

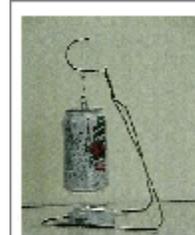
# Hero's Engine

## Description

An easy steam engine (Hero's engine) is constructed from a soda can and a swivel. Burning fuel heats the engine to produce steam. The chemical energy in the fuel is converted to a frantic rotation of the can illustrating the conversion of chemical energy to thermal energy to mechanical energy.

## Chemical Concepts

- ! Energy is conserved.
- ! Chemical energy may be converted into kinetic energy.
- ! The energy of reaction is the difference in potential energy stored in chemical bonds before and after reaction.
- ! Kinetic energy may be used to do work.



## Safety

Keep a fire extinguisher and/or a soaking wet towel nearby.  
Wear safety goggles.

## Procedure

Using an unopened soda can, turn the ring-shaped opening tab 180° so it overlaps the oval-shaped seal. Then carefully bend it so it extends straight upward without breaking the seal to provide a convenient handle. If the seal around the mouth should break, start again with a new can. This step can get messy! Lay the soda can on its side, and firmly press a pin into the can. Note: depending on the can's orientation, soda may squirt out of the hole. Pivot the pin to one side in order to distort the hole so that it opens tangential to the side of the can. Hold the can hole-side down over a sink or cup and gently shake to facilitate the draining of the soda.

When the pressure in the can, no longer squirts soda out, make a second hole directly opposite the first (or at a 90 degree angle to the first hole). Pivot the pin to distort the hole. (Important: the holes must both open tangentially in the same direction - both clockwise or both counterclockwise.) Empty all soda out of the can. Either place the can in a sink with one hole down for a few minutes or blow in the top hole to force the liquid out the bottom hole.

Fill the can 1/8 to 1/4 full with water. This may be done by any of a number of ways; perhaps the simplest is just to place the can on its side in a pan containing 2-3 cm of water, with one hole on bottom (submerged), and let the water leak in over the course of 10-15 minutes. Placing something over the can to weight it down into the water more facilitates this filling process. (Submerging the can completely does not work as well.) Squeezing the can gently to force air out while completely submerged can speed up the process.

One end of the swivel opens like a safety pin. Clip this end of the swivel to the tab of the can. The source of fuel is sterno.

Attach the other end of the swivel to the stand. Establish a cool flame on a Bunsen burner and place it under the can, adjusting the ring height if necessary. An inexpensive stand may be made by bending a hanger. Slip the other end of the swivel directly onto the hook of the hanger.

Once the water inside starts boiling and the steam starts spurting out the pin holes, the can begins spinning quite rapidly, and continues for several minutes. (To increase the duration of the spin, use more water, but expect a proportionately longer heat-up period.)

Time: 35 minutes

Materials: Sterno, soda can (top seal intact), straight pin, swivel (fishing tackle), ring stand or hanger stand, Bunsen burner or container in which to burn fuel (second soda can)

<http://chemmovies.unl.edu/chemistry/beckerdemos/BD053.html>