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For the 2nd group image, the flow investigated is a fire. Fire is a natural phenomenon that can be displayed in many different ways. Every picture of a fire is different. There was a slight breeze outside so there was a possibility of a capturing a fire vortex. After taking dozens of pictures, I was finally able to capture a vortex in the fire which can be seen in the photo.

Sticks were picked off of the ground and were placed in a fire pit. The sticks were then lit on fire with a propane torch until the sticks were able to burn without the aid of the torch. The sticks took about a minute of torching to begin to burn. A schematic of the apparatus can be seen below.

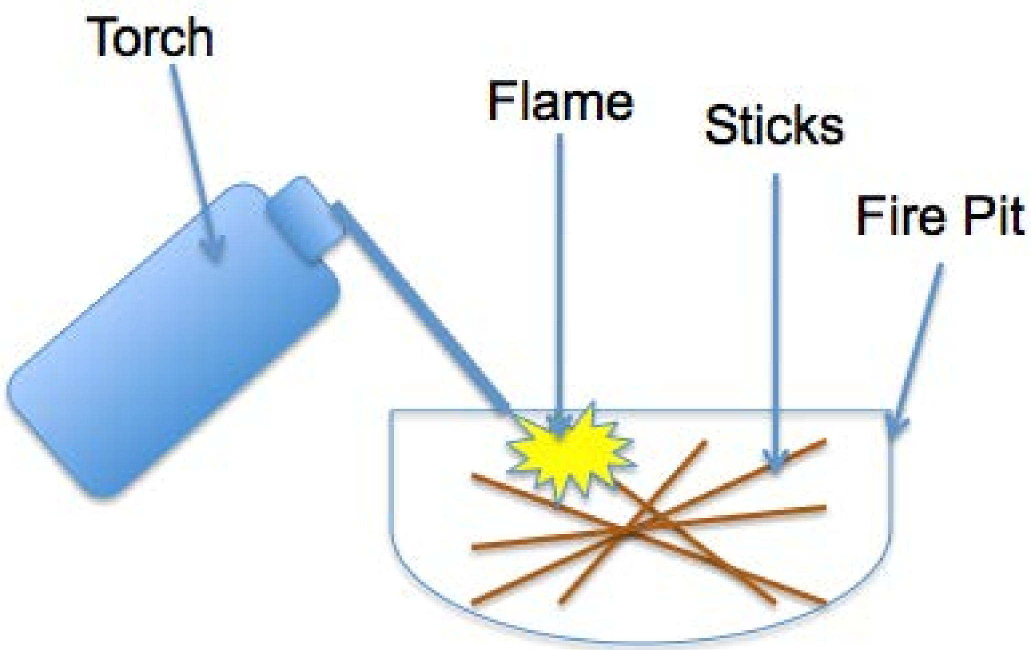

Figure 1. Shows the Flow Apparatus

Fire occurs through the process of combustion. The sticks are the fuel to the combustion in which the oxygen from the flame oxidizes the sticks and turns them into carbon. Combustion is an exothermic chemical reaction where the sticks are the fuel and the flame from the propane torch is the oxidant. The resulting flames rise up due to the flame being less dense and hotter than the surrounding air. At the top of the picture is a small vortex, this can be classified as a Type 1 fire whirl. To analyze the flow, the Reynolds number will be calculated assuming the flow is air. Assuming the temperature of the fire to be 800K, the kinematic viscosity of air at 800K is $8.23 \times 10^{-6}\ m^2/s$. The velocity at the tangential can be assumed to the speed of the wind at 5 mph or 2.23 m/s. The characteristic length is the diameter of the vortex, 5 cm. The flow can be characterized by its Reynolds number:

$$\mathrm{Re} = \frac{VD}{\upsilon} = \frac{(2.23m/s)(0.05m)}{8.23 \times 10^{-6} m^2/s} = 13548$$

where:

V = velocity
D = diameter of vortex
υ = kinematic viscosity

The flame motion is turbulent and can just one can tell just by looking at the photo. One can tell from the irregularities in the photo. The Reynolds number is larger than 5000, which also hints that the flame is turbulent.

To create the best scenario for photographing the flame, the picture was taken at night. Photographing at night helped ensure that the flame as only light source in the photo. The photo was taken with a Nikon D60 camera. This was used in collaboration with a Nikon DX 18-55 mm lens. To capture the flames in motion, 1/200 shutter speed was used. An aperture of f/3.5 in coordination with an ISO of 800 worked well for the lighting provided by the flame. The distance from the fire was 1 foot away. Photo editing was done with iPhoto. The contrast and exposure were slightly adjusted to enhance the flame color. Sharpness was also increased to get a more focused image. A great deal of editing was done to edit out the majority of the sticks from the photo to focus on the flame itself. The original and post-processed photo can be seen below.

Figure 2. Shows the flame before and after the photo editing

The 2nd team image shows a flame vortex that wraps around another flame. I like that the image was able to come out in such good detail. Adjusting the camera to capture the flame with minimal motion blur was not easy and took many trials. The final editing isolated the flame from its surroundings and enhanced the flame to where it showed much more depth.

The photo quality could have been improved by taking the picture from a closer position. Some quality seemed to be lost with the cropping of the image

References:

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