MODELING OF AN OSCILLATING CAM-SLIDER MECHANISM

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ABSTRACT: This work consists of 3D modelling of a cam-piston oscillating mechanism in the computer-aided design software SolidWorks. The mechanism was taken from the book "Five Hundred and Seven Mechanical Movements" by Henry T. Brown and was adapted by us from the shown illustration.

KEYWORDS: follower, cam, oscillation, intermittent, cyclicity.

1. Introduction

The subject of the paper is the modelling and simulation of an oscillating cam-piston mechanism. The studied mechanism consists of a disc-shaped cam, a follower which traces the unique shaped groove in the disc bed, connected by a shaft and a ball bearing, a connecting rod which is set in motion by the follower and an oscillating wheel driven by this connecting rod. Modeling and simulation were performed in SolidWorks 2023, the computer-aided design (CAD) and computer-aided engineering (CAE) software for modeling solid parts, published by Dassault Systèmes.

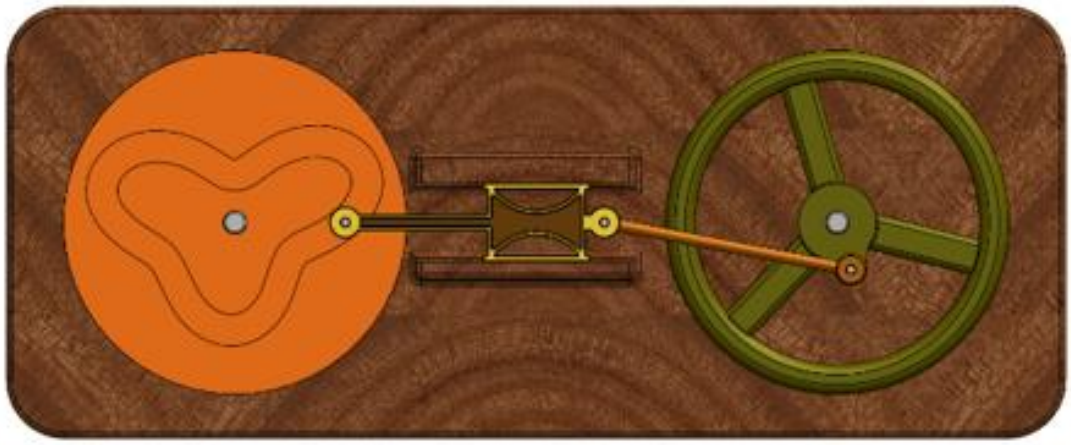

Fig. 1. Front view of the mechanism

2. Current stage

The main purpose of the chosen oscillating cam-piston mechanism is to use it as a subject of study and as a practical example. The mechanism offers students and researchers the opportunity to understand and apply physical principles and concepts of dynamics in a real-world context, which is why we decided to revive the illustration from the 1908 book [2] by 3D modelling and simulating it.

Through the oscillating cam-piston mechanism, students can gain a practical understanding of theoretical concepts such as oscillatory motion, force interaction and energy transfer in a mechanical system. It provides a concrete and tangible example, which facilitates learning and allows students to observe the effects of these principles in an interactive environment.

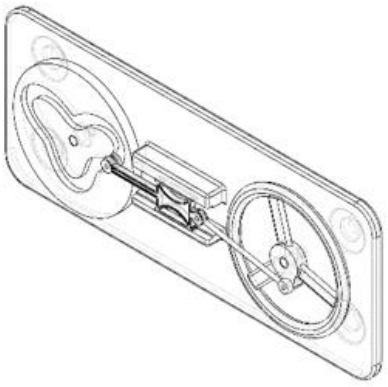

Fig. 2. Isometric view of the mechanism

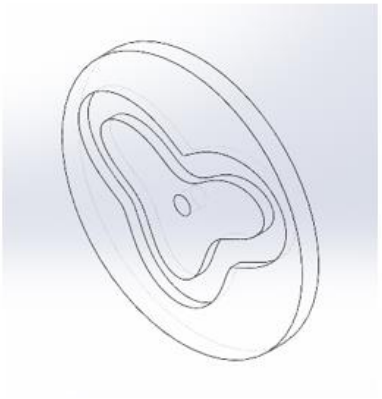

Fig. 3. Disc cam

Although a basic oscillating cam-piston mechanism can be an excellent platform to develop engineering applications, to impact research by investigating complex phenomena associated with oscillatory motion or to develop methods for control and optimization of oscillatory systems, the uniqueness of the modeled mechanism provides another perspective on the concept. The most important thing is that the student has to deal with as many examples as possible throughout their undergraduate studies, whether often encountered in the real world or not.

3. Mentions and remarks

At first glance, although a unique oscillating mechanism, once the simulation is examined, it can be associated with the mechanism present at the wheels of a steam locomotive.

The real use case for this type of mechanism in manufacturing, in the absence of CNC machines, is in the mechanical replication of parts, where the cam is the replicated profile.

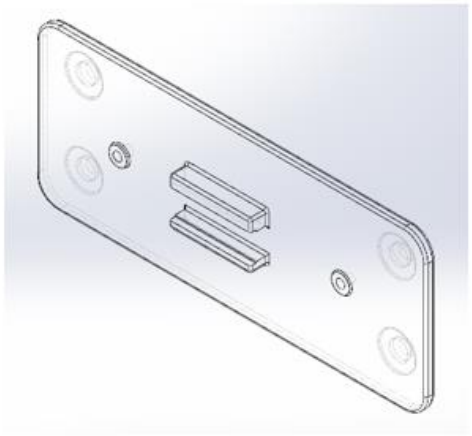

Fig. 4. Support plate

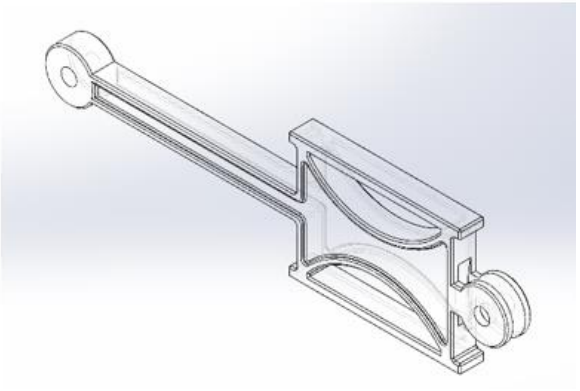

Fig. 5. Slider-Follower

4. Modeling of the oscillating cam-piston mechanism

In figures 4 to 12 is presented the modeling of the component parts of this mechanism in SolidWorks. The parts are put together and the simulation of its operation is made.

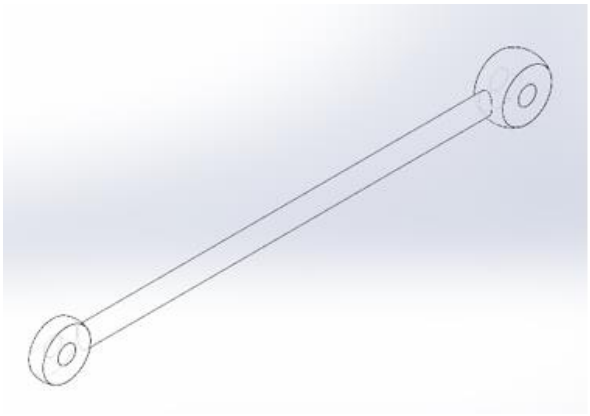

Fig. 6. Connecting Rod

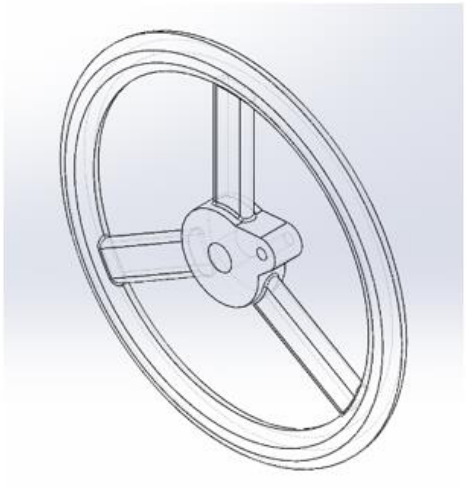

Fig. 7. Oscillating wheel

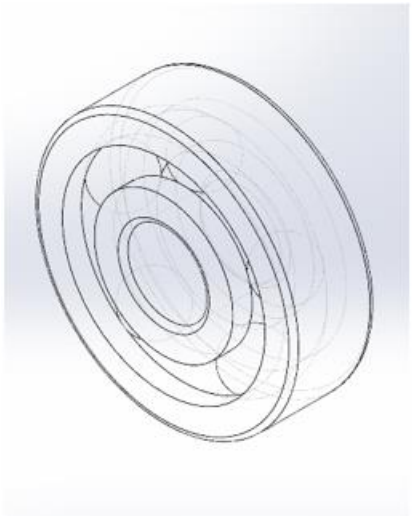

Fig. 8. Ball Bearing DIN 625 SKF

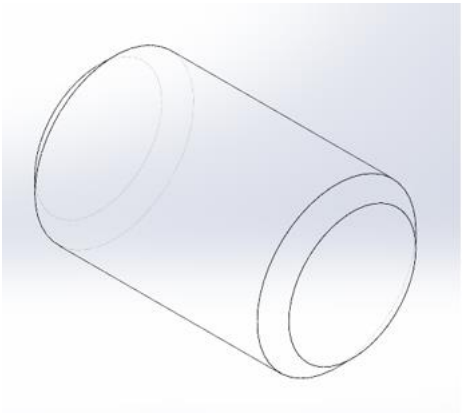

Fig. 9. Pin 5x8

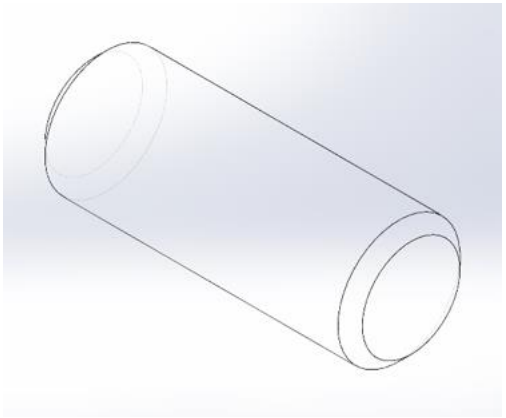

Fig. 10. Pin 5x13

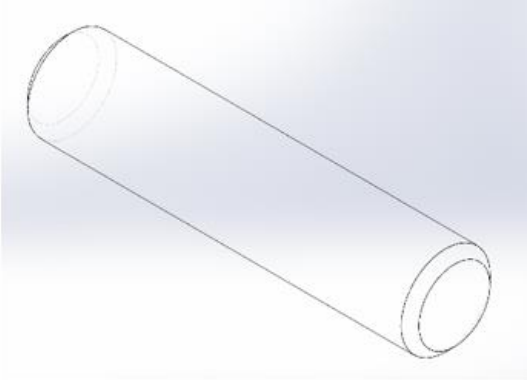

Fig. 11. Pin 5x22

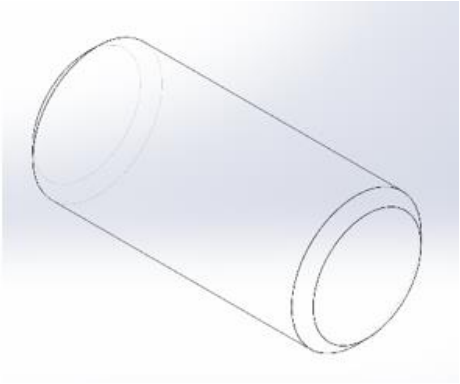

Fig. 12. Shaft 11x26

5. Materials

For a potential manufacture of the mechanism, with the exception of the basic plate for which the ideal material is wood, the rest of the parts will be made from 45 steel, even though in the CAD files we used "polished steel" for a better look.

6. Conclusions

Through the modelling and simulation process we can provide students with an example of an oscillating cam-piston mechanism in a modern manner to facilitate the learning process.

We discovered an online video [1] of an oscillating mechanism, studied it [2] and adapted and modelled it in a computer-aided design application. The mechanism consists of a cam with a unique shape, a follower that traces the "groove" in the cam bed, a connecting lever that is set in motion by the piston, and an oscillating wheel driven by mentioned connecting rod. The main objective is to model and simulate [3] this mechanism in order to use it as an subject of study. This was carried out in the computer-aided design application SolidWorks [4], published by Dassault Systèmes.

7. Reference

[1]. Stăncescu, A. (2022), https://www.youtube.com/watch?v=l2e7kPSAmg8
[2]. Brown, H.T. (1908), “Five Hundred and Seven Mechanical Movements”;
[3]. “The online edition of the classic technical reference Five Hundred and Seven Mechanical Movements by Henry T. Brown”, http://507movements.com
[4]. SolidWorks, https://en.wikipedia.org/wiki/SolidWorks