

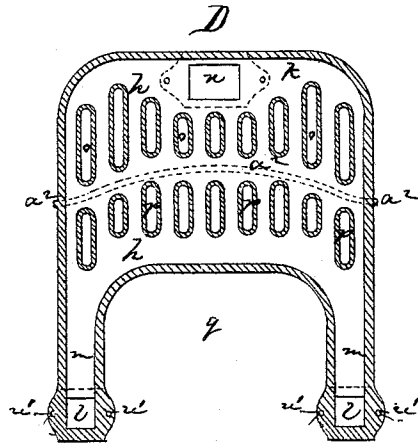
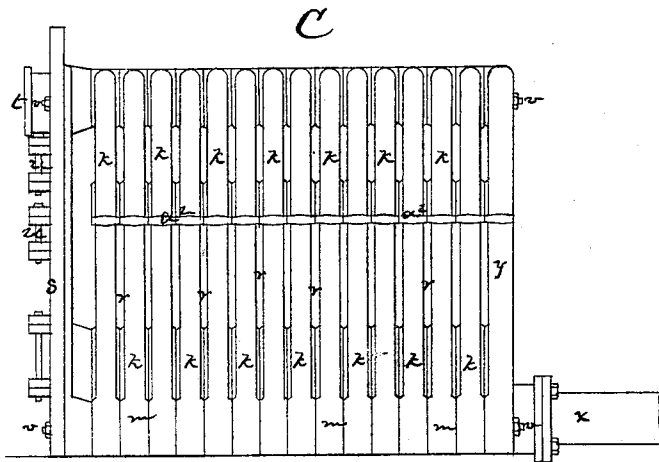


SETH WILLIAMS.

Improvement in Heating Apparatus for Hot-Water or Steam.

No. 127,817.

Patented June 11, 1872.



WITNESSES.

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# UNITED STATES PATENT OFFICE.

SETH WILLIAMS, OF CAMBRIDGE, MASSACHUSETTS.

## IMPROVEMENT IN HEATING APPARATUS FOR HOT WATER OR STEAM.

Specification forming part of Letters Patent No. 127,817, dated June 11, 1872.

*To all whom it may concern:*

Be it known that I, SETH WILLIAMS, of Cambridge, in the county of Middlesex and State of Massachusetts, have invented an Improved Heating Apparatus; and I do hereby declare that the following, taken in connection with the drawing which accompanies and forms part of this specification, is a description of my invention sufficient to enable those skilled in the art to practice it.

My invention relates particularly to the construction of a heating apparatus designed to heat water for distribution through pipes, although the construction is to a greater or less extent adapted for a steam-heater.

In my construction I employ an assemblage of hollow plates, preferably arranged so that each makes a vertical member of a horizontal series, each plate having a main central water-passage through its upper part and a similar passage at the bottom of each of two hollow side legs, each plate being thickened at these three through-passages, so that the projecting faces of these parts form the abutting joints of the adjacent plates, leaving narrow vertical fire-spaces between them, the connected passages of the adjacent plates forming continuous water-passages, by which the water is circulated through all of the plates, from end to end of the series, the assembled plates being bolted together and to the end plates by bolts running through the bolt-holes at the sides of the long water passages. The front plate of the series may be also the furnace-door plate, said plate being made hollow or with a thin water-chamber, and the rear plate is similarly hollow and forms the rear wall of the fire-pot, and, with these exceptions, each vertical and chambered plate is made with an arch or open space at its lower part, so that the lower parts of the series constitute a long chamber and form, with the front and rear plates, the fire-pot and flame or combustion chamber, opening freely at its top into the spaces between the plates, (interrupted, however, or its height determined and limited, by a horizontal partition, made by ribs formed on the opposite faces of each plate, the edges of the ribs abutting and forming the partition,) and also opening into and through the spaces between the vertical legs of the hot-water or hollow plates at the sides of the chamber. Each plate is also

made with a series of flame or smoke flues extending through it.

The assemblage of connected plates having this general construction and connection is placed in a suitable brick-work frame or chamber, the sides of the plates and the tops coming quite near to the side walls and roof of the brick-work, leaving narrow spaces, with which the fire-chamber communicates freely through the spaces between the plates, the upper part being divided from the lower part by extensions of the ribs before spoken of, said upper part of the spaces between the upper parts of the hollow plates constituting one chamber, and the lower part—the spaces between the lower parts of the hot-water plates and the fire-pot space—constituting another chamber. Beneath the assemblage of pipes is a suitable grate, forming the top of the ash-pit, and air for support of combustion is preferably received at the rear part of the ash-pit through suitable inlet-pipes extending through the brick-work, said pipes being regulated by proper registers, the air passing up into the fire-pot and flame-chamber, and the flames and volatile products of combustion passing up between and all around the water-legs to the roof formed by the ribs, and up and forward through the flame-chamber and through the spaces at the outer sides of the water-legs, coursing through a vertical flame-space between the furnace-door plate and the next plate of the series of hollow plates into the upper chamber, through which chamber and through the spaces between the upper parts of the plates and through the series of openings made through the plates they pass rearward, and escape into and through flues located at the rear end of the brick-work, passing into a direct flue leading from the top of the brick-work chamber if a direct draught is wanted, as in kindling or quickening the fire, or into and through a flue at the bottom of said chamber if the fire be established, the upper flue in the latter case being closed. The cold-water or inlet pipe preferably leads into the bottom of the hot-water chamber of the rear plate, and the hot-water or outlet pipe preferably from the upper part of the hollow door-plate at the front of the furnace, and by the connection of all the chambers together, both at top and at bottom, and the formation of each with the flame-passages through it,

(which passages form horizontal flame-flues,) and all with the thin flame-spaces between them, (forming vertical flame-flues,) the water is distributed throughout the thin chambers, and thereby constitutes a vast continuous thin water-sheet, coursing through the chambers, and presented at every point to the heated metal surfaces, so that it is rapidly and increasingly heated as it passes through the chambers and from the inlet to the outlet pipe, and with a minimum expenditure of fuel. The invention primarily consists in the construction, general arrangement, and connection of the hollow or chambered hot-water plates.

The drawing represents an apparatus embodying my invention.

A shows a side view of the furnace. B is a sectional plan of the furnace, showing a top view of the hot-water plates. C is a side view of the assemblage of plates. D shows a section of one of the chambered plates.

*a* denotes the brick-work, built to form or contain a rectangular chamber, *b*, in the lower part of which is located the ash-pit, which may have a sifting-chamber and a bottom chamber, over which is the grate, preferably formed with removable side bars and a center tipping-grate. Upon a grate-frame or flat plates at the sides and end of the grate is placed the sectional boiler or assemblage of vertical hollow hot-water plates *k*. Each plate or section *k* is formed with a thin connected water-space, *h*, extending entirely through it, as seen at D, the openings into said space being through two inlet-passages, *l l*, at the bottom of two legs, *m m*, and the outlet being through a passage, *n*, at the top of each section. Each plate or section is made with a series of flame or smoke passages, *o p*, extending through it, and with an open fire-pot and main combustion-chamber, *q*, between the legs *m m*; and at each water-passage *l n* the plate is cast thicker and with planed or straight faces, so that when the plates are assembled and united the said faces make the joints, leaving a vertical flame-space, *r*, between each two plates, the lower parts of which spaces open from the fire-pot space or combustion-chamber *q*. At the front end of the furnace is the door-plate *s*, said plate being shown as made with the fire-pot door *t*, and with flue-cleaning doors *u*, and being otherwise preferably cast hollow, or with a vertical water-chamber opposite to the end section *k*, the hot-water or outlet pipe *t* being shown as passing through the door-plate in line with the passages *n*. At the sides of each passage *l n* each plate *k* is made with a bolt-hole, *w'*, and through each line of said holes a screw bolt or rod, *v*, passes, the plates *k* and the door-plate *s* and rear plate *w* being connected and drawn tightly and firmly together by said bolts and their nuts, so that the connected plates form an assemblage, constituting, in effect, one water-chamber, divided into a series of thin vertical compartments, the water preferably entering, through an inlet-pipe, *x*, into the lower part of the rear plate *y*, said plate being made hollow

(or with a water-chamber) and covering all the vertical space at the rear end of the plates *k*, and forming the rear wall of the fire-pot and combustion-chamber. By the construction, arrangement, and union of the sections the vertical spaces *r* are left between the adjacent plates, such spaces constituting flame and smoke flues for the free passage of the products of combustion. Each of these spaces is divided into upper and lower vertical spaces by abutting ribs *a<sup>2</sup>* extending from opposite sides of each plate, these ribs forming a partition between the two spaces, and the volatile products of combustion pass freely, not only through these spaces between the plates, both vertically and laterally, but also through the openings in each plate, the corresponding openings in the series of plates constituting long flame or smoke flues, running from end to end of the assembled plates. There may be a narrow flue-space, *b<sup>2</sup>*, between each side of the plate and the adjacent furnace-wall, and between the top of the plate and the roof. At the rear part of the furnace, and at either one or each side thereof, is an air or draught opening, *c<sup>2</sup>*, regulated by a suitable register, *d<sup>2</sup>*, said opening extending into the ash-pit just beneath the grate. Air for the support of combustion passes into the furnace at such opening or openings, and through the fire-pot and its fuel from the rear to the front, the flames and other products of combustion passing through the fire-pot and through the spaces *r* between the plates, and through the flame-flues *p* and up to the partition *a<sup>2</sup>*, and always toward the front end of the furnace, until they strike the front plate *s*, where they pass upward through the vertical space *e<sup>2</sup>* to the upper part of the chamber; here they take the reverse direction, passing rearward through the flame-flues *o*, through the spaces *r* between the plates, and above the partition, finally escaping (if the direct chimney-draught is open, as in kindling or quickening the fire) through a flue into the chimney. If the damper *f<sup>2</sup>* be closed, then the products of combustion, after passing to the rear of the furnace, pass down by the rear plate *y* into a horizontal flue, escaping therefrom through openings into another horizontal flue, and thence into the chimney *g<sup>2</sup>*. By this tortuous and subdivided course, and by the construction of the plates with their very thin water-spaces, and the arrangement of the frame-spaces both between and through them, the water in the plates is rapidly heated and courses rapidly through the plates, passing into the pipe *x* through the passages *l l*, and up, through each and every plate *k*, to the top passage *n*; and thence, through the passage *n*, out through the pipe *v*; and thence, through the heat-distributing pipes, back to the inlet-pipe *x*, (if distributing-pipes are to be used in connection with the apparatus,) or directly back to the inlet-pipe if air is to be heated by direct contact with the plates, and such heated air disseminated by suitable hot-air distributing-pipes. Through the front plate of

the furnace I make two openings, closed by suitable doors *u u*, the upper one of said openings being opposite the line of flame-flues *o*, and the lower one opposite the line of flame-flues *p*, and by opening said doors the two lines of flues may be reached with a suitable brush on a long handle, to clean from the plates around said flues all sooty deposits. Through the side walls of the brick-work similar openings *l<sup>2</sup> m<sup>2</sup>*, closed by suitable doors, may be made for access to the flame-spaces between the plates for the same purposes, one opening, *l<sup>2</sup>*, being placed for access to the lower spaces at the front part, and the other opening opposite thereto, on the other side of the brick-work, being placed higher up for access to the

upper front spaces, and the two doors *m<sup>2</sup>* being similarly arranged, one giving access to the rear spaces *r* below the partition, and the other to the rear spaces above the partition.

I claim—

The series of vertical hollow or chambered plates *k*, each made with the legs *m m*, fire-pot space *q*, flame-flues *o p*, connecting water-passages *l n*, and partition-ribs *a<sup>2</sup>*, and with the projecting joint-faces, and having vertical spaces *r* between them, substantially as shown and described.

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Witnesses:

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