HOW A SWING IS WORKED—A LECTURE EXPERIMENT.

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Everyone is familiar with swinging by alternately crouching down and standing up in a swing. The process of gradually *increasing* the *amplitude* of the swing is brought about as follows: The start is usually made by jumping back from the ground, and then crouching down while the swing is moving from A to B (Figure 1). At B, the swinger stands up until he reaches C. On the return, the swinger crouches from C to B, and stands up from B to A.

It occurred to the writer some time ago that a lecture experiment to illustrate this process of swinging would be of interest, and the simple apparatus here illustrated and described resulted.

FIGURE 1.

The swing (Figure 2), one meter long, has mounted on the seat a small electromagnet (M) with a movable iron rod for a core. To the upper end of this rod is fastened a brass cylinder of about 100 grams mass. The cylinder is held one and a half inches above the magnet by a spring (S). Wires from the electromagnet are fastened to heavier wires which serve as the swing supports, and connections are made from the upper ends of these wires to a four volt storage battery. A key of the push but-

ton type is mounted on the base, and enables the operator to energize the electromagnet at will.

The swing is given an initial amplitude of three or four inches, and then as it leaves the A position the circuit is closed by the button, and the brass cylinder is pulled down toward the magnet a distance of about half an inch. This represents the crouching position of the swinger. As the swing passes the B position, the

FIGURE 2.

circuit is opened, and the coiled spring raises the brass cylinder to its original position. On the return from C to B, the circuit is closed, and opened at B as before.

Some little practice is required to operate the push button at the proper instant, but when this has been obtained, the amplitude of the swing can be nearly doubled in fifteen to twenty vibrations.

In the actual case of swinging, the energy necessary to maintain and increase the amplitude of the swing is furnished by the

swinger in changing his position from crouching to upright. The kinetic energy of the swinger has increased, and as he stood up his potential energy also increased. He had to *do more work* in bringing his body *in* nearer the axis of rotation. This is easily seen if one considers the *increase* in the force necessary to pull a *revolving* mass in closer to the center.

In the electrical swing, the energy is furnished by the current.

The equations giving the kinetic energies, and the increased angle of swing, are of interest.

Let W represent the weight of the swinger, k , his swing radius about the axis of suspension when crouching from A to B, and k' , when standing up from B to C. The distances of his center of gravity from the axis are r and r' , in the two positions, and θ and θ' , the angles of swing on the AB and BC sides, respectively.

The kinetic energy at B coming from A is

$$E = \frac{Wk^2w^2}{2g} \text{ and at B on leaving}$$

after standing up is

$$E_1 = \frac{Wk_1^2w_1^2}{2g}.$$

The angular momenta are the same, so

$$Wk^2w = Wk_1^2w_1.$$

Therefore,

$$\frac{E}{E_1} = \frac{w}{w_1} = \frac{k_1^2}{k^2} \text{ or } E_1 > E.$$

The angle of swing, θ_1 is given by:

$$\sin \frac{\theta_1}{2} = \frac{k}{k_1} \sqrt{\frac{r}{r_1}} \sin \frac{\theta}{2}.$$

PROSPECTS OF OIL AND GAS IN NORTHERN OKLAHOMA —GOVERNMENT GEOLOGIST MAKES REPORT.

The work of locating places where oil and gas are likely to be found by drilling is a task for painstaking and scientific geology. Although geologists can not positively determine whether oil and gas can be found in any region, they can locate the geologic structures—the rock arches and domes—which have a great influence on the accumulation of oil and gas. For this reason, most of the large oil companies now employ geologists to guide them in leasing and in locating exploratory wells.

The United States Geological Survey, Department of the Interior, has a corps of trained geologists working throughout the country to obtain information that will assist in developing our oil and gas resources, but their work, unlike that of the geologists in the employ of oil and gas companies, is done for the benefit of the country as a whole, and the landowner as well as the oil man can make use of the information they obtain.