Each of these main columns is further divided into three smaller columns, the center one of which is left blank for recording the test data. To the left of this is the scale for the individual factor, effective temperatures in degrees, dust in particles per cubic foot, carbon dioxide in parts per 10,000, etc. On the right of each central column is the penalization scale. This is arranged with main graduations of 1 per cent which are numbered. Each graduation is further subdivided into fifths so that the scale may be read to 0.2 of 1 per cent on the scale, or by interpolation to 0.1 per cent.

The chart gives not only final percentage of the test as a whole, but also indicates at a glance which factors are satisfactory and which at fault. In this way it is a convenient guide in correcting bad conditions, and bringing the final percentage up to the point desired.

Making the Test

In making a Synthetic Air Chart test the observer first divides the room by imaginary lines into small sections, each section having an area of approximately 200 sq. ft. of floor space. He locates an observation station in the center of each section. Taking a

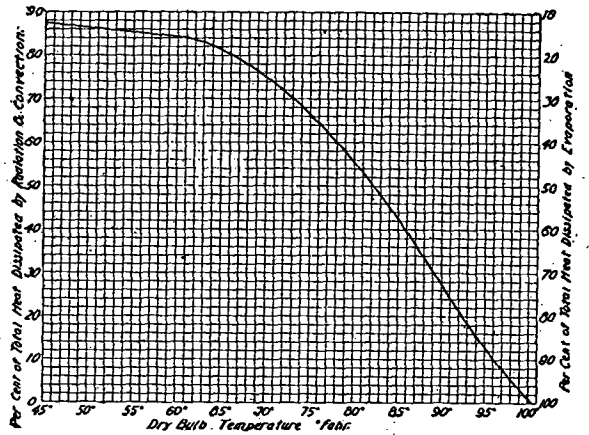

Fig. 9. Relation between Heat Loss from the Human Body by Evaporation, Radiation, Convection and Dry-Bulb Temperature

school classroom for example, the room should first be divided into four equal rectangular areas by imaginary lines bisecting at right angles through the center of the room. (*See* Fig. 11.) Four stations are now selected, one at the center of each rectangle. These stations are numbered *1, 2, 3* and *4*. It is always well to use a standard method of numbering stations, so that whoever reads the report can visualize each location.

Standing at the rear of the room facing the teacher's desk *No. 1* is the station nearest the teacher at her right. *No. 2* is the one directly back of *No. 1*. *No. 3* is the station nearest the teacher at her left, and *No. 4* the remaining station.

The tests are conducted in the following manner:

Column A.—A Psychrometer reading is taken at each station beginning with *1*, following with *2, 3 and 4*. The wet and dry-bulb readings are separately recorded on the data sheet (Fig. 12) for each station.

Column B.—Dust determinations are next made at stations *1, 2, 3 and 4*, and the count of particles per cubic foot recorded from each station. The scale of the chart is arranged for a direct reading dust counter. If some other type of instrument is used, a correction factor is, of course, necessary.

Column C.—Culture plates are next exposed to determine the bacterial content of the air. One plate is exposed at each station for two minutes, incubated, and the colonies that develop are counted and recorded for each plate. The average of all plates is plotted on the chart.

Column D.—Odor determinations are made of the room as a whole. The observer should go outside of the room or preferably outside of the building for a few moments previous to making the test. He then enters the room quickly, and makes his determinations of the air in the classroom by means of the olfactory sense, recording the results whether perfect, very faint, noticeable, etc., in accordance with the following table.

Freedom from Odors

100%	95%	90%	85%	80%	75%	70%
Perfect	Very Faint	Faint	Noticeable	Distinct	Decided	Strong

An Odorometer consists of a case of six vials each containing an odor substance in varying strength. It adds materially in classifying and standardizing odor perception. Its use, however, is not imperative.

Column E.—Samples of air are next taken at each station, and later analyzed for carbon dioxide, and results of this analysis plotted in *Column E* in parts in 10,000.

Column F.—Distribution of the air in the room is determined from the CO_2 analysis taken at the various stations.

The following example illustrates the method of making the calculation:

Stations	CO_2
1	11.1
2	9.4
3	10.4
4	9.9
Total	40.8
Average	10.2

Stations	Variations from the Average
1	11.1 − 10.2 = 0.9
2	10.2 − 9.4 = 0.8
3	10.4 − 10.2 = 0.2
4	10.2 − 9.9 = 0.3
Total	2.2
Average	0.55

$$\frac{0.55 \times 100}{10.2} = 5.4 = \text{per cent of variation.}$$

$$100 - 5.4 = 94.6 = \text{final per cent of distribution.}$$

After the tests have been made as described, the observer completes his test by a study of air motion and air currents. This is done by liberated puffs of ammonium chloride in different locations in the room with a suitable apparatus. Observations of the velocity and direction of travel of these small artificial smoke clouds add materially in obtaining a true conception of the velocity and general behavior of the air currents in the room.

Plotting the Test Data

The results of the tests are plotted in each column as previously described. The following data from the test illustrated on the chart on page 414 will make the entire procedure clear:

Average Dry-Bulb temp. 75 deg.—Wet-Bulb temp. 59.7 deg.—Effective temp. 67.4 deg.

Effective temp. Dif. 3.4 deg.—Plot in Column *A*.		
Aver. Dust Count for 4 Stations—7,000 particles per cu. ft.		—Plot in Column *B*.
Aver. Bacteria for 4 Stations	— 3.5	—Plot in Column *C*.
Aver. Odors Percentage	— 90 per cent	—Plot in Column *D*.
Aver. CO_2	— 10.2	—Plot in Column *E*.
Distribution Per Cent	— 94.2 per cent	—Plot in Column *F*.

Adding the penalization for these factors found at the right of each column and subtracting the sum from 100 gives a final percentage of perfect of 84.7, which is plotted in the last column.

TESTING METHODS AND INSTRUMENTS

Temperatures

In the measuring of room temperatures care must be exercised to prevent the results from being affected by the body heat of the observer, by drafts from doors, windows and other openings or by radiant heat