

Heating and Ventilation of School Buildings.

By Parker Keeler.

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Outline.

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The right temperature for a school room

Complete ventilation impossible.

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Conclusion.

Heating and Ventilation of School Buildings.

About thirty years ago America began to realize the importance of the subjects of heating and ventilation, especially as applied to school buildings, though not until recently have these subjects received anything like the attention they deserve.

A large percentage of all children under fifteen years of age spend a great part of each year inside the schoolroom, and consequently a careful study of the healthfulness of these buildings is of the utmost importance.

Children during school age are in their period of most rapid bodily growth and if we would secure equally rapid mental development we must first look to their physical conditions. Both mental and spiritual growth are dependent upon the bodily conditions. The tissues of the body are being rapidly renewed and impurities are thrown off from the lungs and through the skin very rapidly. A great many children are crowded in a small space, and if the

air is not frequently renewed it soon becomes extremely dangerous to health and life.

In our climate, it is impossible to have, at the same time, good ventilation, sufficient heating, and cheapness. The average board of school trustees are unwilling to spend a large sum of money for proper ventilation, owing to their limited means and to their ignorance of the importance of the subject. Good ventilation is expensive. It costs considerable to put in good ventilating machinery and the constant cost of running the machinery is considerable. But should we do without it on that account? Shall we place a price on health? No! Upon the health and vigor of the schoolchildren depends the life and prosperity of the nation.

The two subjects, heating and ventilation necessarily go together, and we cannot consider one without the other.

The right temperature for a school room in our country is from 65 to 70 degrees, though in England, owing to the larger amount of moisture in that climate, 59

degrees is the standard.

Complete ventilation, that is to keep the air in the schoolroom as pure as that outside, is manifestly impossible. We can only strive to keep the vitiated air diluted with pure air to a certain standard of purity. A common erroneous idea is that it is the presence of carbonic acid in the air that makes it impure. While the tests for ascertaining the purity of air consist in determining the amount of carbonic acid in the air, it is only because of other impurities found in company with carbonic acid which are hard to detect.

The question at once arises; how shall this impure air be replaced by pure air?—a question easy to ask but more difficult to answer. There are two general systems of ventilation by mechanical means. One is by propulsion and the other is by extraction.

In propulsion, fresh air is forced into the room to drive out the impure air. In very warm weather the air may be retained in underground chambers, where the soil is pure, long enough to

be cooled before entering the rooms.

In extraction the impure air is drawn out of the rooms and pure air allowed to flow in and take its place. In cases of extraction it has been found best to provide one extraction shaft to which the extraction flues from each room are connected. Thus but one fan is required to ventilate a whole building.

In ventilating, care must be taken to prevent draughts. The air should not move at a greater velocity than 120 feet per minute where it can strike the person. In designing a school building, from 150 to 200 cubic feet of air space, and at least fifteen feet of floor space, should be allowed to each pupil.

During cold weather, when the school room requires heating, the heating and ventilation are usually combined.

Heating by stoves is the most common method in one or two room school buildings. This is the most economical and, if done in the right way, both in respect to heating and ventilation, is an excellent way. The stove should be three

or four times as large as is commonly used. A good method is to surround the stove with a round jacket of sheet iron six or eight inches from the stove and reaching from the floor to some distance above the top of the stove. A fresh air passage is secured through the floor to the outside of the building but never to the basement. The motion of the air is much ^{more} rapid with the jacket than without, and the warm air is rapidly diffused throughout the room. Persons near the ~~the~~ stove and those at the farthest part of the room are equally comfortable.

The ventilator opening enters a shaft close to the floor, the shaft being prolonged upward above the top of the building. In addition to this ventilator, it is necessary to have another near the ceiling to be opened only when airing out the room while it is empty.

When the stove is not needed, the air inlet is placed near the top of the room. To prevent the inside air from passing out of the inlet a device known as the Eureka ventilator may be used. This consists of openings through a double wall,

the outside opening being considerably below the opening on the inside. The air enters the outside opening and passes upward between the walls and then enters the room near the ceiling. Slats like ordinary window blinds are placed across both openings, the outside slats to shed water in a storm, and those on the inside to give the air an upward motion and diffuse it through the room and also to prevent the air from striking the heads of the pupils. A hinged trap door operated by a pulley and cord, may be arranged to close the ventilator when not in use.

School buildings of several rooms can seldom be successfully heated or ventilated by means of stoves. There are three general methods of heating where stoves are not used, namely; by means of hot air, hot water, and steam. All have their advantages and disadvantages. Different authorities differ as to which of the three methods is best for the school room.

In the hot air system, the buildings are heated by furnaces placed in the basement. One furnace may be used

or several close together. They are thus easier attended to than stoves. All dust, dirt, and confusion in the schoolroom is also avoided. Another great advantage comes from the fact that it is impossible to heat with hot air without having ventilation. If the hot air is to pass into the room provision must be made for the removal of the vitiated air.

In small buildings hot air is probably best. It takes less care and the rooms can be heated quicker than by steam or hot water. They can also be cooled down quicker and fuel may thus be saved.

There are several disadvantages in the use of hot air. Unlike radiant heat, the air is warmed, and not the walls and furniture of the room. If no provision is made for moistening the air it dries out the throats and lungs of the pupils and causes diseases of these organs. It also damages the walls and furniture of the room by shrinkage and drying out. Shallow pans of water may be placed where the warm air will pass over them before entering the room. There is danger however of getting too much moisture in the air. This is also

injurious to the pupils and destroys the furniture, books, etc.

A great mistake that has often been made in heating by this method is to heat a small quantity of air to a very high temperature, instead of heating a large quantity to the necessary temperature. The temperature should never be raised above 100 degrees Fahrenheit. Frequently the effort is made to force the air into the room without providing for the removal of the foul air. This is manifestly impossible.

Steam and hot water systems are often preferred to the hot air system. One reason for this is because steam and hot water can be conveyed long distances. One heating plant can thus be used for several buildings, while with hot air the furnaces must be near the rooms to be heated. The danger of heating the apparatus to an excessively high temperature is not so great with hot water as with hot air, as it is impossible to raise the temperature much above 212 degrees with hot water. The hot

water system however is little used in this country, except in greenhouses. With steam heat there is some danger from fire where the pipes come in contact with the wood.

It is not the best plan to have the radiators in the class rooms either with steam or hot water, though this will do for halls and corridors. The best way is to place the radiators at the bottom of a fresh air flue. Each radiator then acts as a separate air furnace.

There is yet much room for improvement in the methods of heating and ventilation. While much has been done in the last few years probably much more will be done in the near future, since people are beginning to realize how important these subjects really are.

The school buildings of the future will have the best heating and ventilation that money, skill, and ingenuity can procure, while the school children will be healthy, robust, and wide awake, instead of the dull, listless, pupils we often see in the poorly heated and poorly ventilated

school houses of today.