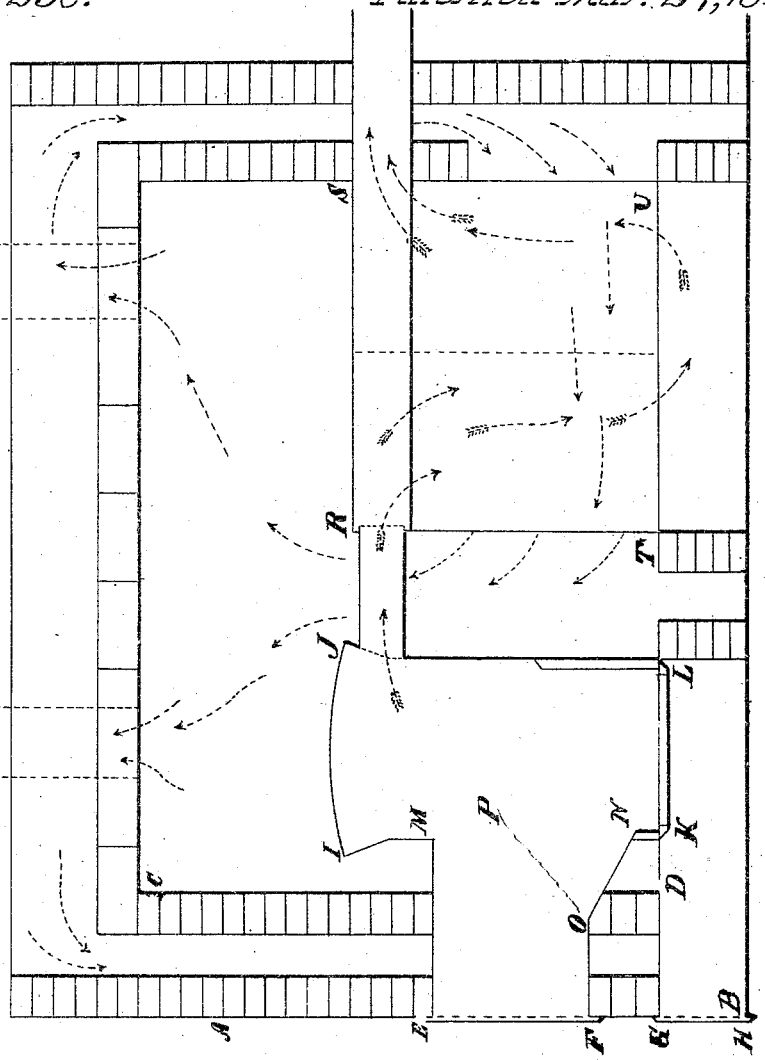
Sheet 1-3 Sheets.

H. Bushnell.

Hot-Air Furnace.

No. 6,238. Patented Mar. 27, 1849.

Fig. 1. Sectional View



Sheet 2-3 Sheets.

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No. 6,238. Patented Mar. 27, 1849.

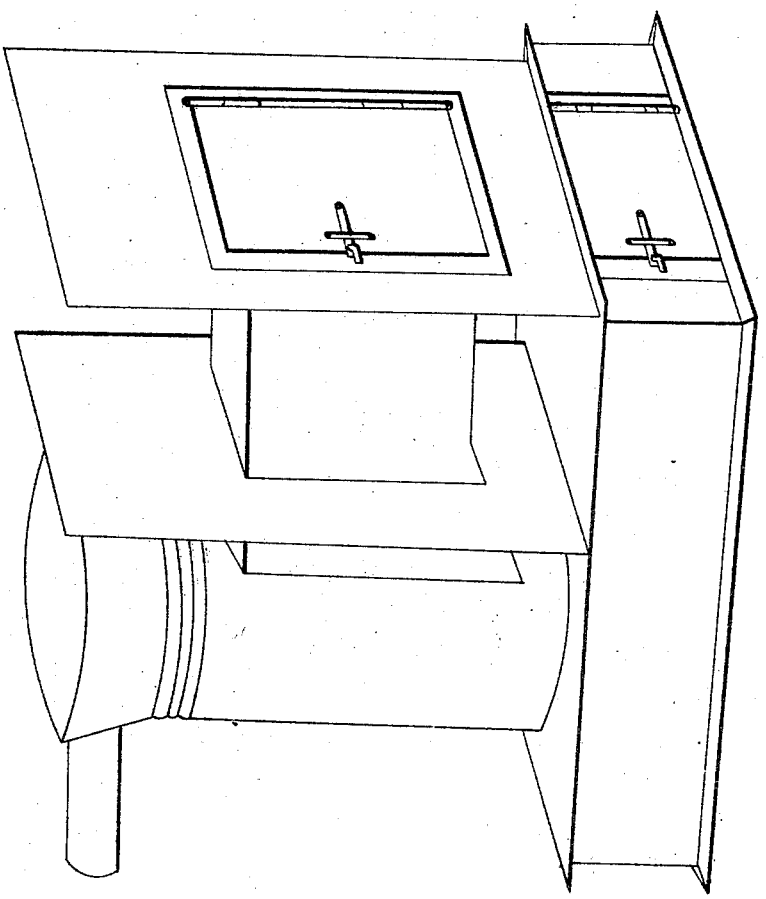


Fig. 2.

H. Bushnell.

Sheet 3-3 Sheets.

Hot-Air Furnace

No. 6,238. Patented Mar. 27, 1849.

Fig. 3.

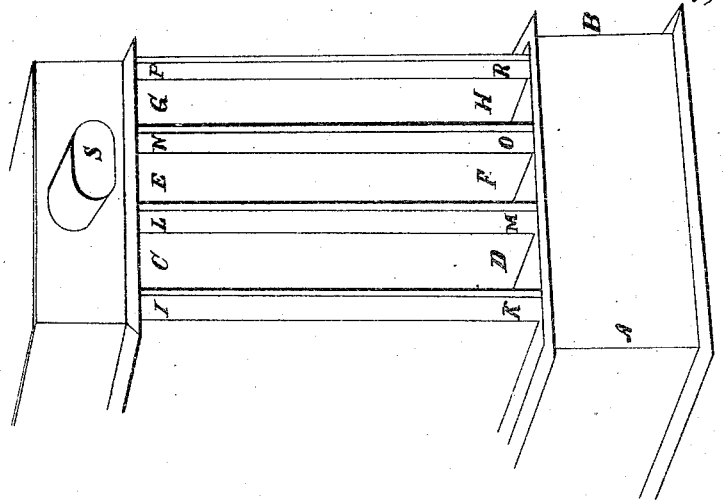
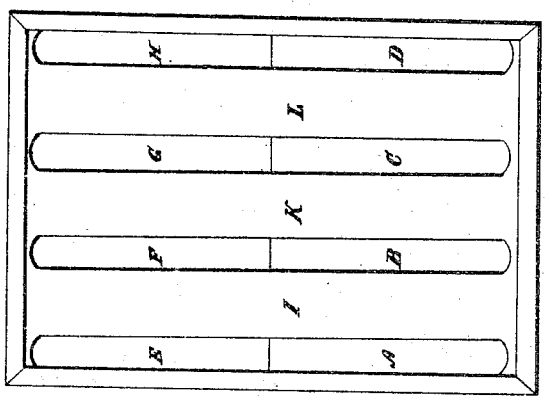


Fig. 4.



UNITED STATES PATENT OFFICE.

HORACE BUSHNELL, OF HARTFORD, CONNECTICUT.

AIR-HEATING FURNACE.

Specification of Letters Patent No. 6,238, dated March 27, 1849.

To all whom it may concern:

Be it known that I, HORACE BUSHNELL, of Hartford, in the county of Hartford and State of Connecticut, have invented a new and Improved Apparatus for the Warming of Apartments, commonly called a "Furnace," of which the following is a full and exact description.

The apparatus consists of two parts; a burner or combustion pot for the easier management of the fire in the process of combustion; and a new apparatus for the extraction of the heat from the smoke and gases, or for the communication of the heat to the air preparatory to its being passed into the apartments to be warmed; both of which will be described separately and by reference to the drawings herewith transmitted The two parts are both to be included, after the ordinary method, in a small brick vault or chamber and the air is to be passed, in a heated state, from that chamber, through pipes of tin, to the several apartments to be warmed. This chamber is ordinarily placed in the cellar and is built with two single walls of brick a few inches apart between which the cold air, introduced at the top from without, passes down to enter into the vault or chamber through the inner of the two walls at the bottom of the same.

No improvement is claimed in the brick chamber thus far described.

The burner is to be a circular cast iron pot set over an ash pit of brick in the ordinary manner. The feed door and mouth piece are to connect with the burner pot above the fire, not in the fire and near to the bottom of the burner as represented in drawings Nos. I and II. The drawing No. II represents the burner in perspective. The drawing No. I exhibits a perpendicular section of the same together with the radiator in connection, and the air chamber.

A, B, and C, D, are the outer and inner faces of the brick chamber.

E, F, is the feed door.

G, H, is the ashpit door.

I, J, K, L, is the circular part or body of the burner.

E, M, N, F, is the mouth piece or feed pipe entering into the burner within one or two inches of the grate K, L. The coals will then lie piled against the back of the burner falling out a little into the mouth piece in the line O, P. Then the fire may be stirred, not underneath but by running a stiff poker in at the feed door directly under the fire and along the top of the grate and breaking down across the point O as a fulcrum. This will throw up the coal and let the ashes drop through the grate.

The improvement claimed relates to the extraction of the heat from the smoke or gas after the combustion, or, what is the same, to the communication of the heat to the air which is to be thrown into the apartments. This is accomplished by means of an apparatus sometimes called a radiator, constructed in the manner represented by drawing No. I where a perpendicular section R, S, T, U, is given and also more especially by drawings Nos. III and IV. No. III is an end view of the radiator in perspective. A, B, is a pit of brick work on which the iron work of the radiator is placed. The openings C, D, E, F, and G, H, are introduction pipes of iron through which the cold air passes as it comes into the inner chamber of the furnace as shown by the black arrows, drawing No. I. Meantime the gas or smoke passing into the pipe S falls down the interstices I, K, L, M, N, O, P, Q, or through the openings A, B, C, D, represented in drawing No. IV which is a horizontal section of the radiator. Then the smoke falling into the brick pit underneath rises again in the openings E, F, G, H, (drawing No. IV) and passes off at the back end of the radiator through the wall of the chamber. The course of the draft is shown by the red arrows in drawing No. I.

Another view of the introduction pipes above named may be seen in the drawing No. IV where they are represented by the spaces I, K, L. These pipes may be two and a half feet long with an opening of two feet by three inches and their number may be greater or less according to the extent of the apartments to be warmed. The interstices between them only need to be wide enough to give passage to the gas or smoke generated by the burner. If they are one inch wide it will ordinarily suffice. The radiator thus constructed it will be seen is virtually a box I, P, R, K, Drawing No. III, filled with the hot gas or smoke through which the introduction pipes above described conduct the air, to be heated as it passes, by the hot smoke on the outside. First the cold air from out of doors is con-

ducted through the outer wall of the brick chamber at the top. Thence it falls down between the two walls where it is collected into a channel or trunk under the walls or inside of the chamber itself in which it is conducted along the floor of the chamber and around to the back end of the radiator where it is poured into the introduction pipes above described to be heated in passing through. The circulation of the gas or smoke may be varied at pleasure and where the number of introduction pipes is increased it may be well to pass the smoke up and down about the pipes twice giving thus a protracted circulation.

The advantages of this new apparatus are first that it will clear itself of ashes so as never to require attention or to be disturbed in any way, for the box I, P, R, K, inverted over the brick pit A, B, is in fact a settling box as well as a radiator and the ashes falling down between the introduction pipes will settle in the bottom of the pit which being a foot or more in depth it will never be filled before the iron work itself is worn out. Therefore the work may stand from year to year and it will always be ready for use. Secondly this radiator is believed to answer scientifically the problem how to circulate gas so as to communicate to the air the greatest amount of heat with the smallest amount of heating surface, that is with the least expense possible. For the arrangement is such as to keep the air that is coming to the iron surface to be heated always at the greatest possible difference of temperature from it so that the transmission of heat from one to the other is more rapid than it could be if the difference of temperature were smaller. And this it secures by virtue of two peculiarities—that the air is heated not in a free state as in other furnaces (that is not after it has been already mixed with the half heated air of the furnace chamber), but before it is free and while it is passing in, so that the iron surface has an opportunity to act upon the air at its lowest temperature—also that while the air is passing one way inside of the introduction pipes above described the smoke or gas is passing also the other way, on their outside and thus the mean difference of temperature between the two currents at any point where they are in contact is the greatest possible. As the air is heated in the process of flowing in it comes in contact with a surface continually hotter till it pours out directly against the body of the burner itself. On the other hand as the gas or smoke is cooled in flowing away toward the chimney it comes in contact with air at a still lower temperature so that it may still yield up more of the little heat it has left till it makes its exit.

What I claim therefore as my invention is—

The arrangement of the air heating flues or spaces, in combination with the descending and ascending draft as herein above described, so that the air to be heated shall enter and come into contact first with the coolest portion of the flue and issue from the warmest into the air chamber.

HORACE BUSHNELL.

Witnesses:

WILLIAM N. MATSON,

NATHL. MATSON.