

## Hot Air Furnace.

Patented July 6, 1869.



*Inventor:*

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# United States Patent Office.

MARK ANTHONY CUSHING, OF AURORA, ILLINOIS.

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## HOT-AIR FURNACE.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, MARK ANTHONY CUSHING, of Aurora, Kane county, Illinois, have invented a new and useful Improvement in Furnaces and apparatus for heating-purposes; and I hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, making a part of this specification.

In the accompanying drawings—

Figure 1 represents a view of the said improvement, applied to a heating-furnace for warming houses, with the front wall of the enclosed chamber removed, to show the internal arrangement. A represents the furnace proper, in which the fuel is placed for combustion. The lower part of said furnace is composed of cast-iron rings, forming the part in which is placed the fire-pot, underneath which is an ordinary fire or coal-grate. At the bottom, the door *e* opens into the ash-pit. *f* is a damper, by the opening or closing of which air is admitted or excluded from the grate at the bottom of the fire-pot. The upper portion of the furnace is composed of a sheet-iron drum, in which is the feed-door *d*, just above the surface of the fire-pot, opening into the combustion-chamber formed by the sheet-iron drum. *c c* is an opening or tube connecting the outer atmosphere with the combustion-chamber, the object of which is to throw air upon the surface of the burning fuel, to supply oxygen for the more perfect combustion of the fuel. *G* is a water-tank placed upon the top of the furnace, connected, by means of the pipe *b*, with a water-tank, *G'*, on the outside. *D D D* is a hot-air chamber, surrounding the furnace A and the receiving-chamber B. B represents a chamber to receive the products of combustion passing from the furnace through the connecting-pipe or flue C. The connecting-flue C takes the heated products of combustion directly from the combustion-chamber, and conducts them, in their highly-heated condition, into the chamber enclosed by the drum B, for the purpose of heating said drum, and thereby the surrounding atmosphere. *C' C'* is a pipe for discharging the products of combustion from said receiving-chamber, after they have parted with a large portion of their caloric, otherwise called the smoke-pipe. The pipe *C' C'* is constructed in at least two sections, as seen at *C''*, for the purpose of making an adjustable flue, by raising or lowering the lower end of the said *C' C'*. *E* represents a flue by which heated air is conducted from the hot-air chamber *D D D* to a room above for heating-purposes.

Figure 2 represents an external view of the heating-apparatus, as enclosed within brick walls, showing the door M, opening into the space occupied by furnace, hot-air chamber, and receiving-chamber; also, the

openings at the bottom of wall, marked *a a a*, for the introduction of air into such space, to be heated by the furnace, &c.; also, showing the hot-air flue *E* and the smoke-flue *C'*.

In fig. 1, *h h h* show a rod, connecting with the bottom section of the pipe *C'*, for the purpose of elevating or depressing such section, thereby forming and operating the said adjustable flue.

The door *g*, at the bottom of the receiving-chamber, in fig. 1, is designed as a means of gaining access to said chamber, for purposes of cleaning the same from soot and ashes.

The mode of operating the above is as follows:

First, kindle a fire in the furnace in the usual manner. The products of combustion, together with the heated air within the combustion-chamber, pass through the connecting-pipe C into the receiving-chamber within the drum B. These heated products fill the upper part of the receiving-chamber within the drum, compelling the colder air at the bottom of the chamber to escape through the openings in the lower end of the flue or pipe *C'*, through said pipe *C'*, into the chimney. By heating the upper part of the chamber within the drum, that portion of the escape-pipe *C'* situated in such upper portion of the chamber, becomes heated also, causing the air within the escape-pipe to ascend, thereby creating a draught up said pipe, which takes up and carries off the colder air in the bottom of the receiving-chamber.

When the fire is first kindled in the furnace, that portion of the escape-pipe seen below *C''*, in fig. 1, is raised up by passing within the pipe *C'*, in order to bring the escape-flue nearer to the pipe C, connecting the furnace A with the receiving-chamber within the drum B, thereby giving less revertibility to the draught.

The part of the escape-pipe *C''* which passes within the escape-pipe *C'*, may be extended by construction, if desired, so high as to cause a direct draught from the connecting-pipe C to the mouth of the escape-pipe *C''*, or the current may be made more or less revertible by the depression or elevation of the mouth of the escape-pipe *C''*.

When the furnace is in full operation, the escape-pipe *C''* may be dropped down to the bottom of the drum-chamber B, which may be below the bottom of the furnace, as shown in fig. 1. In such cases, there must be small openings in the bottom of the escape-pipe *C''*, as shown in the figure.

By actual experiment, I have found that three or four one-inch holes through the bottom of the pipe *C''* are sufficient to convey away the gases escaping when the furnace is in full blast.

The advantage of taking up the escaping products of combustion from the extreme bottom of the drum-



chamber B, is that the heat is mostly extracted therefrom before they enter the mouth of the escape-pipe, and, in passing out, they carry off the least possible amount of caloric; consequently, nearly all the caloric is utilized for heating-purposes.

This advantage is increased by causing the drum-chamber B to extend some distance below the bottom of the furnace, upon the principle that the hot air is to be found in the top, and the cold air in the bottom of the receiving-chamber.

When the furnace is in full blast, it is better to close the dampers, admitting air underneath the grate, and to admit air directly to the surface of the solid burning fuel, by any suitable means equivalent to that represented in fig. 1, by pipe *c c*.

The heat of the furnace proper, and also the heat of the escaping products of combustion by heating the drum B, heat the air within the chamber D D D, which is conveyed by any suitable means to the apartments to be heated.

The chamber D D D is supplied with air to be heated, through openings in the bottom of the enclos-

ing wall, as seen at *a a a a*, in figs. 1 and 2 of the accompanying drawings.

Having thus fully described my said invention and improvement, I will proceed to set forth my claims.

1. I claim the furnace A, in combination with a chamber for receiving the heated products of combustion, having within it an escape-pipe, with an adjustable mouth or escape-opening, substantially in the manner and for the purpose above described.

2. I claim a chamber for receiving the products of combustion, separate from the combustion-chamber, having within itself an escape-pipe for the products of combustion, with an adjustable mouth or escape-opening, which may be elevated or depressed, substantially in the manner and for the purpose above described.

3. I claim an adjustable escape-pipe for passing off the products of combustion, by means of which the escape-draught may be made direct or revertible at the pleasure of the operator.

Witnesses: MARK ANTHONY CUSHING.

DANIEL KETCHUM,

JOEL TIFFANY.