4. DAIRY BARN VENTILATION

The following are the salient requirements of dairy barn ventilation:

1. For good ventilation, there should be provided about 3,500 cu. ft. of fresh air per hour per 1,000 lb. of live stock weight.

2. A strong convective circulation is generated by the heat from the bodies of the stock, causing an upward movement toward the ceiling, about them, and a consequent downward movement at the walls.

3. Intake openings should be located in the walls near the ceiling so that incoming cold air, falling toward the floor, will accentuate the convective action induced by the heat within.

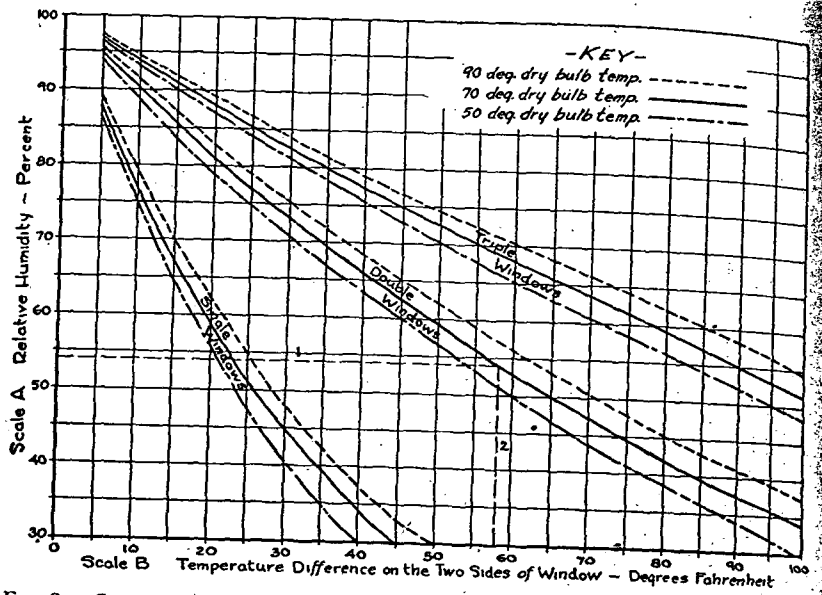

FIG. 2. SATURATION CURVES SHOWING RELATIONSHIP BETWEEN RELATIVE HUMIDITY AND TEMPERATURE DIFFERENCE FOR SINGLE, DOUBLE AND TRIPLE WINDOWS

4. Outlet openings seem to function merely as exhaust ports, to relieve the interior pressure, and appear to have little influence on the direction of air currents. Hence, the spacing or distribution of outlet openings is rather immaterial, so long as the required aggregate area is provided. Area of outlet openings should be about one-third greater than intake.

5. It is better to take the air out at the floor than at the ceiling, since by the former there appears to be a larger volume of warm air held in the stable, which contributes to better temperature control.

6. The active circulation resulting from the down-flowing cold air entering at openings in the walls near the ceiling, cooperating with the convective action induced by the heat of the animals, effectually prevents condensation and keeps the air fresh and odorless.

5. GOVERNMENT BUILDINGS (MECHANICAL EQUIPMENT FOR)

THE GUIDE, 1929, contains a chapter on this subject by N. S. Thompson of the Treasury Department. It contains data on the proportioning of

plumbing fixtures, sewers, water services, fire protection, etc. It also gives rough approximations for determining the wattage for illumination, the number of elevators and the amount of heating surface in radiators. Data is given covering the average fuel and labor and maintenance costs for about 1,400 Treasury Department Buildings. The following is quoted therefrom:

Roughly, 5/10 lb. of coal per cubic foot is required per year for heating the ordinary building, while in buildings containing electric generating plants 1 lb. of coal per cubic foot is approximately correct for all purposes. Roughly, the maximum electrical demand in the large buildings averages 5/10 k.w. per square foot of gross floor area.

For boiler room repairs allow $2.00 per horsepower nominal rating.

For engine room repairs allow $2.00 per annum per kilowatt total nominal rating of generator.

For boiler and engine room supplies allow $2.00 per annum per horsepower of boilers installed.

Boiler room labor averages $2.00 per ton of coal fired, based on an 8 hour shift and 48 hours per week.

Ash removal averages 1/8 of a cubic yard to each ton of coal burned and is estimated to cost $1.00 per cubic yard to remove it.

The labor in a Federal Building containing an electric generating plant will roughly average the same as the cost of the coal, supplies and repairs to the boilers and electric generators.

The fixed charges for machinery in a Federal Building are 3 per cent interest and 5 per cent depreciation per annum on engines, boilers, etc., while on buildings, tunnels, etc., 2 per cent depreciation per annum is allowed.

The annual dividend which must be earned by the ordinary isolated Federal plant in comparison with the purchase of current from a public utility company is 10 per cent on the cost of the Government plant.

6. GREENHOUSE HEATING

It is important that the heat shall be diffused evenly, that there shall be no high-velocity air currents, especially for flowers, and that no rapid temperature fluctuation shall be permitted.

Steam and hot water systems both are used in greenhouse heating. Electrically propelled unit heaters have been used with good results. Unfortunate results occasionally are encountered with all of these different kinds of apparatuses.

Table 1 gives the usual temperatures required in greenhouses. The heat losses from greenhouses are computed the same as are the heat losses from other types of building. The service is for 24 hours per day, and the peak demand occurs when the weather is cold and there is no sunshine, as at night. Leakage of air through cracks in the glass frames is not serious since in cold weather these freeze due to condensation, and seal tightly with ice. The boiler in a greenhouse must always be selected on the basis of the heat demand and will seem large in proportion to the square feet of radiation, since greenhouse radiators or convectors usually are highly efficient. The piping, where direct heaters are used, is designed usually with a view to the kind of plants to be grown, though there is some tendency to use side wall and free hanging overhead heating surface in preference to piping under the plant benches.

It is probable that there are more low-pressure steam heating systems in greenhouses than any other kind of system. It is highly desirable