification with the adaptive control regulator with its technical implementation. This system simulation in the MATLAB (e.g. Simulink) medium has been carried out. The comparative evaluation of the electric drives simulation systems results with the adaptive control regulator with the traditionally used coordinate regulation method has been conducted. So, it has been shown, that the electric drives adaptive control regulator in the system application is provided the manipulator's desired dynamic characteristics . The similar approach to the robot manipulators electric drives system construction can be applied to the overwhelming majority types of the commercially industrial available robots.

The degrees' electric drives of the manipulation robots mobility are subjected the variable loads, which are caused by their configuration changes in the process of the motion, the weight and the dimensions of the cargoes transported, and also by the technological factors and the others. The electric drives load can be varied within the wide limits, and be caused the significant change in the dynamical properties of the electric drive control system [1, 2]. All these systems' peculiarities and the specific features should be considered at the manipulation robots designing.

The Control Dynamics Stabilization Method

So, for example, the degrees electric drives dynamic coupling of the mobility for the flat manipulator, having worked in the polar coordinate system, and having considered in the paper [3], is quite seen in the fact, that the moment of inertia of the angular displacement electric drive load of the manipulator is the variable quantity, and it is depended on the linear extension of the *r* hand:

$$I_n(r) = I_1 + I_{2c} + m_2\left(\frac{l}{2} - r\right)^2, \qquad (1)$$

where I_1 – the moment of inertia of the 1-st level of the manipulator, relative to the axis of rotation I_1 = const; I_{2c} – the moment of inertia of the 2-nd level of the manipulator, relative to the central axis, which is parallel to the axis of rotation. The inertial load variability of the angular position of the electric drive, due to the changes of the manipulator's linear position, is resulted in the quality worsening of the control process by it. This is the well – known challenge, which can be solved, for example, by a certain way, the manipulator's dynamics stabilization.

Here, in order to be improved the further quality improvement of the control process, in the result of the interaction reducing of the manipulator's electric drives, is proposed to be used together with the traditional coordinate control by the manipulator of the optimal adaptive regulator. So, the adaptive regulator implementation is carried out by means of the separate unit, which depending on the manipulator's configuration, automatically, according to the expressions for the values of the gain coefficients in the main chain of the electric drive feedback, it, moreover, is calculated the value of the correction adaptive signal. The adaptive signal is supported the optimal specified value of the gain