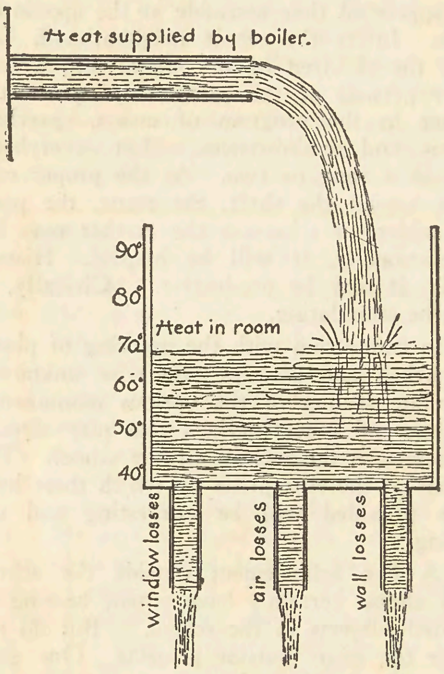
IV

SCHOOL HEATING

School ventilating and school heating are matters that have such an intimate bearing on the health and the intellectual activities of children that it seems worth while to examine in non-technical terms the principles that underlie these matters.

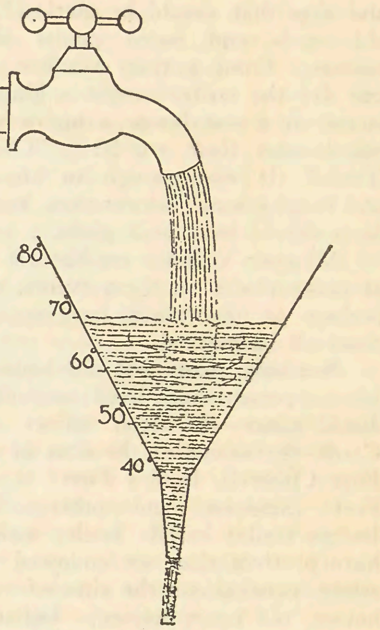
A heating system is an exact analogy to a tank with one inlet representing the heating plant and several outlets representing the various losses of heat from the building.



(Figure No. 1)

Let the height of liquid in the tank represent the temperature in the building. (See figure No. 1) You will note first, that as the liquid rises in the tank the increased pressure causes more liquid to flow out the bottom; second, that unless more liquid is coming in the top than was going out the bottom it will be impossible to fill the tank no matter how long the flow continues; third, that if the rate of liquid coming in is faster than the outlets can take it out when the tank is filled to the point marked 70 degrees, the tank will continue to fill up beyond the proper point. Stated in terms of heating a building, it will get too hot.

These facts are as true for a heating system as for a tank, and it is the difficulty of gauging exactly the proper flow into the tank or building that causes most of the difficulty in heating. Anyone can see how accurate must be the flow into the tank to hold the level exactly at the same point.



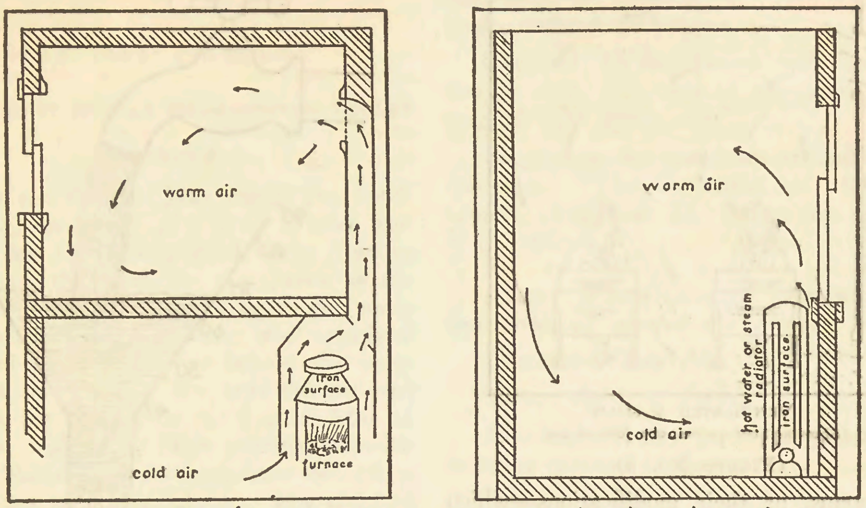
(Figure No. 2)

Try a simple experiment by placing a funnel under the faucet and see if you can regulate the faucet so that the water stays at the same level in the funnel—say one inch from the top. (See figure No. 2) In heating, this is further complicated by the changing winds and outside temperatures which tend to vary the amount of loss.

The writer frequently hears discussions as to the relative merits of steam, warm air and hot water heating systems. In effect they are exactly the same. All are warm air systems. The heat which you feel is the heat of warm air.

This air is in every case heated by its passing over hot iron. (See figure No. 3) Whether the iron is a furnace or a radiator makes no difference so long as the air leaves the iron at practically the same temperature, which it does in all modern plants. Often the terms "dry heat" and "moist heat" are applied to different plants. There is no such effect in the heating itself.

Moist and dry heat are caused by the rel-



Sketch showing how all Heating Systems work by passing air over iron surfaces.

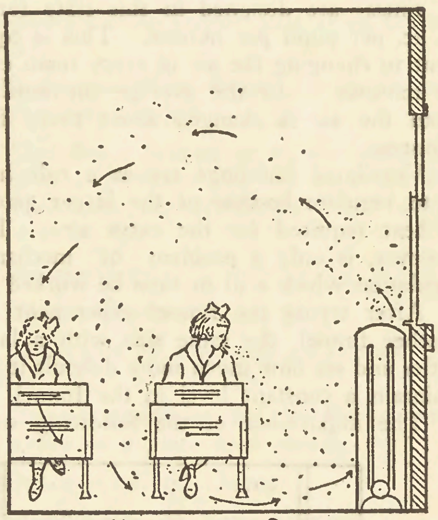
(Figure No. 3)

ative amount of water in the air. Warm air needs more water than cold air for comfort. When the air is passed over a furnace or radiator, unless more water is added it feels dry. In modern heating systems this is to some extent provided for by the use of water pans to supply the additional water needed. In un-ventilated buildings the breath and bodies of the occupants throw off, in time, enough moisture (frequently of a very dangerous character) to give the feeling of moist heat. At the present time there has not to the writer's knowledge been provided an entirely satisfactory moisture control device. In this connection it might be well to remember that:

A stuffy room usually means
too hot or too hot and too moist
A chilly room usually means
too moist and too cool
A dry room usually means
well ventilated room but not enough moisture

It has not been many years since it was thought that anything that would heat was satisfactory. (See figure No. 4) A stove or fireplace in a room usually provided sufficient ventilation because air was taken up the flue. At present, ventilation is demanded and in the future both proper ventilation and proper humidity (moisture) will be regarded as necessary.

Ventilating is done for two purposes, to insure an ample supply of oxygen for breathing and to prevent the spread of disease by removing bacteria as soon as they are breathed out or thrown off by the human body. (See figure No. 5) Either of these reasons is sufficient to make compulsory ventilation of schools a part of the state laws.

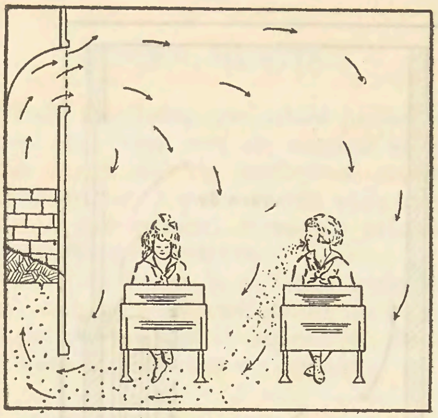


UNVENTILATED ROOM.
Showing how germs are spread.

(Figure No. 4)

In many states it is required that not only schools but theatres, picture shows, churches and all other places where crowds gather, be ventilated.

Both steam blast systems and warm air



Ventilated Room
Showing how germs are forced out.

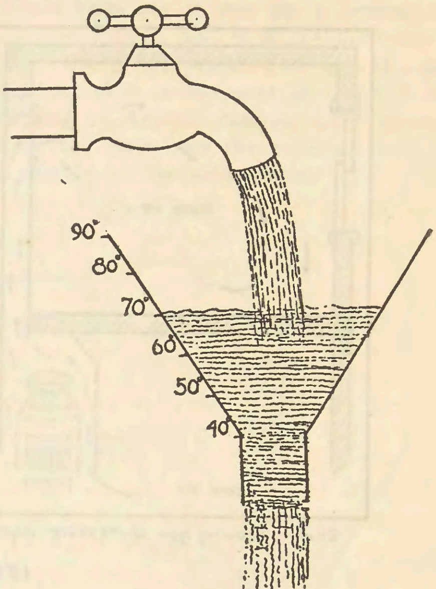
(Figure No. 5)

blast systems, or their modifications—which are at present the only ones suited to furnish the proper amount of air for ventilation at all times—are designed in this state for 30 cu. ft. per pupil per minute. This is equivalent to changing the air in every room every six minutes. In the average un-ventilated room the air is changed about every forty minutes.

Ventilated buildings are as a rule harder to regulate because of the larger amount of heat required for the extra air. This, however, is only a problem of mechanical regulation which will in time be worked out.

After trying the funnel experiment take another funnel, the same size with a larger outlet and see how much more difficult it is to maintain a constant level in the funnel.

The importance of the following words



(Figure No. 6)

of caution are illustrated by Figure No. 7. In ventilated rooms don't open the windows, or the fresh heated air which comes in near the ceiling will go out the window, leaving the impure air pocketed down where the children breathe. If it gets too hot or too stuffy have the janitor (if you have no control device in the room) open the fresh air damper. If you are in an un-ventilated room, keep the window open as much as possible and always make it a point to air the room thoroughly at all recess periods and as often as possible between times.

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Sketch showing effect of an open window in a Ventilated Room.

(Figure No. 7)