Production of agricultural goods, moving away of pus, drift system of batch-type, pig farm, geometry of bath, depth of bath, drift pipe, sewage pump the station, receiving reservoir.

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SETTING GROUND scraper installations FOR manure

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In this article the shortcomings of existing winches installations for manure. The mathematical model of interaction scrapers scraper manure. Designed scraper device with manure scrapers front work surface in a dump that will reduce energy consumption in the manure and improve the quality of cleaning manure channel.

Manure scraper, blade, quality, energy consumption.

Formulation of the problem. Timely cleaned manure from the premises for animal beneficial to improving the microclimate and the level of hygiene. Efficient manure removal system can increase the comfort level of animals, and as a result - increase their productivity. For frequent cleaning of the air decreases levels of nitrous gases and ammonia, which are bad for both the health of animals and their products.

According sanitation and hygiene - all animals and premises must be kept clean. If after cleaning places of animal manure is more 0,15-0,20 kg / m2, very

contaminated their skin and udder, the conditions of infectious diseases [1]. When evaporation of moisture from the manure left by indoor air polluted with noxious gases, increasing its relative humidity.

Analysis of recent research. The research process manure mechanical means are devoted MK Linnik, KE Rostomyan, IP Arbuzov, V. Baryshnikov, VE Veynla, AS Tsyryatyeva, AD Ahasaryana VI Beyttynka, VA Yasenetsky and other scientists.

In particular MV Levchykova developed a method of calculating the number shahu and scrapers (scrapers) installation; AA Shuvalov explored reversal zone delta scrapers scraper installation, and found the optimum weight distribution scrapers for their length; OF Cold

established that the duration reversal scraper idling depends on the initial angle of the rod scraper conveyors.

Significant contribution to the study of adaptive guides working surfaces made of SS Tishchenko.

The purpose of research. To achieve improved quality performance of the scraper settings by changing the design scrapers.

Results. When Loose way of keeping cattle manure removed from open manure channel scraper used for this installation Reciprocating movement of workers, the so-called "delta-scrapers." Scraper installation CS-15, CS-F-170, US-250, USG-3 are for manure of cattle in livestock buildings and combined for the boxed animals. Plants with a high level of unification. Scraper installation USG-3 consists of drive traction chain, intermediate rods, scrapers, rotary rollers [2]. Scraper - a working body that collects and moves the manure channels. It consists of a slider hinge clamps and two scrapers. Depending on the width of the channel sliding scrapers put on clean width from 1.8 to 3 m. At the ends of bolts attached rubber scrapers Cepphus that clean the manure from the channel wall.

Along with the benefits, there are drawbacks winches installations for manure. One drawback is that the scraper installation is qualitatively raked manure manure from the bottom of the channel. Practice shows that the full raking manure to do three or four passes scraper. So there is a need to develop a scraper device full of manure channel and reducing the number of passes. To solve this problem proposed working front surface scrapers perform in a dump.

To work effectively scraper should ensure a constant pressure of manure moving on the worktop scraper.
To this end, the equation has been developed and built based on these curves which are the trajectories of particle motion manure scraper on the work surface. Accordingly scraper blade should be a variable radius of curvature.

This intensive scrapers take compacted manure, due to destruction of relationships between its layers and thus better scrapers pressed against the surface of the manure channel, thus better raked manure.

The essence of the improvement is due drawings (Fig. 1) where in FIG. 1 shows a scraper device in Figure 2 section AA of the scraper.

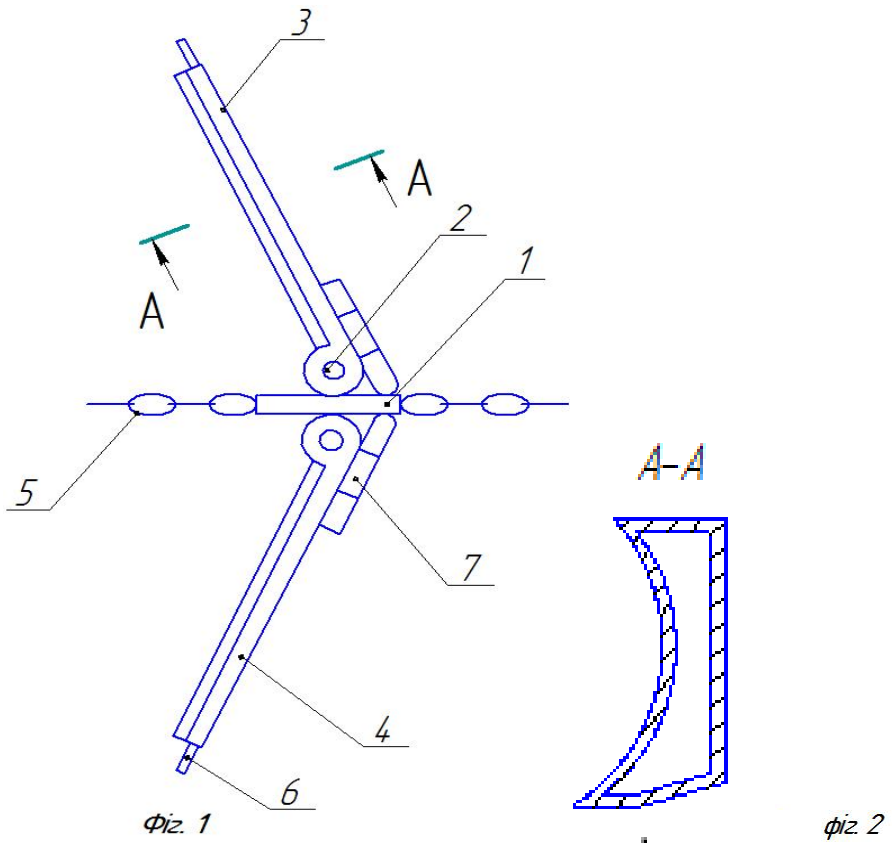

Fig. 1. Designed scraper device manure.

Scraper device consists of a manure slide 1, 2 rotary device, scrapers 3, 4, 5 chains, rubber Cepphus 6 and 7 stops working surface scrapers as dump manure layer allows partially accumulate on the surface of the blade and thus the mass of manure will create additional pressure on the scraper to be pressed him to the bottom of the manure channel. As a result, improve the quality of manure and thus decrease the number of passes scrapers working device. To ensure the reliability of the back surface scraper scraper towards the front surface raised to 10-15 °.

Technical and economic benefits scraper device claimed as compared to the prototype is to increase productivity with less energy consumption and overall costs for cleaning, improves the quality of manure channels. In this development received a patent for utility model number 82787.

PhD, Professor II Revenko in the textbook [1] noted that a significant impact on quality manure scraper has form.

The process scraper movement is such that front scraper and manure scraper is included in a lot of manure, which in theory can be represented as a movement of the working body in the ground. In view of this theory can be seen Academician VP Horyachkina arguing that the work surface tillage machines noted [3] that despite the extraordinary diversity of workers tillage implements, the geometric shape of the

working surface of each reduced to a wedge, wedge that underlies and is the prototype for cultivators paws and other tillage machines. Based on the above it the most efficient construction scraper scraper installation will vhnuta working surface [4]. To work effectively scraper should ensure a constant pressure of manure moving on the worktop scraper. To do this, find the equation and build curves that are the trajectories of particle motion manure scraper on the work surface.

The movement of material particles on the surfaces of gravitational discussed in monographs [5, 6]. As is understood that cylindrical surface with horizontal generators, the motion of the particles can be studied on planar curves - orthogonal cross sections of these surfaces. The relevant sections of these works such surfaces and curves are called gravity, so that the movement of the particles due to force of gravity. The velocity curve in such cases is variable. However, agricultural machines, there may be occasions when the particle moves along the surface with a constant speed (eg, involuntary movement of particles on the surface of the manure scraper [7]). In this case the particles except gravity acting Fth other active force (thrust). We find these curves, the motion on which a constant velocity exert constant pressure. Obviously, these curves have not gravity. Find the curves that provide constant pressure at a constant velocity of the particles of manure on them. Making the assumption that the velocity of the particle on the speed of the scraper is very scraper to the manure channel. Suppose that under the influence of particle staff of manure moving up the curve with constant velocity v (Fig. 2). Find the equation of the curve, which at a given speed v provide constant reaction Fts surface is constant pressure on the surface. In practical terms, this surface will wear down evenly and is less prone to sticky sludge. Will project all forces acting normal to home $\bar{n}$ curve:

$$mg\cos\alpha + mv^2k = F_{\text{тс}}, \qquad (1)$$

where: k - curvature of the curve at this point, m - particle mass, g = 9,81m / s2.

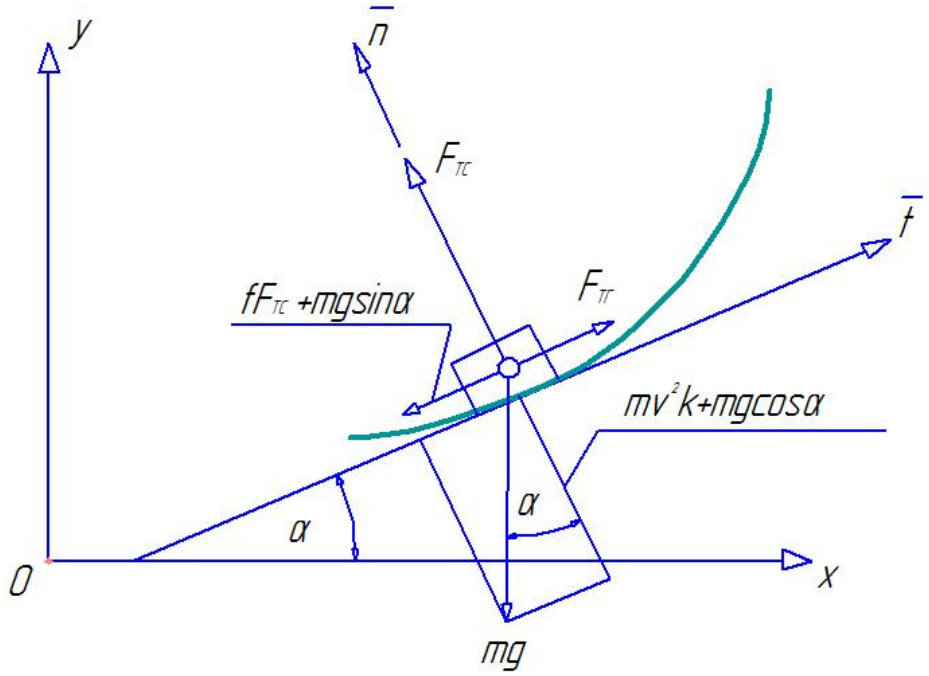

Fig. 2. Expansion of the forces to start normal $\bar{n}$ and tangent $\bar{t}$ curve.

Rewrite equation (1), dividing the left and right parts on the gravity mg and recorded because of known curvature k value of differential geometry $k = \frac{d\alpha}{ds} = 1 : \frac{ds}{d\alpha} = \frac{1}{s'}$ Where s - the arc length of the curve:

$$\cos\alpha + \frac{v^2}{s'g} = \frac{F_{\text{тс}}}{mg}. \qquad (2)$$

The ratio Fts / mg is a constant, it shows that the share of the total pressure forces the particles of component weight particles. Let him through ATS and solve the equation (2) with respect to s':

$$\frac{ds}{d\alpha} = \frac{v^2}{g(a_{\text{тс}} - \cos\alpha)}, \quad \text{so} \quad k = \frac{g}{v^2}(a_{\text{тс}} - \cos\alpha). \qquad (3)$$

Integrating expression (3) is possible for two cases: ats> 1 (ie, the surface pressure is greater than the weight of the particles) and ats <1 (pressure less weight particles). Write the appropriate integrals (continuous integration omitted):

$$s = \frac{v^2}{g}\int \frac{d\alpha}{a_{тс} - \cos\alpha} = \frac{2v^2}{g\sqrt{a_{тс}^2 - 1}} \operatorname{arctg} \sqrt{\frac{a_{тс}+1}{a_{тс}-1}} \operatorname{tg}\frac{\alpha}{2}, \quad (a_{тс} > 1)$$

$$s = \frac{v^2}{g}\int \frac{d\alpha}{a_{тс} - \cos\alpha} = \frac{v^2}{g\sqrt{1 - a_{тс}^2}} \ln \frac{(1+a_{тс})\operatorname{tg}\frac{\alpha}{2} - \sqrt{1-a_{тс}^2}}{(1+a_{тс})\operatorname{tg}\frac{\alpha}{2} + \sqrt{1-a_{тс}^2}}. \quad (a_{тс} < 1) \tag{4}$$

Equation (4) s = s (α) set the pattern of change of the angle α along the arc of the curve, thus determining a curve with its internal properties regardless of its location in a rectangular coordinate system. In differential geometry of curves accepted another record to its internal equation - regardless of the length of the arc curvature k = k (s). This equation is called the natural curve of the equation. Whom we obtain both cases, if the right equation (3) and equation (4) exclude common option α:

$$k = \frac{g(a_{тс}^2 - 1)}{v^2\left[a_{тс} + \cos\left(\frac{g}{v^2}\sqrt{a_{тс}^2 - 1}\, s\right)\right]}; \qquad (a_{тс} > 1)$$

$$k = \frac{2g(1 - a_{тс}^2)e^{\frac{g\sqrt{1-a_{тс}^2}}{v^2}s}}{v^2\left(e^{\frac{2g\sqrt{1-a_{тс}^2}}{v^2}s} - 2a_{тс}e^{\frac{g\sqrt{1-a_{тс}^2}}{v^2}s} + 1\right)}. \qquad (a_{тс} < 1) \tag{5}$$

Natural equation (5) define curves regardless of their position and orientation of the plane. This means that when you turn the curve at a certain angle ε its natural equation does not change. For us, this notation is not acceptable, since the plane orientation of the curve will depend on vectors applied forces, so move on to coordinate entry form. How natural equations of rectangular coordinates described in differential geometry known dependencies:

$$\frac{dx}{ds} = \cos\alpha; \qquad \frac{dy}{ds} = \sin\alpha. \tag{6}$$

Rewrite dependence (6), going to the independent variable α:

$$\frac{dx}{d\alpha}\frac{d\alpha}{ds} = \cos\alpha, \text{ звідки } \frac{dx}{d\alpha} = \frac{ds}{d\alpha}\cos\alpha.$$

Similarly,

$$\frac{dy}{d\alpha} = \frac{ds}{d\alpha}\sin\alpha. \tag{7}$$

Substituting (7) expression $\frac{ds}{d\alpha}$ of (3), we obtain for the dependence of the x and y coordinates of the curve:

$$x = \frac{v^2}{g}\int \frac{\cos\alpha d\alpha}{a_{тс} - \cos\alpha} = \frac{a_{тс}v^2}{g}\int \frac{d\alpha}{a_{тс} - \cos\alpha} - \frac{v^2}{g}\alpha;$$
$$y = \frac{v^2}{g}\int \frac{\sin\alpha d\alpha}{a_{тс} - \cos\alpha} = \frac{v^2}{g}\ln(a_{тс} - \cos\alpha). \quad (8)$$

From (8) shows that after integrating expression y = y (α) has a simple look and look for the coordinates x = x (α) reduced to the integrals (4), so it is divided into two depending for ats> 1 and ats <1 [8]

$$x = \frac{2a_{тс}v^2}{g\sqrt{a_{тс}^2 - 1}}\operatorname{arctg}\sqrt{\frac{a_{тс}+1}{a_{тс}-1}}\operatorname{tg}\frac{\alpha}{2} - \frac{v^2}{g}\alpha; \qquad (a>1) \quad (9)$$

In (8), (9) integration constant omitted because they affect only the parallel transfer curve along the axes Ox and Oy. Fig. 3 based on equations curve y = y (α) from (8) and x = x (α) of (9).

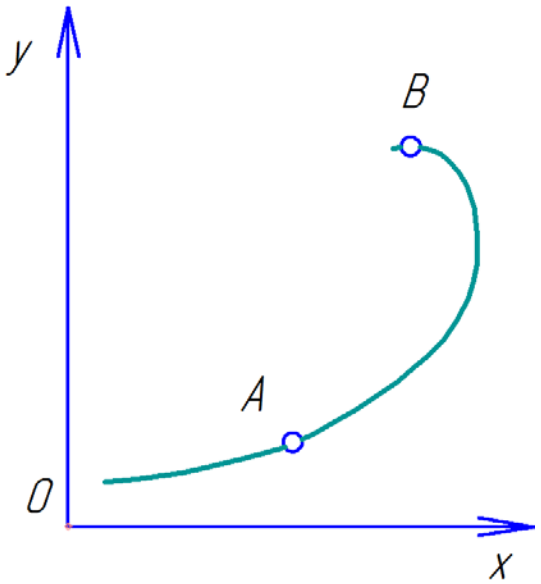

Fig. 3. The curve that provides constant pressure at a constant speed of particles: ats = 1.2; v = 0,2 m / s.

Shown curve section surface pressure at which a given velocity v = 0,2 m / s greater weight particles 1.2 times. plot of curve $\overset{\frown}{AB}$ used as a scraper winches profile settings. According to this account, designed scraper drawing (Fig. 4). To establish the relationship disclosure scraper impact angle γ (deg.) Slope angle scraper scrapers ε0 (deg.) And the speed of the scraper Vsk (m / s) at specific energy intensity improved scraper installations EN (kW h. / T) in production experiments were conducted under the plan Box-Banking.

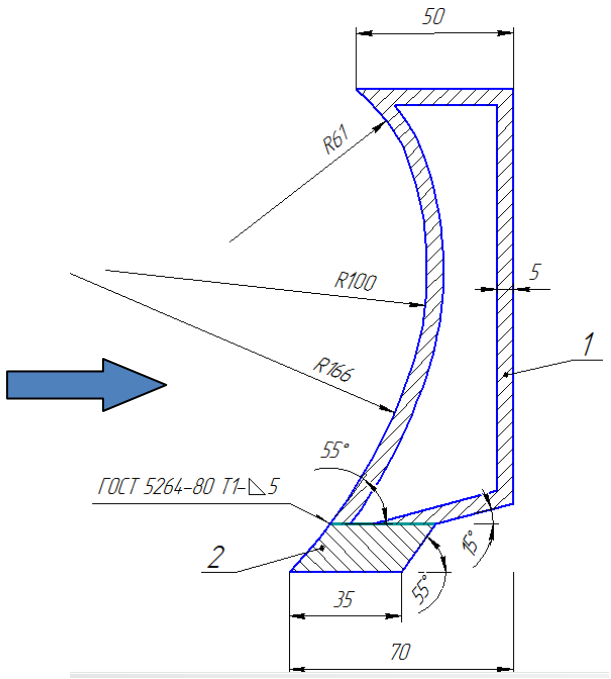

Fig. 4. Designed scraper scraper installation.

According to the drawing made in a metal scraper (Fig. 5).


Fig. 5. Designed scraper winches installed in the metal.

This was the same size manure channel and volume harvested manure. Dependency analysis (Fig. 6, Fig. 7) shows that with increasing inclination angle γ scraper scrapers 30° 90° specific energy intensity varies according to EN parabolic function that has an optimum - minimum value specific energy intensity in the range of tilt angle scraper scrapers 55° 75° and is 0.82; 0.88 and 0.98 kWh / t for the corresponding

values of opening angle scraper 70°; 170° and 120°. Because the angle of scrapers30° the surface of the front wall scraper will accumulate a large amount of manure and pressed to the bottom scraper manure channel with excessive force. And at the angle of the scrapers 60° to 70° pidrizatys layer of manure is wedge-shaped scraper and surface scraper will accumulate this amount of manure that will provide optimal pinning bottom scraper to the manure channel. When angle 90 ° scrapers on manure scraper will not napovzaty and lack wedge on the front wall scraper will lead to the fact that manure will not pidrizatysya and break away from the bottom of the manure channel, and it will take more specific energy intensity.

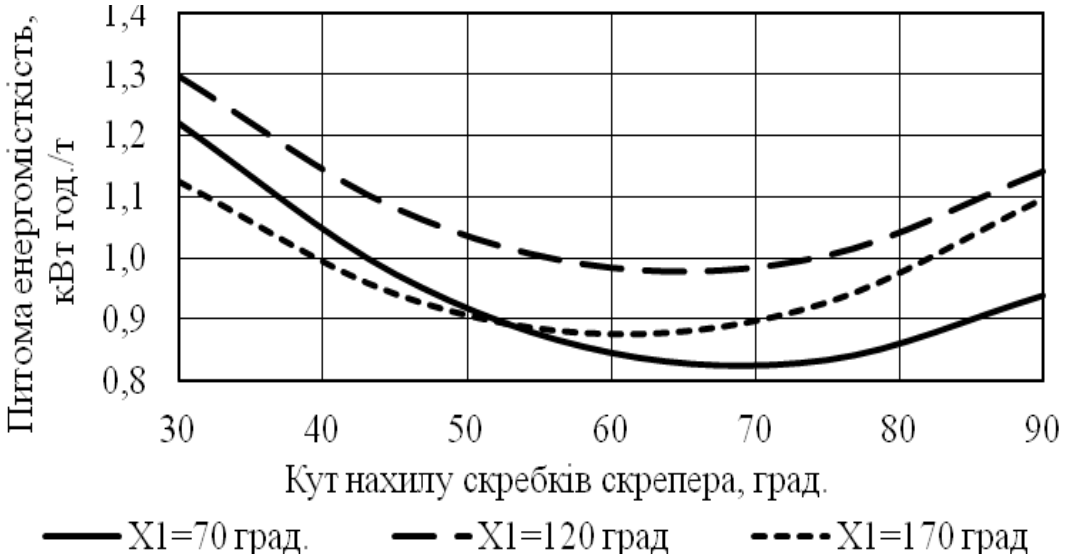

Fig. 6. Dependence of specific energy intensity improved scraper installation on the angle scraper scrapers.

As a result of multifactor experiments were obtained mathematical model - the regression equation in the form of a second order polynomial.

Regression equation specific energy intensity EN (kW h. / ton) of changing the angle of opening scraper γ (deg.) slope angle scrapers Scraper ε0 (deg.), and the speed of the scraper Vsk (m / s) the results of the PFE 33 in the decoded form of equation regression is:

EN = 3,4860648 + 0,0106913γ - 0,0491265ε - 23,9743253υsk - - 0,0000496γ2 + 0,0002610ε2 + 64,6419709υsk2 + 0,0000424γε - - 0,0091172γυsk + 0,0921844ευsk.

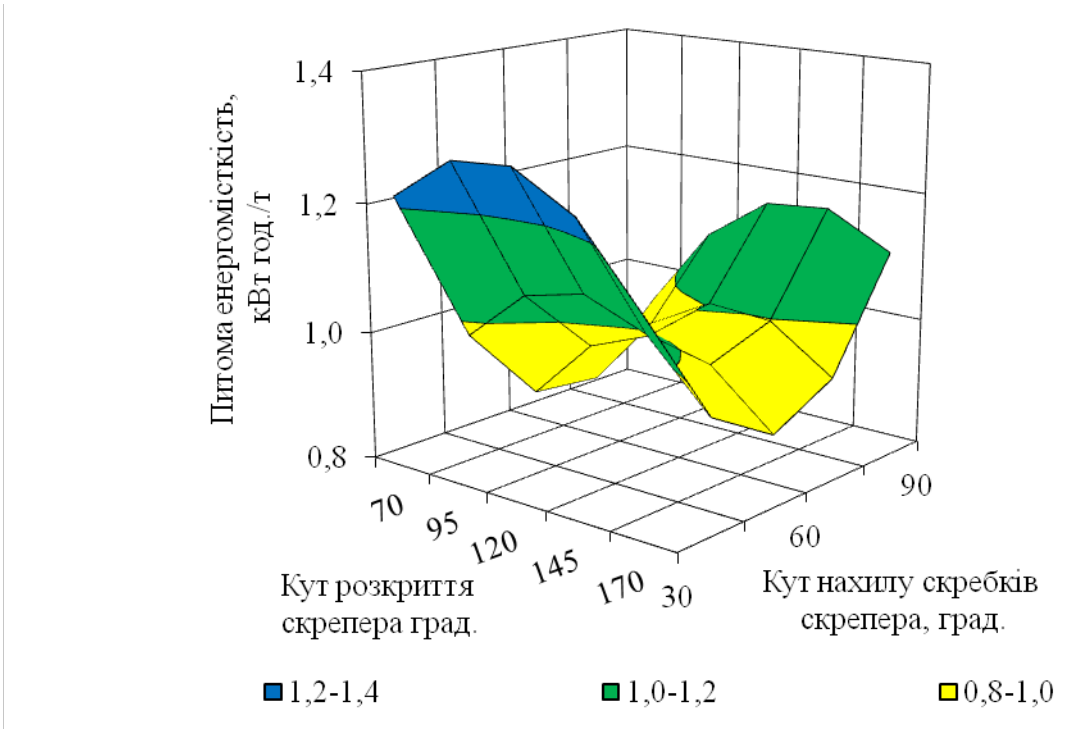

Fig. 7. Dependence of specific energy intensity improved by installing angle scraper opening and the angle of inclination scrapers scraper.

Statistical evaluation of the results included a check on homogeneity of variances by the criterion Cochran. Adequacy Mathematical model and its applicability to describe the process under study examined the criterion of Fisher. Determining the significance of the regression coefficients performed by Student's test. Hypothesis confirmed the adequacy of the equation and can be used to describe the process.

Fig. 8. Scraper optimal parameters.

After optimization calculation based on the equation, it was found that the specific energy consumption with regard to quality manure taken at minumum, corner scraper disclosure γ = 119 °; angle scraper scrapers ε0 = 55 ° (Fig. 8) and the speed of the scraper usk = 0.15 m / s.

Conclusion. The design of the scraper which scrapers working front surface is designed as a blade with a variable radius of curvature, which reduces drag on the separation layer manure spreaders from the bottom of the channel as a layer of manure to accumulate on the scraper and pressed it to the bottom of the manure channel. The result will be reached with full manure channels in one pass through the manure scraper channel, which in turn will reduce energy consumption and total cost of cleaning.

List of references

1. Revenko II Machines and equipment for animal: a textbook / Revenko II, Brahinets MV Rebenko VI - K: Condor, 2009. - 731 p.
2. Equipment for manure scrapers USG-3, 4-AoA, passport UF.17.000 IM, OAO "Kovelselmash", 2008. - 52 p.
3. Guidance for students of specialty 7.090215 "Machinery and equipment of agricultural production" / KI Pieces, PV Sysolin VV Karmanova, *GI Ivanov*. - Kherson: Oldie Plus, 2004. - 308 p.
4. Agricultural machines. Basic theory and calculation: textbook / DG Voytyuk, VM Baranovsky, V. Bulgakov [et al.] Ed. DG Voytyuk. - K .: Higher Education, 2005. - 464 p.
5. Vasilenko PM Motion Theory particles on surfaces sherohovatым agricultural machines / PM Vasilenko. - K .: UASHN, 1960. - 283 p.
6. Zayka P.M. Favourites problem zemledelcheskoy mechanics / PM Zayka. - K .: USHA, 1992. - 507 p.
7. Voytyuk DG Construction of the trajectories of particles on the soil surface and cylindrical section of the curve / DG Voytyuk, SF Pylypaka // APC Technology. - K., 1999. - № 8. - P. 6-9.
8. Pylypaka SF Calculation of cylindrical surface scraper hnoyeprybyralnoyi installation / SF Pylypaka, GA Pigeon, MI Ikalchyk // Scientific Bulletin of National University of Life and Environmental Sciences of Ukraine. Series: Power equipment and agribusiness. - 2013 - Vol. 185, p. 1. - P. 18-24.

In dannoy Article rassmotrenы shortcomings of existing installations skrepernыh Remove manure. Matematycheskaya process model is designed interaction with manure scraper scraper. Is designed skrepernoe Other cleaning devices for frontalnoy with manure scraper in a working poverhnostyu video otvala, something pozvolyt umenshyt at эnerhozatratы Other cleaning and manure Other cleaning uluchshyt Quality navoznoho channel.

Manure, scraper, otval, Quality, эnerhozatratы.

In paper the disadvantages of existing winches facilities for manure. The mathematical model of interaction scraper manure scrapers. Designed scraper device manure from front work surface scrapers in a blade that will reduce energy consumption in manure and improve the quality of cleaning manure channel.

Manure, scraper, blade, quality, and energy consumption.

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SELECT SIZE chain tension ELDERLY Forwarders for manure

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HA. Holub, PhD

The results of experimental studies depending on power consumption when running on inclined conveyors idle on the angle, speed and tension the chain.

The conveyor, chain tension, power consumption, manure.

Formulation of the problem. Timely cleaning livestock buildings and manure, its efficient use - one of the important problems of agricultural production. To remove litter manure from livestock buildings used mostly downhill conveyor operation which should take place with minimal specific energy consumption for transport [1, 3, 5]. However, data on the choice of the value chain tensioning conveyor old and its impact on power consumption inclined conveyors absent [4], which does not choose rational parameters of its work.

The purpose of research. Determine the dependence of power consumption inclined conveyors idling on the value chain tension.

Results. Investigation of inclined conveyors of idle conducted in laboratory conditions using a frequency converter, kilovatmetra, dynamometer and personal computer (Fig. 1) [2]. The tension of the chain scraper dynamometer determined by the level of flex circuit with the ongoing efforts of 0,5 kN.

***Supervisor - PhD, GA Dove**

Intervals of values and levels of varying factors studied are presented in Table. 1.

1. The range of values and levels of varying factors studied

Name factors and its designation	Levels factors	intervals of