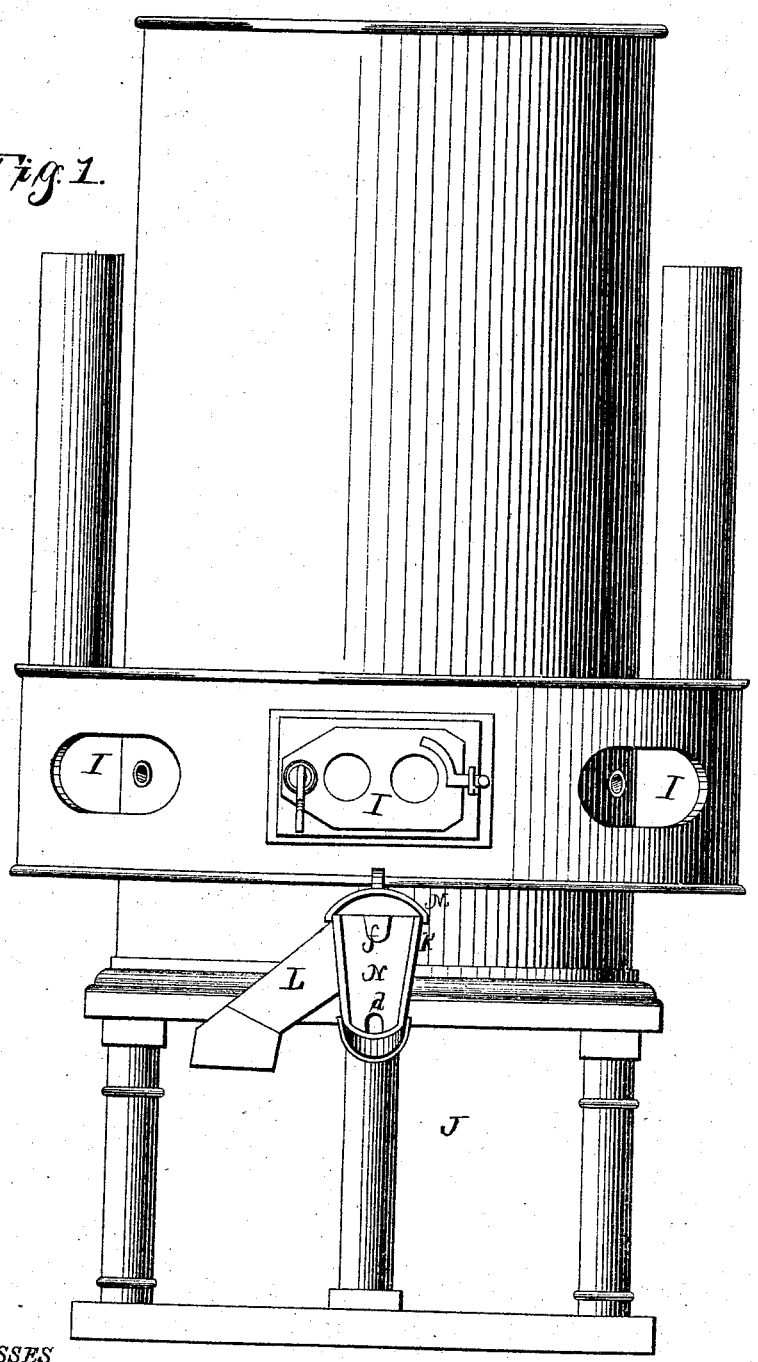
3 Sheets—Sheet 1.

E. C. LITTLE.

CUPOLA FURNACE.

No. 184,161. Patented Nov. 7, 1876.

Fig. 1.



WITNESSES

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3 Sheets—Sheet 2.

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CUPOLA FURNACE.

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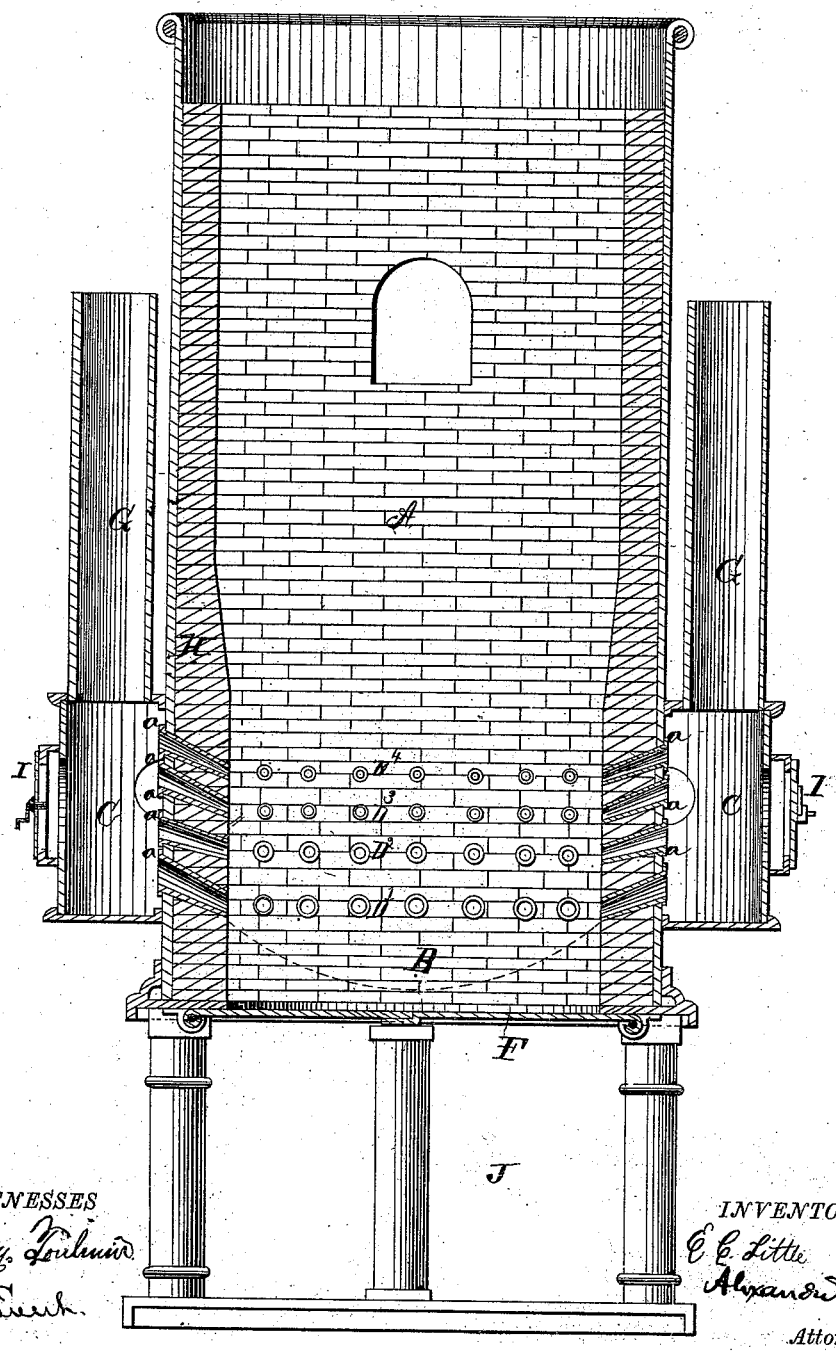
Fig. 2.



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3 Sheets—Sheet 3.

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No. 184,161. Patented Nov. 7, 1876.

Fig. 3.

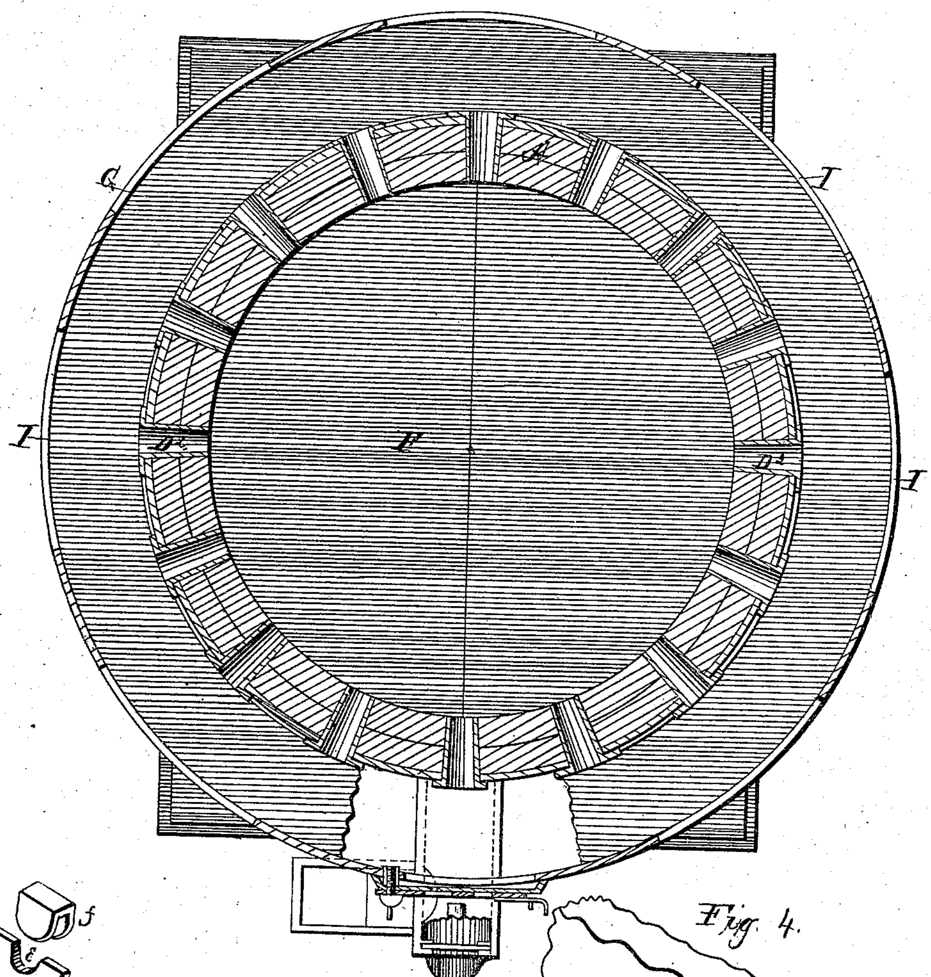
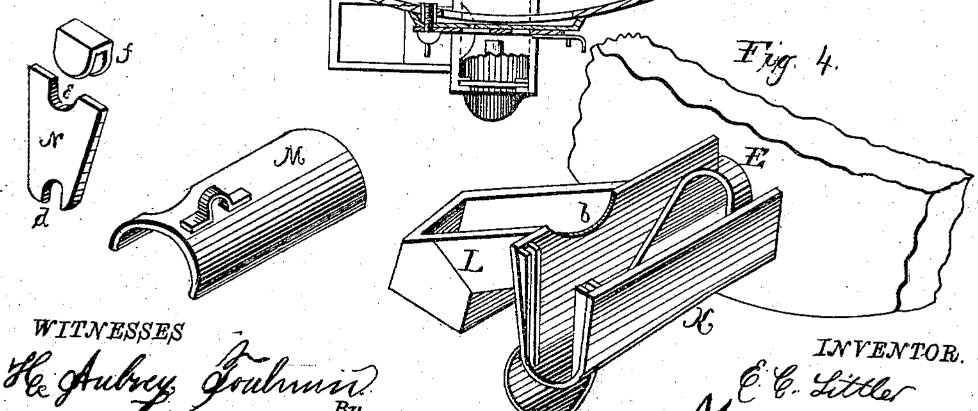


Fig. 4.



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UNITED STATES PATENT OFFICE.

EZEKIEL C. LITTLE, OF ST. LOUIS, MISSOURI.

IMPROVEMENT IN CUPOLA-FURNACES.

Specification forming part of Letters Patent No. **184,161**, dated November 7, 1876; application filed August 12, 1876.

To all whom it may concern:

Be it known that I, EZEKIEL C. LITTLE, of St. Louis, in the county of St. Louis, and in the State of Missouri, have invented certain new and useful Improvements in a Cupola or Melting Furnace; and do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, making a part of this specification.

My invention relates to that class of cupola-furnaces wherein the air is admitted in small and numerous jets, for the purpose of creating a more perfect combustion of the fuel in the interior of the cupola; and it consists in the construction and arrangement of the tuyeres discharging air into the furnace, all as hereinafter more fully set forth.

In order to enable others skilled in the art to which my invention appertains to make and use the same, I will now proceed to describe its construction and operation, referring to the annexed drawing, in which—

Figure 1 is a side elevation of a cupola or smelting furnace embodying my invention. Fig. 2 is a vertical section, and Fig. 3 a horizontal section, of the same. Fig. 4 is a detailed view of a part thereof.

A represents the interior body of the cupola; B, the dotted line or lines of the bed. C is the air-chamber surrounding the furnace, and provided with doors I I. D^1, D^2, D^3, and D^4 are four series of tuyeres. E is the throat or tapping-hole; F, the bed-plate; G, the air-pipes; H, the brick lining, and J the pit.

The object of my invention is to secure an active and uninterrupted melting action, and to prevent clogging or bridging of congealed slag and chilled particles of iron, which form over the ordinary horizontal tuyeres when near the conclusion of the heat.

The novelty of my invention consists in the arrangement of a series of tuyeres, graduating in size from large to small, and placed at an angle verging toward the center of the interior of the cupola, the bottom of which is made concave. The first or lower course, D^1, of tuyeres, which entirely surround the cupola, is placed at an angle to meet the exact center of the concavity of the bottom of the cupola. The second course, D^2, is placed at an angle of, say, about ten degrees nearer the horizontal line. The third and fourth courses, D^3 and D^4, are placed at the same angle as the bottom course, D^1. The object of placing the courses of tuyeres at such angles is to create a more perfect combustion of the fuel, and to force the heat downward upon the melted iron.

The portability of the tuyeres enables me to replace them if burned out on the ends, as they come flush or a little back of the inner wall of the cupola; and they are adapted to all grades of fuel, for when used for coal, and a stronger blast is needed, the upper course can be stopped up or closed off, even while the blast is in operation, thereby creating a stronger blast or pressure on the lower tuyeres or tubes. The lower tubes are pitched to consume the fuel in the interior bed of the cupola.

Heretofore the fuel used with ordinary horizontal tuyeres has been comparatively lost between the bottom of the tuyeres and the bottom or bed of the cupola; but by my arrangement, the tuyeres meeting the concavity of the bed by their pitch or angle, the fuel is entirely consumed upon the melted iron by the blast being forced upon it. The great angle also serves to prevent the melted iron from running back into the chamber C while in process of operation.

The chamber or drum C, that surrounds the cupola, is of sufficient size to incase all of the tuyeres or tubes used, and the distance between the main body or outside or cupola proper and the outside drum is equal to the length of the tubes. The drum is also provided with a sufficient number of doors or openings I, for the purpose of removing the portable tuyeres or tubes in case they should become deranged or burned out, and also to enable me to stop off part of the blast in the event of changing the fuel used.

A greater force of blast is needed for coal than for coke or the lighter grades of fuel; therefore, by shutting off part of the openings the pressure is increased on the remainder. The doors also serve as a draft to the fire before putting on the blast.

In front, at the tapping-hole E, is attached

a slag-catcher and iron-mixer, constructed as follows: N is a box or chamber attached to the cupola, which receives the iron from the body of the cupola. The slag that follows the molten iron into the box or chamber rises to the surface of the melted iron, and is scraped off through an opening, *b*, and through the channel or gutter L, attached to the side of the box, into the pit J under the cupola. The box K is provided with a cover, M, to protect the operatives while catching the molten iron.

It will be noticed that there are two tapping-holes—one, E, in the body of the cupola, and one, *d*, in the front of the chamber K, through the plate N. It is the intention to keep the hole E in the body of the cupola open all the time, and allow the iron to accumulate in the chamber K, and then drawn off through the plate N. This plate is made separate from the box, and sits in slides, so that it can be removed to facilitate the cleaning out of the box or chamber. In the top of the plate N is a small opening or cavity, *e*, so as to reach over and tap the hole E in the body of the cupola without removing the cover M. This cavity is closed by a plate, *f*.

I am aware that a series of tuyeres have been placed one above the other; and graduating in size; also that tuyeres have been arranged in a cupola on an incline; hence I do not claim such as being, broadly, my invention.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

The series of tubes or tuyeres, graduating in size and placed at different angles verging toward the center of the interior of the cupola, the lower course of said tuyeres being inclined on a line with the exact center of the concavity of the bottom, substantially as and for the purposes herein set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 26th day of July, 1876.

EZEKIEL C. LITTLE.

Witnesses:

BENJAMIN SMITH BUCK,

IRWIN E. LITTLE.