at the same time leaving the product in a satisfactory condition of regain for commercial reasons.

As a rule, commercial regain standards are specified percentages which by test have been found equivalent to a so-called *standard atmosphere* with which the goods would be in hygroscopic equilibrium after prolonged exposure. Committee D13 on Textiles of the *American Society for Testing Materials* has adopted a relative humidity of 64 to 66 per cent and a temperature of 70 to 80 F as the standard atmosphere for textile testing.

ATMOSPHERIC CONDITIONS REQUIRED

The most desirable relative humidity during processing depends upon the product and the nature of the process. As far as the behavior of the material itself and its desired final condition are concerned, each material and process represents a different problem. The best relative humidity may range up to 100 per cent. Similarly the most desirable temperature may range between wide limits for different materials and treatments. Extremes in either relative humidity or temperature require relatively expensive equipment for maintaining these conditions and controlling them automatically. Also, in departments where people are working, their health, comfort, and productive efficiency must be considered. A compromise often is desirable.

It is generally considered that relative humidities below 40 per cent are on the dry side, conducive to low regains, a brittle condition of fibrous materials, prevalence of static electricity, and a tendency toward dryness of the skin and membranes of human beings. At the other end of the scale, humidities above 80 per cent are relatively damp, conducive to high regains, extreme softness, and pliability.

Table 2 lists desirable temperatures and humidities for industrial processing. In using this table, care must be taken in qualifying the process. In preparing many materials, conditions are not maintained constantly, but different temperatures and humidities are held for varying lengths of time.

AIR CONDITIONING OF LIBRARIES[1]

Temperature has little effect on the preservation of books. A temperature over 100 F, combined with low relative humidity, may cause the book materials to become brittle, while a temperature much below freezing may cause permanent deterioration of the glue in the binding. The relative humidity should be maintained between 40 and 70 per cent, although these limits need not hold 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 which will not cause any permanent damage unless the book is used while in this condition, as a subsequent increase in humidity will bring the materials back to their normal condition. If the relative humidity gets above 80 per cent, the growth of mildew may be expected.

One of the principal agents of destruction and deterioration of paper and books in libraries is sulphur dioxide gas in the air. If air containing

[1]See *U. S. Bureau of Standards Bulletin No.* 128 entitled A Survey of Storage Conditions in Libraries, by Kimberly and Hicks.

sulphur dioxide is allowed to come in contact with cellulose, the principal constituent of paper, sulphuric acid is formed on the surface. This acid is not volatile at ordinary temperatures and therefore accumulates throughout the life of the paper. The destructive effect of the acid on the paper is independent of the relative humidity of the surrounding air. Low alkaline concentration spray water may be used in an air washer to neutralize the acid condition. Such an air washer must be especially constructed to resist corrosion.

BANANA RIPENING

Ripe bananas are very perishable and for this reason men who deal in them must depend mainly upon control of the ripening speed as a means of regulating their daily supply of the fruit. Knowledge and experience are required in regulating the ripening treatment and to control the ripening speed. An accurate appraisal must be based upon a careful examination of the fruit when received to determine its condition, and periodically, thereafter, to determine the rate of ripening.

Fast ripening may be accomplished in from three to four days after the green fruit is placed in a ripening room by adjusting the temperatures of the room until the pulp temperature reaches about 70 F. In warming up cool fruit, quick heating is recommended, and it is good practice to use sufficient heat to raise the average fruit temperature at the rate of 2 to 3 deg per hour. After the first 24 hours, the room should be held at 68 F until the fruit is colored and then reduced to 66 F and held at this temperature. A high relative humidity of from 90 to 95 per cent should be maintained until the bananas show color, when it may be reduced to about 80 per cent. High humidity is important during the warming period. No ventilation should be used until the fruit has colored, after which ventilation at a rate not to exceed four changes per hour may be used to assist in reducing the humidity and to freshen the air in the room. If the fruit shows slow or uneven ripening characteristics, one or two applications of ethylene gas of approximately 1 cu ft per 1000 cu ft of room space may be used.

Medium speed ripening of bananas in from five to seven days may be accomplished by holding the fruit at 64 F. The humidity and ventilation control should be the same as for fast ripening. A treatment with ethylene gas will seldom be necessary. For slow ripening in from nine to ten days, the fruit should be held at from 60 to 62 F. Temperatures below 62 F are not advisable for very thin fruit. The humidity should be the same as for fast ripening, and ventilation (up to 3 or 4 air changes per hour) should be used provided the humidity can be maintained. Ethylene gas treatment will not be required.

For holding ripened bananas, temperatures between 56 and 60 F are recommended. A reduction in humidity is beneficial in toughening the peel and reducing the mould, but too low a humidity will cause shrinkage. Although exact humidity control is not essential, the desirable range is between 75 and 80 per cent.

LUMBER DRYING

The United States Forest Products Laboratory, Madison, Wis., has