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The Energy Effective Method of Modeling and Manufacturing of New Profile Teeth of Saw

Azizov Shuhrat Mamatovich, Ph.D

Professor in Mechanical Engineering Department, Namangan Institute of Engineering and Technology, Kasansayskaya 7, Namangan, Uzbekistan

Abstract

Effective machining of modern day demands the new approach to designing of technology of machining which, allows considering all technological parameters of machining, as reduction of speed and reduction of giving depending on a material of an operating mode, features of the car, tools and material volume. Management of physical quantities of operations allows us to reach faster processes of machining when in comparison with old technologies of machining the current technology differs with high speed and also increases productivity. In manuscript showed energy effective method modeling and manufacturing of a new profile of a tooth of a saw.

Keywords: Energy effective; Cutting of sheet; Effective machining; Technology mechanical-processing

Introduction

Now in many countries are used old technology manufacturing ginning machines for ginning raw cotton. Also includes following operations. Punching of disks of necessary diameter 320 mm and an internal aperture 60 mm, transportation, cutting of teeth on teeth cutting machine, sharpening and training of working parts of a teeth of a saw is sharp sheet on press cutting machine. This operation is very time-consuming and demands very many time and labor and the big investment. As working hours saw gin disk in the working chamber are 72-80 h, it is important to check the increasing capacity of working saws. For this purpose it is necessary to improve properties of a saw and replacement of a material by stronger materials [1-3].

The research is carried out by using Euler's following formula:

$$P_K = \frac{\pi^2 E J_{\min}}{(\mu \cdot l)^2} \tag{1}$$

Stress that is resulting in a cross section of the rod when reaching compressive force to the critical value, called the critical σk. Euler's formula (1) is valid if (critical stress does not exceed the limit of proportionality). Usually, the condition of applicability of Euler's formula is expressed in terms of the rod flexibility λ is calculated by the formula (2).

$$\lambda = \frac{\mu \cdot l}{i_{\min}} \tag{2}$$

Where,

l-length of saw or rod

I_{min} – minimum moment of inertia

Materials and Methods

Results of research show the geometric characteristics of the saw and gasket of saw gin as well as define acceptable normal load for saw gin at different distances between the saw. In such cases, the strength and stability of saws are determined not only by its size but also on other complex geometrical characteristics with cross-section of saws and gasket. For example in Figure 1, we can, clearly will see influences between saw distances on stability using different types of steels. The result has shown that at 45°C degrees stability of steel is high at between saw distances of 22 mm (Figure 2). Also we have revealed that tool steel P9 has the greatest indicator of stability of critical force.

In Figure 3, we can see that increases of an indicator, the minimum moment of inertia leads to stability increase (critical force) saw a disk. From this we can look at an ellipse of inertia and have measured its positions from any point of an ellipse to predict stability of a detail to certain loadings [3,4].

We conducted research about saw and gasket at different distances between the saw. In order to ensure the sustainability of saw at work in dynamic loads, we using the geometric characteristics determined the optimal parameters between the saw distances. Using these indicators, we can simulate the best option of working parts of gin and increase the life of saws twice.

These researches have allowed to define a necessary material to increase working hours of saw disk in the working chamber from 100

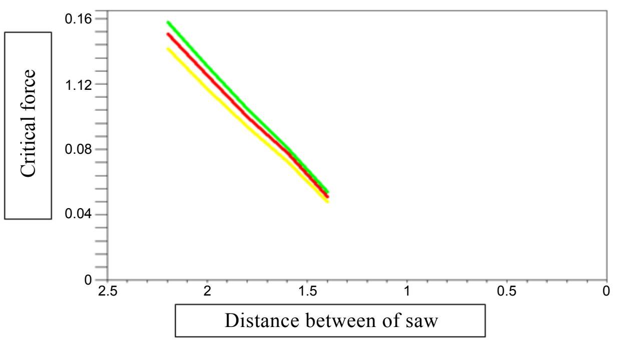

Figure 1: Interrelation critical force with the different size of gasket.

***Corresponding author:** Mamatovich AZ, Professor in Mechanical Engineering Department, Namangan Institute of Engineering and Technology, Kasansayskaya 7, Namangan, Uzbekistan; Tel: +998902148101; E-mail: azizovshuhrat@gmail.com

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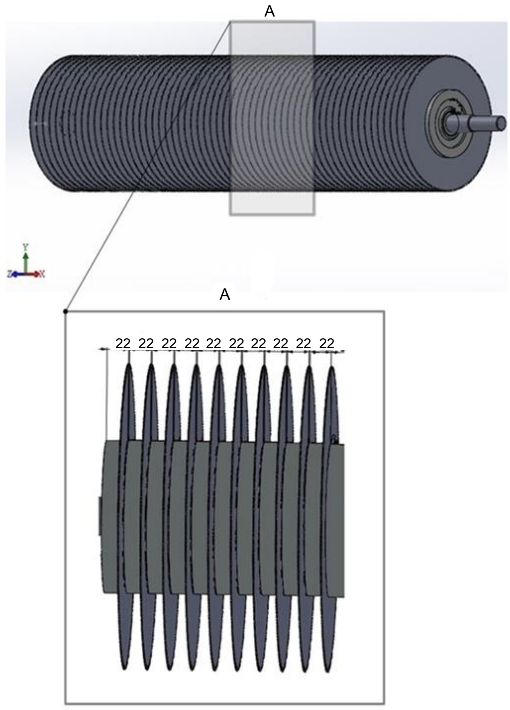

Figure 2: Saw cylinder of gin and distance between of saw.

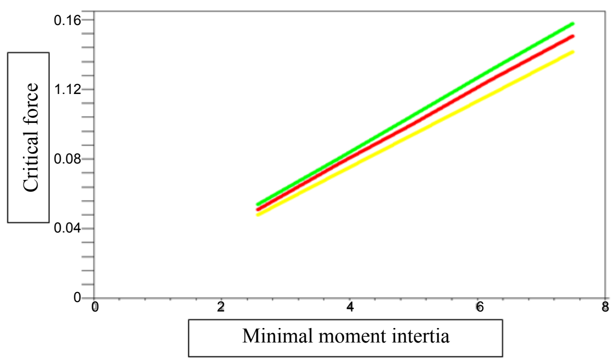

Figure 3: Interrelation critical force with the minimal moment inertia.

to 180 hours. Calculations have shown that the most average (Table 1) indicator of critical loading has a material from U8 at a mode to work 45°C degrees in working chamber Pk=0.148 Mpa. Above average (Table 2) indicator of critical loading has a material from 12X1MΦ in the way of work 45^0 C degrees in working chamber Pk=0.151 Mpa. The high indicator of critical loading (Table 3) has a material from P9 in the way of work 45°C degrees in working chamber Pk=0.156 Mpa. From above listed calculations it is visible that the highest indicator of critical loading has the materials from fast cutting steel P9 and 12X1 MΦ. Usage of these materials for manufacturing of disks will allow to increase working time of saws and to save much money and resources [3-6].

Results and Discussions

But at present the old saw manufacturing technology will complicate possibility of processing of tool steels and turn to fast wear process of

B cm	μ	L cm	Temper	E_{MPa}	Jmin	$P_{k\ Mpa}$	λ
2,2	2	16	250	2	7,49	0.144	4.27
2,2	2	16	300	1.99	7,49	0.143	4.27
2,2	2	16	350	1.985	7,49	0.143	4.27
2,2	2	16	400	1.98	7,49	0.142	4.27
2,2	2	16	450	1.97	7,49	0.142	4.27

Table 1: U8 Critical force Pk (the loss of stability in elastic stage) with different distance between of saw's.

B cm	μ	L cm	Temper	E_{MPa}	Jmin	$P_{k\ Mpa}$	λ
2,2	2	16	250	2.1	7,49	0.151	4.27
2,2	2	16	300	2.09	7,49	0.15	4.27
2,2	2	16	350	2.085	7,49	0.15	4.27
2,2	2	16	400	2.08	7,49	0.15	4.27
2,2	2	16	450	2.07	7,49	0.149	4.27

Table 2: 12X1MΦ Critical force Pk (the loss of stability in elastic stage) with different distance between of saw's.

B cm	μ	L cm	Temper	E_{MPa}	Jmin	$P_{k\ Mpa}$	λ
2,2	2	16	250	2.2	7,49	0.158	4.27
2,2	2	16	300	2.19	7,49	0.157	4.27
2,2	2	16	350	2.185	7,49	0.157	4.27
2,2	2	16	400	2.18	7,49	0.157	4.27
2,2	2	16	450	2.175	7,49	0.156	4.27

Table 3: P9 Critical force Pk (the loss of stability in elastic stage) with different distance between of saw's.

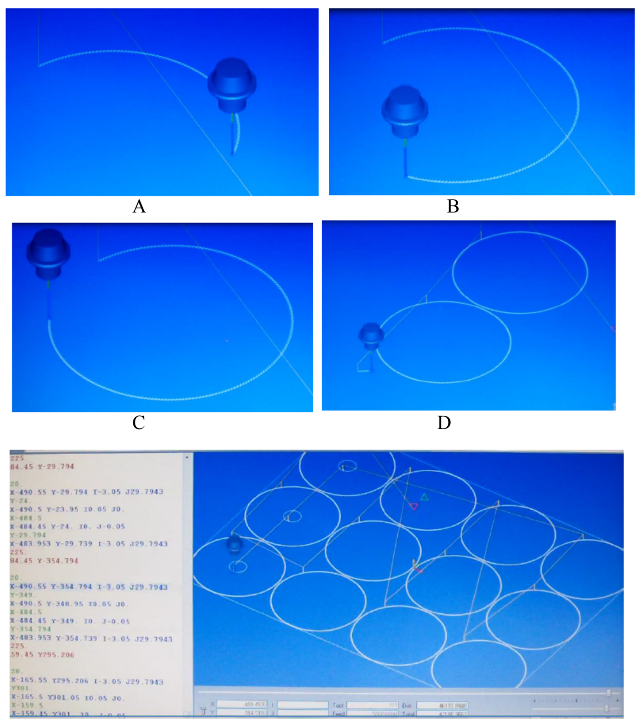

Figure 4: Choice of an optimum mode of machining Solid CAM.

punches and matrixes teeth opening machine tools. For this purpose it is necessary to use front lines of technology for processing of tool steels of laser and water cutting. As one tooth has height of 4 mm and width of 4 mm and a thickness of 1 mm it leads to fasten heating of a tooth at use laser are sharp and to complicate process of shining shown at Figure 4. We have chosen the technology of processing with the help of water cutting. Process saw manufacturing will include two technological chains it is sharp teeth's of a saw (Figure 5).

This approach of mechanical processing demands decision-making in a mode of real time and to optimizes a tool way in order to keep a constant force of the cutting tool during the whole process of machining [6-10].

Thus we can simulate a way of machining by means of Solid CAM (A-E).

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%
O6655 (NEW SAW PROFLE TEETH)
G90
G17
G80 G49 G40
G91 G28 Z0.
G00 X0. Y0.
M1
(FIST SAW)
G0 G54 G90 X-143.9624 Y-65.559
M8
Z25.
Z5.
G1 G94 Z2. F33.
(FIST SAW)
G2 X-147.965 Y-60.962 I5.2208 J8.5876 F500.
X-147.877 Y-60.916 I0.0459 J0.0199
G3 X-147.222 Y-61.663 I2.4819 J1.5149
G1 X-147.221 Y-61.664
G3 X-146.384 Y-62.22 I2.8818 J3.433
X-145.256 Y-62.704 I3.4973 J6.5959
X-144.418 Y-62.959 I3.761 J10.8574
G1 X-143.676 Y-63.156
G3 X-143.556 Y-62.885 I0.0386 J0.1449
G1 X-145.76 Y-61.459
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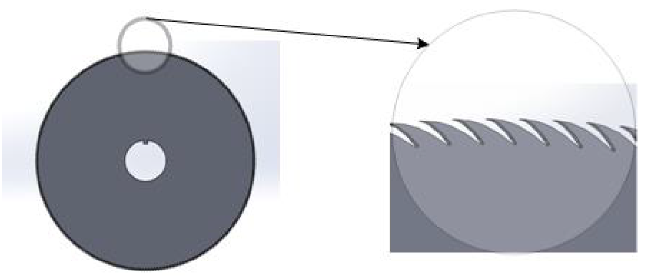

Figure 5: It is presented that frontal kind of a saw and the increased kind of teeth of saw.

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G2 X-149.631 Y-56.751 I5.4617 J8.4364
X-149.541 Y-56.707 I0.0465 J0.0186
G3 X-148.908 Y-57.472 I2.5239 J1.4441
X-148.086 Y-58.052 I2.9778 J3.3501
G1 Y-58.053
G3 X-146.972 Y-58.568 I3.6826 J6.4943
X-146.142 Y-58.847 I4.0668 J10.7467
G1 X-145.406 Y-59.065
G3 X-145.278 Y-58.798 I0.0427 J0.1438
G1 X-147.441 Y-57.309
G2 X-151.177 Y-52.494 I5.6982 J8.2784
X-151.086 Y-52.453 I0.0469 J0.0172
G3 X-150.475 Y-53.235 I2.5638 J1.3722
G1 X-150.474
G3 X-149.67 Y-53.838 I3.0715 J3.2646
X-148.571 Y-54.385 I3.8649 J6.3876
G1 Y-54.386
G3 X-158.01 Y-22.577 I2.782 J0.8399
G1 Y11.638
G3 X-157.159 Y11.025 I8.3587 J7.884
G1 X-156.593 Y10.507
G3 X-156.361 Y10.691 I0.1013 J0.1106
G1 X-157.654 Y12.976
G2 X-158.907 Y18.941 I8.7459 J4.9509
X-158.807 Y18.938 I0.0498 J-0.005
G3 X-158.6 Y17.967 I2.9056 J0.1121
X-158.14 Y17.072 I4.1914 J1.5923
X-157.391 Y16.099 I6.2724 J4.0546
G1 X-157.39
G3 X-156.784 Y15.468 I8.5805 J7.6464
G1 X-156.233 Y14.934
G3 X-155.996 Y15.112 I0.1044 J0.1077
G1 X-157.224 Y17.432
G2 X-158.307 Y23.43 I8.8825 J4.7014
X-158.208 Y23.424 I0.0496 J-0.0065
G3 X-158.028 Y22.448 I2.9077 J0.0298
X-157.593 Y21.541 I4.2348 J1.473
X-156.872 Y20.547 I6.3847 J3.8755 ...................................
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G1 X-137.803 Y-75.113
G3 X-137.706 Y-74.833 I0.0262 J0.1477
G1 X-140.023 Y-73.599
G2 X-144.279 Y-69.236 I4.7266 J8.8692
X-144.193 Y-69.185 I0.0447 J0.0224
G3 X-143.498 Y-69.894 I2.3921 J1.6528
G1 X-143.497
G3 X-142.63 Y-70.402 I2.6829 J3.5904
G1 X-142.629
G3 X-141.476 Y-70.821 I3.1185 J6.7831
X-140.625 Y-71.028 I3.1407 J11.0526
G1 X-139.873 Y-71.184
G3 X-139.769 Y-70.906 I0.0304 J0.1469
G1 X-142.049 Y-69.607
G2 X-146.181 Y-65.125 I4.9757 J8.7319
X-146.094 Y-65.077 I0.0453 J0.0211
G3 X-145.418 Y-65.805 I2.438 J1.5845
X-144.565 Y-66.337 I2.7834 J3.5131
G1 X-144.564
G3 X-143.423 Y-66.789 I3.3092 J6.6922
X-142.579 Y-67.02 I3.4523 J10.9594
G1 X-141.832 Y-67.197
G3 X-141.719 Y-66.923 I0.0345 J0.146
G1 X-143.962 Y-65.559
G0 Z25.
M9
G91 G28 Z0.
G30 X0. Y0.
G90
M30 %
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In Figure 4 A-C the machining way is represented at manufacturing of one saw with a new profile of a tooth on the equipment by water cutting. Before manufacturing of a saw we will put some sheets against each other and so it is created some layers from a demanded material of sheet using accuracy water cutting we can put simultaneously for processing for example 5 layers of metal sheet. In Figure 5 the machining way is represented at manufacturing some quantity of saws with a new profile of a tooth on the equipment by water cutting.

Conclusion

The result shows that the usage hydro abrasive cutting for manufacturing of a saw with a new profile of a tooth by means of program Solid CAM will allow raising productivity several times. We have achieved reducing time of machining to 60% according to usual machining.

From this follows that we can let out new energy and resource saving saws from tool steels which will help to save much money spent for acquisition of materials and on processing of metals. Introduction of a new profile of a tooth of a saw will allow on 15-20% raising productivity at branch of a seed from a cotton fiber. Use of new saws from tool steels in single-chamber two cylinder gin will allow to increase capacity of saws several times.

Considering above stated data we can tell that the industry using energy saving in cotton processing industries will save technologies on resources and the electric power. This will raise energy efficiency and resource saving of the equipment.

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