ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

The Results Of Studies Of The Milking Machine With Stepped Nipple Tubes.

AV Yashin[1]*, IN Semov[1], Yu V Polyvyanyj[1], AV Machnev[1], PN Khorev[1], and AL Mishanin[2].

[1]PhD in Technical Sciences, (Penza SAU)
[2]PhD in Technical Sciences (Samara SAA)

ABSTRACT

The article discusses the problem of extremely severe effects on the nipple receptors and, accordingly, inhibition of the lactation reflex, which leads to a decrease in one-time milk yield and the effectiveness of the milking machine. The design of the milking machine with stepped nipple tubes is proposed, which allows to obtain the maximum peak intensity, the shortest duration and the greatest completeness of milking. The main structural and technological parameters of the milking machine are substantiated.

Keywords: milking machine, stepped nipple tube, intensity of milking

Corresponding author

ISSN: 0975-8585

INTRODUCTION

The main task of dairy cattle breeding is a further increase in the rate of milk production based on the increase in dairy reproductive performance of cows. The most important reserve for the growth of milk productivity is the use of milking equipment that best meets the physiology of animals, as well as its proper selection and operation [1].

Currently, there are many designs of milking machines, differing in the number of working cycles, methods of removing milk from the udder of the cow, the design of teat cups, teat tubes, etc. Despite the structural differences, the milking machines based on the “suction” method of milk removal and having a two-chamber design of teat cups, have gained great popularity. This design leads to significant savings in the number of types of teat cups, in particular the teat tubes, because they are in many ways universal and are suitable for most cows with different nipple shapes. In a push-pull milking machine, the “compression” and “sucking” cycles are distinguished [2]. At the same time, these machines do not meet the basic physiological and veterinary requirements. The action of such a milking machine does not cause a state of readiness of a cow for the active release of milk during milking. The mechanism of action of the working bodies of the machine does not reflect the actions of the calf's sucking apparatus and the work of the milkman's hand. During milking with the compression cycle, the nipples are subject to excessive deformation, which leads to less yield per unit of time (intensity of projection) [3].

The analysis of the designs of existing milking machines has led to the conclusion that one of their main drawbacks is the extremely severe effect on the nipple receptors and, accordingly, inhibition of the milk flow reflex, which leads to a decrease in one-time milk yield and intensity of milking [4].

MATERIALS AND METHODS

To increase the intensity and completeness of milking, a milking machine with stepped nipple tubes is offered, containing a pulsator, a collector, milk tubes and four teat cups, each of which consists of a stepped nipple tube with a different number of steps located in the sleeve(Figure 1).

a ***b*** ***c***

Figure 1: General view of the teat tubes of the milking machine with the number of steps : a) - three; b) - four; c) – five

The laboratory research program of an experimental design sample of a milking machine with stepped nipple tubes on an experimental stand (Figure 2) included the determination of the intensity of milking for design and technological parameters optimization.

ISSN: 0975-8585

The peak production rate was taken as an indicator evaluating the process of milking by a milking machine with stepped nipple tubes. Peak intensity of milking by the milking machine in experimental studies was defined as the ratio of the volume of milk produced during the time of milking.

Based on a priori information, exploratory experiments, a theoretical assessment of the intensity of milking and substantiating the design and technological parameters of the milking machine with stepped nipple tubes, the most significant factors were selected: vacuum pressure - x1, tact coefficient - x2.

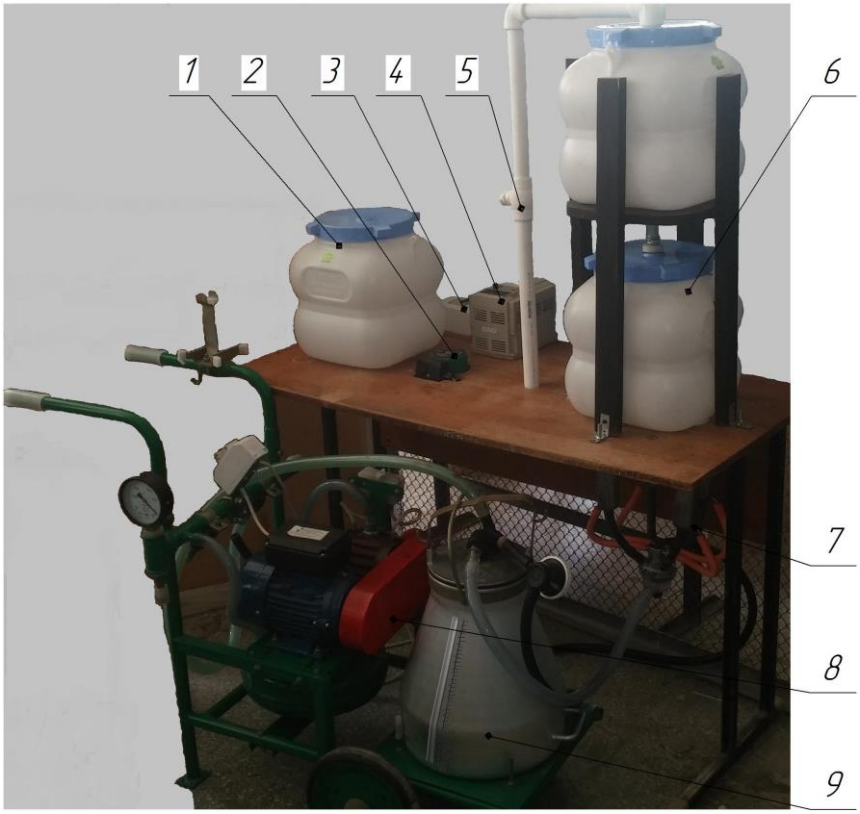

Figure 2: General view of the laboratory stand for research of a milking machine with stepped nipple tubes: 1-buffer capacity; 2 - OASIS CN-25 circulating pump; 3 - automatic shutdown; 4 - Vesper E-8300 frequency converter; 5 - fluid forced shutdown valve; 6 - artificial udder; 7 - milking machine with stepped nipple tubes; 8- a unit of individual milking AID-2; 9 - milking bucket with a milk simulator level accounting scale

Mathematical processing of research results was carried out using computer programs Statistica 6.0, MathCAD 2001 RUS, Microsoft Excel. At the same time, statistical processing of the results of a two-factor experiment, was carried out first by the Statistica 6.0 Multiple Regression module (when attempting to describe the linear model) and the Nonlinear Estimation module of the Statistica 6.0 program (when describing higher-order models). In determining the adequacy of the model (based on the multiple correlation coefficient and F-test), statistical data and Microsoft Excel were used. In determining the optimal values of the factors, the MathCAD 2001 RUS program was used. For that the listing for solving the problem of finding the extremum of a function (adequate to the regression equation model) was developed.

EXPERIMENTAL PART

Adequate mathematical dependences of the peak intensity of milking cows by the milking machine were obtained:

The dependences with three-step nipple tubes from the design and technological parameters in coded form with a multiple correlation coefficient R = 0.99 and convergence of the calculated and experimental data, F-test = 0.985 are:

$$Q_3 = 3{,}164 + 0{,}24 \cdot x_1 + 0{,}368 \cdot x_2 - 0{,}168 \cdot x_1^2 - 0{,}191\, x_2^2,\ l/min; \quad (1)$$

The dependences with four-step nipple tubes from the design and technological parameters in coded form with a multiple correlation coefficient R = 0.99 and convergence of the calculated and experimental data, F-test = 0.99 are:

$$Q_4 = 3{,}25 + 0{,}235 \cdot x_1 + 0{,}378 \cdot x_2 - 0{,}228 \cdot x_1^2 - 0{,}218\, x_2^2,\ l/min; \quad (2)$$

The dependences with five-step nipple tubes from the design and technological parameters in coded form with a multiple correlation coefficient R = 0.99 and convergence of the calculated and experimental data, F-test = 0.997 are:

$$Q_5 = 3{,}264 + 0{,}226 \cdot x_1 + 0{,}353 \cdot x_2 - 0{,}23 \cdot x_1^2 - 0{,}2\, x_2^2,\ l/min. \quad (3)$$

According to the results of the experimental data of the maximum peak intensity of milking by devices with three-, four-, and five-step teat tubes it can be concluded:

$$max\ (Q_3 = 3{,}418\ l/min < Q_4 = 3{,}474\ l/min > Q_5 = 3{,}468\ l/min).$$

Consequently, a milking machine with four-step nipple tubes has a maximum peak intensity of milking due to the influence of the ratio of the thickness and height of the step nipple tubes [5].

CONCLUSION

The use of the milking machine with four-step nipple tubes allowed to get the maximum peak intensity of milking of 3.474 l / min with optimal parameters: vacuum pressure - 47.6 kPa, coefficient of tact - $k_{макт} = 0{,}74$. In addition, a more complete milk yield per unit of time was provided, which also reduced the overall milking duration from 230 s to 207 s, respectively, for a commercially available milking machine and for a milking machine with four-step teat tubes. At the same time, the total milk yield was 98.4% and 97.1%, respectively, for the milking machine with four-step nipple tubes and for the mass-produced milking machine, which was 1.3% more, and the amount of residual milk did not exceed the requirements.

REFERENCES

[1] Bondarev, S.N. On the question of the correct choice of the teat rubber of the milking machine / S.N. Bondarev, A.V. Kitun // Bulletin of the Kursk State Agricultural Academy. - 2017. - № 2. - p. 38-43.

[2] Machnev A.V. Technologies and means of agricultural mechanization / A.V. Machnech, N.P. Larushin, A.V. Yashin et al. / Penza .: RIO PSAU, 2016. - 254 p.

[3] Trubnikov, V.N. Modernized teat rubber milking machine / V.N. Trubnikov, N.V. Konyaev, I.F. Saraev, S.N. Burlakov, A.S. Skvortsov // Regional Bulletin. - 2017. - № 4 (9). - p. 8-10.

[4] Yashin, A.V. Classification of the design of milking machines and the prospects for their improvement / A.V. Yashin, I.N. Syomov, A.V. Zavyalov // Col. int. scientific Conf.: Modern technologies in animal husbandry: problems and solutions. Michurinsk. - 2017. - p. 228-233.

[5] Yashin, A.V. Justification of the minimum thickness of the working part of the suction tube / A.V. Yashin, V.A. Ovtov, A.V. Zavyalov, O.S. Kalinin // Col. int. scientific Conf .: Innovative ideas of young researchers for the agro-industrial complex of Russia, a collection of materials of the All-Russian scientific-practical conference of young scientists. Penza .: RIO PSAU. - 2017. - p. 138-140.