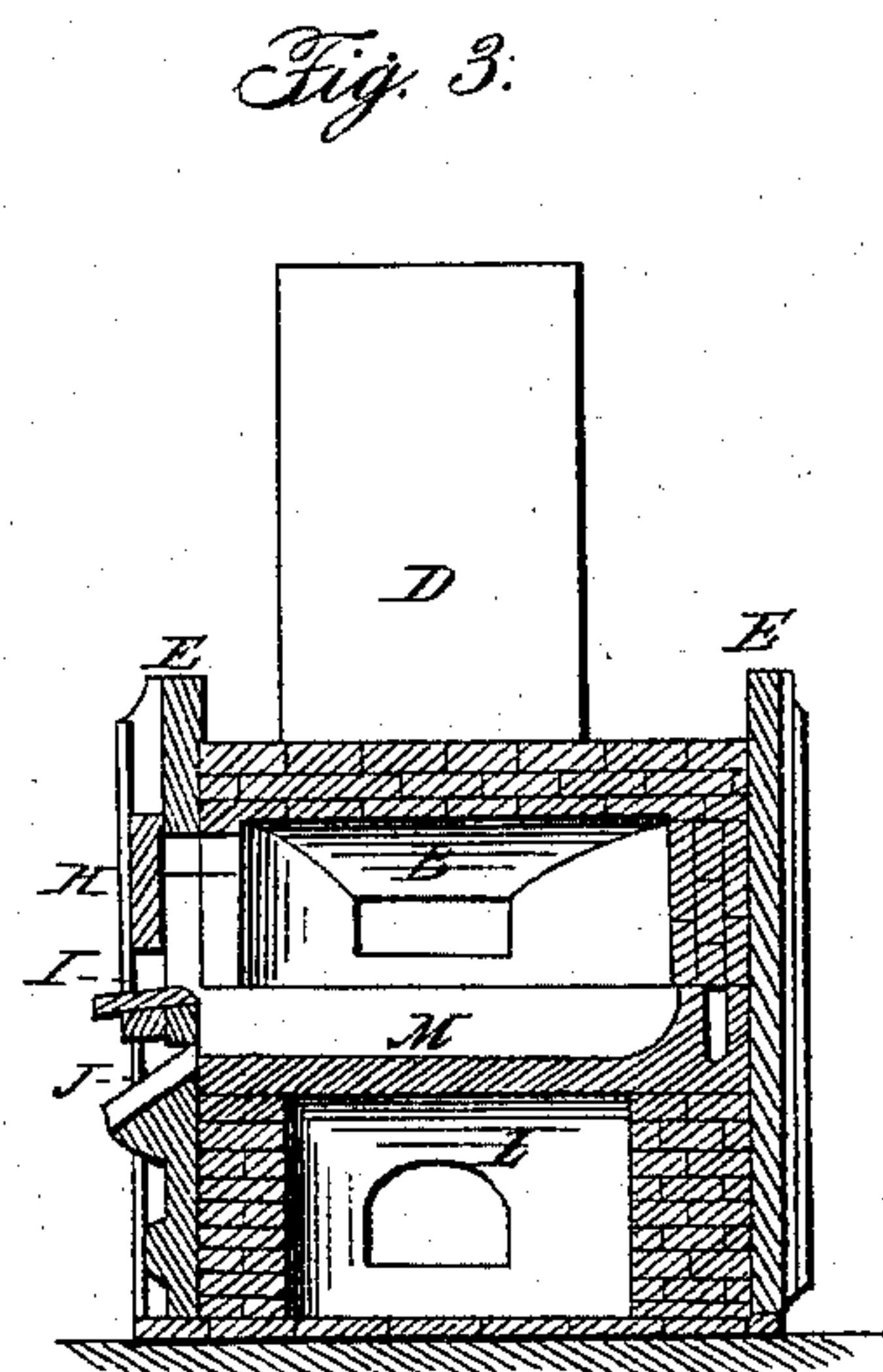
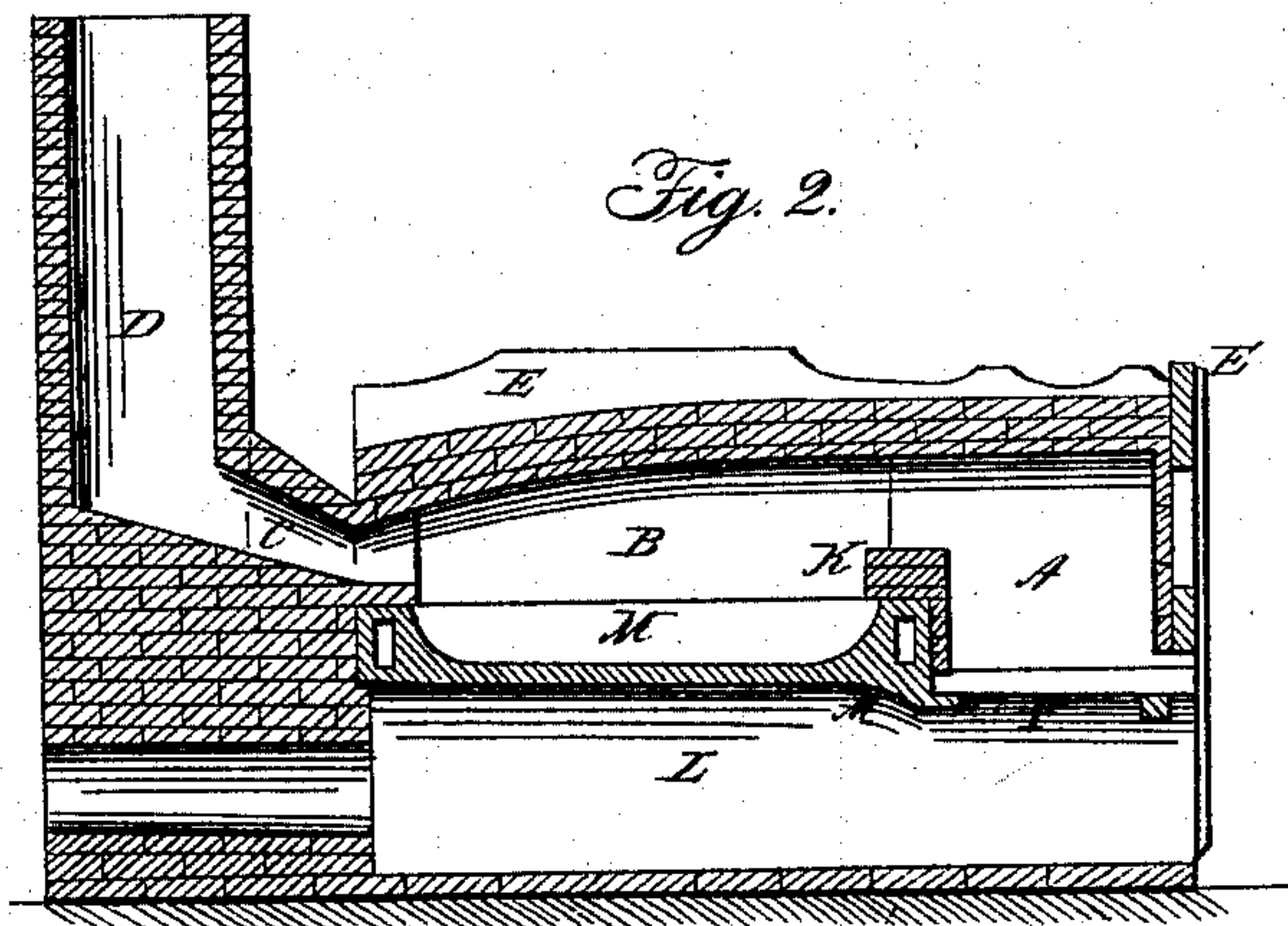
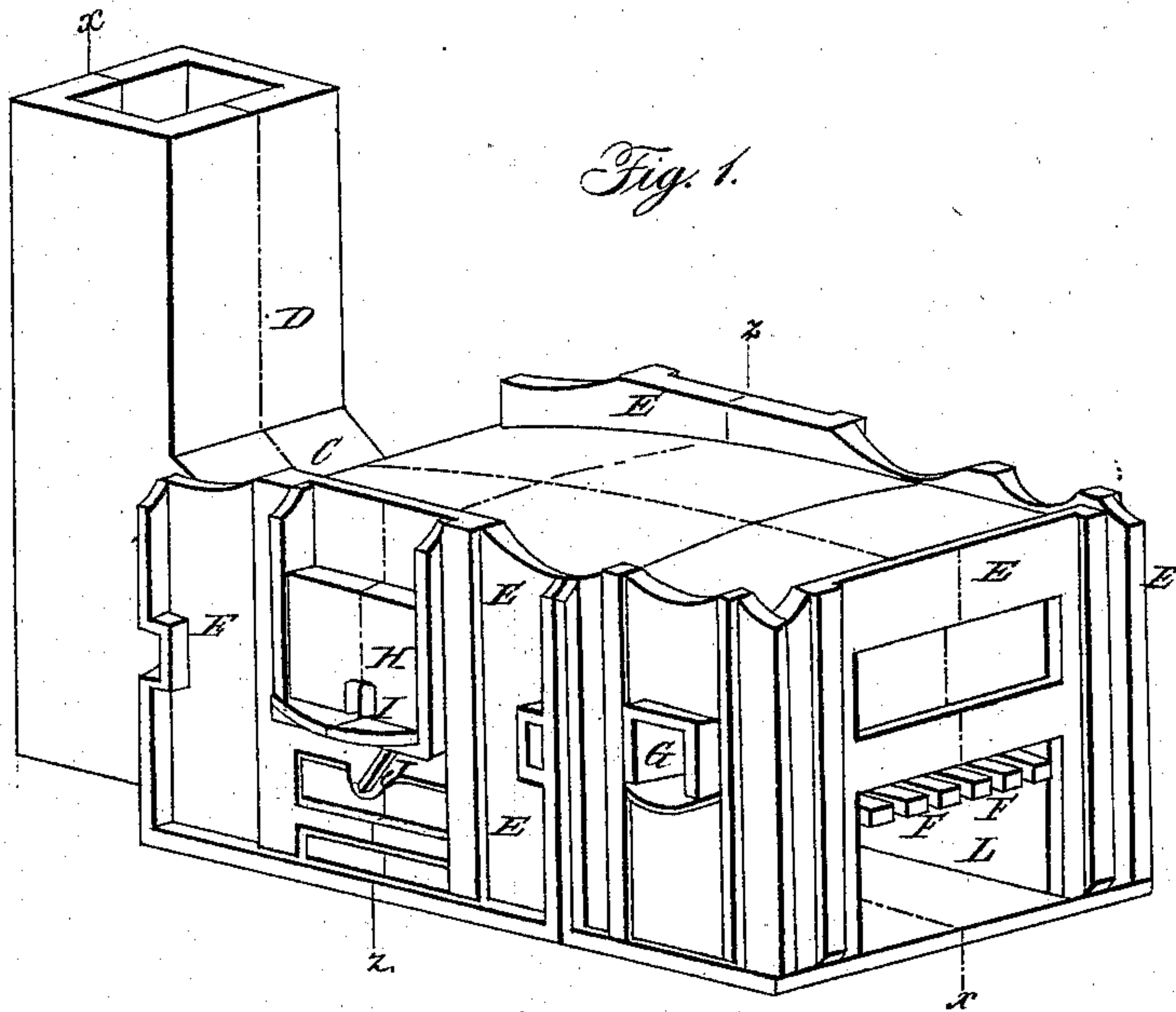


C. D. BAKER.  
Reverberating Furnace.

No. 48,355.

Patented June 27, 1865.



**Witnesses:**

*C. D. Smith*  
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# UNITED STATES PATENT OFFICE.

CHRISTOPHER D. BAKER, OF WHEELING, WEST VIRGINIA.

## IMPROVED FURNACE FOR BOILING IRON.

Specification forming part of Letters Patent No. 48,355, dated June 27, 1865.

*To all whom it may concern:*

Be it known that I, CHRISTOPHER D. BAKER, of Wheeling, in the county of Ohio and State of West Virginia, have made new and useful Improvements in Furnaces for Boiling Iron; and I do hereby declare the following to be a full, clear, and exact description of the nature, construction, and operation of the same, reference being had to the accompanying drawings, which are made part of this specification, and in which—

Figure 1 is an outline perspective view of my furnace. Fig. 2 is a longitudinal vertical section on the line *xx*, Fig. 1. Fig. 3 is a transverse vertical section at the line *zz*, Fig. 1.

The same letters refer to corresponding parts in the different figures.

My improvements have reference to the more economical working of the iron, both in respect of coal saved and in the actual effective influence on the iron itself.

The devices by which these ends are accomplished consist of an improved construction of the chill or iron bed, in the location of the chimney-aperture relatively to the iron-chamber, and in the structure of the exit-flue.

To enable one skilled in the art of manufacturing iron and in constructing appliances therefor to construct and use the same, I will proceed to describe my invention in detail.

The furnace is constructed generally in the usual manner, of iron and fire-brick, and consists of a fire-chamber, A, and an iron-chamber, B, in which the iron is placed and heated by the reverberating flames from the fire-chamber. C is the neck of the chimney, and D the stack. E E are the binding-plates, which form the exterior walls and confine the fire-brick which lines the furnace and forms the roof. F are the grate-bars. G is the stock-hole for the introduction of fuel; H, the door at which the iron is introduced and withdrawn; I, the stopper-hole in the same, which is used as a peep and paddle hole and is stopped on occasions with clay. J is the tap-hole; K, the fire-bridge; L, the chamber underneath, through which the air is at liberty to circulate; and M the chill, which forms the bed for the iron, and which I will proceed to describe more particularly, as it exhibits some of the points of novelty of my invention. It will be necessary, however, in the first place, to give an idea of the mode of

operation in "boiling" the iron, as we term it, in the West, and which I understand to be the same operation as that known by the term of "puddling." Be that as it may, it consists in heating the cast-iron and preparing it with "raddles" and paddles, so as to change its nature and fit it for the trip-hammer or squeezer.

It is necessary to prepare the bed for the reception of the iron, because it consists of a cast-iron plate and surrounding sides, which require protection. It is prepared to resist the heat by burning a quantity of wrought-iron—say, about one hundred pounds of scrap—to a "cinder," as it is technically called, which adheres to the bottom, having a thickness of, say, two inches. This works out probably every day in the course of six heats, which is a common day's duty, and must be replaced each day. About five hundred-weight of ore, under ordinary circumstances, is then placed in the chamber, melted into a slag, and then piled up around the edges to protect the chills. I will here mention that I aim to do the same duty with about half the quantity of ore. This is saved, first, by raising the edges of the bottom plate, (it being usually flat,) so that so great a height of chill is not required to be protected by ore; and, secondly, by flaring the chills outwardly. The pile of ore raised against them maintains its position more readily, and may be reduced in quantity. Though the exact size is not material, I will mention, for the guidance of the expert who may read my specification, that I raise the bottom about one and a half inch, beginning at a point, say, three inches from the margin of the iron-chamber, except at the furnace-door, and I make the chills to flare outwardly about one and a half inch.

The neck of the flue which connects the iron-chamber with the stack has its narrow throat presented to the chamber, so as to cause the reverberation of the flame to be confined to the said chamber, and admitting the volatile results to pass away in a direction approximating to their line of final escape up the chimney, instead of being deflected downwardly. By this means I regulate the draft by means of the number of square inches of aperture of the throat, instead of regulating it by means of what is called in the trade a "velvet-tree," which consists of an arch in the stack at the



point where the volatile results were deflected upwardly into the chimney. At this point the clay which melts from behind the fire-bridge, detritus from the chimney, &c., will collect and form a slag, which has to be removed—say once a week—by knocking down the “take-up” or that portion of the brick-work beneath an arch in the back of the chimney, which is adapted for occasional removal and replacement. This jars and unsettles the stack, and I avoid the necessity for this operation by making the floor of the neck-flue and the continuation of it, or the oblique bottom of the stack-flue, on an upward slant, so that any detritus or slag which collects in the flue will find its way back into the iron-chamber, where it is extracted by being collected on the hooks from off the molten iron, and the hooks being plunged in the water the slag breaks off and is thus disposed of. It does not hurt the iron at all, and is thus more conveniently got rid of than by the old plan of knocking a hole in the chimney and getting it out by sledge and crow-bar.

Many practical advantages are gained by these devices which will commend themselves to the practical worker in iron.

As a result of the change in the flue, I am enabled to run off the usual duty of a furnace—say twenty-eight hundred pounds—in six heats with eight to ten bushels less of coal than the ordinary quantity, which latter may be from thirty to thirty-five bushels, according to quality. I ascribe the saving to the fact that the draft is more perfect and the reverberation of the flames confined to the iron-chamber. This brings me to another point.

It is usual in building boiling-furnaces to strike a center-line from the middle of the chimney in the plan, through the furnace, and then make a lining of brick inside of the binding-plates of thirteen inches thick on the side opposite to the door, and nine inches on the side adjacent to the door. It is necessary to taper away to nothing the lining on the sides of the door, so that the ravel and paddles which are introduced through the stopper-hole to stir and work the iron may reach all parts of the chamber, and thus by this inequality the flame of the furnace is unequally directed upon the iron, and is too much deflected to the side away from the door, which is the especial point where it is most required and which should be the hottest point, as thereby the iron is protected from the air which enters at the stopper-hole.

I place my boiling-furnace in such relation to the stack that the central line of the fire and iron chambers agrees with the center of the stack, notwithstanding the disparity of the thickness of the lining on the different sides, so that the reverberating flames are not deflected from the iron in the proximity of the door. Thus the furnace is built not exactly in line with the center of the flue or the stack, but in such a way that the contained chamber

has the requisite central relation to make equable action on the metal.

The necessity of reaching the iron by the ravel and paddles occasions the disparity of the thickness in the lining of the two sides, as has been said, and I meet the difficulty by making the stack and flue bear a central relation to the chambers instead of to the furnace as a whole in its exterior dimensions. By this means the flame working to the door will not allow the entrance of air to act upon the iron.

As a result of my improvement, which I have endeavored to set forth with clearness and precision, I am enabled to contract very materially the size of the furnace.

Without stating that the following proportions are by any means universal, I have commonly found the proportions of the boiling-furnace to be as follows: The iron-chamber six by five feet, with a furnace four feet by three feet ten inches, with an aperture at the face of the flue-bridge of twenty-two by nine inches, the flue being sixteen by sixteen inches. I have reduced my iron-chamber to five by four, and by placing the regulating-aperture at the entrance of the neck I make that my regulating-point and reduce it to sixteen by seven inches, and work more iron with a proportionately smaller fire-chamber three feet by two feet ten inches, with a reduction of eight to ten bushels of coal per diem. I claim that I am able to make this contraction without limiting the capacity of the furnace to turn out iron by means of my improved construction, and I will state a few of the advantages which result therefrom.

I have spoken of the saving of coal, which is, under all circumstances, a very heavy item, and is here materially reduced. The diminution in size is directly utilized in the lessened cost of construction and material. The stack improvement avoids the necessity of tearing down a portion of the stack to get out the accumulation of slag and detritus which collect, and though, as I have heard it remarked, this does not cost anything, for it is the business of the boiler to keep his furnace in order, and this is generally done with pick and crow-bar on a Sunday, when the fire is out, yet the suggestion is not remarkable for good morals, good sense, or economy, and I demonstrate that the practice is unnecessary.

It would be a mistake to forget to state that the facility for handling the iron is very materially increased by the diminution in the area in the floor of the iron-chamber. As I am addressing myself to experts, I do not deem it necessary to enlarge upon the subject. They all know what hard and continuous work it is to keep the iron well worked and turned, and how its quality depends upon the method and skill with which the ravel and paddles are worked, and also the necessity that the operator is under of taking advantage by leverage upon his paddle in turning. The reduction in the width of the iron-chamber, which I claim is rendered possible by the improvements I have



developed and explained, affords a much greater leverage, inasmuch as the far sides and ends of the chamber are brought so much nearer to the stopper-hole through which the paddle is introduced. The increased ease enables the workman to turn the iron more rapidly, which is quite an object.

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

1. Placing the iron-chamber in the described position relatively to the exit-flue, for the purpose described.

2. Shelving upwardly the margin of the floor of the chamber in the manner and for the purpose set forth.

3. Shelving outwardly the chill or wall of the iron-chamber, for the purpose described.

4. Making the throat or regulating-point at the entrance of the neck so as to limit the reverberation to the chamber itself.

5. Making the lower end of the stack-flue inclined, and as such leading toward the flue which connects to the iron-chamber, so as to favor the discharge of detritus collecting in the flues into the said chamber.

To the above specification of my improvement in furnaces for boiling iron I have signed my hand this 14th day of April, 1865.

C. D. BAKER.

Witnesses:

EDWARD H. KNIGHT,  
W. F. HALL.