ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Designing Apparatus for Fixing Sheep at Veterinary Treatment.

Vladimir Ivanovich Trukhachev*, Boris Alekseevich Doronin, Olga Ivanovna Detistova, and Dmitriy Ivanovich Gritsay.

Stavropol State Agrarian University, Zootekhnicheskiy lane 12, Stavropol 355017, Russia.

ABSTRACT

The relevance of research problem is lack of theoretical bases and experimental data for creation a technological equipment for fixing sheep at zootechnical and veterinary treatments. The purpose of article is a theoretical and experimental study of structural, kinematic and dynamic parameters of apparatus for fixing sheep at zootechnical treatment with two belt conveyors constituting the grooved shape. The experimental results confirmed the validity of analytical dependences. The results of research will enable designers to create technological equipment to perform zootechnical treatment of sheep with the required quality and high productivity.

Keywords: sheep, veterinary treatment, apparatus for fixing sheep, belt conveyors

***Corresponding author**

ISSN: 0975-8585

INTRODUCTION

To improve the quality of zootechnical and veterinary treatments sheep (sheep shearing, labeling, valuation, trimming hooves, immunization, and vaccination) and increasing productivity, taking into account international experience, we developed and tested apparat for fixing sheep at zootechnical treatment (Figure 1).

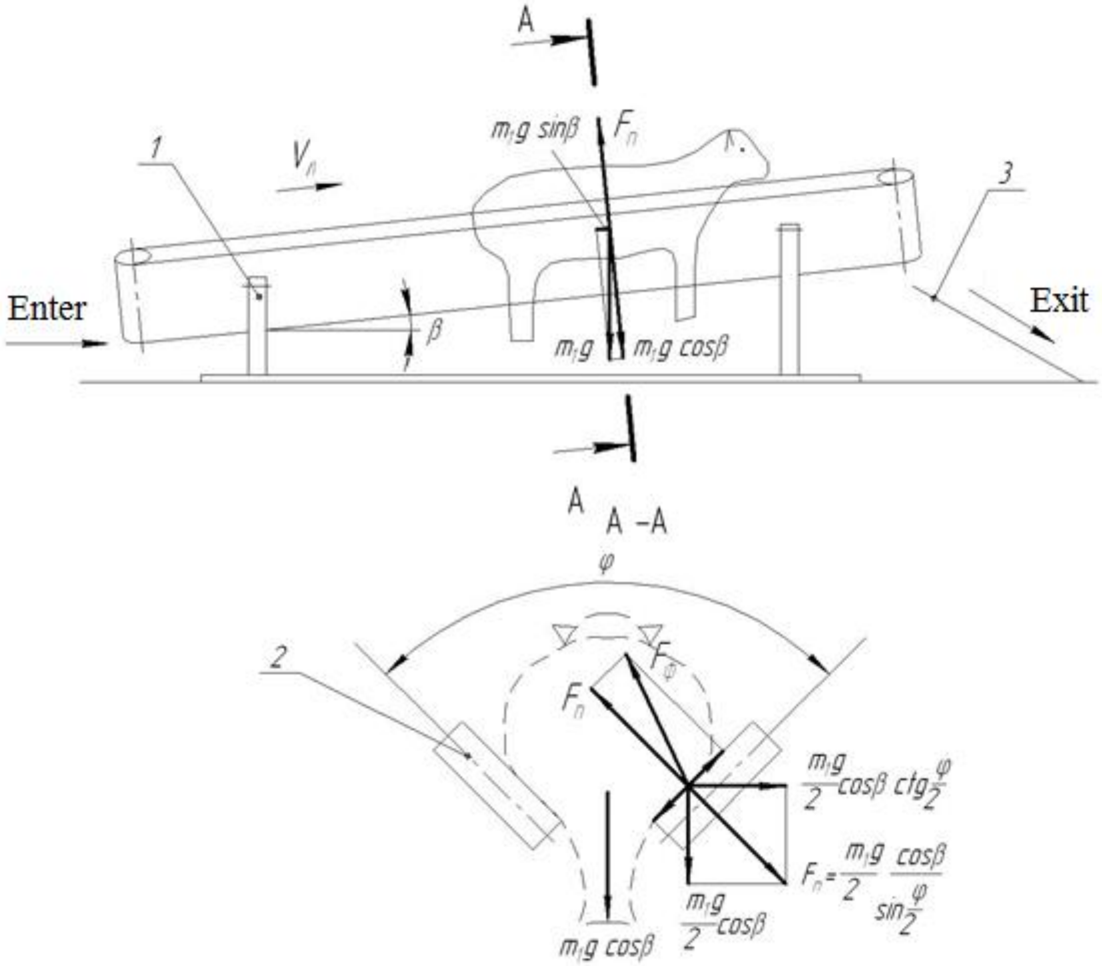

Figure 1: Apparatus for fixing sheep at zootechnical and veterinary treatments and the forces acting on the animal, for example a conveyor: 1 - installation of the frame; 2 - belt conveyors; 3 - inclined board for sheep gathering.

The installation operates as follows. The animal enters the receiving part of the installation of a split "input" and conveyed to the operator area for the implementation of zootechnical and veterinary treatments [2, 6]. Location conveyor belt at an angle to the horizontal ensures separation animal limb support from the ground, and *V*-shaped arrangement of the conveyor with an angle φ detects sheep mass m_1 by gravity (m_1g). Given the basic dimensions of the sheep (length 940 mm, sheep - up to 1300 mm), the length of the installation taken within 3.0 m, which can simultaneously be two sheep, one at the entrance, the second - at the exit [1, 5].

MATERIALS AND METHODS

For research the enforce of moving belt resistance is determined the force of gravity of mass per unit length of sheep (Fig. 2).

$$m = m_1/a\ ; \qquad q = mg\ , \qquad (1)$$

where m_1 – sheep weight, kg; a – the distance between the sheep, m; m – linear mass sheep, kg/m; g – acceleration of gravity, m/s^2; q – the force of gravity per mass, N/m.

Figure2: Scheme for calculation of linear gravity

To determine the forces generated during movement of sheep by two conveyors considered two planes: the plane of gravity and the I-I plane II-II, perpendicular to the axis of the conveyor (figure 3).

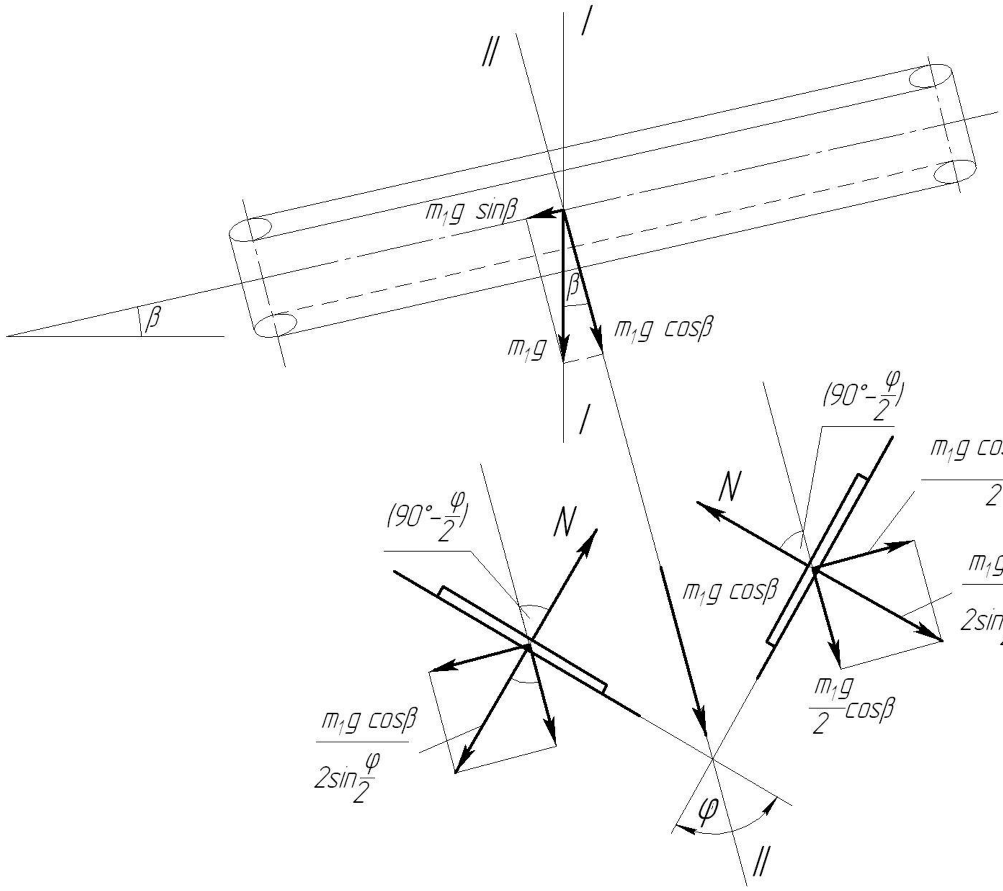

Figure 3: Diagram of the forces in the installation during move and fixing sheep

To determine the normal running pressure forces *N* acting on the belt conveyors force projected onto the plane II-II

$$2N \cdot \cos\left(90° - \frac{\varphi}{2}\right) - q\cos\beta = 0, \qquad \text{therefore} \qquad N = \frac{q\cos\beta}{2\sin\frac{\varphi}{2}} = \frac{m_1 g\cos\beta}{2a\sin\frac{\varphi}{2}}. \qquad (2)$$

The components of the normal force *N* to the pressure of the conveyor are defined in the plane II-II (Fig. 3) through a mass of conveyed sheep

$$\frac{q}{2}\cos\beta = \frac{m_1 g\cdot\cos\beta}{2a} \qquad \text{and} \qquad \frac{m_1 g\cdot\cos\beta\cdot\text{ctg}\frac{\varphi}{2}}{2a}. \qquad (3)$$

The total resistance force laden branches of the conveyor will be:

$$T = T_{bup} + T_m + T_{xx} + T_j, \qquad (4)$$

where T – total traction tape, N; T_{bup} – tractive effort tape to lift the sheep, H, $T_{bup} = \frac{q}{2}\sin\beta \cdot L = \frac{m_1 g}{2a}\sin\beta \cdot L$, here L – conveyor length, m; T_m – tractive effort to move the sheep, N, $T_{nep} = \frac{q\cos\beta}{2\sin\frac{\varphi}{2}} \cdot L \cdot \omega = \frac{m_1 g\cos\beta}{2a\sin\frac{\varphi}{2}} \cdot L \cdot \omega$, here ω –drag coefficient of the tape; T_{xx} – tractive force on the tape idling, N.

Traction force on idling is have determined by the force of the tape:

$$T_{xx} = 2m_0 g \cdot \cos\beta \cdot \sin\frac{\varphi}{2} \cdot L \cdot \omega,$$

where m_0 – mass per unit length of the conveyor belt, kg/m.

Tractive force to overcome the forces of inertia $T_j$it can be determined by introducing the concepts of conditional performance conveyor and a conditional second job.

Conventional conveyor performance Q (ton/hr) is $Q = 3{,}6mV_l = 3{,}6\frac{m_1}{a}V_l$,

where V_l – belt speed, m / sec.

Seconds weight m_c (Kg / s) is have determined $m_s = \frac{Q}{3{,}6}$.

Then the second work of the inertial forces is $A_s = \frac{Q\left(V_l^2 - V_0^2\right)}{2 \cdot 3{,}6} = T_j V_l$,

therefore
$$T_j = \frac{Q\left(V_l^2 - V_0^2\right)}{2 \cdot 3{,}6V_l},$$

where V_0 – sheep initial velocity, m/s.

by substituting $Q = 3{,}6\frac{m_1}{a}V_l$, get $T_j = \frac{m_1\left(V_l^2 - V_0^2\right)}{2a}$.

Expressions for T_{bup}, T_m, T_{xx} и T_j substituted in the (4) and general formula efforts laden branch conveyor resistance will be in the form

$$T = \frac{m_1 g}{2a}\sin\beta \cdot L + \frac{m_1 g \cdot \cos\beta}{2a \cdot \sin\frac{\varphi}{2}} \cdot L \cdot \omega + 2m_0 g \cdot \cos\beta \cdot \sin\frac{\varphi}{2} \cdot L \cdot \omega + \frac{m_1\left(V_l^2 - V_0^2\right)}{2a}. \quad (5)$$

Analyzing the expression (5) for the parameters$m_1 \approx$ 100 kg; $L \approx 3 \div 4$ m; $\beta \approx 20° \div 30°$; $\varphi = 90°$; $\omega = 0{,}3$; $m_0 \approx 2 \div 3$ kg; $V_л \approx 1$ m/s; $a \approx 1 \div 2$ m, can see, that $\frac{T_{xx} + T_j}{T_{bup} + T_m} \approx 0{,}08 \div 0{,}1$, therefore dependence (5) can be represented as follows

$$T = \frac{K_u m_1 g L}{2a} \cdot \left(\sin\beta + \frac{\cos\beta}{\sin\frac{\varphi}{2}} \cdot \omega \right), \qquad (6)$$

where K_u – coefficient reflecting the idling resistance force and inertial forces, $K_u \approx 1{,}1 \div 1{,}2$.

RESULTS AND DISCUSSION

Graphic dependence (Fig. 4) show that the strength of the tape resistance increases with decreasing angle between the conveyors and the zoom ratio by the tape deck.

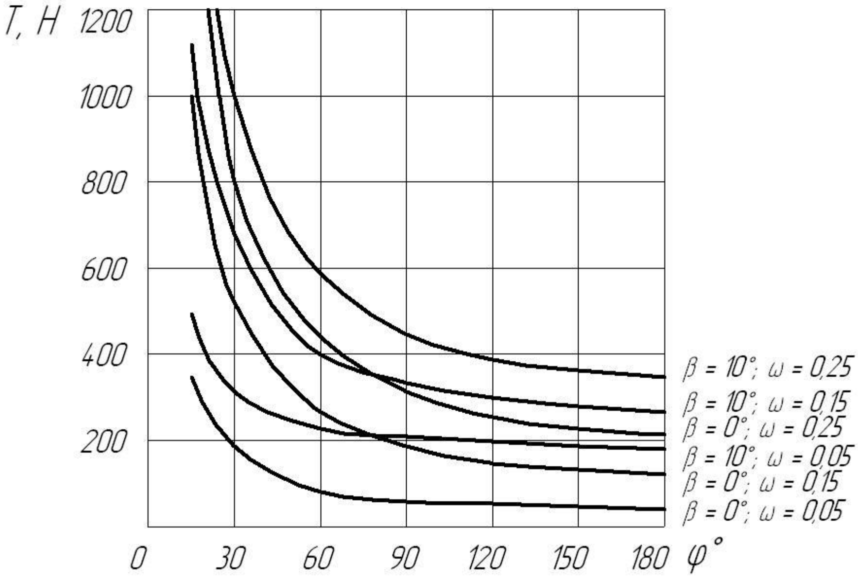

Figure 4: The power of resistance movement of the conveyor beltdepending on the installation characteristics

A significant increase in the resistance force occurs as the angle between the conveyors, especially less than 90 degrees [4, 7].

Therefore, in the design of the plant to reduce energy consumption for the drive expedient transporters have an angle of 90 degrees or more, and the supporting surfaces of conveyors belts performed using support rollers.

Drive power conveyor systems for handling sheep zootechnical treatment based on the dependence

$$P = \frac{K_u m_1 g L}{2a} \cdot \left(\sin\beta + \frac{\cos\beta}{\sin\frac{\varphi}{2}} \cdot \omega \right) \cdot V_l, \qquad (7)$$

where V_l – belt speed, V_l = 0,3...0,6 m/s.

Fig. 5 is a graph of the necessary power conveyor drive, depending on the setting of parameters and weight of the animal.

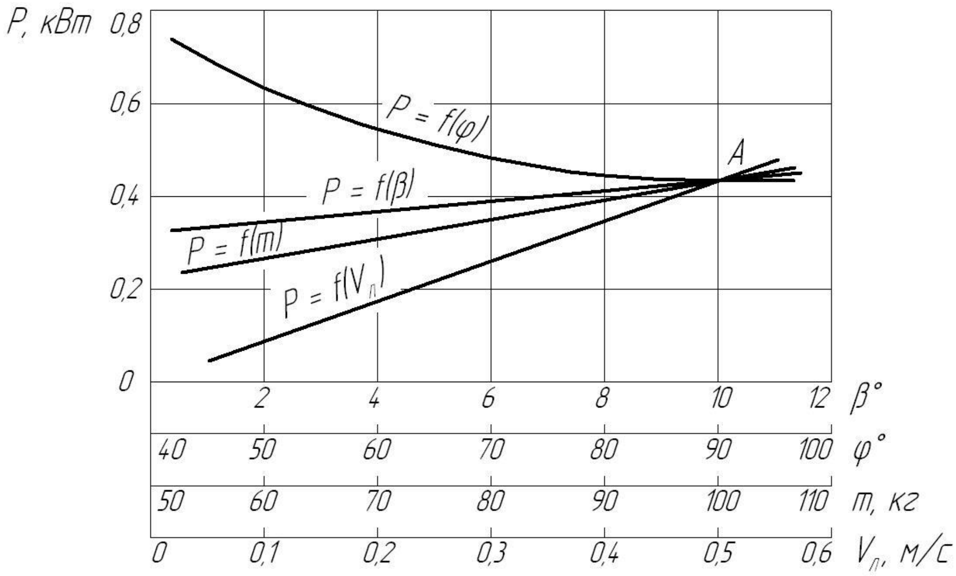

Figure 5: Drive power conveyors, depending on the parameter settings and animal

At this intersection of the power P value at one point "A" indicates that a change in one or another of the argument (parameter setup mass or sheep), other arguments assumed constant with maximum possible values [4].

In view of the finding on the installation of two sheep at the same time (input and output) required drive power is about 0.8 ... 1.0 kW. With increasing angle φ between the conveyorsdrive station required power is reduced, but the reduced and fixing properties of *V*-shaped arrangement of conveyors. Therefore, the optimal angle is recommended to take φ = 90°. The other parameters affect the output is directly proportional to and are encouraged to take practical use within: *m* = 90 ... 120 kg; β = 6° ... 10°; V_l = 0.3 ... 0.6 m/s.

CONCLUSION

The experimental studies of changes in the power of the conveyor drive, depending on the structural and kinematic parameter settings show that the relative deviation values calculated theoretically on the proposed analytical dependences and obtained experimentally, is not more than 14%. This confirms the correctness of the analytical expressions for theoretical study and quite adequate description of the real process. The results are the designers of agricultural machinery for the design of technological equipment for the sheep.

REFERENCES

[1] Ivan Vasil'evich Kapustin, Vitaly Anatol'evich Grinchenko, Dmitry Ivanovich Gritsay, and Elena Ivanovna Kapustina. Res J Pharm Biol Chem Sci 2016;7(2):338-343.

[2] Viktor Ivanovich Marchenko, Dmitry Alekseevich Sidelnikov, Dmitry Ivanovich Gritsay, Eugene Vasilyevich Gerasimov, and Igor Igorevich Shvetsov. Res J Pharm Biol Chem Sci 2016;7(3):1913-1918.

[3] Boris Alekseevich Doronin, Anatolii Timofeevich Lebedev, Olga Ivanovna Detistova, and Dmitriy Ivanovich Gritsay. Res J Pharm Biol Chem Sci 2016;7(3):1895-1901.

[4] Ivan Vyacheslavovich Atanov, Ivan Vasil'evich Kapustin, Vitaliy Anatol'evich Grinchenko, Dmitriy Ivanovich Gritsay and Elena Ivanovna Kapustina. Res J Pharm Biol Chem Sci 2016;7(4):1927-1932.

[5] Sergei Nikolaevich Shlykov, Ivan Fedorovich Gorlov, Viktor Ivanovich Guzenko, Vladimir Anatol'yevich Meshcheryakov, and Ruslan Saferbegovich Omarov. Res J Pharm Biol Chem Sci 2016;7(4):1715-1719

[6] Sergei Nikolaevich Shlykov, Ivan Fedorovich Gorlov, Viktor Ivanovich Guzenko, Anna Viktorovna Morgunova, and Ruslan Saferbegovich Omarov. Res J Pharm Biol Chem Sci 2016;7(4):1714-1717.

[7] Sadovoy, V., Omarov, R., Shlykov, S., Shchedrina, T. Assessment compliance of qualitative food characteristics to standard requirements. Engineering for Rural Development Volume 2016-January, 2016, Pages 360-363.