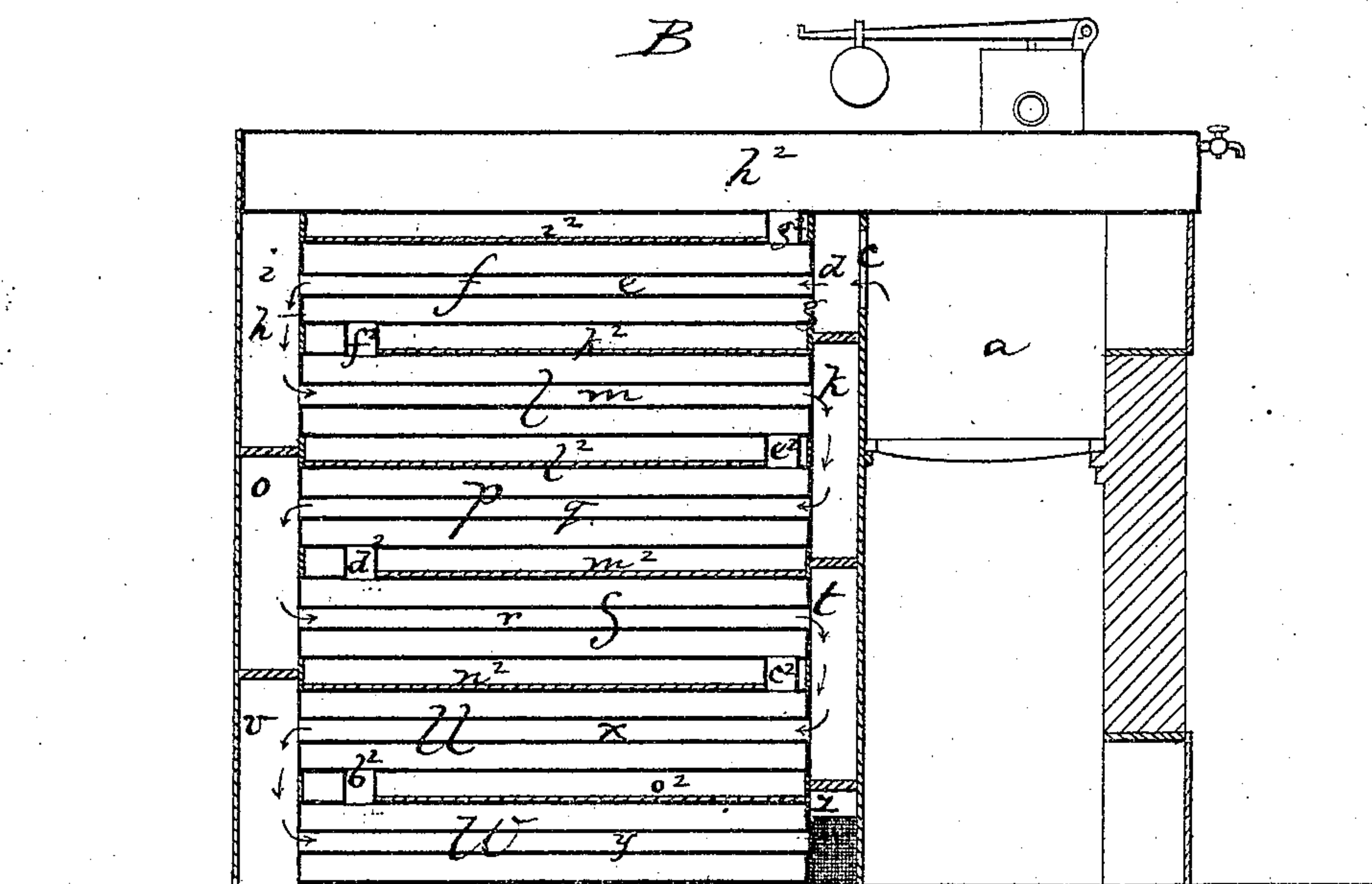
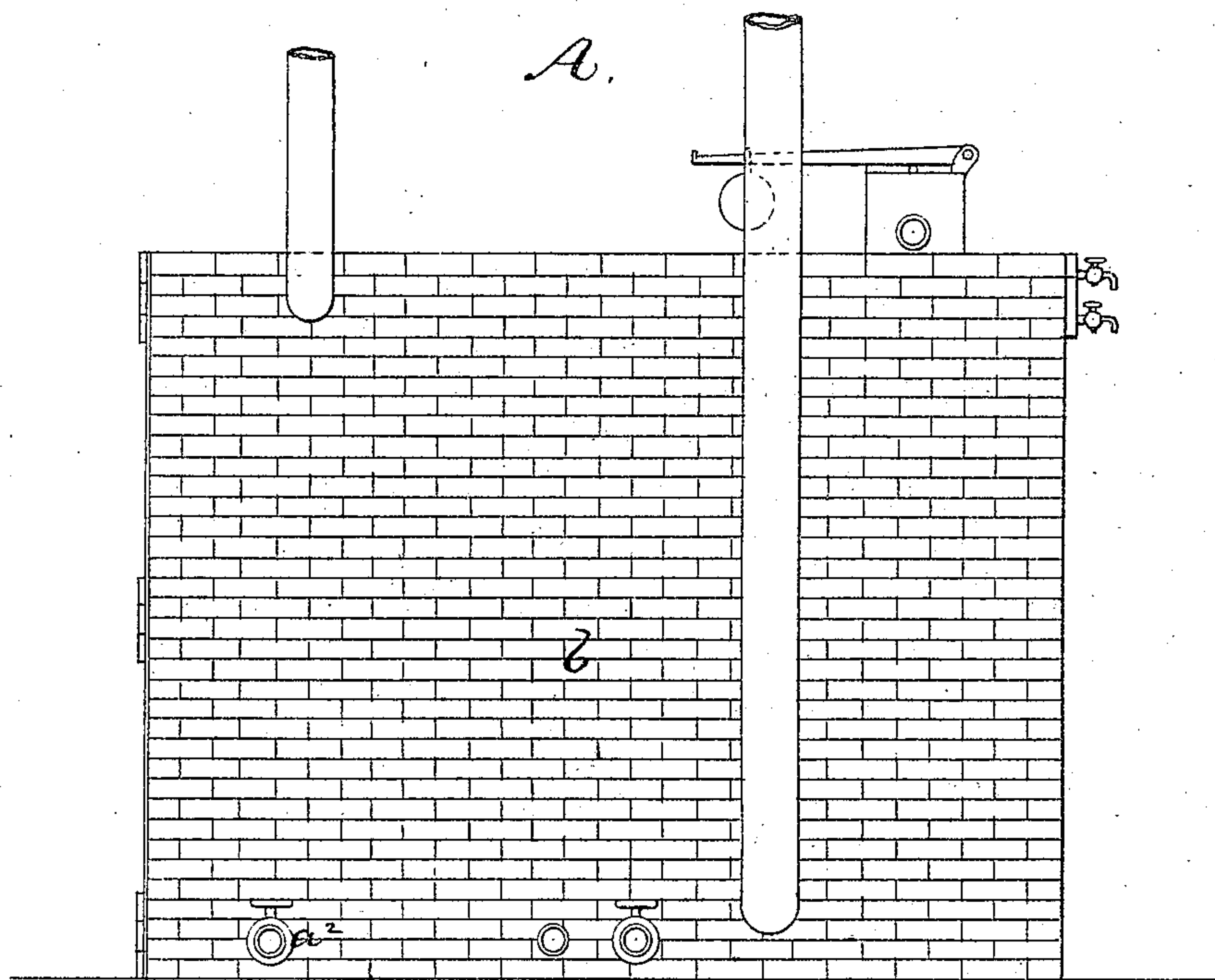


G. F. BURKHARDT.

Improvement in Steam Heaters.

No. 119,816.

Patented Oct. 10, 1871.



Witnesses { Mo. W. Frothingham.  
G. B. Kidder.

G. F. Burkhardt.  
By his Atty.

Crosby & Gould.



# UNITED STATES PATENT OFFICE.

GOTTLIEB F. BURKHARDT, OF BOSTON HIGHLANDS, MASSACHUSETTS.

## IMPROVEMENT IN STEAM-HEATERS.

Specification forming part of Letters Patent No. 119,816, dated October 10, 1871.

*To all whom it may concern:*

Be it known that I, GOTTLIEB F. BURKHARDT, of Boston Highlands, in the 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 to the arrangement of parts of an apparatus designed to heat water and air for heating buildings or apartments, a furnace being combined directly with the apparatus, or the apparatus being an attachment to an ordinary furnace or other heat-generator. My invention consists in the relative arrangement of a series of water and air-compartments and a series of flue-passages, such compartments and passages extending horizontally through the apparatus and making a vertical tier of passages, the smoke, flames, and other volatile products of combustion entering the front end of the upper flue-pipes, passing through the upper boiler-sections; thence down a vertical rear flue into the rear end of the flue-pipes extending through the second boiler-section; thence down a vertical front flue-space into the front end of the flue-pipes of the third boiler-section; and so on through the whole series of flue-pipes into the bottom one, from whence they escape through a front flue-space into the chimney; the boiler or hot-water sections also communicating—the upper section by a vertical pipe leading into the front part of the second section; this by a pipe leading from its rear part into the rear part of the third section; and so on through the series, the water being supplied to the bottom section of the series, and being conducted from the top section to suitable radiators, and the circulation being effected by suitable return-pipes; there being, also, between each two adjacent hot-water or boiler-sections a horizontal air-space divided by a horizontal partition into two compartments, connecting alternately at the front and rear, so that fresh air received into the front end of the lower chamber passes to the rear thereof under the lower partition, and over and in contact with the top of the lower boiler-section; thence around the end of the partition into the air-space over the partition, through which it passes in contact with the whole surface of the next section, and

under the second partition to the rear of the compartment; thence around the rear end of the second partition into the next compartment above, occupied in part by the next boiler-section; and so on through the series of hot-air compartments, becoming gradually or more and more heated by contact with the outer surfaces of the successive sections of the boiler, and finally passing through suitable hot-air-distributing pipes extending from the top of the apparatus.

The drawing represents an apparatus embodying the invention.

A shows a side elevation of the same, and B a sectional elevation thereof. *a* denotes a furnace or fire-pot, located in the upper part and at the front end of a casing of masonry, *b*. From the upper part of the fire-pot leads a flue-opening, *c*, entering a flue-chamber, *d*, from which chamber leads a series of horizontal flue-pipes, *e*, which extend through a correspondingly long water-chamber or boiler, *f*, located in the upper part of the apparatus, the flue-pipes extending from tube-sheet *g* to tube-sheet *h*, as in an ordinary horizontal boiler. At their rear ends the flue-pipes *e* debouch into a vertical flue-chamber, *i*, between which and another vertical flue-chamber, *k*, in the front part of the apparatus, is placed a second horizontal water-chamber or boiler, *l*, flue-pipes *m* passing through such chamber from tube-sheet to tube-sheet thereof, said pipes opening from the flue-space *i* and into the vertical flue-space *k* at the front end of the boiler-section *l*. Between the bottom part of the flue-chamber *k* and another flue-chamber, *o*, at the rear end of the apparatus extends a third water-chamber or boiler-section, *p*, through which flue-pipes *q* extend into the flue-chamber *o*; flue-pipes *r* extending through another and similar water-chamber, *s*, into another and similar vertical flue-space, *t*, at the front of the apparatus, from the bottom of which extends another water-chamber, *u*, to a rear flue-chamber, *v*, from which extends to the front of the apparatus the bottom water-chamber *w*, flue-pipes *x* extending through water-chamber *u* into flue-chamber *v* and flue-pipes *y* from said chamber *v* through water-chamber *w* into the bottom front flue-chamber *z*, from which the flames or smoke and other volatile products of combustion escape into the chimney. Water from a supply-pipe, *a*<sup>2</sup>, enters the water chamber *w*, and as it is heated passes



up through a short tube,  $b^2$ , at the rear of said chamber into the rear of the next chamber,  $u$ , through which it flows, passing from the front part of said chamber through connecting-tube  $c^2$  into chamber  $s$ , through chamber  $s$ , and through connecting-tube  $d^2$  into chamber  $p$ ; through chamber  $p$  and connecting-tube  $e^2$  up into chamber  $l$ ; through chamber  $l$  and connecting-tube  $f^2$  up into chamber  $f$ ; through chamber  $f$  and tube  $g^2$  into top chamber  $h^2$ ; from which it is disseminated to suitable radiators, descending from which, as it becomes cool, it again enters supply-pipe  $a^2$  to be again reheated, as before. The water is gradually heated, and as it ascends passes into contact with flues more and more directly heated, or nearer and nearer to the furnace or source of heat. Steam may be generated in the upper chamber, and it, instead of hot water, conveyed through the heat-disseminating pipes and the upper water-chamber or boiler  $h^2$  may extend directly over the fire-pot, and may be provided with a safety-valve, gauge-cocks, &c. Between each two adjacent water-chambers  $h^2 f$ ,  $f l$ ,  $l p$ ,  $p s$ ,  $s u$ , and  $u v$ , is an air-space divided by a horizontal partition, the respective partitions being denoted by the letters  $i^2$ ,  $k^2$ ,  $l^2$ ,  $m^2$ ,  $n^2$ , and  $o^2$ ; and at one end of each partition a space is left to connect the space below the partition with that above it, such connecting spaces being alternately at opposite ends of the respective partitions.

Into the lower space which surrounds the bottom water-chamber a cold-air pipe or box opens, and the cold air passes through said space around the rear end of the partition  $o^2$  up into the space over said partition and under and around the water-chamber  $u$ , passing through which space it passes up around the front of the next partition  $n^2$ , and so on until it reaches the upper hot-air chamber in the upper part of the apparatus, under and at the sides of the upper water-chamber or boiler-section  $h^2$ , having in its contact with the succession of increasingly-heated water-chambers or boiler-sections become more and more heated and ready for conveyance, by suitable distributing-pipes, to any apartments to be warmed. Of course the series of air and water-chambers or spaces and flues may be greater or less in number than that shown, the relative arrangement being substantially the same.

I claim—

The series of horizontal water-chambers, horizontal flue-pipes, vertical flue-spaces, and horizontal air-chambers, having the relative arrangement and respective connections, substantially as shown and described.

GOTTLIEB F. BURKHARDT.

Witnesses:

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