

do more than that, having regard to the safety of the public and the convenience of the men. I think the combination of the air brake and the track brake is the best and safest system that can be adopted in Auckland. In my opinion they are sufficient to meet all the service conditions in Auckland. I do not think—a car travelling down College Hill at thirty miles per hour, and the air brake alone being allowed to be used—that you could expect the car to be pulled up in less than ten car-lengths. It was an abnormal condition, and absolutely unlikely to occur in ordinary working, unless the motorman had lost his head, and then you never know what a man might do. The track brake has to be applied before negotiating the down grades, and under ordinary circumstances it is unlikely that the car would ever attain such a speed on such a grade, and I say it is unreasonable to expect the brakes on the car to hold it. The track brake should be used: it was unreasonable to call on the air brake to attempt to hold the car. The magnetic brake under ordinary conditions would not work at such a test for the reasons given, necessitating the restrictions as to limiting the speed before the magnetic brake is used. I should like to explain the necessity for limiting the speed: the reason is, the voltage generated by the motors is proportional to the current that is passing through the fields, and the speed of the car; consequently, to limit excessive current it would be necessary to provide more resistance in the magnetic-brake circuit. The magnetic-brake shoes of the latest pattern are saturated with a current of 20 amperes. At a high rate of speed, if the magnetic brake is suddenly applied, it is possible to get up to 350 amperes on the brake circuits. No motor would stand that, as, with the sudden application and the sudden generation, the current, instead of taking the proper path, would flash over the brushes. I know the Thompson-Houston magnetic brake. The general observations I have made apply equally to any other form of magnetic brake.

By Mr. Rosser: The Auckland cars, being equipped with the present hand-brake and the hand track brake, are already sufficiently equipped, in my opinion. I have seen a great many of the cars in operation, and have travelled on them at various times, and have always been satisfied with the manner in which the brakes acted and the way the stops were made. I cannot say I should be surprised if you told me that twenty-seven motormen on the previous inquiry declared the brakes to be inoperative, unless I heard their statement as to the conditions. I should not be surprised if you told me that one man was killed at Karangahape Road on a greasy rail one Saturday night on a slight up grade, and that the car travelled some distance afterwards. I should say that the men you refer to were medically unfit. I should certainly be surprised to know that six men are now suffering from the working of the brakes, by abdominal strain, appendicitis, or rupture. I am not surprised that men ask for a more powerful brake to ease the physical strain. If the men can get out of unnecessary work, they will. I really do not think the application of the hand-brake is likely to be the cause of such serious results unless the men are physically unfit. It may be the case that they have to produce a doctor's certificate before entering the service, but at the same time I do not think the operation of the hand-brake can be held to be responsible for the cause of these strains. I have had no cases like that through the operation of the hand-brake.

By Mr. Wyllie: I have had no experience of the pneumatic-operated track brake, and can give no opinion on it.

By the Chairman: I carried out some experiments at Pittsburg on the ordinary tram-lines. The cars there are equipped with the magnetic brakes. I have the results of those experiments, and can let you have them, also results of those I made at Glasgow. They were made under ordinary service conditions. I had many cars at my disposal, and took them over the various grades, and satisfied myself as to the operation of the magnetic brake. In Pittsburg the conclusion I came to was that, although the brake was an admirable one in ordinary cases, it was inadvisable to use it as a coasting brake. On one line near the river you get a long coast of a mile and a half or so, and I found it was not advisable to coast on the magnetic brake unless the motors were provided with increased capacity. In Adelaide, where there is no grade whatever, I have provided 10 per cent. extra capacity on the motors, and I have prohibited the use of the magnetic brake in coasting down those grades—which rule also applies to Sydney. You suggest that if we took a car fitted with a rheostatic brake, and allowed it to coast, the current generated by the motors would be less than the current required to be supplied to them on the upward grade: that would all depend on what resistance there is in circuit, as it follows that the amount of current is regulated by the amount of resistance in circuit. The result of the experiment I made last week was that the current in some cases exceeded 350 amperes. It appears from a theoretical basis that the current when coasting down-hill should be less than the current taken up-hill. It is a fact that we do get, under ordinary service conditions, much more current than we estimate in our calculations. The magnetic brake would take less current than the rheostatic brake to give the same retardation. With the magnetic brake you have three retarding efforts—firstly, you have the negative torque on the motors; secondly, you have the friction of the shoes on the wheels; and, thirdly, the friction of the shoe on the rails. Yes, I agree with you that the Newell magnetic brake should take less current than the pure magnetic. You ask if it is not accepted that the current taken in coasting, comparing the rheostatic pure magnetic braking and the combined magnetic braking is in the ratio of 1, 3, and 5: that has been found as the result of experiments; but the results of experiments are usually different from those obtained under service conditions, where you have to take into account the human element. We train our men how to use the seven brake notches, and they are told certain speeds for the application of each notch; but they do not follow those instructions, and the current generated is greater than under the conditions of experimental test. We found that by putting ampere-hour meters in the brake circuit there was a difference of 50 per cent. in the current generated by the motors by one man as compared with another man. That shows that the test conditions cannot be compared to service conditions. As to a double-decker coasting down a gradient of 1 in 13, and the consumption being only four