period of at least ten minutes at the time the samples of air were being collected. The smoking-room, the drawing-room, and other small rooms constitute separate problems.

In order to test the consistency of the results obtained, and to find if the carbon dioxid actually does go up in proportion to the number of passengers, the 555 observations were divided into four groups, according to the number of passengers (Table III.). It is seen that it increases with the number of passengers:

TABLE III.—RELATION OF AIR POLLUTION TO NUMBER OF PASSENGERS.

	—Carb. diox.; parts per 10,000—	
No. of Pass.	Cars with nat. vent.	Cars with exhaust vent.
Under 10.....	5.91	5.58
10 to 15.....	6.62	5.95
15 to 20.....	7.38	6.46
Over 20.....	8.85	7.24
Average	6.88	6.11

A further method of determining the ventilation of the cars equipped with exhaust ventilators was applied as follows: When trains pass through tunnels the cars receive a considerable amount of engine gas. We may compute the fresh air supplied to these cars by observing the rate of disappearance of this gas (carbon dioxid) after leaving the tunnel. Determinations showed considerable irregularity, but the basic conditions also varied, and the final level to which the carbon dioxid was approaching was different for different cars. It is, neevrtheless, clear that the disappearance of the gas is rapid.

When taking samples of air from the berths it was the rule to take, as near simultaneously as possible, an average sample from the aisle for comparison. Samples from each place were generally repeated at 15-minute intervals, until 20 or more had been collected in the car. Two lower berths on each side of the car were generally selected, and one or two uppers when possible.

Popular opinion ascribes better ventilation to the upper than to the lower berth in a sleeping-car. The reason generally given in support of this opinion is that the berth curtain entirely covers the lower and only partly the upper. It is supposed that the curtain hinders the progress of air-currents. The tests show that the air contamination is not very different on the two sides of the curtain; but it may be contended that this is a matter of equalization by the diffusion of gases, and that the circulation of fresh air is chiefly through the body of the car.

In order to gain some information concerning the conditions that would obtain if the closed berth had to lose its carbon dioxid by diffusion through the curtain, a series of experiments was conducted with the purpose of determining the rate of diffusion under similar conditions. The results show that the berth does not act as a closed compartment, but is essentially a part of the general space of the car body, and is subject to the effects of air-supply and air-currents through and around the curtain very much as it would be were the curtain entirely absent.

Observations were made in crowded smoking-rooms of cars without ventilators. The occupants were from 4 to 7; the carbon dioxid from 10.5 to 20.5 per 10,000. The average carbon dioxid (14.88), with the average occupants (5.85), would be maintained by an air-supply of 3,225 cubic feet per hour for the room. Similar observations in smoking-rooms equipped with exhaust ventilators showed carbon dioxid from 7 to 16.5 per 10,000, with 4 to 8 occupants. The averages were 6.1 occupants and 11.41 carbon dioxid the equivalent air-supply would be 4,940 cubic feet. No account is taken of the carbon dioxid produced by the burning of tobacco and matches.

About 200 samples of air from still cars have been analyzed. It is usual to find that the carbon dioxid rapidly increases when a train stops running. This increase reaches its maximum only after a considerable time, and the final height is variable, depending largely on the force of the outside wind. A strong wind will drive much air into the car, a light one proportionately less. Among these 200 observations the carbon dioxid passed 20 per 10,000, but twice (20.5 and 21.5), both in lower berths. It is usual to find the maximum around 15 in cars that are occupied at stations awaiting very late departures.

It has been shown that an average of over 40,000 cubic feet of air per hour enters the breathing-zone of sleeping-cars equipped with the type of exhaust ventilator herein considered. It has been further shown that approximately twice this much air leaves from the upper portion