results of several analyses of air from cars (see Table II.).

In 1904, Dudley* reported on analyses of the air of cars of the Pennsylvania Co., which were ventliated by the excellent system which he devised. He found from 10 to 18 parts of carbon dioxid per 10,000 in runnig cars, and 20 to 21 parts in cars standing still for 20 mins. The 52 people in the cars are assumed to have produced 0.72 cubic feet of carbon dioxid each per hour; from which is estimated 26,000 to 62,000 cubic feet of air-supply per hour for the moving and 22,000 to 23,000 for the still cars. More recently the air of cars running in the New York Subway (but more particularly of the subway itself) has been thoroughly studied experimentally by Soper.† Similar studies have been carried out in Paris by Lucien-Groux and others. But these cars have little in common with the railway coach.

In literature on this subject, the information concerning the actual conditions of the air in railway cars is very meagre. It is adequate on the application of ventilating devices, but there is no series of analyses extensive enough on which to base any comprehensive opinion as to the deficiencies of natural ventilation to be overcome, or as to the adequacy of the devices applied in keeping the air of the breathing-zone freed from the products of respiration.

The ventilating device upon which this report is based is designed to remove air by exhaustion from the upper portion of the car, and its opertion is dependent on train motion.‡ Anemometer readings have shown that each such exhaust ventilator will remove an average of about 15,000 cubic feet of air per hour at a train speed of 40 miles per hour, and proportionately more or less for faster or slower speeds. While there is considerable variation under apparently similar conditions, the outward flow is constant. One ventilator is placed over each alternate section of a sleeping-car, while two are applied to the smoking-room and one to the stateroom. Toilet and dressing-rooms are also equipped with one each in recent practice.

It is readily seen that a very large volume of air leaves the car through these openings it must enter somewhere. The question was, does it enter at such places and take such courses as to cause a free dilution of the air at the breathing level in the occupied car? There seems no adequate way to answer this question except by determining the carbon dioxid in such air, from which the amount of dilution may be computed as already indicated. It was desirable also to make determinations in cars not having the exhaust ventilators, but depending upon natural ventilation.

Nearly 3,000 carbon dioxid determinations were made for all purposes in connection with this work; about 2,000 of these weer of the air from over 200 sleeping-cars. A considerable number were made of the air of day coaches, suburban cars, street-cars, stores, restaurants, offices, and the open air for comparative purposes, and others for the purpose of establishing certain facts experimentally.

TABLE II.—COMPARATIVE RESULTS OF TESTS OF CARBON DIOXIDE IN AIR.

Place.	No. of observations.	CO_2 per 10,000			Equiv. hourly air supply per person, cu. ft.
		Ave.	Max.	Min.	
Sleeping cars (body)	294	6.20	10.0	...	2,727
Sleeping cars (berths)	690	6.96	13.5	...	2,027
Day coaches (32 passengers)	43	9.38	21.0	...	1,100
Street cars	45	15.10	29.0	...	541
Elevated cars	17	13.90	26.5	...	674
Suburban coaches	47	14.30	38.0	...	583
Stores	23	8.80	10.0	...	1,250
Restaurants	51	16.10	26.0	...	496
Offices	26	13.91	19.0	...	670
Sleeping cars (12 passengers)	..	18.0	22.0	11.3	M.C.B.
Chair cars (17 passengers)	.	10.7	15.5	7.0	re-
Suburban cars (half-full)	..	13.8	21.7	6.9	port