

*Jos. Watts,
Furnace.*

Patented Mar. 24. 1868.

N^o 76,010.

Fig. 1.

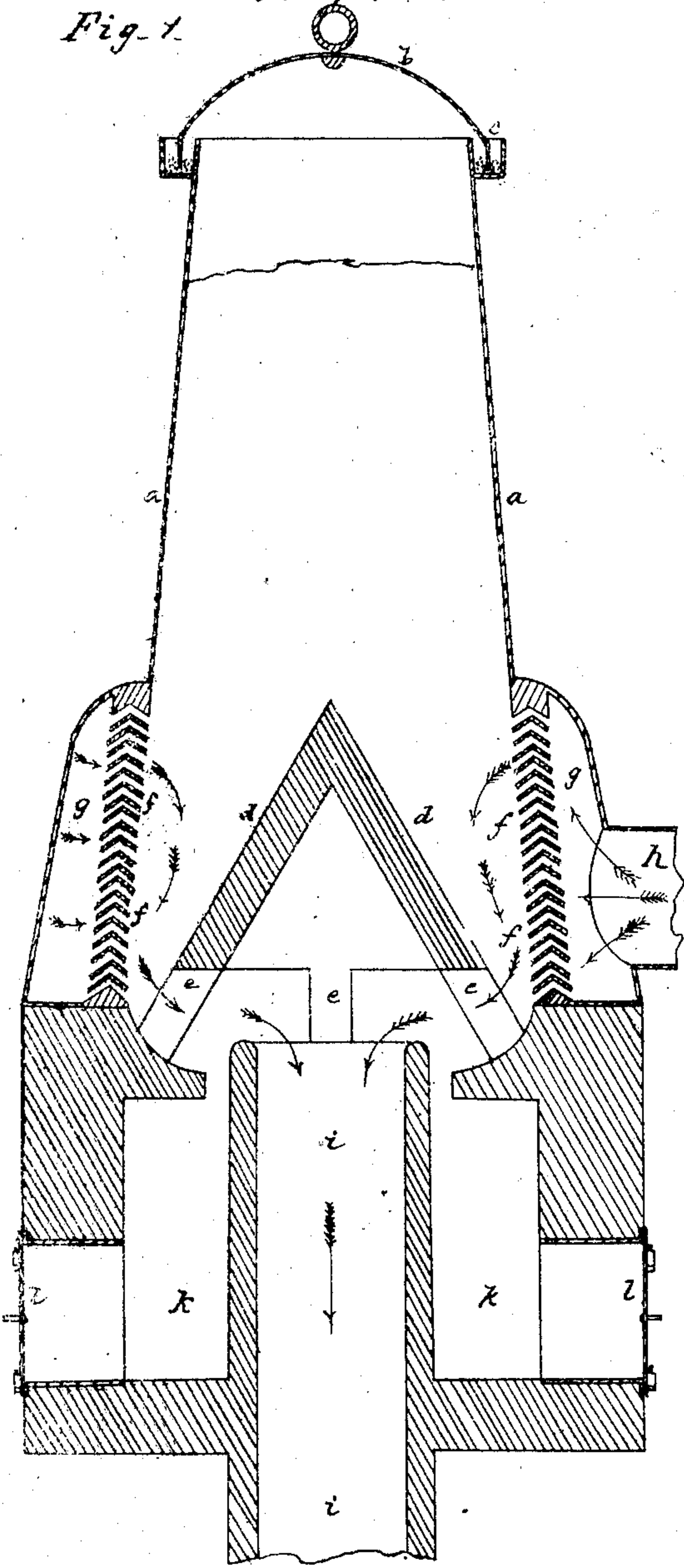


Fig. 3.

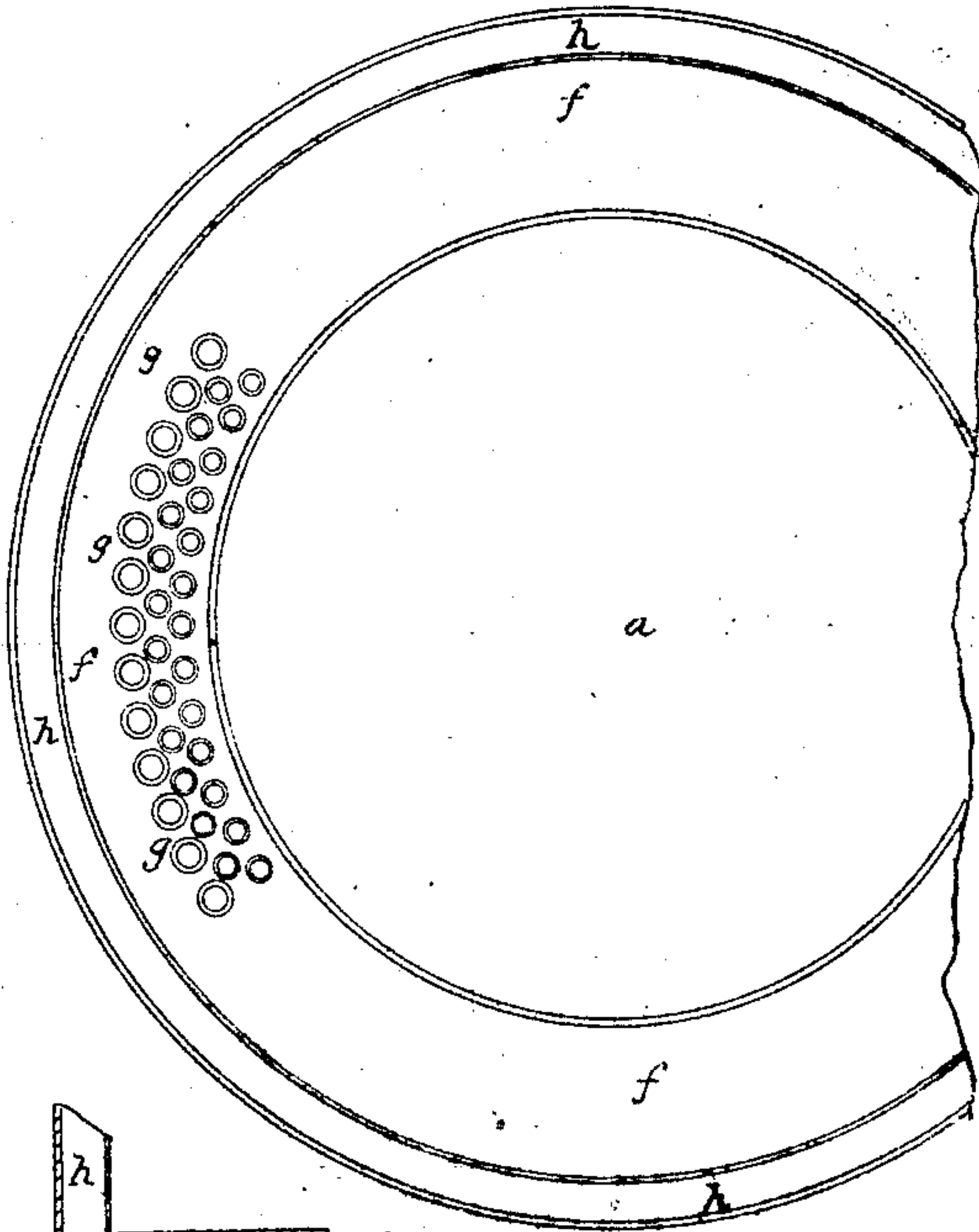
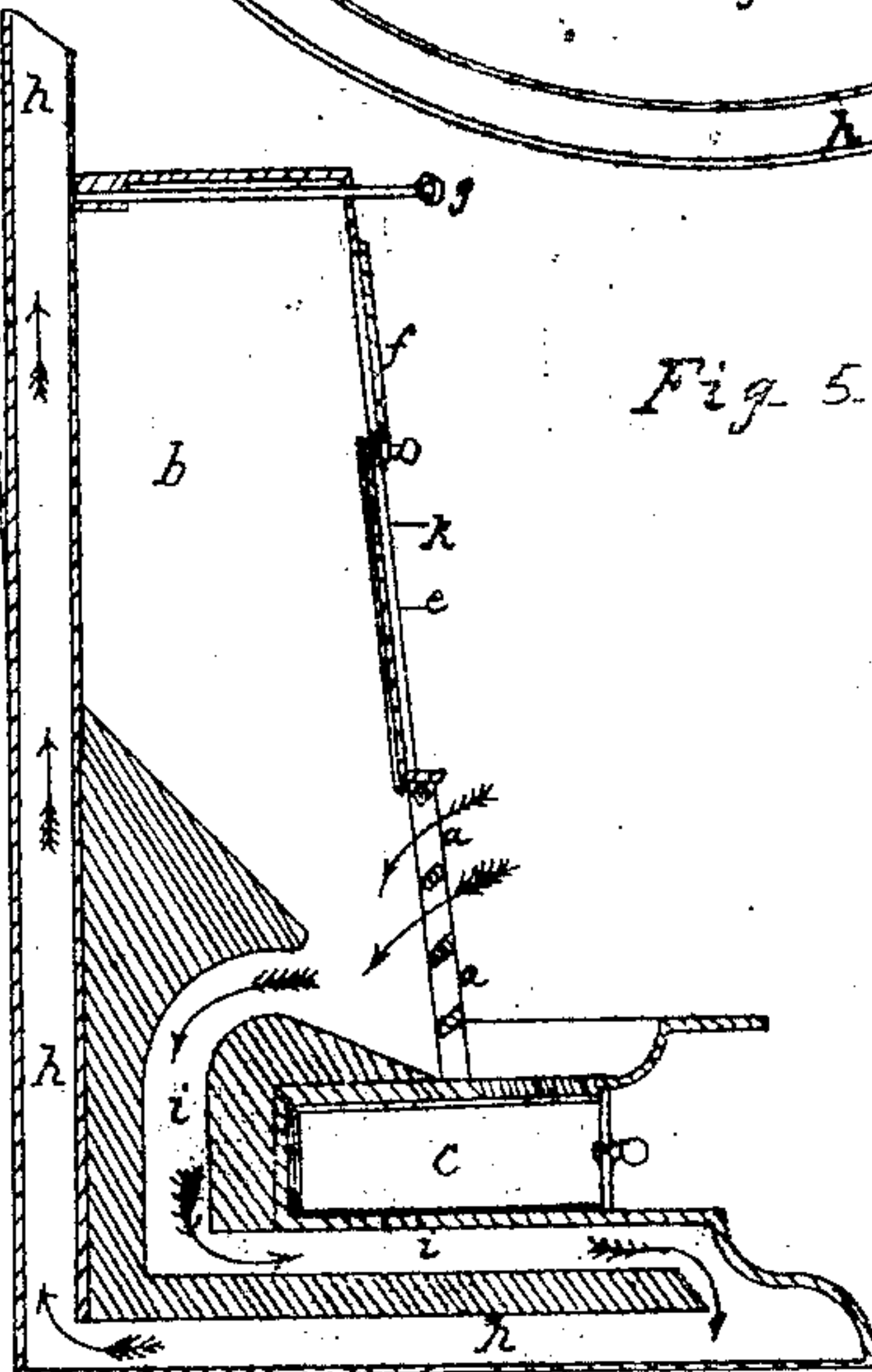


Fig. 5.



Witnesses.

Elihu Burritt.
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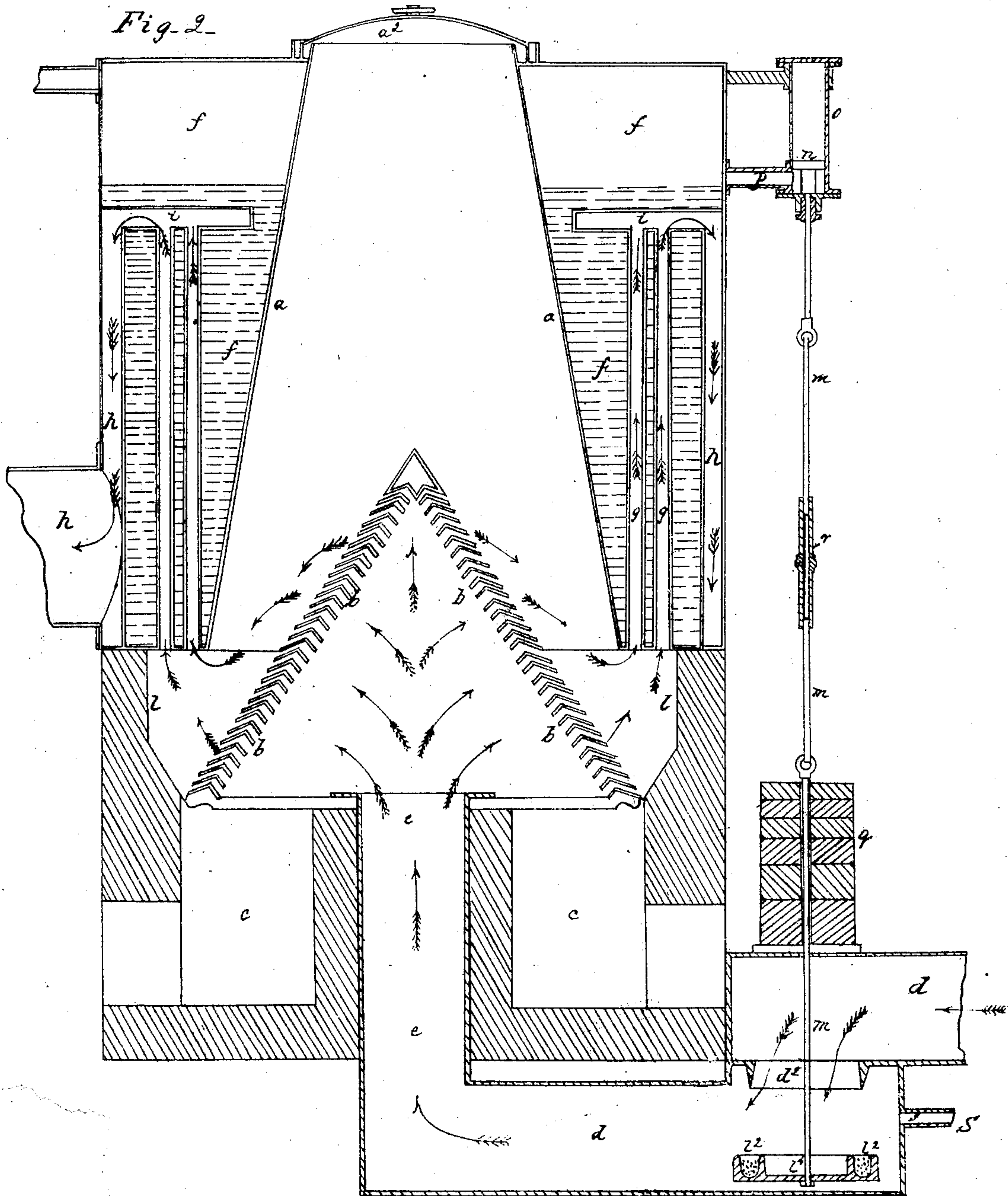
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Witnesses.

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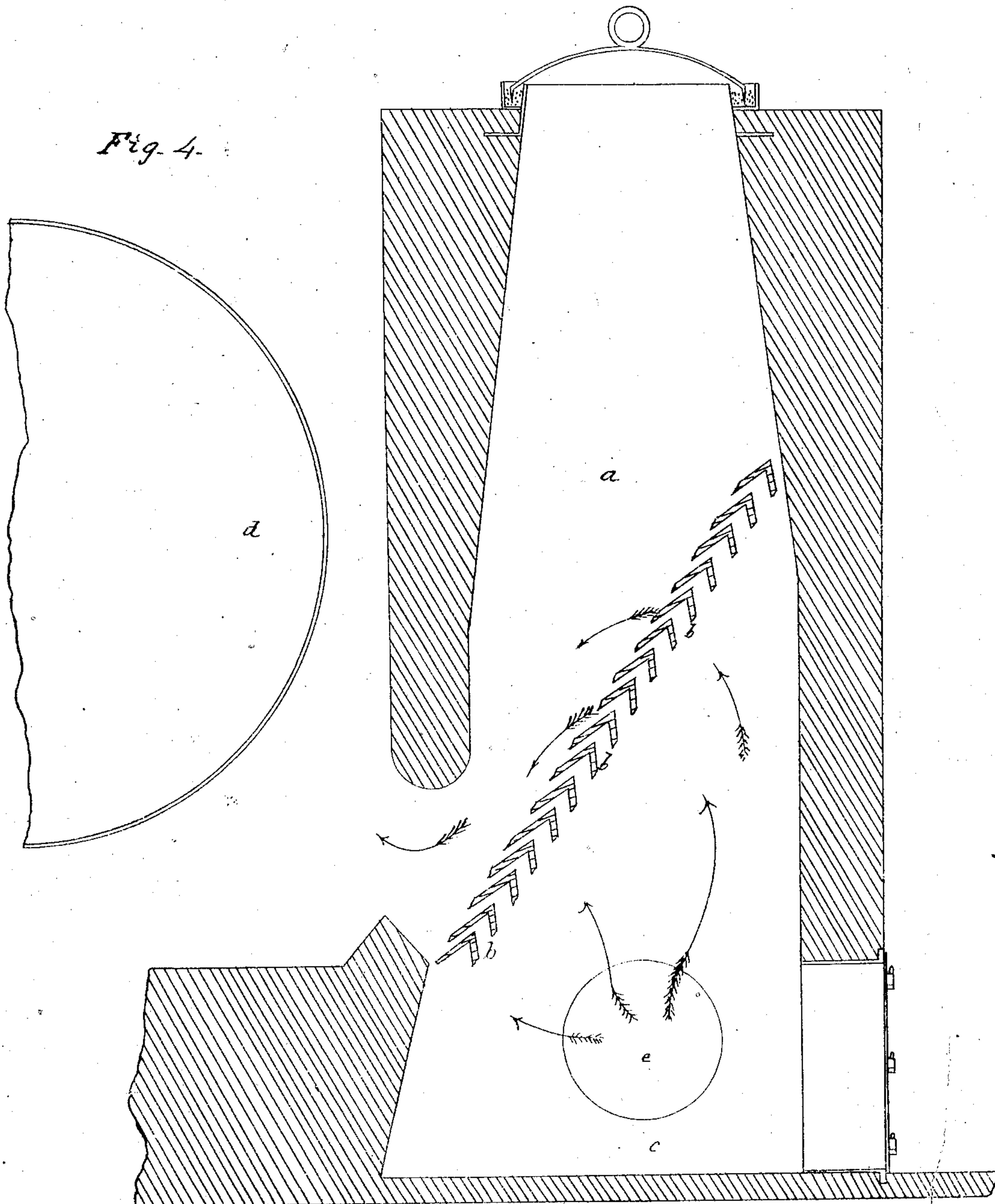
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Fig. 4.



Witnesses.

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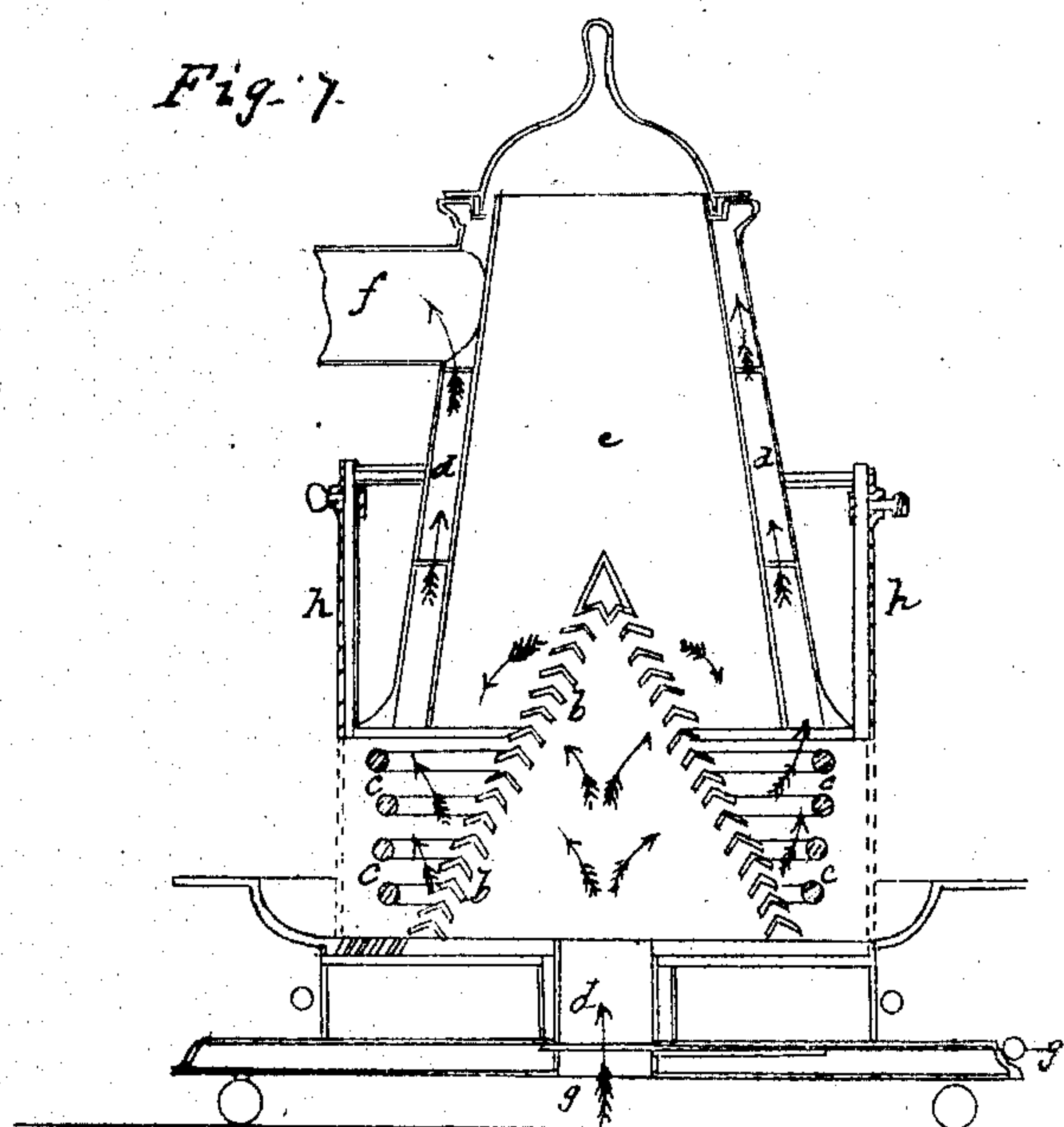
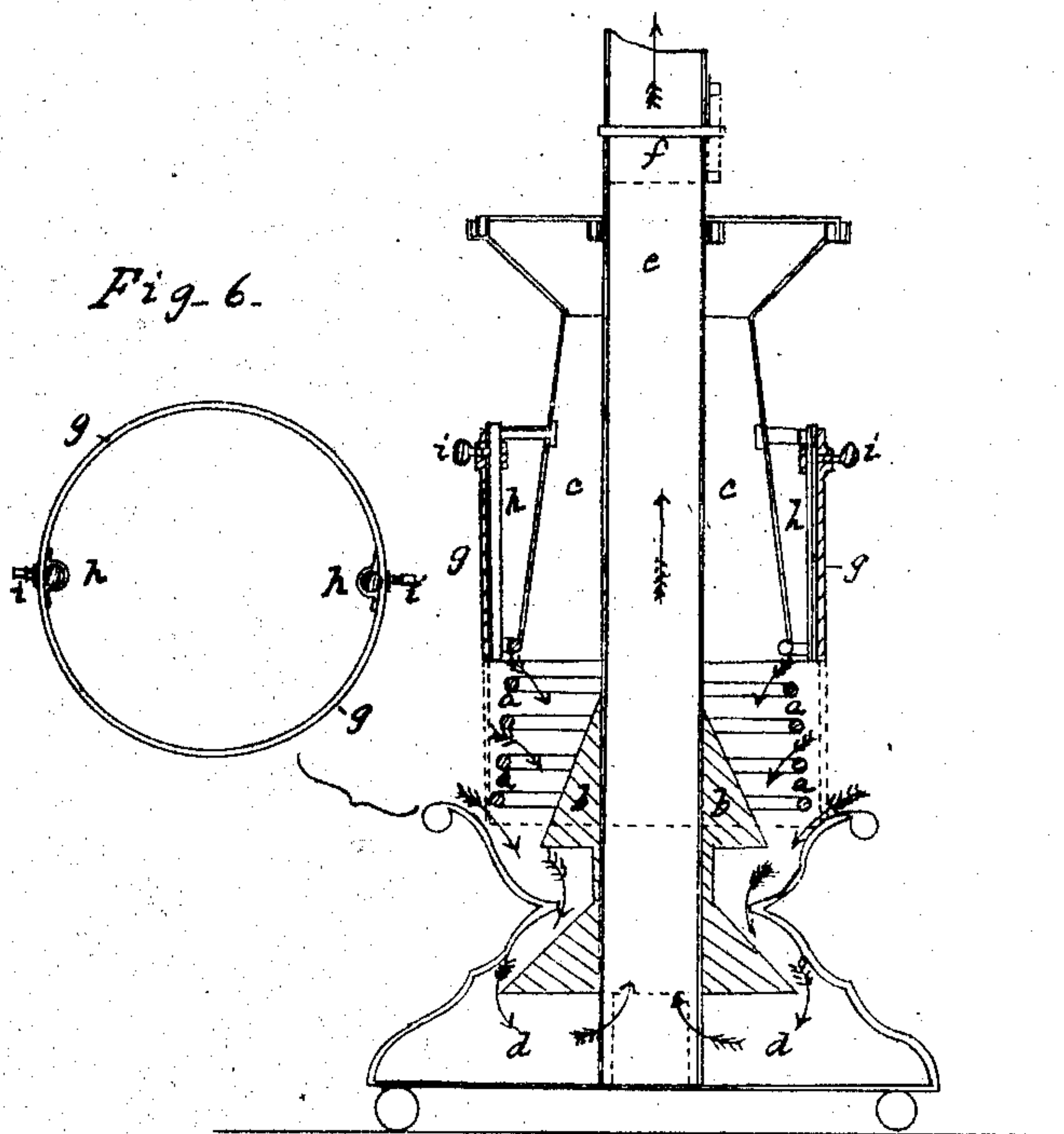
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JOSEPH WATTS, OF BIRMINGHAM, GREAT BRITAIN.

Letters Patent No. 76,010, dated March 24, 1868.

IMPROVEMENT IN HEATING-FURNACES.

The Schedule referred to in these Letters Patent and making part of the same.

Be it known that I, JOSEPH WATTS, of Birmingham, in the county of Warwick, solicitor's clerk, have invented new and useful Improvements in Furnaces and Fireplaces, and in utilizing the waste heat of the said furnaces and fireplaces, and in utilizing and obtaining motive power from the air supplied to furnaces and fireplaces; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the annexed drawings, making a part of this specification, in which—

Figure 1 represents a vertical section of one form of furnace, in which a direct-downward draught is employed.

Figure 2, a vertical section of another furnace combined with a vertical steam-boiler.

Figure 3, a horizontal section of the same.

Figure 4, a vertical section of another furnace for heating a horizontal steam-boiler.

Figure 5, a vertical section of a fireplace of stove or grate for domestic purposes.

Figure 6, a vertical section of another fireplace or stove for domestic use; and

Figure 7, a vertical section of another arrangement of fireplace or stove.

All of which are constructed according to my invention.

The object of the first part of my said invention is to produce perfect combustion of fuel and its consequent economization. This is effected by introducing the gases or air for combustion in the same direction as the fuel used, and causing the same to pass downward, instead of upward, as is usual, through such fuel, and thence, between the grate or fire-bars upon which the said fuel rests, into the outer atmosphere at a point sufficiently elevated to produce the required amount of draught.

I prefer to construct the furnace in the following manner: I make the said furnace of a receptacle or chamber, to which I prefer to give the figure of a vertical pyramid. The fire or grate-bars are fixed in the pyramidal chamber, and are placed, by preference, at an angle of about forty-five degrees in order to facilitate the removal of the ashes through the said fire-bars by means of the weight of the superincumbent fuel. That portion of the chamber underneath the grate or fire-bars has an opening provided with a closely-fitting door or slide for closing it, which opening communicates directly with the flues of a steam-boiler, or with a series of flues, pipes, or chambers, which it is intended to heat, and which may be connected with malting-kilns or otherwise applied to heating purposes. The heated air and products of combustion from the furnace, after traversing the said flues, pipes, or chambers, pass to a chimney. I introduce the fuel to the pyramidal chamber at or near the top or narrowest part thereof, which is then closed up air-tight by a door or otherwise, and the atmospheric air necessary for combustion, either hot or cold, is introduced into the chamber at a point sufficiently high above the grate-bars to allow of the formation of a continuous stratum of carbonized fuel sufficient in quantity to burn all the volatile products of the fuel in process of carbonization.

The atmospheric air supplied to the furnace may be heated by being passed between or around the series of flues, pipes, or chambers through which the products of combustion from the furnace pass. The said heated air, prior to its introduction into the furnace, may be used for drying, evaporating, and ventilating. When the air supplied to the furnace is not heated, it may be made to pass over liquids for the purpose of cooling them, or be otherwise applied for cooling purposes, such as the cooling and drying of malt and cooling worts.

By the arrangements described, the maximum amount of heat is obtained from the said fuel, and the said fuel consequently economized.

This part of my invention may be applied to existing furnaces and fireplaces of the ordinary kind in the following manner; that is to say, I close the outlet above the grate to the chimney by a slide or valve, which may be opened or closed at pleasure, and I make another outlet or communication with the chimney at any convenient place underneath the grate-bars, which last-mentioned outlet I also provide with a slide or valve so constructed as to allow of the draught of the chimney being regulated at pleasure. By these means the current of atmospheric air will be directed through the fuel downward, and similar combustion will consequently take place to that mentioned in the furnace herein first described. By means of the two slides regulating the openings into the chimney, either method of effecting combustion may be used at pleasure.

For the purpose of obtaining motive-power from the atmospheric air supplied to furnaces, I place a fan or

fans in a pipe or passage, through which the whole of the atmospheric air required for combustion is made to pass, which said air, as it passes, impinges upon the vanes of the said fan or fans, and gives motion thereto, which motion may be transmitted from the axes of the said fans, by a train of wheels or other gearing to the machine or apparatus which it is wished to actuate. The quantity of air passing through the pipe or passage described may be regulated by a slide or throttle-valve.

Having explained the nature of my invention, I will proceed to describe, with reference to the accompanying drawings, the manner in which the same is to be performed. In fig. 1, *a* is the pyramidal chamber, containing the fuel, the said chamber being closed air-tight by the lid or cover *b* after the fuel has been introduced. The said lid or cover dips into a groove or trough, *c*, containing sand, situated around the top of the chamber *a*. At the base of the chamber *a*, and in the axis thereof, is a conical hollow bed, *d*, constructed of fire-clay or other suitable material, upon which bed the superincumbent fuel is supported. This bed is carried by supports or arches, *e*, resting on the extreme base of the chamber *a*. At the open sides of the lower part of the chamber *a* are circular fire or grate-bars, *f*, having in cross-section an angle not less acute than that represented, and outside the said fire or grate-bars is an annular chamber, *g*, to which chamber air or gas for supporting the combustion of the fuel between the bed *d* and fire-bars *f* is supplied by the passage or flue *h*, which flue, *h*, is provided at any convenient part with a valve or damper connected with a piston loaded with any required weight, and working in a cylinder connected with the boiler or chamber the furnace or fireplace is designed to heat, by means of a closed vessel containing water placed therein, by which means the expansion of the steam or water in such boiler or vessel is made to actuate the said piston and weights, and lift the said valve or damper, and thus regulate the admission of air to the furnace or fireplace and thereby prevent any unnecessary consumption of fuel in the furnace or fireplace. In the axis of the furnace, and below the bed *d*, is a flue or channel, *i*, into which the heated air and products of combustion from the fuel in the lower part of the chamber *a* pass. The flue or channel *i* communicates with the flues or steam-boiler, or with other flues, pipes, or chambers, which it is intended to heat, and which may be connected with malting-kilns or otherwise applied to heating purposes. The heated air and products of combustion, after traversing the flues of the boiler or other flues or chambers, pass to a chimney of a suitable elevation. *k* is the ash-pit closed air-tight by the doors *l*.

By an examination of fig. 1, it will be seen that the air or gaseous matter supplied by the pipe or channel *h* enters the external chamber *g*, and passes between the fire-bars *f* into the fuel situated between the said bars and bed *d*, descending through the incandescent fuel into the flue *i*, as indicated by the arrows.

By the arrangement described, a continual supply of fresh air is introduced into the fireplace, and very perfect combustion of the fuel obtained. As the combustion proceeds, the fuel in process of exhaustion gradually travels down the inclined sides of the bed *d*, its place being taken by a fresh quantity of the superincumbent fuel, the ashes and refuse matters falling into the ash-pit *k*.

In figs. 2 and 3, *a* is the fuel-chamber, closed air-tight by the lid or cover *a*², and *b b* are the circular grate or fire-bars at the base of the fuel-chamber, the said grate or fire-bars being arranged in the form of a hollow cone. *c* is the ash-pit, closed air-tight by doors, as in fig. 1. Air or gas for the combustion of the fuel resting on the fire-bars *b b* passes by the horizontal and vertical pipes or passages *d e* into the middle of the fireplace, and below the fire-bars *b b*. *f* is the boiler, situated around the central fuel-chamber *a*, in which boiler a series of vertical pipes or flues, *g g*, and an annular flue, *h*, are made, the flues *g* and *h* communicating with each other at top by the horizontal flue *i*. The annular flue *h* opens into the outlet-channel *k*. The air for combustion being introduced into the centre of the fireplace, passes between the fire-bars *b*, and through the fuel supported upon them, as indicated by the arrows, a downward draught passing through the stratum of fuel between the upper grate-bars and sides of the chamber *a*, and an upward draught through the fuel situated between the lower grate-bars and sides *l* of the fireplace. By this means all the volatile portions of the fuel, which in the usual upward draught escape as smoke are consumed in its downward passage with the downward draught before described, and before it reaches the bottom of the fireplace, where its combustion is assisted and completed by the upward draught before described, the ashes and refuse matters falling into the ash-pit *c*.

The heated air and products of combustion pass from the fireplace into the flues *g h* of the steam-boiler *f*, through which they circulate and heat the water in the said boiler, and finally escape by the horizontal flue or passage *k*, to be utilized, as hereinbefore explained. The opening *d*² in the pipe *d*, by which air is admitted to the fireplace of the furnace, may be closed by a valve or closing-plate, *l*¹, fixed to the rod *m*, the annular rim of the opening *d*² entering a trough or groove, *l*², filled with sand in the said valve or plate *l*¹. An air-tight joint is thus made.

In order to regulate the admission of air to the fireplace, and the consequent combustion and economization of the fuel, I connect the rod *m* of the plate *l*¹ with a piston, *n*, working in the cylinder *o*, opening by the pipe *p* into the interior of the steam-boiler *f*. The rod *m* is loaded by the weights *q* to the pressure at which it is wished to work the boiler. When the pressure of the steam in the boiler is sufficient to raise the weighted piston *n*, the latter moves in its cylinder, and thereby raises the valve *l*¹ and cuts off the supply of air to the fireplace. When a very slow combustion is required, the passage *d*² may be temporarily closed by raising the valve *l*, by means of a screw-box, *r*, working on the screwed ends of the rod *m*, and a small quantity of air allowed to enter the fireplace by the pipe *s*, which pipe may be furnished with a stop-cock. By this means the trouble of relighting the fire of the furnace is obviated. Portions of the side of the fireplace *l* are capable of being opened and reclosed for facilitating the removal of any obstruction which may be formed upon the fire-bars.

In fig. 4, *a* is the fuel-chamber, and *b b* the inclined fire-bars; *c* is the ash-pit, and *d* the horizontal boiler. A pipe or flue, *e*, opening into the ash-pit and provided with an air-tight valve, as hereinbefore described, supplies air to the fireplace, the said air passing between the fire-bars and through the fuel in a manner similar to

that described with respect to the furnace, fig. 2. The course of the air and products of combustion is indicated by the arrows. In obtaining motive-power from the air supplied to furnaces, I place the fan or fans hereinbefore referred to in the flues or passages *h*, *d*, and *e*, figs. 1, 2, and 4, which air on its way, to the fire-places, impinges upon the vanes of the fan or fans and gives motion thereto, which motion may be transmitted by any convenient gearing to the machine or apparatus to be actuated.

In fig. 5, *a* are the fire-bars, *b* the fuel-chamber, and *c* the ash-pan. The upper part of the fireplace is closed by a hood or cover, *e*, the said covered part constituting the fuel-chamber. Fuel is introduced at the door *f*. *g* is a throttle-valve, by which the draught through the flue *h* may be regulated. The course of the air is indicated by arrows. *k* is a slide, furnished with a set-screw, running in a groove between the fire and fire-bars *a*, for the double purpose of regulating the amount of fire exposed to view, and for shutting off the draught whilst fresh fuel is added through the door *f* to prevent an upward draught. The hot air and products of combustion pass from the fire by the flue *h* to the chimney. The heating of the foot or base of the fireplace causes a large amount of heat to be radiated into the room.

In fig. 6, *a* are the ring-like fire-bars; *b*, the back of the grate; *c*, the fuel-chamber; *d*, the base or foot of the grate; *e*, the central flue; *g* is the slide to regulate the fire-surface and prevent upward draught while supplying fresh fuel to the chamber *c*. The said slide works upon the grooved upright bars *h*, and is fixed by the set-screws *i* working in the said bars. The depressed position of the slide *g* is indicated by dotted lines. Air entering between the bars *a*, supports the combustion of the fuel, and the heated air and products of combustion, descending through the foot *d*, pass by the central flue *e* to the chimney, as indicated by the arrows. *f* is a throttle-valve, by which the draught may be regulated. The foot *d* is provided with a door or doors for the removal of the ashes from it.

Fig. 7. In this arrangement the air enters by the central flue *a*, and is regulated by a tight-fitting slide, *g*, and, passing between the conical set of fire-bars *b*, supports the combustion of the fuel between the said bars *b* and the outer bars *c*. *h* is the slide for regulating the fire-surface, and preventing upward draught, the said slide *h* being similar to that represented in connection with the fireplace or stove, (fig. 6.). The heated air and products of combustion pass between the casing *d* and fuel-chamber *e*, and escape by the pipe *f* into the chimney. Besides the heat radiated from the fire in the grate, the casing *d* becomes strongly heated, and radiates a large amount of heat into the room. The course of the air and products of combustion is indicated by the arrows.

Having now described the nature of my invention, and the manner in which the same is to be performed, I wish it to be understood that I do not limit myself to the precise details herein described and illustrated, as the same may be varied without departing from the nature of my invention; but

I claim as my invention—

1. Arranging the grate-bars or fire-bars in such a manner as to deflect the draught, or a portion thereof, in a downward direction, or in the direction in which the fuel is introduced, substantially as and for the purpose set forth.
2. The grate-bars *f* *b*, bent in A-shape, substantially as and for the purposes described.
3. In combination with the grate-bars *f*, a conical hollow bed, *d*, and the flue *e*, below the grate and bed, forming a downward and outward passage for the heated air and products of combustion, substantially as and for the purposes described.
4. A grate formed of consecutive rings of A-shaped grate-bars, arranged above each other in any suitable manner, substantially as and for the purpose set forth.

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Witnesses :

ELIHU BURRITT,
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