

Methods for Increasing the Resources of the Crankshaft Mechanisms

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ABSTRACT: On the basis of the analysis of the operation of the crank-rocker and crank-rocker mechanisms, new kinematic diagrams of the flat crank-rocker mechanisms have been developed. To eliminate shock phenomena in the extreme positions of the links, the kinematic pairs of the mechanism have elastic elements.

KEYWORD:Rocker, crank, connecting rod, rack, mechanism, link, impact, kinematic pair, reaction force, hinge, elastic element, bushing.

I. INTRODUCTION

Based on an analysis of the cranial and coronary mechanisms, the main shortcomings of such mechanisms have been identified.New kinematic diagrams of crankshafts have been developed to address the identified shortcomings.All mechanisms composed only of solids are divided into two large groups: those with lower pairs, which are sometimes called rods or levers, and those with higher pairs. Of the mechanisms with lower pairs, the four-link mechanism has the greatest prevalence [1].

II. RELATED WORK

In the known mechanism there are four links: a crank-carrying out a full rotation around a fixed axis, a rocker-arm performing a rocking motion, a connecting rod performing a flat-parallel complex movement, a stand (body) - a fixed link [2]. The mechanism makes it possible to obtain different laws of motion of the connecting rod and the rocker arm in the plane, as well as their points, which depend mainly on the ratio of lengths of the links.

III. LITERATURE SURVEY

The drawback of the known crankshaft mechanism is that of impact events in kinematic pairs at the extreme positions of the links, which leads to a reduction in the operating life of the mechanism, especially in high-speed operating modes of the mechanism. In addition, this mechanism does not allow for the necessary adjustments to the movement of the connecting rod and the rocker arm. To eliminate the impact phenomena in the kinematic pairs in the extreme positions of the shuttle and the rocker, as well as to make the necessary adjustments to the laws of their movement. The design of the mechanism has been improved by depreciating the impact characteristics of the output link. The essence of the recommended crankshaft mechanism is that the mechanism comprises a crank, a connecting rod, a rocker and a stand (body) which are interconnected by kinematic pairs (hinges), wherein the kinematic pair (hinge) The rocker arm is connected to the bar by means of a rubber cushion, and rubber shock absorbers are mounted in the body on both sides of the rocker with the possibility of interaction with the rocker arm in the extreme positions thereof.

IV. METHODOLOGY

This construction makes it possible to amortize the peak values of reaction forces in the kinematic pair (hinge) of the rocker arm with the stability and allows smooth transition modes of oscillation of the rocker arm in the extreme positions thereof, which results in a significant increase in the reliability and capacity of the mechanism. The cranking mechanism consists of a post 1 (body), a crank 2, a connecting rod 3 and a rocker 4 connected to each other by means of joints A, B, C, D. The joint D. of the rocker arm 4 is mounted on a post 1 by means of a rubber cushion 5, Rubber

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(elastic) shock absorbers 6 and 7 connected to pillar 1 (fig. 1) are mounted on both sides of rocket 4 with the possibility of interaction in the outer positions of the rocker arm.

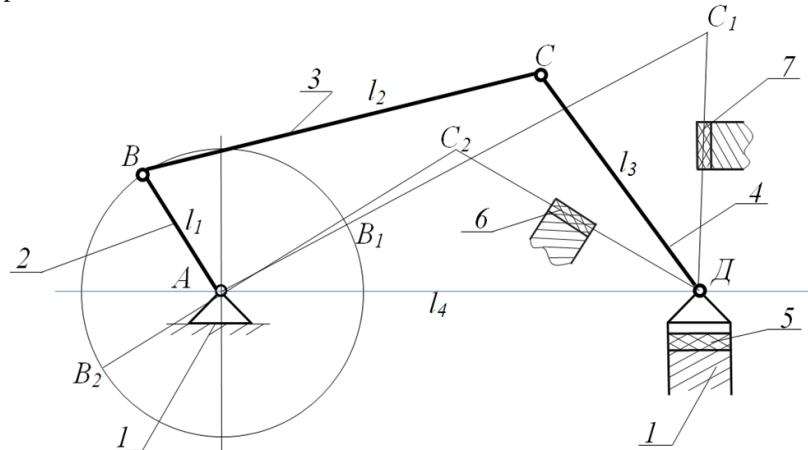


Fig. 1. Crankshaft mechanism

The crankshaft mechanism works as follows. Crankshaft 2 receives rotational motions from the drive engine (not shown in Fig. 2). Accordingly, the motion from crank 2 is transmitted to shuttle 3, onwards and to rocker 4. The motion of the mechanism occurs in the plane. Furthermore, in the extreme positions of crank 2, rod 3 and rocker 4, striking phenomena occur in kinematic pairs A, B, C, D between links 2,3,4 and 1. In impacts, the rubber cushion 5 deforms and absorbs the peak response forces of the D bar 4.

V. EXPERIMENTAL RESULTS

The recommended next crank-and-rocker mechanism consists of a rack 1, a crank 2, a connecting rod 3 and a rocker arm 4. The hinges between links 2 and 3, 3 and 4, 4 and 1 are made composite, which includes an axis 5, mounted on it an elastic sleeve 6, on which is fitted with a sleeve 7 rigidly connected to the links 1, 2, 3, 4 of the mechanism. In this case, the thicknesses of the elastic bushings 6 are selected:

$$\Delta_1 = \frac{l_2}{l_1} \cdot 1,0 \text{ mm}; \Delta_2 = \frac{l_3}{l_2} \cdot 1,0 \text{ MM}; \Delta_3 = \frac{l_4}{l_3} \cdot 1,0 \text{ mm}.$$

where, l_1, l_2, l_3, l_4 - respectively the length of the links 1, 2, 3, 4.

The crank-rocker mechanism works as follows. Crank 2 receives rotary motion from the drive motor (not shown in the figure). Accordingly, the movement from the crank 2 is transferred to the connecting rod 3, then to the rocker arm 4. The movement of the mechanism occurs in the plane. In this case, in the extreme positions of the crank 2, the connecting rod 3 and the rocker arm 4, shock phenomena occur in the kinematic pairs between the links 2, 3, 4 and 1. During the impacts, the elastic sleeve 6 cushions the shock, the reaction force decreases.

In addition, due to the deformation of the elastic sleeve 6, the lengths change l_1, l_2, l_3, l_4 . This leads to a changed trajectory of movement of the points of links 2, 3, 4. Therefore, choosing the thickness (stiffness) of the elastic sleeve 6, you can adjust its deformation, thereby the necessary laws (trajectory) of movement of links 2, 3, 4 of the mechanism (Fig. 2) [3].

In this case, the thickness of the elastic sleeve 6 in the composite hinges (kinematic pairs) is chosen equal to the ratio of the length of the next link to the length of the previous link and multiplied by 1.0 mm. The greater the difference in lengths between adjacent links, the greater the reaction force and impact interaction in the kinematic pair. Therefore, the thickness of the deformation of the elastic sleeve 6 will also be large.

Therefore, the choice of the thicknesses of the elastic bushings of 6 kinematic pairs corresponds to:

$$\Delta_1 = \frac{l_2}{l_1} \cdot 1,0 \text{ MM}; \Delta_2 = \frac{l_3}{l_2} \cdot 1,0 \text{ MM}; \Delta_3 = \frac{l_4}{l_3} \cdot 1,0 \text{ mm}$$

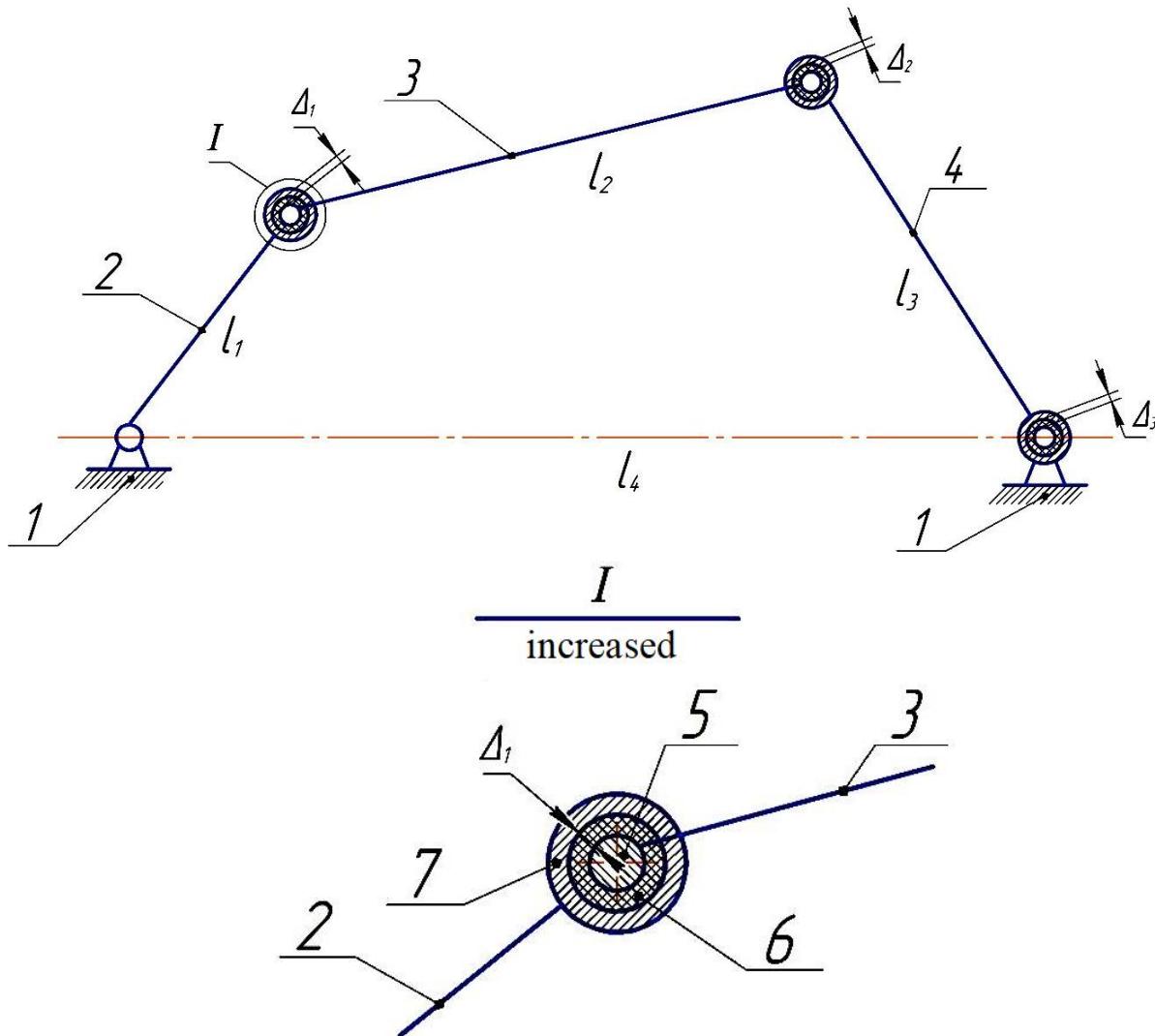


Fig. 2. Crankshaft mechanism

In fact, the flexible bushes 6 reduce or eliminate the amount of redundant bonds in kinematic pairs [4]. For the recommended mechanism $q = 1 - 6n + 5P_5 - K = 1 - 6 \cdot 3 + 5 \cdot 4 - 3 = 0$.

Therefore, there are no redundant links in the recommended crankshaft mechanism. This increases the service life.

The following result can be obtained on the first mechanism proposed: At the extremities of C1 and C2 of the rocker arm 4, the maximum accelerations occur, resulting in additional disposal forces. The interaction of the rocker arm 4 in these positions with the rubber shock absorbers 6 and 7 results in some absorption of the forces and a smooth transition of the motion mode of the mechanism.

The proposed design of a crank-crank mechanism makes it possible to smooth transition modes of oscillations of the rocker arm in the extreme positions thereof, resulting in a significant increase in the reliability and service life of the mechanism.

We can see that the following result was achieved on the next 2 mechanisms: The mechanism allows the necessary changes (adjustments) of the movement of the links (points of links) within the limits necessary for the intensification of technological processes in the machine.



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VI. CONCLUSION

In the first version of the mechanism, due to the interaction of the rocker with rubber shock absorbers, the forces are absorbed, which leads to a smooth transition of the movement mode of the mechanism. In the second version of the mechanism, elastic bushings reduce or eliminate the number of redundant links, which leads to an increase in the resource of the mechanism.

REFERENCES

- [1] Levitsky N.I. The theory of mechanisms and machines. Ed. "Science", M.: 1997, 574 p.
- [2] Kenjaboyev Sh., Djuraev A. The study of the effect of the parameters of elastic coupling on the hacker of motion of the rocker arm of the crank and beam mechanism. International Journal of Advanced Research in Science, Engineering and Technology.India, 2018.-№5. -p. 6309-6313.
- [3] Kenjaboyev Sh., Djuraev A. Kinematic analysis of the crank-beam mechanism with compound hinges with fixed changes in the length of the links. European science review, Vienna, 2017.-№9-10.-p. 96-101.
- [4]. KenjaboevSh.Sh. Development of structural schemes and calculation methods of flexible joints and flexible elements: Techn. fan. doc. diss. avtoref. - Tashkent, 2019. - 64 p