yspolzovanы for animals poenyya How to yndyvydualnыh economy and in so krupnыh zhyvotnovodcheskyh enterprises.

Constructions, Poenyya, equipment, animal:.

Reasonable rational scheme of universal system of watering animals, as well as construction of drinking bowls, which can be used for watering animals in individual farms and livestock in large enterprises.

Design, watering, equipment, animal.

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Theoretical studies PNEVMOVTRAT TROHTRUBNOHO concentric heat recovery units

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Theoretical study pnevmovtrat trohtrubnoho concentric heat utilizers for livestock buildings. As a result of studies found

pattern of change of pressure loss and power pnevmovtrat of structural and technological parameters of heat utilizers (length, radius and outer duct feeding air flow).

Resistance parameters, air duct, power, heat recovery units, pressure.

Problem. Much of the year, and for some technologies and throughout the year, most farm animals are indoors. In this regard, the livestock buildings need to create a microclimate that meets the physiology of animals and birds and beneficial effect on their state of health, productivity and quality [1].

For maximum performance animals microclimate in livestock buildings (air and temperature) should ensure from the energy point of view, regenerative heat utilizers, the use of which saves the energy needed to heat the indoor air.

The study of the process of heat exchangers in the subject of many domestic and foreign operations. In [2, 3] The method of calculation of heat transfer and fluid dynamics to practical problems of natural circulation heat exchange pipes heated.

In [4, 5] determined the distribution of heat exchangers in the U-shaped with liquid coolant particular set temperature distribution along the length of the heat exchanger tubes.

In [2] indicated dimensionless dependence for calculating heat transfer and fluid flow inside the heat exchanger pipes with exhaust mine. The disadvantage of the proposed technique is narrow scope - dvotrubnyh heat.

The purpose of research. Set the pattern of change of pressure loss and power pnevmovtrat trohtrubnoho concentric heat utilizers of its structural and technological parameters.

The aim of this research is the definition of rational structural and technological parameters trohtrubnoho concentric heat utilizers.

The object of study: the process of effective distribution of air flow in air ducts trohtrubnoho concentric heat utilizers.

Purpose of the study: dependence of pressure losses and power pnevmovtrat trohtrubnoho concentric heat utilizers of its structural and technological parameters.

Results. One way to improve the efficiency of the developed trohtrubnoho concentric heat utilizers for livestock buildings are pnevmovtrat reduction in pumping air through it, which can be achieved by optimizing its structural and technological parameters.

Consider the design scheme trohtrubnoho concentric heat utilizers (Fig. 1).

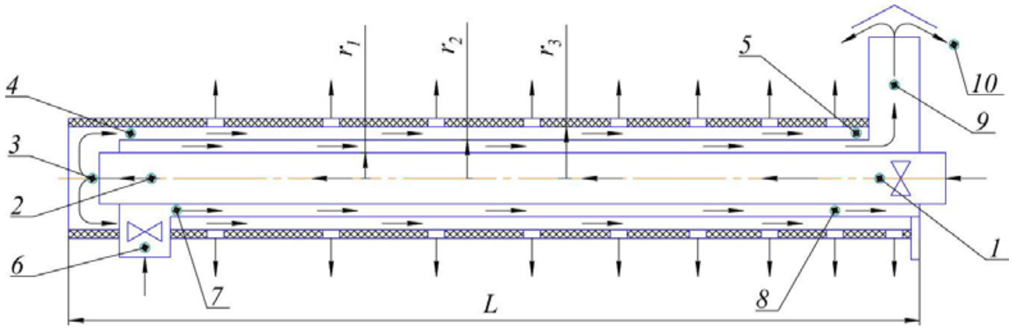

Fig. 1. Scheme for calculating trohtrubnoho pneumatic concentric heat utilizers.

Each section of the movement of the air flow in air ducts trohtrubnoho concentric heat utilizers, full of pressure, which is to overcome the hydraulic resistance strength is lost, because through molecular and turbulent viscosity moving air mechanical work of the resistance is converted into heat [6].Δrf; local resistanceΔp_l.

The pneumatic friction caused by the viscosity (both molecular and turbulent) air that occurs when it moves, and there is an exchange of momentum between molecules (in laminar motion) and between individual particles (in turbulent motion) of adjacent layers of air, moving at different speeds [7].

Local support arising from the local disruption of normal flow, flow separation from the walls, vyhroutvorennya intense turbulent mixing and flow in air-ground configuration changes or when meeting and flow around obstacles. These effects increase the exchange of momentum between particles moving air (ie friction), increasing energy dissipation [7].

Consider pneumatic pressure loss at each site trohtrubnoho concentric heat utilizers by Fig. 1.

Pressure losses due to friction in the duct of constant cross-section in areas 1-2, 4-5, 7-8 [8]

$$\Delta p_{f\,1-2} = \kappa_1 \frac{L}{d_1} \frac{\rho(T_1)\, v_1^{\,2}}{2}, \tag{1}$$

$$\Delta p_{f\,7-8} = \kappa_2 \frac{L}{d_2} \frac{\rho(T_2)\, v_2^{\,2}}{2}, \tag{2}$$

$$\Delta p_{f\,4-5} = \kappa_3 \frac{L}{d_3} \frac{\rho(T_3)\, v_3^{\,2}}{2}, \tag{3}$$

where κ_i - Drag coefficient of friction; L - length of pipe, m; *di* - An effective diameter of the i-th pipe, m [9]:

$$d_i = \frac{4A_i}{p_i}, \tag{4}$$

where Ai - sectional area of the i-th duct: for 1st - A1 = π · r12, 2nd - A2 = (r22 - r12), 3rd - A3 = π · (r32 - r12); pi - the total perimeter of the cross-section i-th duct: for 1st - p1 = 2πr1, 2nd - p2 = 2π (r2 + r1), 3rd - p3 = 2π (r3 + r2); ρ (Ti) - air density in the i-th air vents at constant pressure, which is related to its temperature, kg / m3:

$$\rho(T_i) = \rho_{н.у.} \frac{273}{T_i}; \tag{5}$$

where ρn.u. - Density of air at standard conditions (Tn.u. = 273 K, Pn.u. = 101325Pa) ρn.u. = 1.293 kg / m3 [10]; vi - air velocity in the i-th pipe, m / s:

$$v_i = \frac{V_i}{A_i}, \tag{6}$$

where Vi - volume air flow in the i-th pipe, m3 / s.

As a result of the calculation by formula (4) we obtain the effective diameter of the airways: for 1st - d1 = 2r1, 2nd - d2 = 2 (r2 - r1), 3rd - d3 = 2 (r3 - r2).

According to research, the drag coefficient of friction in turbulent motion depends on the Reynolds number and roughness of the walls of the airways. By AD Altshulya, it is [8, 11]:

$$\kappa_i = 0{,}11\sqrt[4]{\frac{68}{\mathrm{Re}_i} + \frac{\psi}{d_i}}, \tag{7}$$

where ψ - equivalent roughness of the walls of the pipe, polyethylene to take ψ = 0.1 mm [8];

Rei - Reynolds number for the air flow in the i-th Air delivery:

$$\mathrm{Re}_i = \frac{d_i \cdot v_i \cdot \rho(T_i)}{\mu}, \tag{8}$$

where *μ* - Dynamic viscosity of air, μ = 18,27 · 10-6 N · s / m 2 [10].

According to [8] pressure loss in the knee (section 12):

$$\Delta p_{16\text{-}7} = 4\alpha \sin^2 \frac{\theta_{6-7}}{2} \frac{\rho(T_2)\, v_2^2}{2}, \tag{9}$$

$$\Delta p_{18\text{-}9} = 4\alpha \sin^2 \frac{\theta_{8-9}}{2} \frac{\rho(T_2)\, v_2^2}{2}, \tag{10}$$

where α - Amortization factor for knee permanent section α = 0.55; θ - The angle of the knee, according to Figure 1: $\theta_{6\text{-}7}$ = $\theta_{8\text{-}9}$ = 90 °.

Loss of pressure in space (ring) turn 180 ° injection (section 2-3-4 and 9-10) [7, 11]:

$$\Delta p_{12\text{-}3} = \zeta_{2-3} \frac{\rho(T_1)\, v_1^2}{2}, \tag{11}$$

$$\Delta p_{19\text{-}10} = \zeta_{9-10} \frac{\rho(T_2)\, v_2^2}{2}, \tag{12}$$

where ζ - Coefficient of local resistance to the space (ring) rotate 180 ° injection, according to [7, 11] $\zeta_{2\text{-}3}$ = $\zeta_{9\text{-}10}$ = 2.

Medium pressure losses that occur during the passage of air through the holes on the section 4-5 according to research [8] can be calculated by the formula:

$$\Delta p'_{14\text{-}5} = \xi_{4-5} \frac{\rho(T_3)\, v_3^2}{2}, \tag{13}$$

where $\xi_{4\text{-}5}$ - Factor costs hole, according to [8] accept $\xi_{4\text{-}5}$ = 4.

Pressure losses in trohtrubnomu concentric heat recovery units are defined as the sum of all pressure losses:

$$\begin{aligned}\Delta p = \Delta p_{\mathrm{f}\,1\text{-}2} + \Delta p_{12\text{-}3\text{-}4} + \Delta p_{\mathrm{f}\,4\text{-}5} + \Delta p'_{14\text{-}5} + \\ + \Delta p_{16\text{-}7} + \Delta p_{\mathrm{f}\,17\text{-}8} + \Delta p_{18\text{-}9} + \Delta p_{19\text{-}10}.\end{aligned} \tag{14}$$

Taking equal volume of air flow in all air ducts Vi = V power required for pumping air through trohtrubnyy concentric heat recovery units, is given by:

$$N_f = \frac{V\, \Delta p}{\eta_{\text{п}}}, \tag{15}$$

where $\eta_{Section}$ - Full efficiency fan $\eta_{Section}$ = 0.8 [12].

According to the analysis of research ventilation [8] accept the terms of effective equality duct diameters to ensure uniformity of cost pressures. However, given the availability of distribution holes in the outer pipe its effective diameter should be 8-12% higher [8]. Given the above, we have:

$$2r1 = 2 \cdot (r2 - r1) = 2\ 1{,}1 \cdot (r3 - r2), \qquad (16)$$

$$\begin{cases} r_1 \approx 0{,}343 \cdot r_3, \\ r_2 \approx 0{,}686 \cdot r_3. \end{cases} \qquad (17)$$

According dependencies (1) - (16) and varying structural and technological parameters, namely the outer duct radius r3, its length L and V supply air flow over a wide range, we obtain the dependence of the power required for pumping air through concentric trohtrubnyy heat recovery units of the above factors (Fig. 2, Fig. 3).

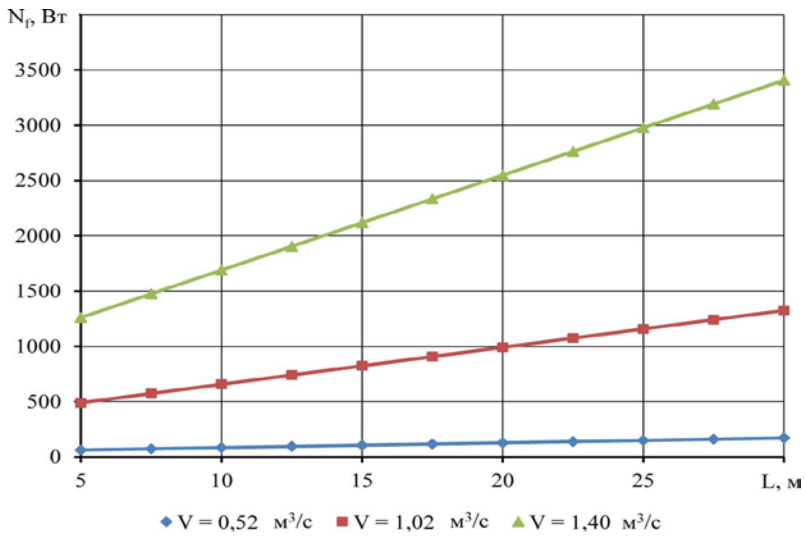

Fig. 2. Dependence of power change of length N pnevmovtrat heat utilizers L and V feed air flow at fixed values of the radius of the outer duct r3 =0.47 m.

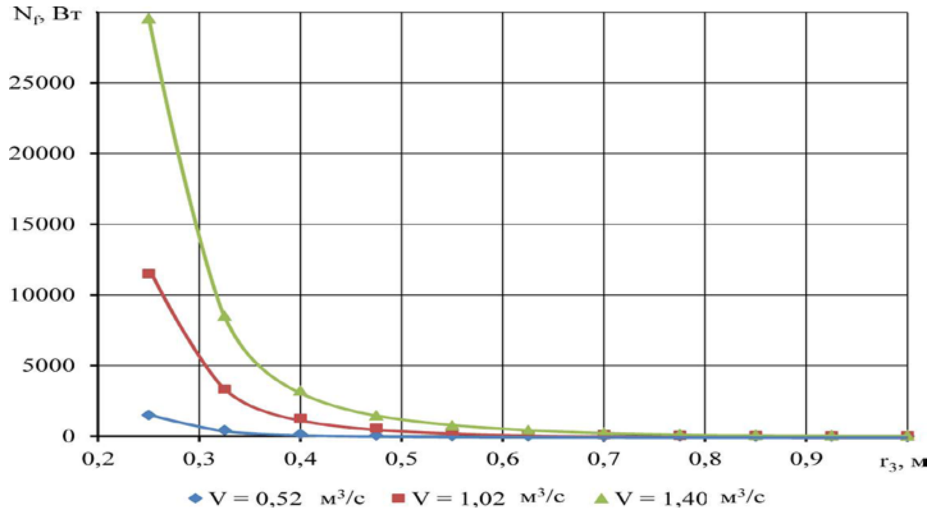

Fig. 3. Dependence of change of power N pnevmovtrat radius of the outer duct r3 and feed air stream V with fixed values of length L = heat utilizers7.5 m.

Conclusion. As a result of theoretical studies found changes depending on pressure loss Δp and power N pnevmovtrat heat utilizers of length L, radius r3 and external air-flow air feed V.

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Provedenы Theoretical Studies pnevmopoter trehtrubnoho kontsentrycheskoho teploutylyzatora for zhyvotnovodcheskyh premises. As a result of set of research zakonomernost Changed Potter and pressure-power pnevmovtrat a constructive and technological parameters teploutylyzatora (dlynы, On external RADIUS duct and air flow entries).

Resistance, Options, air, duct, power, teploutylyzatorov, pressure.

Theoretical study air losses three pipe concentric heat utilizers forfarm buildings. Our results established pattern of change of pressure loss and power air losses of structural and technological parameters of heat utilizers (length, radius and outer duct feeding air flow).

Resistance, parameters, air, air duct, power, heat recovery units, pressure.

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Wear SURFACE sieve UNDER GRAIN MATERIAL

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As the separation classifiers crushed grain mass using a variety of devices, including the largest distribution became sieve. Included features a perforated structure their systems and analyzed the wear facets holes and milled grain material.