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As a result of techno-economic calculation established, something Application for breast Farms with 100 heads poholovem system servokontrolya razrabotannoho rotatsyonnoho plate-proof vacuum pump installation doylnoy ymeet Benefits for indicators эnerhozatrat - эkonomyya electricity to 2.44 times. Term okupaemosty at 2.6 Introduction sostavyt Manuscript and the Economic hodovoy effect sostavljaet 13264 USD.

The Economic effect, doylnaya installation system servokontrolem, vacuum pump, Electricity, effectiveness.

As a result of technical and economic calculation established that the application on a dairy farm with 100 head of livestock servo control system developed by the rotary vane vacuum pump as a part of the milking plant has advantages in terms of energy - energy savings in 2.44 times. the payback period will be the introduction of 2.6 years and an annual economic impact is 13264 UAH.

Economic effect, milking unit, servo control system, vacuum pump, power, efficiency.

UDC 637,116

TIME CHARACTERISTICS OF ROBOTYPNEVMOELEKTROMAHNITNOHO pulsator pairs

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

Pnevmoelektromahnitnyy pulsator, timing characteristics, transients algorithm.

Formulation of the problem. The introduction of milking cows using automated milking puts high demands on the basic elements of executive milking apparatus. Use pnevmomembrannyh pulsators hinders or prevents the development and implementation of automated milking agricultural enterprises as impossible of adaptive changes in process parameters during the process. Pnevmoelektromahnitni pulsator can be used in automated systems management with feedback on the intensity of milk. The duration of the signal delay is insignificant and largely dependent on the time delays that occur in the pneumatic system pulsator, milking cup, and is independent of the feedback time technological change settings.

However, the need to set clear boundaries change time characteristics, delay and transition to generate the indicator diagram to implement the proper construction of the control algorithm, and hence to the possibility of rapid adaptation to machine milking physiology of milk cows.

Analysis of recent research. The most common design pnevmoelektromahnitnyh pulsators, allowing to automate the process of milking can be divided according to the method used for electricity fed from the pulsator amplifying element and without it. Devices that do not have amplification level, characterized by increased energy consumption and thus in contemporary stringent requirements on energy saving technologies is not a promising area of research. Therefore, the use of existing pulsators amplifying link, for example [1-3], should be considered as the main direction of improvement of milking machines.

The inclusion of additional elements into the design pulsator despite the reduction of energy consumption leads to more dynamic and transient processes [4-6] that are within a certain time, which can sometimes be critical to ensure natural and economical milking. A growing number of researchers and scientists agree that the creation of biologically reasonable way of removing milk from the udder of a cow

should provide not only are the main characteristics of the process of milking a ripple frequency, ratio and cycles mentioned vacuum pressure [7-9], but phase shift, the duration of the phases of milking, Rise time and pulse recession vacuum pressure, synchronous or asynchrony milking etc. [10, 11].

Thus, the work [10] points to the increasing number of milk received and reducing the duration of milking with decreasing pulse duration of the recession vacuum pressure. But other scientists have studied the ratio of cycles [11] and found that the peak of milk and quantity of milk received depends on the ratio of cycles. Requirements of the standard of the technical specifications milking of ISO 5707: 2012 specifies that the duration of phase b shall not exceed 30% of the duration of the entire cycle ripple and phase d - at least 15% and no less than 150 ms. The value of the efficiency of machine milking depends on how harmoniously combines deterministic mechanical system of milking machines and stochastic physiological characteristics of cows. Therefore, the definition of time performance to ensure proper saving algorithm and adaptive milking [12] for certain developed and tested pulsators [1, 4] is one of the priority tasks.

The purpose of research. According to the proposed description [13] of the electromagnetic pulsator in statics and dynamics, as well as recommendations for the duration of the phases of pulsator according to the requirements of the standard and duration transients conduct simulation length front and decline pulse vacuum pressure and time delays, resulting availability inertial units are already pulsator, milking cup for conditions pnevmoelektromahnitnoho pairs pulsator action [2].

Results. In determining the temporal characteristics of the pulsator [2] should take into account its design features. The main ones are the volume control and chambers, overflow diameter and calibrated apertures options moving parts and resilient membranes.

Under the proposed equations that describe the movement of valve-shtokovoyi pulsator and filling the air control chamber [13]

$$\begin{cases} m_k \dfrac{d^2x}{dt^2} = (zP_a - P_1)S_1 + G_k - cx - (P_a - P_1)S_2 \\ \dfrac{dz}{dt} = \dfrac{K_1 V_0}{(V_0 + xS_1)} z^{\frac{k-1}{k}} \sqrt{1 - z^{\frac{k-1}{k}}} \end{cases},$$

where: mk - mass valves and piston rod, kg; Ri - the pressure in the respective chambers pulsator, kPa; Si - area corresponding bypass openings m2;
Gk - The weight of valves, N; s - the elasticity of the membrane, N / m2; x - displacement valves, meters; V0 - initial volume of the control chamber pulsator, m3; K1 - coefficient structurally technological parameters pulsator, s-1 [13]; $z = P_3 / P_a$ - The ratio of pressure.

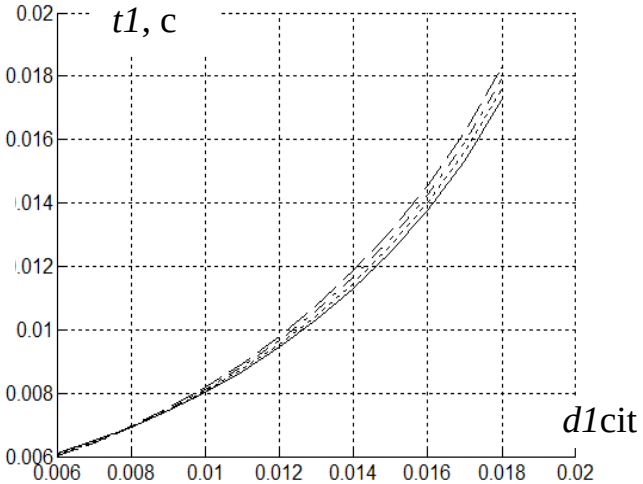
The simulation duration time delay completion of the transition movement valve pulsator of compression stroke to stroke sucking (Fig. 1). This delay is beginning backlog sucking cycle from the time when the power supply was suspended electromagnet pulsator.

Since the effect of structural dimensions and vacuum pressure on the temporal characteristics that are significant for the design of control unit pulsators should take into account the specific value of the advance termination of power supply to the electromagnets. When using the diameter of the upper overflow hole with a diameter of 14 mm should be provided time delay in the range 0,017-0,02 with.

Pulsator transition from sucking to stroke compression stroke also has a distinctive period during which the process of pumping air from the control chamber and valve movement shtokovoyi-up group. This period defines the time delay of the completion of the transition movement pulsator valve stroke of sucking to the compression stroke and is by integrating the system of equations [13]:

$$\begin{cases} m_k \dfrac{d^2x}{dt^2} = c(h_1 - x) - G_k + (P_a - P_1)S_3 - (zP_1 - P_1)S_1 \\ \dfrac{dz}{dt} = -\dfrac{K_3 V_1}{(V_1 - xS_1)} z\sqrt{z^{\frac{k-1}{k}} - 1} \end{cases};$$

where: h1 - progress valves, meters; V1 - the maximum amount of the control chamber pulsator m3.



———— P1 = 40 kPa; - - - - - - - - - - - - - - - - P1 = 48 kPa;

---------- P1 = 44 kPa; – – – – – – – – – P1 = 52 kPa

Fig. 1. Dependence of the length of the time delay valve movement completion of overflow hole diameter upper pulsator during the transition from compression stroke to sucking.

Found that most described on time delay affects calibrated hole diameter (Fig. 2) for supplying vacuum pressure in a control chamber pulsator.

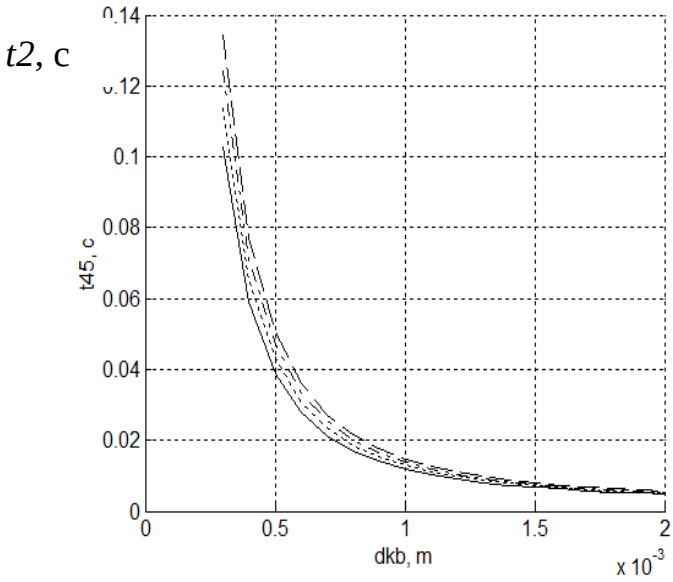
As seen from the construction of a maximum length of time delay will come with the required diameter of the calibrated hole connection control camera with camera constant vacuum pressure dkv = 0,3..0,5 mm. To a lesser extent, changes in the values of small diameter lower overflow orifice diameter and membrane. Thus longest time delay will occur at dkv = 0.3 mm and equal 0,12-0,13 s at a nominal pressure 48 kPa. Therefore, these values should offset the change in the date of withdrawal and the power of electromagnets Milking apparatus. If we consider the adiabatic process of filling or pumping air from the chamber pulsator, connecting hoses and milking cups, its duration will be determined by known integral equations [13]:

$$t_{\phi} = \frac{1}{K_1} \int_{z}^{z_1} \frac{dz}{z\sqrt{z^{\frac{k-z}{k}} - 1}},$$

where: $z = \frac{P}{P_1}$, $z_1 = \frac{P_a}{P_1}$;

$$t_c = \frac{1}{K_2} \int_{\frac{1}{z_1}}^{z} \frac{dz}{z^{\frac{k-1}{k}}\sqrt{1 - z^{\frac{k-z}{k}}}},$$

where: $z = \frac{P}{P_a}$.



*dkv*cit

———— P1 = 40 kPa; -·-·-·-·-·-·- P1 = 48 kPa;

---------- P1 = 44 kPa; – – – – – – – – – P1 = 52 kPa

Fig. 2. Dependence of the length of the time delay valve movement completion calibrated on the diameter of the hole in the transition from the pulsator to beat sucking compression.

The same range of variation in the length of the front and decline pulse indicator diagram due to the same adiabatic process pumping and filling the closed volume chambers milking apparatus. This change in vacuum pressure within 44-52 kPa is immaterial effect (to 18.5%). But with the required diameter bypass holes 6 mm length of the front and decline increases to 0.14-0.18 sec. Taking into account the recommendations according to standard milking machines and research scientists [10, 11], should ensure that reducing the length of the front and extend the recession. This can be done by selecting the respective values of the diameters of the bypass openings connecting the chamber with variable pressure vacuum chambers constant vacuum and atmospheric pressure or making adjustments to the algorithm of the control unit [14].

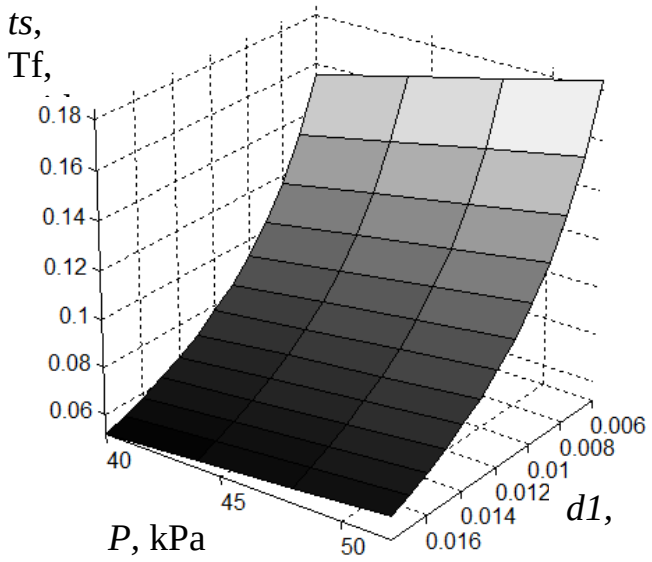


Fig. 3. Dependence of the length of the front and decline of the indicator chart in the lower and upper diameter bypass holes 6 mm diameter membrane and Dm = 30 mm.

Conclusions

Use pnevmoelektromahnitnoho pulsator pairs action with the amplifying element reduces the power consumption but there are time delays completion of movement of valves that need to be considered when designing future pulsator control unit and the algorithm of its work. Temporal characteristics should be provided within, not beyond the recommended intervals, thus creating and saving nablyzhuyuchy milking

it to the natural process of removing milk.

Changing the length of the front and the decline of the indicator chart available by installing the appropriate set and calibrated diameter bypass holes.

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

Pnevmoэlektromahnytnyy pulsator, vremennые characteristics perehodnые 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