

Methodological Notes**DEMONSTRATION OF THE MOTION OF THE MASS CENTER OF A  
MECHANICAL SYSTEM**

E. KHAMITOV and S. BAĬGUSKAROV

Bashkirian State Pedagogical Institute, Ufa

Usp. Fiz. Nauk 104, 319 (June, 1971)

IT is known that the mass center of a mechanical system moves like a material point with a mass equal to the sum of the masses of all the bodies of the system, to which the resultant of all the external forces is applied. This important law of the mechanics of a system of bodies is illustrated in lectures with the aid of a "falling board," pendulum on a moving carriage, etc.<sup>[1]</sup>

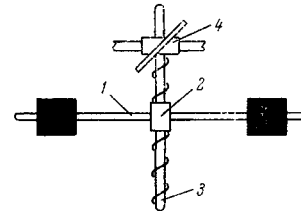
It is useful to supplement such demonstrations with the following simple variant.

The mechanical system consists of two rods 1, fastened to a tube 2, and of two bulky rubber sleeves which can slide over the rods with sufficient friction (see the figure).

A metallic rod 3 on which a wire is helically wound and soldered is mounted vertically at a certain height above the demonstration table with the aid of stands and a sleeve 4. The rod can be replaced by a twisted pair of two steel wires of 3–4 mm diameter. When the system moves downward along the rod, a small projection inside the tube 2 causes the system to rotate.

The rubber sleeves are first placed symmetrically relative to the rod 3, and then the axis of rotation of the system of rods 1 passes through the mass center. In this case the system, once freed from the guiding rod, rotates and falls vertically downward; the mass center of the system moves vertically.

By varying the arrangement of the rubber sleeves, it is possible to displace the mass center away from the rotation axis. Then, moving along a spiral, the mass



center already has a horizontal velocity, in addition to the vertical one, at the instant when the system is released. The mass center therefore moves along a parabola.

Prior to the demonstration, it is necessary to place the guide rod by trial and error in such a way that after the start of the free fall of the system the mass center moves in the plane that is most convenient for observation in the lecture room.

The dimensions of the device are as follows: length of rods 1—15 cm each with diameter 0.5 cm; length of guide rod 3—35 cm. Rubber stoppers No. 45 are used as the sliding weights.

<sup>1</sup>M. A. Grabovskiĭ et al., *Lektsionny demonstratsii po fizike* (Physics Lecture Demonstrations), V. I. Ivernova, ed., Nauka, 1965.

Translated by J. G. Adashko