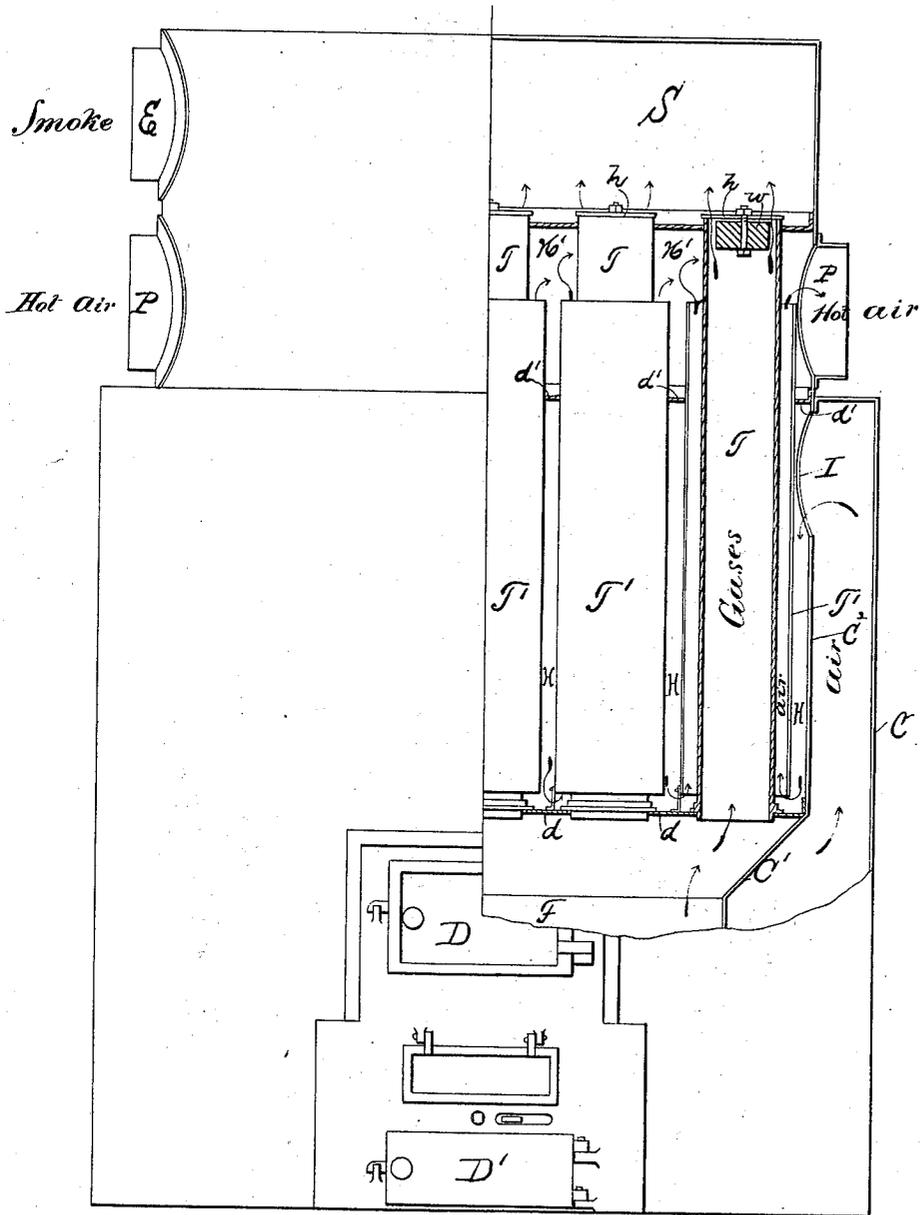


(No Model.)

E. F. EDGAR.
HOT AIR FURNACE.

No. 566,450.

Patented Aug. 25, 1896.



WITNESSES:

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ELLIS F. EDGAR, OF WOODBRIDGE, NEW JERSEY.

HOT-AIR FURNACE.

SPECIFICATION forming part of Letters Patent No. 566,450, dated August 25, 1896.

Application filed February 5, 1896. Serial No. 578,084. (No model.)

To all whom it may concern:

Be it known that I, ELLIS F. EDGAR, a citizen of the United States of America, and a resident of Woodbridge, in the county of Middlesex and State of New Jersey, have invented certain new and useful Improvements in Hot-Air Furnaces, of which the following is a specification, reference being had to the accompanying drawing, forming part of the same, in which the single figure is a front elevation of a furnace embodying my invention with a part of the casing cut away and certain parts shown in section to more clearly exhibit its peculiar features.

My invention relates to hot-air furnaces, which are usually placed in a cellar or other part of a building the immediate atmosphere of which part it is generally not desired to heat, the purpose being to heat air which may through pipes or other conduits be conducted to other portions of the building and there utilized, and there are at least four desirable points for attainment: that the heat shall be utilized to heat air before the gases produced by combustion pass out of the heater to the chimney; that the heat shall not be unduly wasted by radiation into the apartment occupied by the heater; that fresh air may be introduced to be heated and thereafter conducted to the register or other device for utilizing it, and that the introduction of said fresh air may be so devised that it shall not, at its temperature of introduction, be permitted to sweep through the furnace and thence to the register before it has been raised to a proper degree. The first, second, and fourth points have been difficult of attainment, and furnaces heretofore constructed have been especially faulty in these particulars, but in the present invention they are well secured.

C is the main casing of the furnace, with fire and ash doors D and D', and the usual appliances for regulating and operating it, a cold-air-entrance port (not shown) being, as usual, arranged to open through the base into the space between casing C and the casing C' of the fire-space. Within the space inclosed by the casing C (which in some instances might be omitted, but with less satisfactory results) I provide a hot-air chamber H by interposing a diaphragm *d* over the fire-space F of the furnace, another, *d'*, a distance above

the first and connecting the two by a casing C², (shown as a continuation of casing C'), reaching from one diaphragm to the other, and at the upper part of casing C², I arrange air-inlets I, opening through it into chamber H. Above chamber H, I arrange a second hot-air chamber H', with one or more ports P for conducting the heated air to the register-conduits, and above chamber H', I construct a smoke-box S, with an exit E, leading to the chimney or other draft-exit.

Secured to the diaphragm *d* of the fire-space, passing through diaphragm *d'* and chamber H' and opening into smoke-box S, I arrange one or more (preferably a series of) fire-tubes T, more or less open at the ends, and about each, but within casing C², I place what I term "circulator-tubes" T', sufficiently raised from diaphragm *d* (or perforated at the bottom) to permit the entrance there of air, and likewise arranged to discharge it into chamber H', usually by being passed through diaphragm *d'* into chamber H' and left open at the top, as shown, the joints between tubes T and diaphragm *d* and the casing of smoke-box S and tubes T' and diaphragm *d'* being substantially tight.

In order to prevent the heat and uncondensed gases of the fire from escaping to the smoke-box and chimney too rapidly and before sufficiently surrendering their heat-units to the air desired to be heated, I contract the draft-space of the fire-tubes T, preferably by suspending in them near their upper ends fire-proof (usually fire-clay) plugs or walls *w*, (secured to hangers *h*, resting on the upper ends of the tubes,) so closing said tubes that the united cross-areas of the spaces between said plugs and the tubes T shall approximate the cross-area of the draft-exit, though I do not limit myself to this particular means of contracting said draft-spaces.

Cold air entering within casing C at the bottom passes upward, meanwhile in contact with the exterior face of casing C' and C², and having its temperature raised by radiation therefrom, (and forming an air-cushion to prevent the escape of said heat by radiation till it reaches and enters the inlets I, the heat tending to cause a current in that direction.

If casing C were omitted, its course would

be to passages I, but the air-cushion effect would be to some extent lacking. Entering chamber H through passages I, this air seeks an outlet, for it increases in volume because
 5 of heat from tubes T' and diaphragm d, in fact from all the surrounding metal; but there is no outlet from H except through tubes T', that is, the space between tubes T' and T. The air, therefore, necessarily seeks the open-
 10 ings into tubes T' (at the bottom) and passes up within them in contact with the fire-tubes T and out into the hot-air chamber H', from which it may be conducted through ports P to the points desired. Fresh currents of air
 15 are thereby continually brought into close contact with fire-tubes T, so abstracting their heat as to prolong their lives, and the contraction of the draft-spaces of said tubes, substantially at the end of the body to be heated,
 20 insures the delivery of the heat-units of the consuming fuel within the area where they can be best utilized, while at the same time I have three air-cushions, (between tubes T and T', between tubes T' and casing C², and
 25 between casing C² and casing C,) which effectually prevent undue radiation of heat into the apartment containing the furnace, but utilize substantially all of it in performing the work the furnace is intended to do.
 30 At the same time no current of fresh cold air admitted into the space within casing C can rapidly sweep through to the registers without being materially tempered, for it must first pass up to inlets I, then down to the bot-
 35 tom openings in tubes T', and then up between said tubes and the fire-tubes before it can reach the chamber from which delivery is made, during all of which course it is in close contact with heating-surfaces and for a
 40 great part of which it is divided into comparatively thin sheets, whereby its ready heating is greatly assisted. My arrangement also readily permits easy cleaning of the furnace.

It has been suggested by some furnacemen
 45 who have examined the invention that possibly the air would not pass freely down from inlets I to the bottom of tubes T'; but a moment's consideration will disprove this, for the air within tubes T' and in contact with
 50 tubes T (the hottest portions of the furnace which are in contact with the air to be heated) will naturally have the highest temperature, and under well-known laws will rise, especially as there is an outlet at the top of said
 55 tubes. Its place must be taken by other (and cooler) air, which can only come, and must come, in through inlets I and down outside of tubes T', there being a siphon action to assist this movement in addition to the action
 60 of the natural law under which hot air rises and is replaced by cooler and more dense air which descends to take its place.

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

65 1. The combination in a hot-air furnace, of a fire-space and a smoke-exit, one or more fire-tubes connecting the two, one or more

circulator-tubes, open at or near the top and bottom respectively, surrounding the fire tube or tubes, and two hot-air spaces, each
 70 inclosing some portion of said tubes, one provided with one or more air-inlets and communicating with one end of the circulator-tube and the other provided with one or more
 75 outlets and communicating with the opposite end of the circulator-tube, all substantially as set forth.

2. The combination in a hot-air furnace, of a fire-space and a smoke-exit, one or more fire-tubes connecting the two, one or more
 80 circulator-tubes, open at or near the top and bottom respectively, surrounding the fire tube or tubes, two hot-air spaces, each inclosing some portion of said tubes, one provided
 85 with one or more air-inlets and communicating with one end of the circulator-tube and the other provided with one or more outlets and communicating with the opposite end of the circulator-tube and a casing inclosing the
 90 first hot-air space and its inlets and provided with a cold-air port, all substantially as set forth.

3. The combination in a hot-air furnace, of a fire-space and a smoke-exit, one or more fire-tubes connecting the two, one or more
 95 circulator-tubes, open at or near the top and bottom respectively, surrounding the fire tube or tubes, two hot-air spaces, each inclosing some portion of said tubes, one provided
 100 with one or more air-inlets near the top and communicating with one end of the circulator-tube and the other provided with one or more outlets and communicating with the
 105 opposite end of the circulator-tube and a casing inclosing the first hot-air space and its inlets and provided with a cold-air port at or near the bottom all substantially as set forth.

4. The combination in a hot-air furnace, of a fire-space and a smoke-exit, one or more fire-tubes (with contracted draft-spaces,) connect-
 110 ing the two, one or more circulator-tubes, open at or near the top and bottom respectively, surrounding the fire tube or tubes, and two hot-air spaces, each inclosing some portion
 115 of said tubes, one provided with one or more air-inlets and communicating with one end of the circulator-tube and the other provided with one or more outlets and communicating with the opposite end of the circulator-tube all substantially as set forth. 120

5. The combination in a hot-air furnace, of a fire-space and a smoke-exit, one or more fire-tubes, (with draft-spaces contracted by fireproof plugs placed near their upper ends,) connect-
 125 ing the two, one or more circulator-tubes, open at or near the top and bottom respectively, surrounding the fire tube or tubes, and two hot-air spaces, each inclosing some portion of said tubes, one provided with one
 130 or more air-inlets and communicating with one end of the circulator-tube and the other provided with one or more outlets and communicating with the opposite end of the circulator-tube all substantially as set forth.

6. The combination in a hot-air furnace, of
 a fire-space and a smoke-exit, one or more
 fire-tubes connecting the two, one or more
 circulator-tubes, open at or near the top and
 5 bottom respectively, surrounding the fire
 tube or tubes, a smoke-box and two hot-air
 spaces arranged respectively one above the
 other as set forth, each hot-air space inclos-
 ing some portion of said tubes, one provided
 10 with one or more air-inlets and communicat-
 ing with one end of the circulator-tube and
 the other provided with one or more outlets
 and communicating with the opposite end of
 the circulator-tube all substantially as set
 15 forth.

7. The combination in a hot-air furnace, of
 a fire-space and a smoke-exit, one or more
 fire-tubes connecting the two, one or more
 circulator-tubes, open at or near the top and
 20 bottom respectively, surrounding the fire

tube or tubes, a smoke-box and two hot-air
 chambers arranged respectively one above the
 other as set forth, each hot-air chamber in-
 closing some portion of said tubes, one pro-
 vided with one or more air-inlets and com- 25
 municating with one end of the circulator-
 tube and the other provided with one or more
 outlets and communicating with the opposite
 end of the circulator-tube, and a casing in-
 closing the first hot-air chamber and its in- 30
 lets and provided with a cold-air port, all sub-
 stantially as set forth.

In testimony that I claim the foregoing as
 my invention I have signed my name, in pres-
 35 ence of two witnesses, this 1st day of Febru-
 ary, 1896.

E. F. EDGAR.

Witnesses:

PETER B. VERMILYA,
 A. G. N. VERMILYA.