The average carbon dioxide content of the 4 samples taken in the room is 5.7 or 1.7 parts more than the outside sample, which, according to the chart, is 99.5 per cent perfect for this factor and calls for 0.4 per cent penalization for imperfection of ventilation.

There are no other injurious substances indicated hence no penalization is given for such factors.

The variations of the carbon dioxide content of the four stations from their average are as follows:—

Station No. 1	6.3 − 5.7 = 0.6	parts per 10,000
" " 2	6.0 − 5.7 = 0.3	" " 10,000
" " 3	5.7 − 5.6 = 0.1	" " 10,000
" " 4	5.7 − 5.0 = 0.7	" " 10,000
	4 | 1.7	

The average variation is 0.42, and the percentage of variation is $\frac{0.42}{5.7} \times 100 = 7.4$ per cent. Therefore the percentage distribution is $100 - 7.4 = 92.6$, and the percentage penalization for imperfect ventilation is 2.2.

The percentage of perfection for each factor is indicated in the chart, Fig. 2 and are summed up in Table 1. The sum of all the penalizations for imperfection in ventilation is 15.6 and the percentage of perfection of ventilation is 100 minus 15.6 or 84.4 which is shown in the last column of the chart.

TABLE 1. TYPICAL RESULTS OF ANALYSIS BY HILL SYNTHETIC AIR CHART

FACTOR	PERCENTAGE OF PERFECTION FOR FACTOR	PERCENTAGE OF PENALIZATION FOR FACTOR	PERCENTAGE OF PENALIZATION FOR IMPERFECT VENTILATION	PERCENTAGE OF PERFECTION FOR VENTILATION
Effective Temperature	89.5	10.5	9.5	....
Dust	96.0	4.0	1.0	....
Bacteria	98.0	2.0	1.0	....
Odor	90.0	10.0	1.5	....
Carbon Dioxide	99.5	0.5	0.4	....
Distribution	92.6	7.4	2.2	....
Total			15.6	84.4

The above observations are made as follows: The wet and dry bulb temperatures are determined with a sling psychrometer, the air velocity is determined by observing the speed of a smoke cloud with the aid of a stop watch. The smoke cloud may be caused by means of an ammonium cloud apparatus, or by exploding a smoke bomb, or by other means.

The dust count is made by means of the Hill dust counter. In this instrument a given volume of air is made to impinge against a glass microscope cover slip coated with an adhesive. The particles are counted under a microscope of definite magnification and the number corrected per cu. ft. of air.

Carbon dioxide samples are taken in 120 cc. rubber stoppered bottles by exhausting air from the bottles with an atomizing bulb, Fig. 8. The bottle should be held at arms length while sampling so as not to be contaminated with the observer's breath and then tightly stopped until the sample can be analysed on a Peterson-Palmquist apparatus for carbon dioxide.

CHAPTER XVIII

HOW TEMPERATURE, HUMIDITY AND AIR MOTION AFFECT HUMAN COMFORT

AN ordinary thermometer is only of relative value for indicating a person's feeling of comfort as the sense of warmth experienced by the human body is not due alone to the temperature registered by the dry bulb thermometer, neither does it depend solely upon the wet bulb temperature. Dry air at a relatively high temperature may feel cooler than air of considerably lower temperature with high moisture content.

This is according to the conclusions determined through a series of investigations conducted by the Society in conjunction with the U. S. Public Health Service and the U. S. Bureau of Mines at Pittsburgh, Pa.

Human comfort or discomfort depend largely on body temperature and therefore on the relation between the rate of heat production and dissipation. By the process of metabolism heat is constantly generated within the body, while on the other hand, loss of heat is constantly occurring from the surface of the body by radiation, convection and evaporation. To maintain a constant body temperature the loss of heat must equal the heat produced. It is therefore apparent that any interference with the elimination of heat from the body is accompanied by a rise in temperature and a feeling of discomfort.

There are three principal factors affecting loss of body heat:

1. Temperature. 2. Humidity. 3. Air motion.

As the temperature of the air and surrounding objects rises, the loss of heat by convection and radiation decreases. When the air temperature reaches that of the body, the loss by radiation and convection ceases. Finally as the air temperature exceeds that of the body, heat passes from the air to the body.

If on the other hand, the relative humidity is increased the heat loss by evaporation decreases. If while the dry bulb temperature increases, the wet bulb temperature decreases sufficiently, the increase in loss of heat by evaporation may be made equal to the decrease in loss of heat by radiation and convection, resulting in no change in body temperature or comfort.

From the above, it is concluded that there must necessarily exist certain combinations of temperatures and humidities, which produce the same total body heat loss by radiation, convection and evaporation and therefore the same feeling of comfort or discomfort. Lines passing through such air conditions plotted as a psychrometric chart may be called

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