BRAKING AND TRACTION BRAKES.

INTRODUCTION BY PRESIDENT SCOTT.

In considering the engineering problems connected with the operation of cars or trains, our minds naturally turn to the positive features. The motive power and the means provided for controlling it while starting or running cars or trains are the matters which at first attract attention. The negative problems, however, are of importance and become of greater moment as weights and speeds increase.

I well remember as a boy the difficulties encountered by passenger trains in stopping at stations. The brakemen were called to the platforms by the engine whistle, but frequently the trains were considerably past the station platforms before they stopped. It was then necessary to back to the station. I remember also learning from a friendly engineer that the engineers of his road insisted that their pay should be increased for the added duties which were to be placed upon them when they would be called upon to do the work of the brakemen through the agency of the air brake.

Difficult braking problems are now being encountered in electric traction. Weights have increased tenfold and speeds on our streets have increased three or fourfold, thereby increasing the stored energy in the car one hundred times, and the old hand brake of the horse car is inadequate. Interurban railways with their still heavier cars and far greater speeds make the problem of braking quite similar to that in steam railway service.

In electric service on elevated and underground city railways, where stops are frequent and high schedule speeds are essential, certain new elements have entered into the braking problem.

Ordinarily, brakes are for the purpose of facilitating traffic and preventing accident. The new feature of commercial value which has come into the problem is that of quick retardation. The run from one station to the next consists in acceleration, running at a sensibly constant maximum speed, and retardation. To increase schedule speed, it is important to lessen the time of retardation as well as that of acceleration. This is a new demand. It presents a new point of view in braking problems which have not previously been of importance in regular service.

This is illustrated by the marked difference which may be made in the schedule speed under average conditions such as prevail on the elevated railways of Greater New York, by changing from a low rate of braking to quick retardation. A change in the rate of retardation from one mile per hour per second to three miles per hour per second, all other conditions remaining exactly the same, increases the schedule speed about 10 per cent. This effects a saving in time to the passengers of 10 per cent., and it reduces the number of trains required for carrying a given number of passengers by 10 per cent.; or what is more important, the same cars may carry 10 per cent. more passengers.

We may divide the brakes in ordinary use into two classes; hand brakes and power brakes. The latter may be again subdivided into air brakes and electric brakes. When the air brake is used on electric cars, electricity is an acceptable auxiliary through the agency of the motor-driven pump.

Electric brakes are of several general types. The motor itself may act as a brake in either of several ways. The motor may be reversed. This is a severe measure which is seldom applied except in an emergency. The motor may be used as a dynamo for absorbing the energy or motion of the car. The power delivered by the motor (or dynamo) may be employed usefully by being returned to the line, in charging a storage battery on the car, or by heating rheostats which are used for heating the car, or on the other hand, it may be wasted in rheostats under the car.

Again, the current from the motor may be used for operating some form of magnetic brake. In this case the car is retarded both by the energy taken by the motor acting as a dynamo and also by the friction produced in the magnetic brake. The brake in this case may consist of two discs one stationary and the other mounted on the car axle, or it may be a track brake in which there is friction between moving shoes and the track rail.

Magnetic brakes may be operated independently of the motors by current obtained from the line or from a storage battery.

These methods indicate various ways in which electricity may be used for braking and make obvious the extreme flexibility of electricity in its application to problems of this kind. The application of the braking effect in proper amount at the proper time and with a reliable method of control, places very exacting requirements upon the designer of braking appliances.

The importance of the braking problem makes it a fitting and appropriate subject for consideration by this INSTITUTE. We may congratulate ourselves upon having to-night two papers, one of which presents the results of tests upon an important city railway, while the other sets forth the general problem of braking in a comprehensive manner and presents the subject in a way which will be of great value to those who have to deal with the design and equipment of braking apparatus and to those who are called upon to determine the requirements and to select the apparatus for particular installations.