

HEATING AND VENTILATION.

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THIS subject receives too little thoughtful attention from those who build school-houses, or from those who have the responsibility for their construction. Very few school-houses have proper or adequate provision for ventilation. Indeed, scientific investigation has hardly determined the conditions and means necessary.

Pure air in sufficient quantities for respiration must be entering the room at all times, and it must be warmed before coming in contact with the pupils. In rooms thoroughly heated by furnaces, the necessary supply of warm air comes in through the registers. When rooms are heated by direct radiation, whether by stoves or steam-radiators, provision should be made to admit free air in such manner as to come in contact with the heating surfaces before distribution.

The second condition necessary to secure ventilation is a proper arrangement for removing the foul air. This must be done by means of openings of sufficient size into air ducts, *heated so as to insure a strong draught*. All chimneys should be built sufficiently large to have two or three flues—a small one for smoke, and one or two others, depending upon the number of rooms to be ventilated—to carry off the foul air. From every room there should be two openings of sufficient size into the ventilating flues—one near the ceiling, one near the floor. The heated air of the room always rises to the top because of its comparative rarity, while the noxious gases from the body and breath will be found in all parts of the room because of the law of diffusion. In order to warm the room the upper

register must be closed, so that the warm air may not escape, and the lower register must be open, so that the cold air may pass out and allow the warm air to descend and fill the room.

The ventilation should be principally through the lower register, to draw off the stratum of air in which the pupils are placed when in their seats, and which becomes impure from contact with the body and by respiration. The upper register should be closed when the room is cold, partially open when the room is warm, and wide open when the room becomes over-heated. The register near the floor should be wide open at all times, as only cold, impure air will escape through it.

These statements are based upon philosophical principle; but, as facts and figures are more convincing to some people, the following experiments are noted:

The school-room used for the tests has proper means of ventilation, upper and lower openings into a chimney. First experiment: The chimney registers were closed so that no air could escape, and a strong current of hot air from the furnace was admitted to the room. Thermometers were placed upon the wall at the top of the room, at the middle, and at the level occupied by the pupils when in their seats. Result: The mercury in the highest thermometer rose 14° in thirty minutes, reaching 72° ; in the middle thermometer, 12° ; in the lowest thermometer but 8° , reaching a temperature of only 55° , nearly 15° below the standard. The warm air was entirely above the pupils' heads, even