

## Fluidized Sand Bed

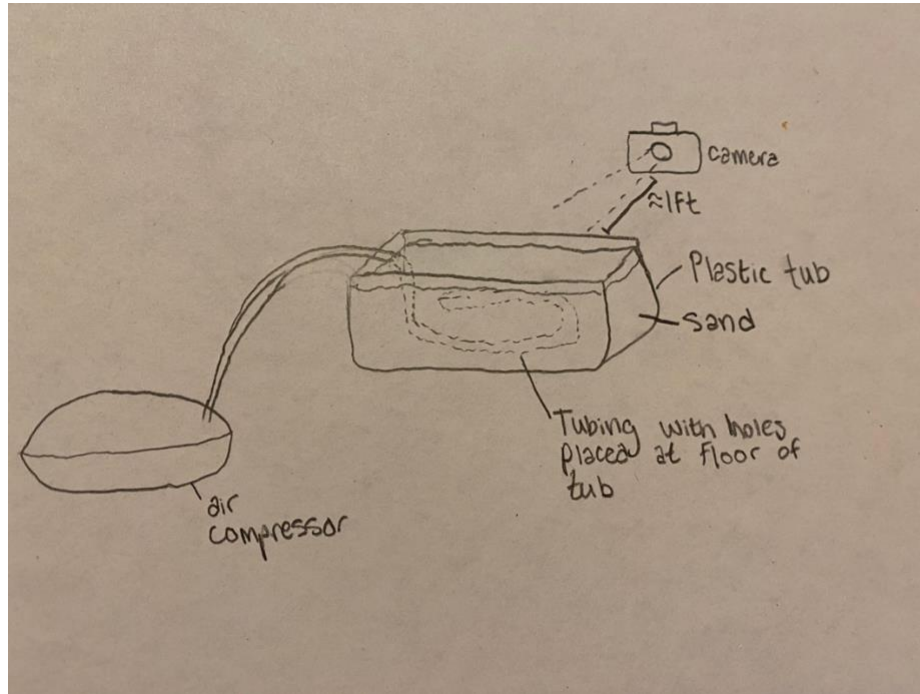
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### Background

The purpose of this image assignment was to capture the complex phenomena of a fluidized bed using sand. From an artistic perspective, our group wanted to capture the different movements of the sand that can be created by pumping air into a bed of sand. This phenomenon was selected because it is very intriguing to be able to take a solid and make it have fluid properties. A common example of this phenomenon is quicksand, which is a combination of air pockets and sand. As a group we decided to capture this phenomenon in a video instead of a photograph since the movement would be so fast and difficult to capture adequately without a high-speed camera. The tubing and air compressor were provided by Sam Brown.

### Flow Apparatus



To create the flow captured, holes were poked in plastic tubing 1.25 in. apart by Sam and wrapped around the base of a 9'' x 14'' plastic tub. The tubing was also connected to an air compressor. Finely processed sand was then poured over the tubing until the tub was mostly full. The air compressor was then turned on full power and a video was taken of the fluid bed that formed. The physics of this bed mostly involve the air that flows between the particles of sand. When the air is blown into the container, it increases the space between sand particles. This space allows the particles to move more freely among each other because the internal friction in the sand is reduced. As a result, the particles are allowed to move freely as particles do in a liquid (Rossignol, 2017).

### Visualization Technique

The experiment was performed using a clear plastic bin. The purpose of this was to be able to see cross sections of the flow. A 150-psi air compressor was used to deliver the pressurized air into the bin. We used clear plastic tubing so that it did not cause any obvious

distractions in our shots. The video was taken in a garage, with a ceiling light. Additional lighting included the flashlight from both Dawood and mine's iPhones.

### **Photographic Technique**

The video was taken on my Nikon D3300 DSLR camera. We chose to use this because the 18-55mm DX lens has a vibration reduction setting. This was slightly helpful because we did not have a tripod and there was obvious movement in the frame from me holding the camera, so the movement was very slightly decreased. The video was shot at 359 ISO, f/4.2 aperture, and the dimensions were 1920 x 1080 pixels. The depth of field was about 1ft and the field of view was the tub at 9'' x 14''. The video was edited in iMovie. Although the final video was 1 shot, I cut 2 separate videos of the fluidized bed together so that the audience could see the phenomenon from different angles. I removed the sound from the original videos and added background music. I also slowed down the video to 0.5x the original speed because the sand was moving very fast and could be visualized better when it was slowed down.

### **Image Analysis**

Overall, I enjoyed my video because I think it reveals how the appearance of a state of matter can be made to appear different, even for a well-known solid substance like sand. I think that the video adequately captures the fluid physics of a fluidized bed. I do not like that the image has a lot of motion from not using a tripod. I also think that the depth of field could be increased. If I were to repeat this project, I would try using a slow-motion camera on a tripod to try and capture a clearer video of each sand particle moving.

### **Resources**

Rossignol, D. (2017, September 9). Sand Instantly Turns Into a Fluid If You Blow Air Through It. Retrieved November 11, 2019, from <https://nerdist.com/article/sand-fluid-air-bubble-fluidized-bed/>.