

Ventilation of the Home.
Fannie J. Cress.

Ventilation of the Home.

Introduction

Air

Composition and Relative Amounts.

Oxygen

Nitrogen

Carbon Dioxide - Test.

Ammonia

Dust and Organic Matter.

Home as a Protection.

Definition and Explanation of Ventilation

Principle of Ventilation.

Knowledge of the Ancients on this subject.

Reasons.

To remove impurities

Dust, Organic Matter and Moisture

A Popular Fallacy.

In Selecting a Method we must consider

(1) Size of the room

(2) Amount needed by each one.

(3) Amount needed in different work.

Dependent on

(1) The rate at which foul air rises

(2) The rate at which foul air is diffused.

Old Method.

Kinds of methods.

Natural Agencies.

Difficulties

Cracks and Leaks

Porous Walls.

Tubes and Shafts.

Diffusion

Perflation

Fire-place

Chimney

A Board

A Porous Brick

Heat Agency

Objects

Stove Improvements

Improved Shafts

Ventilating Stoves

Gas Stoves

Gas Light

Electricity

Improved Fire-place.

Mechanical Agency.

Fans - Electric - Propulsion.

Blowers.

Pumps.

Conclusion.

The question of ventilation although an old one, must be constantly brought to our minds or we grow careless and do not give it the attention it deserves. It is also a question, the principles of which are not well understood by the majority of people. In order that we may do our part to remedy a large amount of the injury which is done by living in ill-ventilated homes, either through ignorance of the laws of health or carelessness, it is necessary for us to study the conditions under which thorough ventilation is secured.

One of the most important things to be considered, is the air and its composition. The earth is surrounded by a covering from fifty to five hundred miles in depth, which we call the atmosphere. This consists of the air which becomes rarer and rarer as we ascend, and less able to support life. The chief constituents of the air when pure, are oxygen and nitrogen, found in the proportion, by weight, of seventy-seven parts of nitrogen to twenty-three parts of oxygen in every hundred parts air and, by volume, of four parts of nitrogen to one part of oxygen. Besides these, the air contains small quantities of water in the form of vapor; ammonia, three

parts in ten thousand parts of air; the same amount of carbon dioxide; one part of ozone in seven hundred thousand parts of air; and nitrous and nitric compounds.

The oxygen of the air is essential to the life of man but is too active and must be diluted with inactive nitrogen. It is taken into the lungs of the individual and from there distributed to all parts of the body by means of the blood. It is used in building up the system.

For a good many years it was supposed that carbon dioxide or carbonic acid was a poison but later investigations show that it is not poisonous but will cause death because it takes the place of the oxygen which our bodies require. It is always given off from the lungs in company with organic matter, the two being inseparable companions. The organic matter is a poison. So the carbon dioxide if not itself a poison indicates the presence of one. If the carbon dioxide exceeds six parts in ten thousand parts of air, it is by those occupying the room because it takes the place of oxygen, the lack of which causes the occupants to become drowsy. In air which has once been breathed there is five per cent of

carbon dioxide, and thus the air is rendered useless for breathing again.

A good test to discover the amount of carbon dioxide in a room is known as the Household Test. It was originated by Dr. Smith. Five bottles differing in size are partly filled with lime water. They are arranged in order of size and beginning at the smallest, observations are made to see in which bottle the water is cloudy. By referring to a table prepared for the purpose you can find the amount of carbon dioxide corresponding to that which would make the water in that bottle cloudy and, in this way, discover the amount of carbon dioxide in the air of the room. This test depends on the fact that carbon dioxide in certain quantities will produce a white precipitate with lime water.

Ammonia has a peculiar effect on the body, making the blood more fluid, and interfering with the process of oxidation of organic matter. An over supply of ammonia thus has a very injurious effect on the system. Its outward effects can be noted in the pallor of the cheek and the feebleness of those who live in an atmosphere containing a large amount of ammonia.

Particles of dust and organic matter in the air

render it unfit for our use. The lamps, gas, and stoves take a great deal of oxygen from the air, and return to it the products of combustion which are very injurious.

All this goes to show that it is necessary for health that we should breathe pure air, and plenty of it.

As large quantities of carbon dioxide, ammonia and organic matter are given off from the body at every breath, the air in the home must be changed and changed frequently. The home is made for our protection. Clothing serves the same purpose and, if in clothing which leaves a part of the body free, we recognize the fact that we must not exclude the air from the body, how much more necessary it is that it should not be excluded from the home where we must live day after day. The changing of the air is accomplished by means of ventilation.

Ventilation has been defined as the "maintenance of the atmosphere of a dwelling in that condition of purity, temperature, movement and moisture which is found to be most agreeable to the inhabitants and most conducive to health and vigor." As to purity it is necessary to provide for the removal of all matter which is injurious to the body in any way. The temperature must be such that the occupants of the room will feel no

discomfort and there must be no draught. The air must be kept in motion in order to successfully remove the impure air and replace it with fresh air. This is one of the essential features in ventilation. Regarding moisture, it is required that we have it well regulated. If there is too much moisture, it will give a chilling sensation to the person and, if too little, will take moisture from the body to supply what is needed in the air.

No good effects will be felt in either way.

The principle of ventilation consists in removing the impurities of the air and supplying fresh air by means of currents of air but this must be done without creating a draught. He should know exactly what is meant by a draught before going farther. It is a "one-sided cooling of the body or parts of the body by irregular radiation of heat or by cold air reaching one part of the body more than another." In order to avoid a draught provision should be made to introduce the air at a number of small openings instead of one large one and also by introducing it above the heads of the people in the room.

Even among the ancients we find evidences of the recognition of the importance of ventilation. The Egyptians in building the pyramids made use of it. In the

Pyramid of Cheops a passage has been found leading from the outside to the interior which must have conveyed the air in and out of the great tomb. We still follow the Greeks in the use of fire, as a means of ventilation, while the Romans accomplished the same object by the use of bellows.

As so many persons pay no attention to this subject, yet apparently have good health it becomes a question whether there are any reasons why we should ventilate. On examination we find several good reasons. The first is, to remove the impurities of the air. Among the impurities we find organic matter which can be detected by the odor, which we designate as a close smell, and should be removed for this reason if no other. Then there are particles of dust which get into our throats and cause us to cough disagreeably. Besides these we find germs of disease floating around in the air. The second reason is, to remove the unnecessary moisture given off with each breath. And last of all, we should supply the house with fresh air if for no other reason than the invigorating effects.

We do not notice the evil effects of

impure air because after a short time we become used to them. A tinner working at his trade becomes use to it and does not notice that the fine particles are filling his lungs until too late for the recovery of health. So it is with the impurities of the air. They are inhaled until the strength diminishes and, if disease attacks the body in this condition, there is little hope for the recovery of the patient. The ill-used body has not sufficient vitality to cope with the disease and premature death is the result. Many diseases are caused by poor ventilation but, if taken in time, fresh air will do wonders toward restoring health. In homes where fresh air is excluded, we find nervous women and children constantly troubled with colds. Many ladies who live in such homes are unable to venture out doors in the cold weather. The mucous membrane lining the throat becomes so sensitive that only a small amount of cold is necessary to inflame it and prove a very serious thing.

A popular fallacy which leads to wrong ventilation when there is a desire to do the

right thing for health, is that the impure air falls to the floor. In accordance with the law of nature that the lighter air rises and the heavier sinks to the floor, we would naturally think that air loaded with impurities would fall to the floor. And so it would if not influenced by other causes. But the fact is impure air when heated is lighter than pure air because it contains carbon dioxide which becomes lighter when heated. For this reason it is necessary to have an outlet for it at the top of the room. The fresh air should be admitted at the bottom of the room under these circumstances.

In securing a good method of ventilation, we must understand the characteristics of the room to be ventilated. A great deal depends on the size of the room and it is well to start with lofty rooms so as to have a good supply of air at the beginning. Another condition is the amount of air required by each person. Each adult needs two hundred and fifty cubic feet of air in an hour, two children requiring as much as one adult. In calculating the amount needed for a given room, we must not neglect the furniture. The amount will also

vary with the use to which the room is put. A person in walking consumes three times as much air as one sitting or lying. Hence we need in the bedroom and more in the kitchen in the same length of time.

Ventilation depends on two things, the rate at which foul air rises and the rate at which it is diffused. When the doors and windows are opened wide, the proper ventilation is not secured. Certainly plenty of air is let in but the impure air still remains in the top of the room and is difficult to remove. There is another difficulty in this method in that there is danger of leaving the doors and windows open too long, thus allowing the occupants of the room to become chilled. In winter when this method is dangerous, the air of the room can be changed completely in one and one fourth minutes and the danger lies in leaving them open half an hour or so. Some other arrangement must be made to remedy these faults.

Over a hundred years ago a writer on this subject gave a simple method of ventilation which can be profitably used today. A single tube opened from the upper part of the room, through which the impure air could

escape through the roof. Another tube was also placed in the upper part of the room near the ceiling but it ran down the outside of the house almost to the ground and through this the pure, fresh air was carried into the room.

For convenience the methods of ventilation have been divided by some writers into three kinds. The first is the natural or spontaneous method called the exterior wind agency. The second is by the operation of gravity obtained in ventilation by heat agency. And third is the mechanical means such as fans, blowers or pumps, called mechanical agency.

The natural method is one in which no special appliances are used. This method depends on the fact that there is a difference between the temperature inside the house and that outside. In any method which depends on the agency of the wind, we meet a difficulty in regulating the velocity of the wind and the amount of its movement. Another difficulty is that it cannot be in summer. While we do not realize the fact, much fresh air gets into the house under doors and through cracks and crevices in the building. But even if these are filled up there is another agency which we seldom think of.

This is the porosity of the walls. We do not notice this because it does not reach our senses. Our first thought would be that a brick house would allow more air to pass through it than a stone one but we find that more mortar is used with stone than brick and it is very porous. So one is about as good as the other.

In the use of tubes and shafts, galvanized iron or some other material which does not rust or oxidize should be used. The reason for this is that in rusting oxygen is used and this oxygen must be taken from the air. The object in introducing the air in this way is to get all the oxygen possible as we do not wish to lose any. When this method is used, the opening should be near the ground so as to secure the purest air and inlet flues should be used in the basement and lower floor.

By diffusion the gases of the air are so mixed that the air soon becomes uniform throughout. The gases brought in contact mix readily to produce this condition. By this means we can get purer air than we had before but the organic matter still remains suspended in it.

"Perflation is the setting in motion of masses of air by impact of other masses." We use this 230

method when we open two windows on opposite sides of the room. This arrangement does very well in summer when we do not feel a draught but in winter it can only be used in unoccupied rooms.

The fire place forms a good ventilator. Many people in the summer shut up the fire-place tightly so as to hide it, not realizing the benefit it would be to have purer air. In the winter a fire-place is almost an essential for this purpose. Though it the impure air is allowed to escape. The cold air follows the warm air, and if we have an inlet for the cold air, it will rush in to take of the warm air which has gone up through the chimney. The opening for fresh air should be near the top of the room so that the feet will be kept as warm as the rest of the body. The fire-place is powerful enough to draw all the cold air it needs through any convenient opening. Part of the air becomes heated and passes up the chimney while the rest rises to the top of the room, becomes cold and falls to the floor again to be again heated by the fire-place. In this way constant currents of air are produced by the fire-place. If the room is so large that it needs two grates 228

both should be placed on one side of the room or if shafts are used in connection with the fire-place they should be on the same side of the room as the grate.

The chimney makes a good ventilator. In winter when there is fire in the stoves, currents of air are started in the room and the impure air is taken up the chimney. It is a good plan to have a shaft surrounding the chimney, on one side of which is a valve so arranged that the temperature of the air can be regulated as it enters.

A very simple method is to place a board about three or four inches in width under the lower sash and all the air necessary will get in at the place where the two sash overlap. The air can be directed upward by fastening a piece of zinc to the window in a horizontal position.

In some cases it is profitable to use a porous brick the size of an ordinary one, put in the place of it. If the draught gets too strong you can easily regulate it by covering up the brick.

Heat is an important agent in the process of ventilation. The object of it is to first heat the air to the same temperature as that in the

room before it is admitted. In this way all the bad effects of cold air are overcome. Many think that because the air is warm, it is impure. This is not at all true. By special appliances the air can be heated and still be as pure as ever.

One simple method used in connection with a stove is to have a pipe communicating with the outside air. It comes up through the floor under the stove and on the top of the pipe is a fringe covering the entire bottom of the stove and about two inches high around the edge. In this way the air is heated before it is distributed into the room.

It could improve on the use of shafts as employed in the natural method by regulating the height at which the air is admitted to it. We can do this by having an aperture at the top and one at the bottom. In the winter the aperture at the top can be entirely closed and the air heated before it is taken into the room. In summer both openings are used to give as much air as possible.

Ventilating stoves have been invented in which the air is passed over steam and hot water pipes before it is taken where needed.

In some cases use is made of gas stoves. The gas will produce heat and, as the efficiency of any material depends on the amount of heat it will produce, gas answers the purpose as well, if not better, than other materials. It has been found that better effects are obtained from heating a large body of air to a small extent than from heating a small amount of air a good deal. In the former case the amount of heat required is very slight. It is well to have the apertures of such a size that the air will pass through them rapidly, producing a stronger current than the wind would. The air is admitted by large tubes or shafts of considerable length. It is then heated and passed in, at the top of the room to be withdrawn at the bottom.

The gas light may be used for this purpose but it leaves the products of combustion in the air. But this can be remedied by the use of a tube surrounding the light, which constitutes the outlet shaft. A larger one is placed around this, the two being unconnected. The fresh air finds its way through suitable tubes and apertures connected with the bottom of the outer tube. In passing through the outer one, the air 219

comes in contact with the inner tube, which raises its temperature and when ready for use produces no chilling effects. But other jets should be used for light as light is produced at the expense of heat.

The use of electricity for heating the air will be welcomed as no products of combustion from it will taint the atmosphere. At present it cannot be used to any great extent but look to it to do much good in the future.

A fire-place for ventilation was invented by Captain Galton of the British army. An ordinary flue is made of some good conducting and radiating material surrounded by another one into which the air is admitted at the back of the grate. The air coming in contact with the heated flue is warmed and it ascends in accordance with the law of nature and is then taken wherever wanted. It is admitted to the room near the ceiling. The air already in the room must find an outlet and seeks the grate as a good place. Here it is used to support combustion. In this way a great deal of air is utilized which would otherwise be lost.

Under the mechanical agency as already 203

explained we have fans, blowers and pumps. The object in each of these is to produce a current of air. Propulsion is the driving out of foul air by pure air through the agency of fans. In the larger cities where it is difficult to change the air frequently electric fans are used which consist of two plates revolving on each other so rapidly that they produce rapid motion in the air. Dining rooms are sometimes provided with wooden fans which create currents of air by rapid revolutions produced by electricity.

With so many methods of ventilation, some of which are so simple and inexpensive there is no reason why we should not have plenty of pure, fresh air in our rooms and none should suffer for the lack of ventilation.

When people persist in following out old customs even if they know them to be injurious we think of the Chinese and their blind devotion to custom. Those who carried loads on their backs were in the habit of balancing them with a stone. When some more intelligent person asked why they did not balance one load with another, they answered that their ancestors were accustomed

to use a stone and should they be wiser than their ancestors? Let us hope that we will make better use of our knowledge and be wiser than our ancestors. So we will grow stronger and better able to do more good in the world.