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In Example doylnoho apparatus, air-oborudovannoho электромahnytnым pulsators pairwise action, opredelenы Some characteristics vremennыe works while zadannыh konstruktsyonnыh Size and nominal value vacuum pressure. Pryvedenы recommendations on building a block management algorithm work электромahnytnым pulsators with usylytelnoy Zveniv Pneumatic type.

Pnevmoэлектромahnytnyy pulsator, vremennыe characteristics perehodnыe processes, algorithm work.

The example of the milking machine equipped pnevmoelektromagnetic pairs pulsators actions identified some characteristics of time for a given structural size and the nominal vacuum pressure. The recommendations on the design of the algorithm of the control unit with electromagnetic pulsators amplifying element pneumatic type.

Pnevmoelektromagnetic pulsator, time characteristics, transients algorithm.

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JUSTIFICATION GEOMETRIC PARAMETERS OF ROTARY VACUUM PUMPS WITH AN INCLINED PLACING PLATES

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An exact solution of the problem on the basis of cross-sectional area of the working chamber rotary vacuum pump with a sloping placing plates depending on the angle of rotation of the rotor. Showing differences of the new solution compared to existing.

The vacuum pump, air distribution phase, the volume of the working chamber.

Formulation of the problem. Low volumetric efficiency of existing rotary milking vacuum pumps primarily due to large domestic air overflows. According to the literature, the internal flow accounts for about 60% loss of volume pump performance [1]. The main parameter is laid at the design stage pump, which significantly affects the internal flow of air is air distribution phase, ie the position and size of the suction and pumping of windows, which are determined based on the following considerations: [1]

- position of the lower edge of the suction box is chosen so that rozimknennya working chamber of the suction pipe occurred at a time when the volume of the working chamber reaches the maximum value;
- the position of the upper edge of the suction box must be selected from the condition of equality of pressure in the chamber tube and suction at the initial moment;
- position of the lower edge of the window by forcing the same conditions, but at the beginning of injection;

- the position of the top edge forcing windows must meet the minimum volume of the working chamber at the end of injection.

From the above it is clear that justified the choice of location and size of windows depends primarily on the correct definition of the working chamber volume changes depending on the angle of rotation of the rotor.

Analysis of recent research. The current method of determining changes depending on the volume of the working chamber V_{φ}, Which determines the maximum theoretical performance, the angle of rotation of the rotor φ when the angle between the plates β for rotary vacuum pumps with radial placement of the plates is driven by the authors [1, 2] and is as follows:

$$V_{\varphi} = S_{\varphi} \cdot l = \frac{1}{2} l \int_{\varphi - \frac{\beta}{2}}^{\varphi + \frac{\beta}{2}} \rho^2 d\varphi - r^2 \frac{\beta}{2}, \qquad (1)$$

where: S_{φ} - Cross-sectional area of the working chamber, m2; l - length of the rotor, m; ρ - The relative eccentricity, m; r - the radius of the rotor, m.

The purpose of research. Refine method of calculating cross-sectional area of the working chamber rotary vacuum pump with a sloping placing plates depending on the angle of rotation of the rotor.

Results. Equation (1) accurately describes the dynamics of volume pump chamber for radial placement of the plates at the same time, the authors propose using this dependency and placing pumps with sloping plates, angle ψ not exceeding 30°. Indeed, to calculate performance pump (rate action) this dependence can be used because the amount of deviation is less than 5%.

As seen in the first part of equation (1) defining the size when calculating the volume of the working chamber is its cross-sectional area S_{φ}Because this task is to develop a reliable method of calculation of change depending on the angle of rotation of the rotor φ for pumps with an inclined placing plates.

Solution of the task is illustrated in Fig. 1, which shows that working plate oriented along the tangent to some radius r0 and form each of the neighboring angles.

Getting XOY coordinate system coincides with the point of intersection of the axes of two adjacent plates. When rotating the rotor to rotate along with plates that are cut off between the surface of the rotor radius r and the inner surface of the stator radius R volume working chamber. The provisions of the coordinate system of the rotation of the rotor will always be determined angleφWhich forms the radius of a CD with a fixed horizontal diameter rotor. Radius CD is always perpendicular to the axis OX axis at the point of contact to a circle of radius r0.

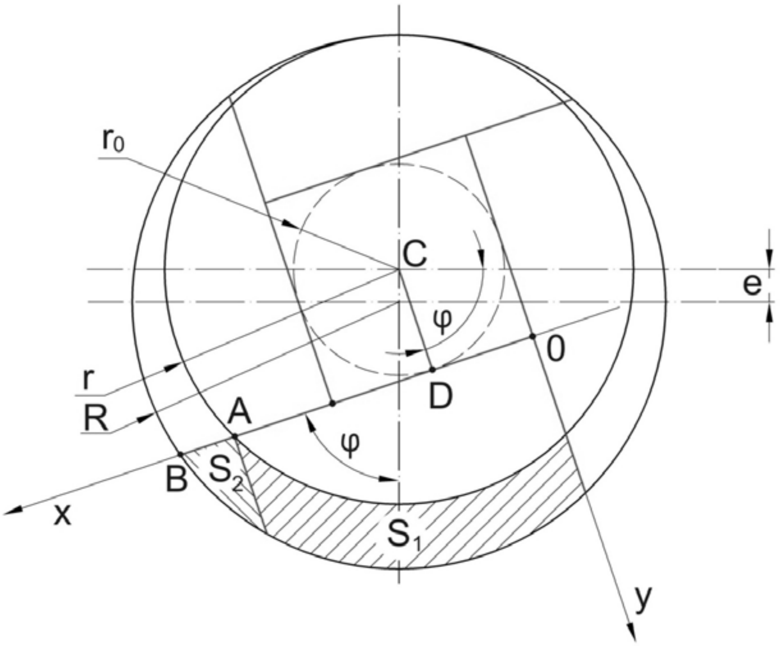

Fig. 1. Design model.

Obviously, for any angle equation circuit section of the rotor and always will be:

$$(x - r_0)^2 + (y + r_0)^2 = r^2. \quad (2)$$

For circuit section stator equation have the angle φ:

$$(x - r_0 - e\cos\varphi)^2 + (y + r_0 - e\sin\varphi)^2 = R^2. \quad (3)$$

where: e - eccentricity pump.

Coordinates of the point A - point characteristic section camera point of intersection of the circle of radius r with the axis OX, we find from equation (2). For y = 0, we have:

$$x^2 - 2xr_0 - r^2 + 2r_0^2 = 0.$$

Where,

$$x_A = \frac{2r_0^2 + \sqrt{2r_0^2 + 4(r^2 - 2r_0^2)}}{2} \quad (4)$$

Point B is found from the equation (3) that for y = 0 is:

$$x^2 - 2x(r_0 + e\cos\varphi) + 2r_0^2 + 2r_0 e(\cos\varphi - \sin\varphi) + e^2 - R^2 = 0$$

where

$$x_B = \frac{2(r_0 + e\cos\varphi) + \sqrt{(2r_0 + e\cos\varphi)^2 + 4\left[R^2 - 2r_0^2 - 2r_0 e(\cos\varphi - \sin\varphi) - e^2\right]}}{2}. \quad (5)$$

From equations (2) and (3): $y = \sqrt{r^2 - (x - r_0)^2} - r_0 = f_1(x)$;

$$y = \sqrt{R^2 - (x - r_0 - e\cos\omega t)^2} - r_0 + e\sin\omega t = f_2(x).$$

Some camera-sectional area S1, for which 0≤h≤hA (Fig. 1), we find a $S_1 = \int_0^{x_A}\left[f_2(x) - f_1(x)\right]dx.$

That is,

$$S_1 = \int_0^{x_A}\left[\sqrt{R^2 - (x - r_0 - e\cos\omega t)^2} + e\sin\omega t - \sqrt{r^2 - (x - r_0)^2}\right]dx =$$

$$= \left[\frac{1}{2}(x - r_0 + e\cos\omega t)\sqrt{R^2 - (x - r_0 - e\cos\omega t)^2} + \frac{R^2}{2}\arcsin\frac{x - r_0 - e\cos\omega t}{R}\right]_0^{x_A} +$$

$$+ e\sin\omega t \cdot x_A - \left[\frac{1}{2}(x - r_0)\sqrt{r^2 - (x - r)^2} + \frac{r^2}{2}\arcsin\frac{x - r_0}{r}\right]_0^{x_A} = \quad (6)$$

$$= \frac{1}{2}\left[(x_A + e\cos\omega t)\cdot(\sqrt{R^2 - (x_A - r_0 - e\cos\omega t)^2} - \sqrt{R^2 - (r_0 + e\cos\omega t)^2}\right] +$$

$$+ \frac{R^2}{2}(\arcsin\frac{x_A - r_0 - e\cos\omega t}{R} + \arcsin\frac{r_0 - e\cos\omega t}{R}) -$$

$$- \frac{1}{2}\left[(x_A - r_0)\sqrt{r^2 - (x_A - r_0)^2} + r_0\sqrt{(r^2 - r_0^2)}\right] + \frac{r^2}{2}(\arcsin\frac{x_A - r_0}{r} + \arcsin\frac{r_0}{r}) + e\sin\omega t \cdot x_A$$

Another section of the area camera S2, for which hA≤h≤hV (Fig. 1), we find both:

$$S_2 = \int_{X_A}^{X_B} f_2 dx.$$

That is,

$$S_2 = \int_{x_A}^{x_B}\left[\sqrt{R^2 - (x - r_0 - e\cos\omega t)^2} - r_0 + e\sin\omega t\right]dx =$$

$$= \left[\frac{1}{2}(x - r_0 + e\cos\omega t)\sqrt{R^2 - (x - r_0 - e\cos\omega t)^2} + \frac{R^2}{2}\arcsin\frac{x - r_0 - e\cos\omega t}{R} - r_0 x + e\sin\omega t \cdot x\right]_{x_A}^{x_B} = \quad (7)$$

$$= \frac{1}{2}\left[(x_B - r_0 + e\cos\omega t)\cdot(\sqrt{R^2 - (x_B - r_0 - e\cos\omega t)^2} - (x_A - r_0 - e\cos\omega t)\sqrt{R^2 - (x_A - r_0 + e\cos\omega t)^2}\right] +$$

$$+ \frac{R^2}{2}\left[\arcsin\frac{x_B - r_0 - e\cos\omega t}{R} - \arcsin\frac{x_A - r_0 - e\cos\omega t}{R}\right] - r_0(x_B - x_A) + e\sin\omega t(x_B - x_A).$$

For the cross-sectional area $S_\varphi = S_1 + S_2$, Through software MS Exsel built tracker S_φ = F (φ) To pump the following geometric parameters: stator diameter - 105 mm; Rotor diameter - 88 mm; eccentricity - 8.5 mm; the angle plates - 45°. Dependence S (φ)shown in Fig. 2 dashed lines, solid line provides the same dependence as defined by the formula (1).

Comparison of the curves indicates that the use of formulas (6), (7) there are some differences that significantly affect estimated performance (deviation less than 0.5%). As for air distribution phase, the maximum value of S_φAnd hence the volume of the working chamber there is not a point that meetsφ= 0°And the point that is shifted 13.4° (Fig. 2). Shifting minimum S_φ not so significant and is 2.8°.

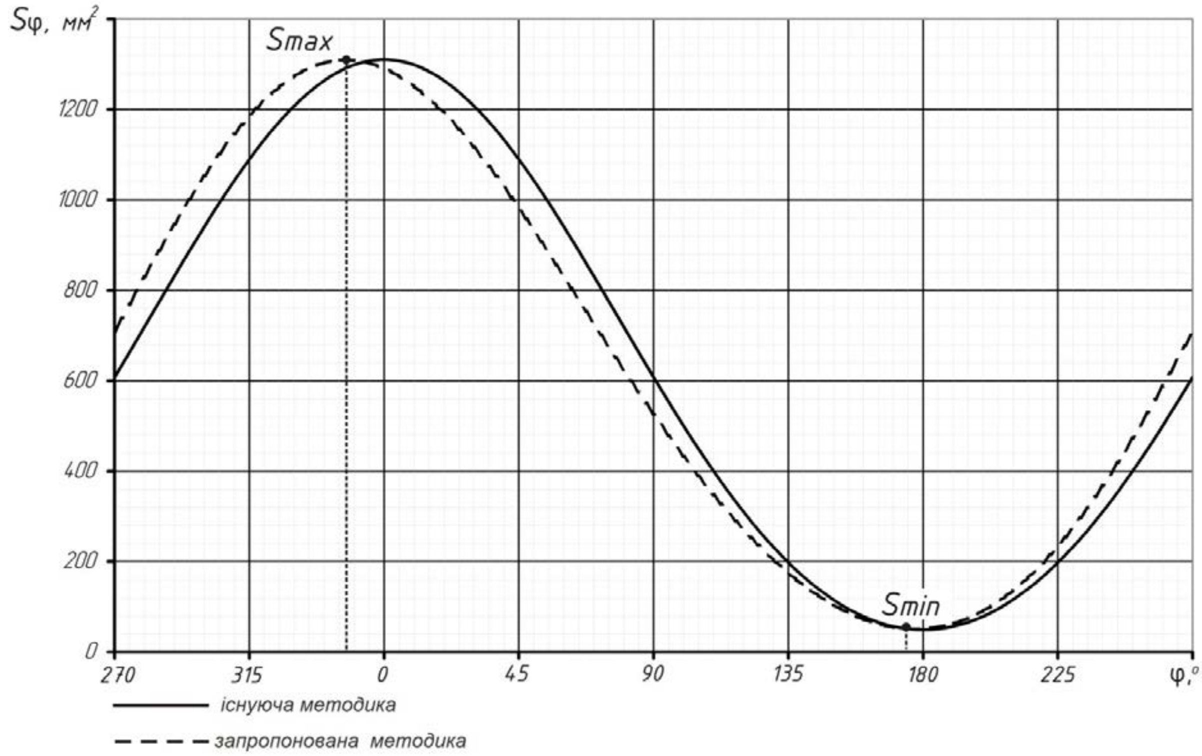

Fig. 2. Dependence of the cross-sectional area of the working chamber of the angle of rotation of the rotor φ pump.

In addition, the obtained dependence shows that displacement curves observed in almost the entire range of values of the angle of rotation of the rotor φ.

Conclusion. In general, the results of the following conclusions: The exact solution of the problem on the basis of cross-sectional area of the working chamber rotary vacuum pump with a sloping placing plates depending on the angle of rotation of the rotor; got the opportunity to more accurately determine the position of the suction and pumping windows.

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Proposals tochnoe decision problem by calculating Square transverse cross-section a working камеrы rotatsyonnoho vacuum pump с naklonnыmy plates in dependence from angle rotation of the rotor. Showing otlychyya new solutions compared with of existing.

Vacuum pump, air apportionment phases, Volume of a working камеrы.

The exact decision of a problem by calculation of the area of cross-section section of the working chamber of the rotary vacuum pump depending on a rotor angle of rotation is offered. Differences of the new decision in comparison with existing are shown.

Vacuum pump, the phase distribution of the air, volume of the working chamber.

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Energetic PARAMETERS plate Vacuum pumps

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The results of theoretical investigations plate rotary vacuum pumps on their basis The necessary guidelines on the design and operation. Unified theoretical position calculation capacity friction vacuum pump with radial and inclined plates.

Vacuum pump friction plate capacity.

Formulation of the problem. The most loaded parts of vacuum pumps is plate plate. Depending on the size of the pump, pressure drop, a material plates, cooling and lubrication method put the 2 to 30 plates.