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ANALYSIS OF STRUCTURES AND PARAMETERS ROBOTYPNEVMOMEMBRANNYH pulsator pairs DIYITA GROUND mode of operation

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The paper presents an analysis of existing structures with pneumatic diaphragm pulsators connected in pairs that showed that they condition the optimum ratio of the length of the suction and compression cycles provided. Therefore, the proposed new design pnevmomembrannoho pulsator, which is made of two parts, one of which is driving and the other slave.

Pulsator pairs, cycle, vacuum, vacuum network milking machine.

Formulation of the problem. To ensure the efficiency of the milking cows must adapt working hours milking machine to the intensity of milk. Due to the fact that working hours milking apparatus characterized ripple frequency, ratio and cycles largest vacuum pressure

in the chamber milking cup, is especially Milking devices that provide management and correlation of milking rhythm cycles. Pulsator providing process pairwise milking where replacement cycles held alternately in pairs milking cups have several advantages over synchronous: minimum mutual influence of milking machines while simultaneously work, improve the vacuum network partial prevention of the "napovzannya" milking cups for milking at the end of milking; made imitation udder massage.

World leading companies engaged in the development and implementation of milking machines on the market, "Vestfalia-separator", "Impulsa", "Alfa laval", JSC "Bratslav" and others prefer pairwise milking pulsator. Proanalizuvashy of existing pulsators that are most common in Ukraine can say the following. Milking machine "Impulsa" M-59 and M-66 workflow is due to strong connection block valve bar. However, due to the connection of the valve blocks can be implemented milking paired with a ratio of compression cycles to sucking only as 50:50, which does

not meet the physiological requirements for pairwise correlation cycles milking machines, which should be about 70:30.

One possible embodiment of pairwise milking with optimal cycles is the use of two independently working pulsators one of which serves one pair of teats, and the other another, eg milking machine developed in NUBiP.

In this milking machines due to the inevitable mismatch ripple frequency pulsators is some continuous phase offset pressure indicator diagrams, respectively, as of the time the milking machine operates synchronously, and some in pairs. This lack has pulsator "Impulsa-90" (Fig. 1). Pulsator currently consists of the case 1, 2 and 5 valves, membranes 3 and 4, 6 and throttle valve 7. Filter 2 is connected with membrane 3, the valve membrane 5 with 4 valves are not connected to each other and the valve 5 is saddle valve 2. It has six chambers, of which 1p1 and 1p2 - constant vacuum pressure, 2p1, 2p2 4P and variable vacuum pressure 3p constant atmospheric pressure. Moreover, the camera is managing 4P [2, 4].

Similar functions sells pulsator circuit is shown in (Fig. 2). This pulsator has 12 cameras, camera 1n - constant vacuum pressure, 21n and 22n - variable vacuum pressure, 3n - constant atmospheric pressure, 41n and 42n variable vacuum pressure (control), 51n and 52n camera control position of the lower axis 5 and valve 3 and camera 61n and 62n - top management position of axes 4 and 2. The lower valve membrane 8, 5-axis and 3-valve having two stable (left and right) position. The presence in one of the chambers 51n or 52n vacuum pressure can change the position of the valve axis 5 and 3 reversed as a result of atmospheric pressure on one of the membranes 8. Control the camera 41n or 42n connected by a channel section which can change the adjusting screw 6, so 4 valve axis 2 and 7 membranes change their movement with a delay in time.

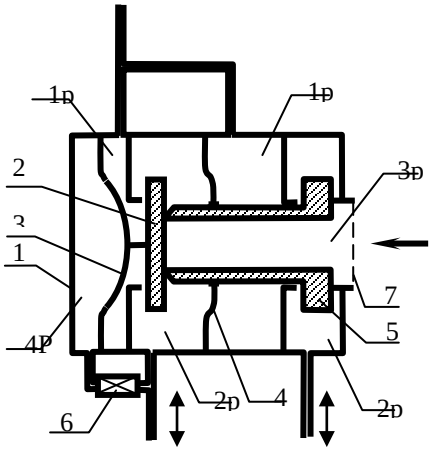


Fig. 1. Scheme pulsator "Impulsa-90": 1 - the case; 2, 5 - valves; 3, 4 - membrane; 6 - throttle; 7 - filter.

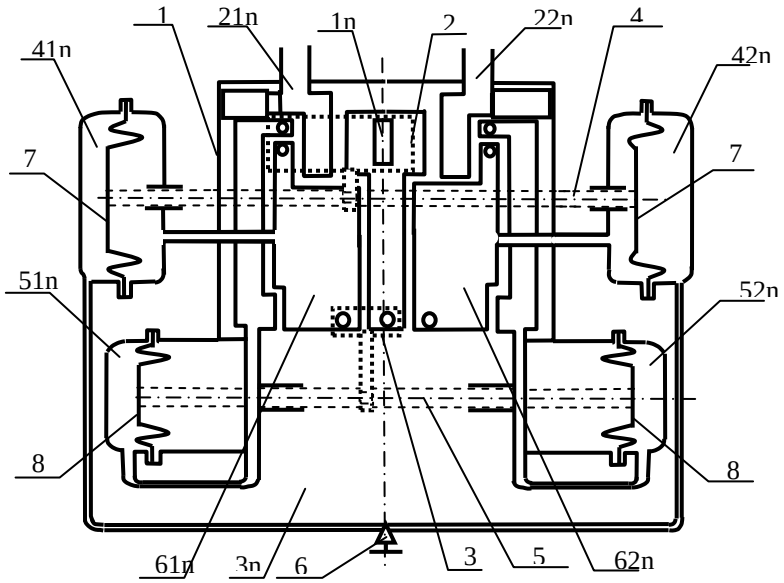


Fig. 2. Scheme pairwise pulsator: 1 - the case; 2 - the top valve; 3 - bottom valve; 4 - upper axis; 5 - lower axis; 6 - adjusting screw; 7 - upper membrane; 8 - lower membrane.

Pealizatsiya regime pairwise milking can be achieved using electromagnetic pulsators, but this type pulsators need additional grid or power source, leading to increase in cost of funds as the installation of the system and its operation.

The purpose of research is to develop pairwise pnevmomembrannoho pulsator with adjustable and optimal ratio of cycles performed based on uniform milking machine ADU-1 and verify its operability.

Research results. As seen from the analysis of existing pulsators they provided value correction cycles in a separate pairs of milking cups that adapt neumozhlyvlyuye milking apparatus to the udder asymmetry caused by the individual characteristics of the animal. This disadvantage can be eliminated if pulsator perform two sections based on uniform simultaneous pulsator ADU-1, each with a block valve is not mechanically connected to each other, one located on the second coaxially and interconnected in such a way camera constant atmospheric pressure lower driving section bordered by alternating vacuum chamber pressure driven top that has an extra hole that connects it to the atmosphere through an additional valve. Additional valve mechanically connected with the block valve driving section, and a constant vacuum pressure chamber two sections connected by a channel, which connects to the source of vacuum pressure [1, 4].

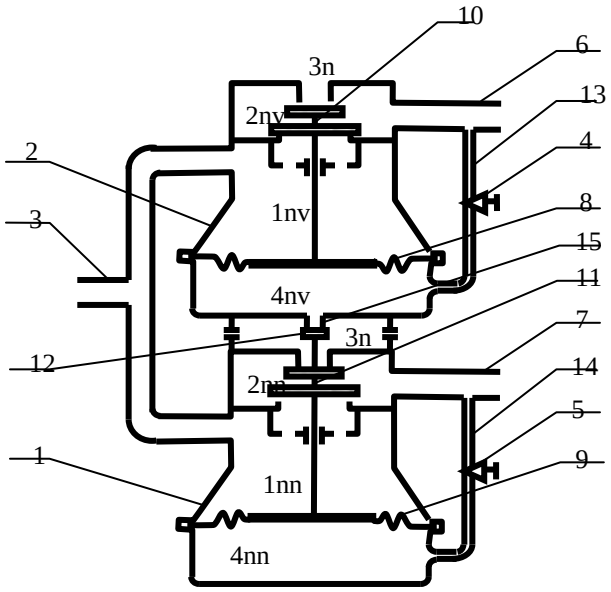


Fig. 3. pnevmopulsator pairs: 1, 2 - housing; 3, 6, 7 - pipes; 4, 5 - inductors; 8, 9 - membrane; 10, 11, 12 - valves; 13, 14, 15 - channels.

The proposed pnevmomembrannyy pulsator (Fig. 3) pairwise milking works as follows. When connecting pipe 3 to vakuumprovodu in cells and 1pv 1pn set vacuum pressure, and the cells 4pv and 4pn is pressure. Due to the pressure difference between the chambers and 4pv 1pv and 4pn 1pn and under atmospheric pressure membranes 8 and 9 valve blocks both sections occupy the top position and the additional valve 12 adjacent to the seat 15. The cells 4pv and 4pn pressure decreases by suction through the air respective throttle channels of the camera and 2pv 2pn, which at this time is a vacuum pressure due to a combination of cameras and 1pv 1pn.

At some point in time, due to adjusting the throttle 4, which complies with the early movement of the valve block 10 it suddenly takes a lower position due to the forces acting on the valve of the chamber 3pv. While the valve unit driving section 11 is still in the top position by an appropriate infusion throttle 5. In the next period of time, due to adjustable throttle 5, block valves driven section also takes a lower position, combining with the camera and 3pn 4pv through opening additional valve 12. due to the intake of air from the chamber 3pn in 4pv and by the action of atmospheric pressure on the membrane unit 8 valves driven section takes the top position.

The camera 4pn via throttle channel 14 receives air from the chamber 2pn that at this time the camera is connected to and disconnected from 3pn camera 1pn and pressure when it meets the conditions of the transition block valve driving section it will take up the top position. This situation corresponds to the initial state of the valve sections, and therefore the process is repeated.

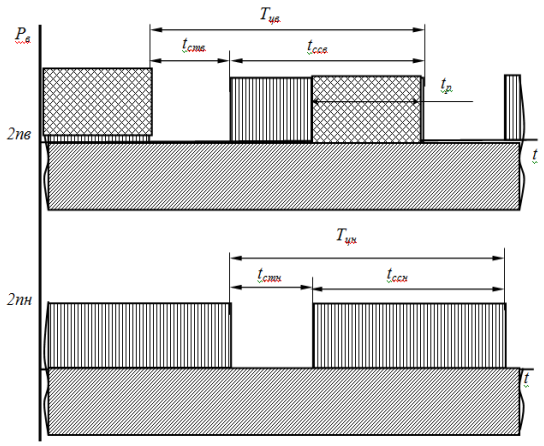
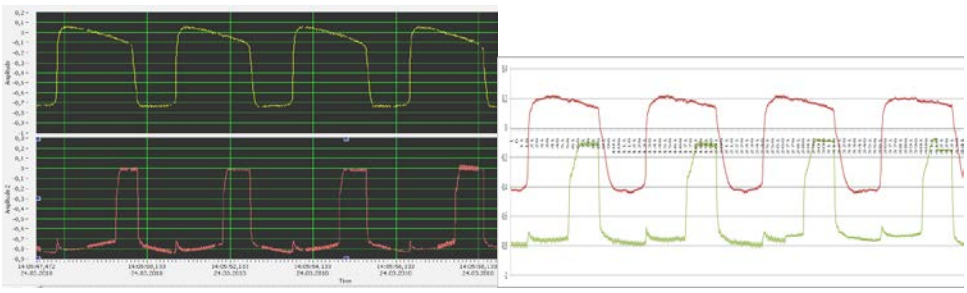


Fig. 4. Indicator Diagram of pulsator: - in betwen c[illegible]ber milking cup; - In piddiykoviy chamber mi[illegible] cup; - Part of the chart where possible [illegible]tment ratio cycles in the driven pulsator section.

Phase shift cycles driven and driving sections made adjusting the duration of the upper block valve in the up position is unlinked from the camera chamber 4pv 3pn additional valve. Indicator Chart 2pv pressure in the chamber and process described 2pn of pnevmomembrannoho pairwise milking pulsator shown in Fig. 4. As shown in the indicator diagram (Fig. 4), pairwise milking process takes place, value and duration of sucking compression cycles in both pairs of glasses milking offset phase alternating cycles provided the ratio of cycles that would correspond to the physiology of cows, and the above described pulsator operation, availability choke 5 allows you to adjust the rhythm of milking, and throttle adjustment ratio provides 4 cycles sucking tccv to tctv compression stroke of the driven part pulsator that in unrealized analyzed pulsator.

The software part complex for research milking machines milking pairwise LabVIEW software package provides firm National Instruments [3, 5, 6].Experimentally derived indicator diagram of (Fig. 5) newly pnevmomembrannoho pulsator pairs unaochnyuvalys action and registered on the PC in real time.



and) B)

Fig. 5. Experimentally derived indicator diagram of pnevmomembrannoho pairs pulsator steps reproduced in software environments: a)LabVIEW; b) Excel.

The regression equation depending on the ratio of cycles vakummetrychnoho pressure, intensity and frequency of pulsations of milk with natural values of variables for the driving section:

$$t_{cc1} / t_{cm1} = 1,76659943 + 18460,264 \cdot V + 0,00001199 \cdot P - 0,3632890 \cdot P \cdot V - \\ -\nu(0,0278079 + 23375,53698 \cdot V + 0,00001362 \cdot P - 0,412828 \cdot P \cdot V), \quad (1)$$

and driven:

$$t_{cc2} / t_{cm2} = 5,207860376 - 52898,4085755 \cdot V - 0,00004013 \cdot P + 1,216055 \cdot P \cdot V - \\ -\nu(2,8776177 - 60111,8279 \cdot V - 0,0000456 \cdot P + 1,38181 \cdot P \cdot V). \quad (2)$$

Value cycles pulsator driving section for stable frequency pulsations (v = const) v = 0,88 Hz recommended by the vacuum pressure in the range of 35000 to 52000 Pa and intensity of milk 0,00001333-0,00005333 m3 / s ratio provided 1.6 cycles -1.7 to pulsator driving section and 2.7 for the driven. Thus, changing the clocks vakummetrychnoho independent of pressure and influence of milk only has effect on driving pulsator section. In the slave section of these factors have no significant effect. Influence of milk and pulsation frequency to work pulsator (ratio of cycles tcc / tst) shown in Fig. 6.

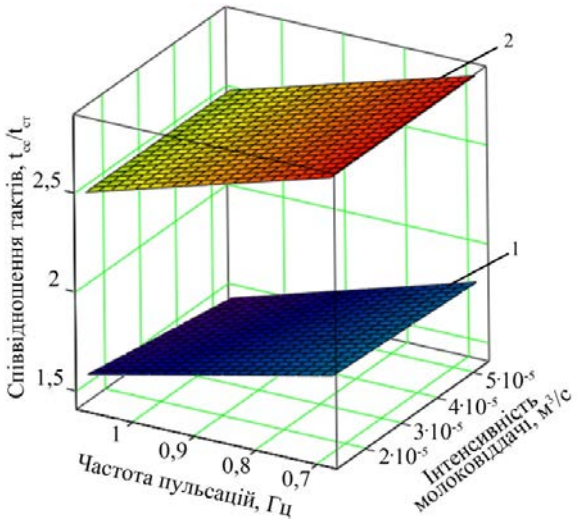


Fig. 6. Dependence ratio of driving cycles 1 and 2 sections pulsator driven by the frequency of milk and ripple.

Analyzing the response surface can be argued that in the intensity of milk0.00001333-0.00005333 m3 / s and frequency pulsations 0,68-1,08 Hz clock cycles provided value to 1.4-1.8 pulsator driving section and driven to 2,45-2,9. Changing the clocks on the frequency and intensity of pulsations of milk has a more pronounced effect on driving

pulsator section, and the slave section, this effect is linear, provided the average value of vacuum pressure P = 43500 Pa.

Value cycles pulsator driving section for stable intensity of milk (V = const) V = 0,00003333 m3 / s recommended vacuum pressure in the range of 35000 to 52000 Pa 0,68-1,08 Hz frequency ripple ratio provided 1.5 cycles -1.8 to pulsator driving section and driven to 2,5-2,9. Thus, the ratio of cycles of vacuum pressure does not change, but the frequency of pulsations has a more pronounced effect on both the linear section pulsator. Little impact traced vacuum pressure in determining the significance of the coefficients in regression models.

The process of milking cows milking machines with pulsators pairs pnevmomembrannym proposed action carried out by the working pressure vacuum ... 35000 52000 Pa. The relative length of sucking in driving cycle section was 60 ± 5% Compression - 40 ± 5% and ± 70 Powered respectively 5% and 30 ± 5% ripple frequency 0.8-1 Hz.

I checked under production conditions of the milking machine pulsators equipped with adjustable stroke length Powered by sucking in Section confirmed its efficiency (Fig. 7).

1 2 3

Fig. 7. Orientation Milking machine at work: close to horizontal (1); close to vertical (2); angle (3).

It was established that the orientation in space pulsator does not affect the validity of his work.

Conclusion. The scheme provides pairwise pnevmopulsatora: the optimal ratio of cycles corresponding to the reflex of the animals; independent regulation ratio cycles in both pairs milking cups that provide job milking apparatus according to the physiological characteristics of cows; reduce costs money and time to implementation in production, through the use of standardized units; use complex software company National Instruments LabView possible to verify the implementation of pairwise milking regime by showing instantaneous pressure change in the respective chambers pulsator in real time.

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In the article presented analysis of existing structures with pulsators Pneumatic membrane pairs soedynennыh, kotoryya showed that they have the best terms sootnoshenyya Duration vsasыvanyya clock and szhatyya not predusmotreno. Therefore predlahaetsya Novaya Constructions pnevmomembrannoho pulsator, vыpolnennaya IZ two parts, one IZ kotorыh veduschaya and second vedomaya.

Pulsator poparnыy, tact, vacuum vakuumnaya Network, doyInыy apparatus.

In paper the analysis of existing designs pneumatically of membranous pulsators pairwise suct has shown, that in them the condition of an optimum ratio of duration of clock ticks a suction and compressions is not provided. A new design of pneumomembranous pulsator therefore is offered, which one is made from two sections, one of which is leading, and second conducted.

Pulsator pairwise, synchronic, clock tick, vacuum, vacuum network, dairy milking.

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Low energy machine milking cow