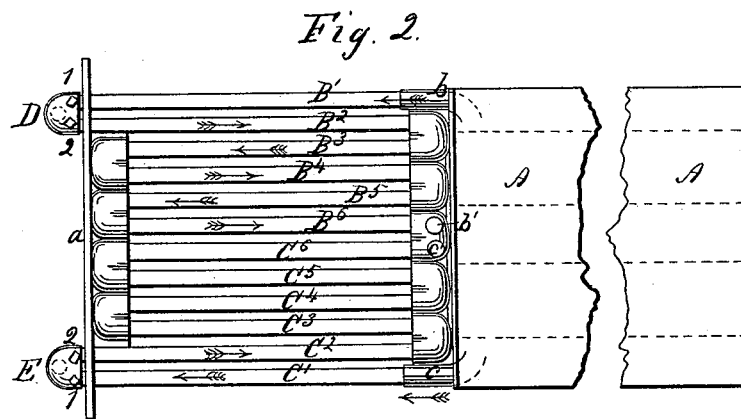
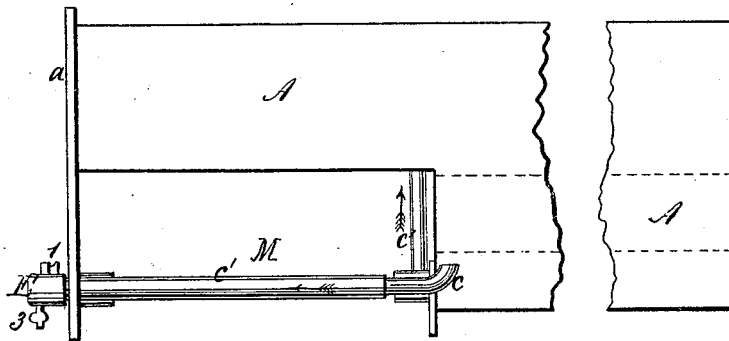


*E. Thayer,*  
*Furnace Grate.*  
*N<sup>o</sup> 47,052. Patented Mar. 28, 1865.*  
*Fig. 1*



*Witnesses;*  
*Thomas Stetson*  
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# UNITED STATES PATENT OFFICE.

ELI THAYER, OF WORCESTER, MASSACHUSETTS.

## IMPROVEMENT IN GRATE-BARS FOR BOILERS.

Specification forming part of Letters Patent No. 47,052, dated March 28, 1865.

*To all whom it may concern:*

Be it known that I, ELI THAYER, of the city and county of Worcester, and the State of Massachusetts, have invented certain new and useful Improvements in Water-Grates for Steam-Boilers; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a side elevation and Fig. 2 a plan view.

Similar letters of reference indicate like parts in both figures.

The nature of my invention consists in connecting the tubular grate-bars in sections and providing them with cocks so arranged that the water may be caused to circulate through the several sections by the levity of the steam under ordinary conditions and blown with the full force of the steam through any given section at intervals in order to clean them in the manner which will be fully set forth below.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation by the aid of the drawings and of the letters of reference marked thereon.

A is the body of the boiler, constructed in a form which is much used in manufactories. The furnace M is recessed into the cylindrical part of the boiler. My invention is applicable to other forms of boiler. I prefer this for general stationary purposes.

B<sup>1</sup>, B<sup>2</sup>, B<sup>3</sup>, B<sup>4</sup>, B<sup>5</sup>, B<sup>6</sup>, C<sup>1</sup>, C<sup>2</sup>, C<sup>3</sup>, C<sup>4</sup>, C<sup>5</sup>, and C<sup>6</sup> are hollow bars or flattened tubes, arranged to serve as grate-bars for my furnace. They may be of any durable material, but I prefer wrought-iron. These bars are coupled together at their ends by return bends in the manner represented. The tube B<sup>1</sup> is connected with the lower portion of the boiler by the bent pipe b. A similar service is performed on the opposite side for the tube C<sup>1</sup> by the pipe c. The pipes B<sup>6</sup> and C<sup>6</sup> are connected with the boiler through pipes b' c'. These pipes extend upward through the furnace and project somewhat above the crown-sheet. One pipe, in lieu of the two pipes b' and c', may suffice.

The pipes B<sup>1</sup> and B<sup>2</sup> extend out through the front plate, a, of the furnace, and are connected by a return bend, D, of sufficient capacity to

accommodate three cocks, 1, 2, and 3, arranged as represented. The cock 3 is a blow-off cock, and puts the interior of the bend D in communication with the external air whenever it is turned in the proper position for the purpose. The cock 1 controls the communication between the return bend D and the pipe B<sup>1</sup>. The similar cock 2 controls the communication between the bend D and the pipe B<sup>2</sup>. The pipes C<sup>1</sup> and C<sup>2</sup> are correspondingly arranged and connected by the aid of the return bend E and its cocks 1, 2, and 3.

Under ordinary circumstances when the boiler is working, the blow-off cocks 3 3 are closed and the controlling-cocks 1 and 2 are wide open. In this condition the intense heat of the fire in the furnace M causes a rapid evolution of steam in the upright connections b' c', as also more or less in the interior of all the grate-bars B', &c. The expansion of the particles of water into steam induces an active circulation, the water mingled with steam rising through the pipes b' and c', and being discharged near the water-line where the steam becomes available for power, while the dense water in the lower portion of the boiler flows, in continuous streams through the pipes b and c into the bars B<sup>1</sup> and C<sup>1</sup>, from whence it circulates through the several connections and through the successive bars, making a continuous circulation flowing out from the boiler through the connections b and c and returning through the connections b' and c'. At short intervals I interrupt this process by opening one of the blow-off cocks and blow through that portion of the grate which is in connection. If I open the blow-off cock 3 in the bend D, the water tends to rush violently from the boiler, not only through the pipe b and bar B<sup>1</sup>, but also through the pipe b' and the bars B<sup>6</sup> B<sup>5</sup>, &c. Now, by closing the cock 1, I can concentrate the blow-off action entirely on the tubes between the bend D and the pipe b'. After this has continued a little time, I open the cock 1 and close the cock 2. This concentrates the action on the pipes b and B<sup>1</sup>. By closing the blow-off cock 3 and opening both the cocks 1 and 2, I restore the whole to its former or ordinary condition. A similar operation with the cocks in the bend E blows off and cleans the pipe C<sup>1</sup> and the pipes C<sup>5</sup>, &c.

It will be evident that instead of placing the

bend D on extensions of the outermost pipes, B' B<sup>2</sup>, it might be placed on similar extensions of the pipes B<sup>3</sup> B<sup>4</sup>, and the same might be done with the bend E. This change would reduce the number of bars to be blown through when the cock 2 is open and would increase the number to be blown through when the cock 1 is open in the act of blowing off. I propose to increase and diminish the number of bars thus connected and blown through on either side of the blow-off cock at pleasure; but access to the fire-door is made more convenient by arranging the parts exactly as I have indicated in the drawings.

I do not deem it essential to employ any particular kind of cocks. Any cock, valve, or stop-gate which is adapted for steam pressure may be used successfully. Cheap, ordinary blow-off cocks will answer.

Any of the approved plans for disconnecting, so as to readily remove the whole or a portion of the grate, may be applied in connection with my invention. I have not deemed it necessary to indicate any such, as they form no portion of my invention.

In the circulation of the water through my grate no chance is afforded for any bar or bars to remain unaffected, because the same water which flows through the bar B' must flow also through the bars B<sup>2</sup>, B<sup>3</sup>, B<sup>4</sup>, B<sup>5</sup>, and B<sup>6</sup> in succession; and it will be observed that the water enters the grate where the furnace is coldest and leaves it where it is hottest, thus

creating and sustaining a constant circulation through the bars of the grate, by which means they are always kept at an even temperature. In the blowing off, the water which issues through the pipe B<sup>6</sup> must travel through the pipes B<sup>5</sup>, B<sup>4</sup>, B<sup>3</sup>, and B<sup>2</sup> in succession, so as to leave no part unaffected however numerous may be the bars which are connected in any given series.

My arrangement involves but little expense or complexity, and the parts to be operated are outside of the boiler and very conveniently accessible. By reason of my division of the bars into sections, each adapted to be thoroughly cleansed as often as may be required, I am able to overcome some of the serious difficulties which have attended the use of water-grates, and thereby successfully to promote the durability of the grates and the efficiency of the steam-generating power of boilers.

Having now fully described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

The hollow grate-bars connected with the boiler through the pipes *b b'* and *c c'*, and adapted to be cleansed by the aid of the cocks 1 2 3, arranged in the manner substantially as herein described.

ELI THAYER.

Witnesses:

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D. W. STETSON.