



OMAHA MAKER GROUP



Explore Technology, Science, & Art

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How to Make a Hero's Steam Engine

Description:

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

Materials:

Unopened soda can, thread, a small nail or pin, thread, something to hang the can over the fuel, candle or "Sterno" fuel, lighter, gloves

Step 1 Do this outside or over a sink. Use a pin or small nail to make a hole in the side of a soda can. The can must still be unopened. When you pull the pin out there will likely be some spray.

Step 2 Empty the can through the pinhole. Depending on the soda in the can, shaking it will increase the pressure in the can causing the soda to come out faster. Don't worry if there's a little soda left when you're done.

Step 3 Make another hole in the other side of the can.

Step 4 Put the pin back in one of the holes and pull it down as shown in the photos below. This modifies the hole enough for the steam to later come out at an angle with respect to the can.

Step 5 Do the same for the other hole, pulling the pin in the same direction with respect to the can.

Step 6 Put a little water in the can through one of the small holes. It doesn't need to be much, and less is better than more since it takes time to heat the water to steam.



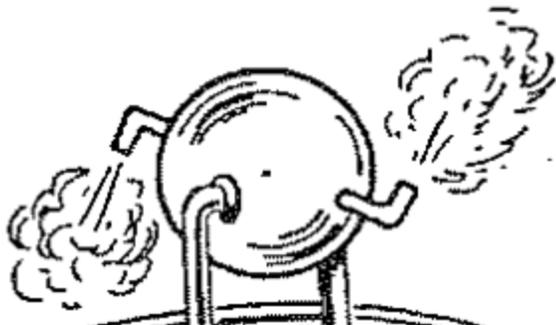
Step 7 To hang the can, find something to hang it from. You can use a wire coat hanger, PVC, or a shelf.

Step 8 Gently lift up on the tab in the top of the can and put the thread under it. Make sure you don't break the seal at the top of the can. The only openings in the can should be the two holes you made in the sides. You can see that there's a small circle (really a rivet) in the top of the can. That circle is in the center, so the string should be centered over that. Adjust the length of the thread so the can is about 1" over the fuel.



Step 9 Light up the candle or Sterno fuel. Take all necessary safety precautions.

Step 10 Heat the bottom of the can. The candle/Sterno will take a while to heat the water in the can to boiling, so you might use a butane torch to add additional heat. The water will start to boil. When it does, it rotates quite fast.



Brief History:

The basic concept is over 2,000 years old! An **aeolipile** (or **aeolipyle**, or **eolipile**), also known as a **Hero's engine**, is a simple bladeless radial steam turbine which spins when the central water container is heated. Torque is produced by steam jets exiting the turbine, much like a tip jet or rocket engine. In the 1st century AD, Hero of Alexandria described the device in Roman Egypt, and many sources give him the credit for its invention.

The aeolipile which Hero described is considered to be the first recorded steam engine or reaction steam turbine. The name – derived from the Greek word Αἰολος and Latin word *pila* – translates to "the ball of Aeolus", Aeolus being the Greek god of the air and wind.

The aeolipile consists of a vessel, usually a "simple" solid of revolution, such as a sphere or a cylinder, arranged to rotate on its axis, having oppositely bent or curved nozzles projecting from it (tipjets). When the vessel is pressurized with steam, steam is expelled through the nozzles, which generates thrust due to the rocket principle as a consequence of the 2nd and 3rd of Newton's laws of motion. When the nozzles, pointing in different directions, produce forces along different lines of action perpendicular to the axis of the bearings, the thrusts combine to result in a rotational moment (mechanical couple), or torque, causing the vessel to spin about its axis. Aerodynamic drag and frictional forces in the bearings build up quickly with increasing rotational speed (rpm) and consume the accelerating torque, eventually cancelling it and achieving a steady state speed.

Other Resources:

<https://www.flinnsci.com/api/library/Download/88a197faa21144a48bafdf639fcbd5bd>

<https://en.wikipedia.org/wiki/Aeolipile>

<https://www.ancient-origins.net/ancient-technology/ancient-invention-steam-engine-hero-alexandria-001467>

<https://kotaku.com/the-greek-engineer-who-invented-the-steam-engine-2-000-5742457>

https://rimstar.org/science_electronics_projects/heros_steam_engine_soda_can.htm

<http://dwb5.unl.edu/CHEM/Becker/Becker-053.html>

<https://sci-toys.com/scitoys/scitoys/thermo/thermo.html>

<https://www.instructables.com/id/Heros-Engine/>

<https://www.howtosmile.org/resource/smile-000-000-001-039>