

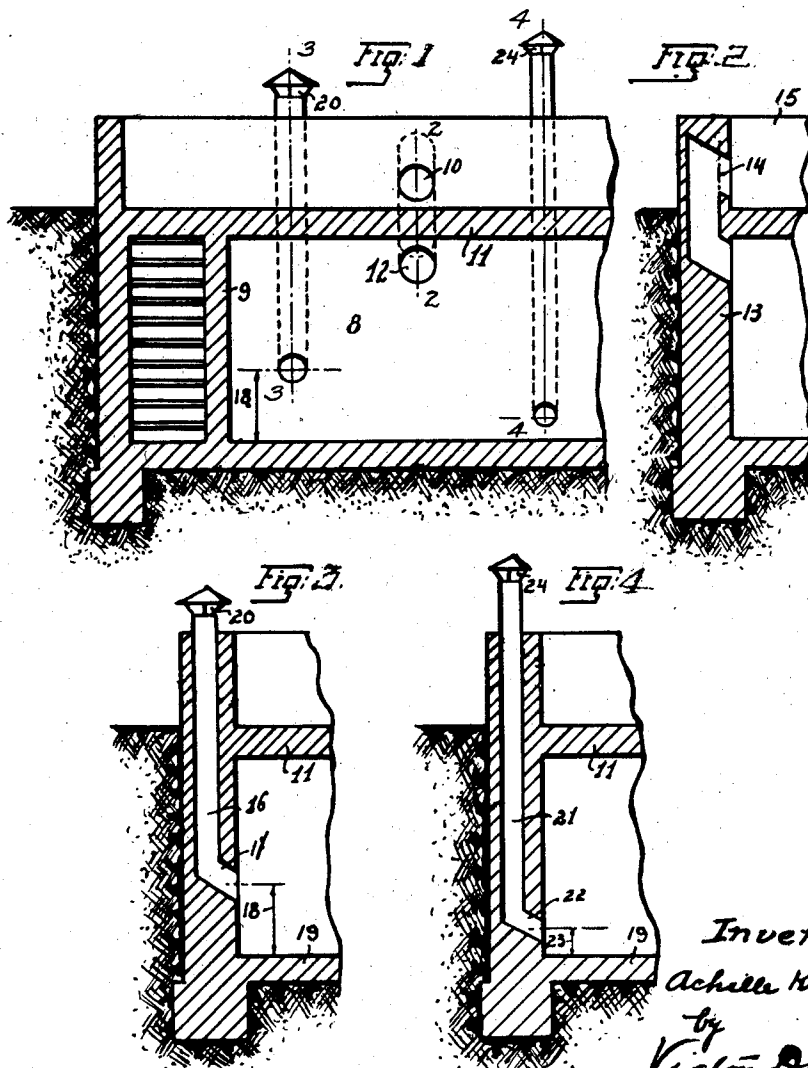
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SYSTEM OF VERTICAL DIFFERENTIAL VENTILATION

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SYSTEM OF VERTICAL DIFFERENTIAL VENTILATION.

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My invention relates to a system for vertical differential ventilation which is adapted to be used in order to renew the air in any substantially closed chamber by continuous exchange, whatever may be the temperature inside or outside the rooms which are to be ventilated, the nature, the position, or the area of the said chambers whether they be situated under the level of the ground, under the level of the water, or above this level such as it may be the case in ships, underground tunnels and the like, and more especially when it is not possible to reach the outer atmosphere in the horizontal direction.

My process is essentially based on the cooperation of ducts or chimneys which are vertical or inclined, and which have different sections or diameters and different lengths, their number being at the minimum of two for each room or for each chamber to be ventilated, the said ducts or chimneys being arranged in the thickness of the walls or along these walls or in the form of columns, or in any other suitable form in order to produce by a chimney of a relatively greater section and of a relatively smaller length, a quick escapement of the light air which is stopped under pressure against the ceiling of the room, and to obtain through the chimneys or ducts, of a relatively greater length and of a smaller section, opening at different levels above the ground, an introduction of fresh air into the room or eventually an introduction of fresh air and an escapement of air, in cooperation with the chimney or duct arranged under the ceiling.

In order to explain the invention more fully it will be described hereinafter with reference to the annexed drawing in which—

Fig. 1 is a longitudinal section of a room, which is supposed to be an underground room without direct communication with the outer atmosphere in the horizontal direction and to be provided with the system of ventilation according to this invention.

Fig. 2 is a cross section taken through line 2—2 in Fig. 1.

Fig. 3 is a similar cross section taken through line 3—3 in Fig. 1 and

Fig. 4 is a cross section taken through line 4—4 in Fig. 1.

In the processes of vertical ventilation which have heretofore been used and which are based on the principles of Reckmagel, Ser and other experts in the art, the escape-

ment of the air from the rooms or other places is caused by the utilization of ducts or chimneys in each room to be ventilated, each room having an inlet port or opening and an outlet port connecting the room to the free air at a certain height above the room or place to be ventilated.

Experiments have shown that, when the depression in such a duct or chimney exceeds a given limit, its sucking action is transmitted directly through the atmosphere of the room to the outer air through the fissures or the joints of the doors and windows or through an inlet port leading to a connecting stairway provided for this purpose at the level of the floor or pavement. In such a system the outer air, sucked in through the port, or the fissures, or the joints of the doors and windows passes at full speed as a projectile, in producing a blow of air, the trajectory of which is the shortest distance between the fissures or the like and the duct. The greater the depression in the duct, the more bent is the trajectory of this blow of air. This displacement of air at a great speed has no effect on the ventilation or on the renewal of the greater portion of air in the room or place which is ventilated in this way. In summer, when the outer temperature has reached a certain degree, the column of air contained in the duct or chimney, being more dense (because it is less hot, than the outer air) and being no more supported at the interior inlet port under the ceiling, by layers of air having a density equal to its density, descends and tends to escape to the outside in following the way of less resistance and in stretching in layers on the floor.

From the point of view of the exchange of the air in the rooms or places, such a natural vertical inverted ventilation is not efficacious, being rather injurious, because it attracts the smells of soot in the rooms or places together with the dusts which have accumulated by the heating during the winter. In underground places or rooms which are surrounded on all sides by walls, this system of vertical ventilation is not operative.

These drawbacks are overcome by means of the system forming the subject matter of my invention which is based, in order to ventilate a place or room 8 surrounded on all sides by walls 9 or built in the ground, or enclosed in the shell of a vessel, on the cooperation of ducts, or chimneys of different sections and

of different lengths and connecting the interior of each chamber to be ventilated to the outside atmosphere.

In the example shown, the system comprises
 5 a duct 10 of relatively greater section and shorter length but, sufficient in order to put in direct contact, through the shortest way, the light air, accumulated under pressure
 10 against the ceiling 11, with the outer air, in order to allow its escapement as quickly as possible and also with the least resistance.

As shown on Fig. 2, this chimney 10 opens by an inlet 12 just under the ceiling 11, passes into the wall 13 and opens by a port 14 in
 15 the outer air at the level of the terrace 15, the port 14 being directed either towards the terrace as shown or any other desired direction. With this chimney or duct 10, cooperates a chimney 16 of relatively smaller section and of greater length. The lower port
 20 17 of this chimney descends to a given distance 18 above the ground 19, for example to a distance of about 60 cm.

This port 17 may however be arranged in
 25 certain cases at a greater height, for instance at 2 or 3 meters above the ground according to the places or rooms to be ventilated.

The chimney 16, contrarily to what is the case with regard to the duct 10, is used for
 30 the introduction of fresh air by difference of density and of volume. To this end, it opens in the outer air, at 20, as shown in Fig. 3. The system may comprise a third chimney or duct 21 the section of which is still smaller
 35 than the section of the chimney 16 and opens, through a port 22 at a distance 23 above the ground this distance being different from the distance between the ground and the port 17 of the chimney 16. In this case, the third
 40 chimney or duct 21 which opens also in the outer air at 24 is used for the introduction of fresh air, if, in consequence of a difference of temperature, the chimney or duct 16 would be used for a moment, for the escapement of
 45 air in cooperation with the chimney 10.

The sections of the chimneys or ducts 10, 16 and 21 being in predetermined proportions, their combined action results in complete ventilation through the continuous exchange of air caused thereby regardless of the
 50 level or volume of the room being ventilated. Without the proper cooperation of the various ducts the equality of the air in the chimneys or ducts would not exist and complete
 55 ventilation could not be obtained.

The described system has many advantages from the point of view of the renewal of the air by continuous exchanges, whatever may be the temperature inside or outside
 60 places or rooms from which it is not possible to reach the outer atmosphere in horizontal direction, such as in cellars, tunnels, ships, and other buildings. It may be also used with success to ventilate the interiors of buildings of great volume in which the ventilation

is secured by the system of differential horizontal ventilation, and in which apertures are used for the introduction of air, these apertures being arranged with different aspects in the walls of a building and cooperating with apertures for the passage of air in the separating walls of places or rooms situated on the same level. In this case, indeed, it may happen that on account of the great dimension of the places or rooms, a stopper
 70 of inert air is formed in the middle of the aerial volume to be renewed; in this case the above described system will remove the inertia of the stopper thus producing a kind of ventilation relay.

Similarly, in movable enclosures, such as railways, carriages, motor vehicles, running at a great speed, the immobility of the inner air is due to the sliding along the walls of the outer inert atmosphere which acts as a barrier at the inlet and at the outlet when there is no lateral additional pressure of the wind. The same condition results at the port of a chimney. When the speed of the surrounding air is greater than the tension of the warm
 80 gases discharged from the chimney, as in some instances, the complete escape of the warm gases is prevented by the surrounding air and there is a flow back through the chimney. In the instance of a moving vehicle, the speed of the vehicle increases the inertia of the air and renders it relatively rigid and when the atmosphere is very warm the transfer of air will not take place because of the fact that the vehicle carries a portion of the surrounding atmosphere with it. This happens, for instance, in a railway car traveling at high speed when all of the windows are open, the temperature high, and no wind blowing.

The described system is also particularly suitable for the ventilation of places or rooms which are fit into recesses or which are disposed under the ground and which have no lateral contact with the outer atmosphere; in consequence, it may be used for the ventilation of ships, tunnels, cellars, undergrounds, and the like. In each case, and according to the character of the places or rooms, a number of similar elements of ventilation may be used, each comprising on the minimum two, or a greater number of ducts or chimneys of different sections and of different lengths.

What I claim is:

1. In a system for the ventilation of a chamber or the like, a substantially vertical duct connecting the upper portion of said chamber with the external atmosphere whereby the upper strata of air in said chamber may pass upwardly and outwardly, and a second duct of relatively smaller cross section and longer length than said first mentioned duct, connecting the lower portion of said chamber with the atmosphere whereby air from the exterior may flow downwardly and into
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said chamber thus causing a continuous flow of air through said chamber.

2. In a system for the ventilation of a chamber or the like, a substantially vertical duct connecting the upper portion of said chamber with the external atmosphere whereby the upper strata of air in said chamber may escape to the exterior and a plurality of other ducts successively smaller in diameter and longer than said first mentioned duct and connecting successively lower portions of said chamber to the external atmosphere whereby air may pass into said chamber to cause a continuous change of air therein.

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