DESIGN AND TYPES OF CAM MECHANISMS

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Abstract: *This article provides a comprehensive overview of the design, operating principle, and main types of cam mechanisms. The importance of cam mechanisms in mechanical engineering, their role in transmitting and converting motion, and their applications are analyzed. The structure and application areas of disc, cylindrical, and other types of cam mechanisms are also considered. The article also provides information on the advantages, disadvantages, and ways to improve the efficiency of these mechanisms.*

Keywords *: Sleeve mechanism, spring, rotary motion, oscillatory motion, e-distance.*

Many auxiliary operations in modern automatic machines are performed by cam mechanisms . With the help of such mechanisms , it is possible to obtain any law of motion of the driven link. In some cases, laws that cannot be realized using a lever mechanism can be performed with a cam mechanism. For example, in the gas distribution mechanism of an internal combustion engine, cam mechanisms accurately perform the process of automatically opening and closing the valves at the right time. The cam mechanism includes a link that forms a higher kinematic pair, the connecting element of which is a curved line of variable radius. The working surfaces of the cam and the pusher are worn during operation. In order to reduce wear and achieve uniform wear of the pusher's contact surface, increase the

reliability of the mechanism and extend its service life, various forms of higher kinematic pairs are used.

A clutch mechanism is a mechanical system that primarily serves to transmit and transform motion according to a given pattern, and its design consists of several basic elements.

The sleeve is the main driving element, which usually performs a rotary motion and, through its special profile, determines the law of motion of the output link.

A pusher is an element that contacts the profile of the nozzle, receives its movement, and performs a forward or oscillating motion.

The shaft (axle) is the main part that drives the nozzle, to which an external torque is transmitted.

Guide elements – serve to ensure precise and stable movement of the actuator.

Spring (in some cases) – used to keep the plunger in constant contact with the nozzle.

The main task of a lever mechanism is to generate motion according to a given law:

Speed of the nozzle mechanism:

Here:

ω – corner speed

Acceleration of the muzzle mechanism:

The principle of operation of the sleeve mechanism is that when the sleeve rotates, its profile moves the actuator according to a certain pattern. As a result, the rotational motion is converted into a translational or oscillating motion. Despite its simplicity, such a design allows for high-precision motion transmission and is widely used in automatic devices and mechanical engineering systems.

The following are the advantages of lever mechanisms:

1) by changing the cam profile, it is possible to obtain almost any law of motion of the driven link;

2) high efficiency can be achieved by rationally choosing the law of motion of the driven link;

3) the law of motion of the driven link can be changed by replacing the bushing;

4) small dimensions of the mechanism can be used;

5) In automatic machines, it is possible to perform coordinated operation of several mechanisms.

Therefore, sleeve mechanisms are widely used in transmission mechanisms of working bodies of various automatic machines, metalworking machines, and in many other cases.

One of the main disadvantages of sleeve mechanisms is the presence of a large specific pressure and rapid wear of the sleeve surface. Therefore, high-quality materials are required in the manufacture of the sleeve. In addition, in some cases, additional force is required using a spring to form a kinematic pair between the sleeve and the actuator.

By type, sleeve mechanisms are divided into spatial and flat. In spatial sleeve mechanisms, the sleeves are usually cylindrical in shape with grooves, in which the rollers of the pusher move (Figure 1).

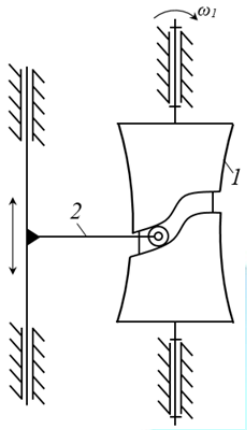


Figure 1

Flat -clamp mechanisms perform reciprocating (Figure 2) or rotary (Figure 3) motion. Flat -clamp mechanisms with rotary motion are widely used in machinery.

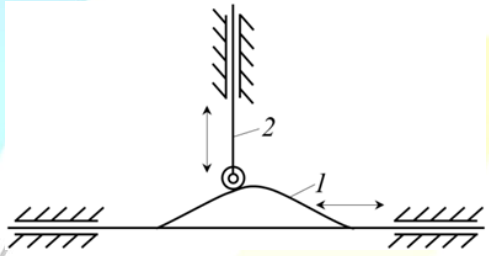


Figure 2

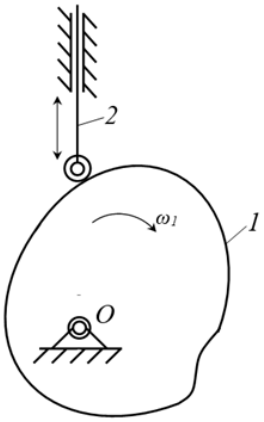


Figure 3

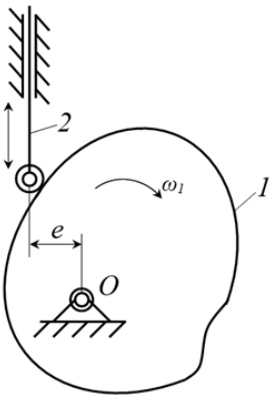


Figure 4

Reciprocating piston mechanisms are themselves divided into two types: central (axial) and non-central (deaxial). Central sleeve mechanisms are those in which the axis of the actuator's motion passes through the center of the sleeve's axis of rotation. Non-central sleeve mechanisms are those in which the axis of the actuator's motion passes at *e*some distance from the center of the sleeve's axis of rotation. This *e* distance is called the off-axis distance (Figure 4). According to the shape of the contact surface with the sleeve, they can be divided into types with a sharp tip, roller and flat surface (talkatellite), and according to the type of movement, they can be divided into reciprocating, oscillating and complex types (Figure 5).

Scheme A is a mechanism with a roller actuator that moves forward and backward along a straight line.

Scheme B is a cam mechanism with a flat plate actuator that moves forward and backward along a straight line.

Scheme C – a cam mechanism with a movable, roller, and rocker arm.

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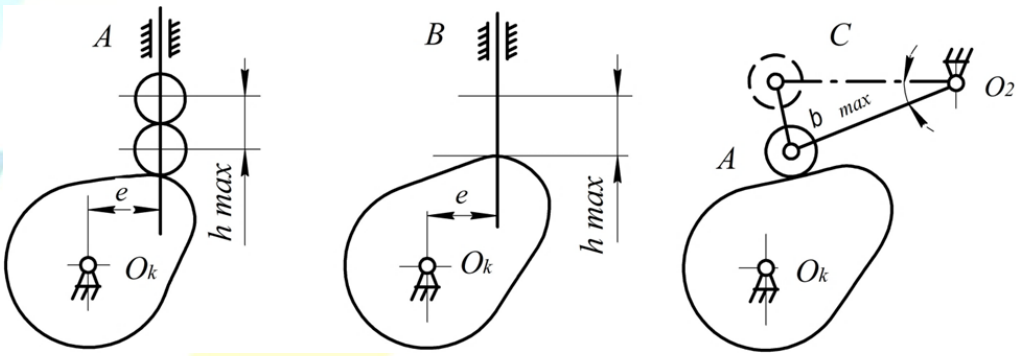


Figure 5.

Piston mechanisms are divided into the following types according to the movement of the actuator: stop-rise-stop, stop-rise-fall-stop, rise-fall-rise; types according to their design: wedge-shaped, spherical, globoidal, cylindrical, conical, disk (radial), spiral, double-disk; types according to the method of maintaining contact with the actuator: there are types of connection by its own weight, by spring force, by geometric shape.

From the above, it can be said that at high speeds, due to the elasticity and inertia of the joints, vibration processes inevitably develop in ball-bearing mechanisms, which ultimately leads to a decrease in performance and reliability.

Conclusion. Sleeve mechanisms are widely used and important mechanisms in mechanical engineering. Their correct design and selection of the appropriate type ensure the reliability and long-term operation of the mechanism. The analysis presented in this article serves as a theoretical basis for the design and practical application of sleeve mechanisms.

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