2 Sheets—Sheet 1.

C. B. GREGORY.

Furnace.

No. 228,061. Patented May 25, 1880.

Fig. 1.

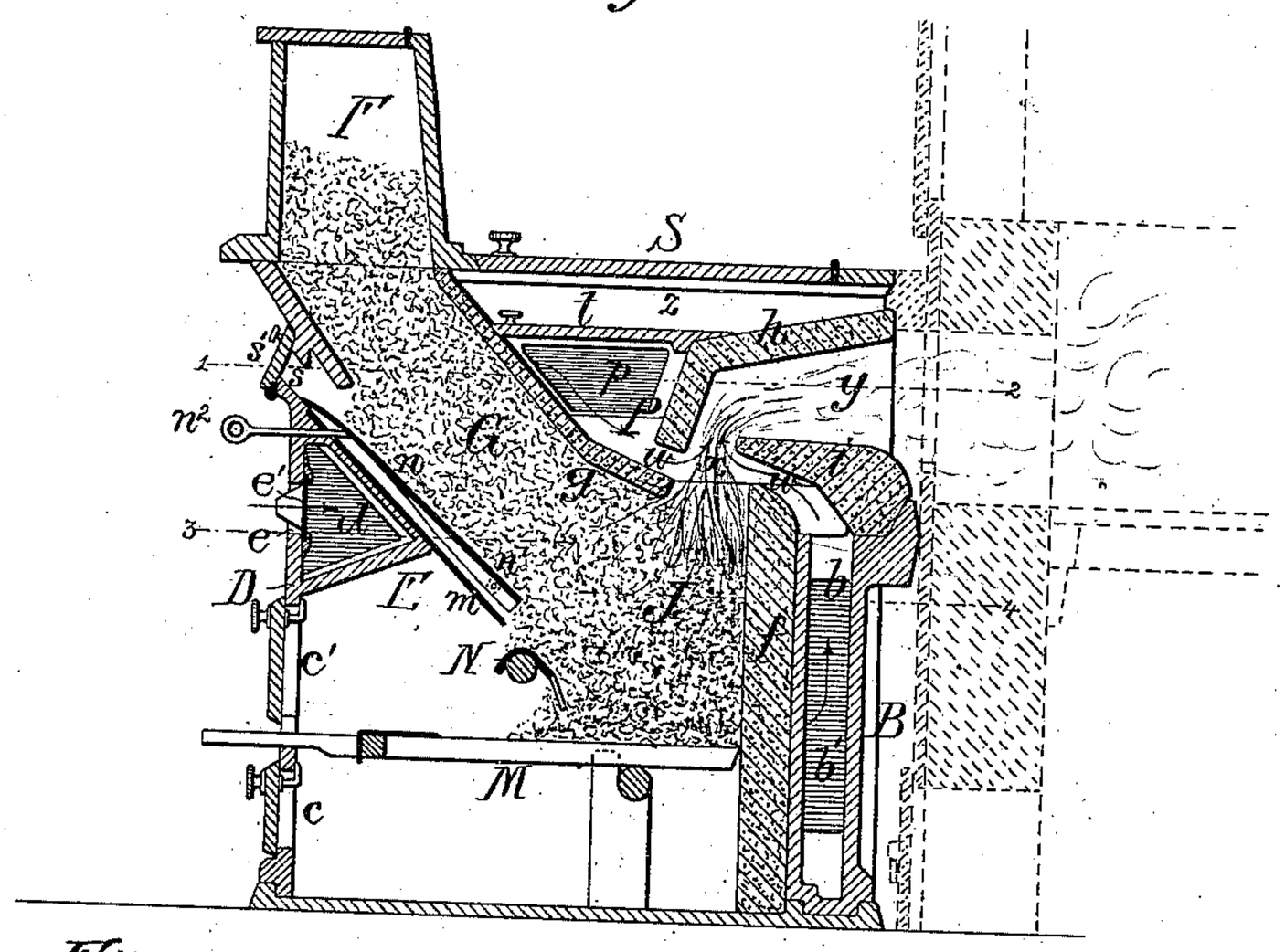


Fig. 2.

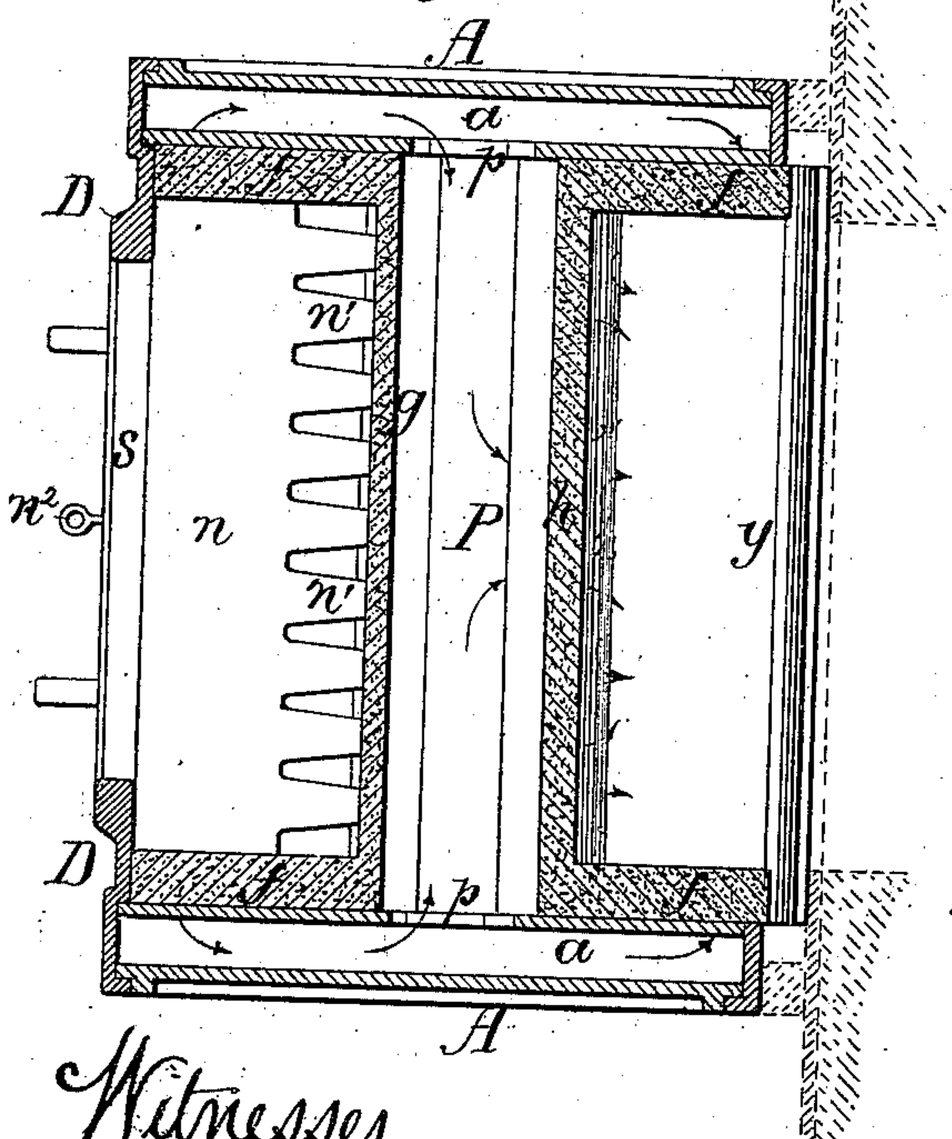
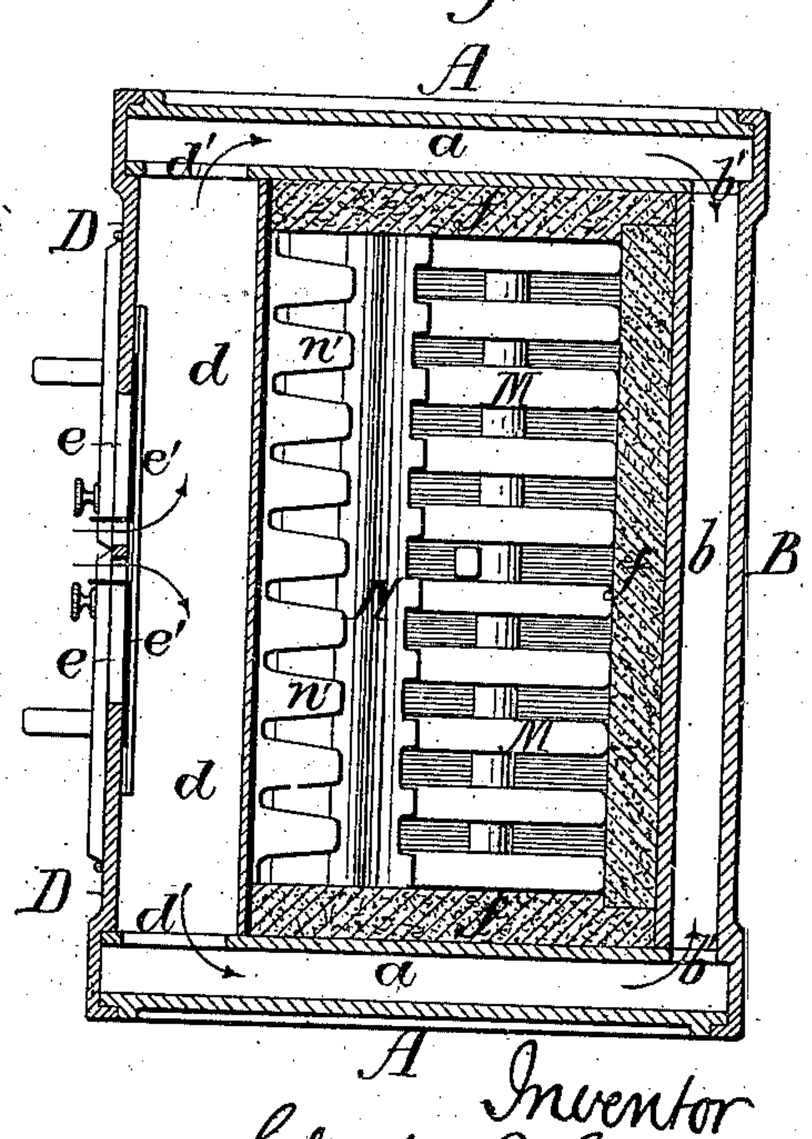


Fig. 3.



Witnesses
Henry Howson Jr.
Harry Smith

Inventor
Clark B. Gregory
by his Attorneys
Howson and Sons

2 Sheets—Sheet 2

C. B. GREGORY.

Furnace.

No. 228,061. Patented May 25, 1880.

Fig 4

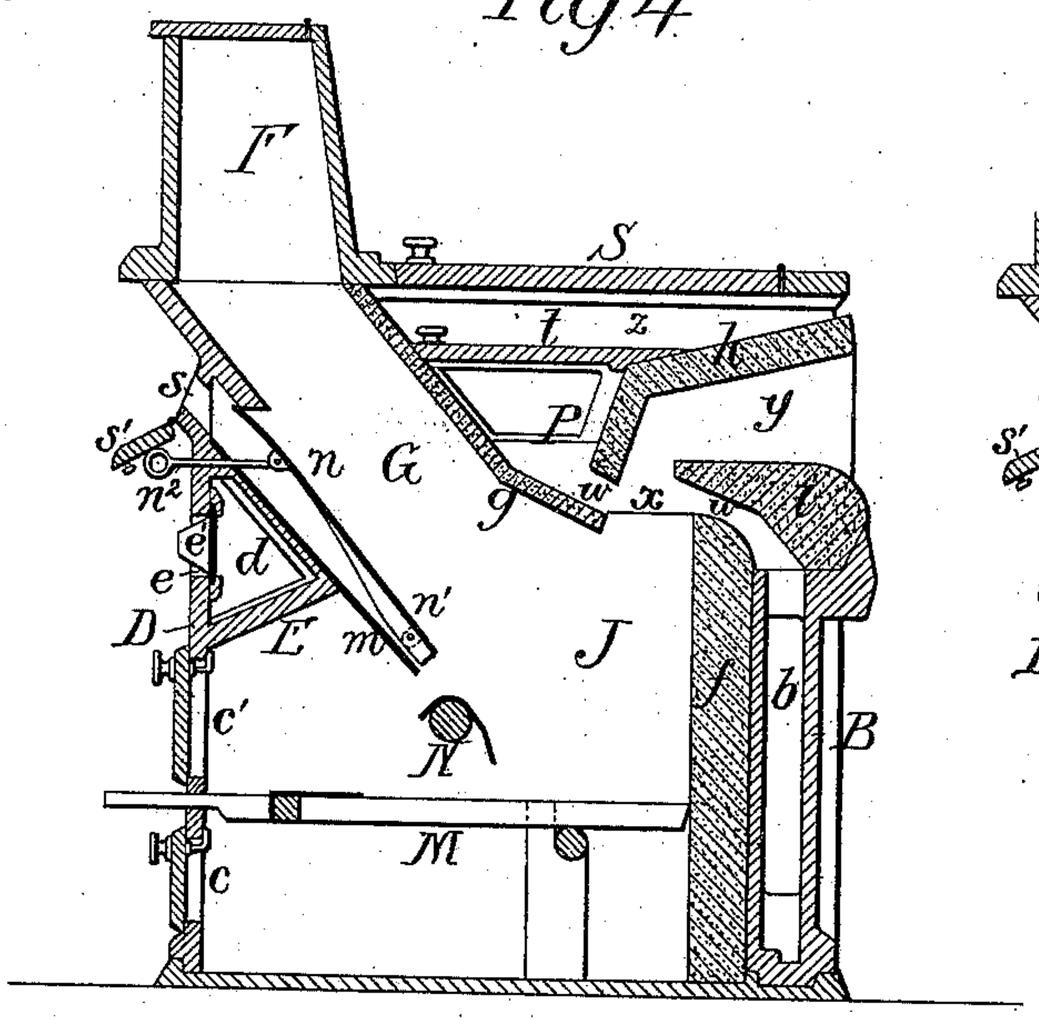


Fig 7

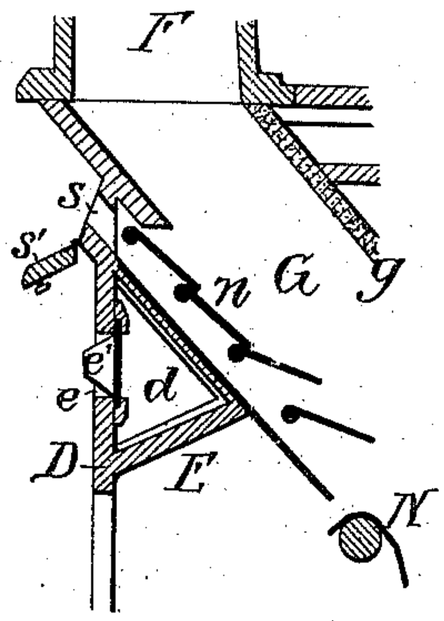


Fig 5

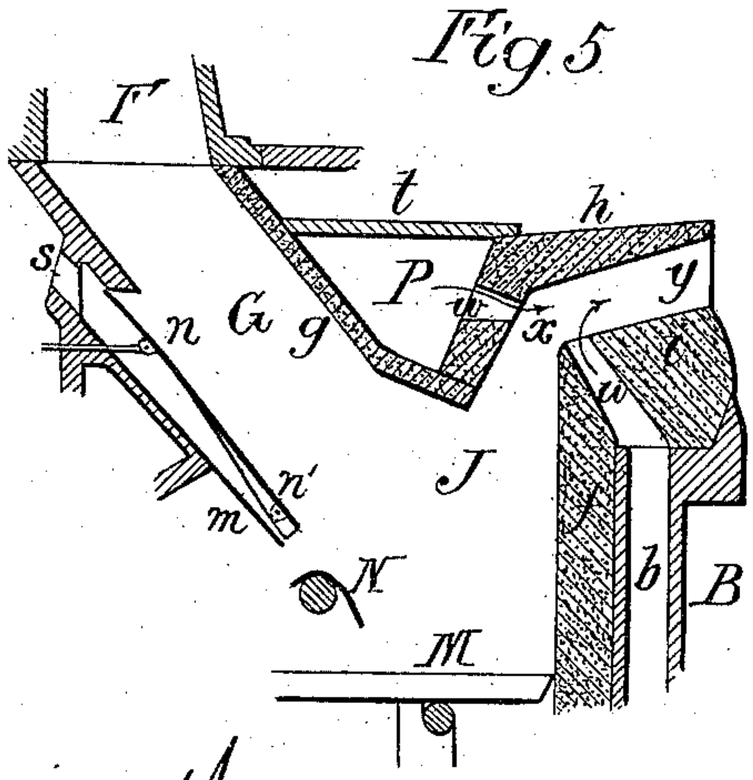
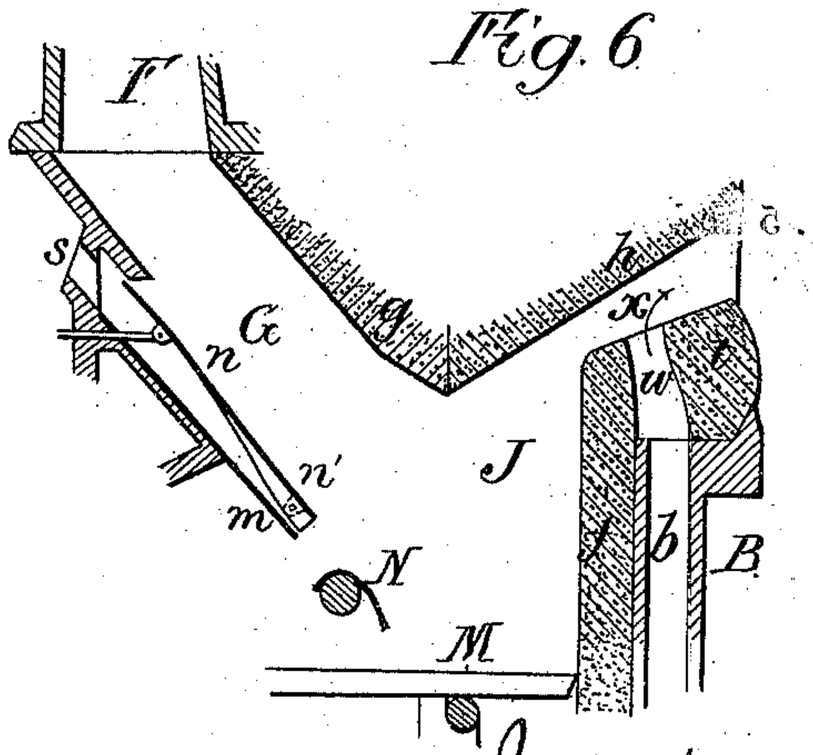


Fig 6



Witnesses

Henry Howson Jr

Harry Smith

Inventor

Clark B. Gregory

by his Attorneys

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UNITED STATES PATENT OFFICE.

CLARK B. GREGORY, OF BEVERLY, NEW JERSEY.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 228,061, dated May 25, 1880.

Application filed November 12, 1879.

To all whom it may concern:

Be it known that I, CLARK B. GREGORY, of Beverly, Burlington county, New Jersey, have invented a new and useful Improvement in the Combustion of Fuel and in Furnaces therefor, of which the following is a specification.

The object of my invention is to provide for the complete combustion of the gases evolved from the burning fuel in the grate of a fire-place.

The invention consists in the combination of a combustion-chamber, a fuel-reservoir, and an inclined passage connecting the two with the casing of the furnace, having air-heating passages communicating with the contracted outlet of the combustion-chamber.

The invention further consists in certain details of construction too fully described hereinafter to need specific preliminary explanation.

In the accompanying drawings, Figure 1, Sheet 1, represents a longitudinal section of a furnace constructed for carrying out my invention; Fig. 2, a sectional plan on the line 1 2, Fig. 1; Fig. 3, a sectional plan on the line 3 4, Fig. 1; Fig. 4, Sheet 2, a longitudinal section of the furnace, with some of the parts in a different position from that shown in Fig. 1; Figs 5 and 6, sectional diagrams illustrating different forms of air-supplying passages, and Fig. 7 a view showing a modification of part of the furnace.

A A are the side walls of the furnace, and B the back wall, all of which are hollow, the side walls, A, inclosing chambers *a* and the back wall, B, inclosing a chamber, *b*, said chambers *a* and *b* communicating with each other through openings *b'*.

The front plate, D, of the furnace has the usual ash-pit opening *c* and an opening, *c'*, both of these openings being provided with suitable doors.

On the inner side of the plate D, above the opening *c'*, is formed a box, E, inclosing a chamber, *d*, which communicates, through openings *d'* in the inner shell of each side wall, A, with the chambers *a* within said walls.

An inlet-opening, *e*, is formed in the front plate, D, opposite the chamber *d*, and this opening is provided with suitable sliding doors *e'*, by adjusting which the area of the inlet may be enlarged or diminished, for a purpose explained hereinafter.

The side and back walls of the furnace are lined with blocks *f* of fire-clay or other refractory material, and attached to or forming part of these blocks are transverse slabs *g*, *h*, and *i*, also of refractory material, said slabs being arranged in respect to each other as shown in Fig. 1.

Secured to and projecting downward from the box E is a plate, *m*, and above the latter is a plate, *n*, the lower end of which is slotted so as to form a number of fingers, *n'*.

The plate *n* is pivoted at the lower end, so that its upper end may be moved by means of a rod, n^2, either to the position shown in Fig. 1 or to that shown in Fig. 4.

In the plate D, above the upper end of the plates *m* and *n*, is an opening, *s*, which is provided with a hinged lid or cover, *s'*.

A reservoir, F, is formed in the top of the furnace, this reservoir communicating through the inclined passage G with the combustion-chamber J, which is bounded by the plate *n*, the slab *g*, the back plate, *f*, a horizontal grate, M, and a transverse grate-bar, N, the latter being arranged between the lower end of the plate *n* and the grate M.

The slabs *g* and *h*, in connection with a removable cover-plate, *t*, inclose a transverse chamber, P, which communicates through openings *p* with the chambers *a* in the side walls, A.

The chamber P communicates, through an opening, *w*, with a contracted passage, *x*, through which the products of combustion from the chamber J are compelled to pass in order to reach the discharge-passage *y*. The chamber *b*, in the back wall, B, also communicates with the passage *x* through an opening, *w*, the mouth of which is opposite, or nearly opposite, to the mouth of the opening *w* of the chamber P.

The width of the passage *x* should be such that volumes of air issuing from the opposite openings *w* will meet and mingle with each other, and the area of the openings *w* should be so proportioned in respect to the area of the passage *x* that the combined volumes of air issuing from said openings will be equal

to the volume of the products of combustion with which the air is brought into contact.

Access to the plate *t* and to the interior of the chamber P is provided for by hinging a section, S, of the top plate of the furnace so that it can be opened when desired, an air-space, *z*, intervening between the said top plate and the plate *t* and serving to prevent the imparting of excessive heat to the plate S.

The operation of the furnace is as follows: Fuel is introduced into the resevoir E until the chamber J and passage G are filled and the reservoir partly filled. When the fuel is ignited the products of combustion pass through the contracted passage *x* and escape from the discharge-opening *y* of the furnace. Cold air enters the chamber *d* and traverses the same and the passages *a* in the side walls, A, a portion of this air entering the chamber P through the openings *p*, and the remainder entering the chamber *b* through the openings *b'*. The air becomes highly heated in its course through the chambers before it issues from the openings *w* into the contracted passage *x*, where it mingles with the products of combustion and causes the ignition of all of the inflammable gases before they escape from the discharge-opening *y*.

Owing to the contraction of the passage *x*, the volumes of air from the openings *w* meet each other, and thus insure the bringing of volumes of hot air into contact with all parts of the products of combustion, thereby preventing the passage of any of the gases without admixture with a sufficient supply of oxygen to insure their thorough combustion.

Air for the draft may be permitted to enter the openings *c c'*, and the cover of the opening *s* may be opened so as to permit the entrance of air at this point. When the plate *n* is in the position shown in Fig. 1, the air thus entering at the opening *s* causes the ignition of the fuel resting on the plate *n*, and the latter thus forms part of the effective grate-surface. When highly inflammable fuel is employed, however, the door *s'* should be closed, or if allowed to remain open the plate *n* should be adjusted to the position shown in Fig. 4, so that a space, *v*, shall intervene between the plates *m* and *n*, through which space cold air circulates and prevents the excessive heating of the front plate of the furnace, combustion of the fuel on the plate *n* in this case being limited to the lower slotted portion, *n'*, of the latter.

The same result may be attained by substituting for the plate *n* a series of transverse pivoted sections, as shown in Fig. 7, these sections being independently adjustable, so that the grate-surface may be increased or diminished at pleasure at different points.

The entrance of air into the chamber *d* is controlled by the adjustment of the slides *e'*, care being taken to permit the entrance of such an amount of air that the volume projected from the openings *w* will equal the volume of the products of combustion passing through the contracted outlet *x* of the combustion-chamber.

The chamber J being always filled with a mass of incandescent fuel, the volume of gases emanating therefrom and passing through the outlet *x* must always be at a uniform, or nearly uniform, temperature, the introduction of fresh fuel having no tendency to retard combustion or lower the temperature of the gases, owing to the fact that such fresh fuel is introduced at a point comparatively remote from that at which combustion takes place.

The fuel may be agitated, when desired, by inserting a suitable implement into the spaces between the grate N and the grate M or the lower end of the plate *n*, and when the latter plate is in the position shown in Fig. 1 the fuel may be further agitated by an implement inserted through the opening *s*. The grate M may also be agitated, if necessary.

It will be observed that the structure shown in the drawings is self-contained and portable and can be applied directly to an ordinary boiler-furnace, as shown by the dotted lines in Figs. 1 and 2—for instance, the discharge-opening *y* of the furnace coinciding with the usual feed-opening of the boiler-furnace, so that the volume of flame which issues from said opening *y* shall pass directly into the chamber beneath the boiler.

By this means my invention may be applied with facility to furnaces of the usual construction, no change in the furnace being demanded except the removal of the usual fire-doors and the closing of the joints between the casing of the improved furnace and the front plate of the old furnace.

Fig. 5, Sheet 2, shows a modified arrangement of the air-delivery openings *w* in respect to the contracted outlet *x* of the combustion-chamber, and Fig. 6 shows a furnace in which but one opening is used.

The arrangement of outlet *x* and passages *w* shown in Figs. 1 and 4 is preferred, however, owing to the fact that when the furnace is thus constructed the gases pass through the outlet in a vertical column, and the opposing currents of air are projected into said column in a horizontal, or substantially horizontal, course. By this means the draft acts with equal force on both volumes of air, and the latter are therefore of uniform strength. The introduction of the volumes of air in this direction, moreover, insures the meeting and commingling of said volumes of air before they are carried up by the products of combustion.

I do not desire to claim broadly the projecting of opposing volumes of heated air into the products of combustion as the latter pass through the contracted outlet of a combustion-chamber; but

I claim as my invention—

1. The combination, in a furnace, of the combustion-chamber J, having grate and contracted outlet, the fuel-reservoir F, the inclined passage G, connecting said fuel-reservoir and the combustion-chamber, and the casing of

the furnace, having an air-heating chamber or chambers communicating with the contracted outlet of the combustion-chamber, all substantially as specified.

2. The combination of the reservoir F with a furnace having outer casing, lining, and grate, constructed and combined substantially as described, so as to form a combustion-chamber, J, with contracted vertical outlet *x*, an inclined passage, G, connecting the reservoir and combustion-chamber, and air-heating chambers terminating in opposite horizontal, or substantially horizontal, passages *w*, communicating with the vertical outlet *x*, as specified.

3. The combination of the casing of the furnace and its lining-blocks *f* with the transverse slabs *g*, *h*, and *i*, forming the contracted outlet *x* of the combustion-chamber J, and the passages *w w*, communicating therewith, all as set forth.

4. The combination of the front plate, D, having a valved opening, *e*, and box F, inclosing chamber *d*, the hollow side walls, inclosing chambers *a*, the hollow rear wall, inclosing a chamber, *b*, and the transverse chamber P, said chambers communicating with each other and with the contracted outlet *x* of the combustion-chamber, all substantially as specified.

5. The combination of the plate *n*, the grate M, and the intervening grate-bar N, as set forth.

6. The combination of the inclined and grated plate *n*, the inclined plate *m*, arranged in respect to said plate *n* as described, so as to form an intervening space, and the front plate, D, having an air-opening, *s*, located adjacent to the upper ends of the said plates *m* and *n*, whereby a current of cold air is caused to pass downward through the space between them and away from the front plate, as set forth.

7. The combination, in a furnace, of the combustion-chamber J, the fuel-reservoir F, the inclined passage G, connecting the two, the plate *n*, forming the bottom of said passage, and the front plate, D, having an opening, *s*, at the top of said plate *n*, all substantially as specified.

8. The combination of the side walls, A, having chambers *a*, with the transverse slabs *g* and *h* and the cover-plate *t*, forming the transverse air-chamber P, as specified.

9. The combination of the front plate, D, having an opening, *s*, the plate *m*, and the plate *n*, adjustable in respect to said plate *m*, so as to vary the effective grate-surface, as described.

10. The combination of the transverse air-chamber P with the hollow walls of the furnace, containing chambers communicating therewith, and the top plate of the furnace, arranged in respect to the casing of the air-chamber as described, whereby a space, *z*, is formed above the same, as set forth.

11. The combination of the hollow side walls containing air-chambers, as described, the transverse air-chamber P, having a detachable top plate, *t*, and the top plate of the furnace, having a movable section, S, as set forth.

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

CLARK B. GREGORY.

Witnesses:
ALEXANDER PATTERSON,
HARRY SMITH.