

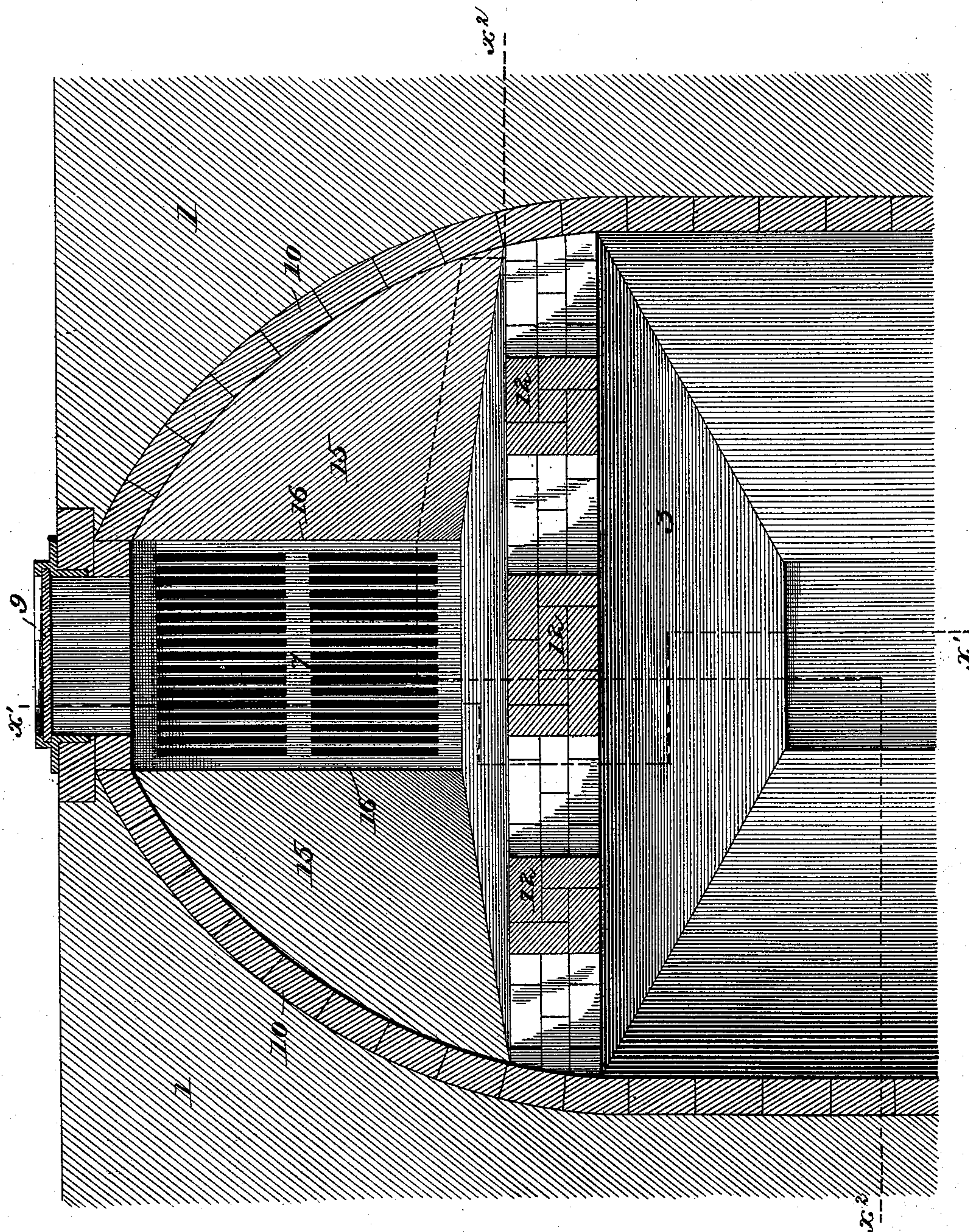
(No Model.)

5 Sheets—Sheet 1.

D. E. HEALY.
GRADUAL COMBUSTION FURNACE.

No. 539,771.

Patented May 21, 1895.



Witnesses:
John Enders Jr.
James Lavallin

Fig. 1.

Inventor
Daniel E. Healy.
by Robert Burns
Attorney.

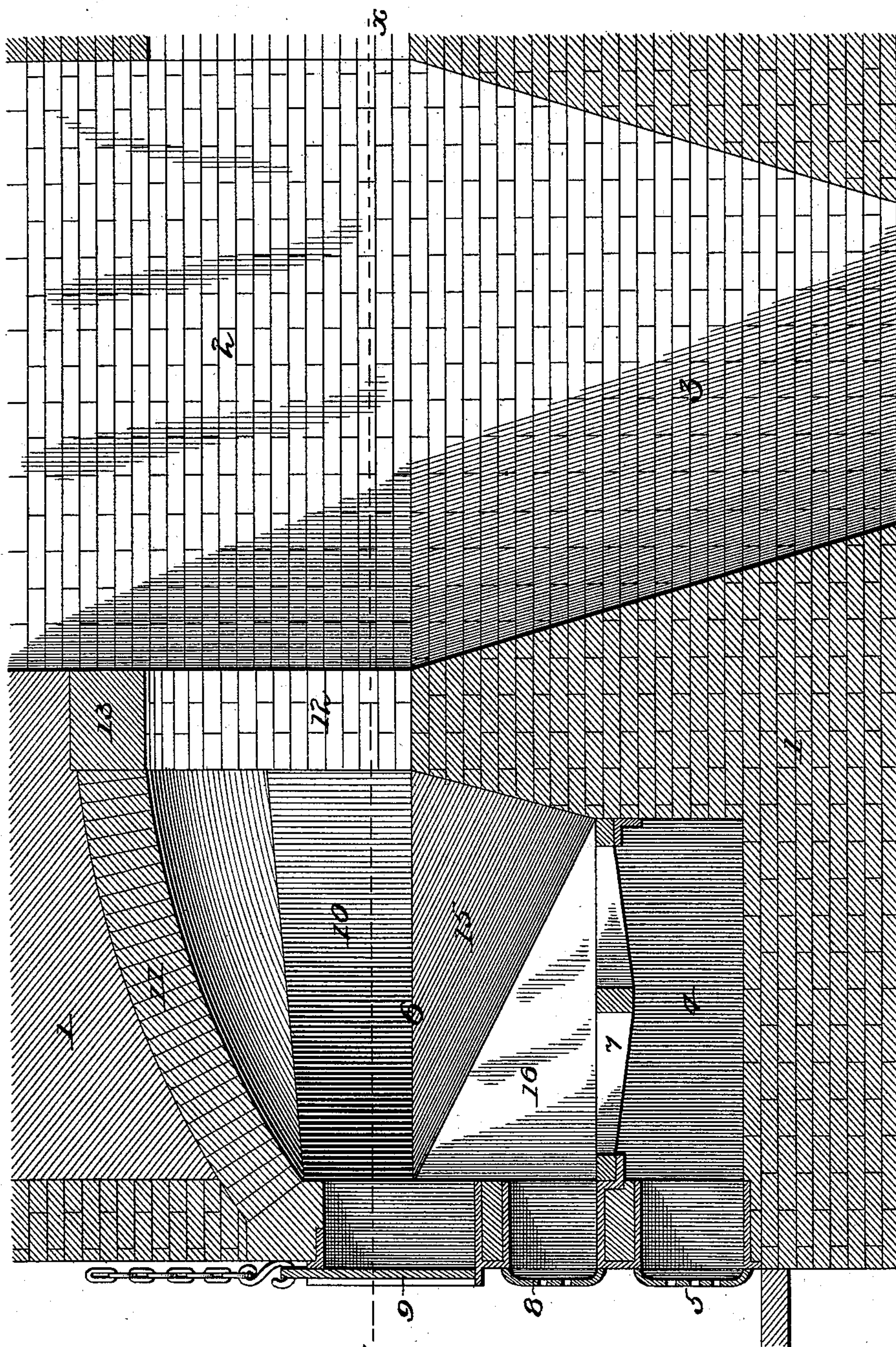
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5 Sheets—Sheet 2.

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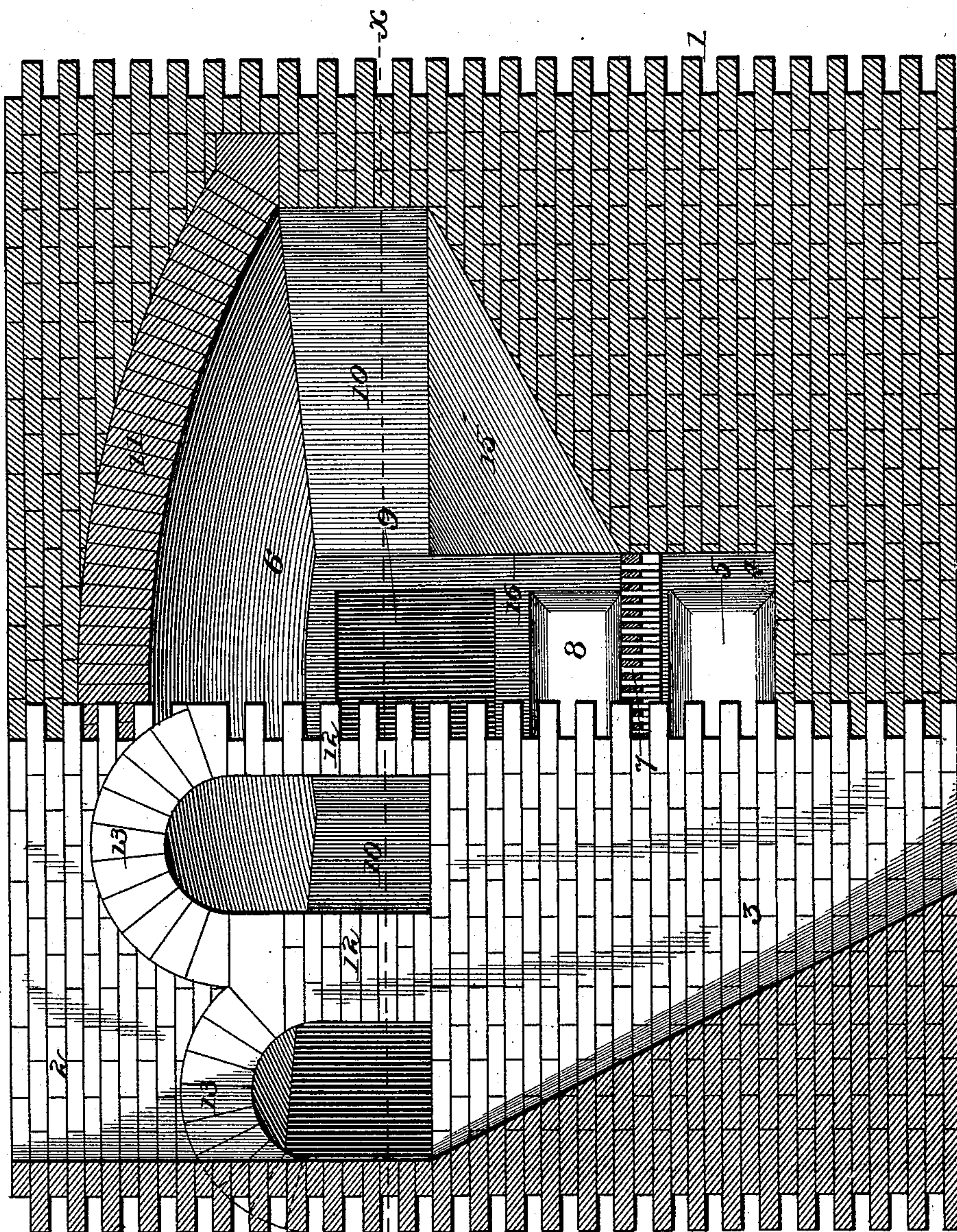
Fig. 2.

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Fig. 3.

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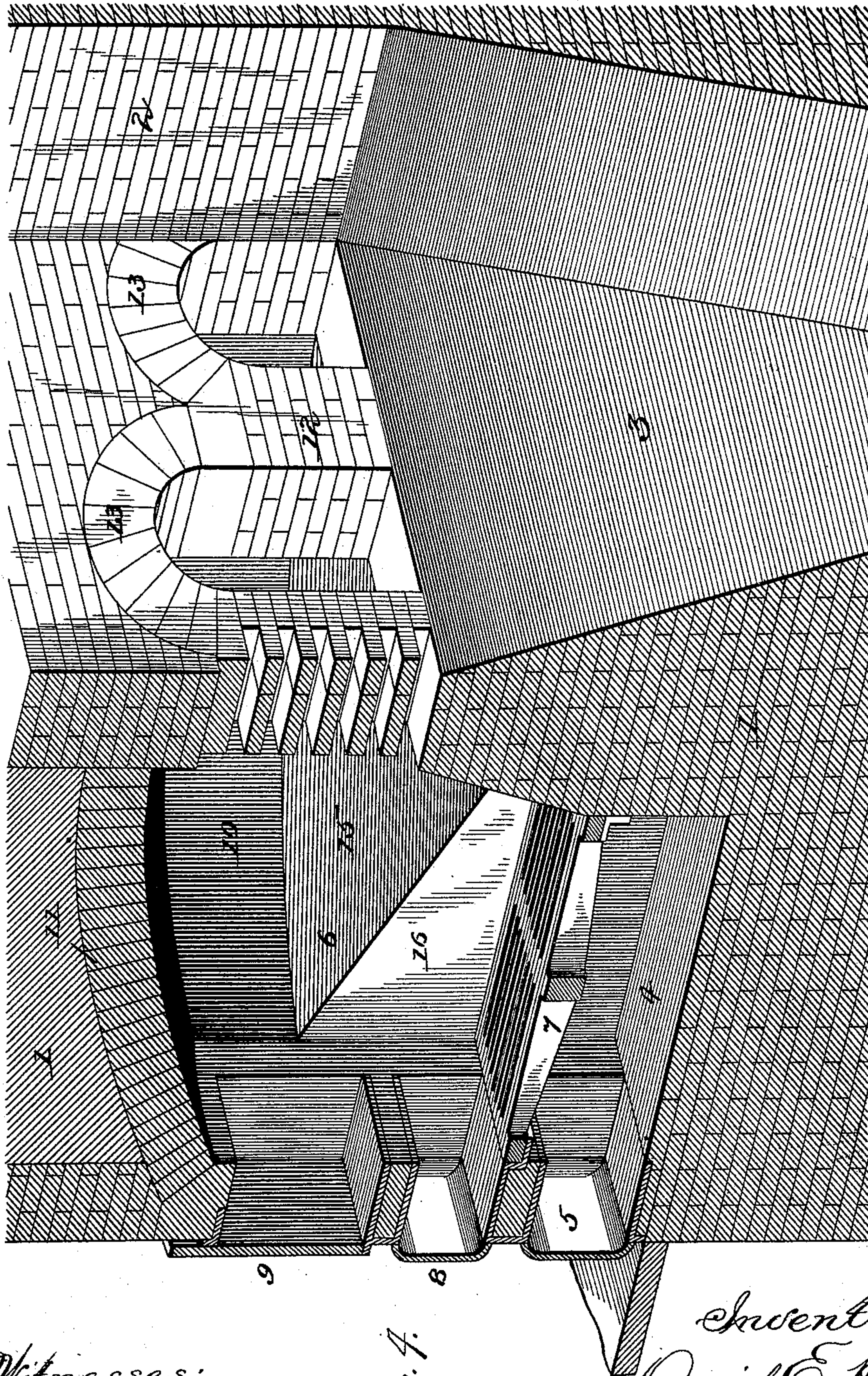
(No Model.)

5 Sheets—Sheet 4.

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Fig. 4.

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Fig. 7.

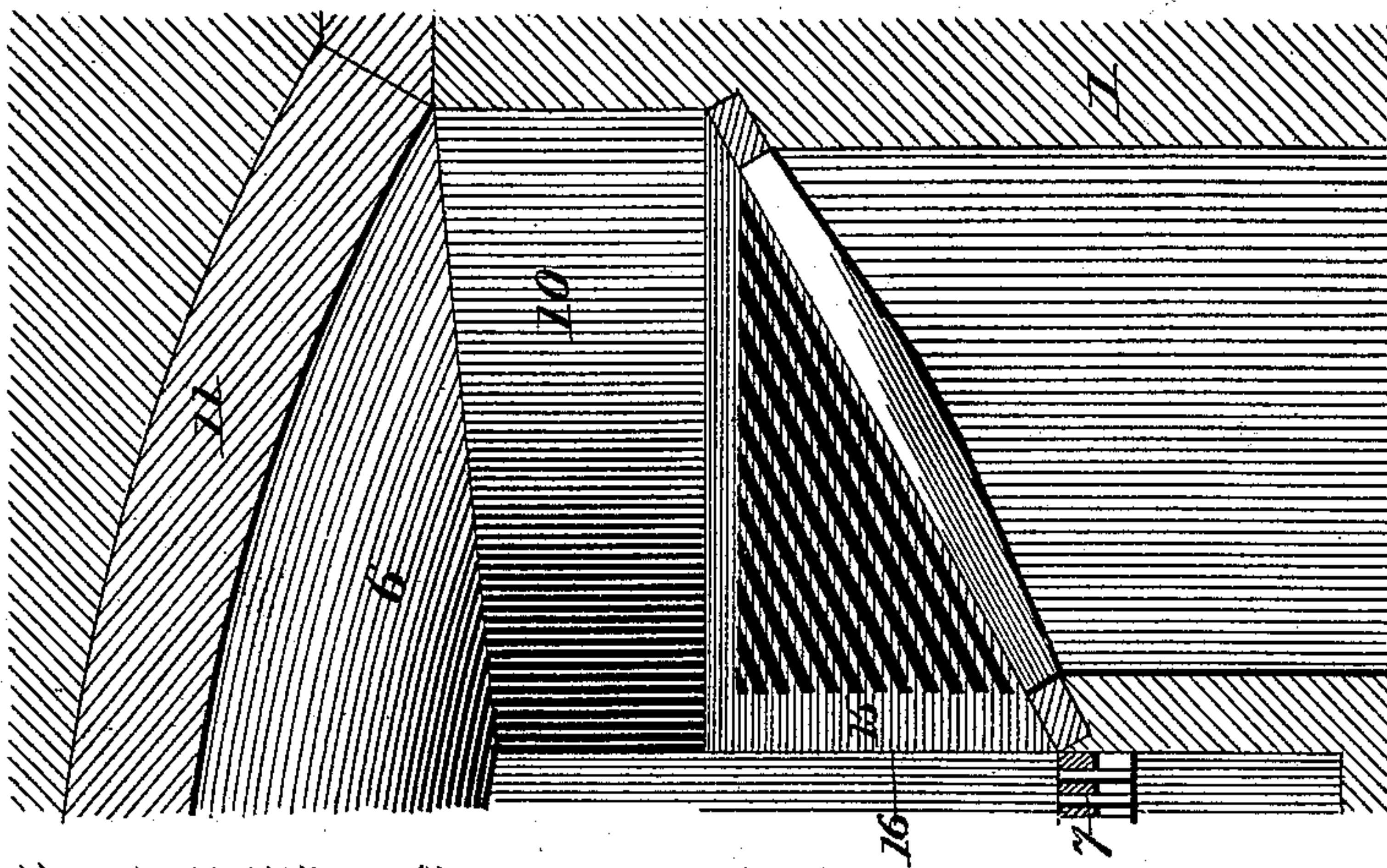


Fig. 6.

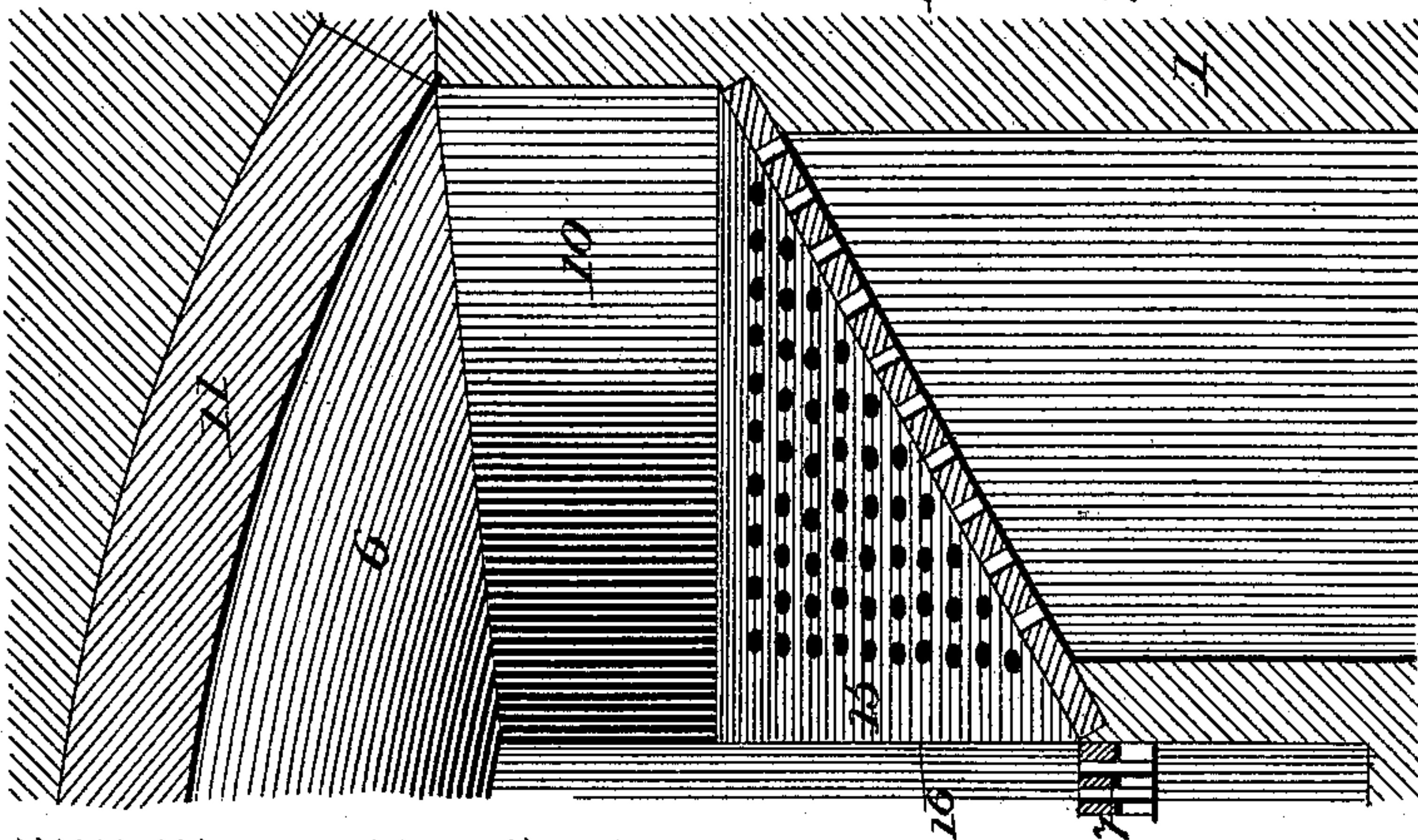
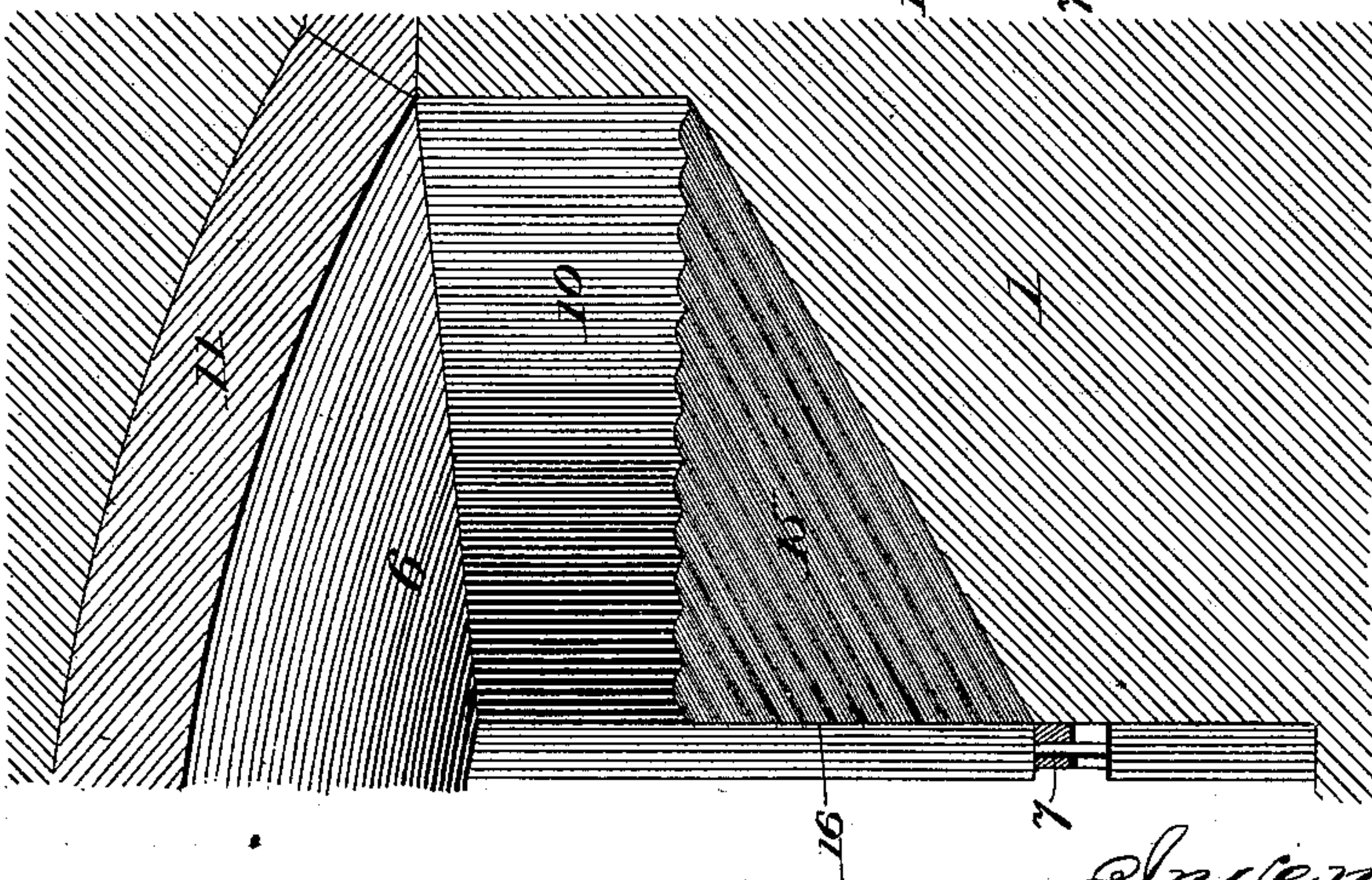


Fig. 5.



Witnesses:
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Inventor,
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by Robert Burns
Attorney.

UNITED STATES PATENT OFFICE.

DANIEL E. HEALY, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO
RICHARD I. STEARNS, OF SAME PLACE.

GRADUAL-COMBUSTION FURNACE.

SPECIFICATION forming part of Letters Patent No. 539,771, dated May 21, 1895.

Application filed March 31, 1894. Serial No. 505,921. (No model.)

To all whom it may concern:

Be it known that I, DANIEL E. HEALY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Gradual-Combustion Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification.

This invention relates to certain improvements in that class of furnaces, for burning slack coal, garbage, and other like refuse and which are generally known as the gradual combustion type of furnace; and the present improvements have for their object, to provide a simple, durable, and efficient construction and arrangement of the furnace parts, by means of which the fuel in its gradual descent, from its point of income down onto the fire grate, is exposed to a gradually greater heat that distills off and consumes the volatile portions of the fuel in a gradual and effective manner before the fixed or non-volatile portions reach the fire grate to be finally consumed in maintaining the fire thereon. In this manner very perfect results are attained in the combustion of refuse material containing large amounts of water and other volatile constituents. I attain such object by the construction and arrangement of parts illustrated in the accompanying drawings, in which—

Figure 1 is a horizontal section at line xx , Figs. 2 and 3, illustrating my present invention applied to the furnace of a continuous-burning limekiln; Fig. 2, a vertical longitudinal section of the same at line $x'X'$, Fig. 1; Fig. 3, a vertical transverse section of the same at line x^2x^2 , Fig. 1; Fig. 4, a sectional perspective view of one-half of the furnace, and Figs. 5, 6, and 7 detail vertical transverse sections illustrating modified forms of the inclined breasts or surfaces of the present invention.

Similar numerals of reference indicate like parts in the several views.

In the accompanying drawings I illustrate my present improvements as applied to a continuous burning lime kiln. My invention

however relates solely to the construction of the furnace shown connected therewith.

Referring to the drawings, 1 represents the inclosing walls of a lime kiln, 2 the barrel or burning chamber thereof, and 3 the lime kettle, into which the lime after burning descends, prior to removal therefrom through an opening at its lower end, closed by a suitable door or gate.

The present furnace will as usual be formed in the side walls of the kiln, and will be provided with the usual ash pit, 4, having an access door 5, and a fire chamber 6, having a rectangular fire grate 7, a fire grate cleaning door 8, and a fuel feeding door 9.

In the present invention, the main features of novelty, consist in the construction of the fuel containing portion of the fire chamber, of an upwardly and rearwardly flaring form, the bottom and most restricted portion, whereof is formed by a fire grate, 7, substantially rectangular in form and of a correspondingly restricted area. In the construction of such fuel containing portion of the fire chamber, the side walls thereof will be beveled or chamfered off, so as to form at each side of the fire grate 7, triangular shaped surfaces or breasts 15, extending from the base of the side walls 10, of the upper portion of the fire chamber, to the rear corners of the fire grate 7. As so arranged the surfaces of such breasts 15, will have a downward inclination toward the grate and toward the rear of the furnace, and merge into the vertical wall 16, at each side of the fire grate 7, and which are also of a triangular form as illustrated in Figs. 2, 3 and 4.

With the improved furnace construction as above described, the combustion of the fuel immediately adjacent to, as well as upon the fire grate 7, is of a local or secondary nature, and acts mainly, to drive off the volatile portions or constituents of the superimposed body of fuel, the combustion of which volatile portions of the fuel in the greatly enlarged portion of the fire chamber, above the body of fuel is effected by a supply of air, introduced in a manner mainly independent of the fire grate 7, and the local combustion at such point; such independent supply of air

being had through the firing door, or other usual opening in the front wall of the furnace. This combustion of the volatile constituents of the fuel in the upper and expanded portion of the fire chamber produces the main heating effects of the furnace, and by means of the above described construction, assisted in a great measure, by the supplementary flaring construction of the other portions of the fire chamber as hereinafter described, the volume of such combustion is made greatest toward the rear end, or outlet for the products of combustion from the fire chamber, and inversely diminished toward the front end of the furnace, owing not only to the flaring nature of the fire chamber, toward its rear end, but also to the correspondingly gradually increasing amount of volatile constituents that are driven off from the fuel at successive points toward the rear of the fire chamber.

The present backwardly and upwardly flaring nature of the fuel containing portion of the fire chamber, as above set forth, also causes the fuel as it progressively consumes, to gradually descend onto the fire grate, not only in a downward but also in a rearward manner, so as to maintain a progressively larger amount of local heat or combustion toward the rear portion of the fire grate 7, to cause a greater amount of volatile constituents to be driven off from the superimposed fuel in a progressive manner toward the rear of the fire chamber, and thus coact in attaining the more perfect results that are the objects of the present invention.

Another and important factor in the proper combustion of horse manure, and other like moist fuel, is afforded by the inclined surfaces or breasts 15, that for such uses are built up of fire brick or other analogous heat retaining material, to retain heat, and assist in the desiccation of the refuse matter that constitutes the fuel, and which in the feeding of the furnace is thrown or shoveled upon such inclined breasts or surfaces, from which as it diminishes in volume, due to its desiccation, and the combustion of the gases evolved therefrom, gravitates down onto the fire grate 7, in a downwardly and rearwardly manner, to be completely consumed in maintaining a local fire upon the fire grate 7.

As an adjunct to the improved construction heretofore described, the side walls 10, of the upper or combustion portion of the fire chamber, are flared apart or widened toward the rear of the furnace, and preferably in a curved manner, as illustrated in Figs. 1 and 4; and the crowned furnace top 11, also flares or rises toward the rear, preferably in the form of an expanding arch, as illustrated in Figs. 2, 3 and 4, its rear and expanded end next to the lime burning or other chamber 2, being supported by a series of pillars 12, connected together at the top by a series of small

connecting arches 13, the spaces between the said pillars forming the outlet openings from the fire chamber of the furnace into the lime burning or other chamber, in connection with which the furnace is used.

In Figs. 1, 2, 3 and 4, of the drawings I have illustrated the inclined surfaces or breasts 15, as being plane and imperforate, and while preference is given to such form for most uses, it is however within the province of the present invention to make such breasts 15, of a corrugated nature as shown in Fig. 5, a perforated nature, as shown in Fig. 6, or a grated nature, as shown in Fig. 7.

In the practical and continued use of a furnace constructed in accordance with the present drawings I have successfully fired lime kilns, with horse droppings, almost wholly as a fuel, using a few sticks of wood occasionally, more however to keep such fuel material from settling too rapidly and compactly onto the fire grate so as to prevent the ascent of the necessary amount of air to support the proper local combustion of the fuel at such point.

While the present furnace construction as shown in the drawings, is specially designed for the combustion of garbage or other refuse, it is capable however, of use with other fuel such as coal, with a corresponding result as to perfect combustion thereof in a smokeless and economic manner; and while my present invention is shown and described in connection with a lime kiln, I do not in any manner limit myself to such particular application as the invention may be used for any other analogous uses, where fuel of any nature is intended to be burned in an economic and smokeless manner.

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

1. In a gradual combustion furnace, the combination of a central fire grate, and side fuel supporting surfaces, that have a downward inclination, toward the grate and toward the rear of the furnace, substantially as set forth.

2. In a gradual combustion furnace, the combination of a furnace chamber flared rearwardly, a central fire grate, and side fuel supporting surfaces, that have a downward inclination, toward the grate, and toward the rear of the furnace, substantially as set forth.

3. In a gradual combustion furnace, the combination of a furnace chamber flared rearwardly, in both an upward and lateral direction, a central fire grate, and side fuel supporting surfaces, that have a downward inclination, toward the grate, and toward the rear of the furnace, substantially as set forth.

4. In a gradual combustion furnace, the combination of a central fire grate, side fuel supporting surfaces, that have a downward inclination, toward the grate and toward the

rear of the furnace, and a feeding door or opening, arranged some distance above the fire grate, substantially as set forth.

5 In a gradual combustion furnace, the combination of a furnace chamber flared rearwardly, in both an upward and lateral direction, a series of vertical pillars dividing the outlet from the furnace chamber, a central fire grate, and side fuel supporting surfaces,

that have a downward inclination, toward the grate, and toward the rear of the furnace, substantially as set forth.

In testimony whereof witness my hand this 19th day of March, 1894.

DANIEL E. HEALY.

In presence of—

R. I. STEARNS,
ROBERT BURNS.