MECHANICAL ENGINEERING

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THE PERSPECTIVE OF THE USE OF THE NEW CUTTING MACHINE WHILE SCYTHING GRASSES

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Abstract
The experimental sample of rectilinearly moving segmented mowing-machine of new construction and of minor power is represented, which can be used in small contour as well as medium type plots and mining terms for preparing food for neat horned cattle. Mowing-machine has 3-7 kvt power engine, sharp machine, new construction equipment of adherence set between engine and sharp equipment necessary for mowing work process, safe and economic manufacturing.
Keywords: Equipment; segment; trap; escalating star; overlapping.

Introduction: Nowadays mowing-machines are equipped with basically segmented and rotationally sharp machines (Phillip c. Jonson 2012). Segmented sharp machines work at comparatively low speed and have constructional complexity and relatively big weight and as for the mowing-machines having rotation sharp machines, they have big speed of working but as a result of practical research test in terms of mining field it was found out that they do not fully meet the requirements related to the harvesting without any loss but segmented machine which works on the principles of scissors through inter-action of segments dealt with the harvesting without any loss

under the terms of mining field but with less productivity on the plot of one and the same area.

As you may know, considering the world practice experience the small and medium power mowing-machines are: manually mechanically transferrable, manually motorized, hanging or relocation wheeled mowing-machines. Among mechanic mowing-machines following are remarkable: Husqvarna 540 9649440-01 (www.husqvarna.com) manufactured in Switzerland, rill Razorcut Premium 33 manufactured in Germany (http://www.reelmowerguide.com/brill-razorcut-premium-38-reel-lawnmower) and other which are operated directly by operator with relocation without engine. The manual minor powered rotation mowing-machines are divided in mowing-machines which operate on electric as well as in-house combustion engnes, and from them folowing electric mowing-machines are remarkable: MTD ET 700 41AC175G678 manufactured in Germany (http://www.heise.de/preisvergleich/eu/mtd-et700-elektro-rasentrimmer), Oleo-Mac TR92E 6002-9002 manufactured in Italy (http://www.oleo-mac.co.uk) and other, and in-house combustion working mowing-machines are: Stihl ES 38414000112377 manufactured in Germany (http://www.stihl.de), MTD 790 M AST manufactured in Mexico, Caiman VS 256W LUXE – manufactured in (http://electromenagers.org/en/trimmer/2115-caiman-vs256w-tu26-luxe.html) and other. From the wheeled relocation small powered mowing-machines following area remarkable: Swisher SST 22 625 NA – manufactured in Usa (http://www.homedepot.com/p/Swisher-6-75-Gross-Torque-163cc-Gas-Walk-Behind-String-Trimmer-ST67522BS), Triunfo – manufactured in Portugal (http://www.triunfo.com/), Briggs and strattion – manufactured in France (https://www.briggsandstratton.com), Billy Coat BC2403JC – manufactureed in USA and other.

As you may know the presented mowing-machines basically work on rotation sharp machines having high work speed but during the rotation manual mowing-machine test process several times were the herb cultures cut to their stems and in case of field food making the process of cutting clean at comparatively low level which caused certain difficulties while harvesting. But in case of using segmented mowing-machine Нева КН -1.1 which is manufactured in Russia (http://machinspec.ru/kommunalnaya/kosilka/dlja-motobloka-neva.html) comparing to rotation type this process is excluded but in case of work low work speed terms we received the low productivity of machine. The aim of our research is to process machine for cutting without support, being rectilinearly relocating segmented one of new construction, which will solve mentioned problem.

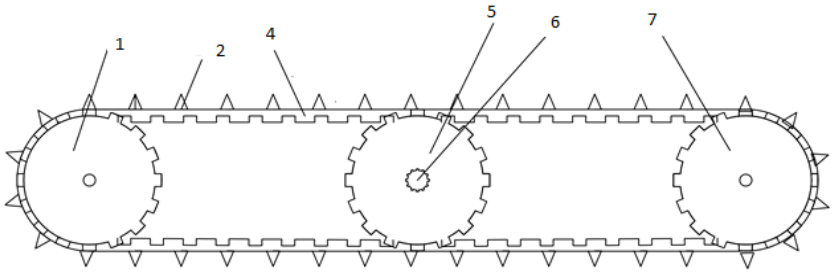
Materials and Methods

Aim and methods of research. The aim of the scientific work research is to process the construction of rectilinearly relocating segmented sharp machine on the base of minor powered energetic means in terms of field for the

alternative of using the mentioned in preparing raw food, namely, the forms of segments of sharp machine are processed, the mechanism for transmission, machine construction and safety transmitting mechanism. The basic parameters of machine will be calculated and relevant methods of optimization of its construction will be determined.

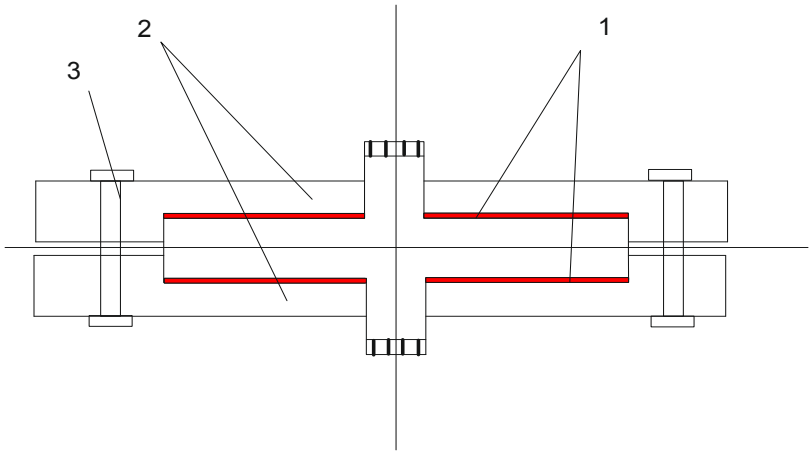
Review of research results. The stable food base of animal-breeding is the term for further development of important field of agriculture. In the process of working on the construction of sharp mechanism of mowing-machines we considered the basic events of agri-technique of mowing like: obtaining maximally good food, mowing down at the height of 4-4.5cm, the stem should be cut without extra parceling and tearing off, it should be well adjusted to relief and the grass mew should be set up in rows without touching motoblocks to wheels.

Considering the above mentioned gaps the rectilinearly relocating segmented sharp machine has been processed which has following parts:



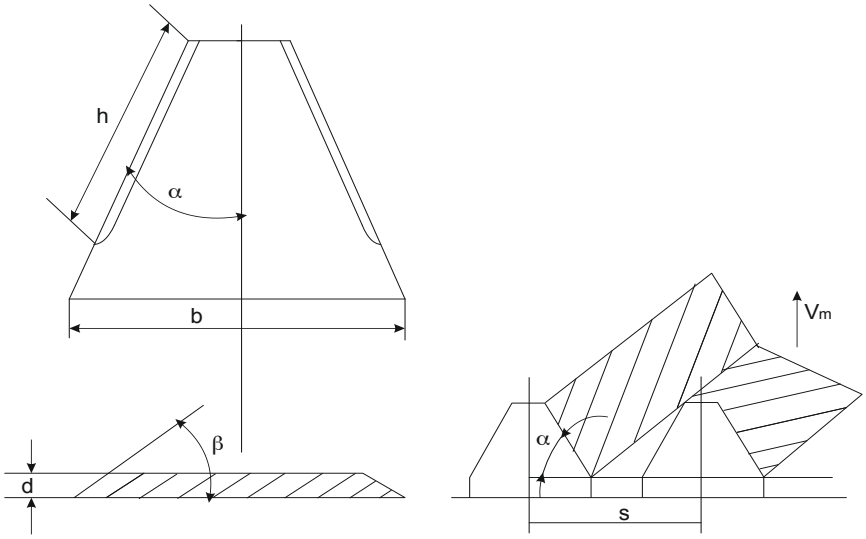
Pic.1 Rectilinearly relocating segmented sharp machine

Escalating stars 1, 3, sharp segments 2, toothed trap 4, driving star 5, driving tooth wheel 6. Sharp machine of mowing relocates through electric or in-hous combustion engine driving star, which moves toothed trap, on which there are triangular sharp segments and sharp segments relocating rectilinearly which accomplished the work process of mowing. For the purpose of safe work of trap the leading star of sharp machine drives from mechanism of adherence which has the ability to protect when touching solid bodies or big resistance. It comprises: clipping mechanisms 3, plural stocks 1 and overlapping 2 when sharp machine works exceedingly $\sigma_{\mathbf{P}} = \mathbf{0,4 \times\times 10^{8}}$ n/sq.m. resistance, overlapping 1 stops at sharp machine, and through plural stocks engine makes unoccupied relocation. After resistance is taken off machine gets back to the work process of mowing.



Pic. 2. Mechanism of adherence

Cutting the stem of herbs is determined by many factors which are directly related to the stem consistency and sizes and the basic requirement of technologic process is the secrecy of machine, energy volume, taking good and quick harvest. Meeting this criteria depends on the efficiency of sharp machine sharp segment which is determined by following factors:



Pic. 3. Basic parameters of sharp segment

Cutting speed V, segment sharpening angle (β), segment inclination angle (α), segment knife thickness (δ), segment thickness (δ_0) (Phillip c. Jonson, 2012).

The relative speed of sharp machine cuting edge is determined from the version (Trublin E.I., Ablikov, 2008)

$$V_{relativ} \geq \sqrt{V_{cr}^2 - V_m^2}$$

Where V_{cr}- is the critical speed of edge, V_m- speed of machine relocation.

The distance between sharp segments is determined by following equation:

$$S = hctg\alpha + hctg\beta$$

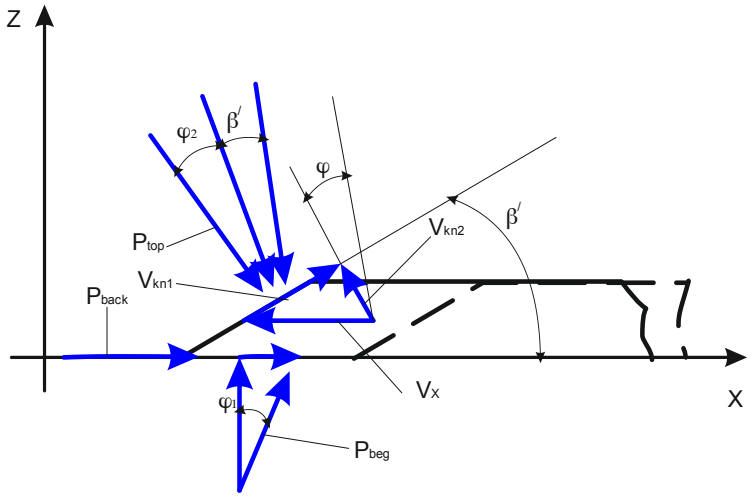
Where α is the segment inclination angle and β is the absolute speed vector inclination corner of cutting edge. The coefficient of using sharp edge is calculated under equation

$$K = \frac{V_m}{V_{relativ}}(\frac{S}{h} - ctg\alpha)$$

Experimentally it is found out that following forces act on the cutting segment (pic. 4): material resistance P_{bac}, stem de-formation resistance force - P_{tp}, φ_2 - friction force, friction resistance force on the edge at inclination φ_3-angle and normal -P_{bask}, and P_{top} is related to P_b in following way:

$$P_3 = P_2 \frac{\cos(\varphi_2 + \beta')}{\cos\varphi_3}$$

Where β' is the projection of sharpening angle



Pic. 4, forces acting on segment when relocating

The relocation of towards X axis divide in four stages X_1, X_2, X_3 where relevantly the forces of cutting resistance are P_{bac}, P_{top}, P_{be} (Makharoblidze R.M., Tedoradze O.M, 1995) where

$$P_{bec} = \frac{E_1 Z_u}{E_1 + E_2}\left[E_2 \frac{x}{x_y} + \frac{\eta V_x}{x_y}\left(\frac{E_2}{E_1 + E_2} - 1\right)\left(exp\left(-\frac{E_1 - E_2}{\eta V_x} x\right) - 1\right)\right] dy$$

$$P_{top} = 0{,}2 + 0.2(\sin(\varphi_2 + \beta) + \cos(\varphi_2 + \beta)\, tg\varphi_2)$$

$$P_{be} = 0{,}2 + 0.4(\sin(\varphi_2 + \beta) + \cos(\varphi_2 + \beta)\, tg\varphi_3)$$

The stem consistency will be taken into consideration having following arguments :

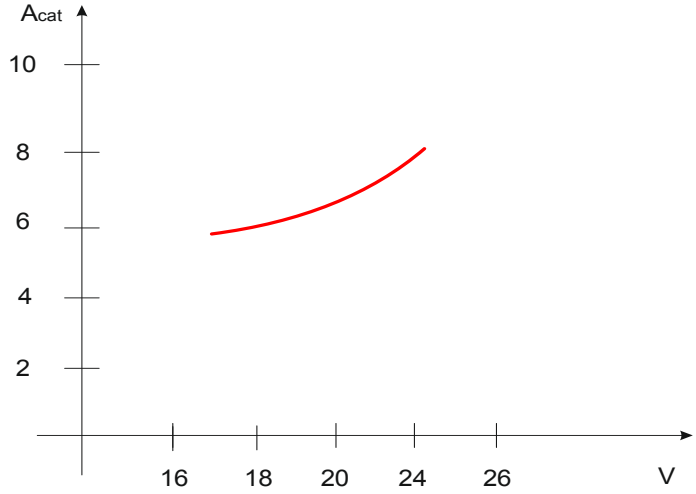
$E_1 = 9{,}98 \cdot 10^8$ n/m^2 , $E_2 = 6{,}40 \cdot 10^8$ n/m^2, $\eta = 3{,}5 \cdot 10^6$ n.sm/m^2, n=0,3, $\xi = 5{,}2$, $\sigma_v = 0{,}4 \cdot 10^8$ n/m^2, $\varphi_{min} = 8{,}1^v$, $\varphi_{max} = 34^v$. [2].

Based on the calculation we got : $P_{bec} = 1{,}8$, $P_{top} = 1{,}9$, $P_{be} = 3{,}8$.

And the force of entire resistance is $P_x = 7{,}5$ n.m^2

And the segment relocation energy in case of edge speed $V = 17, 19, 21, 23$ m/sec when $\varphi = 9$ relevantly receive : $A_{cat} = \cos(\alpha - \varphi_1) P_x = \cos(27^0 - 12^0) \cdot 7{,}5 = 6{,}7$ j. $A_{cat} = 6{,}9$ j, $A_{cat} = 7{,}1$ j, $A_{cat} = 7{,}5$ j.

Let's draw the graph of speed and circle energy volume:



Pic. 5 the graph of speed and circle energy volume

In cases of sharp segment α =47^0; h=0,04m ; V_{cr} =20m/sec V_m=0,2m/sec β=27^0 you will get :

$$V_{relativ} \geq \sqrt{V_{cr}^2 - V_m^2} = \sqrt{20^2 - 0{,}2^2} = 19 \text{ m/sec}$$

And

$$S = 0{,}4(tg47^0 + ctg27^0) = 0{,}1 \text{ m}$$

and $K_{use} = 0{,}8$

Conclusion

Presented cutting machine in comparison with the rotation machine is characterized with whole range of advantages, for example :

1. Such type of machine provides the constant speed, when the speed of circle in rotation machine is changeable according to the height of segment and location.
2. The inclination of such type machine's cutting edge in the period of whole phase of circle whihc has positive impact on the quality of circle.

3. The cutting edge of such machine is equally charged during the entire phase of circle which creates the conditions available for machine to operate.

4. The coefficient of using the sharp segment of cutting machine of such type reaches rate 1 which in rotation cutting machines is impossible.

On the basis of mentioned conclusions we may presume that new model of rectilinearly relocating segmented mowing-machine among minor and medium powered mowing-machines provides the process of taking harvest efficiently, with quality and no loss.

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