(No Model.)

F. B. NICHOLS.

RADIATING FLUE.

No. 267,362. Patented Nov. 14, 1882.

Fig. 1.

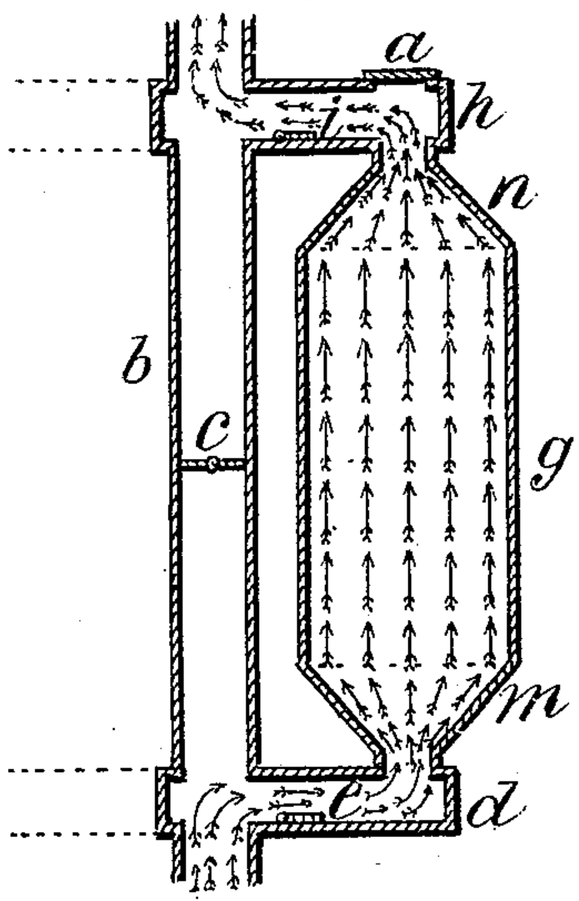


Fig. 2.

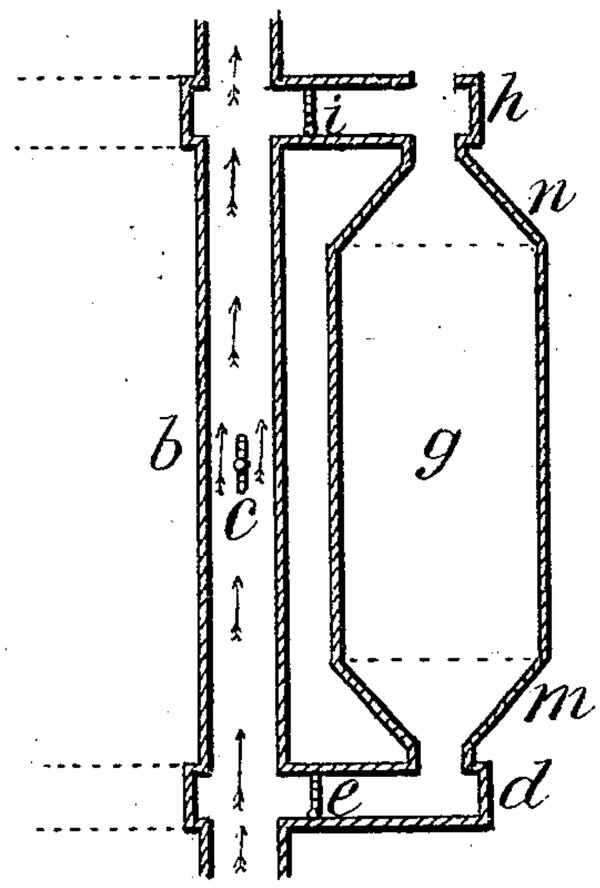


Fig. 3.

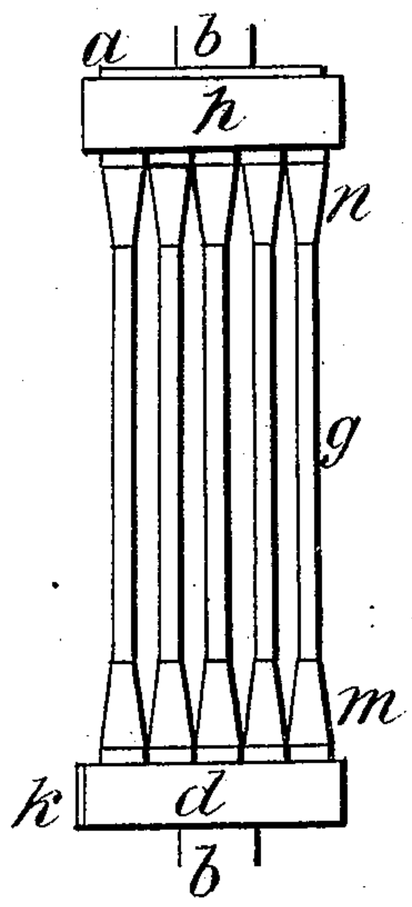


Fig. 4.

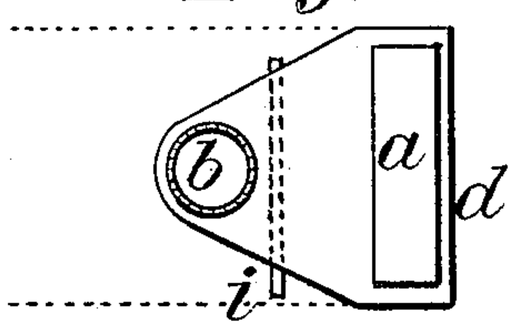


Fig. 5.

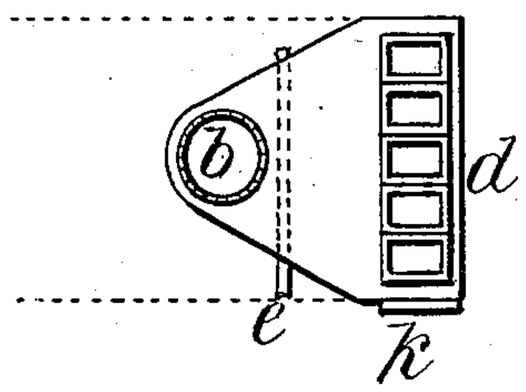


Fig. 6.

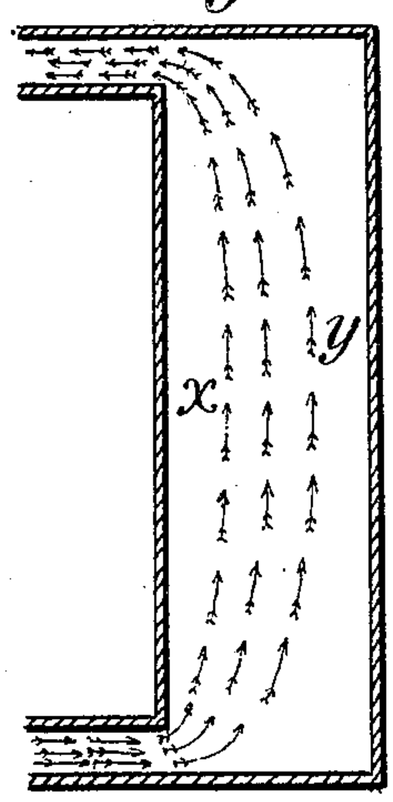
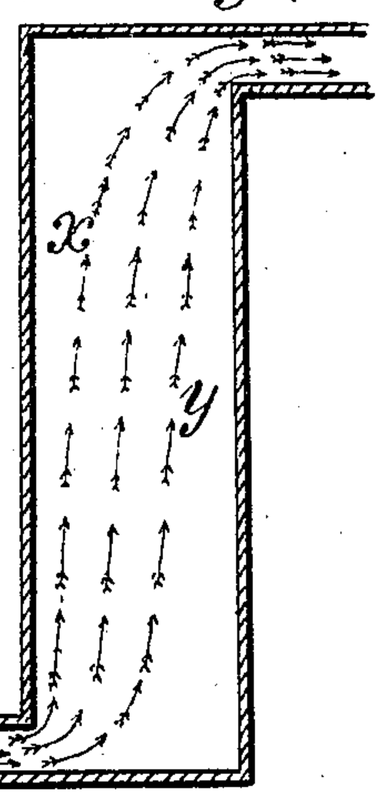


Fig. 7.



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UNITED STATES PATENT OFFICE.

FREDERIC B. NICHOLS, OF HALIFAX, NOVA SCOTIA, CANADA, ASSIGNOR OF ONE-HALF TO CATHCART THOMSON, OF SAME PLACE.

RADIATING-FLUE.

SPECIFICATION forming part of Letters Patent No. 267,362, dated November 14, 1882.

Application filed February 21, 1882. (No model.)

To all whom it may concern:

Be it known that I, FREDERIC BOOTH NICHOLS, a citizen of the United States, residing at Halifax, in the county of Halifax and Province of Nova Scotia, Dominion of Canada, have invented new and useful Improvements in Radiating-Flues, of which the following is a specification, illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section on the longer horizontal axis of the flat flue, the arrows showing the direction taken by the draft through the different parts of the apparatus. Fig. 2 is a corresponding section, showing dampers in main flues closed, shutting off the draft from the flat flue, and damper in connecting-pipe or waste-flue open, with arrows showing draft through it, the lid in the upper main flue being open for cleaning the flat flue. Fig. 3 is a vertical view on the short axis of the flat flues arranged in series. Figs. 4 and 5 are plan views of the upper and lower main flues, respectively. Figs. 6 and 7 show the direction the draft would take through flat flues opening direct from and to main flues.

My invention relates to improvements in radiating-flues or hot-air flues for heating one or more apartments by direct radiation into them, or to previously heating the air that is afterward conveyed to the apartments to be heated; and it consists of one or a series of flat flues with a piece at the bottom which diverges on the longest side and converges on the narrow side as it rises upward from its connection with the main flue that proceeds direct from the combustion-chamber, whether it be a stove or a furnace, the top of the flat flue being surmounted by a piece the counterpart of the lower one, but which, being inverted, converges on the long side and diverges on the short side toward its connection with the main flue above. These main flues are connected by a pipe or flue of sufficient capacity to carry off all the products of combustion, and it is provided with a damper. Both the lower and upper main flues are likewise provided with dampers placed between the connecting pipe or flue and the openings leading to the flat flues, and the upper main flue has a door or lid immediately over the opening from the flat flue—or if a series of them are used over and along the entire length of them—for the purpose of brushing off the soot, the lower main flue having a door for removing it.

So far as I am aware, in all previous arrangements for heating by means of the radiation from pipes, flues, or drums conveying away the products of combustion their area of capacity or cubic contents has been in all cases very great as compared with the area of radiating-surface presented, and where narrow or flat flues giving relatively larger radiating-surfaces have been used, that soon become covered with soot, if not choked by it, no convenient provision had been made for cleaning them while combustion was going on, being an obstacle so great as to preclude their use. Likewise in hot-air furnaces, from the same causes, the amount of radiating-surface is so limited that recourse must be had to very high temperature in order to make them effective, the heat frequently being great enough to partly deoxidize the air and burn the organic matter floating in it, giving rise to disagreeable and unhealthy products, so much so that other means for heating buildings are fast supplanting them. Furthermore, by all of the methods heretofore used a great portion of the hot products of combustion pass off and out of the chimney, without producing any result, by radiation.

All the disadvantages referred to are intended to be obviated by my improved flues, which present a very large area of radiating-surface as compared with their internal capacity—as, for example, a round pipe six inches in diameter, having an internal area of capacity of 28.27 square inches, presents only 18.84 square inches of radiating-surface per inch in height, whereas a flat flue three-fourths of an inch between its walls by 37.69 inches, which will give the same internal capacity, will present 76.78 square inches of surface per inch in height, being a fraction over four times as much, and this increases in great ratio with an increase in the diameter of the pipe. Thus a round pipe twelve inches in diameter, having an internal capacity of 113.09 square inches, presents only 37.69 square inches of surface

per inch in height. A flat flue three-fourths of an inch between its walls, having the same internal capacity, presents 303.06 square inches of surface per inch in height, or eight times as much.

It will be seen that under the usual conditions of burning fuel for warming buildings a vast volume of hot vapors passes off, the greater part of it not coming in contact with the radiating-flues at all, and consequently producing no effect, all of which is made available for radiation in my system. As it is obvious that flues with a space of only three-fourths of an inch between their walls would become so clogged as to stop the draft if not frequently cleaned, a very convenient means for doing it while combustion is going on has been provided.

The flat flues, when intended for direct radiation into the room to be warmed, are best made of sheet-iron, and for anthracite or coke need not be more than three-quarters of an inch between the walls, and for bituminous coal need not exceed one inch. As it would be inconvenient to make so narrow a flue with capacity equal to a pipe of even six inches in diameter, it is advisable to obtain the required capacity by employing a number of them. Twelve or fifteen inches in longest axis will be found the most convenient size for most purposes. The height may be more or less, according to the height of the apartment in which it is placed. Room enough must always be left between the top and the ceiling to conveniently clean the flues.

In Figs. 6 and 7 the arrows show the direction taken by the draft when entering and leaving narrow flat flues relatively long in the other horizontal axis, when their openings communicate directly with the main flues. The disposition, as proved by experiment, is to take the most direct course, thus avoiding the spaces *x y*, leaving them nearly cold. This unequal distribution of the draft is avoided by the form—or, more properly, the internal conditions—of the parts connecting the flat flues with the lower and upper main flues, which, to distinguish them, may be called "draft-distributers," and form an essential feature of my invention. These draft-distributers *m n*, where they enter the main flues *d h*, should be short parallelograms, as seen in Fig. 5, and the longest side should correspond with the long side of the flat flue *g*. They should have a nipple or other means of connecting with the main flues, and from these nipples diverge on the long side and converge on the short side to their juncture with the flat flue, where another nipple or other means of connecting them with the flat flue should be provided. The draft-distributers should have a capacity at their opening into the main flues somewhat larger than the capacity of a cross-section of the flat flue to insure their conveying sufficient current to completely sweep through their whole space. The main flues should, for the same reason, have somewhat greater capacity in their transverse section than the combined capacity of all the flat flues of a series on a horizontal section of them. The main flues should be connected by a pipe or flue, *b*, that may be called the "waste-flue." This waste-flue should have a damper, *c*, and both the lower and upper main flues should have dampers *e i* placed between the waste-flue and the draft-distributers. These dampers may be made in any of the usual forms that are most convenient, which will depend in great measure on the size of the whole apparatus. For the main flues, hinging them at the bottom, as shown in the drawings, will be found a convenient method.

In first kindling a fire the damper *c* in the waste-flue must be open to give a free passage to the products of combustion, and all communication with the flat flues cut off by closing dampers *e i* in the main flues, as the tar and other products of the combustion of wood cannot be removed after collecting on the flat flues, and would soon injure them in many ways. When the fire gets thoroughly kindled the dampers *e i* should first be opened, and then damper *c* closed. This will soon heat the flat flues, which will give out a large amount of radiated heat, but of no great intensity, as their combined capacity should be considerably more than double what would be necessary to carry off all the products of combustion, but should not be so largely in excess as to reduce the hot vapors so low in temperature as to stop the draft. These flat flues are so effective that in practice I have found the same calorific effects produced with one-half the fuel necessary to produce the same temperature for the same length of time when the draft was conducted directly off to the chimney by the waste-flue, which my experiments have proved to be literally a waste-flue, and that is the condition presented in all usual apparatus for heating purposes.

When it is necessary to clean the flat flues the damper *c* in the waste-flue is opened and the dampers *e i* in the main flues are closed, as shown in Fig. 2, which shutting off all communication with the fire on that side, the door or lid *a* over the flat flues can be opened, and a suitable brush with a long handle is inserted to brush down the soot, which is afterward removed by opening the lower door or lid, *k*. This can be done at any time, even when vigorous combustion is going on. Care must be taken to have these doors tightly closed before turning on the draft again to the flat flues, which should be done before shutting damper *c*.

When attached to a stove to be used for direct radiation the main flues should be made in the form seen in Figs. 4 and 5. In using these flues in combination with a large furnace for heating the air that is afterward conducted to different parts of the building in the usual way the whole apparatus (including the waste-flue) should be incased, and have the pipes or flues for the egress of warm air so arranged in connection with the aperture for the admission of cold air as to diffuse it uniformly

up through the spaces between and around the hot flues that carry away the products of combustion. Whatever means are used to incase the hot flues, provision should be made that easy access can be had to the dampers and to the doors or lids for cleaning the flues and regulating the draft.

Instead of the waste-flue extending below, as shown in the drawings, the main flue *d* should be longer and wider, as shown by the dotted lines, extending beyond, and communicate direct with the furnace, or, better still, with a fire-brick chamber back of the bridge-wall. The upper main flue, *h*, should likewise be wider to allow of two or more waste-flues to connect them, if greater capacity is required or if it offer any convenience. If the number be increased, they should each have a damper, and then become the equivalents of *b* and *c* in the combination. The flues and other parts for this purpose may be of cast-iron, with the same internal conditions as when made of sheet-iron, and in other respects conform to the same conditions.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

The door or lid *a*, immediately over the opening into the draft-distributer *n*, surmounting a thin flat flue and door, *k*, in combination with dampers *i* and *e*, arranged as described, so as to completely isolate the draft-distributers *m* and *n* and the thin flat flue *g* from the flue *b* for the purpose of cleaning the thin flat flues and draft-distributers while combustion is going on in the stove or furnace to which the said parts are attached, all in the manner and for the purpose herein specified.

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