

J. C. BAUM.
Smoke-Consuming Furnace.

No. 163,295.

Patented May 18, 1875.

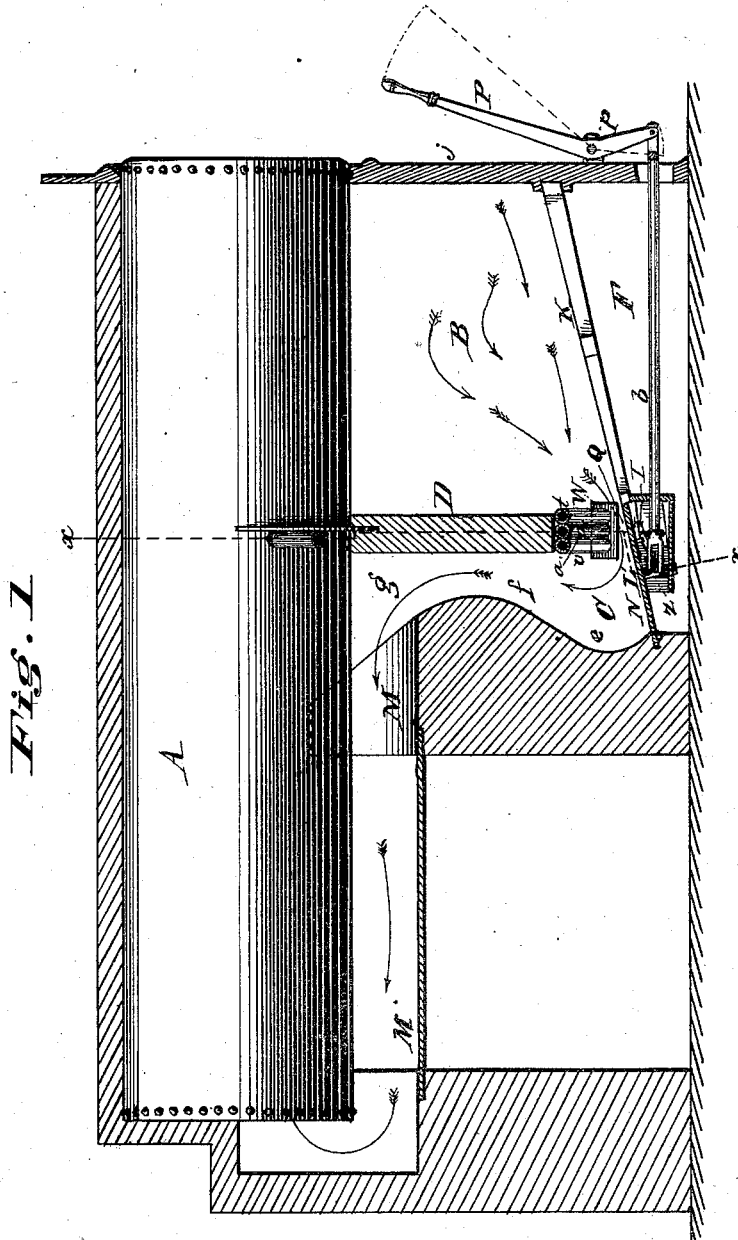


Fig. 1

Attest
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his Attorney.

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Fig. 2

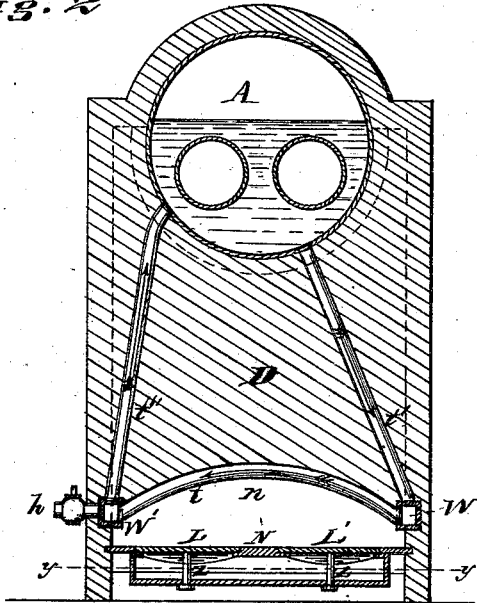
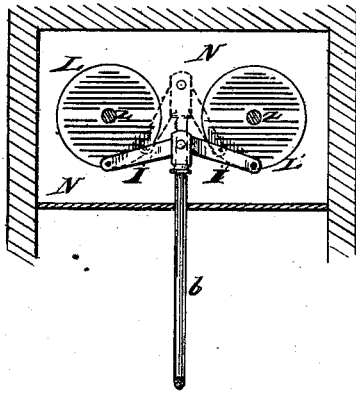


Fig. 3



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UNITED STATES PATENT OFFICE.

JOHN C. BAUM, OF CINCINNATI, OHIO.

IMPROVEMENT IN SMOKE-CONSUMING FURNACES.

Specification forming part of Letters Patent No. 163,295, dated May 18, 1875; application filed August 14, 1874.

To all whom it may concern:

Be it known that I, JOHN C. BAUM, of the city of Cincinnati, State of Ohio, have invented certain new and useful Improvements in Smoke-Consuming Furnaces, of which the following is a specification:

My improvements relate to that class of smoke-consuming furnaces where the furnace is divided into a generating coking-chamber and a combustion-chamber.

My improvements are, primarily, three in number.

The first consists in the novel configuration of the combustion-chamber, and providing the same with a grate for the support of a bed of incandescent fuel, whereby the unconsumed gases and volatile carbon entering therein from the generating-chamber are thereupon mixed with atmospheric air, and thoroughly consumed. In this connection I have also devised a peculiar arrangement of the diaphragm dividing the combustion from the generating chamber with reference to the grates of these chambers, which form a continuous surface.

The second improvement becomes valuable when the smoke-consuming furnace is employed in connection with apparatus for the ebullition or evaporation of liquids; and consists in such an arrangement of one or more pipes connected with the boiler or evaporator that the pipes shall maintain a diaphragm between the generating and combustion chambers, and also agitate the liquid in the boiler or evaporator, and, consequently, aid in the evaporation or ebullition of the same.

The third improvement relates to a device and its location whereby one or more grates placed in the bottom of the combustion-chamber can be effectively and conveniently rotated.

In the accompanying drawings, Figure 1, Sheet 1, represents a vertical central longitudinal section of a furnace embodying my improvements, the steam-boiler upon the furnace being shown in side elevation. Fig. 2, Sheet 2, is a vertical transverse section of the same furnace, the section being taken at the dotted line *x x* in Fig. 1; and Fig. 3, Sheet 2, is a view of the under side of the rotary grates and a portion of the device for rotating them,

said view being taken through the furnace at the dotted line *y y*, Fig. 2.

A designates a tubular steam-boiler; B, the generating-chamber of the furnace, provided with a door, *j*; C, the combustion-chamber. A diaphragm, arched at bottom and closely joined to the sides of the furnace and the bottom of the boiler, separates the two chambers B and C, and prevents all communication between them, except under the arch *n*. The brick-work of this diaphragm is supported by a frame-work consisting of three pipes, *t u v*, Fig. 1, placed side by side. One end of these pipes is connected with a pipe, *t'*, communicating with the boiler near or at its bottom. The other end of these pipes is connected with a pipe, *t''*, entering the boiler immediately below the water-line. The lower end of the pipe *t'* of the boiler is secured to the one end of the pipe-sections of the arch by a hollow box-joint, *w*, and the lower end of the pipe *t''* is secured to the other end of the pipe-sections of the arch by a like hollow joint, *w'*. Connected with this latter is a blow-off pipe and valve, *h*. C represents the combustion-chamber, consisting of the several portions *e f g*. The lower portion *e* is wide from front to rear, the middle portion *f* is quite narrow from front to rear, and is nothing more or less than a throat, while the upper portion *g* is wide from front to rear. This enlargement, narrowing, and enlargement of the combustion-chamber are preferably made at its rear side. The back of the throat *f* merges gradually into the other portions, so that the rear side of the chamber forms a curved surface, a vertical transverse section of which shows a line curved very much in the form of an inverted S, or scroll, as may be seen in Fig. 1, Sheet 1, of the drawing. The upper part *g* of the combustion-chamber opens into a flue, M. This latter communicates with the rear end of the tubular flues through the boiler. The bottom of the generating-chamber B is formed by the grate K, inclined from front to rear. The bottom of the combustion-chamber, and of the passage-way under the diaphragm, lies in the same inclined plane as grate K, the inclination of the grate K and bottom N being to facilitate the passage of fuel over them. In the

bottom N are two rotary grates, L L', large enough to lie beneath the combustion-chamber and the passage-way under the diaphragm. The grates rotate on a center-pin, *z*. The device for rotating them consists of a toggle-joint, I I', operated by a rod, *b*, which extends through the ash-pit F and the front end of the furnace. A hand-lever, P, of the first class, fulcrumed on pin P' at the front end of the furnace, and connected at its lower end to that end of rod *b* which projects beyond the front of the furnace, operates the rod.

The mode in which my improvements operate is as follows, premising that a fire has been already kindled in the furnace, and the same heated:

The chamber B being charged through door *j* with fresh fuel, the latter begins to coke, and generates hydrocarbon and other inflammable gases. These rise from the fire, but, because of the diaphragm, are compelled to pass under the arch, and in immediate proximity to the bed of the fire, by which means they are concentrated and intensely heated, ready for ignition. Their velocity is at the same time accelerated. Part ignite immediately, part remain unconsumed. They pass rapidly from under the arch into the enlarged portion *e* of the combustion-chamber. Here they are met with a very intense heat generated in the combustion-chamber by the combustion of like gases which have previously entered, and are still more highly heated by a fresh supply of oxygen derived from a current of atmospheric air admitted through the grates L L', and also by being compressed and their draft retarded by the throat *f*. They are then consumed. Should any of them for some reason not be perfectly consumed before passing through the throat *f*, such portion upon entering the upper portion *g* of the combustion-chamber will immediately expand, and ignite and give off their heat. The smoke has now all been consumed, both that portion of it which consists of black carbonaceous particles and the part known as white vapor. All that remains is heated air, and an inconsiderable amount of invisible indestructible gases. This residue passes under the boiler through flue M, and returns through the flues of the boiler into the smoke-stack.

The rotating grates extend under the arch of the diaphragm in order that the passage under the arch as well as the combustion-chamber may be cleared of ashes. The use of them obviates the necessity of poking the fire, and hence prevents, to a great extent, the formation of clinker, and shuts out the enormous influx of air which enters the generating-chamber while the fire is poked, and reduces the temperature of the furnace to such a degree that the consumption of the smoke for the time being is impossible.

The location of the lever by which the fire-

man rotates the grates is very convenient, and the toggle-joint is a very serviceable device for rotating them.

The main purpose of the employment of the water-pipes *t u v* is, to provide that which will support and maintain the brick diaphragm, and also withstand the intense heat to which the arch is subjected. When the diaphragm is unsupported, the intense heat around and under it frequently cracks it. The water in pipes *t u v* is heated, rises through pipe *t'*, and enters the boiler, leaving these pipes to be filled by pipe *t'* with cooler water from the boiler. Thus a current of water is established through these pipes, by means of which they are preserved from burning out or exploding. The current of water thus established also agitates the water of the boiler, assisting the ebullition and evaporation of the same. The heat at the arch is also thus immediately utilized. The blow-off pipe *h* affords a convenient method of cleaning out the pipes and the boiler.

Obviously the number of pipes sustaining the diaphragm may be increased or diminished, according to the size and weight of the diaphragm, without altering essentially their value as a support for the diaphragm. A diaphragm thus supported by a pipe connected with the boiler or evaporator is, so far as I am aware, entirely new; and I desire to claim it thus supported when separating the generating and combustion chambers.

The most important features of my combustion-chamber are the enlarged portion *e* and the throat *f*.

What I claim as new, and desire to secure by Letters Patent, is—

1. The chambers B and C, communicating at the bottom by opening Q, in combination with the continuous grate surface and bottom K N and diaphragm D, substantially as specified.

2. The bridge-wall of the furnace having a curved front surface, in combination with the diaphragm D confronting it, to form in rear of chamber B the chamber C, with the alternately enlarged and contracted portions *e f g*, the bottom of said chamber being formed by a grate-surface, substantially as and for the purpose specified.

3. The boiler A and continuous grate surface and bottom K N, in combination with the diaphragm D and its supporting and circulating pipe or pipes, the diaphragm reaching from the boiler to near the grate-surface, all substantially as and for the purpose specified.

4. The combination of the rotary grates L L', toggle-joint I I', rod *b*, and lever P, for the purpose mentioned.

J. C. BAUM.

In presence of—

D. P. KENNEDY,
R. J. GARRETTE.