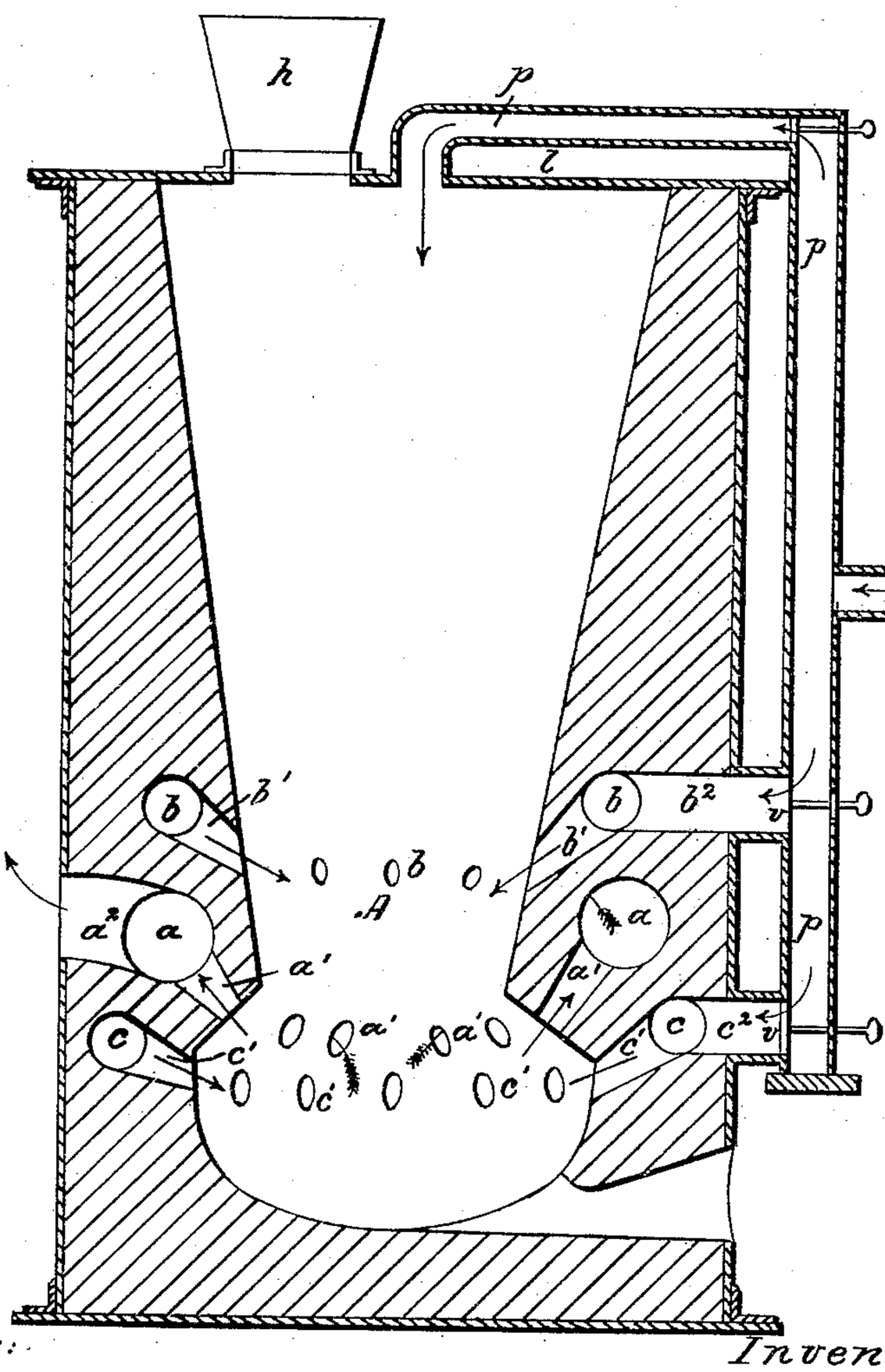
7 Sheets—Sheet 1.

E. B. WILSON.

Fireplace and Furnace.

No. 45,111. Patented Nov. 15, 1864.

Fig: 1.



Witnesses:

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Fireplace and Furnace.

No. 45,111. Patented Nov. 15, 1864.

Fig: 2.

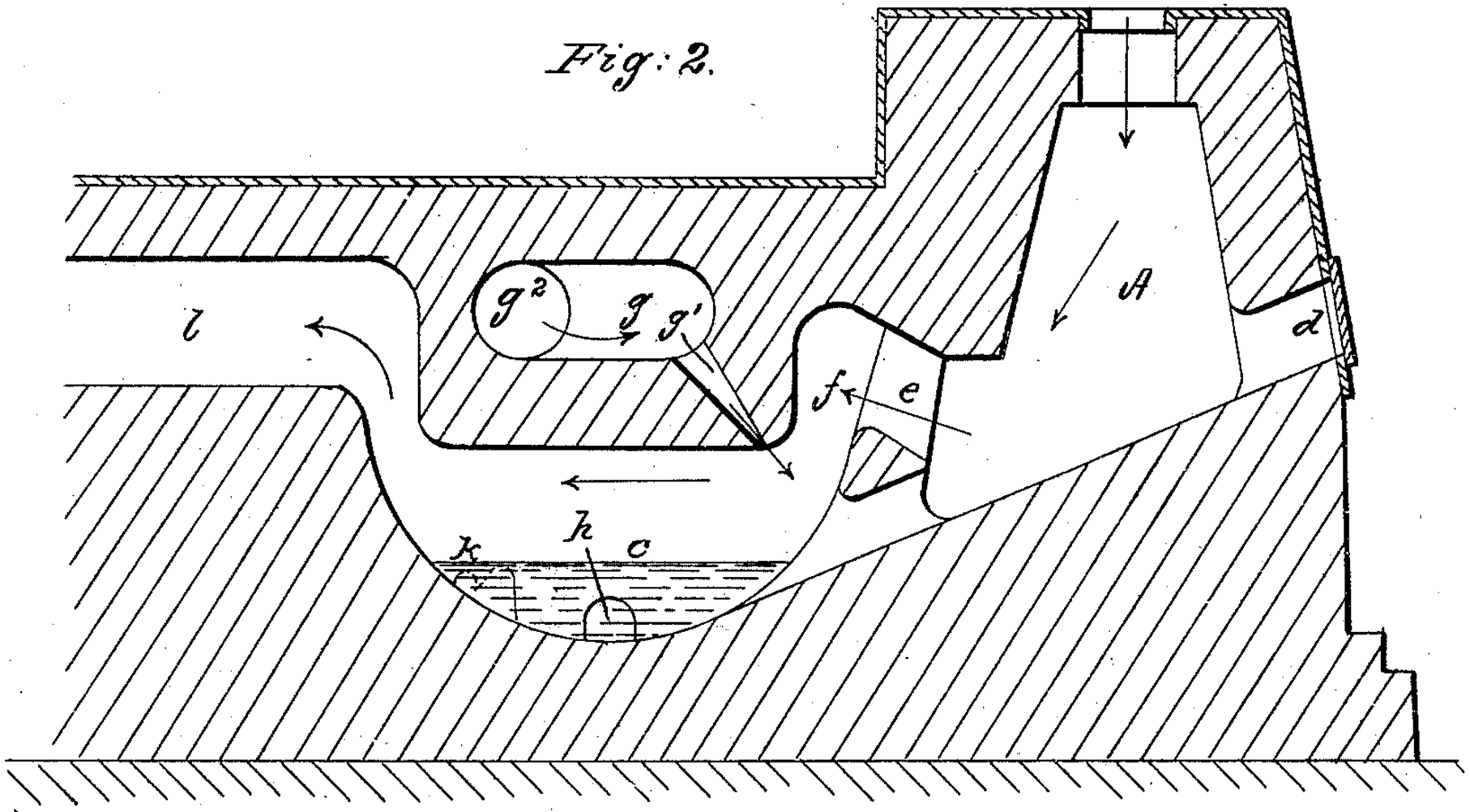
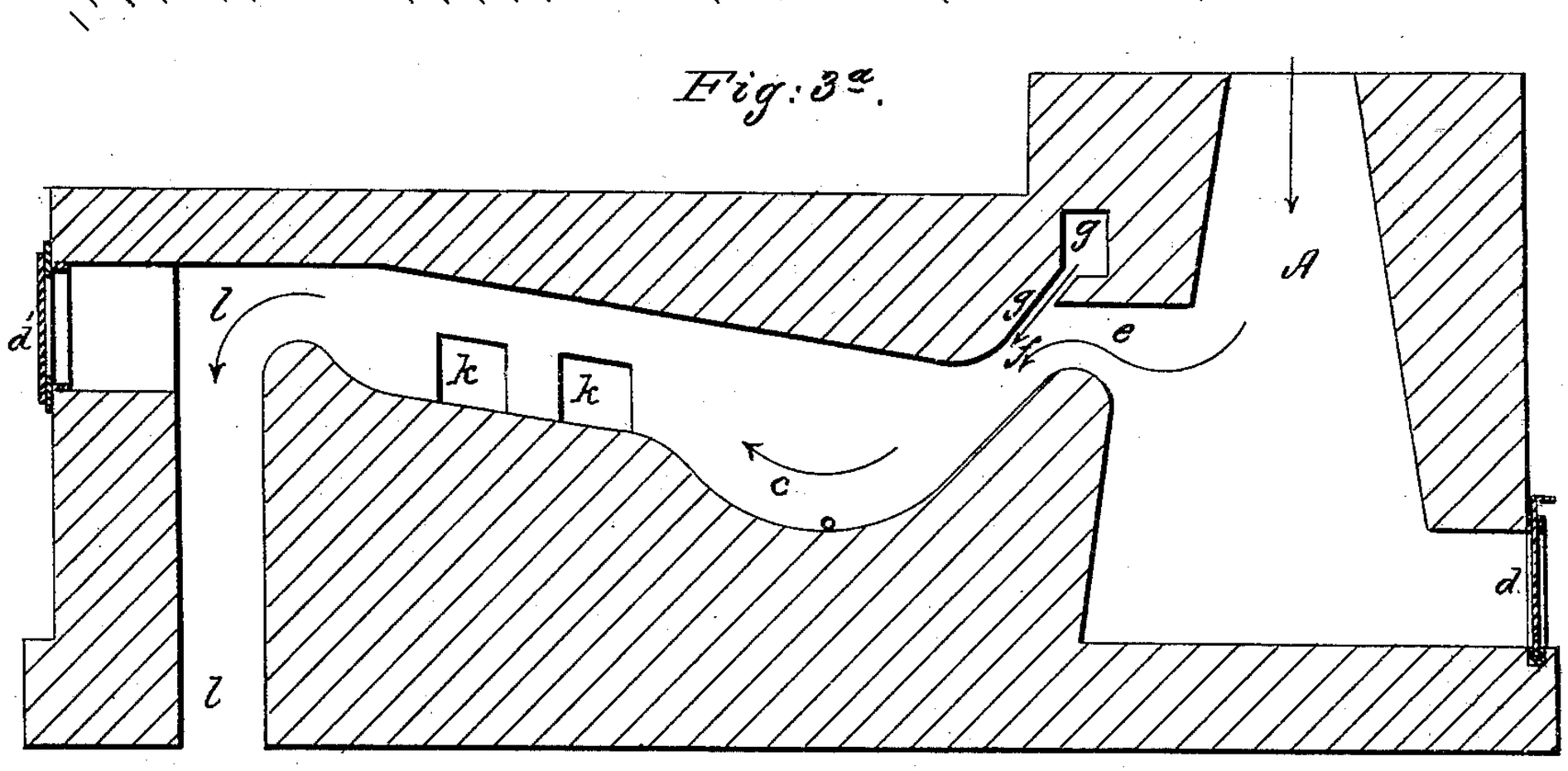


Fig: 3ª.



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7 Sheets—Sheet 3.

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Fireplace and Furnace.

No. 45,111. Patented Nov. 15, 1864.

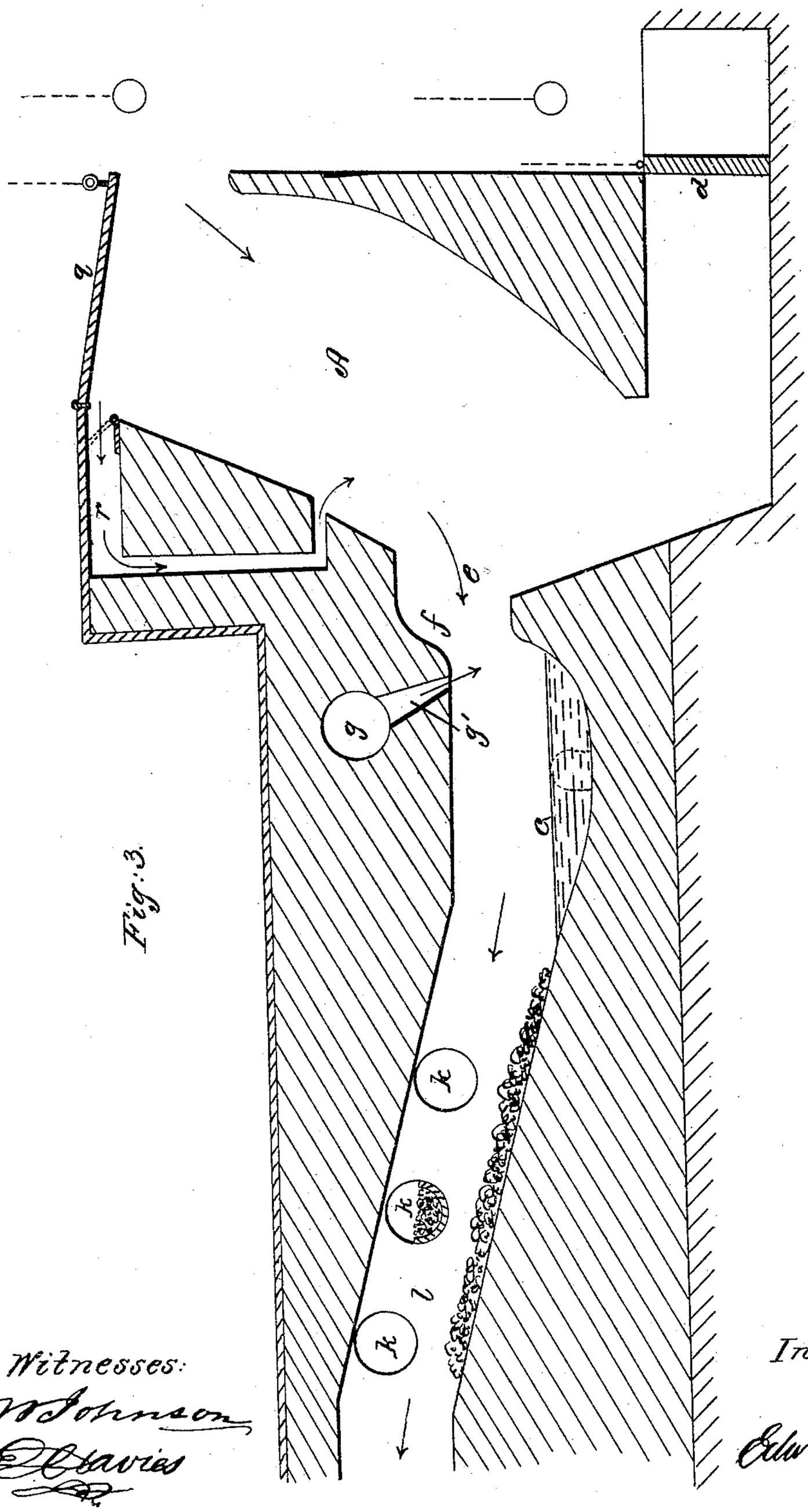

Fig. 3.

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7 Sheets—Sheet 4.

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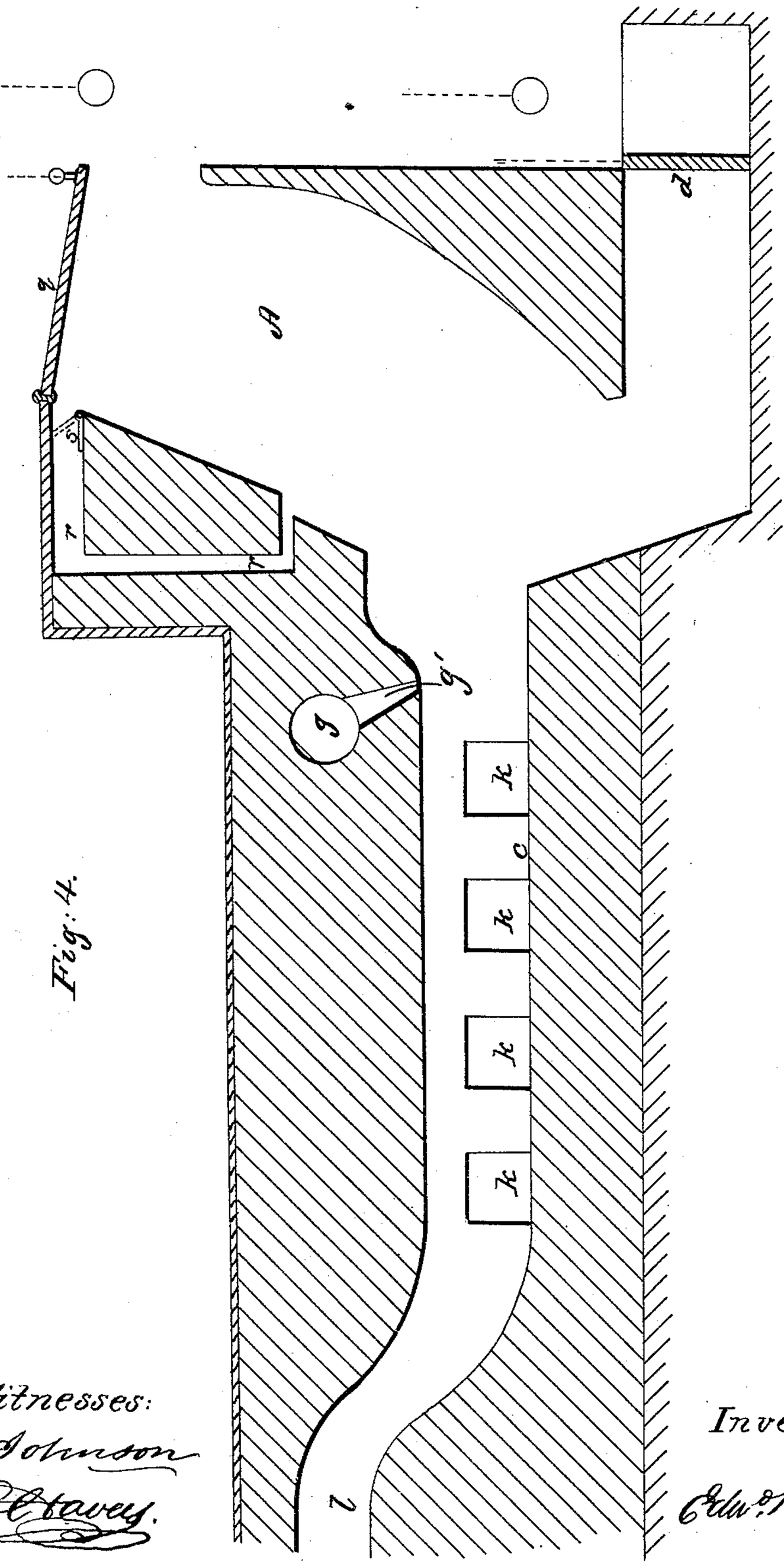

Fig: 4.

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7 Sheets—Sheet 5.

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Fireplace and Furnace.

No. 45,111. Patented Nov. 15, 1864.

Fig. 6.

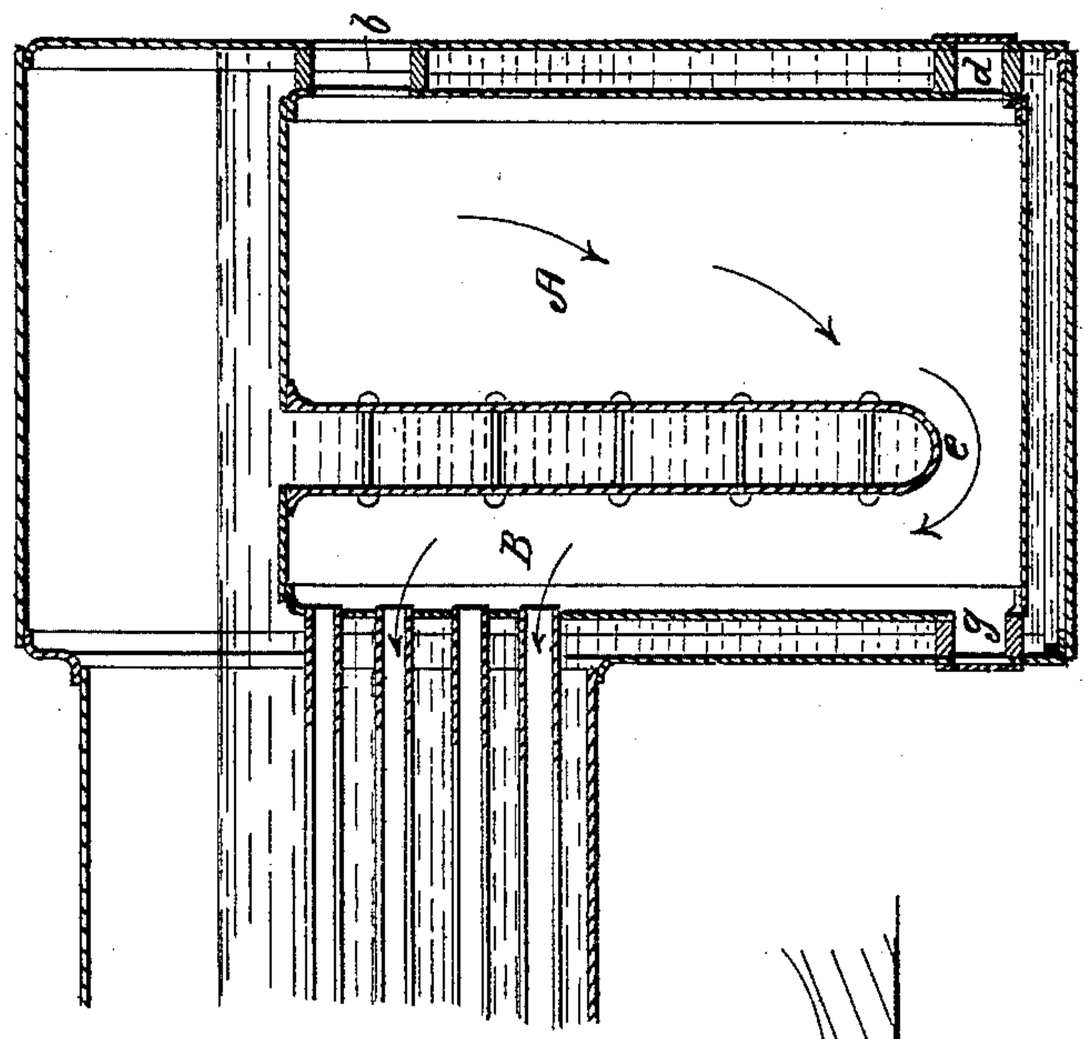
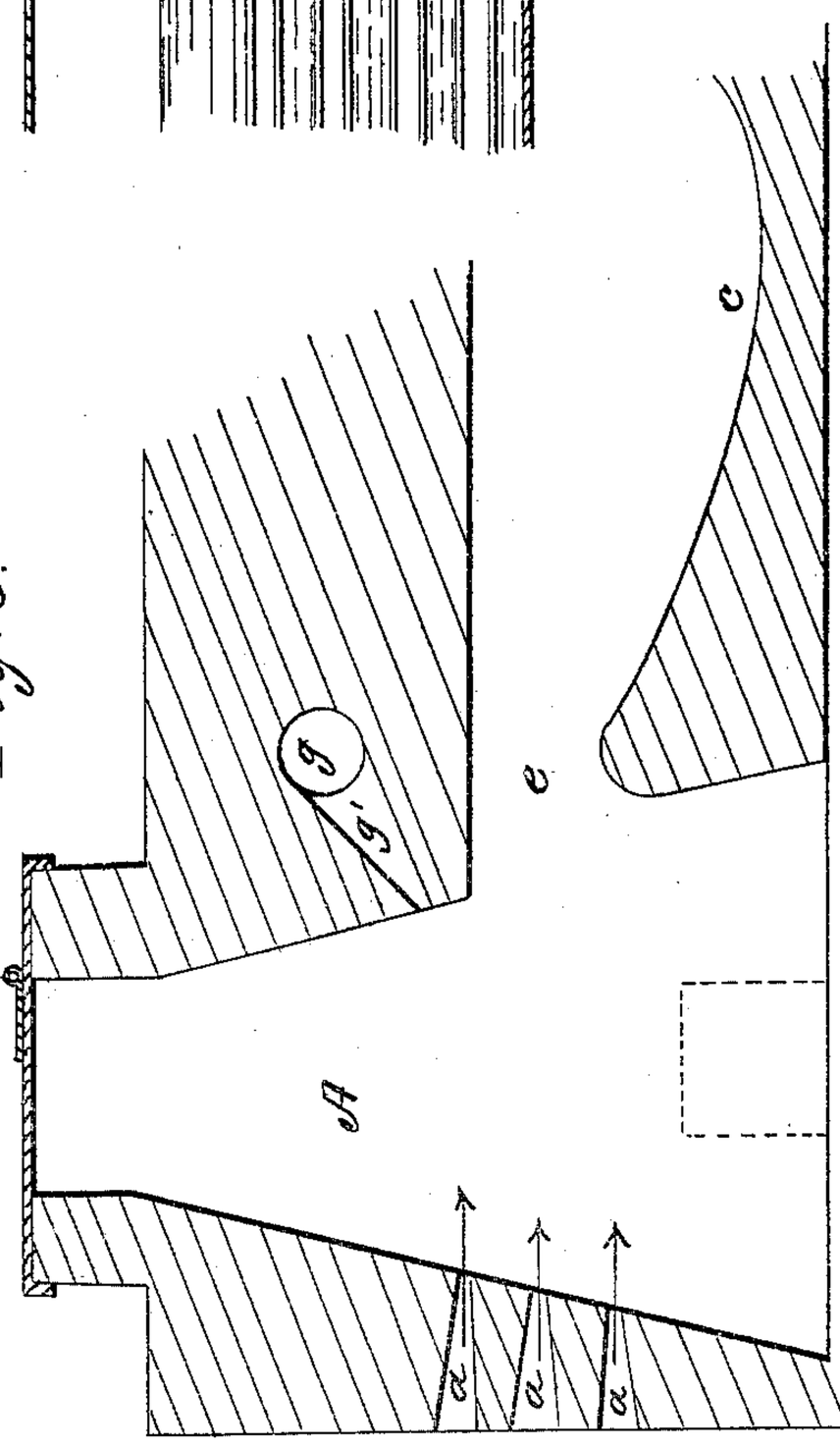


Fig. 5.



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7 Sheets—Sheet 6.

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Fireplace and Furnace.

No. 45,111. Patented Nov. 15, 1864.

Fig: 8

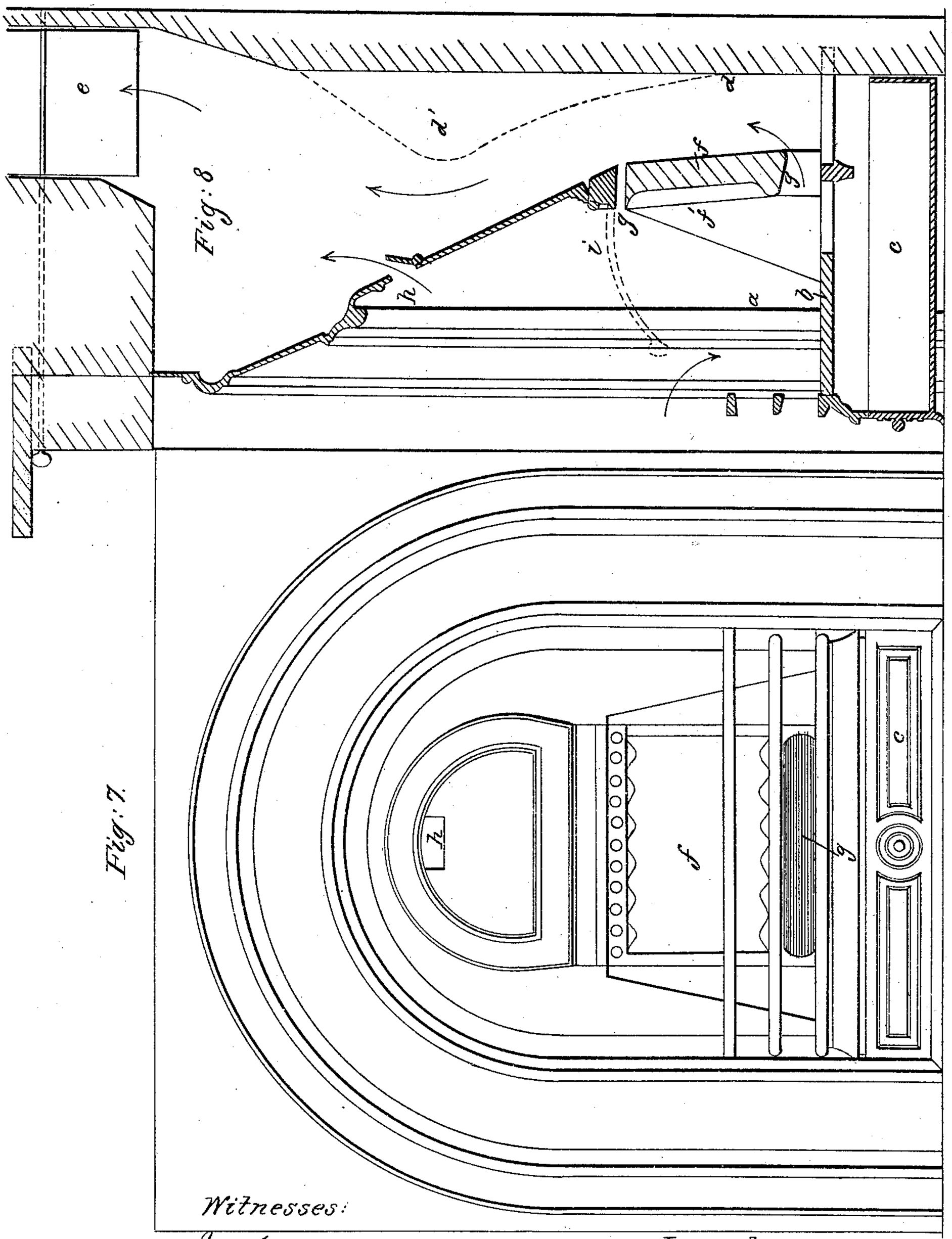

Fig: 7.

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Fireplace and Furnace.

No. 45,111. Patented Nov. 15, 1864.

Fig: 9.

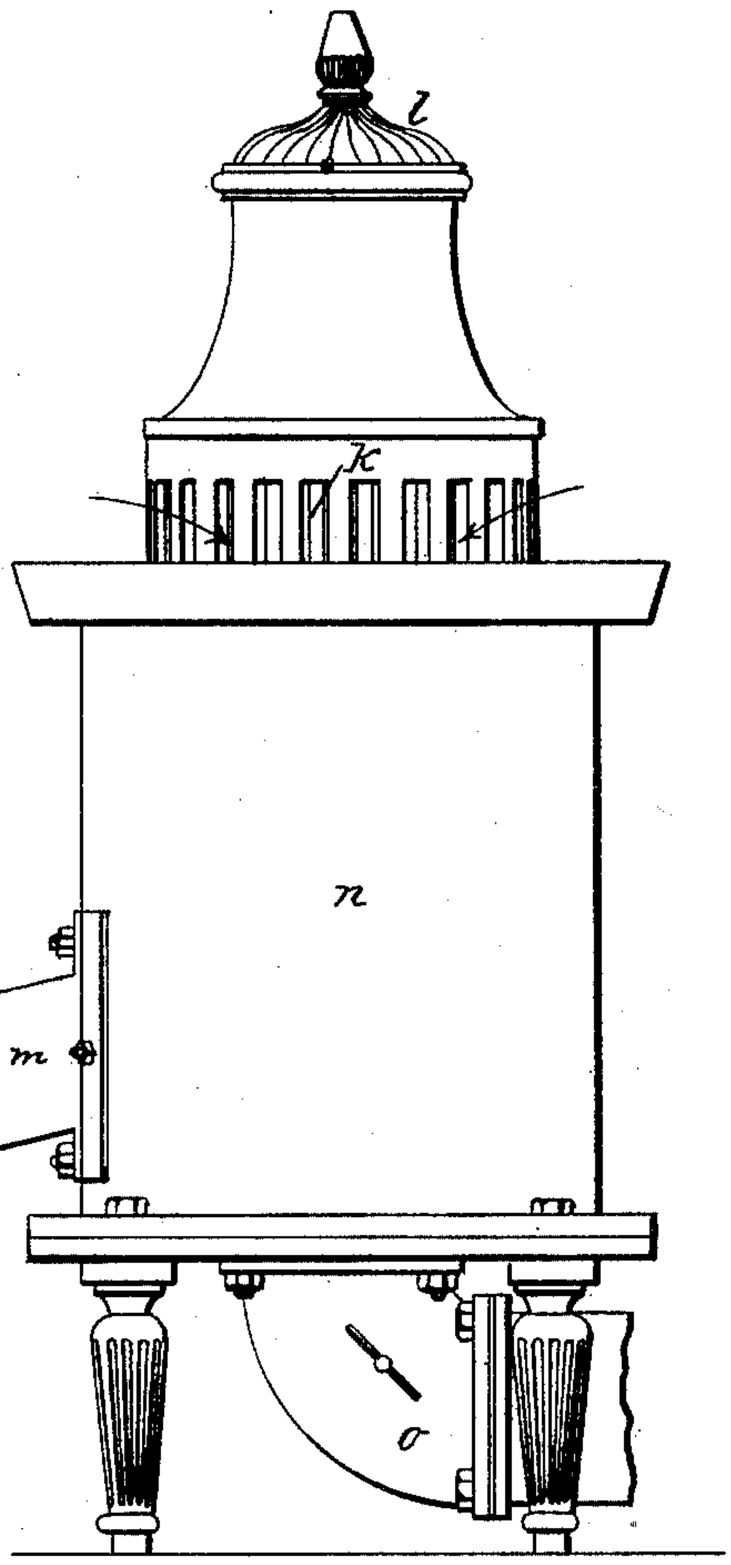
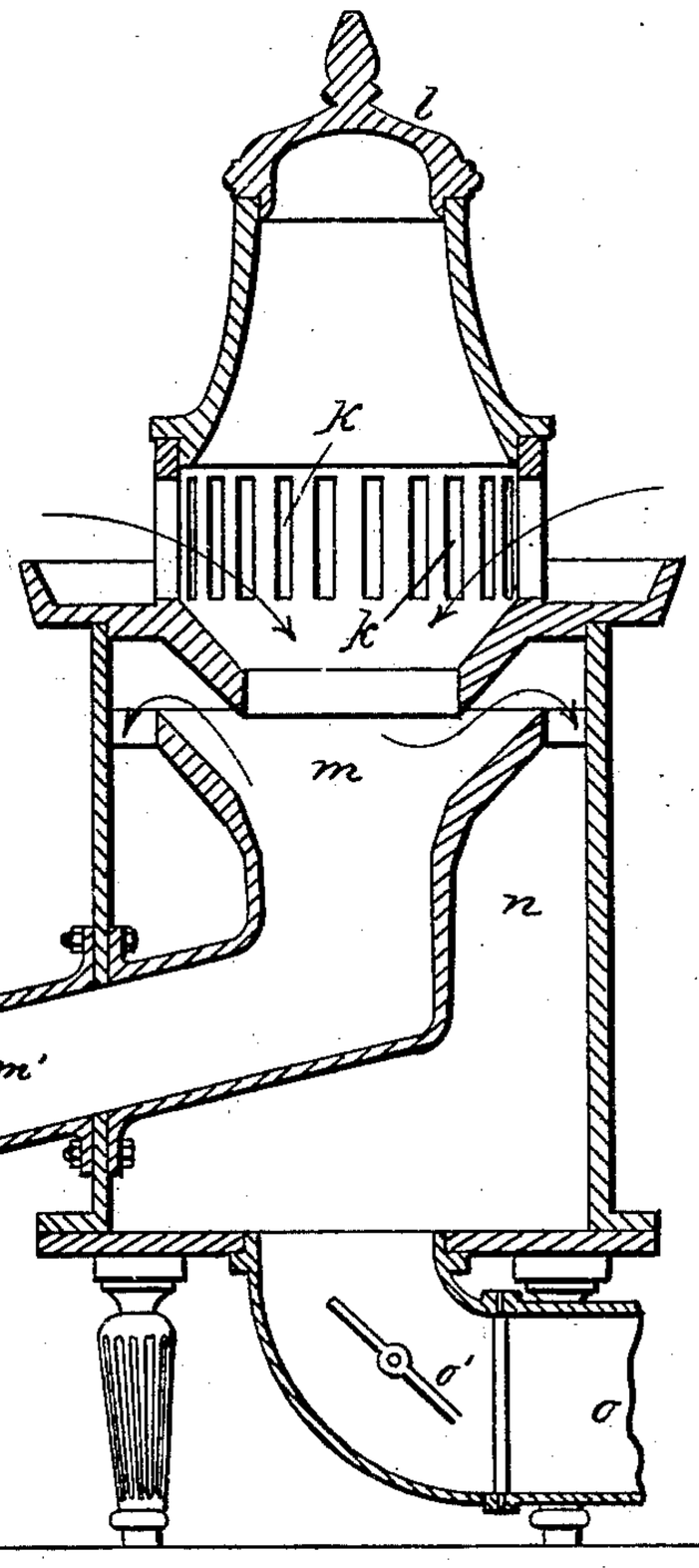


Fig: 10.



Witnesses:

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A. Davies

Inventor:

Edw. B. Wilson.

UNITED STATES PATENT OFFICE.

EDWARD BROWN WILSON, OF NO. 10 STRAND, COUNTY OF MIDDLESEX, ENGLAND.

IMPROVEMENT IN FIRE-PLACES AND FURNACES.

Specification forming part of Letters Patent No. 45,111, dated November 15, 1864.

To all whom it may concern:

Be it known that I, EDWARD BROWN WILSON, of No. 10 Strand, in the county of Middlesex, England, have invented certain new and useful Improvements in Fire-Places and Furnaces; and I hereby declare that the following is a full, clear, and exact description of the same.

My invention relates to the construction and working of furnaces and fire-places in such a manner that when fresh fuel is supplied as usual on the top of the fuel already ignited the gases generated therefrom are made to pass downward through the hot fuel, in lieu of, as heretofore, ascending through the fresh fuel, and air is also supplied at such points and in such quantity as may be suitable for complete combustion. In applying this system I employ different modes of construction suited, respectively, to the different purposes for which heat is required; and I will therefore describe several different modes as examples of the manner in which my system is applied in different cases.

First. When the furnace is of the form of a cupola or blast furnace for reducing ores or melting metals—the material to be operated upon being mingled with the fuel—I employ the following mode of construction, (shown in vertical section at Fig. 1,) *a* is a flue formed in the lining of the furnace, having numerous apertures, *a'*, leading into the body of the furnace A, and a communication, a^2, with a chimney, this communication being provided with a suitable damper for regulating the draft. *b* and *c* are two other flues, also formed in the lining of the furnace, having apertures *b'* and *c'*, leading into the body of the furnace, and provided with communications b^2 and c^2 with the exterior of the furnace, these communications being also provided with valves or dampers. The interior of the furnace being charged with fuel and the material to be reduced or melted, air enters at the upper part, either direct from the atmosphere or by the blast-pipe, as shown, (the combustion taking place downward,) and also by the flues *b*, and *c* and their apertures *b'* and *c'*, to support the combustion, and the products of combustion issue by the apertures *a'* and the flue *a*, and pass, by the communication a^2, to the chimney, as indicated by the arrows. I prefer to make all the apertures *a'*, *b'*, and *c'* sloping downward into the interior, as shown in the drawings. When it is desired to work with a blast, I close the top of the furnace by a cover, *l*, fitted with a pipe, *p*, for entering air, and also with a suitable hopper arrangement, *h*, for the admission of the charge, and I then connect the pipe *p*, which communicates through the cover, and also the communications b^2 and c^2, with a blast-pipe regulating the quantity of blast that enters at each place by means of valves or dampers *v v*. The heat of the products of combustion passing by the channel a^2 to the chimney may employed to heat the blast or entering air, or for any other convenient purpose.

Secondly. When the material to be operated upon is mingled with the fuel, but after fusion has to be subjected to heat, I employ the mode of construction represented in longitudinal vertical section at Fig. 2. A is a chamber, which is charged with fuel and the material to be fused, and is supplied with air at the top. The sides of this chamber are made inclined, so that the contents may descend freely without hanging to the sides. The bottom is made sloping down to an aperture, *b*, through which the material fused in the chamber A flows down into a lower chamber or basin *c*. *d* is an opening covered by a door for removing ash or clearing the aperture *b*. *e* is one of several apertures formed in the side of the chamber *a*, for the passage of the gaseous products of combustion into a chamber, *f*. These passages *e* are sloped upward, to prevent fuel from passing through them. *g* is a chamber supplied with air, which may be heated or mingled with steam for certain purposes, and communicating by numerous small apertures, of which *g* is one, with the chamber *f*. *h* is a door and tapping-hole formed at one side of the basin *c*, the bottom of which is made to slope toward the tapping-hole. *k* is a small basin to receive the slag formed at one side of the principal basin, *c*, having also a tapping-hole. *l* is a flue communicating with a chimney, and furnished with a damper for regulating the draft. The aperture g^2, by which the chamber *g* is supplied, is also fitted with a valve or damper for

regulating the quantity of air admitted. The action of this furnace is as follows: The chamber A being filled with fuel and kindled, air enters at the top, and, passing through the ignited fuel, maintains its combustion. The gaseous products of combustion pass through the apertures *e* into the chamber *f*, where they mingle with the air entering by the apertures *g'*, which serve to complete their combustion. The mingled gases thence sweep in a state of flame along the chambers *c*, playing principally on its bottom when so directed, as in this example, and finally issue by the flue *l* and pass onto the chimney. In their course thither some portion of their heat may be utilized for heating the air supplied at g^2 or for other purposes. When the furnace and basin have been heated to the required degree, the material to be fused is charged along with the fuel into the chamber A, and as it melts it flows by the passage *b* into the basin *c*. When the fused material rises to a level higher than that of the edge of the small basin *k*, the scum or slag floating on its surface overflows into *k*, and is removed by the tapping-hole of *k*. The material itself, after it has been subjected to the heat and gases in the basin *c* for a sufficient time, is removed by the tapping-hole *h*.

Thirdly. When the material is to be fused and operated upon by heat and gases, but not mingled with the fuel—as, for instance, in puddling iron, I employ the mode of construction represented in Figs. 3 and 3ª. A is the fuel-chamber supplied at the top, as described in reference to Fig. 2, and having inclined sides and a bottom sloping forward to an ash-pit with closed door *d*. The passages and chambers *e f g g'* are arranged in a similar manner to that described in reference to Fig. 2. The chamber *c* is elongated, and its bottom is made to slope gradually upward to the flue *l*. At various points of this slope doors *k k k*, of any convenient form, are provided for the introduction of the material to be fused. The mode of operation of this furnace is similar to that already described, except that the material to be operated upon, instead of being charged with the fuel in the chamber A, is supplied by the openings *k*, and laid on the slope of the basin, the hot products of combustion playing over it. When it is melted, it flows down the slope to the basin *c*, where it may be retained subject to the heat or gases; or when iron is under treatment it may be puddled in the usual way; or it may be decarbonized partially or entirely by the action of the gases. I find it convenient to supply the material at the apertures *k k*, so as to avoid to some extent the admission of cold air, in the following manner: I make these openings circular and cover them externally with a slide or shutter, and I provide a semi-cylindrical trough, *k'*, or a half-tube of sufficient length to extend across the furnace-chamber, which I charge with the material to be melted while it is outside of the furnace. I then open the slide or shutter of one of the circular openings *k* and thrust the trough through it. I then turn it round in the circular hole, and the material drops from it onto the sloping bed of the furnace, after which I withdraw the trough and close the slide or shutter. In order to effectually consume any smoke which may form at the surface of the fresh fuel or at the mouth of the chamber A, I propose to apply a hinged plate or hood, *q*, to the top of the chamber A, which may be made to open or close, more or less, and to form an air-passage, *r*, provided with a damper or regulator, *s*, in the upper and back portion of the fuel-chamber. Any smoke which may be produced on the surface of the fuel will by the arrangement above described be immediately carried off by the current of air down the heated passage *r*, and back into the lower and highly-heated part of the fuel-chamber, where it will be completely consumed. Counter-weights or any other convenient contrivance may be employed for regulating the position of the plate or hood *q* and controlling the inlet of air to the chamber A. The arrangement above described is equally applicable to the furnace shown in Fig. 2, although not shown in that figure. Fig. 3ª represents a furnace very similar to Fig. 3. The shape of the fuel-chamber is, however, slightly different, and a door, *d'*, is shown for the facility of pushing the material forward down the slope leading to the basin *c*. The same letters of reference indicate corresponding parts in Figs. 3 and 3ª.

Fourthly. When the material to be operated on is not to be fused but only heated—as for iron or steel or other metals to be forged or rolled, blowing glass, baking pottery, or such like operations—I construct the furnace like that represented in Fig. 3; but as in this case no basin is required for receiving fused material, I construct the bed of the furnace nearly or quite level, and instead of circular openings—such as *k*—I form ordinary doors, *k*, for admitting the material to be heated, as represented in Fig. 4, in which the same letters of reference indicate the corresponding parts in Fig. 3. The action of the furnace being precisely similar to that already described, I need not further refer to it. Fig. 5 represents another modification of furnace, wherein the fuel-chamber A has an additional supply of air, either direct from the atmosphere or by blast-pipes, through a number of apertures, *a a a*, made in the front of the fuel-chamber. This chamber may communicate with the hearth or basin *c*, either directly in the manner shown in Fig. 5, or in the manner hereinbefore described in reference to Figs. 2, 3, and 4. *g* and *g'* represent, respectively, the air chamber and passage or passages hereinbefore described, but which in this case are represented as opening direct into the fuel-chamber A.

Fifthly. In applying my system to other purposes—such as steam-boilers or bar-heating furnaces—I construct the fire-chamber in the mode already described, and conduct the hot products of combustion through the flues

or tubes. Fig. 6 is an example of the fire-box of a locomotive-engine constructed in this manner. The fire-box is divided by an inclined diaphragm or water-chamber into two portions, A and B. A is a chamber, which is supplied with fuel by the door *b* at the top, and having an ash-door, *d*, at the bottom; and B is a chamber which receives the products of combustion from the chamber A through an opening or openings, *e*, formed either through the diaphragm *f* or under the bottom edge thereof, as shown. *g* is an ash-door at the bottom of the chamber B, having openings or perforations controlled by a valve or shutter, by which fresh air is permitted to enter the chamber B and mingle with the gases therein, so as to complete their combustion before passing through the tubes of the boiler.

Sixthly. In constructing ordinary or domestic fire-places so as to operate according to my system, I adopt the mode represented in Figs. 7 and 8. Fig. 7 is a front elevation, and Fig. 8 a section, of a fire-place constructed or altered according to my invention. *a* is the fire-place for holding the fuel to be consumed, with front bars of ordinary construction. *b* is the bottom, which I make entirely closed, or with grated openings to permit ashes to drop into a closed drawer, *c*, fitted below. *d* is the back, which I prefer to incline forward, as indicated by the dotted line *d'*. *e* is a damper in the chimney, which may be conveniently arranged as a throttle-valve for regulating the draft. *f* is a diaphragm separating the front or combustion chamber from the back chamber or flue. *g* is an opening extending the whole width of the fire-place between the diaphragm and the bottom of the fire-place; or instead of one opening it may consist of numerous holes forming a channel or channels for the passage of gaseous products of combustion from the front, as indicated by the arrow. *f'* are fluted hollows formed in the front of the diaphragm, to serve as channels for smoke and air behind the fuel in the fire-place. *h* is an opening fitted with a valve, which may be opened or closed at pleasure, by which smoke or gases rising from the upper surface of the fuel in the fire-place can escape into the chimney. Sometimes I form the upper part of the diaphragm, as indicated by the dotted lines *i* partly covering over the fire-place, as a hood; and in that case I provide openings *g'*, by which smoke or gas may escape from under the hood into the chimney. Instead of making the diaphragm interposed between the front and back parts of the fire-place, as represented in Fig. 2, I sometimes use two diaphragms fitted near each end of the fire-place, dividing it transversely instead of longitudinally, with similar arrangements of parts, as may be readily understood.

Seventhly. When the fire-place is not placed in the recess of a chimney, but when it is desirable that it should be accessible all round, I adopt the construction represented in Figs. 9 and 10. Fig. 9 is an elevation, and Fig. 10 a section, of a fire-place or stove of cylindrical form constructed according to my invention. *k* is the fire-box having an opening at top for supplying fuel, fitted with a movable cover, *l*, and having a grating round its lower part. *m* is a bent tube or vessel for receiving the ashes, fitted with a door, *m'*, by which they can be removed at pleasure. *n* is a hot chamber, into which the products of combustion issue from the lower part of the fire-box. *o* is a tube fitted with a damper, (which may conveniently be worked as a throttle-valve,) *o'*, leading to a chimney or flue. In said figures the arrows indicate the direction which the air supplying the fuel and the gaseous products of combustion are caused to take by the draft of the chimney, the object of the arrangement in either case being that the air necessary for the combustion of the fuel shall enter at the top where the fresh fuel is supplied, and descend along with the gases evolved from the fuel through the hot or incandescent embers at the bottom, and thus that more complete combustion of smoke or inflammable gases may be secured.

Having thus described my said invention and shown the manner in which the same is or may be applied, I claim—

The method herein described of construction and working of fire-places and furnaces in such manner that when fresh fuel is supplied as usual on the top of the fuel already ignited the gases generated therefrom are made to pass downward through the hot fuel, air being supplied at such points and in such quantities as may be suitable for complete combustion, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EDWD. B. WILSON.

Witnesses:
J. HENRY JOHNSON,
E. C. DAVIES.