air is being diluted constantly.

It is plainly impossible to measure directly the amount of air flowing into a car, since it enters at many points and at constantly changing velocities. But the amount of the interchange may be readily computed from the actual amount of carbon dioxid found from time to time by applying the figures given above to a simple mathematical procedure. Suppose a car contains 20 people and its atmosphere is found to have an average of 10 parts of carbon dioxid per 10,000. The incoming fresh air contains 4 parts, hence each person present). The computation is better represented by the general formula:

$$A = v\,p \div (x - N)$$

v = the CO_2 by one person (cubic feet per hour),

p = the number of persons in the room,

x = the proportion of CO_2 in the air of the room,

N = the proportion of CO_2 in the outside air (0.0004),

A = the air-supply to the room (cubic feet per hour).

TABLE I.—SUMMARY OF THE RESULTS OF NUMEROUS TESTS TO DETERMINE THE CONDITION OF THE AIR IN SLEEPING-CARS.
(Normal carbon dioxide in air; 4 parts per 10,000.)

	Ave. No. of people in car.	Carbon dioxide per 10,000 parts of air. Ave.	Min.	Max.	Necessary air to maintain ave. carb. diox. cu. ft. per hr.
Cars With Natural Ventilation:					
1. Decks open; doors and windows closed....	15	7.19	3.5	13.0	28,300
2. Ditto, but one or both doors open to vestibule	10	5.40	3.5	8.5	40,700
3. All decks, doors and windows closed	13	8.33	5.5	15.0	18,500
4. In lower berth (A).....	16	8.32	5.0	18.0	1,389 per berth
5. In aisle opposite lower berth (B).....	16	7.32	4.5	10.0	....
6. In upper berth (C).....	21	9.17	4.5	18.5	1,161 per berth
7. In aisle opposite upper berth (D).....	21	8.37	6.0	13.0	....
(4 to 7; windows and doors closed.)					
Cars with Exhaust Ventilators:					
8. Decks open; doors and windows closed (day)	13	6.01	4.5	10.0	38,400
9. Ditto; for aisle only (night)	16	6.33	4.5	10.0	41,300
10. One or both doors open to vestibule.....	14	5.50	3.5	9.0	57,900
11. In lower berth (A).....	16	6.96	4.5	13.5	2,027 per berth
12. In aisle opposite lower berth (B).....	16	6.33	4.5	10.0	....
13. In upper berth (C).....	17	6.70	4.5	10.5	2,222 per berth
14. In aisle opposite upper berth (D).....	17	5.95	4.5	9.5	....
(11 to 14; windows and doors closed.)					
Berth Tests.					per berth
15. Cars with natural vent; lower berth.....	..	8.45	...	....	1,354
16. Upper berth.....	..	8.85	...	....	1,237
17. Cars with exhaust vent; lower berth.....	..	6.51	...	....	2,391
18. Upper berth	..	6.70	...	....	2,222
19. Berth with one person.....	..	7.36	...	....	1,785
20. Berth with two persons.....	..	9.91	...	....	2,027

Note—Observations (A) and (B) and observations (C) and (D) were made at the same level (lower and upper respectively), but on opposite sides of the berth curtains.

the respiratory contamination of the car air is represented by only 6 parts.

The 20 people produce 20 times 0.6 cubic feet, or 12 cubic feet of carbon dioxid per hour. With what amount of air must the 12 cubic feet be diluted so that the air will contain 6 parts of carbon dioxide in 10,000? The simple proportion, 6 : 10,000 :: 12 : ?, gives 20,000 as the answer (or 1,000 cubic feet per hour for

Some 15 or 20 years ago analyses of the air from passenger cars were made by Prof. Nickols, for the Board of Railroad Commissioners of Massachusetts. About the same time the Pennsylvania Railway took up the subject and had a few tests made. In 1894 a committee of the Master Car Builders' Association made a somewhat extensive report on the subject of car ventilation, and with it submitted the