B. HERSHEY.

STEAM-BOILER FURNACE.

No. 187,136. Patented Feb. 6, 1877.

Fig. 1.

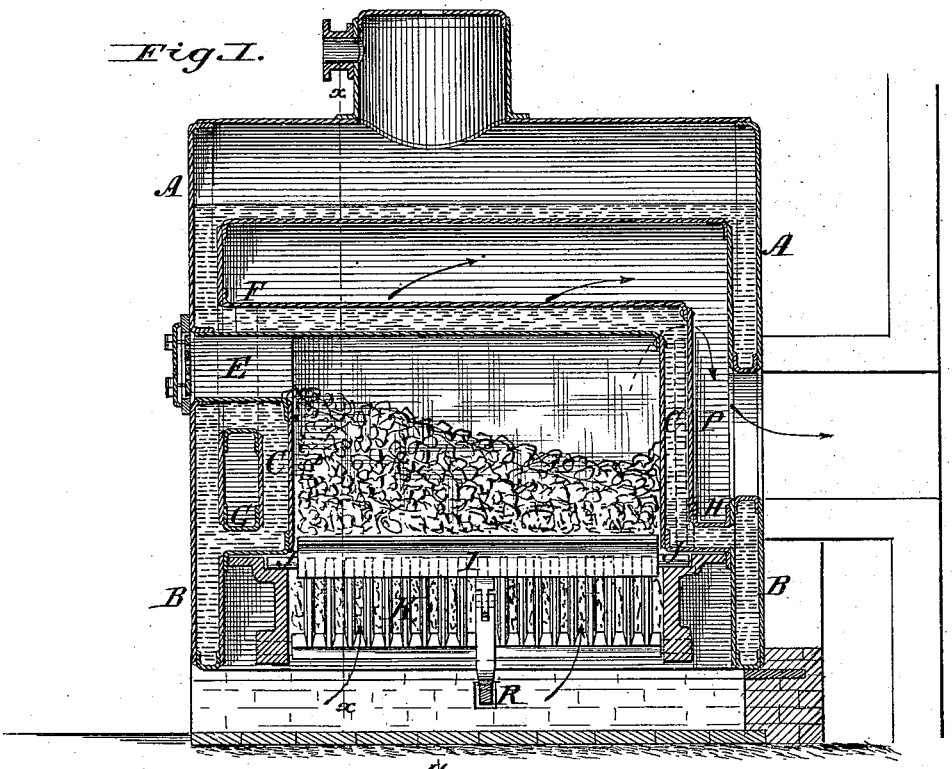
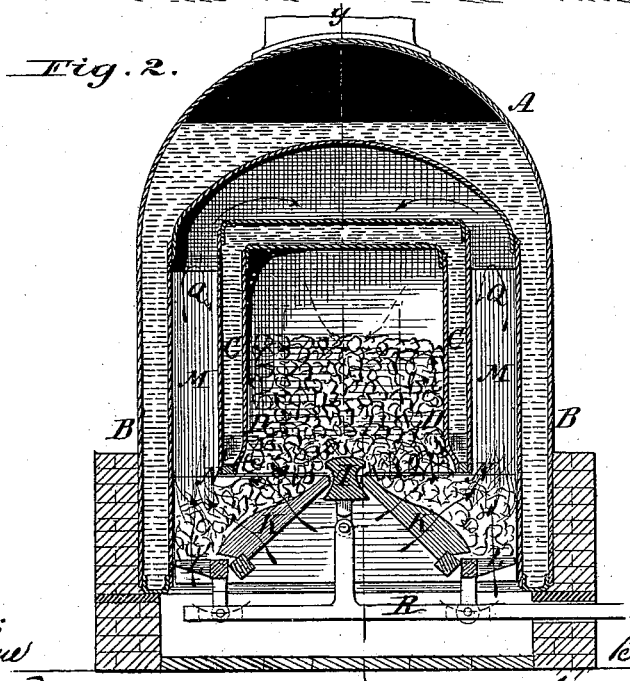



Fig. 2.

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# UNITED STATES PATENT OFFICE.

BENJAMIN HERSHEY, OF ERIE, PENNSYLVANIA.

## IMPROVEMENT IN STEAM-BOILER FURNACES.

Specification forming part of Letters Patent No. **187,136**, dated February 6, 1877; application filed December 8, 1876.

*To all whom it may concern:*

Be it known that I, BENJAMIN HERSHEY, of Erie, in the county of Erie and State of Pennsylvania, have invented certain new and useful Improvements in Steam-Boiler Furnaces, of which the following is a specification:

The object of my invention is to increase the combustion and heating capacity of steam-boiler furnaces in which an inner and an outer water-chamber is specially adapted to operate in conjunction with inner and outer grates to accomplish the purpose designed.

My invention consists, first, in the combination, with an inner and outer water-chamber, the former consisting of the fuel-receiver, of inner and outer grates, independent of each other, adapted to operate in conjunction with the chamber water-legs, so that the best effect is obtained in preserving a coal-bed of uniform depth immediately upon the grates, and in which the space between the inner water-legs shall receive and hold the fuel in position, and cause it to gradually settle down as the lower portion burns out, thus securing a combustion immediately in the vicinity of and between the water-legs at each side of the furnace, while the fuel-chamber proper, being within the interior boiler, may be filled up without interfering with the process of combustion. The inner water-chamber joins at its top the front side of the outer water-chamber for the escape of steam, while at its lower side the inner water-chamber joins the outer one at both ends for water-circulation, and these parts serve as permanent fastenings.

A diving-flue is formed at the rear of the inner water-chamber, to cause the entire products of combustion to pass in close and continuous contact with the surfaces to be heated, and to interrupt the direct flue-escape, and form at the same time a space for the deposit of sparks in front of the flue-sheet.

In the accompanying drawing, Figure 1 represents a vertical longitudinal section of a boiler-furnace embracing my invention; and Fig. 2, a cross-section thereof, showing the relative and combined positions of the grates with the water-legs of inner and outer water-chambers.

The boiler A proper may be of the ordinary construction of boilers having water-legs B, and suitably supported upon a brick foundation, and provided with a dome, from which a pipe or pipes may connect with heating-coils or otherwise, and having a rear opening through which the products of combustion pass off. An inner water-chamber, C, is arranged within the outer one; but its water-legs D are shorter than the outer ones, and it forms the fuel-chamber proper, having an opening, E, through which the coal is introduced. These two chambers are joined by a front extension, F, at the top of the inner chamber, to afford a free escape of the steam generated within the walls of the inner chamber, while front and rear extensions G and H at its lower portion afford means of communication between the two chambers. These connections serve as fastenings for the inner chamber.

Now, I make no claim to a boiler-furnace having an inner and outer water-chamber; but the essential feature of my invention lies in the advantageous adaptation and combination of inner and outer grates with such construction and arrangement of water-chambers. This combination is to obtain certain highly-desirable results, which a flat grate is inadequate to produce.

Centrally with the inner chamber, and at or nearly on a level with its lower portion, a bar, I, is longitudinally arranged upon pivots J, so that it may be rocked. It is of angular form, to adapt it as a rocking breaker for the body of the coal which it supports. In conjunction with this breaking-bar downwardly-inclined grates K K are arranged on each side thereof, being suitably pivoted in frames at a point nearly on a level with the lower portion of the outer water-leg, and so that the lower ends of their bars shall be on about a vertical line with the outer walls of the inner water-chamber, while from the lower ends of these grates I arrange side grates L L, which extend to and join the inner walls of the outer water-legs in horizontal positions, so that these grates not only bear a relation to the fuel-chamber, but to the flues M M, formed between the water-legs of the two chambers. By this relative arrangement of the water-legs and the grates it will be seen that the distance

from the lowest part of the inner water-chamber at N and the side grate is greater than that between the point N and the grate, which gives a comparatively thin body of coal upon the grate proper and at the points of draft, as the coal will stand inclined upon the grate-surfaces, while the supply may partly or wholly fill the chamber above the breaking-bar. This gives a large disproportion between the actual grate-surface and the area of openings through which the draft can pass directly into the flues surrounding the inner water-chamber.

The object of this is to obtain a slower circulation of the air through the burning fuel while the arrangement compels the more thorough mingling of the products of combustion, and lessens the escape without having aided in the production of heat. The draft is directed through the grates to the side flues, at which point the combustion is never deadened by supplying coal, as the latter feeds down from the supply in condition to give the best effect, the center breaking-bar, the inclined and side grates all performing their proper functions only in their relation with the water-legs and the side flues. The breaking-bar may be wholly of iron, or partly iron shielded with fire-brick, to protect it from being burnt out too readily.

At the back of the inner water-chamber a diving-flue, P, is formed by means of two vertical partitions, Q Q, (seen in Fig. 2,) the object of which is to cause the draft to rise over the inner water-chamber and then descend to the exit-flue. These partitions in the side flues form barriers to the direct escape of the heat, while the flue which they form makes a place for the sparks, from which they may be drawn by a suitable opening at the bottom.

The upper edges of the inclined grates rest upon and against the sides of the breaker-bar, and for that purpose the latter is recessed to allow the bar to be rocked without disturbing the connection therewith of the grates; but on the contrary the recessed bearing-sides of the rocker-bar are of such form as to serve as cams or lifters, which, as the bar is rocked, lift and shake the inclined grates upon their lower pivoted bars. The ridge rocker-bar, therefore, supports the body of the coal above the grates, prepares the coal, and feeds it upon the grates, and forms the shaker for the inner grates.

The bottom or side grate-bars L and the cross rock-bar I are connected by a shaker-bar, R, by joint connections, so that all the grates can be shaken together and with equal movement to discharge the ashes and feed the coal down to the grates.

My improvement effects a material saving of fuel, the smoke and gases being consumed by reason of the special matters which I have pointed out.

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

1. The combination, with an inner and outer water-chamber, the former constituting the fuel-receiver, of inner and outer independent grates adapted to operate in conjunction with the chamber water-legs, substantially as described.

2. The combination, with an inner and an outer water-chamber and inner and outer independent grates adapted to operate in conjunction with the water-legs, of the side flues M M formed between said water-chambers, substantially as described.

3. The inner grates K K, arranged in inclined positions with respect to the lower portions of the inner water-chamber and combined for use with bottom or side grates L, arranged in a horizontal position and located at or near the lower end of the outer water-legs, the side flues M, and the fuel-chamber, substantially as described.

4. The combination, with the fuel-chamber formed by the inner water-legs and the grates, arranged in an inclined position with respect to the lower portion of the inner water-chamber, of a central cross rock-bar, I, whereon the fuel is supported, prepared, and fed down between the grates and the inner water-legs, substantially as described.

5. The combination, with the side flues M M and the inclined and horizontal grates, of the rear diving-flue P, substantially as described.

6. The inner water-chamber, having the top and bottom horizontal end extensions F G H, combined with the outer water-chamber, the side flues M, and the diving-flue P, substantially as described.

7. The combination, with inclined pivoted grates, of a cross-bar, I, arranged to have a rocking motion between said inclined grates, and adapted to operate in conjunction with the inner and outer water-legs for the purpose of properly distributing the fuel to the horizontal grate and combustion-chamber, substantially as described.

In testimony that I claim the foregoing I have hereunto set my hand in the presence of the subscribing witnesses.

B. HERSHEY.

Witnesses:
JAMES L. NORRIS,
ALBERT H. NORRIS.