No. 649,502. Patented May 15, 1900.

J. A. WILLS.

HEATING APPARATUS.

(Application filed Mar. 20, 1899.)

(No Model.) 2 Sheets—Sheet 1.

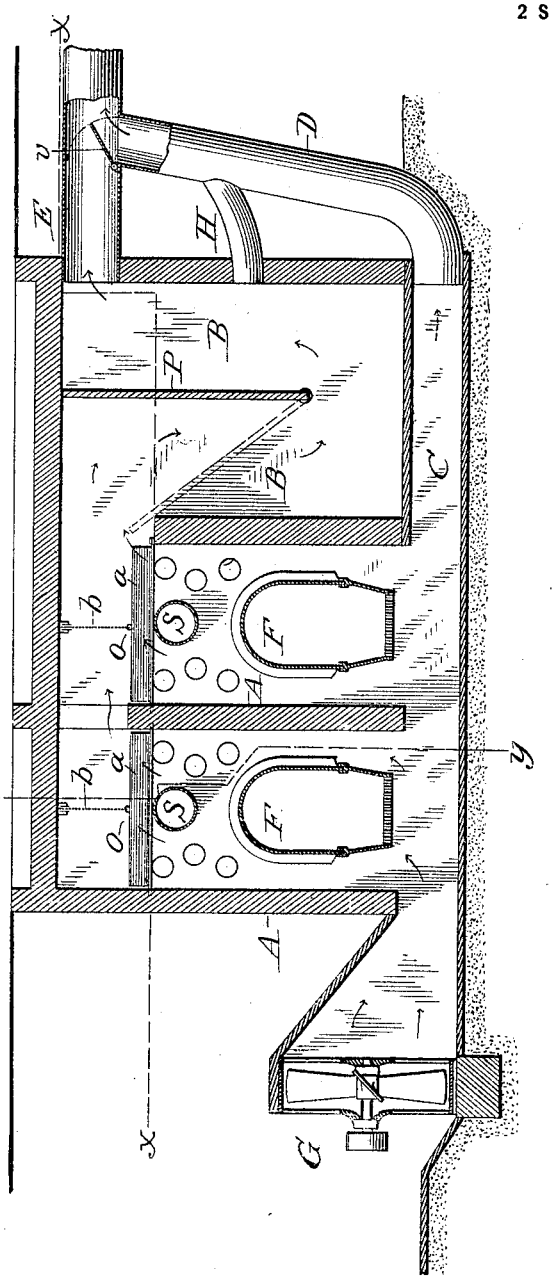

Fig. 1.

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Fig. 2.

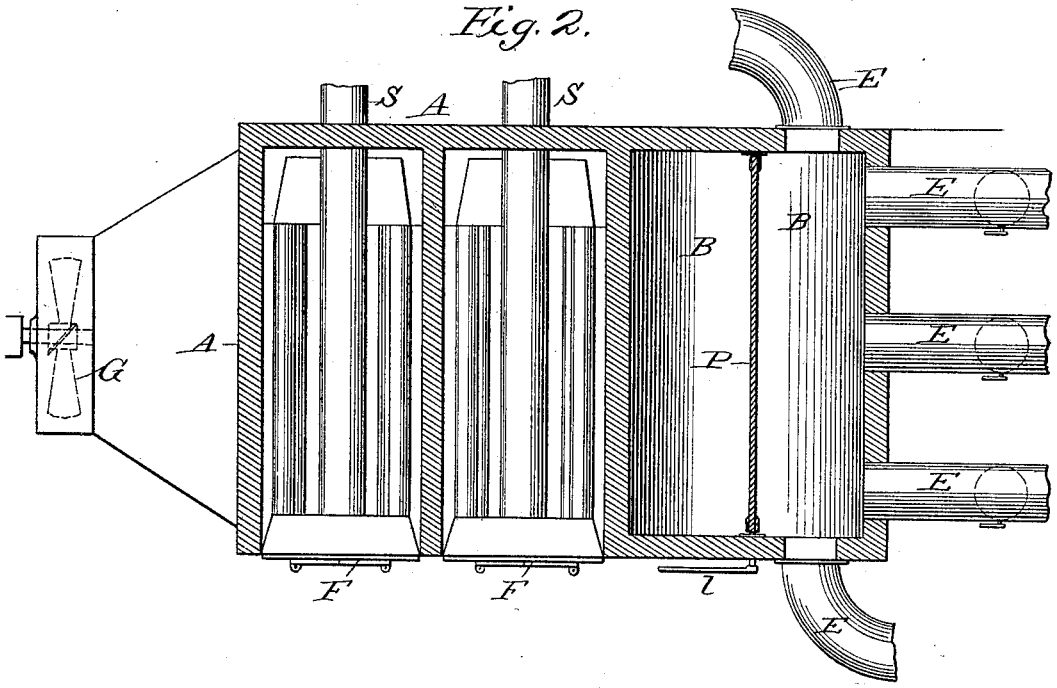
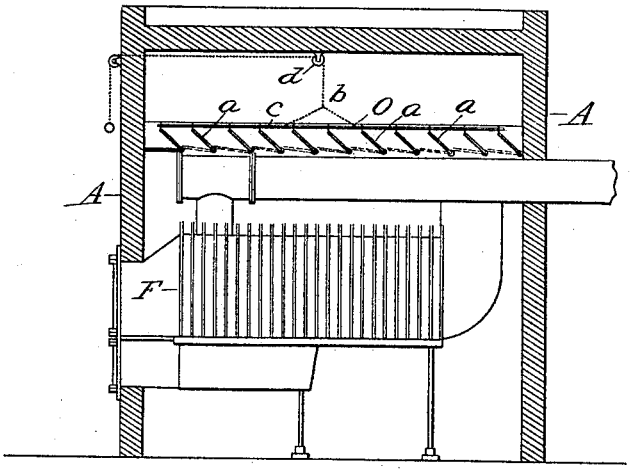


Fig. 3.



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UNITED STATES PATENT OFFICE.

JAMES ALMEDAY WILLS, OF PHILADELPHIA, PENNSYLVANIA.

HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 649,502, dated May 15, 1900.

Application filed March 20, 1899. Serial No. 709,828. (No model.)

To all whom it may concern:

Be it known that I, JAMES ALMEDAY WILLS, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Heating Apparatus, of which the following is a specification.

My present invention relates to apparatus for heating and ventilating large buildings; and the invention consists in means for equalizing the temperature of the air as it passes from the different parts of the furnaces, in means for mixing the hot and cold air or delivering either alone at will, and in means for shutting off the air-supply from any one or more of the furnaces at will, as hereinafter more fully set forth.

In the accompanying drawings, Figure 1 is a transverse vertical section of the apparatus. Fig. 2 is a horizontal section on the line *x x* of Fig. 1, and Fig. 3 is a vertical section on the line *y y* of Fig. 1.

This apparatus is designed for use in heating large buildings—such as school-buildings, court-houses, and the like—in which there are numerous rooms to be heated and in which several furnaces are used (usually two or more, set side by side) to supply the requisite amount of heated air for properly warming the rooms and at the same time furnish the proper amount of fresh air for the inmates to breathe and which should be not less than fifty cubic feet per minute for each person. To properly warm such a volume of cold air requires very large furnaces, and hence the furnaces now used are from seven to fourteen feet in length. As ordinarily set the air is brought in under the furnaces at one side, as represented in Figs. 1 and 2, the air being taken off through pipes or flues at the top on the opposite side. In some cases, owing to the construction of the building, it becomes necessary to bring the cold air in under the rear end of the furnaces. In either case, owing to the great length of the furnaces and the fact that they are much hotter at the front than at the rear end, the air is much more heated at the front than at the rear, and when the hot-air pipes or outlets are arranged along the side in the same horizontal plane, as they usually have to be, I have found by experience that there is a great difference in the temperature of the air which is conveyed by the various pipes or flues, those near the front taking the hottest air and those at the rear the coldest, and that, hence, while some of the rooms are overheated others are not sufficiently heated. To remedy this difficulty, I provide a large air-mixing chamber B, as shown in Fig. 1, into which the hot air from all the furnaces passes, as indicated by the arrows in Fig. 1. In order to hold the air in this chamber and cause that from the hotter and cooler ends of the furnaces to become thoroughly intermingled, I locate in the center of the chamber a diaphragm or partition P, as shown in Fig. 1, so that the air has to pass down one side and up the other, during which time it will become mixed and its temperature practically equalized and rendered uniform before it enters the pipes or flues E leading to the various rooms of the building, and by that means secure a much more uniform temperature in all the rooms. This diaphragm I make of sheet metal and at its lower edge secure it to a rod mounted in the walls A of the chamber, the rod projecting outside of the wall at one side, where it is provided with a handle or lever *l*, by which the diaphragm can be secured in an upright position or turned to an inclined position, as indicated by the dotted lines, as shown in Fig. 1, or be fastened at any intermediate point, as may be desired. Ordinarily during the day it is kept in the upright position, so that all the air will have to pass down under it; but by opening it slightly, so that a portion of the air may pass over it and the rest under it, eddies or currents are created, by which the air from the various parts of the furnaces is more effectually mixed or intermingled. At night, when little or no fire is kept up, the diaphragm may be turned to the position shown by the dotted lines, thereby preventing the air from passing under it and permitting the air to pass directly to the pipes or flues E. At such times of course but little air will pass, as ordinarily the apparatus will not be run during the night.

In order to regulate the temperature of the air, the furnaces are set high enough to permit the cold air to pass under them into a flue or duct C underneath the mixing-cham-

ber B, from which a pipe D extends up to and connects with each of the hot-air pipes E, as shown in Fig. 1, there being a valve V arranged at the mouth of the pipes D, as shown, by the openings of which the flow of the hot air is restricted and the cold air admitted, the two currents being thus united in the pipe or flue E, by which means the temperature of the air entering the room can be regulated as desired. Another pipe H is preferably arranged to connect the mixing-chamber with each of the cold-air pipes D, so that warm air may pass from the chamber B into the pipes D lower down and become mixed before entering the pipe E. When no cold air is needed to mix with the warm air, the valve V will be closed.

In order to secure the requisite volume of air and force it through the apparatus, I use a fan G, so located as to force the cold air in, around, and over the furnaces and under the diaphragm in the mixing-chamber and from thence through the pipes or flues E into the various rooms. To provide means for still further regulating the flow of the air and the amount of heat, I place in each furnace-chamber, directly over the furnace, a valve O, which is preferably made of a series of pivoted sheet-metal plates *a*, connected by a rod *c*, so as to open and close like the slats of a window-blind, this being operated by a chain or wire cord passing over a pulley *d* and thence out at the front, as shown in Figs. 1 and 3. It will of course be understood that any other form or construction of valve may be used so long as it will shut off the flow of air from the furnace; but that shown is simple and effective.

When but little heat is required, as in very mild weather, the valve O over one or more of the several furnaces will be closed, when of course more of the cold air will be forced through the duct C and pipes D to mingle with the warm air in the pipes E, and by properly adjusting the valves V, which control the admixture of hot and cold air, the air can be supplied to the various rooms at the desired temperature.

While in the drawings I have shown but two furnaces for illustration, it is obvious that any number may be thus arranged side by side, and in very large buildings as many as ten furnaces have been so used.

It is obvious that other forms of heaters may be used, such as coils or radiators using either steam or hot water, and which, if they do not fill the heating-chamber, or, as is frequently the case, have to be located nearer one end than the other, will heat the air unequally, and even when they do fill the chamber, if the air enters at one end, as the necessities of the situation frequently compel, and where a forced draft is used, the air will be less heated at the end where it enters than at the opposite end, and in all such cases the mixing-chamber is of decided benefit. This mixing-chamber I prefer to make as large as the situation will permit. It is obvious that the partition or diaphragm P may be made stationary, and where there is room to extend the chamber B several such diaphragms may be used, they being so arranged as to cause the air to pass alternately under and over them, so as to insure a complete and thorough admixture of the warmer and cooler air, the main object of this feature of my invention being to secure an equal temperature of the warm air entering all the different rooms of the building wherever the rooms may be located, whether on the first or other floors or whether near to or distant from the heaters, the fan forcing the air to all rooms alike.

While in the drawings I have shown pipes for conveying both the warm and the cold air, it is of course obvious that flues may be built in the walls for that purpose, and where the building is planned with a view to this plan of heating flues are usually so built. It is also obvious that the bottom of the mixing-chamber, where the air passes under the diaphragm, may be made in the form of an inverted arch or that curved sheets of metal may be placed in the corners or angles to facilitate the passage of the air; but I prefer not to do this except where several diaphragms are used, as these angles tend to break up the passing current and insure a more perfect admixture of the air.

In practice I have found this invention to give most satisfactory results by securing a much more uniform temperature in the various rooms than could be secured when the same heaters were used without the mixing-chamber and that, too, whether a fan was or was not used. I prefer, however, to use the fan in all cases where it is possible.

Having thus fully described my invention, what I claim is—

1. In an apparatus for warming buildings, the combination of an elongated furnace or heater set in a chamber of its own, and a separate additional air-mixing chamber interposed between the furnace or heater and the air pipes or flues leading to the rooms to be warmed, substantially as herein described, whereby the air from the cooler portion of the heater and that from the warmer portion shall be intermingled and rendered uniform in temperature before entering the pipes or flues leading to the rooms, for the purpose of securing a more uniform temperature in the several rooms.

2. In combination with a heater set in a chamber of its own, a separate air receiving and mixing chamber provided with a diaphragm adapted to deflect the passing current of air and thereby secure a more thorough admixture of the warmer and cooler portions or currents flowing from the heater, substantially as and for the purpose set forth.

3. In combination, two or more furnaces, each set in a separate heating-chamber, an air receiving and mixing chamber arranged to receive the warm air from all of said furnaces,

and a valve *o* arranged to shut off the flow of warm air from each heating-chamber separately, whereby the amount of heated air delivered to the receiving and mixing chamber may be varied or regulated at will.

4. The combination in a heating apparatus, of one or more furnaces or heaters, an air receiving and mixing chamber separate and apart from the chamber or chambers, in which the heater or heaters are set, a series of warm-air pipes or flues E leading from said receiving-chamber, a corresponding set of cold-air pipes or flues D connecting with the warm-air pipes or flues with a valve *v* at their junction, and a fan or blower arranged to force air through the same, substantially as shown and described.

In witness whereof I hereunto set my hand in the presence of two witnesses.

JAMES ALMEDAY WILLS.

Witnesses:
ANNA MCKERNAN,
M. A. MURPHY.