(No Model.)

2 Sheets—Sheet 1.

F. H. FOOTE.

BLAST FURNACE.

No. 582,817. Patented May 18, 1897.

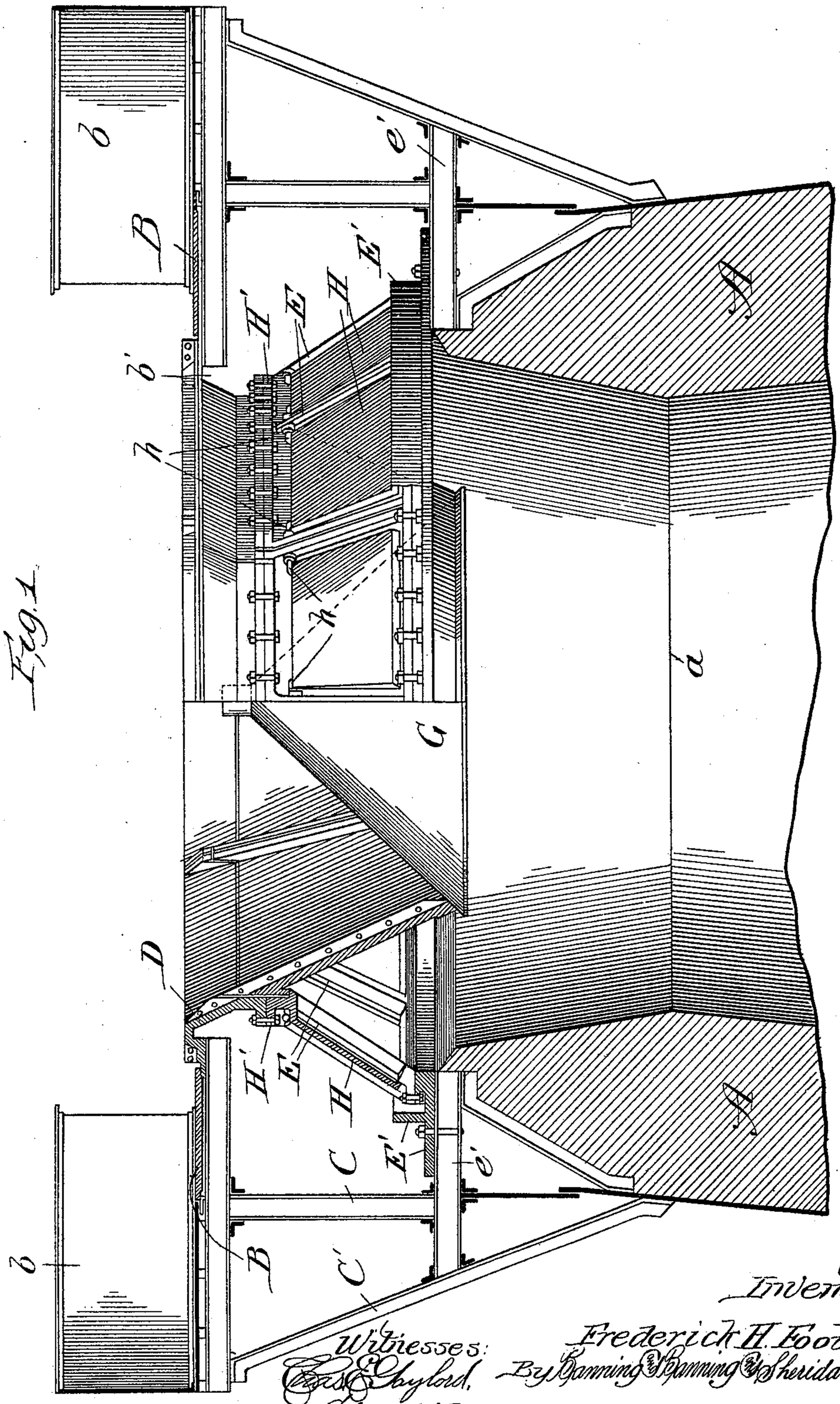

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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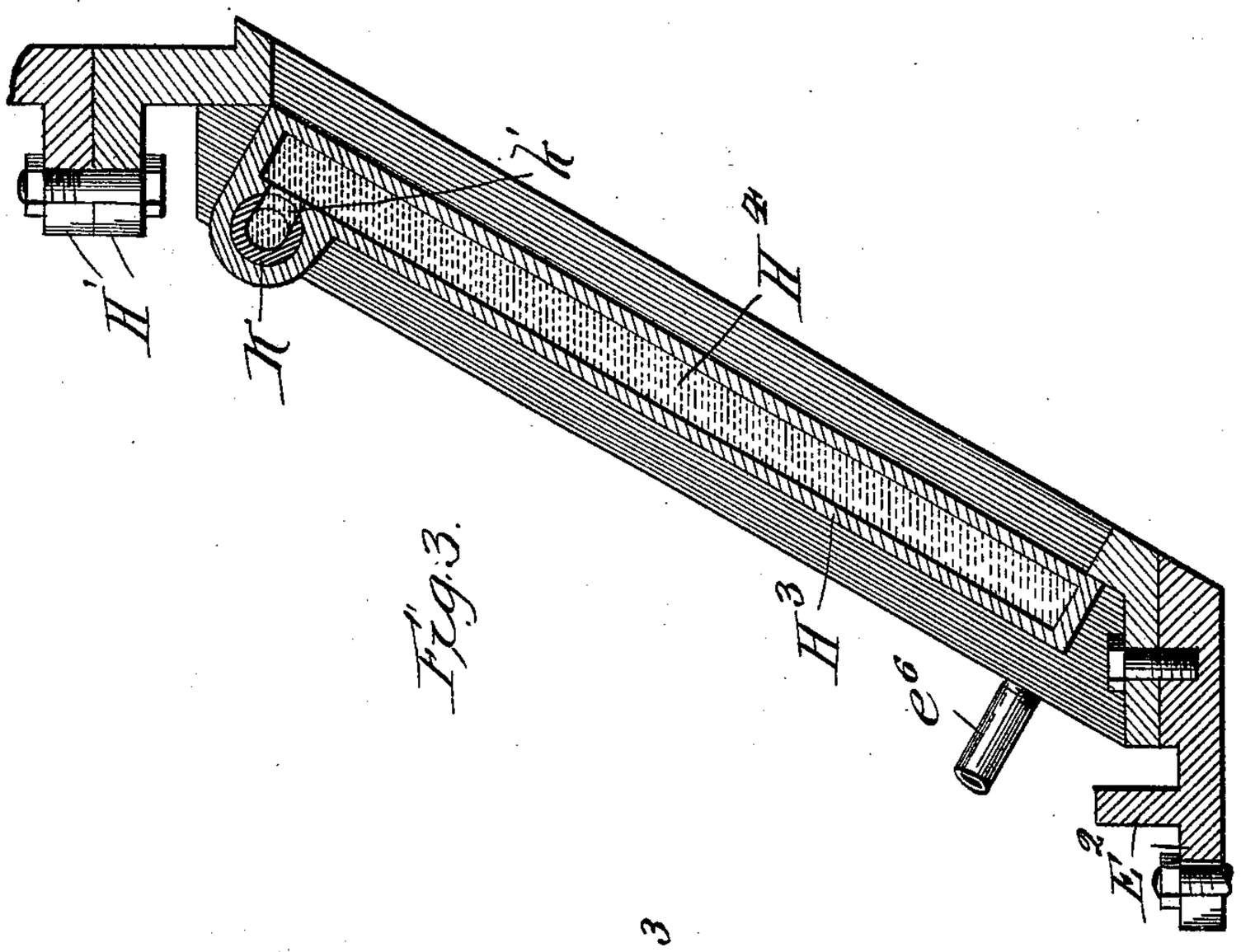

Fig. 3.

Fig. 2.

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UNITED STATES PATENT OFFICE.

FREDERICK H. FOOTE, OF CHICAGO, ILLINOIS.

BLAST-FURNACE.

SPECIFICATION forming part of Letters Patent No. 582,817, dated May 18, 1897.

Application filed September 11, 1896. Serial No. 605,460. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK H. FOOTE, a citizen of the United States, residing at Chicago, Cook county, Illinois, have invented certain new and useful Improvements in Blast-Furnaces, of which the following in a specification.

The object of my invention is to provide simple, economical, efficient, and safe mechanism to be used in connection with blast-furnaces; and the invention consists in the features, combinations, and details of construction hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a vertical sectional elevation of the top of the blast-furnace fitted with my improvements; Fig. 2, a side elevation of one of the safety doors and framework, shown partly in section; and Fig. 3, a transverse sectional elevation of Fig. 2, taken on line 3 thereof.

In the art to which this invention relates it is well known that sudden formations of explosive gas take place, and on the introduction of the desired quantity of oxygen, either from the oxids of the metals or atmospheric air, an explosion is liable to occur, which usually results in the destruction of the upper part of the furnace, as well as in the loss of life and limb of the operatives in charge. The principal object of my invention, therefore, is to provide a blast-furnace with a safety-top mechanism or structure which will relieve sudden or excessive pressure and permit the explosive gas, flames, and shock resulting therefrom to escape without injury to the structure or to the operatives.

In constructing my improvement I use a furnace A of the desired size and shape and provide it with a dumping-platform B, having a railing *b* around the outer edge thereof to protect the operatives and prevent them from falling over the edge. This platform may be made of steel or other relatively non-combustible material and is held in position on the brickwork of the furnace by means of a series of posts C C′, which are securely anchored in any desired manner to the furnace-shell.

The platform is provided with a central opening *b′* in line with and of size equal to the opening in the upper part of the furnace, and in this opening is inserted a hopper D of the desired size and incline. This hopper is supported in position by being secured to the shell and by means of a set of angular braces E, that connect it with a supporting-ring E′. This supporting-ring is secured to the metal beams *e′*, which in turn are secured to the supporting parts. The hopper is provided with a movable feed-bell G, which is so arranged as to have the desired vertical movement for the purpose of admitting the required amount of ores and materials to the furnace. I have not shown and do not think it necessary to describe the mechanism for raising and lowering this bell, as it is so well known in the art that further description and details might only tend to confuse or render ambiguous the novel portions.

In order to provide means for the safe exit of excess of pressure due to sudden explosions, I provide angular braces E, alluded to above, and between each set of such angular braces I provide a swinging door H, pivoted at its upper portion *h* to a ring H′, that surrounds and secures the braces to the hopper portion. These doors are arranged, preferably, at an angle of about thirty degrees to the perpendicular, and are preferably formed of heavy materials, such as iron, so that if they are opened from any cause whatever they will immediately fall back into their normally-closed position on the cessation of the pressure or extraneous force. The "explosion-doors," as I term them, and the outer side of the hopper form an annular V-shaped channel of the area about equal to the area of the narrowest portion *a* of the furnace, so that when an explosion occurs the pressure in almost all instances enters this annular V-shaped channel and forces its way out through the point of least resistance—viz., the swinging doors. The operatives on the dumping-platform are protected from the flames by means of the metal floor, so that the flames pass through the surrounding atmosphere without doing any damage to the operatives or mechanism.

In Figs. 2 and 3 I have shown modified forms of doors and supporting-framework, which are water-jacketed in order to prevent undue expansion or contraction of the metals and consequent warping which might take

place from being in contact with high degrees of heat. In describing the structure shown in these figures I desire it to be understood that all the rest of the mechanisms may be substantially the same as have been described in connection with Fig. 1, and I only show so much of such figure and mechanical elements as will enable a clear understanding of the devices and their operation.

In Figs. 2 and 3, E^2 is the supporting-rim, and E^3 angular braces or ribs that assist in supporting the hopper as well as providing a framework for the explosion-doors. These ribs or braces are made hollow, so as to provide chambers e^5, and are provided at their lower ends with inlet-pipes e^6, by which water is admitted to the same. These ribs are provided with projecting bosses E^4 at their upper portion, and the explosion-doors H^3, with lugs h^4 at their upper portions, arranged to come opposite the bosses on the ribs or framework. The lugs of the doors are perforated and the bosses of the ribs provided with threaded openings, so that hollow plugs or pivots K may be inserted through the lugs to engage with the bosses on the ribs. These pivot-plugs are shouldered, so as to be securely tightened against their shoulders and prevent movement of the same. They are also provided with axial openings k, that register with openings d^7 in the ribs, so that water may flow through the ribs, through the openings e^7 in the bosses, through the axial openings k in the pivot-plugs, through the radial opening k' in the pivot-plug to enter the water-chambers H^4 of the explosion-doors. In the figures referred to I have only shown one lug, but it will be understood that the opposite lug is provided with a similar pivot-plug, so that water may flow through the door into the next rib or brace of the framework, and from there on into the other doors, as desired.

The advantages derived from the use of my structure will be manifest to those skilled in the art, and consist principally in the mechanism that provides for the safety of the operatives and in preventing the destruction of the upper portion of the furnace.

While I have described my invention with more or less minuteness as regards details and as being embodied in certain precise forms, I do not desire to be limited thereto unduly any more than is pointed out in the claims. On the contrary I contemplate all proper changes in form, construction, and arrangement, the omission of immaterial elements, and the substitution of equivalents, as circumstances may suggest or render expedient.

I claim—

1. In a blast-furnace, the combination of a hopper portion, a feed-bell located centrally therein, a dumping-platform surrounding the upper portion of the hopper, and a set of swinging doors arranged on the furnace adjacent to the hopper and forming in connection with the hopper an annular chamber having annular communication with and forming part of the smelting-chamber so arranged that explosive gases may enter the same, open the doors and be expelled directly into the open air, substantially as described.

2. In a blast-furnace, the combination of a cone-shaped hopper portion, a conical feed-bell located centrally therein, a dumping-platform surrounding the upper portion of the hopper, metallic posts supporting the dumping-platform and anchoring the same to the furnace-walls, and a set of swinging doors arranged at an angle to the perpendicular and pivoted at their upper portion surrounding the hopper portion so as to form in connection therewith an annular chamber having annular communication with and forming part of the smelting-chamber, whereby explosive gases are guided to contact the doors, open the same and be expelled into the outer air, substantially as described.

3. In a blast-furnace, the combination of a hopper portion, a platform surrounding the same, a set of swinging doors provided with water-jackets arranged on the furnace adjacent to the hopper and forming in connection therewith, an annular extension of the smelting-chamber, and a supporting-frame for the swinging doors provided with water-chambers communicating with the water-chambers of the swinging doors for the purpose of supplying a current of water to such doors and supporting them in position, substantially as described.

FREDERICK H. FOOTE.

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