Available online www.ejaet.com

European Journal of Advances in Engineering and Technology, 2016, 3(1): 43-46

Research Article ISSN: 2394 - 658X

The Device for Cutting the Unbroken Plastic Bars

Sabirov B[1], Ruziev I[1], Radjabov M[2], Samandarov A[1] and Rajabov J[1]

[1]*Department of General Engineering Science,*
Faculty of Chemical Technology, Urgench State University, Urgench, Khorezm, Uzbekistan
[2] *Department of Industrial Engineering, University of Padua, Padua, Italy*
r-misha38@rambler.ru

ABSTRACT

One of the actual questions of the present time is the necessity of widely increasing degree of automatization of productive process and raising the reliability the technological equipments, lowering of their material and power consumption . Due to this issues research on this area is very important. This article discusses the (standalone) device for cutting a plastic bar. The analysis is done for the forces acting on the components of the installation when cutting plastic bar.

Key words: Soap, cutting element, lever, drum, corner cutting, perpendicular cutting

---

INTRODUCTION

The introduction of mechanized and automized processes at the enterprises completely, in many cases, occurs at the expense of application of complex lines including all basic and subsidiary equipments [1- 3]. Separate types of the equipments working in the structure of a complex automized line should have enough high reliability and longevity, as the inaccuracies in each unit of equipment course in idle time of all line. At manufacture of such productions, as soaps in food production, brick in building, and also at the manufacture of some aspects of special production the method of unbroken plastic bar is used.

In the automatization of cutting the continuously driven plastic bar there appeared unexpected problem consisting of providing the measurement of length of a sawed piece and process of cutting of a bar in the condition of its continuous driving. For this purpose or the measuring and cutting tools of the automatic device should be synchronously driving with the plastic bar, or the digitization of these processes is required.

In the above-mentioned devices, there are examples uses of both these principles. In some devices, such way of digitization is used for a sawing of enough long piece of a bar, in order to carry it out of a zone of driving and then to cut the long piece into required length of pieces. However this digitization of process essentially influences on lowering of producing of the manufacture. In some other devices, the synchronization of driving of cutting elements with driving plastic bar is used. Thus, a signal for security of synchronization in the majority of devices is received from different surfaces of plastic bar. However in all mentioned devices the transmission of this signal from a bar to the executive organ is carried out through a long enough kinematic chain, which is powering up frictional, h-pole serrated, chain and other elements. At the result large, enough errors distorting the length of a sawed piece, and also perpendicularly and plane of surface of the cutting are concentrated.

Taking into account the above-stated deficiencies of known devices, an automatic machine of a new rotor construction for cutting of a plastic bar is developed. The device consists of two drums on which the levers with flat knives at the ends are fixed. The device ensures the position of knives perpendicular towards a direction of driving of a bar in any position of levers. The driving of rotation of drums and signal of synchronization are received immediately from a back driven plastic bar. The further synchronous horizontal and vertical cutting stroke is made together with a bar. As several cutting knives are in the condition of cutting simultaneously, the continuity of the cutting process is insured after an exit of the next knife from a cutting zone. As it is seen from the construction (fig-1) of excluding from the chain of synchronization of intermediate links together with deriving of an immediate signal of synchronization from the basic of a face surface of a bar provides a high exactitude of length of a sawed piece. A fixed vertical position of cutting knives and their flat construction ensures a high scale of perpendicularly and plane of a surface of cutting.

It is established, that in many cases the energy of driven plastic bar appears to be sufficient as for security of synchronization of driving of knives, and for the immediate process of cutting. On the occasions, when for the process of cutting are required large efforts in the device low-powered supporting drive can be entered. Carried out kinematic and dynamic analysis has shown that the new construction ensures steady operation of an automatic machine at high efficiency depending on the speed of plastic bar or productivity shnek press, giving a bar, and high exactitude of the size of a sawed piece, and also high scale of a perpendicularly and plane of a surface of cutting. In the kinematic analysis mentioned below laws describing synchronic driving of a point plastic bar and the appropriate point of a cutting knife are used. (Fig. 1)

$$\left.\begin{aligned} x &= r\cos\alpha - l\cos\eta \\ y &= r\sin\alpha + l\cos\eta \end{aligned}\right\} \tag{1}$$

During the operation of the device of cutting, it is necessary; that the levers with their rollers should be pressed to a template, for security of effort of synchronization of speeds of a bar and knife, or the fixed force closure of levers with a template must be required.

On the basis if kinematic accounts it is established that the flowing angle η of inclination of levers should submit to the following condition:

$$\eta = \arccos\frac{1}{l}\left(r\cos\alpha + l\cos\eta_k - k\cdot r\left(\alpha - \frac{\pi}{2}\right)\right) \tag{2}$$

At the result of definition a value of a corner η and radius r, the opportunity for account of coordinates of points the defining profile of a template and for manufacture it with a high exactitude, obtained on machine tool with numerical program control.

Analysis of the forces and reactions acting on the cutting device from the plastic bars (Fig. 2) showed that the most unfavourable from the point of view of the drum rotation by the energy of the plastic bars, is the end of the cut, where the knife is at the lowest point of its trajectory. Because at this point the reaction opposing the torque generated by the pushing force Ft plastic bars has a maximum value for a given position of elements of the device, there is a danger of jammed wedge effect.

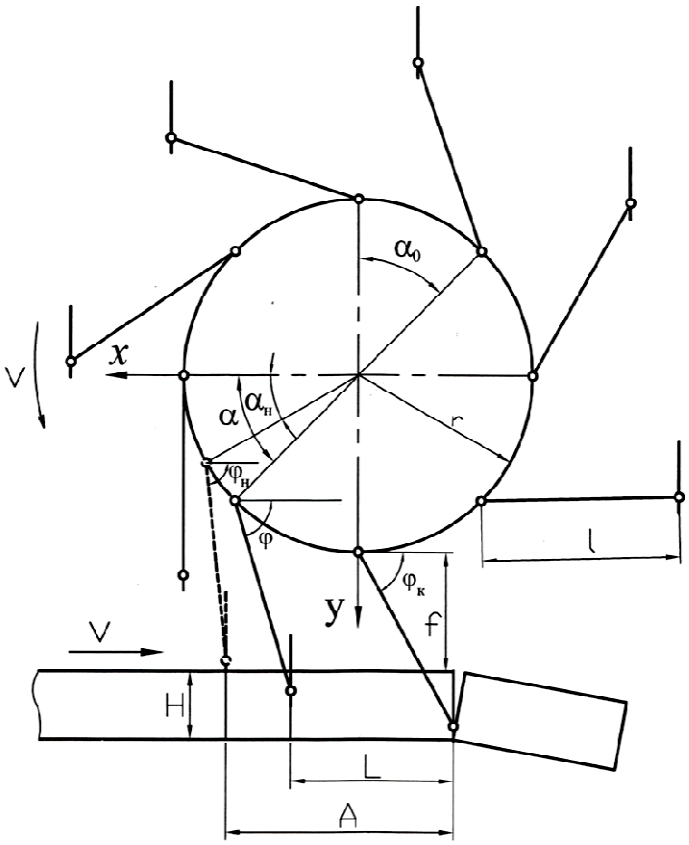

Fig. 1 Conducted of dynamic analysis of the forces and reactions in the process of cutting

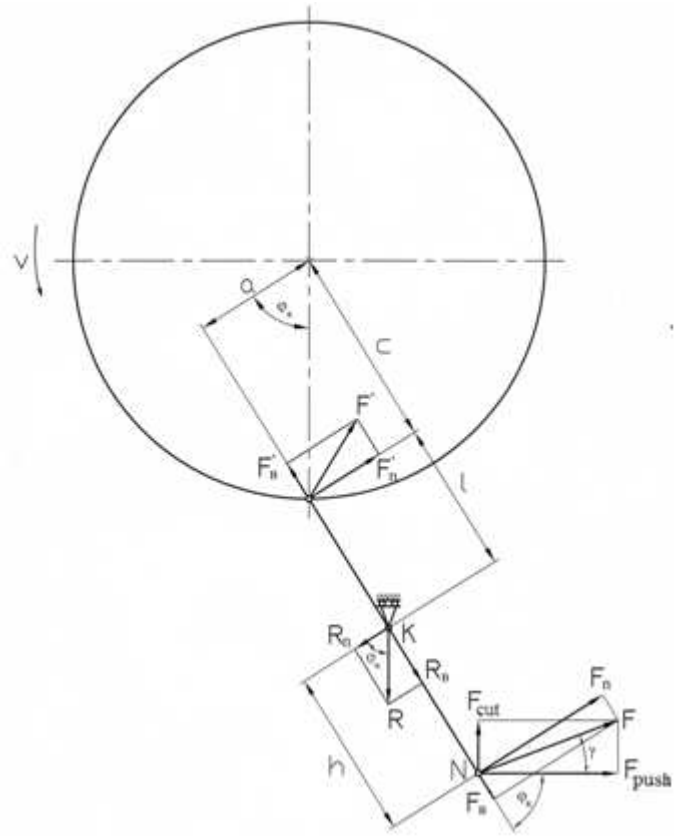

Fig.2 Driving forces and reactions acting on the device critical position

RESULTS AND DISCUSSION

It was established that for ensure the rotation of the drum, apparatus for cutting plastic beam due to the energy of the beam is necessary meet the following conditions:

- In finding the knife in the lower point of his trajectory, torque, acting on the drums the device was greater than zero:
- Index the angle of the cut should not exceed the found critical value.

$$\varphi_k \le arcctg\left[-\frac{1}{ctg\gamma}+\sqrt{\frac{1}{ctg^2}+1}\right] \quad (3)$$

CONCLUSION

At the results of research designed and built a prototype of a fundamentally new universal and energy saving device without auxiliary drives and the drive transmission that promises large gains in industrial production.

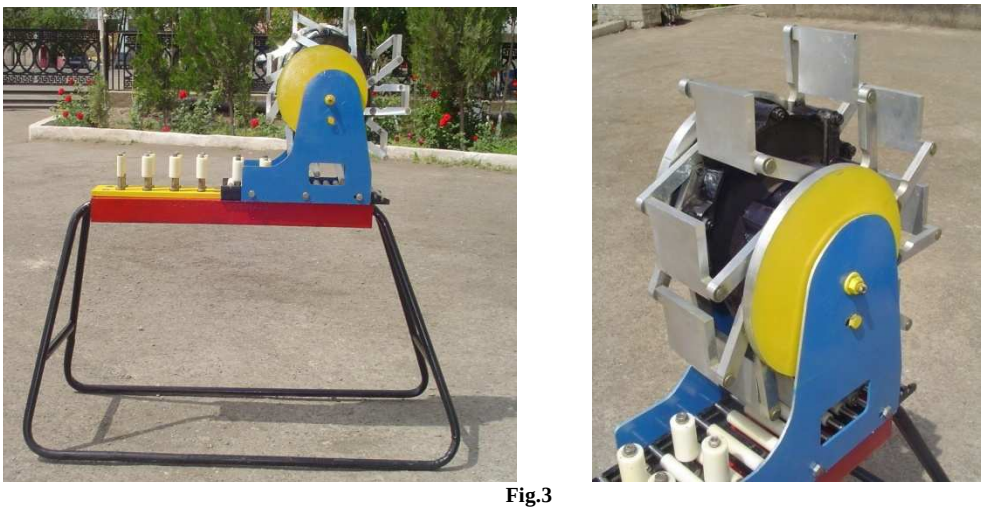

Fig.3

The trials of a trial sample have shown, that the basic advantages of the device are observance of such requirements to the constructions, as lowering its material capacity, heightening of an exactitude of length of sawed pieces of a perpendicularly and the plane of surface of cutting, and reliability of the mechanism at the expense of exception of a network of intermediate mechanisms ensuring transmission of energy displacing the plastic bar, to the elements of the device.

REFERENCES

[1] AN Daursky and YuA Machihin, *Cutting Food Materials, Food Industry*, Moscow, Russia, **1980**.
[2] KZ Iskaliev, MA Rabil and NB Tervo, On the Question of the Study of the Dynamics of Elements Cutting Machine Rotary Type, *Proceedings VNII strommasha, Gatchina*, Russia **1971**.
[3] IM Tovbin, MN Zaliopo and AM Zhuravlev, *Manufacture of Soap, Food Industry*, Moscow, Russia, **2005**.