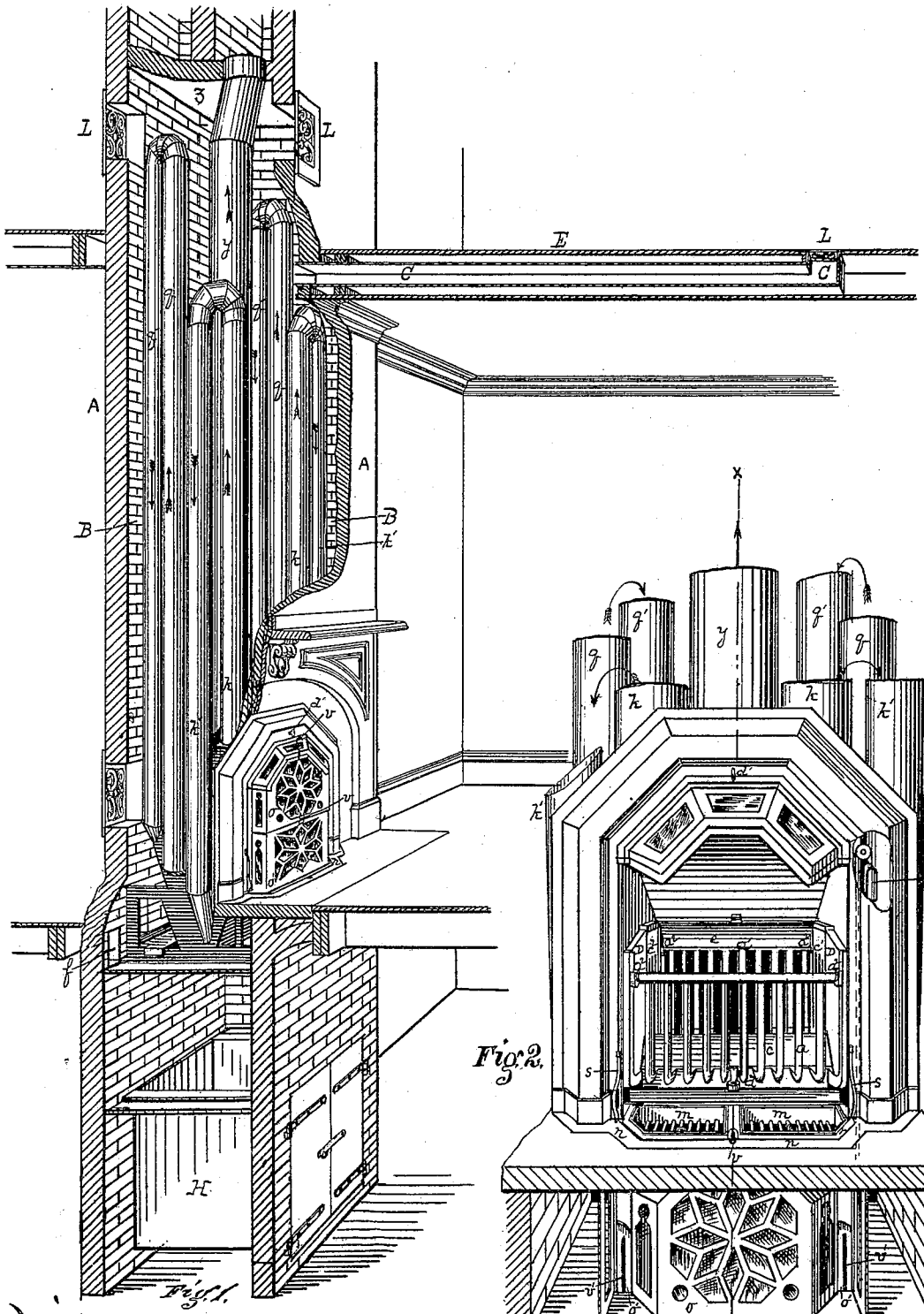
2 Sheets—Sheet 1.

I. W. BEALL.

FIRE-PLACE HEATER.

No. 174,654. Patented March 14, 1876.



Witnesses
Claudius L. Barber
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2 Sheets—Sheet 2.

I. W. BEALL.

FIRE-PLACE HEATER.

No. 174,654. Patented March 14, 1876.

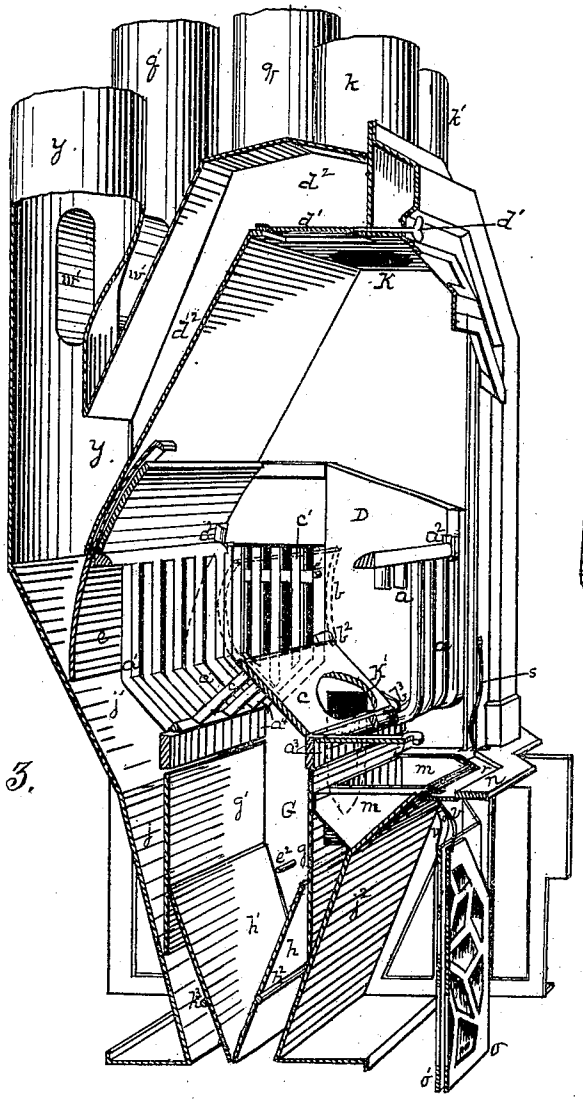

Fig. 3.

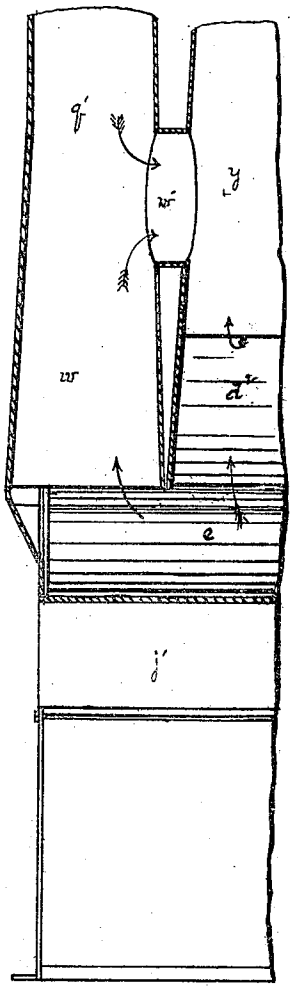

Fig. 4.

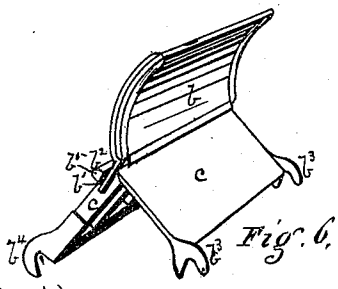

Fig. 6.

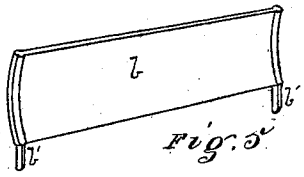

Fig. 5.

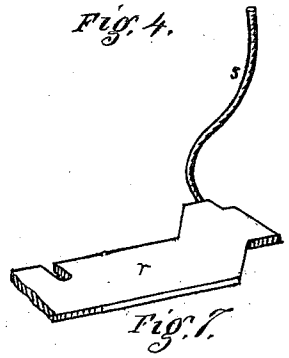

Fig. 7.

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UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN FIRE-PLACE HEATERS.

Specification forming part of Letters Patent No. **174,654**, dated March 14, 1876; application filed February 12, 1876.

To all whom it may concern:

Be it known that I, ISAAC W. BEALL, of Sewickly, county of Allegheny, State of Pennsylvania, have invented or discovered a new and useful Improvement in Fire-Place Heaters; and I do hereby declare the following to be a full, clear, concise and exact description thereof, reference being had to the accompanying drawing, making a part of this specification, in which—like letters indicating like parts—

Figure 1 represents, in perspective, my improved furnace, as placed in an ordinary chimney, the wall A of the chimney being broken away in part. Fig. 2 is a front perspective view of the same, apart from inclosing walls or chimney. Fig. 3 is a sectional view through the line *x x*, Fig. 2, the parts represented being shown in perspective. Fig. 4 is a detached view of the escape-flues *w q' y* on the back of the furnace. Fig. 5 represents a metallic plate or diaphragm used to divide the burning fuel in the fire basket or grate, and is shown in position in Fig. 3 by the dotted lines *b b*. Fig. 6 shows more fully the manner in which this plate or diaphragm is secured in position, along with other features of my invention, presently to be described; and Fig. 7 represents a part of a movable hearth-piece shown in position at *r*, Fig. 3.

My improved grate or furnace is designed to occupy the same position in an ordinary house-chimney as the common open coal-grate.

The walls of the chimney A, Fig. 1, form an outside casing or inclosure for the several parts of the furnace, and the open space B between these inclosing-walls and the parts of the furnace proper is used as an air-chamber, cold air being admitted through suitable openings at or near the bottom of the furnace, as at *f*. The air, being heated by the heat radiated and conducted from the inclosed parts of the furnace, rises and is conveyed by pipes C and registers L to any desired part of the house.

As illustrated in Fig. 1, the pipes C may be laid between the joists of the floor E, or arranged in any other desirable way, and the registers L may open from these pipes C or open through the chimney-walls from the air-chamber B direct into the adjoining rooms, while the grate or fire-chamber may open into the same or another room of the house, as in the case of ordinary grates. Thus my improved heater serves the purpose of the ordinary open grate, and at the same time the heat which, in the ordinary grate, is wasted on the chimney, is utilized in heating air in the chamber B, thus economizing fuel and expense; and while I gain this advantage I also secure a nearly, or quite, perfect combustion of the fuel by the new and peculiar construction of the furnace proper, as well as other advantages presently to be described.

The construction of the furnace is as follows: The fire chamber, as seen in Figs. 2, 3, is substantially of the form usual in open coal-grates. The fire-basket *a a*^{1} *c*, which holds the burning fuel, is composed of the front and rear grates *a a*^{1}, which are suspended at the ends of the top bar of each of the grates on the pivot *a*^{2}. Each grate is thus free to swing back and forth upon its pivots *a*^{2} as a center. These grates form the front and rear and a part of the bottom of the fire-basket. The remainder of the bottom of the basket is formed by the angular connecting-piece *c*, Figs. 2, 3, and 6, which hooks to or is jointed with the bottom bars *a*^{3} *a*^{4} of both the front and rear grates *a a*^{1} in such manner that it may be readily removed, but while in place the whole fire-basket may be swung or agitated back and forth.

In Fig. 6 I have shown a convenient method of connecting this bridge-piece *c* with the grate-bars *a a*^{1}. The hook *b*^{3} may engage one of the lower grate-bars, as *a*^{3}, and the hook *b*^{4} the other grate-bar *a*^{4}. As the fire-basket is swung or agitated the front and rear grates *a a*^{1} may thus each swing upon its own pivots *a*^{2} as a center, while the angular bridge-piece *c*, which connects them at the bottom, will not only move back and forth across the space between the grates *a a*^{1}, but will also have a small upward and downward motion in the same space, thus more effectually stirring the lower part of the fire, and clearing it of ashes and other residua of combustion.

For purposes presently to be described, I

prefer to make this angular connecting-piece *c* solid on one of its inclining faces, and grated or with suitable openings on its other face or inclination, as seen in Figs. 3 and 6; and it is also made reversible end for end, thus bringing the grated or solid faces either to the front or rear half of the fire-basket, as desired. The purposes served by this reversible feature of the connecting-piece *c* will presently appear. The curved plate or diaphragm *b*, Figs. 3, 5, and 6, is connected with the angular piece *c* by pins b^1, which pass down through openings in the apex of the piece *c*, as at b^2, Figs. 3 and 6; or it may be connected in any other suitable way, leaving the plate *b* sufficient freedom of motion, so that, as the bridge-piece *c* moves back and forth, the plate *b* may not press so as to bind against the fuel in either the front or rear parts of the fire-basket. The plate *b* may be supported in a sufficiently upright position either by its manner of connection with the piece *c*, or by lugs or pins e^1 projecting from the end of the chamber in the front and rear of the piece *b*. I find a convenient support to consist in pins b^1 passing through the angular bridge-piece *c*, and pressing against either face of the bridge-piece, on its under side, or against the lugs b^5, Fig. 6, which prevents it from falling in one direction, as forward, and a pin or lug, e^1, Fig. 3, to prevent it from falling in the opposite direction; or these pins b^1 may support the diaphragm *b* from falling in either direction by coming against the bridge-piece, as seen in Fig. 6, sufficient play being allowed between the two supports to allow the fire-basket to be readily agitated. The purpose of this plate *b* is to divide the fire when desired, and also along with the solid inclination of the bridge-piece *c* (when such inclination is placed forward as shown in Fig. 3,) to direct the draft which enters through the front grate *a* upward, and prevent it from passing through the body of the fire direct to the back flues or openings. The ends of the fire-basket are formed by the end of the common combustion-chamber, and may be lined with fire brick or tile, or other refractory material, as shown at *d*, Figs. 2 and 3.

Directly beneath the grates or fire-basket, I construct a smoke and gas chamber, G, as follows: The plates *g g'* are hinged to the bottom bars a^3 a^4 of the grates *a* a^1. These plates *g g'* pass down and outside of the plates *h* h^1, which are pivoted to the ends of the furnace-frame by the rods h^2 h^3. The plates *h* h^1 are pivoted below their centers of gravity, and pins or lugs e^2 in the end of the furnace-frame prevent the upper and heavier half of the plates from swinging to or beyond the vertical line of its suspension. Thus the extra weight of the upper part of the plates *h* h^1 tends to keep the two plates closed or in contact at the bottom, and the plates *h* h^1 are so hung in relation to the plates *g g'* that, as the plates *h* h^1 are closed at their lower edges, their upper edges will rest upon the inside of the plates *g g'*. Thus a closed chamber, G, is formed under the fire-grates, to which the smoke and gases which rise from the fire may be brought, and again passed through the fire before they are allowed to escape through the escape-flue, the plates *g g'* and *h* h^1, which form the sides and bottom of the chamber G, being hinged and pivoted as described. As the grates *a* *a'* are agitated or swung, these plates will also be agitated, and the ashes and other residua which enter this gas-chamber between them will be prevented from adhering to the sides of the chamber, and allowed to pass out between the lower edges of the plates *h* h^1, into the ash-pit H in the basement below. Such part of the ashes as falls through the grate a^1, back of this gas-chamber, will be conducted by the inclined sides of the furnace case or frame *j* j^1 into the same ash-pit H, while such part as falls from the front grate *a* will be received by the ash or sifting-pans *m m*, Fig. 2, which have openings or grates to permit the ashes to pass through while the cinders are retained, and such part of the ashes as passes through these pans is conducted by the sides j^2 of the furnace to the ash-pit H.

The sifting-pans *m m* are so made as to be readily removable, and the cinders and other contents may be emptied into the fire and reburned.

Between these pans *m m* and the hearth-piece *n* of the furnace I leave a space through which vertically-sliding doors *o o'* pass, and to cover this space when the doors are up or down I fit a false or moving hearth-piece, *r*, to the under side of the hearth-piece *n*. Springs *s s* are attached to the front or jamb of the furnace-frame, and so connected with the hearth-piece *r* as to cause it to cover the space between the pans *m m* and hearth-piece *n*, when the doors are up or down, as shown in Figs. 1, 2, 3. A detached view of a part of this movable hearth-piece *r*, with one of the springs *s* attached, is shown in Fig. 7.

The doors *o o'* are made to slide vertically, one outside of the other, as the sash of an ordinary window, and are preferably counterbalanced by weights *p*, Fig. 2, suspended by pulley and cord at each side of the doors. I prefer to make the face of the doors angular in form instead of plane, the surface being cast with variously-designed openings or lattice-work, and lined with mica plates. These doors may be made in a single piece, forming one door instead of two, but I consider two preferable, because, by properly adjusting them with reference to each other, an opening for admitting draft to the fire may be made at different points, the doors thus serving the purpose of the ordinary blower or draft front, as well as closing entirely the front of the fire-chamber for either safety or convenience. To the upper edge of each of these doors I attach loops or tags *v*, for convenience in moving the doors. These tags remain a

little above the hearth *n* when the doors are shoved down, as seen in Fig. 2, and serve not only as a convenience in drawing the doors up, but also, by their curved form, press back the movable hearth-piece *r* as the doors are raised.

The springs *s s* are also curved, and the inward deflection passes into slots *v'* in the lower edges of the lower door, when it is raised up, and as the doors are pushed down the edges of the doors press against the inward deflection of the springs *s s* and force them outward, and with them the hearth-piece *r*. Thus, by the combined form of the tags *v*, springs *s s*, and door edges, the upward or downward moving of the doors will, at the proper time, move aside the hearth-piece *r* and open a passage for the doors, the action of the springs *s s* closing the passage after them.

In the crown of the fire-chamber is a damper, d^1, which opens and closes a passage from the fire-chamber to the flue d^2, Fig. 3, which passes back over the top of the fire-chamber and discharges into the common escape-flue *y*. Thus a direct draft is secured from the fire to the escape-flue. But, to secure the full benefit of the several devices in my furnace, I close this damper d', when the smoke and other products of combustion pass upward to the upcast flues *k k*, the opening to one of which is shown in the crown of the fire-chamber K, Fig. 3.

The smoke and gases are conducted by these upcast flues *k k* upward for any desired distance and returned by the downcast flues *k' k'*, which discharge into the smoke-chamber G immediately under the fire, one of which discharge-openings is shown at K', Fig. 3. From this chamber the smoke and gases pass through the back part of the angular bridge-piece *c*, (when it is in the position shown in Fig. 3,) and up through the fire in the back part of the fire-basket.

In this passage through the fire the free carbon in the smoke, carbonic oxide, and what other combustible gases are present, will be wholly consumed—that is, resolved into the products of a perfect combustion. These resulting products pass either to side chambers through the grates c^1 c^2, or through the grate a^1 to the back chamber lying between the grate a^1 and furnace-casing j^1. The regulator *e*, Fig. 3, being raised, these products will pass under it to the escape-flue *y*, and also to the flues *w w*, which are the lower part of the downcast flues *q' q'*, one of which flues, *w*, is shown in Fig. 4. The gaseous products are thence conducted by the cross-flues w^1 w^1, to the common escape-flue *y*, and the whole is discharged. By adjusting the damper *e*, Fig. 3, the whole or a part of the gaseous products may be sent through the end gratings c^1 c^2, whence they are conveyed by the upcast flues *q q*, upward for any desired distance, (see Figs. 1 and 2,) and returned by the downcast flues *q' q'* to the cross flues *w' w'*, through which they will be discharged into the escape-flue *y*, along with that part coming up through the flues *w w* from the back chamber, between a^1 and j^1. The height to which the up and down cast flues are extended is immaterial, and in this respect as well as in regard to their size they may conform to the conditions furnished by the house to which the furnace is applied. The principal object in extending these flues is to give a longer passage to the heated gases through the air-chamber B, inclosed by the chimney-walls A. When adapted to a house of two stories for warming rooms on either floor, I prefer to extend, say, the upcast flues *q q*, Fig. 1, a little above the second floor, into the space ordinarily occupied by a grate, and the remaining upcast flues *k k* I extend to the top of the mantel, or nearly to the second floor. At the upper limit of the air-chamber B, I place across the chimney a tile, *z*, leaving sufficient opening for the escape-flue *y*. The heated air is thus confined to the chamber B, and may be admitted to the desired rooms through the registers L, as before described.

When at any time only a small fire is desired, and that to warm the room into which the fire-chamber opens, I prefer to shift the angular bridge-piece *c* so as to bring the grated inclination forward and build the fire in the forward half of the fire basket only, when, by opening the damper d^1, a direct communication is secured to the escape-flue *y*. Thus my improved furnace may furnish all the advantages of an open agitating-grate, or when desired, combine therewith the many desirable qualities of a house-warming furnace.

The ash-pan H I support on suitable sliding ways, so that it may be readily drawn out and its contents removed, and when the chimney is built against the outer wall of the house the ash-pan H may be made to slide to its place from the outside through the foundation-wall, thus making it more easy to remove the contents. Ordinary flues or pipes are provided for furnishing cold air to the air-chamber B at the points *f*, and the bottom of the air-chamber at the base of the furnace is closed tight to exclude cellar air. When using both divisions of the fire-basket, I prefer to keep the rear division nearly full of fuel, so as to cover or nearly cover the flue-openings through a^1 and c^1 c^2, thus preventing any tendency of the indraft to pass through them to the escape-flue *y*, instead of first passing through the flues *k k*.

The operation of my furnace or heater is as follows: I kindle a fire in the fire-basket or grate *a* a^1 *c*, and, if desired, adjust the doors *o* *o'* to regulate and direct the draft to the front grate *a*, and also the damper d^1 may be turned to open a direct passage from the fire to the escape-flue *y*, when my furnace will operate as the ordinary open grate. But, as soon as the fire is well started, I prefer to close the passage at d^1, and the flue-openings at c^1 c^2, and a^1 being covered with fuel the smoke and heated gases escaping from the upper surface of the fire will rise to the upcast flues *k k* and be conducted by them and the

downcast flues k' k' to the chamber G, immediately under the fire. The angular bridge-piece c being placed as shown in Fig. 3, with its grated or open inclination next the rear-grate a^1, the smoke and gases will pass through these openings and through the fire to the flue-openings, at a^1 c^1 c^2, whence they will be conducted by the flues w w q q' q' to the cross-flues w' w', and by these to the escape-flue y. The damper E may be regulated to permit any amount of the escaping gases to pass, or by closing entirely the whole will pass to the side openings c^1 c^2; but I prefer to permit a part to pass through this opening to the flues w, w, and y, as the action of the two currents through the cross-flues w' w' is beneficial to the draft of the flues q q'.

When it is desired to leave a fire unattended through the night, or at any time, the doors o o' may be raised in front of the fire, as in Fig. 1, thus insuring safety and economy by lessening the draft to the fire; or, when desired, they may be partly or wholly removed, as in Fig. 2, by moving them below the hearth, as described.

By connecting a suitable hook to the projecting loop d, Fig. 2, the whole grate or fire-basket may be agitated by swinging it on the pivots a^2, and the combined action of the front and rear grates a a^1 and angular bridge-piece c changes the form of the receptacle as it is swung, and effectually sifts out ashes and other residua, and at the same time effectually stirs the fuel and increases the fire. And while I gain in this way a perfect combustion of fuel, as well as a convenient and ornamental open grate, I also economize the heat radiated and conducted from the several parts of the furnace by constructing an air-chamber between the walls of the chimney and the furnace, as described.

I claim as my invention—

1. A swinging fire-basket consisting of the front and rear grates a a^1, and connecting-bridge c, constructed and arranged substantially as described, whereby the front and rear grates a a^1 each swing upon its pivots a^2 as a center, and give the bridge-piece c an upward and downward and backward and forward movement within the space between the grates a a^1.

2. The angular bridge-piece c for connecting the grates a a^1 at the bottom by a pivoted or hinged joint, constructed substantially as described.

3. The combination of the grates a a^1 angular piece c, and diaphragm b, constructed and arranged substantially as and for the purposes set forth.

4. The smoke and gas chamber G, having vibratory or oscillating sides and bottom, constructed and arranged substantially as and for the purposes described.

5. The combination of the fire-basket a a^1 c, flues k k k' k', and gas-chamber G, arranged substantially as and for the purposes described.

6. The combination of the vertically-adjustable doors o o', and movable hearth-piece r, and springs s, constructed and arranged substantially as set forth.

7. The combination of the fire-basket a a^1 c, gas and vapor chamber a^1 j^1, and flues w w y, arranged substantially as described.

In testimony whereof I have hereunto set my hand.

ISAAC W. BEALL.

Witnesses:
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JAMES M. CHRISTY.