THESIS.

Subject, The Blast Furnace.

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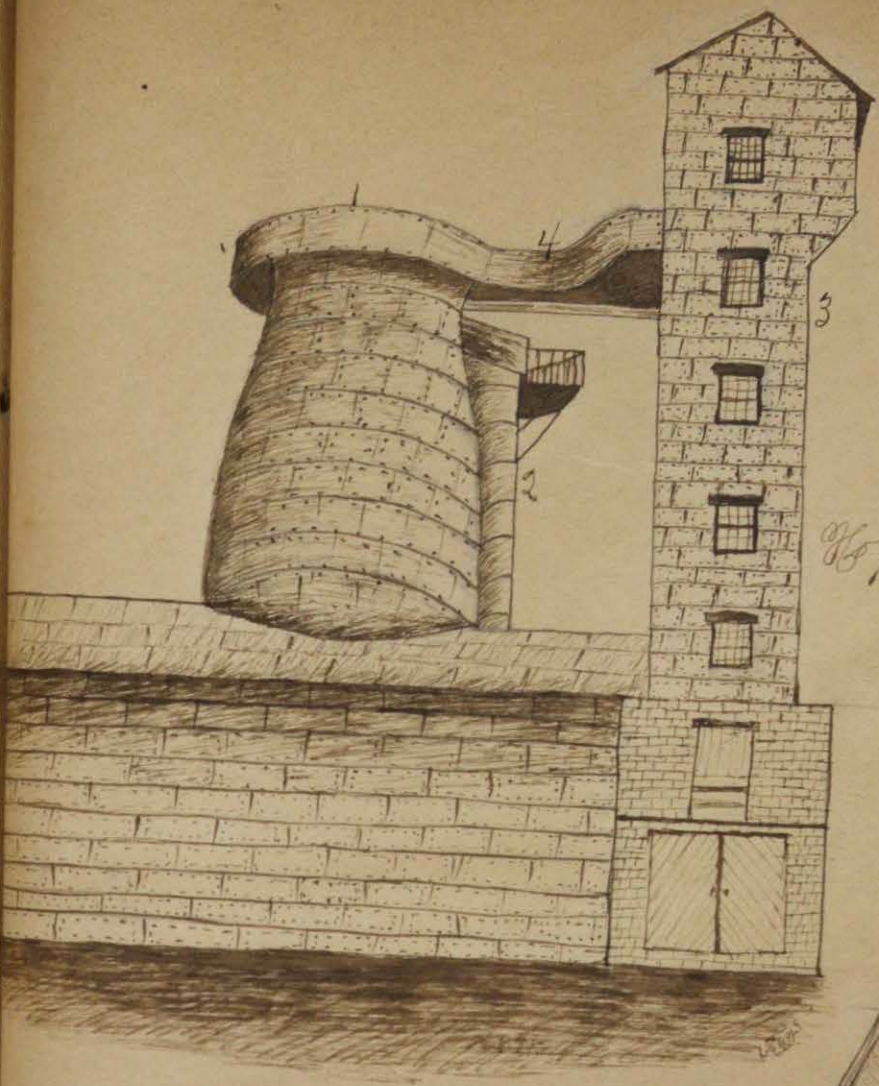
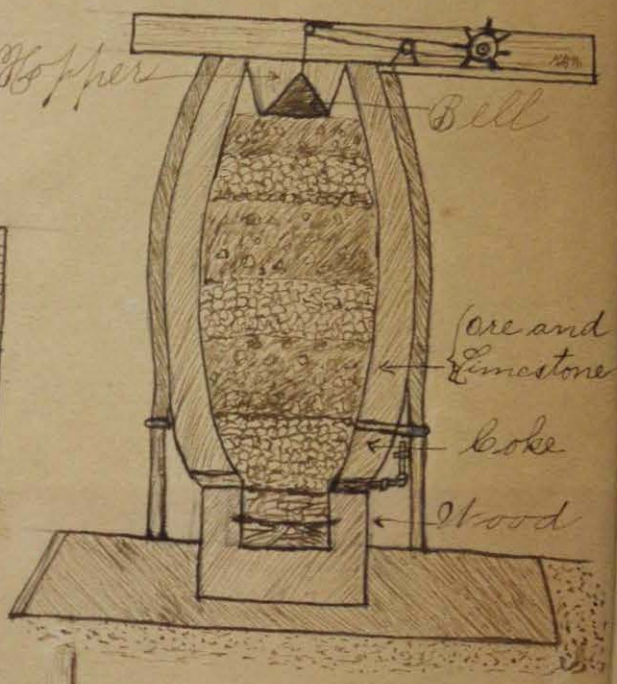
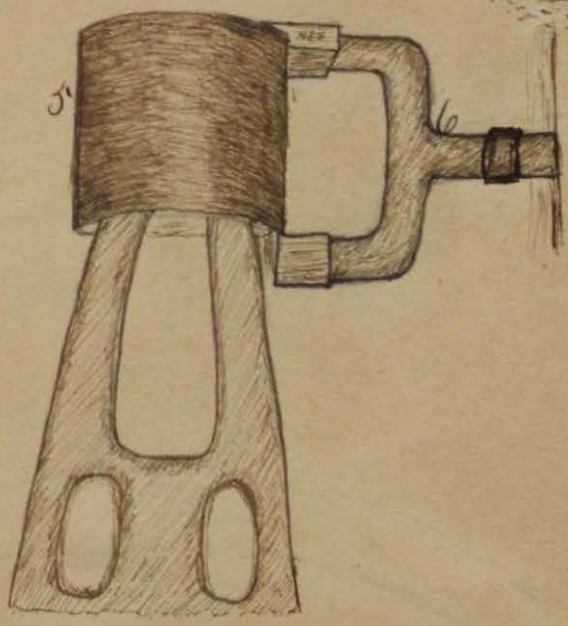
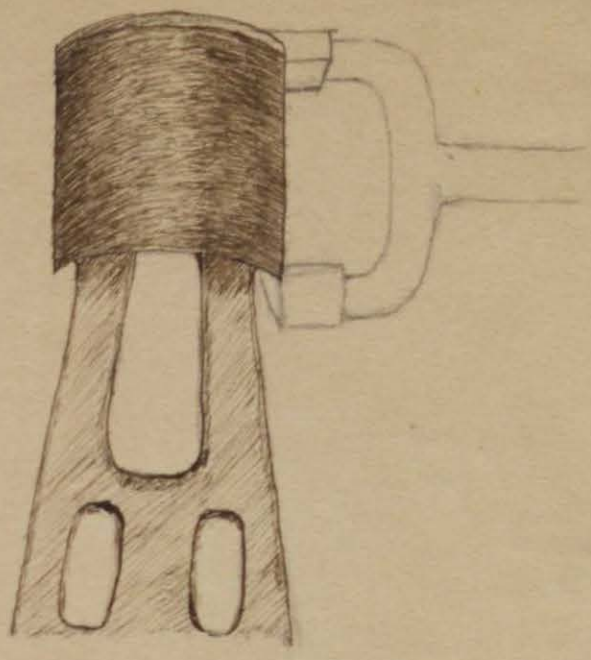
1. Furnace.
2. Down Comer.
3. Hoist House.
4. Bridge.
5. Cold Air Receiver.
6. Pipes leading to hot blast ovens.

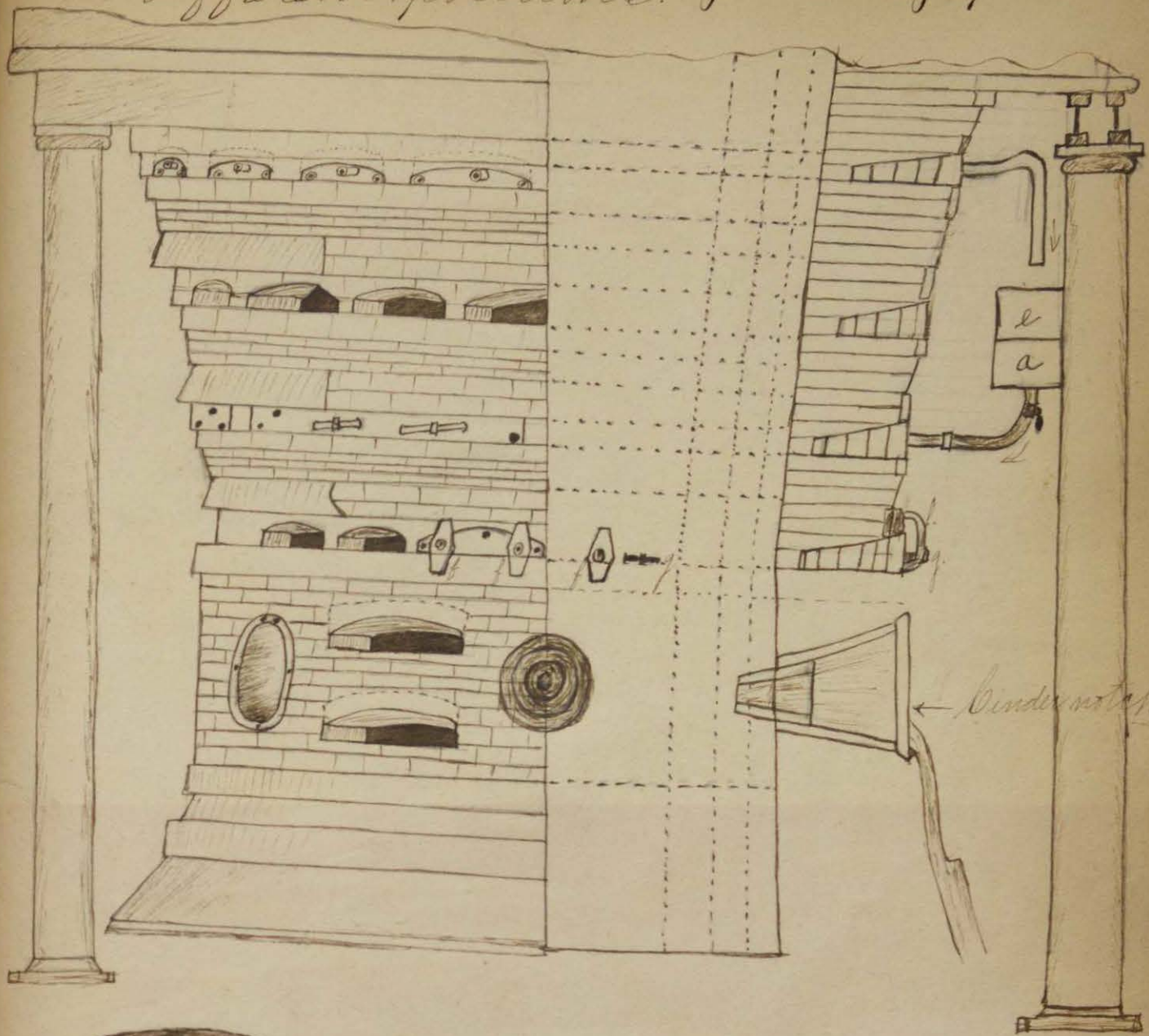




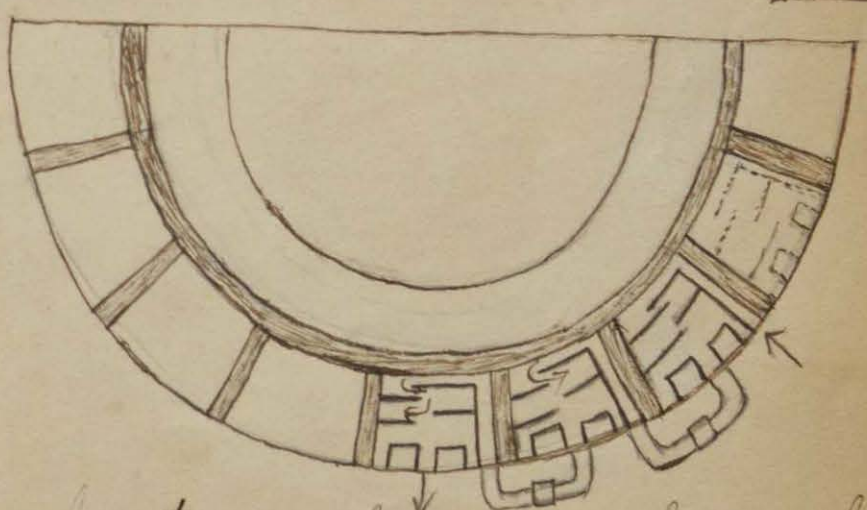




Section of furnace showing cooling plates in different positions.



Tuyere.



Section showing how the water circulates through the cooling plates

Big.

In building a blast furnace, the main part of the shaft is supported on pillars, usually of cast iron. The lowest part is usually in the shape of a cylinder and is called the hearth. In the masonry of the hearth are built the tuyeres, (from 2 to 8 in no.) which are hollow cones, of which a drawing is found on the second page. The tuyeres are all the time supplied with a current of cold water to keep them from burning out so soon.

Blast furnaces differ in height and in diameter. One which I saw and illustrate was sixty-five feet high and about sixteen feet in diameter at the boshes, which are the sloping walls connecting the hearth with the widest part of the furnace. The walls were two feet thick. The hearth of this furnace was 9 ft. high. The part below the tuyeres is called the lower hearth. In this furnace the lower hearth was 4 ft. high. The boshes

extended from the hearth up about 21 ft. In the walls of the boshes of all furnaces, are metal plates through which water is constantly circulating. This water is carried into a pipe which is placed a little above the boshes, and from this main pipe the different plates are supplied. This makes the furnace much more durable by lessening the heat which the walls must necessarily undergo. This will be more clearly understood by examining the drawings on the second page.

The things necessary to the working of the blast furnace are the blowing engines, hot blast ovens, and the hoist.

The engines which do the forcing of the air and regulate the pressure of the blast were in a building almost a hundred feet from the furnace. The waste gas was carried from the top of the furnace through the downcomer, as they call the stack built for the purpose

Notice drawing on first page. This stack carried the gas by an underground passage to the boilers, situated just outside the engine house, and was here used to aid in the heating of the boilers. Now from these boilers were other pipes leading into the engine room, and by this power the engines were run. These engines forced the cold air into a circular shaped tank, known as the cold air receiver, then through pipes, shown in the drawing on page 1. These pipes conducted the cold air to the hot blast ovens, where the air passed through pipes about eight feet long and ten inches in diameter. A cross section of one of these pipes looks as follows (1). These ovens were also heated from the gas which was brought from the top of the furnace. The air is confined in the pipes and and the gas is on the outside of the pipes, and in this way the air is heated.

From the blast ovens a large pipe somewhat over 2 ft. in diameter led the heated air to another large pipe which was around the furnace just above the hearth, and from this large pipe, seven tuyere stalks conducted it to the tuyeres and then into the furnace. These blasts of hot air just mentioned, give rise to the name blast furnace.

Now the building just back of the furnace is used for hoisting the materials to the mouth of the furnace. There are in that building, two elevators. While one is going up with two loaded barrows, the other is coming down with the empty ones. The part leading from the landing of the elevators to the mouth of the furnace is called the bridge. In filling this furnace, the part of the hearth below the tuyeres is filled with wood, then after charging about 7½ tons of coke, small quantities

of limestone and ore are charged, and the amount of limestone and ore is increased as the furnace is being filled, until the last charge put in is in proportion of 37 7/10 % of coke, 14 3/7 % of limestone, and 48 % of ore. The whole amount of coke in the furnace when it is full is 110 tons, of ore 53 tons, and of limestone 25 tons.

After the furnace is full she is lit at the cinder notch by a torch and at each tuyere by long iron rods which have been heated for this purpose. As soon as the coal is burned out in the hearth and the stock begins to descend, filling in more stock is commenced in the proportions of 35 % coke, 13 3/10 % limestone, and 51 7/10 % ore, and as the furnace gets hot this amount is still increased until it resumes a proportion of 30 6/10 % coke, 14 % limestone, and 55 4/10 % ore. This burden is afterwards very often changed

to suit the condition and the working of the furnace. The pressure of air blown by the engines varies from 5 to 7 pounds per square inch and from 3 to 5 pounds per square inch at the tuyeres. The force at the tuyeres not being so great as the force from the engines on account of the distance the air must travel until it reaches the tuyeres.

As the stock gradually becomes heated it sinks to the hearth. For it to get from the top to the bottom of this furnace, takes from 18 to 24 hours. The materials are poured into the hopper and when ready, the bell is lowered and they are dropped into the furnace.

This furnace made six casts of pig iron in 24 hours. Different furnaces of course differ in the number of their casts.

The furnaces being built to-day are, most of them 100 ft. high, and their other parts are large in proportion.

In the hearth, below the tuyeres, which holds the iron when ready to be tapped, there is very little chemical action. The molten mass rests quietly and the iron, being heavier than the slag, separates from it and falls to the bottom. Above this comes the part into which the hot blast is forced, having been before heated to a temperature of from 900 to 1500° Fah. Above this again is the place in which chiefly occurs the reduction of the solids to liquids.

At the very base of the hearth is an opening from which the molten iron runs into a trough of stone or sand and is led off into moulds, made of sand or iron. This is then our pig iron. A pig is about 3½ ft. long and 3½ in. through, and is of triangular shape. The long one formed in the trough by means of which the pigs reach their

moulds is called the sow. The sow and pigs resemble the comb, not poorly. The sow answers for the back of the comb and the pigs for the teeth. In the furnace I have been describing, the cinder notch was at the right hand side, 4 feet from the ground. From this notch the slag runs off through a pipe. See page 2.

From the pigs are made cast-iron, wrought-iron, and steel, from which so many useful things are made.

Bibliography.

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3. Amongst Machines by the author of "The Young Mechanic".
4. Experimental Knowledge.