into the two underlying aquifers, without further preliminary collecting them in the dehumidifying chamber, moreover, the deviated and the inclined wells are also may be used, having penetrated into the underlying ground water carriers.

Thus, the special device for the dehumidifying drainage system is consisted in: the general drying chamber, having made reinforced concrete; the pump for the water pumping; the concrete slab; the measuring piezometer, having combined with the vent pipe; the manhole; the running staples; the pebble – sandy layer; the radial drains with the filtered part; the impervious layer (e.g. the hydro – aquiclude); the wells.

1. The local drying out soil method by the drainage is, practically, to be optimized the water distribution and its further allocation and, moreover, the drainage waters to be re–used in the industry – domestic purposes.

2. The local drying out soil method by the drainage with the water reduction is a more economical one – it is, practically, allowed, without the additional energy – intensive costs use, to be prepared the grounds for the construction of the modern underground structures, the facilities, and the installations.

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## THE TURBULENT JET FLOWS RESEARCH

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The mechanism for the artificial turbulent jets creation, on the basis of the ejection principle, has been, previously, described. Corresponding to this mechanism, we have the addition of the wells sand reduction method, and also the device for its further implementation. The jet streams use, at the wells cleaning, is connected with the two main factors:

1) the impurities' removal (e.g. the sand particles) of the turbulent jet;

2) the impurities diffusion transport increase outside the jet;

3) the temperature inversion violation in the well, having created, in result of the sand addition.

Among these above – listed factors, the notable one is the first factor, the other two ones are presented and associated themselves the related and the ancillary conditions, having initiated by the first one.

So, the two air flows interaction (e.g. the generated and the complexing, the upwelling and the downwelling ones) is resulted in the velocity fields, the pressure transformation, and, eventually, – the impurities field transformation (e.g. by its sizes and the sand particles concentration).

So, on the basis of all these provisions, it has been made the mathematical modeling of the wells cleaning process by the turbulent flows, having generated with the ejection using.

This model is included in itself the two sub – models.

Thus, the first of them, is described the impurities concentration change in the turbulent jet, at the moment of the clearance mechanism action; and the second one – outside of the jet.

So, the state variable of this first model, we'll denote $C_1(x)$, and the second one – $C_2(z,\ t)$. Then, the calculating formulae, having obtained, on the basis of all these models, are taken the following form:

$$C_1 = \frac{\omega}{4\pi D_x^x}\exp\left[-\frac{\nu(H^2+y^2)}{4D_x X}\right], \qquad (1)$$

where $D$ – the diffusion coefficient of the impurities; υ – the velocity of the air stream; $q$ – the flux density (e.g. «the power») impurities source; $H$ – the well height; $(x, y)$ – the coordinates of the points of the horizontal plane.

Having differentiated (1), and equated to the zero, the derivative value $\partial C_1/\partial x$ at the point $x = x_{\max}$, in which the maximum concentration is achieved at the lower boundary of the well (e.g. as the functions $C_1$ from the distance $x$ and the diffusion coefficient D).

Having taken $y = 0$, from the following condition:

$$\frac{\partial C_1(x)}{\partial x} = 0, \qquad (2)$$

we get $x = x_{\max}$:

$$x_{\max} = (VH^2)/(4D). \qquad (3)$$

The time, over which the maximum concentration is achieved, at the fixed distance from the turbulent jet axis (for example, at the distance $r$), is equal to the following:

$$\tau_{\max} = \frac{r^2}{4D}. \qquad (4)$$

So, the formula (4) has been obtained by us from the equation (1), on the basis of the study of the maximum function $C_1$. Then, it is checked by the immediate formulation in (3) at $H = r$).

The initial moment (e.g. the reading) time $\tau = 0$ in the sub–model (1) is taken from the start moment of the mechanism actuation of the clearance, and in the sub–model (2) – from the origin moment of the instantaneous linear source of the instant sand particles. Accordingly, $x$ – the distance from the continuously operating impurities source, and $\tau$ – the time, which is required to be transferred the turbulent flow, having originated the linear instantaneous source at the distance $x$.

The sub–model 2 is based on the equation of the diffusion transport of the particles, having presented in the following form:

$$\frac{\partial C_2}{\partial \tau} = \frac{\partial}{\partial z}\left(D\frac{\partial C_2}{\partial z} - C_2\omega_z\right) + q, \qquad (5)$$

where $\omega_z$ – the speed of the downwelling vertical flow.

In the general case, $q \neq$ const. So, the dependence of $q$ on $\tau$ can be obtained, on the basis of the sub – model 1.

The results of the numerical implementation of the model are allowed to be got the estimates of the magnitude:

$$C = C_1(z) + C_2(x, y), \qquad (6)$$

at the time moment $\tau_{max}$ depending on the model parameters $V$, $W$, $D$, which, in their turn, are depended on the operating principle and the design parameters of the addition of the wells sand reduction mechanism with the turbulent jets using, having generated, on the basis of the ejection.

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## THE VALVE OPENING CONTROL TIME CALCULATION

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Having neglected the membrane mass with the rod and the locking – regulatory body, at moving up, the shut – off and regulating body for the $\Delta h$ motion, is described by the following equation [1]:

$$\omega_K \frac{dH}{dt} = \mu_{VL}\omega_{VL}\sqrt{2gH} - \mu_{SL}(h)\omega_{SL}\sqrt{2gH_K}, \qquad (1)$$

where: $\omega_C dh$ – the volume part of the over – membrane chamber with the $dh$ height, having filled with the water during $dt$; $\mu_{VL}$, $\omega_{VL}$ – the flow rate coefficient and the inlet section of the calibrated hole; $\mu_{SL}(h)$, $\omega_{SL}$ – the flow rate coefficient and the input section of the branch hole; $H_C$ – the head in the over – membrane chamber; $H = H_{IN} - Hc$ – the head outflow through the calibrated hole; $H_{IN}$ – the head at the inlet of the calibrated hole.

Since the system dynamics is studied at the slight movement of the locking – regulatory body ($\Delta h$), then in order to be simplified, we linearize the non – linear equation (1). For the linearization, we'll introduce the variables deviation from the non – initial values. So, we'll denote:

$$h = h_o + \Delta h;\ H = H_o + \Delta H.$$

So, the non – linear function

$$Q_{SL} = \mu_{SL}(h)\omega_{SL}\sqrt{2gH_K}$$

we present in the following form:

$$Q_{SL} = Q(h_O; H_O) + \left(\frac{\partial Q}{\partial h}\right)\Bigg|_{h=h_0} \Delta h + \left(\frac{\partial Q}{\partial H}\right)\Bigg|_{H=H_0} \cdot \Delta H + D_2(\Delta h; \Delta H); \qquad (2)$$

where $D$ ($\Delta h$; $\Delta H$) – is the non – linear one, having contained the $\Delta h$ and $\Delta H$ product and their degrees, which are over the first one. Because of the small deviation values $\Delta h$ and $\Delta H$, the non – linear part of the series can be neglected, and, thus, to be replaced the non – linear function by its linear approximation:

$$Q_{SL} = Q(h_0; H_0) + \left(\frac{\partial Q}{\partial h}\right)\Bigg|_{h=h_0} \cdot \Delta h + \left(\frac{\partial Q}{\partial H}\right)\Bigg|_{H=H_0} \cdot \Delta H. \qquad (3)$$