May 6, 1930. W. SHURTLEFF 1,756,997

HEATING AND VENTILATING UNIT

Filed Aug. 12, 1926

Fig. 3

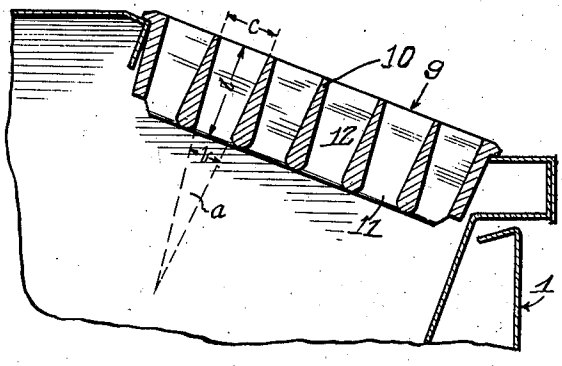


Fig. 1

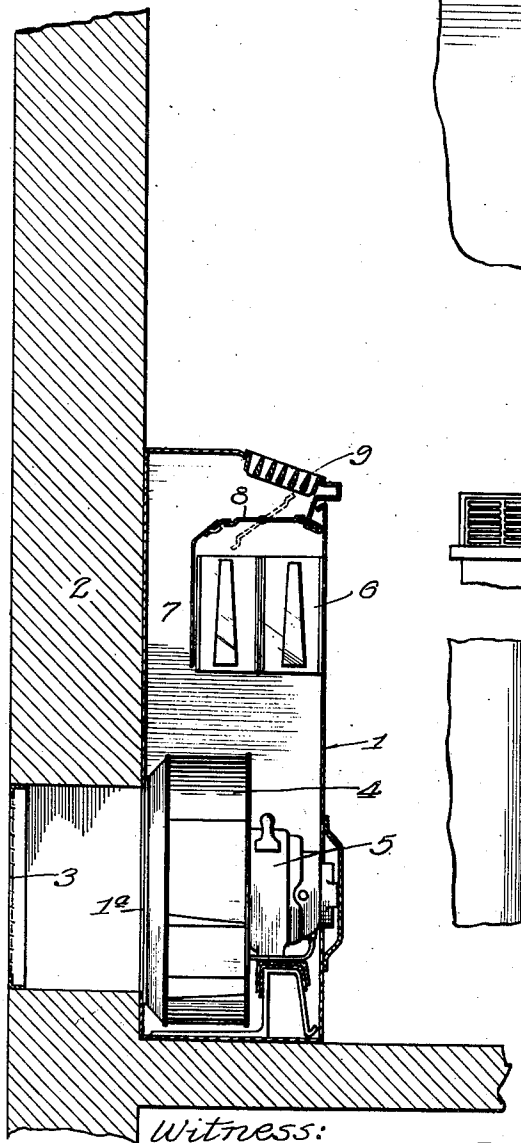
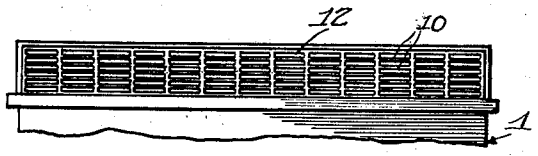


Fig. 2



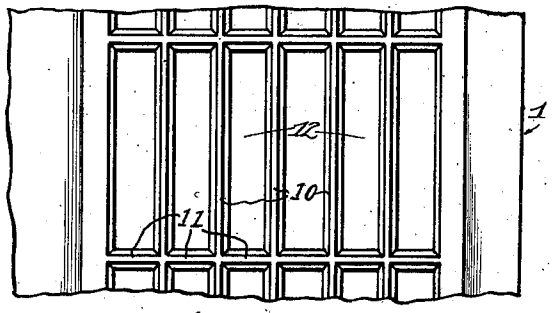


Fig. 4.

Inventor:
Wilfred Shurtleff.

Witness:
Chas. L. Kousek

By. Offield, Mcallister, Scott & Woodbridge Attys.

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UNITED STATES PATENT OFFICE

WILFRED SHURTLEFF, OF MOLINE, ILLINOIS, ASSIGNOR TO THE HERMAN NELSON CORPORATION, OF MOLINE, ILLINOIS, A CORPORATION OF ILLINOIS

HEATING AND VENTILATING UNIT

Application filed August 12, 1926. Serial No. 128,761.

This invention relates to improvements in heating and ventilating units, and more particularly to an apparatus for heating and ventilating purposes designed to be installed in the room to be served and drawing its supply of fresh air from the outside atmosphere through a suitable intake through the outside wall of the building, into a cabinet in which is located a fan which forces the air through a radiator also located in the cabinet, and thence into the room.

The object of the present invention is to provide a construction or design for the air outlet or discharge opening from the cabinet, whereby a closer approximation to the ideal of perfect diffusion and mixing of the fresh air with the air already in the room and give every occupant, wherever located in the room their proportion of fresh air.

The chief advantage of a system of heating and ventilating by apparatus of the character described, particularly for schools and like buildings, resides in the ability to obtain a uniform distribution of a sufficient quantity of fresh tempered air throughout the room, without objectionable drafts. The result is due primarily to the fact that the air is discharged vertically and maintains most of its high initial velocity until it strikes the ceiling and then is spread in all directions at a lower velocity gradually mixing and stirring the room air with the final result of a nearly perfect diffusion and further lowering of the velocity as the momentum is retarded by the inertia of the larger mass of air in the lower portion of the room, thus preventing the discomfort of drafts. A fan of a capacity to deliver the air at the desired velocity and in the required volume is one requirement to bring out this result, but of equal importance is the nature of the discharge outlet which must be designed so that the velocity of the air will be sustained until the stream of air reaches the ceiling. It is essential that the velocity of the air represented in terms of kinetic energy, remain intact until the stream strikes the ceiling and imparts the kinetic energy to the mass of air already in the room near the ceiling causing the air to roll and whirl at a comparatively high velocity near the ceiling and as the energy is dissipated into a larger volume of air at lower levels, the air movement slows down to a point where the occupant does not feel any uncomfortable air movement or draft. Since otherwise the energy is prematurely dissipated and the diffusion and uniform distribution of the air is partially, if not completely lost.

It follows, therefore, that to attain the end in view does not depend merely on providing a discharge opening directed toward the ceiling and the proper size to deliver the air from the fan without loss, but to provide an opening or a multiplicity of openings so designed as to discharge the air from the opening in the form of a stream or jet which will reach the ceiling without appreciable loss of kinetic energy.

Heretofore, little or no particular attention has been paid to the design of the discharge opening other than to its size and direction vertically towards the ceiling, so that the conditions recognized as desirable have only been approached in practice. The object, therefore, of the invention is to provide a properly designed discharge for apparatus of this type, and preferably having the form of a grille, set at an angle to the vertical, but in reality consisting of a multiplicity of small orifices designed to divide the air stream into a large number of small streams or jets, which strike the ceiling toward the center of the room without appreciable loss of kinetic energy.

The application of the principle to a heating and ventilating unit of a preferred type has been illustrated in the drawings, in which

Figure 1 is a view in vertical section through a typical heating and ventilating unit.

Figure 2 is a view in front elevation of the upper portion of the apparatus.

Figure 3 is an enlarged detail view in cross section of the air outlet showing the formation of the grille, and

Figure 4 is a top plan view of a section of the grille.

A heating and ventilating unit comprises in general a cabinet or housing 1, ordinarily

placed on the floor and against an outer wall 2 of the room to be heated and having near its lower end and at its back an outlet opening 1^a registering with a duct 3, extending through the wall. Mounted in the lower part of the housing is a fan 4, driven by a motor 5. Above the fan and in the upper part of the housing is a radiator 6 extending lengthwise thereof and preferably spaced from the back wall, thereby providing a passage 7 connecting the space below the radiator with the space above. A damper 8 above the radiator is operative to shut off the passage of part or all of the air through the radiator, thus diverting or bypassing all or part of the air through the passage 7.

Above the radiator and in the top wall of the radiator is an outlet or discharge opening represented by a grille 9, removably filling in an elongated rectangular opening or slot formed in an inclined wall section 10 extending along the forward edge of the top wall of the cabinet. The opening, therefore, is directed outwardly and upwardly from the cabinet and toward the center of the ceiling of the room.

From the foregoing it is manifest that the air is drawn into the fan and thence discharged upwardly through the radiator 6, or the passage 7, or both, and thence discharged through the outlet into the room in the direction already indicated. The fan is designed to deliver the prescribed volume of air, of say 1200 cubic feet per minute, through the discharge opening at a relatively high velocity.

Referring now to the grille 9, the same comprises a rectangular frame, preferably of cast metal, and relatively narrow in width. Extending lengthwise of the frame is a plurality of parallel blades or louvers 10, spaced apart at equal intervals, a suitable distance. Intersecting these blades are a series of transverse or cross louvers 11 spaced apart from each other at somewhat greater distances, so that the entire area of the grille is subdivided into a multitude of small rectangular openings or orifices 12 of the same relative proportion as the opening in which the grille is fitted.

Directing attention to one of the individual openings 12, it will be observed that the portions of the louvers 10 and 11 surrounding each passage or orifice are of a predetermined cross-sectional contour which may be described as tapering from a rather thick base with a rounded edge to a relatively thin top edge. In practice the length of these openings (l) is about one and one-half inches; the width (b) of the opening at its lower ends about seven-eighths to one inch and diverging at an angle (a) to a width (c) of about one and one-fourth inches at its upper or discharge end. The base edges of the louvers as already suggested, are rounded so that the entrance to each opening has a slight flare in a downward direction, thus introducing a restriction just above the entrance to the passage. Thus taking a cross section of one of the openings 12 (Figure 3) it follows closely the diagrammatic representation of what is termed an orifice having a high coefficient of discharge, that is, an orifice through which a fluid can be discharged with a minimum loss of kinetic energy. Such an orifice would be proportioned so that its length is at least one and one-half times the width at its entrance, and the taper or inclination of its walls at least seven and one-half degrees. While these proportions have been determined for round orifices through which liquids are discharged, it has been found that a close approximation of the same proportions in a rectangular and somewhat elongated orifice or slot for air discharge brings about the same high coefficient of discharge which is desirable for the reasons already set forth.

It is conceivable that a single large opening in the housing might be designed to give the same results, but obviously this would be impractical for the reason that to maintain the proportion of length of orifice to its width, the cabinet would have to be increased in height to provide for the extended opening. But by providing a grille whereby a multiplicity of small orifices are formed, the correct proportions can be maintained within a relatively small space. Thus it is possible by equipping heating and ventilating apparatus with a properly designed discharge opening in the form of a grille, to obtain greater efficiency and more perfect ventilation than would otherwise be possible.

Having set forth the functions of the grille and the advantages thereof, I claim as my invention:

As an article of manufacture, a discharge grille adapted to occupy an elongated discharge opening of a ventilating unit containing means for directing air therethrough, said grille having a plurality of orifices of rectangular outline defined by louvers extending longitudinally and transversely of the grille and of the discharge opening, each of the rectangular walls defining each of said orifices being flared away from each other from the entrance end of each orifice to the discharge end thereof at angles of at least 7½ degrees, thereby increasing the velocity of air issuing from said orifices.

Signed at Moline, Ill., this 9th day of August, 1926.

WILFRED SHURTLEFF.