

# Pop-pop Steam Boat

## Equipment:

pop-pop boat  
big bowl, washtub, small pool or the like  
candle  
matches or lighter  
plastic dropper

## “Chemicals”:

water

## Safety:

The precautions usual in everyday life for handling burning candles have to be observed. Since the boat will get hot, one should not touch it during or shortly after its operating.

## Procedure:

Using the plastic dropper, water is filled into one of the exhaust pipes of the boat until it flows out of the second pipe. The boat is put carefully into the water in a bowl (or the like) making sure that the water stays in the boiler and both exhaust pipes are under the water. The candle is placed into the holder and the wick is lighted. Subsequently, the holder is gently placed underneath the boiler.

## Observation:

After a short while, the boat begins to move with the typical “popping” noise.

## Explanation:

The pop-pop boat is powered by a very simple heat engine without moving parts. The candle heats the water in the boiler. When the water boils it creates a brief burst of wet steam (a mixture of hot water and steam), which is expelled through the pipes in the rear of the boat and the boat moves forward in response to the jet of wet steam (phase 1). Upon leaving the boiler, some of the steam condenses in the cooler part of the pipes thereby creating a partial vacuum, which refills the pipes and boiler with water (phase 2). The cycle can begin again.

The boiler consists of a small metal pan whose top is a slightly convex piece of very thin, springy metal that flexes with the expanding and contracting steam. The resulting rattle gives the pop-pop boat its name.

