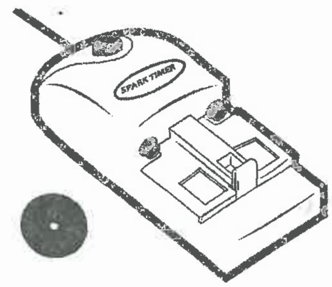
095-18574
Acceleration Spark Timer

Overview:

This apparatus is used for determining the rate of acceleration in a falling weight, calculating the speed of a moving cart or studying the forces of friction. A paper tape is pulled through the timer while a spark at a very precise internal is created which burns tiny dots in the paper strip as it passes. The faster the strip passes through the sparks the larger will be the distance between the dots. It is then easy for the student to calculate the rate of speed for acceleration. As an added benefit, everything on the spark timer is enclosed for safety.



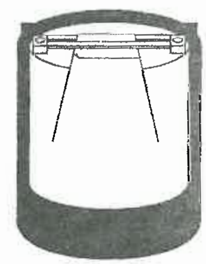
No physics class should be without a good acceleration timer. This acceleration timer is designed as a less expensive alternative to higher priced photogate timers and ultrasonic measuring devices as well as having the added benefit of creating a permanent record of the action being studied.

There are several different acceleration timers on the market. Most of these use a strip of paper attached to the object of study, to record the motion of the object. The problem with many timers is a flaw in their original design in which contact is made with the paper strip that is attached to the item of study. This contact, which is necessary to mark the paper in periodic increments, will also affect the outcome of the experiment due to added friction and the influence of the object of study. Some units use a cheap motor with a battery which does not provide a regular speed especially as the battery looses some of it's charge. A second type uses 110v AC and relies on the fact that household current cycles at 50 or 60 hertz and at a very precise interval. But this buzzer type timer also strikes the drag strip paper to make a mark as the paper passes underneath and so you still encounter the problems of interference and added friction to your experiment.

The best type of acceleration timer (excluding photogates and ultrasonic) is the spark timer. The spark timer uses the same type of drag strip paper used in other timers, however the problem of interference has been eliminated. This is because as the paper travels through the timer, precision timed sparks are created. These sparks burn tiny dots into the paper strip as it passes, without actually touching the strip. The faster the strip passes through the sparks the larger the distance between dots. By knowing the exact frequency of the sparks, it is easy for the student to calculate the rate of acceleration.

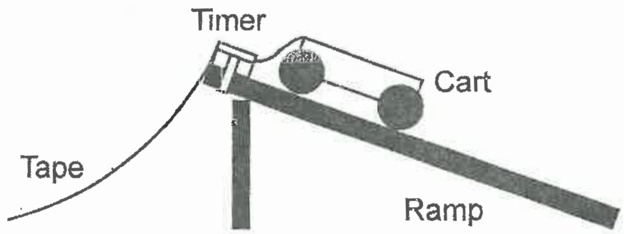
Experiments:

For this experiment you will need nothing more than the spark timer, paper strip and the weight which comes as part of the acceleration timer package. Attach the weight as shown in the illustration. Tear off about four feet of paper.



Next mount the timer to the edge of the table. Make sure that the weight and paper are clear to fall straight down over the edge. Measure the height of the edge of the table to the floor. Make sure that you write this number down.

Now turn on the timer and drop the weight. After the fall is over take a look at your paper strip and notice the patterns of the dots. They should look something like the pattern shown in the previous illustrations of the paper tape. Using a meter stick, measure the distance between the marks. You should observe that the marks got further apart as time went on. This is due to the effects of the acceleration of gravity. As an object falls it is continuously accelerating.



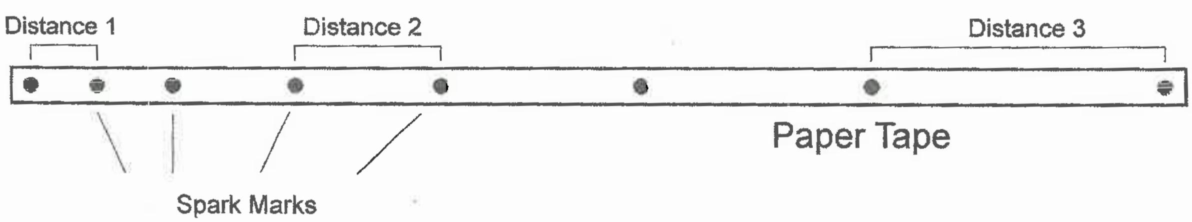
Next try mounting a piece of timer tape to cart. You may need about eight feet for this. Mount the timer as shown and set up the ramp. Allow the cart to travel down the ramp and roll across the table while pulling the tape. You should notice from the marks on the strip that the dots started off close together, got further apart and then slowly got closer together. This coincides with the actions of the cart starting from a resting state, accelerating and then losing momentum and once again slowing back down.

Now add about 200 grams of mass to your cart and repeat the above experiment. What change did you notice in the new paper strip? Place the two paper strips side by side on the table so that you can make a direct comparison.

The increased mass increases the resistance to a change in acceleration due to momentum. This is why you will notice more dots closer together than in the first test. Because the cart was resisting more with the increase in acceleration. However, once the cart got up to speed you will notice with the dots that it also resisted slowing down. An increase of mass causes an increase in resistance to acceleration regardless in that acceleration is up or down.

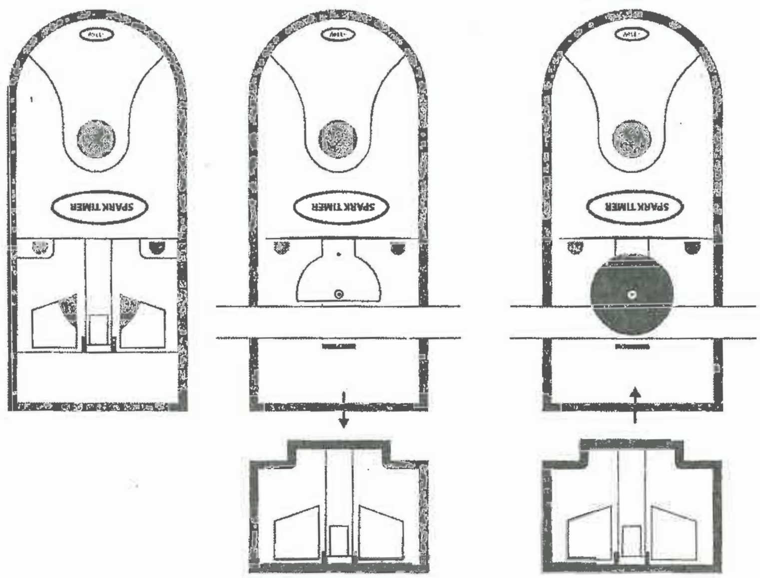
Going one step further:
Is it possible to calculate the speed of a moving cart using the spark timer? Yes it is. Lets suppose that you have a strip of timer paper six meters long and this is attached to a cart. Keep in mind that the sparks are being produced at sixty times per second. Take a meter stick and place one end on a dot and mark this dot. Second make a mark from this first mark one meter long. Third, count the number of dots between the two marks. Lets say that there were thirty dots between these two marks. This means that the cart at this particular moment in time, was traveling at two meters per second (60 dots per meter per second divided by 30 dots). The 60 Hz cycle makes it very easy to calculate the speed. Because if a 1 meter strip has 60 dots within it, it means that the strip was traveling at one meter per second. So we can use this as a mathematical constant. If an area one meter long has 100 dots in it then 60/100 = .6 meters per second. If an area one meter long has 20 dots in it then 60/20 = 3 meters per second. Always count up the number of dots inside a one meter long area and then divide this into 60. Of course this will only give you an average speed and does not take into count accelerating up or down.

When performing the experiments, use a meter stick to measure the distance between the marks. You should observe that the marks get further apart as time goes on. In other words, although the sparks are being made at the same periodic time, as the paper is pulled through faster, the distance will increase.



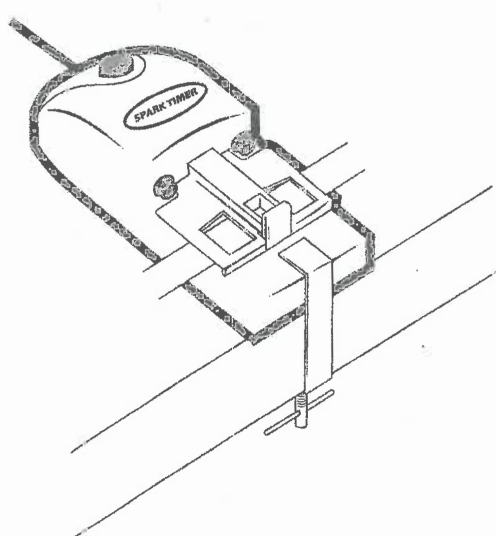
Setting up the timer:

Open the top of the unit by pressing in on the front clip as shown in the illustration with your finger or a blunt object. While holding this clip in, swing the top lid up and out of the slots mounted in the back side. This will exposed the pin for the carbon paper wheel. Place one sheet of carbon disk on the pin as shown and then close the unit by replacing the cover. Make sure that everything snaps back together securely.



In preparing the unit for performing experiments, make sure that the paper tape is running under the carbon wheel.

One final note before you get started. You may want to clamp the unit down to the table using the C-clamp that is also provided. Although this is not necessary and is not possible in some situations, it can help to insure a more accurate reading. The clamp is capable of mounting the unit to a table with a thickness of 1 3/8" (3.5cm) or less. See the illustration for mounting of the clamp.



CYNMAR
86475 Gene Lasserre Blvd.
Yulee, FL • 32097
904-849-1111
Toll Free: 1-800-223-3517
Fax: 1-800-754-5154
E-Mail: cynmar@cynmar.com
Website: www.cynmar.com