Development and research of porous devises for reconstruction turbo foundation of power plants

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Development and research of porous devises for reconstruction turbo foundation of power plants: *Reconstruction of power plants of the Republic of Kazakhstan requires installation of the new equipment on the former bases. For these purposes it is offered to make towards a splitting of reinforced concrete structures and rocks. The technology excludes emergence and development of cracks in turbo foundation and other constructions. The device is equipped with a container of liquid. Device options with ice or a concrete plate are possible. Opposite wall of the device is ribbed. The reflected wave decreases in two and more times.*

Key words: *Turbo foundations, Holography setup, Splitting, Combustion chambers, Capillary and porous structure.*

INTRODUCTION

As a result of inspection of the bases of turbine units and carrying out supervision over an settlement foundations, deformations of buildings, constructions – it is required to make selective openings, cutting down, broadening and destruction of concrete, ferroconcretes, and in the under base plate and the large high-strength stones which volume reaches up to 30-35% of concrete volume. This work has to perform in place; they are often very time-consuming and entrusted to the operational staff [1, 2].

Therefore, for the reconstruction and modernization of turbo foundations, as well as the destruction of oversized, crushing aimed split the become unfit for use of objects of power plants (chimneys, foundations of buildings and constructions, coolers) offer devices performing without dissociating blasting, with no expansion of products of destruction at a considerable distance, does not require removal of people and technology to a safe distance. It also does not require gadding [3, 5].

Moreover, modernization of power plants requires the installation of new equipment on the former foundations. For this purpose it is necessary to make the directed splitting of concrete designs, excepting emergence and development of cracks in the main massif (turbo foundation) [6, 8].

EXPOSITION

For the splitting of the monolith, consisting of different materials (ferroconcrete, solid rock) drilling the holes along the line of the planned split, place an explosive substances (ES) and simultaneously blow up. However, this technology cannot provide the straightness of the plane of division, as the effects of a blast wave reflected from the longitudinal plane of the outcrop, a crack in the propagation output deflected to the side effects of reflected wave [9, p.9].

Therefore in practice often drill the shots repeating a contour of the block which part fill with liquid completely, and the others – partially. The bore-holes filled with liquid part, serve for placing of ES. Thus shots are filled with liquid only in the diametrical plane, forming a liquid crossing point in the direction of the planned line of split. On both to the party of crossing points leave air cavities. As a result, when blasting explosives achieved aimed separation unit. In this case the reflected blast wave also rejects extending crack of split at the exit towards the closest longitudinal plane of an exposure.

For management of the distribution direction of a crack the device for the directed splitting is offered.

In case of split of rocks with a high acoustic wave resistance (granites), liquid replace with a concrete plate with drawing by paste from contact with the massif, and step – from the opposite side.

There are options when the elastic vessel wall is double, between which is poured and frozen water. In this case, the ice will be close to the plane of exposure and to have good contact with the array. On the other hand it will border with liquid core of the tank. This will also increase the absorption coefficient of the energy of the blast wave in comparison with liquid.

Wave resistance of the array determines its ability to reflect and refract elastic waves. Reflection and refraction of waves is on the border of contact blocks, which have sharply different acoustic properties or when switching elastic waves from the block (array) into the environment and vice versa [3, 6].

Experimental research on pulsed holography setup [3, 6] confirmed by theoretical calculations. It is shown that the reflected wave extends according to geometrical and physical laws of acoustics contrary to fears of some theories stated in works [10, 15].

Thus, the device for the directed splitting of the blocks, allowing to operate the direction of distribution by a crack is developed and investigated on models. Thus influence of the reflected blast wave on the direction of distribution of a crack (in two and more times) is sharply weakened. For these purposes the device is supplied with capacity with liquid, or other options (with ice and a concrete plate), and an opposite wall of the device are ribbed. For research of critical thermal streams in the porous cooling system of combustion chambers and snivels of power installations the jet torch was used.

Figure 1 shows destroyed the combustion chamber and supersonic nozzle of such burners [7].

One of important elements of a torch is the cooling system of the combustion chamber and the nozzle device.

For definition of the pro-efficient thermal streams which are taken away by the porous cooling system, we will write down the continuity and movement equations taking into account joint action of gravitational and capillary forces, and forces of gravitation create excess of liquid $\overline{m} = m_{ж} / m_n$ [5, 7]

$$\frac{dV_y}{V_y} = -\frac{\rho_n}{\rho_{ж}} \cdot \frac{L}{\varepsilon \cdot F_{ф}} \cdot V_Z \left[\frac{m_n}{m_{ж}} + 1 \right], \tag{1}$$

$$V_y \frac{dV_y}{d_y} = g \cos\beta + \frac{2\sigma}{\rho_{ж}} \cdot \frac{d}{d_y} \left[\frac{1}{R(y)} \right] - \varepsilon \nu_{ж} V_y / k, \tag{2}$$

where: $m_{ж}$, m_n - consumption of liquid and steam;

V_y - liquid speed in the direction of forces of gravitation of g;

y- coordinate (direction of movement of liquid);

$\rho_п$, $\rho_ж$- density of steam and liquid;

L- length of a steam-generating surface

ε - porosity;

$F_ф$ - section of porous structure;

V_z - steam velocity in Z-coordinate;

z- coordinate (movement direction of steam)

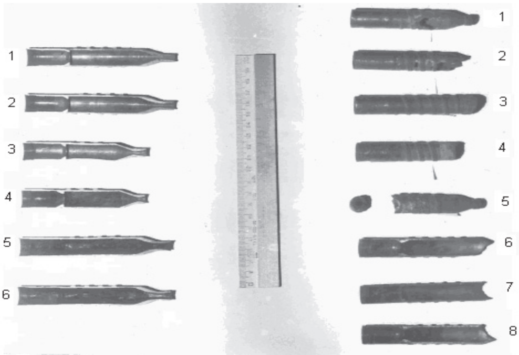
β - the angle of the cooling system to the vertical;

σ - the coefficient of surface tension;

R(y) - the radius of the liquid meniscus;

ν_m - the coefficient of kinematic viscosity;

κ - permeability.



a) b)

Fig.1. The destroyed combustion chambers and supersonic nozzles of a torch:

a) nozzles are executed without wall thickening: 1, 2, 3, 4 – before operation; 5, 6 – after 40 hours of operation (destroyed deflector rings and increased cross sections of nozzles); 1, 2, 5, 6 – α=0,8; 3, 4 - α=0,6; 4 – the combustion chamber with a short nozzle (ensured carrying out of the detonation combustion mode). The cooling system – aqueous ($q_{кр.сеч}$=1·10[6] Вт/м[2]; $\overline{w}_{æ} = 10 ì \ / ñ$);

b) nozzles are executed with a wall thickening 1 - 8 – α=0,6…0,65; destruction resulted from break of gases in the water cooling system at consolidation depressurization; 5 - camera with melted swirl.

Substituting equation (1) in equation (2) with regard to the quantities $V_y = G_{ж}[y]/\rho_{ж} \cdot V_z = q_{кр}/r\rho_n$, and having integrated the received equation ranging from $y_1=0$ to $y_2=H$ and from $R_0 = \infty$ to $R_h = \hat{a}_{\tilde{A}}/2$ we receive:

$$3q_{kp}^2 \cdot h^2[m_n/m_{ж}+1]/2[r\varepsilon\delta_{ф}\rho_{ж}]^2 \cdot \varphi_{kp}^1 -$$
$$-3q_{kp}h^2 \cdot \nu_{ж}/2r\delta_{\phi} \cdot \rho_{ж} \cdot k \cdot \varphi_{kp}^1 + \left[gh\cos B + \frac{2\sigma}{\rho_{ж}R_h}\right] = 0. \quad (3)$$

Solution of the quadratic equation (3) is an expression that specifies the first critical heat flux laboratories and saturated liquid $(\overline{m} \to I)$:

$$q_{kp} = \left[B \pm (B^2 - 4A \cdot C)^{0,5}\right]/2A, \quad (4)$$

where: $q_{кр}$ - critical (maximum) heat flow;

r - heat of vaporization;

$в_г$ - hydraulic diameter of pore structure;

h - height of a steam-generating surface;

$\varphi^{!}_{êð}$ - critical consumable moisture content;

$$A = 3h^2[m_n/m_{ж}+1]/2[r\varepsilon\delta_{\phi} \cdot \rho_{ж}]^2 \cdot \varphi_{кр}^1,$$
$$B = 3h^2\nu_{ж}/2r\delta_{\varphi}\rho_{ж}\kappa\varphi_{кр}^1, \quad (5)$$
$$C = gH\cos\beta + 2\sigma/\rho_{ж}R_h.$$

CONCLUSION

For the purpose of further unification of torches for use of various fuel components (oxygen + kerosene; air + kerosene; air + gasoline), simplification of a design, increase of reliability of cooling, ensuring steady combustion of fuel of various structure under any temperature conditions and temperature increase of products of combustion, the nozzle device and a casing of a torch is made out in the form of capillary and porous structure. The power divider of a gaseous oxidizer is carried out in the form of the high-pressure vortex camera using effect the Ranka-Hilsa, and the camera is supplied with a nozzle, and for branch of an oxidizer there are openings. For receiving bulk of an oxidizer sharply cooled, the nozzle of a power divider is carried out cylindrical, ring, supersonic. More effective heating of fuel are provided to that in the camera of a power divider exhaust outlets in given it are carried out speak rapidly.

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