for the growth of each variety of mildew, but this growth can best be inhibited by depriving the mildew of water or by the use of chemical treatments. Too high a temperature (over 100 deg. fahr.), combined with low relative humidity, may cause the book materials to become brittle. A temperature much below freezing (25 deg. fahr.) may cause permanent deterioration of the glue.

The relative humidity should be maintained between 40 per cent and 70 per cent, although these limits may be exceeded in either direction for short periods of time. If the relative humidity gets much below 40 per cent, first the glue and then the paper will tend to become brittle. This will not cause any permanent damage unless the book is used, or rather abused, while in this condition. Subsequent increase in humidity will bring the materials back to their normal condition. If the relative humidity gets much above 80 per cent, the growth of mildew may be expected.

The tendering, brittleness, and yellowing of books, which are usually looked upon as signs of age may be caused by oxygen plus moisture or by sulphuric acid. The effects can be diminished by using a grade of paper which is as nearly pure cellulose as practicable. The deterioration of the leather bindings can be retarded by occasional applications of neats-foot oil. Sometimes leather and paper contain small amounts of sulphuric acid, put in during the manufacturing process. Such leather or paper is not so suitable for book making as that which is entirely free from acid. The glue used in making books should contain a preservative to prevent any decomposition from the growth of bacteria or mildew. It should also contain some plasticizing agent, such as glycerol, to offset the effect of exposure to low humidity.

Books should be protected, as far as possible, from exposure to direct sunlight, since this accelerates the deteriorating action of other agencies.

11. OZONE AND VENTILATION

THE GUIDE, 1930, contains a bibliography and description of the physical, chemical and germicidal qualities of ozone, with instructions and formulae covering its most effective applications. Ozone is a product of short wave ultra-violet light and is especially valuable in ventilation as a deodorant. The process of ozonating in addition to producing ozone also supplies a considerable percentage of ionized oxygen. Any air which has received ionized oxygen is comparable with the unheated bracing pure air of the country on a sunny spring day.

12. UNIT "COOLERS"

An interesting development is the production of unit recirculating heat absorbers for cooling and dehumidifying the air in rooms occupied by human beings. A device similar to a unit heater, equipped with an electric fan and having a drainage connection to care for condensation is placed within the room, and the cooling accomplished by means of brine circulated through the apparatus. In the case of non-poisonous refrigerants, direct expansion within the heat transfer-surfaces is permissible. For ordinary applications, an air-cooling machine of this type will absorb approximately the heat required to melt 100 lb of ice per hour.

13. ZONING OF HEATING AND VENTILATION

Engineers are paying more and more attention to the control of heating and ventilating equipment with reference to the changing daily outside conditions.

Substantial fuel savings are possible with central manual control whereby the heating may be accentuated on the colder sides of the building, or reduced on the warmer sides of the building. Savings in the fuel cost of hotels, apartment houses and office buildings are often made possible by means of control by zones. Much of the fuel saving by this zoning is affected by the prevention of too many open windows on the leeward or sunny sides of the building.

Remote-controlled, electrically or pneumatically-operated valves are obtainable, and the design of any large building which has no provision for zoned operation is subject to criticism. The various remote supply valves may be operated by thermostats or may be under manual control, or by throwing one switch either type of control may be selected. It is possible also to indicate at a central point, accurately and at low cost, the temperatures throughout the building, which information of course furnishes the inspiration for use of the manual controls. The effect of sunshine on building heat-demand may thus be followed around the building each day.

A further, very simple refinement may cause the fuel-burning device, such as stoker or oil burner or gas flame to be shut down whenever the last zone valve closes, and to resume operation whenever the first zone valve opens, no matter which one this may be.

14. SUN EFFECT ON BUILDINGS

The absorption of solar radiation in the summer by the surfaces of a building exposed to the sun has an important bearing on the capacity of the refrigerating equipment required for air conditioning. These surfaces may be the exterior walls or the roof of the building, or interior surfaces which receive the sun's rays through window glass.

Heat Transfer through Exterior Walls and Roofs

When equilibrium has been established, and the rate of heat flow is therefore constant, the heat transmitted per hour through a wall or roof is equal to the product of the conductance of the structure from the exterior surface to the interior air and the difference between the exterior surface temperature and the interior air temperature. This relation is expressed as follows:

$$H = C_1(t_r - t) \qquad (1)$$

where

H = Heat transmitted through wall or roof, Btu per hour per square foot.
C_1 = Conductance of wall or roof between exterior surface and interior air, Btu per hour per square foot, per degree Fahrenheit difference in temperature.
t_r = Exterior surface temperature, degrees Fahrenheit.
t = Interior air temperature, degrees Fahrenheit.

Under actual conditions, the heat flow due to sun effect is almost never in equilibrium because of the heat capacity of the wall or roof structure.