

No. 682,471.

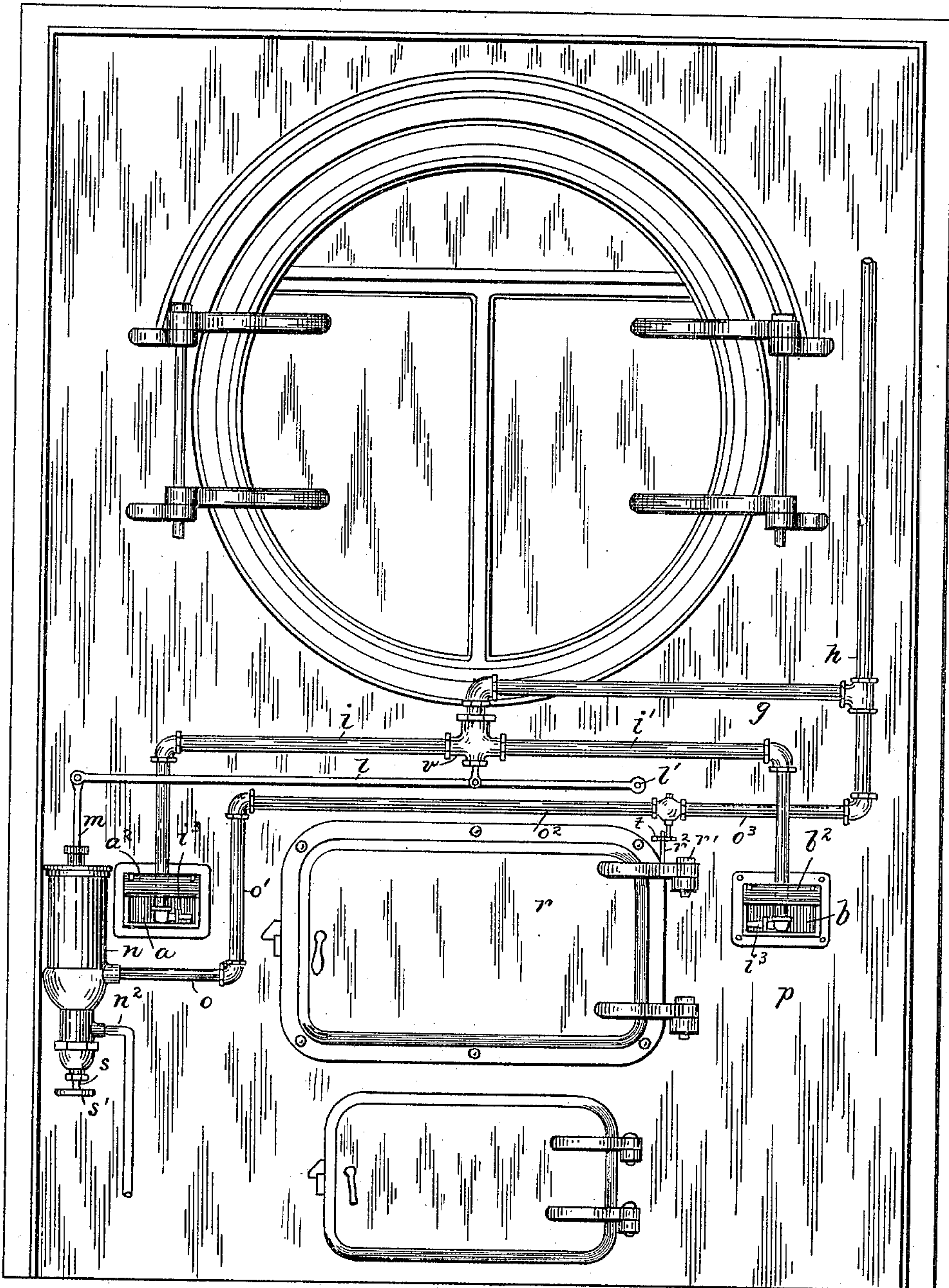
Patented Sept. 10, 1901.

P. F. KING.
AUTOMATIC SMOKE PREVENTER.

(Application filed Mar. 30, 1901.)

(No Model.)

3 Sheets—Sheet 1.



Witnesses:

James Ryan Maydon,
Wm E Brooke

Fig. I

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Phineas F. King
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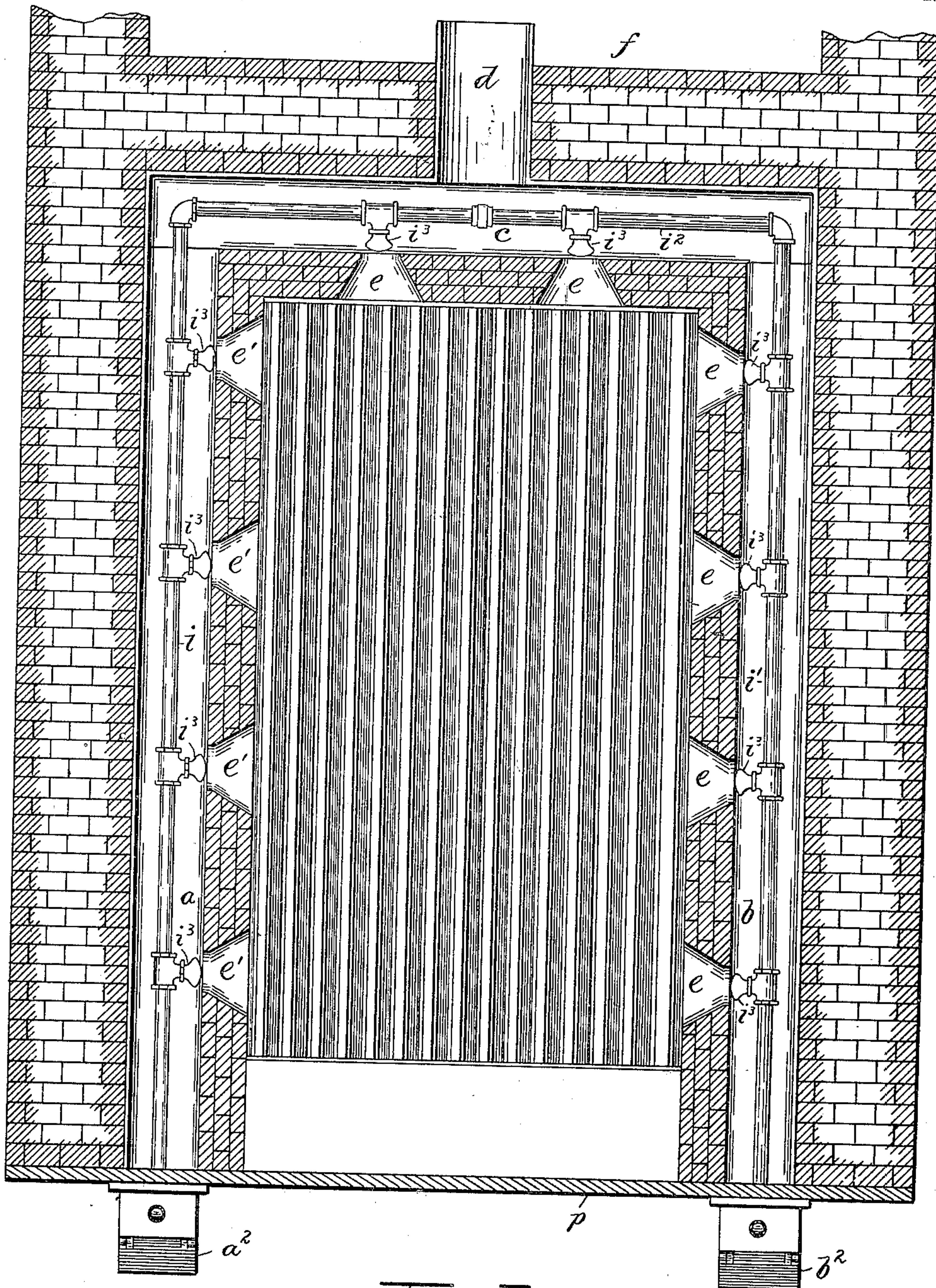


Fig. II

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UNITED STATES PATENT OFFICE.

PHINEAS F. KING, OF CLEVELAND, OHIO, ASSIGNOR OF TWO-THIRDS TO
CHAS. H. TUCKER AND M. J. EDWARDS, OF SAME PLACE.

AUTOMATIC SMOKE-PREVENTER.

SPECIFICATION forming part of Letters Patent No. 682,471, dated September 10, 1901.

Application filed March 30, 1901. Serial No. 53,647. (No model.)

To all whom it may concern:

Be it known that I, PHINEAS F. KING, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Automatic Smoke-Preventers, of which the following is a full, clear, and exact specification, such as will enable those skilled in the art to which it appertains to make and use the same.

The invention relates to apparatus to be attached to furnaces to automatically aid the combustion in said furnaces, and thereby prevent the formation of smoke and a consequent saving of fuel.

It is a well-known fact that in order to secure perfect combustion in a furnace it is necessary to supply a sufficient amount of oxygen with enough heat to secure the union of the carbon in the fuel with the oxygen to form CO₂ gas. If there is not oxygen enough or heat or time enough for this, the carbon is precipitated in fine black particles, which are not combustible at the temperature in which they find themselves. They pass out with the invisible gases from the stack, coloring them black and making what is commonly called "smoke."

One object of my invention is to provide a sufficient and uniform supply of oxygen to all parts of the furnace, thereby aiding perfect combustion to the same degree in the rear of the fire-box as at the front.

Another object of the invention is to provide means to automatically regulate the supply of oxygen to produce the best results.

With these objects in view my invention consists in the construction and combination of the parts, as hereinafter described, and pointed out definitely in the claims.

In the drawings forming a part of this specification, Figure I is a front elevation of a furnace with the improved apparatus attached thereto. Fig. II is a horizontal section through the fire-box and retorts. Fig. III is an enlarged detail view, partially in section, of the automatic mechanism. Fig. IV is a view of the under side of the cut-off valve. Fig. V is a longitudinal section of one of the steam-nozzles. Fig. VI is a horizontal section of a rear corner of the fire-box, showing

a different form of connection between the retorts and flue from that shown in Fig. II.

Similar characters of reference designate similar parts in the drawings and specification.

Referring now particularly to Figs. I, II, and VI of the drawings, *a* and *b* represent retorts which are laid in the side walls of the fire-box and having their front ends extending out through the face-plate *p* of the furnace. In extremely-large furnaces the rear ends of the retorts *a* and *b* are in open communication with a retort *c* laid in the bridge-wall at the rear of the fire-box, open connection being established between said retort *c* and the flue *f* of the stack through the pipe *d*; but in furnaces of the ordinary size the same result is satisfactorily obtained without the use of the retort *c*, the retorts *a* and *b* being connected with the flue *f* by the pipes *b'* passing through the bridge-wall, as shown detailed in Fig. VI. It will readily be seen that by this arrangement of open communication between the outside atmosphere at the front of the furnace and the flue in the stack through the retorts extending the entire length of the fire-box on both sides and their connection with the flue the draft in said flue will draw the outside air through said retorts and furnish a uniform supply of oxygen at all points from the front to the rear of the furnace. The walls of the fire-box are provided at intervals from the front to the rear with a series of openings *e* and *e'*, which register with openings in the retorts *a* and *b* in the construction shown in Fig. II. Like openings communicate with the retort *c*.

Arranged within the retorts *a* and *b* are pipes *i* and *i'*. These pipes in extremely-large furnaces are connected by the pipe *i²* in the retort *c*; but in any case they extend the entire length of the sides of the fire-box or to the extreme rear openings *e* and *e'*. The pipes *i* and *i'* have nipples *i³*, provided with slits *i⁴* in their free ends, attached thereto opposite the openings *e* and *e'* and extend out of the front of the retorts *a* and *b*, passing upward and connecting with the lower chamber *v'* of a valve-casing *v*, the upper chamber *v²* of said casing being connected through the pipe *g* and suitable fittings with a main steam-sup-

ply pipe h . The stem of the valve v^4 is pivotally connected with a lever l , which has its fulcrum l' at one end, the opposite end of said lever being connected with the rod m of a piston m' , which operates in a cylinder n . The interior lower portion of said cylinder is connected through the pipes o o' o^2 o^3 and suitable fittings with the main steam-supply pipe h . A valve w has its seat in the base of the cylinder n and extends down into an annular chamber n' and rests on a spring w' , the tension of said spring w' being regulated by the screw s , provided with a hand-wheel s' . Attached to the annular chamber n' is a waste-pipe n^2 . The pipe o^2 is provided with a cut-off valve x , situated at a convenient point, preferably just over the hinge r' of the door r . The stem of the valve x has an arm t rigidly attached thereto, said arm being provided with a slot t' . A pin r^2 on the door r extends upward and engages the slot t' .

From the foregoing specification of the construction of the apparatus the following description of the operation will be readily understood. The lids a^2 and b^2 at the front of the retorts a and b being open and said retorts being in direct open communication with the flue in the stack, the draft from the stack will draw the oxygen from the exterior in front of the furnace and maintain a uniform supply of oxygen in all parts of the retorts. When the apparatus is in its normal position and the door of the fire-box is closed, the cut-off valve x is closed, and the steam-pressure through the pipe g on the valve v^4 shuts off the steam to the pipes i and i' . Now when the door r is opened and a fresh supply of fuel is furnished to the fire, which is the time that it is desirable to aid the combustion and prevent the formation of smoke, the action of the pin r^2 in the slot t' of the arm t opens the valve x and permits the live steam to enter the cylinder n and close the valve w against the pressure of the spring w' . The pressure of the steam against the piston m' causes it to rise. The piston-rod m being connected with the lever l and the stem of the valve v^4 being attached to the lever l between its fulcrum l' and the point of attachment of the piston-rod m makes the lever l a lever of the second order, with the resistance on the valve v^4 and the power on the piston m' . Now as the area of the face of the piston m' is much greater than the area of the face of the valve v^4 the piston, as above stated, will rise and unseat the valve v^4 , allowing the steam to enter the pipes i and i' , from whence it escapes in spreading jets through the slits i^4 , combining with the air in the retorts, and together they pass through the several openings e and e' and furnish a great and uniform supply of oxygen to all parts of the fire-box, which unites with the carbon of the fuel and aids in perfect combustion and effectually prevents the formation of smoke. When the door r of the fire-box is closed, the action of the pin r^2 on the slotted

lever t closes the valve x and cuts off the supply of steam to the cylinder n . The piston m' will, however, remain up and the valve v^4 open until the steam in the cylinder n becomes condensed, when the pressure of the spring w' will unseat the valve w and allow the condensed steam to escape through the waste-pipe n^2 . The lever l then becomes a lever of the third order, with the power exerted on the valve v^4 and the resistance on the piston m' . Now as the pressure has been removed from under the piston m' by the cutting off of the steam and the opening of the valve w the pressure of the steam on the valve v^4 will cause it to close and cut off the steam from the pipes i and i' . It will readily be seen that the time of the steam-supply to the pipes i and i' can be regulated by the screw s , which controls the tension of the spring w' . The operator can therefore turn on the steam by opening the door r , replenish his fire, and close the door. He can then time his steam-supply and set the screw s to give the desired time, and thereafter the apparatus will automatically perform the functions required to aid the combustion of the fuel and prevent the formation of smoke.

It will be understood that the apparatus will admit of numerous modifications in construction and arrangement of parts without departing from the general nature of the invention.

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

1. In an automatic smoke-preventer direct open communication between the exterior of the front of the fire-box and the flue in the stack through retorts in the walls of said fire-box, and openings from said retorts to the interior of the fire-box at intervals from the front to the rear of same, whereby a uniform supply of oxygen is furnished to all parts of the fire-box, substantially as specified.

2. In an automatic smoke-preventer, retorts in the walls of the fire-box, said retorts extending from the exterior of the front of the fire-box into the flue of the stack and open at both ends, openings from said retorts into the fire-box at intervals from the front to the rear of said fire-box, pipes in said retorts, connected with a steam-supply and provided with openings registering with the openings from the retorts into the fire-box, substantially as specified.

3. In an automatic smoke-preventer, retorts in the walls of the fire-box, said retorts extending from the exterior of the front of the fire-box into the flue of the stack and open at both ends and forming direct open communication between the exterior of the front of said fire-box and the flue in the stack, and having openings into the fire-box at intervals from the front to the rear of same, in combination with pipes in said retorts, connected with a steam-supply and provided with openings registering with the openings

from the retorts into the fire-box, and means for automatically regulating the supply of steam to said pipes, substantially as described.

4. In an automatic smoke-preventer, retorts in the walls of the fire-box, said retorts extending from the exterior of the front of the fire-box into the flue of the stack and open at both ends and forming direct open communication between the exterior of the front of said fire-box and the flue in the stack, and having openings into the fire-box at intervals from the front to the rear of same, in combination with pipes in said retorts, connected with a steam-supply and provided with openings registering with the openings from the retorts into the fire-box, a valve connected with said pipes for regulating the supply of steam to same; a lever connected with the stem of said valve, and means for automatically operating said lever to open and close the valve, substantially as specified.

5. In an automatic smoke-preventer, retorts in the walls of the fire-box, said retorts arranged as shown, whereby open communication and a uniform supply of oxygen is provided from the exterior of the front of the fire-box, and the flue of the stack, said retorts having openings therefrom into the fire-box at intervals from the front to the rear of said fire-box; in combination with pipes in said retorts, connected with a steam-supply and provided with openings registering with the openings from the retorts into the fire-box, a valve connected with said pipes for regulating the supply of steam to them, a lever connected with the stem of said valve, a cylinder having a piston therein, the rod of which is connected with one end of the lever, a pipe connecting the lower part of said cylinder with the steam-supply, a valve in said

pipe for regulating the supply of steam to the cylinder, means for automatically opening said valve when pressure has been relieved therefrom, and suitable means for the escape of condensed steam below the last-named valve, substantially as described.

6. In an automatic smoke-preventer, direct open communication between the exterior of the front of the fire-box and the flue of the stack through retorts arranged in the walls of the fire-box, openings from said retorts into the fire-box, pipes in said retorts having openings therein registering with the openings from the retorts into the fire-box, said pipes being connected with a valve, a steam-supply pipe connected with said valve, the stem of said valve being connected with a lever fulcrumed at one end and having the other end connected with the rod of a piston whose face has a greater area than the area of the valve, and which operates in a cylinder, a pipe connecting the lower part of said cylinder with the steam-supply pipe through a valve, suitable connection between said valve and the door of the fire-box, whereby the opening and closing of said door will open and close said valve, a valve in the base of the cylinder, means for automatically opening said valve when steam-pressure has been relieved therefrom, means for regulating the resistance of the said valve and means for the escape of condensed steam below the last-named valve, substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

PHINEAS F. KING.

Witnesses:

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C. H. TUCKER.