W. KELLY.

Refining Iron.

No. 18,910. Patented Dec. 22, 1857.

Fig 2

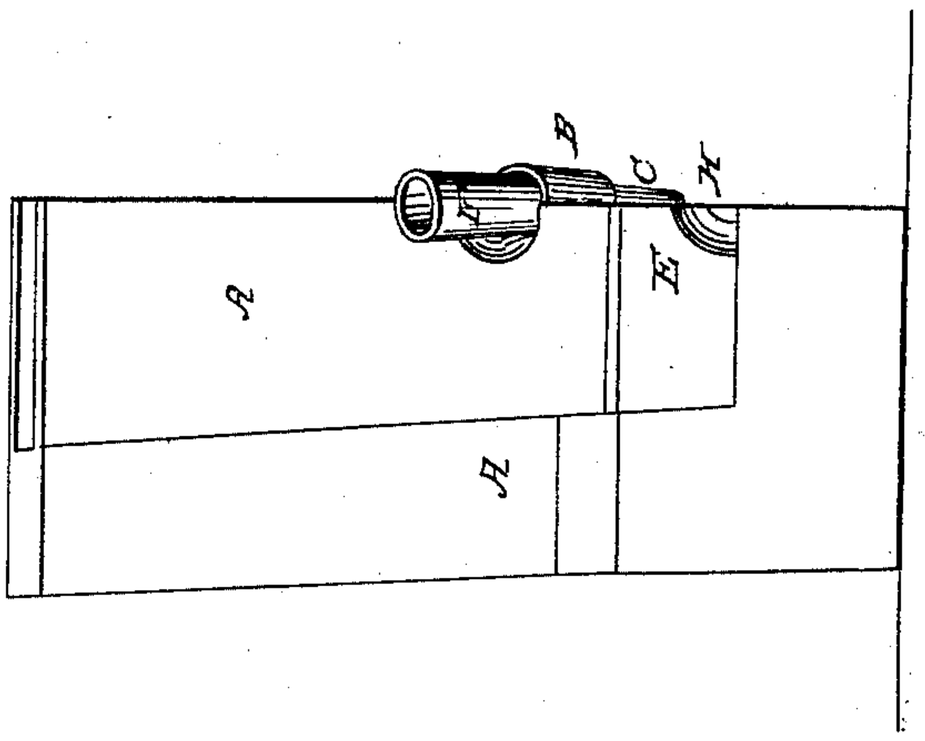
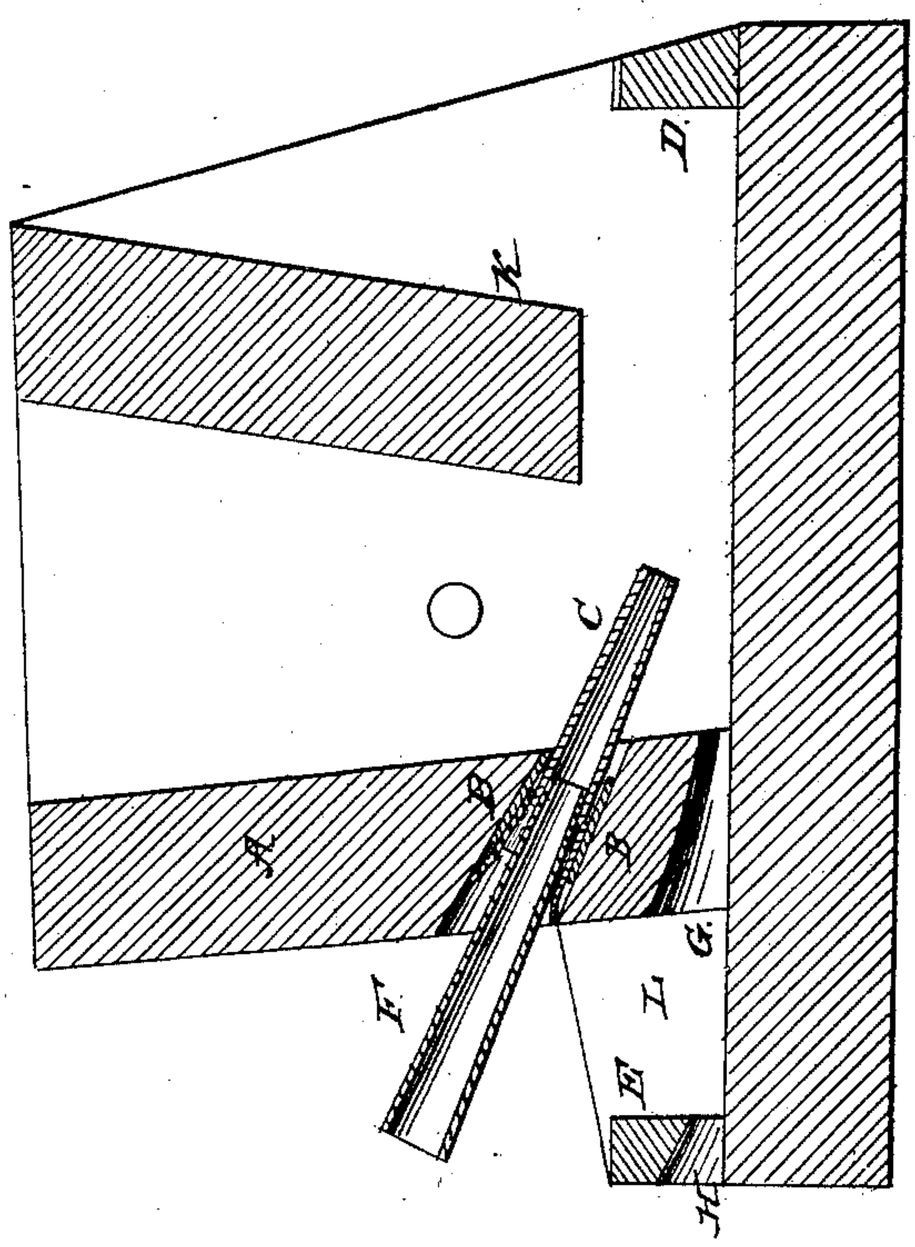


Fig. 1



UNITED STATES PATENT OFFICE.

WILLIAM KELLY, OF LYON COUNTY, KENTUCKY.

IMPROVEMENT IN REFINING IRON.

Specification forming part of Letters Patent No. **18,910**, dated December 22, 1857.

To all whom it may concern:

Be it known that I, WILLIAM KELLY, of Lyon county, in the State of Kentucky, have invented new and useful Improvements in Refining Iron in the Hearths of Blast-Furnaces; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

The nature of my invention consists in certain improvements in the method of refining iron in the hearth of the blast-furnace, and in the use of an additional refining-chamber, as hereinafter to be described.

To enable others skilled in the art to make and use my invention, I shall proceed to describe the same, reference being had to the accompanying drawings, forming part of this specification.

In order to secure a certain and speedy decarbonization and refining of the iron in the hearth of the blast-furnace, I carry the blast down through the liquid mass of iron, nearly to the bottom of the hearth, by means of a tuyere-pipe, instead of depending alone upon the penetrating force of the blast to accomplish its perfect distribution. By this arrangement the blast issues from the tuyere-pipe at a point where it is compelled to mix with the metal, and the result is a perfect and rapid refinement of the iron. One tuyere placed in the back stone or tymp is all that is necessary to refine the liquid iron contained in the hearth of the furnace, provided the blast is of sufficient volume and strength to penetrate and distribute itself through the entire mass. In order to refine and decarbonize crude pig metal or iron in a liquid state, it is not always essential to blow blasts of air directly into it, for if two vessels filled with liquid iron are placed contiguously, and communicating by means of a tap-hole at the bottom, a blast of air driven into either one of them will cause the metal in both to part with its carbon and simultaneously to refine.

In the accompanying drawings, Figure 1 is a vertical section through the center of the hearth of a blast-furnace. Fig. 2 is a back elevation showing permanent tuyere, &c.

In the drawings, A is the back stone or tymp, into which is fixed permanently a tuyere, B. The tuyere-pipe C is made tapering, and enters the liquid iron in the hearth, and is coated over with clay to prevent its melting. Its small end is stopped with clay to prevent the cinder and iron from entering previous to letting on the blast. D is the dam of the hearth. E is the dam of the outside chamber. F is the blow-pipe communicating with the blowing-engine. G is the notch in the back tymp, forming the communication for the metal to run from the hearth to the outside chamber; H, the notch in the dam of the outside chamber, and L is the outside chamber.

The tuyere B is permanently fixed in a circular opening in the back tymp, made for the purpose immediately above the tapping-notch that is in the center of the back stone or tymp, and immediately opposite the front tymp, K, and is so placed that when the hearth is full of iron the metal will come up to but not enter the said tuyere.

I am aware that it is impracticable to use a smelting-tuyere in the back stone or tymp; but for my refining-tuyere it is the right place.

When the hearth is full of iron, or contains a sufficient quantity to commence the process of refining, an entrance is made for the tuyere-pipe C by cleaning the permanent tuyere B of its clay stopper, and also of the stiff cinder accumulated at its end in the hearth, to the extent only that the liquid cinder and metal will not break into said permanent tuyere B. The tuyere-pipe C is then fixed on a bar having shoulders to press against the large end of said pipe, and thrust into tuyere B, and also through the soft cinder, nearly down to the bottom of the hearth, into the liquid iron. The tuyere-pipe C is then wedged fast into the permanent tuyere B, the end of the blow-pipe F is put into the tuyere-pipe C, and after being luted with clay at the connection the blast is let on. The clay stopper being removed, the blast is delivered into, through, and among the liquid iron, and so continued until the process of decarbonization and refining is completed. The furnace is then tapped, the blast stopped, and when the metal has all run from the hearth the blow-pipe is taken out, and the tuyere-pipe C driven into the hearth, a clay stopper rammed into tuyere B, and the blast let onto the smelting-tuyeres, as usual.

Although the refining-tuyere is described

above and shown in the drawings as occupying a certain position in the hearth, it may be placed in the auxiliary chamber, if desired, producing the same effect.

If there is a sufficient amount of blast, the smelting-tuyeres can be used at the same time that the refining-tuyeres are in operation, so that the smelting and refining can go on at the same time.

For the purpose of facilitating the rapid decarbonization of crude iron, it is found necessary to employ fluxes—such as forge-cinder, (made from refined iron,) limestone, and iron in masses or pigs already refined—which fluxes can be put into the hearth at the dam before and during the refining operation.

Solid crude pig-iron can be refined by inserting it into the liquid mass in the hearth, where it will soon melt and undergo the refining operation with that previously in the hearth. When the metal in the hearth begins to refine, it can be told by the gas or smoke of a peculiar color issuing from the stack or chimney simultaneously with the metal becoming white. The change in the color of the metal can be observed through the glass in the permanent blast-pipe, looking down into the metal in the hearth. The degree of heat and whiteness of the metal increases to an incandescent state, so as to be painful to the eyes. The gas or smoke becomes and continues of a reddish brown color. After the metal has reached the condition above described, and has continued so far from ten to forty minutes. The time depending on the strength and volume of the blast and the nature of the metal, (as to extent of carbon,) it is sufficiently refined and may be let out, the metal in the outside chamber being in the same refined condition as that in the hearth, the process having gone on, as above described, simultaneously in both.

Having fully described the nature of my improvements, what I claim as my invention, and desire to secure by Letters Patent, is—

1. Conducting the blast down through the liquid iron to near the bottom of the hearth by the tuyere-pipe C, substantially as and for the purposes described.

2. Refining and decarbonizing crude iron simultaneously in the hearth of a blast-furnace and in an adjoining chamber having communication therewith, when the blast enters directly into but one of either of the chambers, substantially as and for the purposes herein set forth.

WILLIAM KELLY.

Witnesses:

JNO. F. KELLY,

JOHN G. JEFFERSON.