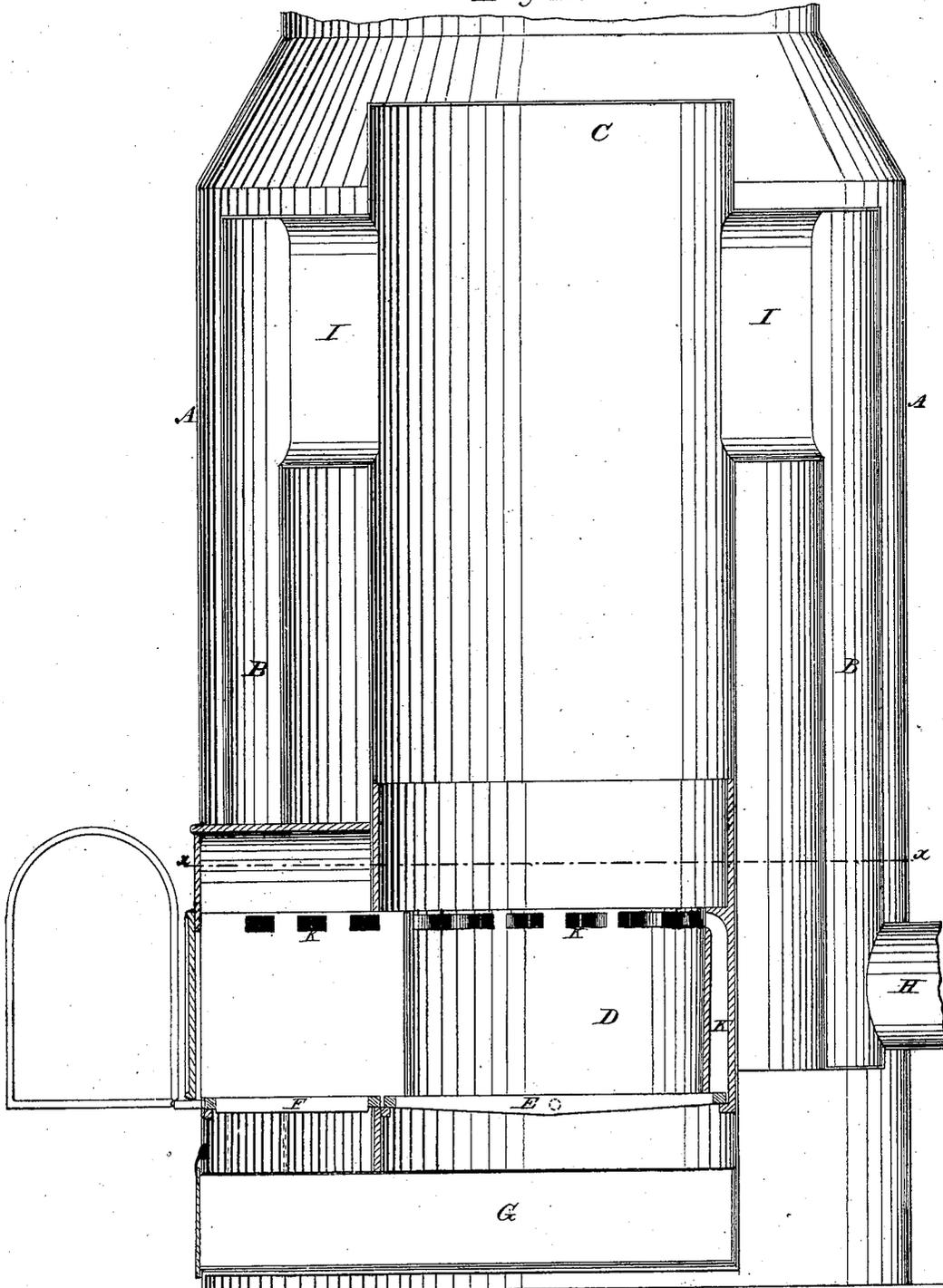


**B. R. HAWLEY.**  
**Furnaces and Furnace Doors.**

No. 136,509.

*Fig. 1.*

Patented March 4, 1873.



*Witnesses:*

*J. C. Wildman*  
*J. C. Brecht*

*Inventor:*

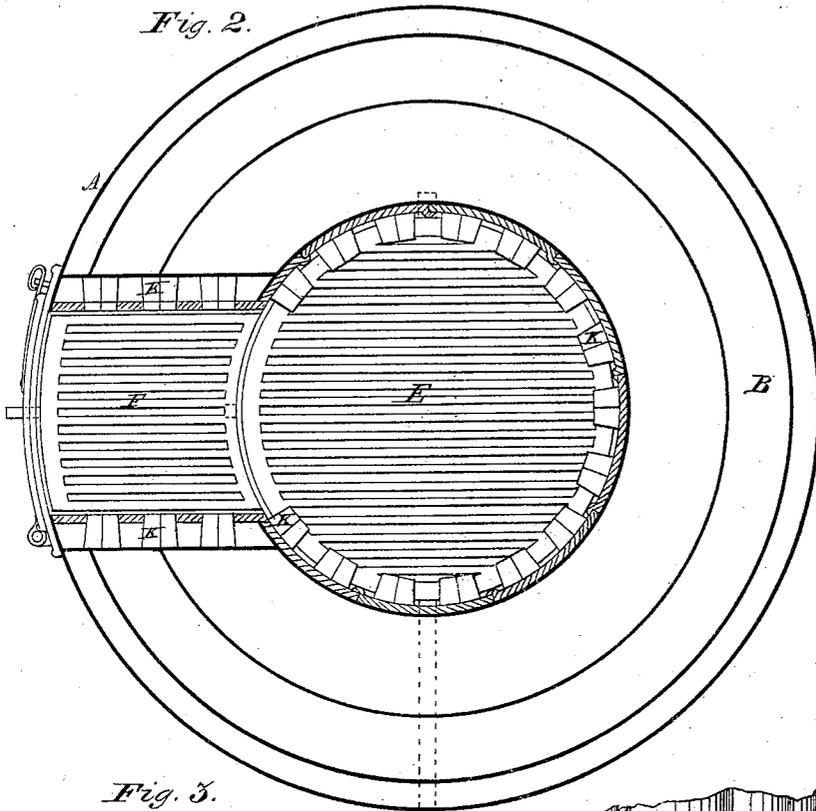
*B. R. Hawley*

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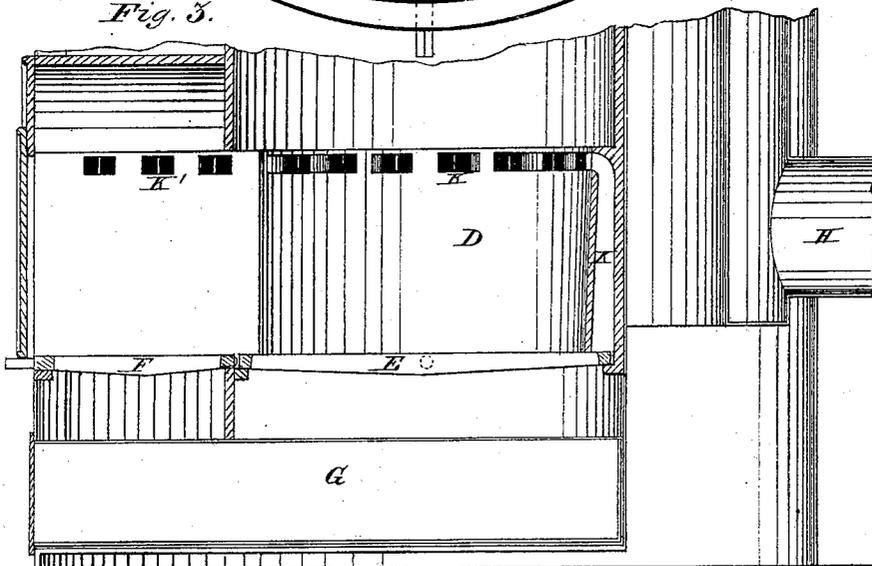
No. 136,509.

Patented March 4, 1873.

*Fig. 2.*



*Fig. 3.*



Witnesses:

*J. C. Wildman*  
*J. C. Brecht,*

Inventor:

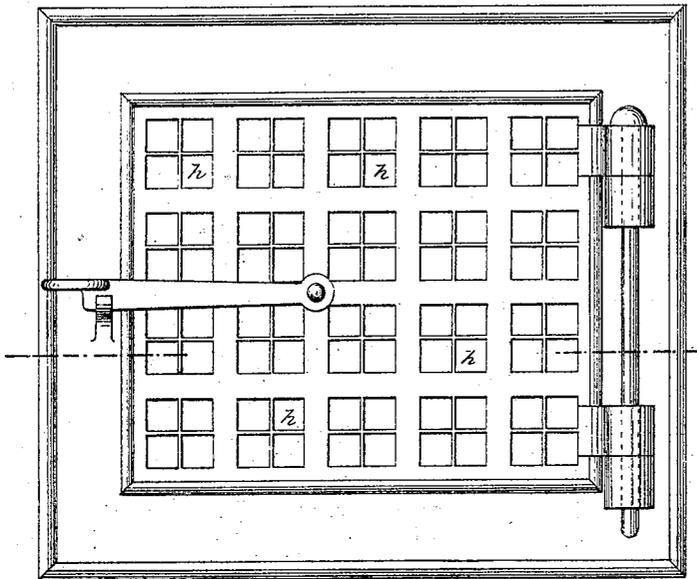
*B. R. Hawley*

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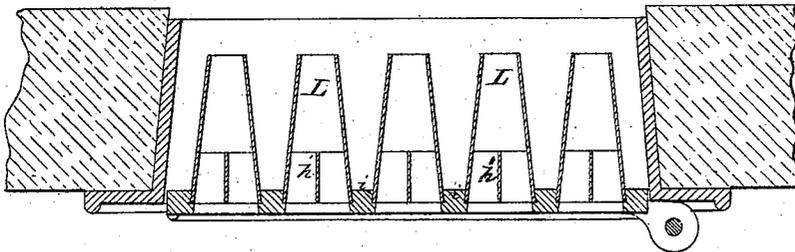
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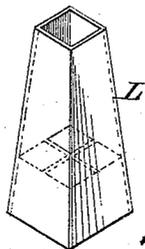
*Fig. 4.*



*Fig. 5.*



*Fig. 6.*



*Witnesses:*

*J. C. Wildman*

*T. C. Brecht.*

*Inventor:*

*B. R. Hawley*

# UNITED STATES PATENT OFFICE.

BENJAMIN R. HAWLEY, OF NORMAL, ILLINOIS.

## IMPROVEMENT IN FURNACES AND FURNACE-DOORS.

Specification forming part of Letters Patent No. 136,509, dated March 4, 1873.

*To all whom it may concern:*

Be it known that I, BENJAMIN R. HAWLEY, of Normal, county of McLean, in the State of Illinois, have invented certain Improvements in Furnaces and Furnace-Doors, of which the following is a specification:

This invention relates to improvements in furnaces and furnace-doors; and it consists, first, in the construction of the furnace, which is provided with any suitable number of conical tubes that project into and enter the fire-box or furnace above the fuel, the object being to prevent the formation of smoke and carbonic oxide, which are usually formed in furnaces; second, it also consists in the construction of the combustion-chamber, in connection with one large annular smoke-flue, which surrounds the whole fire-box, and is connected thereto by one, two, or more elongated openings, by which the carbonic acid (which is, as is well known, the heaviest of the gases) generated by the fuel is enabled to escape at the lowest part of such flues, and settle to the bottom of the smoke-chamber, thus leaving the combustible gases free room for union in the upper part; third, it consists in a peculiar arrangement of grates, which are made in two pieces, viz., the main grate in the furnace, which is pivoted at the sides, and may be shaken or dumped from the outside, and an auxiliary grate instead of the dead plate now commonly used under the chute or feed-passage. The object of this is, that if it is desired to rekindle the fire or supply it with fresh fuel, it is only necessary that the fire left on the auxiliary grate be pushed back on the main grate, and the auxiliary grate may be then dumped or cleared of the clinkers, &c. The fire on the main grate is then pulled back again onto the auxiliary grate, and the main grate dumped, and fresh fuel then added thereto, thus saving the time, inconvenience, and expense in rekindling an entirely new fire. Fourth, it also consists in the peculiar construction of the furnace-doors, as follows: Instead of the thin metal plates with small perforations now commonly used I employ a number of cones cast separate from the door, and held thereto by dovetailed ribs across it, into which the cones are inserted. The object of these is, that a greater amount of heated air can be admitted to the combustion-chamber above the fuel.

By this arrangement the uneven contraction and expansion are also obviated, and the cones can be readily replaced by new ones when they become defective in any manner. Another great advantage is, that it gives a much larger heating or radiating surface, by which the air entering from the outside is heated before it enters the furnace.

I will now proceed to more definitely describe my invention, reference being had to the accompanying drawing.

In the accompanying drawing, Figure 1 is a vertical section of my furnace. Fig. 2 is a cross-section on line X X. Fig. 3 is a vertical section of the lower part. Fig. 4 is a front view of my door. Fig. 5 is a cross-section of the same. Fig. 6 is a cone detached.

In the drawing, A represents the outer shell of the furnace; B, the annular smoke-chamber, connected by one, two, or more branches, I, to the combustion-chamber C. At the lower end is the furnace or fire-pot D, provided with the main grate E, which is pivoted in the sides of the shell. At the front end of the grate E, and extending to the door, is the auxiliary grate F, at the bottom of the feed-chute. Under these grates is a drawer, G, by which the ashes may be taken out in the usual way. The furnace or fire-pot D is provided with a number of tubes, cast therein, and these turn, at their upper ends, toward the furnace, communicating with the air-supply chamber at the bottom. The space in each side of the auxiliary grate is also provided with a number of these flues or tubes, which are of a conical or tapering form, as plainly shown in Fig. 1. To the annular smoke-chamber B is connected the outlet-pipe H, leading to the chimney. The furnace-door, best seen in Figs. 4 and 5, is provided with a number of square holes, *h*, which connect with the cones L, Fig. 6. These cones may be of any desired length or size, and are divided at their base by thin cross-pieces *h*, which may also be of more or less length, and assist in heating the air entering at the mouth.

It will be readily seen that the heating or radiating surface of the cones, which are of more or less length, may be made greater or smaller as desired. The back of the furnace-door is provided with a number of dovetailed grooves, *i*, shown best in Fig. 5, into which

the lower ends of the cones are entered and held by said grooves. When any of the cones become damaged or injured they may be very readily slipped out and replaced by new ones.

The principal advantages of my invention are, that in place of a perforated plate or tube having very small holes, through which the air is admitted in fine jets to the combustion-chamber, as in the furnaces known as the Argand furnaces, by my invention the air enters through the elongated flues or cones, with their divisions or partitions; and it will be seen that a current of air passing into the fire through such a cone must come in direct contact with the sides and partitions, which, being heated, will readily impart their heat to the atoms of air, and, mingling with the gases of the furnace, ignite the gases and prevent the formation of smoke. Another advantage is the peculiar construction of the door-plate and cones; they being cast separate, the contraction and expansion of the door are provided for, and the heat from the furnace will not be radiated through the door, as the radiation from the cones will be at right angles thereto, and reflect the heat from one side to the other, and then be taken up by the air; another advantage being that the cones can be very easily replaced by new ones when they become melted, broken, or otherwise defective. The advantage of the large smoke-flue surrounding the combustion chamber and fire-box, and exhausting the smoke at the bottom thereof, is to prevent the mixing of the carbonic acid generated with the combustible gases, and thus extinguishing or smothering the flames, as is the case when small tubes or flues are used. On the principle that by the gravity of the various gases they will seek their level in any heated chamber exhausting from the bottom, it is well known that the hottest and lightest gases will be at the top, and the heaviest gas, viz., carbonic acid, will flow out at

the lowest point of the elongated openings I, and at once fall out of the way to the base of the smoke-chamber, leaving the combustible gases free to burn. Another advantage is the double grate, by which the fire can be easily rekindled without extinguishing the fire altogether, for cleaning the same or removing the clinkers. By my device the fire may be drawn to the small or auxiliary grate after it is dumped; then the large grate dumped, fresh fuel or coals added, and the fire will be as clean and perfect as a new one.

Having thus described my invention, I claim as new and desire to obtain by Letters Patent—

1. The furnace herein described, with one large annular smoke-chamber, B, surrounding the whole fire-box, substantially as shown, and for the purpose set forth.

2. The arrangement of the main grate E and auxiliary grate F, as and for the purpose herein described.

3. The cone L, placed either vertical or horizontal, when arranged substantially as shown and specified.

4. The double air-chamber around the fire-chamber D and smoke-chamber B, when arranged substantially as and for the purpose described.

5. The furnace D, provided with annular vertical cones K, substantially as and for the purpose described.

6. The combination of the frame and plate with a furnace-door provided with dovetailed grooves *i* and cones L, arranged substantially as and for the purpose described.

7. The combination and arrangement of the shell A, annular smoke-chamber B, flues I, fire-chamber D, grates E F, and feed passage, all arranged substantially as and for the purpose specified.

B. R. HAWLEY.

Witnesses:

KATE HAWLEY,  
JESSIE HOPKINS.