No. 730,654. PATENTED JUNE 9, 1903.

J. W. HORNSEY.

HOT AIR FURNACE.

APPLICATION FILED APR. 17, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 2.

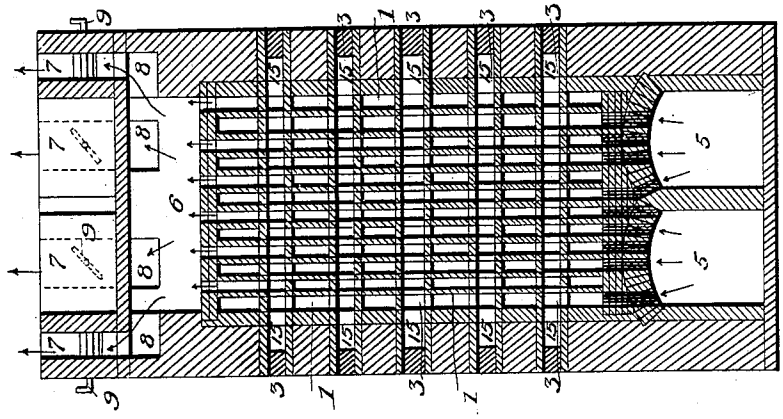
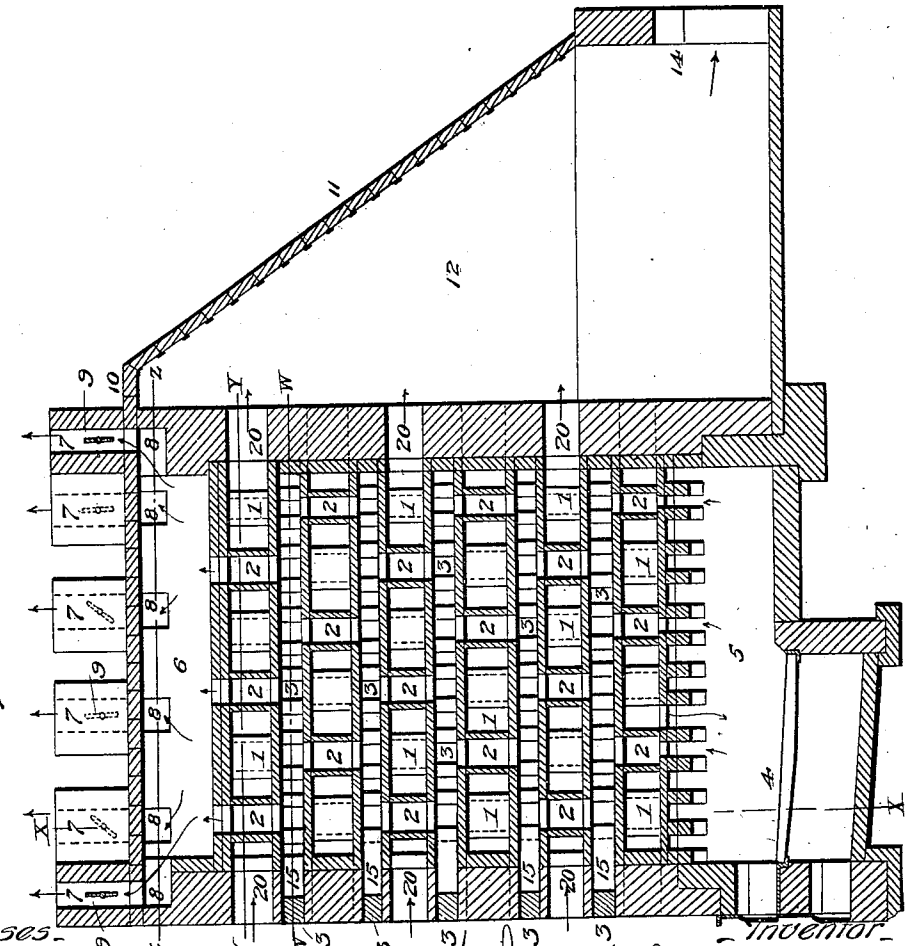


Fig. 1.



Witnesses—

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Inventor—

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 6.

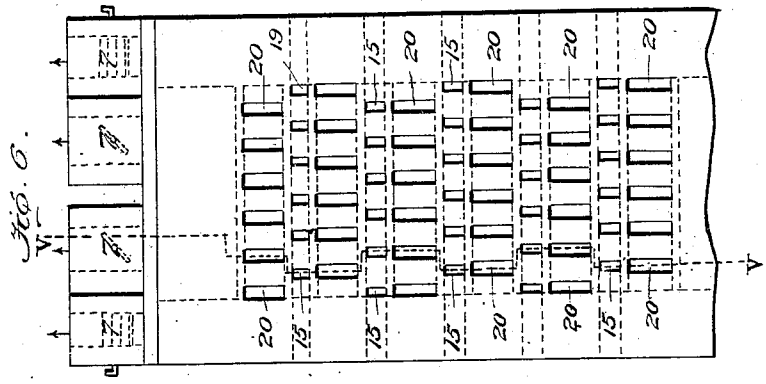


Fig. 4.

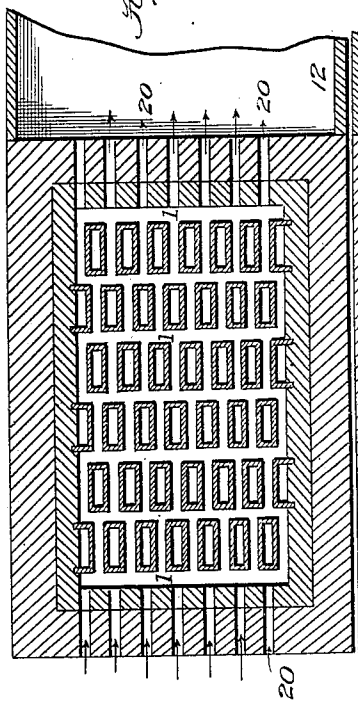


Fig. 3.

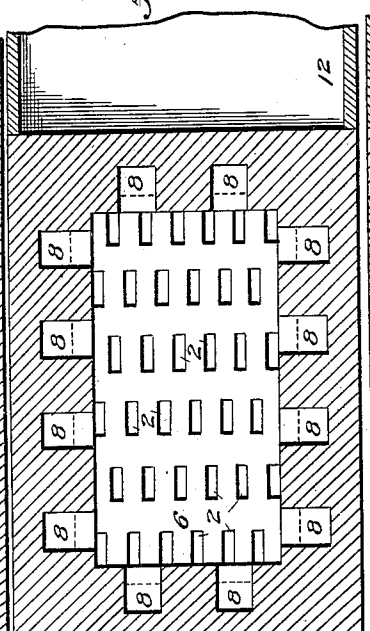
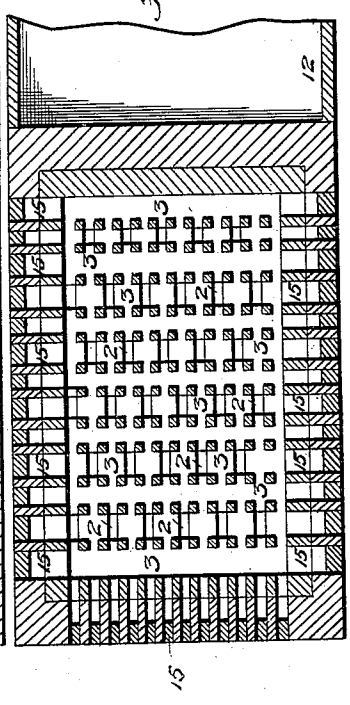


Fig. 5.



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Attys.

No. 730,654. Patented June 9, 1903.

UNITED STATES PATENT OFFICE.

JOHN W. HORNSEY, OF CLEVELAND, OHIO.

HOT-AIR FURNACE.

SPECIFICATION forming part of Letters Patent No. 730,654, dated June 9, 1903.

Application filed April 17, 1902. Serial No. 103,328. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. HORNSEY, a citizen of the United States of America, residing at the city of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Hot-Air Furnaces, of which the following is a specification.

My present invention, which relates to hot-air furnaces, contemplates certain improvements in the type of furnace patented to me May 7, 1901, No. 673,397, the said improvement having for its object the simplification of the furnace structure, together with increased efficiency and economy of space in the installation for drying and for heating.

An important feature of my improvement resides in a novel construction whereby the products of combustion are diffused or expedited in their passage through the radiating structure as may be desired and the flue structure thereby rendered a more uniform reservoir of heat.

The accompanying drawings read in common with the following description will enable any one skilled in the art to which my invention relates to understand its nature and to practice it in the form in which I prefer to employ it; but it will be understood that my invention is not limited to the precise arrangement and construction shown and described, as changes might be made which would properly be within the scope and terms of the claims appended hereto.

Referring to the drawings, Figure 1 shows in vertical section my hot-air furnace embodying my present improvements, the section being taken on the dotted line V V of Fig. 6 to show that the air-flues and the fire-spaces open at the air-inlet side of the furnace-wall and that the openings 15 of the fire-spaces are closed by plugs. Fig. 2 is a vertical section of the same on the line X of Fig. 1, the line of section showing particularly the plugged openings 15 of the fire-spaces in the opposite walls, as in Fig. 5. Fig. 3 is a horizontal section on the line Z of Fig. 1, showing the plurality of chimney-flues opening directly into the chamber, into which all the fire-flues also open. Fig. 4 is a like section taken through one of the horizontal circuitous air-passages on the line Y of Fig. 1, showing in section the vertical fire-flues. Fig. 5 is a like section taken through one of the horizontal fire-spaces on the line W of Fig. 1, showing the provision for cleaning these fire-spaces. Fig. 6 shows in elevation the arrangement of the wall-openings for the admission of the air into the heat-storage structure and the arrangement of the openings for cleaning the fire-spaces.

The heat-storage structure is of fire-resisting material within which air-passages 1 are formed by slabs arranged in horizontal tiers separated and supported by staggered walls forming vertical fire-flues 2, the walls of which pass successively through the tiers of the air-passages. Fire-spaces 3 are formed by and between the horizontal slabs, and into these fire-spaces the vertical fire-flues successively open through the tiers of slabs, whereby the fire-flues heat the air by radiation and form a heat-storage structure or reservoir wherein and through certain passages 1 of which air is caused to constantly pass in comparatively thin volumes independent of and crossing the flues for the products of combustion, the air in its passage extracting the heat radiated from the walls. In this construction of separate and independent passages and flues, the latter for the products of combustion and the passages for the air in thin volumes in contact with and between flue-walls, the heat is maintained at a high temperature and the air is rendered absolutely pure and of a high moisture-absorbing capacity. In the construction shown the fire-box 4, which may be adapted for grate-fire, is preferably located directly beneath the heat-storage flue structure, so that the fire-flues of the latter open directly into the fire-box chamber 5 for an updraft. The heat-storage structure is supplemented by a chamber 6, which is common to all the fire-flues and from the top of which rise a plurality of valve-controlled chimneys 7, whereby in operating the furnace the products of combustion are caused to be diffused through the circuitous fire-flues, and thereby effect a more uniform combustion of the fire products in the perfect diffusion of the heat through the staggered flues.

To secure perfect combustion, high temperature, proper areas, a proper amount of air for combustion, and a complete commin-

gling of the products of combustion and the air supplied for combustion are necessary. Such perfect combustion is obtained to the fullest extent in the heat-storage structure through which the products of combustion are caused to pass from the furnace through a multiple of vertical flues 2, which open into the successive horizontal intersecting spaces 3, which are common to all the products and within which spaces they are commingled. The walls of these successive fire-spaces form also the walls of the successive air-passages 1 and the fire products pass into the shallow fire-spaces toward the exit and into the chamber 6, which has direct communication with a plurality of valve-controlled chimneys, the flues 8 of which enter the chamber at the roof of the furnace. As shown in Fig. 3, this chamber is of rectangular form within the closure-walls, and from the latter the chimneys rise, surrounding the chamber, each chimney being provided with a damper 9, whereby the exit of the products of combustion may be controlled, retarded, and retained within the chamber.

By having a plurality of chimneys all opening directly into a chamber into which all the fire-flues directly open and each chimney controlled independently by a damper the products of combustion may be caused to pass out any one or more of said chimneys at the same temperature, and in this way effect a uniform diffusion of the fire products through the flue structure. The chimney-flues may, if desired, be so controlled as to cause all the products of combustion to be drawn equally from all the flues of the fire-brick structure under all conditions of the draft and to regulate the draft to maintain the heat at the same temperature in the flue structure.

The employment of a plurality of short controllable chimneys surrounding and opening into a chamber into which all the fire-flues directly open is an important provision in affording facility to work the furnace with a draft suited to the flue structure and the desired force of the draft. The roof of this controllable chamber is preferably horizontal and is extended to form the closure 11 for a hot-air-storage chamber 12, into which all the air-passages of the flue structure open.

To insure the complete extraction of the heat from the products of combustion, it is essential that all the radiating-surface be utilized, and to do this it is necessary that the products of combustion be thoroughly and completely diffused through the flue structure and retarded in their passage in such manner as to prevent their escape until as much of their heat as possible has been absorbed. For this purpose it is important that provision be made whereby perfect control may be had over the entrance and passages of the fire products into and through all the staggered flues and successive fire-spaces, and the provision for this purpose is the plurality of chimneys in direct communication with a valve-controlled chamber into which all the fire-flues open.

Referring to Figs. 1 and 4, it will be seen that the air-passages are open at both the closure-walls and that one of said walls is inclosed, so that all these passages open into this closure, which is thereby made a hot-air-storage chamber 12, from which the air is supplied for use and may be drawn therefrom by a suction-fan placed in an opening at 14 and which also draws the air through the staggered passages of the heat-storage structure.

The continuous operation of the furnace is of the last importance; but this is only rendered possible by provision whereby certain of the flues may be kept from choking.

In operating the furnace I have found that the vertical staggered fire-flues 2 are self-cleaning and that the horizontal fire-spaces 3 between the slabs become filled with ashes and stop the draft of the furnace. These fire-spaces are formed by blocks arranged in parallel rows, so as to form spaces unobstructed across the furnace in two directions, as in Figs. 1 and 5, which separate and support the slabs, and between these rows of blocks the fire-flues open in staggered relation between the slabs. The fire products therefore as they pass from the vertical flues impinge against the slabs above and are deflected horizontally, and it is this interruption of the vertical direction of the fire products which causes the deposit of ashes within the fire-spaces between the flue-openings. I therefore provide access to these fire-spaces by openings 15 in the closure-walls, leading from and coincident with the spaces between the rows of blocks and with the flue-openings 2, whereby to render the operation of the furnace continuous for drying and for heating. This arrangement of the blocks in their relation to the rows of flue-openings gives a clear way for introducing a scraper through the closure-wall openings and through the fire-spaces across the fire-flue openings to cause the collected ashes to be pushed and scraped in two directions between the rows of blocks over the flue-openings, through which the ashes fall successively from one fire-space to the other and finally into a chamber common to all the flues.

Referring to Fig. 3, rows of fire-flues 2 are seen opening into the chamber 6, which is within the closure-walls, and it is from these walls that the short chimneys rise and from which the roof extends from the base of the chimneys and forms the closure for the hot-air-storage chamber.

In Fig. 5 is seen the horizontal straight passages for the products of combustion leading through the furnace-walls and intersecting the vertical passages 2 for the products of combustion, whereby the ash deposits in these straight passages may be dislodged and

carried to and through the vertical flues successively from one straight passage to another, the dislodgement being made in lines at right angles to each other between the rows of blocks and from opposite sides of the closure-walls.

While I have shown the vertically-staggered fire-flues opening directly into the chamber of the fire-box, obviously the fire-box may be arranged outside of the flue structure, nor do I wish to confine myself to this direction of the draft.

I claim—

1. In an air-heating furnace, the combination of a fire-brick structure having a plurality of circuitous flues for the products of combustion, a chamber receiving the products of combustion direct from said flues, a plurality of exit-flues leading direct from said chamber, a damper in each exit-flue, and air-passages crossing the aforesaid fire-flues.

2. In an air-heating furnace, the combination of a fire-brick structure having a plurality of circuitous flues for the products of combustion, a chamber receiving the products of combustion direct from said flues, a plurality of exit-flues leading through the closure-walls of said chamber, a damper in each exit-flue, air-passages crossing the aforesaid fire-flues, and a fire-box having communication with the fire-flues.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN W. HORNSEY.

Witnesses:
A. E. H. JOHNSON,
GUY H. JOHNSON.