- - - HEATING AND VENTILATION.- - -

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1[1].Introduction.

1[2].Demand.

2[1].Definition of Heat.

1[2].Discussion.

1[3].Laws.

2[3].Maintainance of proper degree.

3[1].Relation of Heating to Ventilation.

1[2].Methods of Heating and Ventilating.

2[2].Heating and Ventilating combined.

4[1].Pure Air Defined.

1[2].Amount Necessary.

2[2].Methods of Introducing Air.

3[2].Rules.

5[1].Conclusion.

Only twenty-five years ago, little attention was paid to the proper heating and ventilating of buildings, and little was really known about this extremely important scientific subject. But today the knowledge of it and its importance in regard to the great mass of people is becoming more fully realized, and rapid strides are being taken in the practical application of the principles of heating and ventilating.

The demand for artificial heat depends on the climate of the country in which, and the character of the people to which, the heat is to be supplied. The proper temperature for a room in this country is 70° F. tho a play-room, where active exercise is taken, may be heated only to 50° F. In England, on account of the extreme humidity of the atmosphere, it is not necessary to have such a high temperature. Artificial heat is necessary in our latitude during the greater part of the year.

Heat is a sensible quality of objects. It may be measured by means of scientific instruments, but we can tell about it only as we compare a body with other bodies, i e, a body is hotter or colder in comparison with another body.

There is a certain law,well known to chemists, called the "law of diffusion of gases", which states that if two gases are in contact, they will mix and inter-mix, until the resultant is a perfectly mixed or diffused combination of the gases.

Another well-known law is that heated air expands. When heated air and cold air are brought in contact with each other, since the heated air is expanded, it takes a greater bulk of the heated air to be the same quantity of cold, and so is also of a different quality than the unheated, by the law of diffusion of gases just stated, they

will tend to mix, seeking equilibrium. These two facts are of extreme importance in the science of heating and ventilating buildings.

The maintainance of the proper degree of temperature is one of the great problems in perfect heating, and the loss of heat from various sources is quite a large and important factor. The diagram compiled by Wolff, on the foregoing page, shows the loss of heat from buildings and walls. In the diagram, the distances in the horizontal direction represent the required difference in temperature between that of the room and the outside air; the diagonals represent different radiating surfaces of buildings doors, etc, and the heat transmitted per square foot of surface per hour is given by the number in the vertical column.

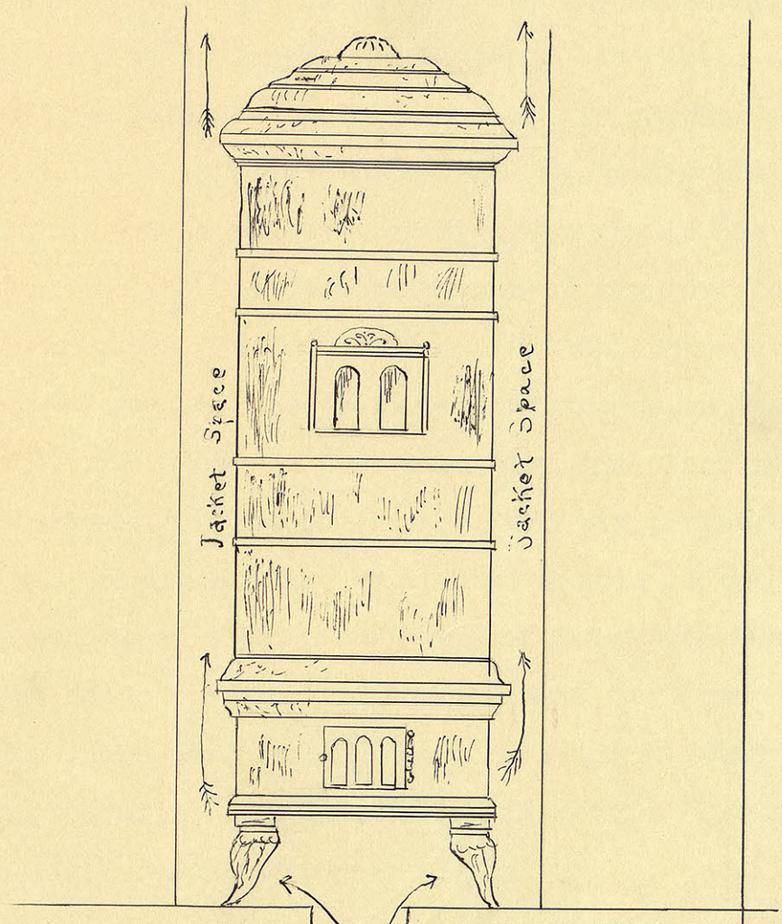
The relation of heating to ventilation, is very close and intimate. To heat a building properly with the required amount of pure air constantly flowing in and kept equally distributed avoiding currents, is the greatest problem and many and various are the methods devised to keep a building heathful and comfortable. The object of all heating and ventilation is to get a pure atmosphere at a proper and equable temperature.

There are various ways of doing this. The most primitive method of heating was the open fire. The Romans used portable stoves and chafing dishes. In Italy and Spain, even now, the brasier with the burning charcoal is used for heating purposes.

Fire-places, used by our grand-parents, are so expensive and give so little heat in proportion to the amount of fuel they consume, that they are not now so much used.

Fire-places can be made quite comfortable in moderate weather, but in severe weather, when the heat is most needed, they fail of the purpose for which they are designed.

Stoves are the most common means of heating used. But when cost is not such an important item, they give way to various other



Heating By Stove.

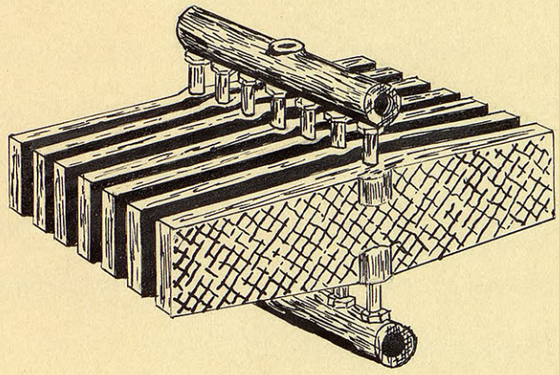
systems of heating. However, since the greater amount of heating is done by this means, I will offer a few suggestions by which improvements can be made, on this nearly universal method of heating.

When the stove is so small that it must be heated very hot in order to raise the temperature of the room to the necessary degree, it will be found a very good plan to place around the stove, a jacket or screen, which will accelerate the currents of air flowing around the stove, and so will heat more air and effect materially the distribution of the heat. This can be easily seen by referring to the illustration on the preceeding page. The jacket is made of zinc or sheet iron, which entirely surrounds the stove except in front where it is necessary to leave it open to gain access to the stove; the space inside the jacket surrounding the stove is connected thru the floor with the outside air. There must also be an exit for the air or there will not be any outflow of the heated air, or inflow of cold to the stove.

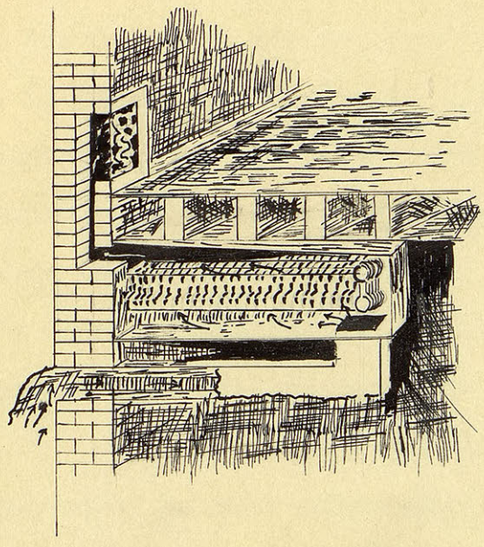
Other methods of heating such as hot water and steam need some attention. But hot water is very expensive as the first cost, and it will occupy a large part of a cellar; yet when in operation it takes less fuel to run it than steam. This method is not very much used, being confined mostly to green-houses.

Steam heat is the cheapest method of heating, tho part of its popularity seems to be due to the fact that the architects who design the buildings pay no particular attention to the details of the heating plan; and it is much easier to put up a steam heating apparatus which will work, than a satisfactory hot water appliance; but usually even tho they do work, it is not properly done, and necessary ventilation is also overlooked.

Some of the advantages of steam heat are (1) it is more easily regulated, (2) it allows changes in heat to be made quicker, (3) it can be carried longer distances without being reheated. Then, too, the pipes are smaller, cheaper, and more easily arranged.



INDIRECT HEATING SURFACE.



ARRANGEMENT OF INDIRECT HEATING SURFACE.

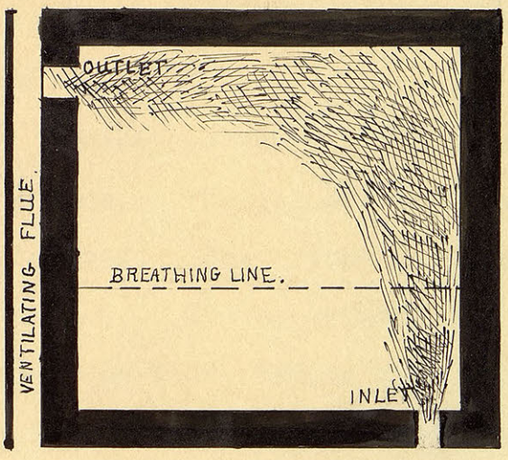
Its principle disadvantages are that it requires constant attention to keep up the heat; the apparatus is also more dangerous, unless regulated by proper persons.

The hot air method is perhaps one of the best. Certainly when combined with direct radiation it cannot be surpassed. Direct radiation is that in which the heating apparatus is placed in the room to be heated, coming in direct contact with the air. This applies to stoves, fire-places and radiators heated with steam or hot water. If the direct radiation by means of any appliances above mentioned is used to heat the air already in the room, and then pure fresh, heated air is passed into the room, this method of heating certainly cannot be much improved upon. By referring to the plate, preceding this page, this method of indirect heating can be seen as it appears in operation. Fresh air from the outside is passed over the heating surfaces, and this heated air passes thru the register into the room. The air being, fresh, having come from the outside, secures good ventilation, at the same time that the room is heated. The box or casing is usally made of wood, lined with bright tin, but a masonry one is better. The flue leading from it should be of masonry, or galvanized iron, and the box should have a door to permit of cleaning.

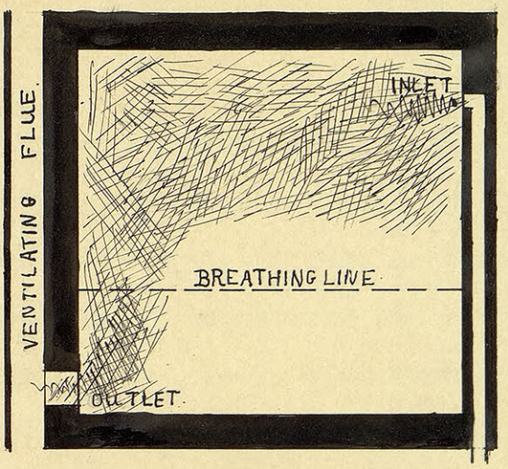
Electricity as a means of heating is so costly that its use is not practical, and so is not very extensive. For this reason, I will not speak of it.

Pure air is composed of seventy-nine parts of nitrogen and twenty-one parts of oxygen, with four parts in ten thousand of carbonic acid. Whenever the amount of carbonic acid increases to six in ten thousand, the air is unhealthful. The air must be constantly renewed to prevent an accumulation of this gas.

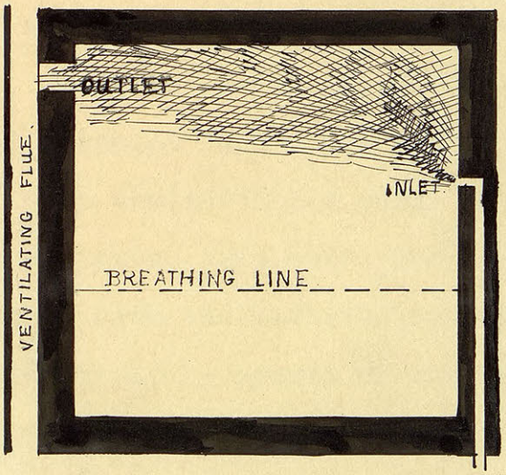
Every person must have from thirty to forty cubic feet of air every minute to get the proper amount of oxygen necessary. Besides this the fires and lamps use a great quantity of oxygen, and this is



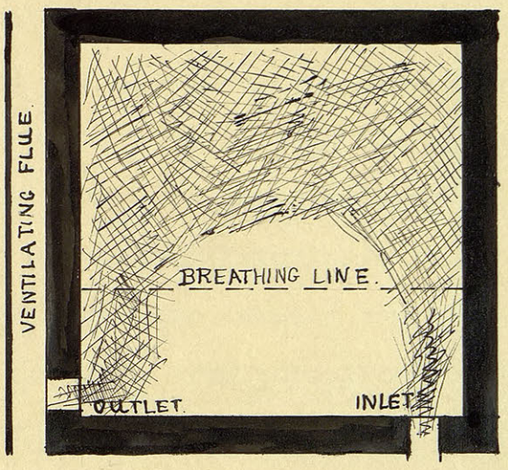
AIR INTRODUCED AT BOTTOM, DISCHARGED AT TOP.



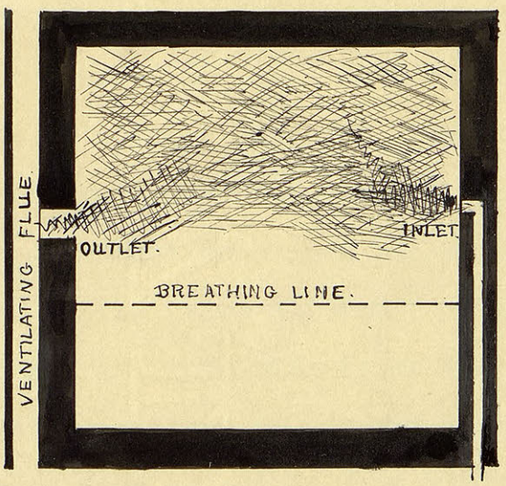
AIR ADMITTED ON SIDE, DISCHARGED NEAR BOTTOM.



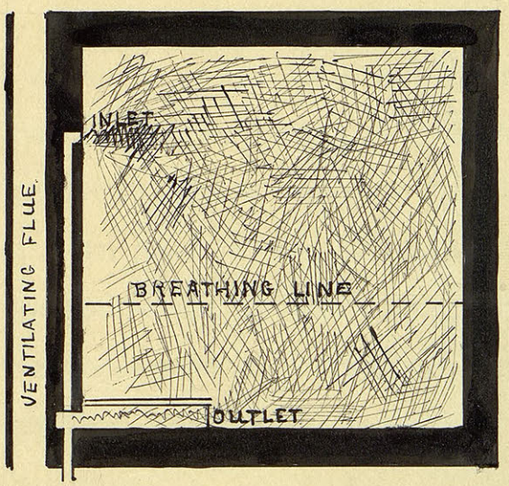
AIR INTRODUCED ON SIDE, DISCHARGED AT TOP.



AIR ADMITTED AT BOTTOM, DISCHARGED NEAR BOTTOM.



AIR INTRODUCED ON SIDE, DISCHARGED ON OPPOSITE SIDE.



INLET NEAR TOP, DISCHARGED NEAR BOTTOM.

the reason why so much depends on the proper ventilation of a building. Pure air is of much greater importance than the heating of a building or room.

There are various means by which we can introduce fresh air into a room. The illustrations preceding show several poor ways and one good way. The figures are sufficiently plain to need no further explanation. The experiments on which the illustrations are based were made by W. R. Briggs in a miniature school room, with smoke passed in so that the direction of the air currents could be seen. The last figure, No. 6, shows the most perfectly ventilated room with the inlet near the top, so that as the air cooled it would fall toward the floor, and after reaching the floor it was carried off by means of the outlet situated just above the floor on the same side as the inlet.

In ventialting a room, the air should be so introduced as to avoid draughts, this being one of the greatest difficulties to be overcome, with the distribution of the fresh air equally over the room. Windows should be opened on the side opposite from the direction from which the wind is blowing. The upper sash may be lowered, drawing the curtain down over the opening, - this gives two openings without a draught.

One of the best methods is to raise the windows about four inches, placing a board in front of the opening between the two sashes, this prevents currents, and is a method which can be used at any time.

In most dwellings and especially in most of the schools there is too little space allowed for each person - too little fresh air admitted, in proportion to the number of persons. Even in some places where there is a sufficient quantity, the manner of obtaining it is so poor as not to give the desired results. Many evil effects in after life are attributable to improper ventilation of schools, and if death does not result, poor health nearly always does. When people, especially children, are exposed to foul air, it may result in

"heaviness, headache, furred tongue, quickehed pulse, febrile symptoms, thirst, loss of appetite, catarrh, bronchitis, consumption, typhus and typhoid fevers, diptheria, scarlet fever, croup and any contagious disease." It also shortens life. "Pure air would result in the saving of millions of money and greatly diminish human suffering.