

# A NEW DEVICE FOR MEASURING THE TIME BETWEEN COINCIDENCES.

BY OLIN L. WILLS.

*Reed College, Portland, Oregon.*

There are several methods for determining the period of a pendulum by comparison with a standard clock, all of which require the observer to make a judgement which is subject to personal error, it may be of the coincidence of a sound with the passing of a certain part of a body past the cross hairs of a telescope or it may be as to whether the image of a lighted Geissler tube makes a straight line after reflection from two mirrors one of which is stationary and the other is swinging in an arc with the pendulum.

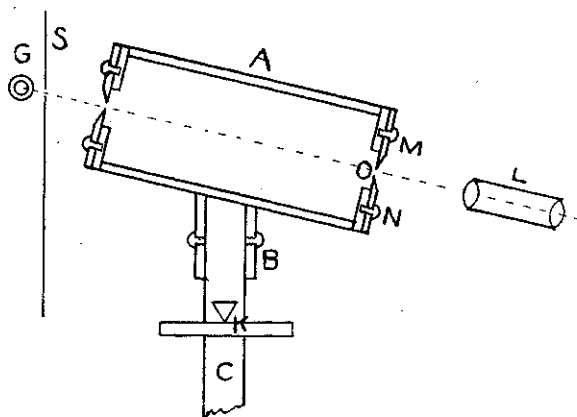


FIG. 1.

The apparatus here described simplifies the operation and gives very accurate results. The operation consists only in recognizing an instantaneous flash of light in which no judgement needs to be made, thus eliminating the personal reaction. The apparatus as illustrated in Fig. 1 was constructed for a Kater's pendulum *C* swinging from knife edges *K*. *A* is a tube on which two end plates are soldered. In these are holes of about half the diameter of the tube. Over these ends are two adjustable slides *M* and *N* with ground edges. The attaching socket *B* is inclined at an angle so that when the pendulum is reversed the telescope will not need to be placed so close to the floor. The whole apparatus is placed on one end of the pendulum. A Geissler tube *G* is placed behind a screen *S* in the rear of the apparatus and a tele-

scope *L* is focussed on the Giessler tube through the slit *O*. The Giessler tube is in circuit with a small induction coil whose primary coil is connected with a battery through the mercury contact of a standard clock. When the clock closes the circuit, that is, when its pendulum is at the lowest part of its swing, the tube flashes. If there is a coincidence, that is, if the pendulum

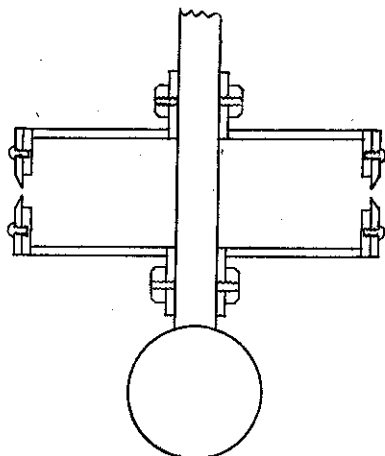


FIG. 2.

*C* is also at its lowest point, the observer can see the light through the telescope. Except at a coincidence no light can be seen. It is obvious that the longer the tube and the narrower the slits the more accurate are the results. A tube about ten centimeters long with slits about one millimeter wide should give good results.

Fig. 2 illustrates a similar piece of apparatus that has a more general application. It consists of two parts so that it can be clamped to any form of pendulum.

#### INDIANS MINED COPPER.

The copper product of Michigan is largely native and is considered for some purposes superior to "electrolytic" copper. "Lake" copper, as the product of Michigan is generally known in the trade, sells generally at about a quarter of a cent a pound above other coppers. The mining of copper in Michigan is of prehistoric origin, the metal having been used by the North American Indians before the advent of the white man. The development of copper mining, however, began in 1845, and since that date to the close of 1913 the production has amounted to over 5,335,000,000 pounds, or about 30 per cent of the total output of the United States.