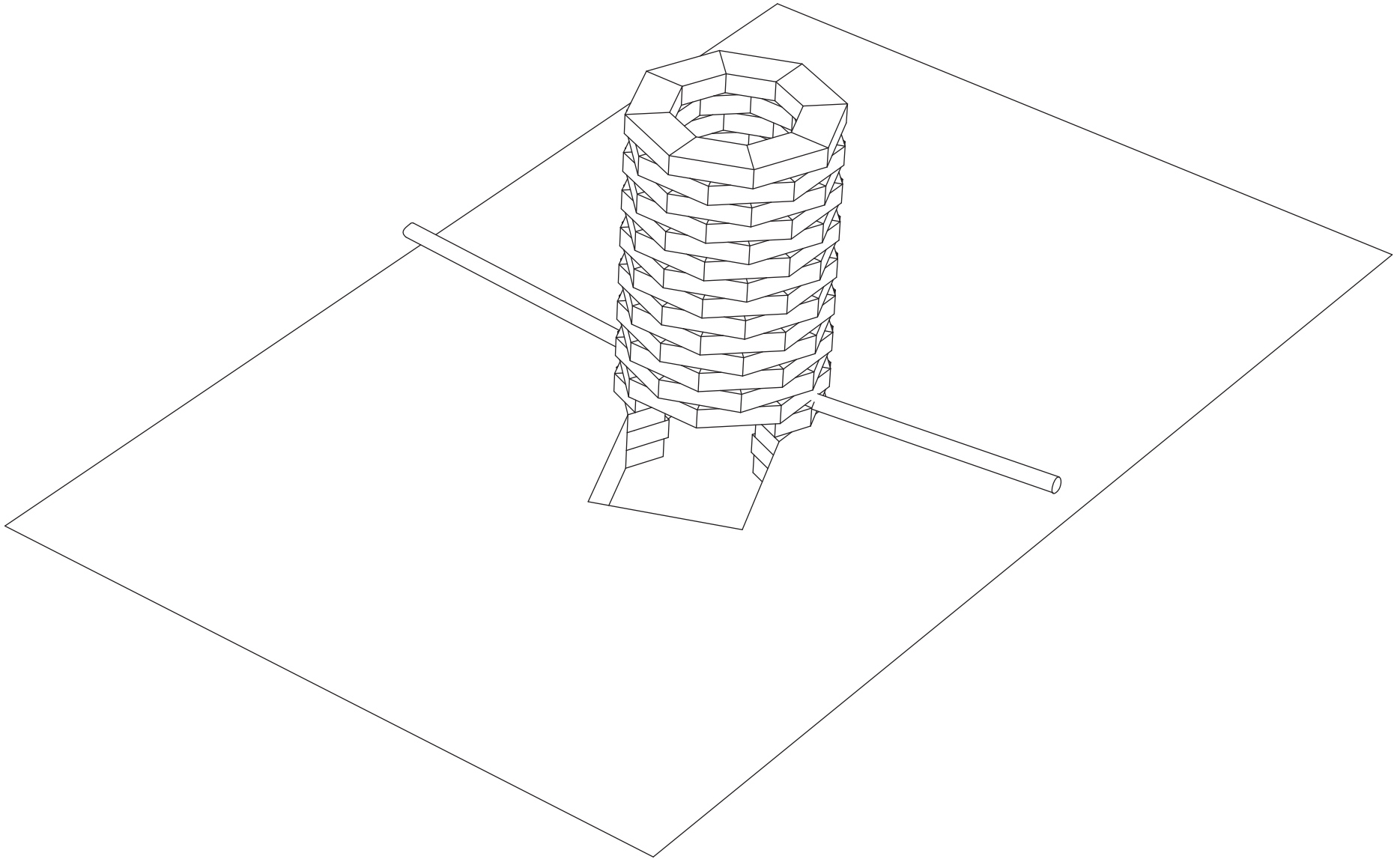


Arch 'n Craft Practicum- Week 4

BLOOMERY DESIGN

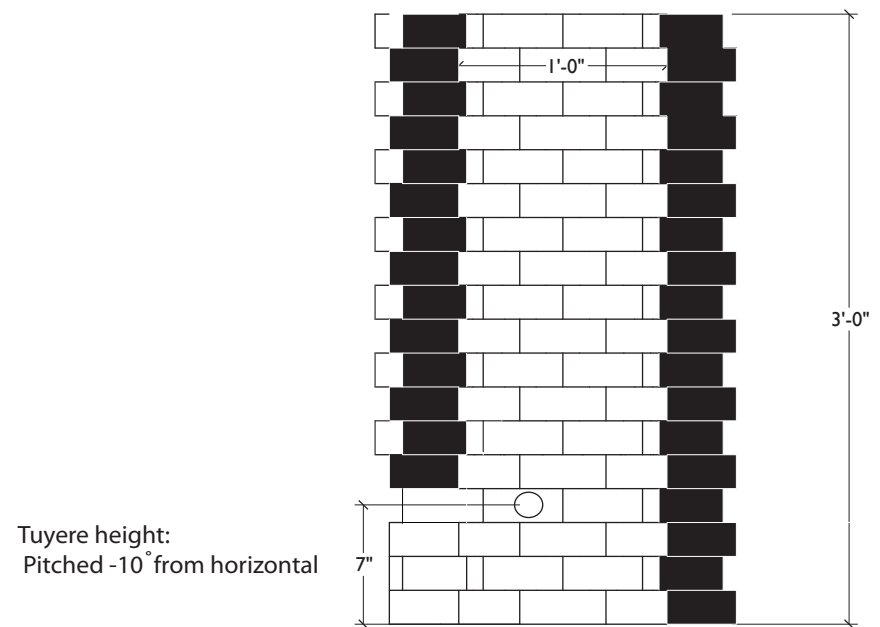
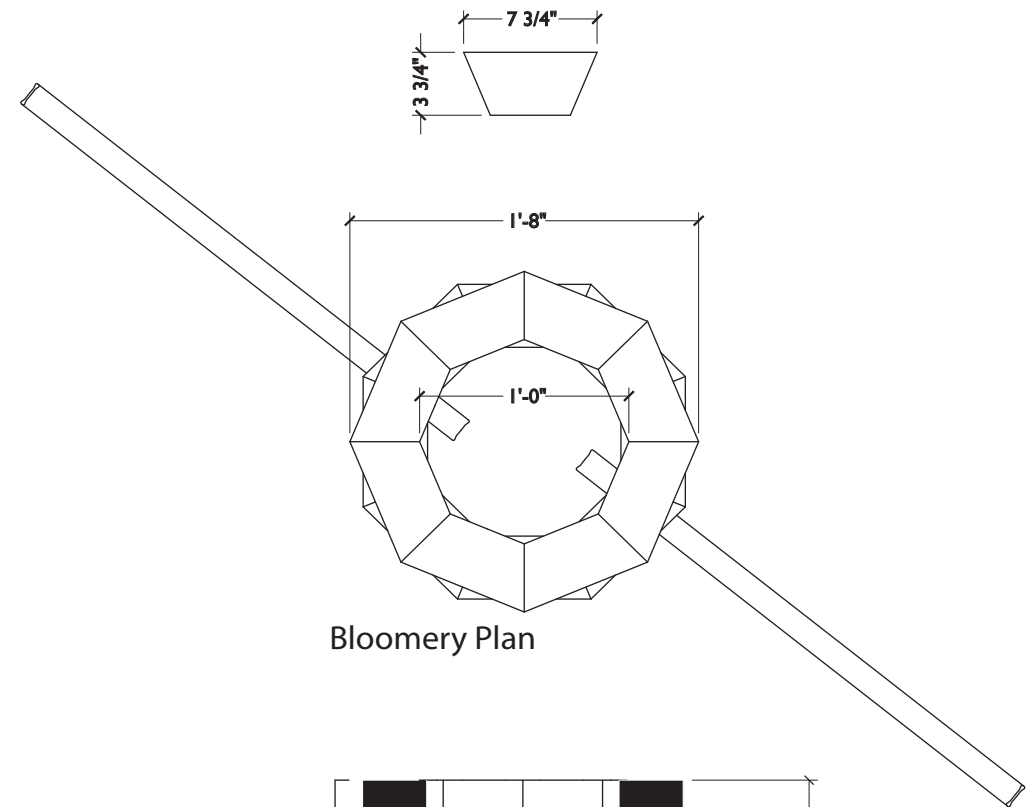


The Stack:

In our ideal model we would use refractory bricks, either rectangular bricks or curved bricks which would help us make a circular stack. The stack would be around 3 feet tall with a 1 foot diameter for the inner wall of the stack. There will be openings about 3 brick lengths up (6-9 inches) from the ground on opposite ends of the stack. Attached to these openings will be our tuyeres which in turn will connect to our air sources. Building a circular stack would be beneficial to the type of air distribution we want to create within our furnace; using two angled tuyeres we would like air to move clockwise and counterclockwise. We would like to line the inside of the stack with clay to provide further insulation. Refractory bricks would be an ideal material to use because the minerals they are composed of do not change chemically when exposed to high heat, some examples of these materials are aluminum, manganese, silica and zirconium.

Other comments:

Although we have opted to use refractory bricks, which would be practical for our intended purpose, we briefly considered using Vycor glass which can withstand high temperatures of up to 900 degrees celsius or approximately 1652 degrees Fahrenheit, which would be enough for our purposes.

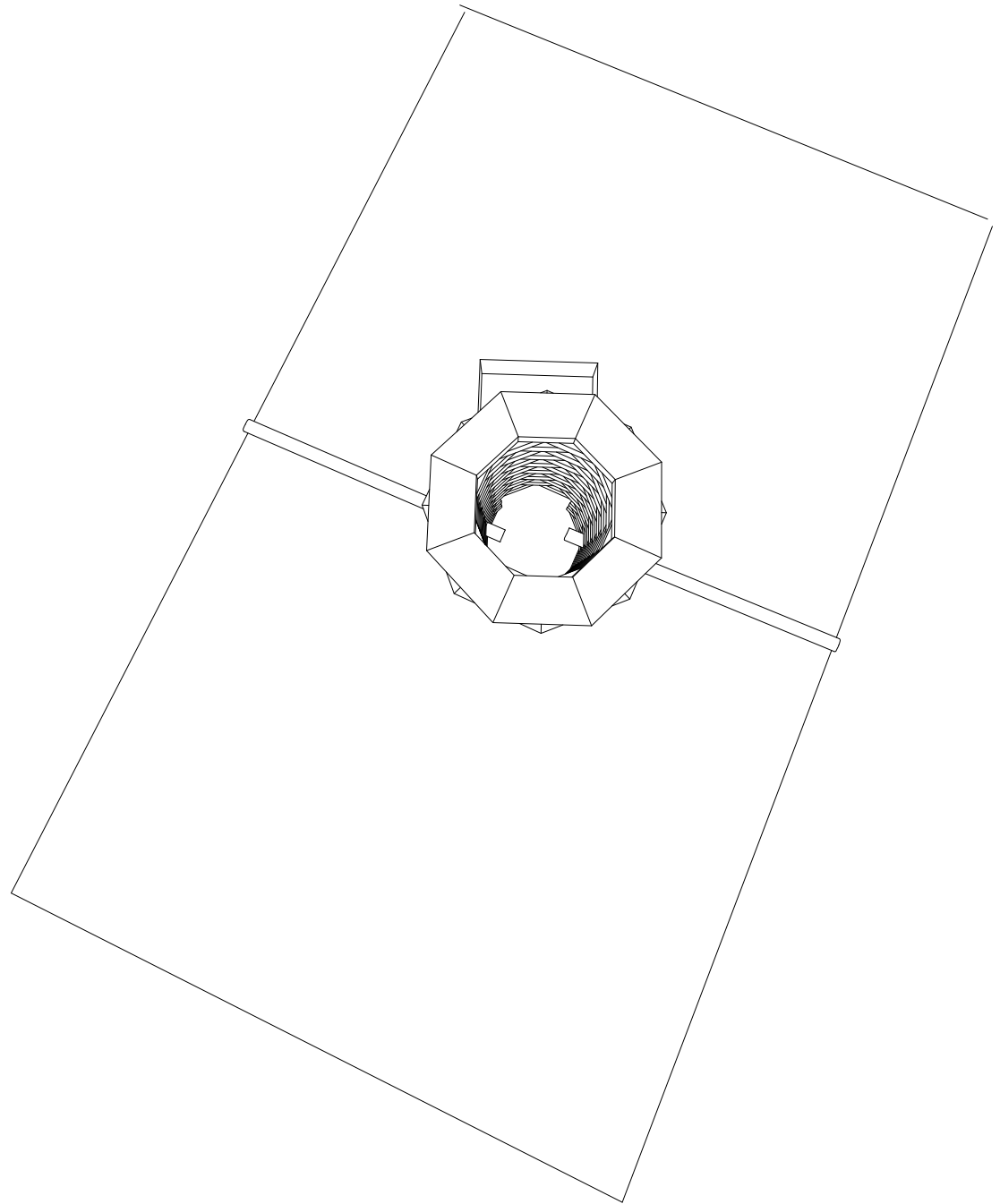


Tuyere height:
Pitched -10° from horizontal

Bloomery Section

Ore/ Charcoal:

Our group has decided to use Magnetite ore along with charcoal for the smelt. After reading anecdotes from various modern smelts, we chose a 1:1 ore to fuel ratio. Given the size of our brick furnace, using 100 lbs of each ore and charcoal should yield a bloom of decent size. We plan to have the raw materials undergo a series of preparation stages before the smelt. First, we take our lump charcoal and break them into 1-inch or smaller pieces. Second, we pound the ore into fist-sized pieces and spread them on top of a large wood fire built in a shallow pit. Third, after the pieces have been orange/red hot for some time, we remove them from the fire and pick out obvious impurities that came up white. Next, we quench the ore pieces in water so they will fracture a bit before being manually pound to pea-size. They are then left to air dry for a couple of days. On the day of the smelt, we first preheat the furnace by lighting up 10 lbs of charcoal at its bottom. The prepared raw materials will then be divided into 5 charges, each with 20 lbs of ore and charcoal respectively. Once the furnace is preheated well, we will add the charges at 20-30 minute intervals for the smelt.

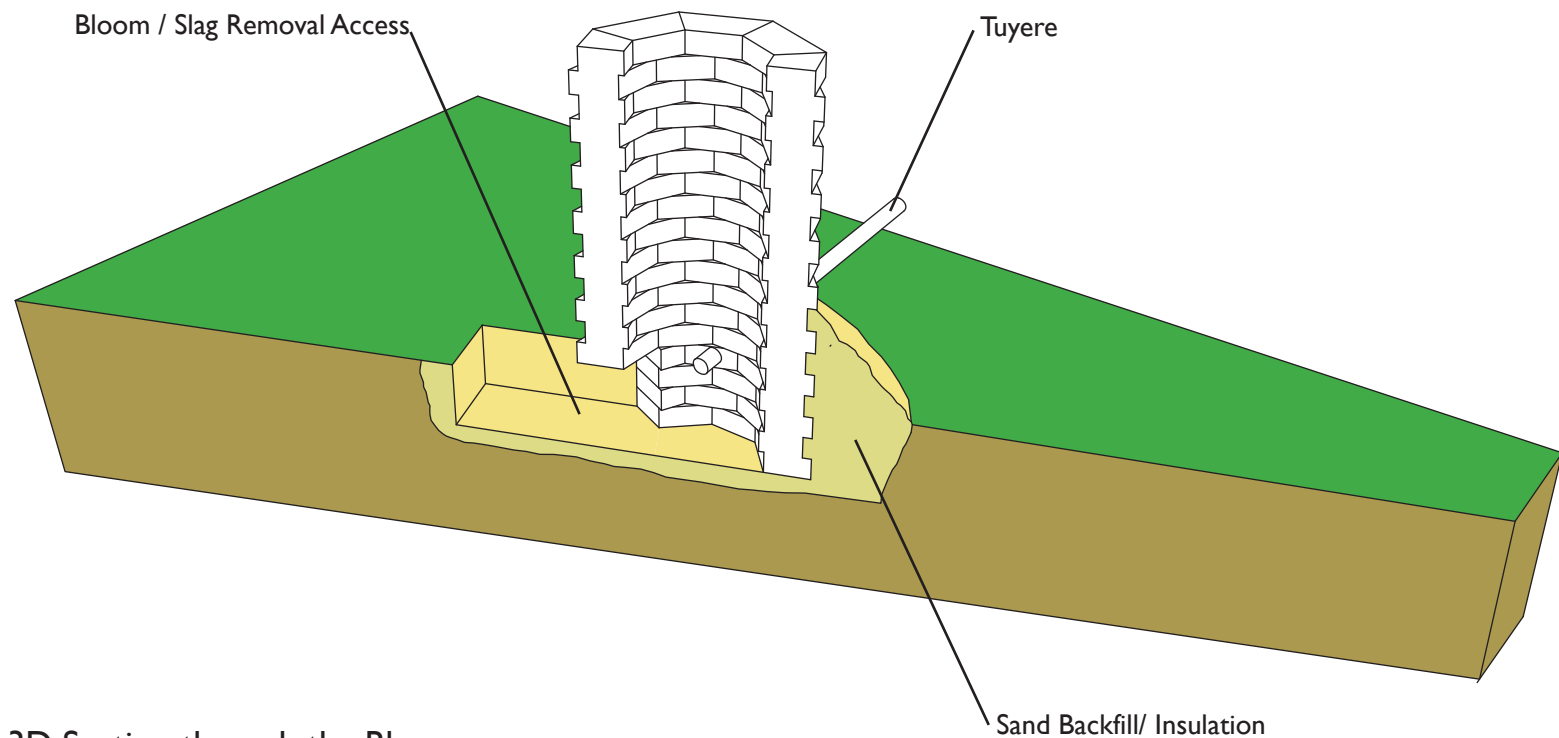


Air Flow:

We plan to construct a flexible system which can use a variety of forced air sources to power our furnace. The best solution we considered was the use of a hair dryer to propel large quantities of warm air into the furnace system. This is more than enough volume for our purposes; while hair dryers move on the order of 40 CFM of air, the amount described by Senn et al in their shaft furnace of a similar scale was merely 13 CFM. In the case that electricity is not available, we plan to replace the hair dryer assembly with a simple pair of mattress foot pumps. These units, while not highly reliable, do move a reasonable quantity of air and fit into our process well. In either case, we plan to build a steel pipe based tuyere that can provide isolation, albeit limited, between the hair dryer and the furnace itself. This entire subsystem is duplicated twice, with the two units on opposite sides of the furnace to provide adequate airflow to all parts of the inside firing area.

Location and Duration:

Our model would be built on a grassy area where we would dig an area of about 2x2ft at a depth of two brick heights (4-6 inches). This cleared area we would then cover in sand to insulate the base. The preparation for the smelt should take up 2-3 days and the smelt itself will take up 6-8 hours.



3D Section through the Bloomery

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