The apparatus consists of an embroidery hoop fastened to a lab rod. A piece of paper (which can be borrowed from a student) is clamped between the two parts of the hoop which is then clamped to a ring stand. Pour in enough water to completely cover the paper, and place under it a bunsen burner. In a very short period of time the water will begin to boil. Shadow projection using a high-intensity lamp makes the steam much more visible to the audience and obviates the need for such statements as "even though you can't see this, the water is now boiling very nicely."

That the paper does not burn depends on two points:

a. The temperature of the upper surface of the paper is that of the water, which will not go above 100 degrees.

b. The temperature of the lower surface of the paper is limited by heat conduction through the thickness of the paper.

A quantitative illustration helps to make the point. For example, suppose you are boiling away 1 gram of water per minute. Then

\[ \frac{Q}{t} = 540 \text{ cal/60s.} \sim 10 \text{ cal/sec.} \]

and

\[ \frac{Q}{t} = k A \frac{\Delta T}{\Delta x} \]

where \( k \) is the thermal conductivity, about \( 3 \times 10^{-4} \) in cgs units. With \( A \) about 100 sq. cm., and \( \Delta x \) about .005 cm, this gives

\[ \Delta T \sim 2^\circ. \]

So, neglecting a few details, the temperature of the lower surface of the paper should not rise above about 102 degrees.