

612-1325 (15-020) Hero's Engine

Introduction: Hero of Alexandria is perhaps the premier inventor of the ancient world. He taught at the library of Alexandria, the greatest repository of knowledge of that age. Among other inventions, he produced a vending machine, a windmill, and a stand alone fountain. His Engine is one of the first known examples of a steam engine. It also incorporates jet propulsion, though it would be many years before this technology became useful.

Hero's Engine is a type of aeolipile. Hero did not invent the instrument, which is a common misconception. Aeolipiles had been described at least 100 years earlier. However, he did publish the definitive work on the subject in *Pneumatica*, a work on air and water pressure, and the effects of steam.

The Engine operates on a simple principle: the expansive properties of steam. When water is boiled, it produces steam, which is essentially water vapor. This gas is many times the volume of water. If water is boiled in an enclosed container, the volume of steam will increase, producing a corresponding increase in pressure. If steam cannot escape it may destroy the vessel holding it!

Hero's Engine is essentially a sealed container, in which water is boiled. Steam is produced and the pressure inside the chamber climbs. In Hero's design, two arms are attached to the chamber, and have a 90° bend to them. This bend causes the ends of the arms to point in opposite directions. If these arms are tubular, steam will escape through them, moving rapidly in opposite directions from the chamber. This will produce a force in accordance with Newton's third law: an action produces an equal and opposite reaction. If the chamber is free to rotate, this force will cause it to spin. Note: our Hero's engine is of a slightly different design. Instead of a spherical chamber with two nozzles, it consists of a flask with two arms, each of which has two bends to direct the steam.

The force produced by the escaping steam is a form of jet propulsion. Although it may be possible to use the engine to rotate a piece of machinery, there is no evidence that the device was ever used to perform useful work.

Operation: To use your Hero's engine, you will need the following items:

- ❑ 1 Bunsen burner.
- ❑ a length of string, enough to reach from a table top to the ceiling.
- ❑ a clip to attach the string to the ceiling.

To use the Engine, place your Bunsen burner on a table, and suspend the Engine a few inches above the highest point of the flame. To hang the Engine, attach the string to the top of the swivel on the chain. The chain should be aligned such that the two segments are set perpendicular to the arms.



Make sure the unit is free to swivel. When you have secured the Engine, fill it about 1/3 of the way full. Check to be certain that the stopper is fitted firmly into the neck of the flask; if the stopper is too loose, steam pressure may cause it to fly off.

Activate your Bunsen burner to boil the water inside. Soon, steam will escape from the nozzles, causing the unit to rotate.

After you have used the engine, be sure to give it ample time to cool. The glass can become very hot and poses a safety hazard if insufficient time is allowed for cool-down. As an added precaution, use a hand protector when handling the hot unit.

Warranty and Parts:

We replace all defective or missing parts free of charge. Additional replacement parts may be ordered toll-free. We accept MasterCard, Visa, checks and School P.O.s. All products warranted to be free from defect for 90 days. Does not apply to accident, misuse or normal wear and tear. Intended for children 13 years of age and up. This item is not a toy. It may contain small parts that can be choking hazards. Adult supervision is required.