The sizes of the particles are given throughout as equivalent impaction diameters (imp. eq.), these being the diameters multiplied by the square root of the specific gravity of the material.[4] Estimates of their sizes were made in one or more of the following ways: (1) polarization of scattered light,[5a] (2) the pattern of the colors produced when white light was passed through a cloud of particles,[5b] (3) "impaction"[6] and (4) microscopic observations. The smallest particle cloud[7] was composed of particles estimated to be about 0.1 μ in diameter (or 0.11 μ imp. eq.) since the polarization was very nearly complete.[5c]

The next cloud was made up of larger particles, estimated to be about 0.25 μ; i. e., there was about 20 to 30 per cent polarization. The scattered light was blue from 0 to 90 degrees, becoming straw colored at about 170 degrees (the angle between the incident and the scattered light rays). About 85 per cent of the material collected is on I_{2S},[8] about 10 per cent on I_1 and about 5 per cent on the filter. Much less than 1 per cent is removed by a cascade impactor.[6a]

The particle size of the next cloud was found to be about 0.55 $\pm$ 0.1 μ (the number after $\pm$ sign being the estimated standard deviation of mass distribution). Estimates based on microscopic counts, polarization of scattered light and comparison of present and previous results with impaction methods were in satisfactory agreement. The average percentage mass distribution by impaction was 0.5 for cascade impactor slide D, 93 for I_1 and 7 for I_{2S}. Individual clouds were somewhat more homogeneous.

The particles of the next cloud were found by microscopic counts to be about 1.4 $\pm$ 0.2 μ (imp. eq.). This was in agreement with estimates from impaction and from the values of the angles to the red maxima. The average percentage mass distribution was slide C=4, D=89, I_1=7. Individual clouds were more homogeneous, there being as much as 95 per cent on slide D in some instances.

From counts and from results of impaction, the particle size of the cloud of next larger particles was estimated to be 2.9 $\pm$ 0.2 μ (imp. eq.). The average percentage distribution of mass was slide B=5, C=85, D=10. A single homogeneous cloud might contain 90 per cent on slide C.

The particle size of the next cloud was estimated from the results of impaction to be about 3.8 μ. This cloud was not nearly as homogeneous as the others, as is indicated by the poor colors observed, as well as by the mass distribution (B=36, C=57, D=7; a sharp cloud, for example, would give 39, 61, <1).

The cloud of largest particles was composed of particles estimated to be 6.3 $\pm$ 0.8 μ (imp. eq.). The average percentage mass distribution was A=2, B=97 and C=1.

Sampling.—Experiments to determine the total fraction expired were carried out as previously described.[3] Small volume critical pressure orifices with two 200-mesh screens were used throughout.[9] The expired air was fractionated into serial fractions. This was accomplished by using a large "mouth tube" (O_2, fig. 1) having four smaller side tubes symmetrically placed, each being at an angle of about 60 degrees with the direction of the larger tube. The impingers (I_1, I_2, ...), each with inlet tubes through a small rubber stopper, were then inserted into these side tubes far enough so that the inlet tubes reached into the large tube (O_2). Any particles entering the inlet tubes were included in the analysis as the tubes were washed down. Behind each sampler was a solenoid valve (A, B, ...) of small volume, the port being 7/32 in.

4. Landahl, H. D., and Tracewell, T.: II. Penetration of Air-Borne Particulates Through the Human Nose, J. Indust. Hyg. & Toxicol. **31**:55, 1949. Landahl.[1b]

5. Sinclair,[2] (*a*) p. 85; (*b*) p. 84; (*c*) p. 86.

6. (*a*) May, K. R.: The Cascade Impactor, J. Sc. Instruments (Brit.) **22**:187, 1945. (*b*) Landahl and Tracewell.[4]

7. In this case the samples were collected with the same collectors as used for the other clouds with, however, dry ice packed around the impingers to bring the efficiency of collection to over 90 per cent. However, experiments with the samples warmed slightly to avoid condensation of moisture gave substantially the same results, indicating that the percentage slip was the same on both "control" and "lung" sides.

8. I_1 and I_{2S} are two critical pressure orifice impingers used in series, the second having two fine mesh screens (Landahl[9]) under the orifice.

9. Landahl, H. D., and Tracewell, T.: Unpublished observations.