outer front wheel of the truck. The writer is convinced that this is true, also that there is no backward skidding of the inner front wheel, which was more than at first expected.

In plate II, there are five figures indicating various conditions that we meet with in general conditions. Fig. 1, shows standard wheels on C.P.R. standard 85 lb. rail straight track. The circumference that is measured in mating wheels is indicated as on "wheel diameter line," 1 in. from the base of flange and about 1 in. from the end of the 1 in 20 taper; that is, the radius of the wheel at the end of the 1 in 20 taper is about 0.05 of an inch less than at the point of measurement, making the small diameter about 0.10 of an inch less than at the point of measurement; that is, the circumference of the wheel at this point is nearly 1/3 of an inch less than at the point of measurement. The other figures are self explanatory, and indicate conditions that do exist, as any investigator can prove for himself by taking small gauge copper or soft iron wire and placing it transversely across the rail under a moving wheel on a curve. The condition shown in fig. 5 will not, of course, be constant, for the reason that the outside wheel in that case is rolling on such a very large diameter that it would soon slip away from the rail entirely if it could be supported on this large diameter; but what takes place in this case, and which can be verified by watching the leading inner wheel of a truck travelling on a worn rail (as is indicated) is a nosing motion; that is the wheel is constantly moving with a jerky motion. This feature can be very well observed by riding on the pilot of a locomotive with a sharp flange pony truck, whenever the same is going over a track where the outer rail on a curve is badly worn.

The writer has purposely called the attention of the reader to plate II and the various figures thereon, to prepare his mind for an explanation of the apparently contradictory evidence obtained in some tests made with a view of attempting to measure the amount of skidding of the wheels. C.P.R. flat car 310,016, gross weight 129,100 lb., was run at a speed of about four miles an hour a distance of about 600 ft. over the above mentioned 8° 10′ curve; the car was started from rest, each wheel marked at point of contact with rail. It was then moved north until the leading wheel had made 70 revolutions, the revolutions on all the other wheels were counted and measurements taken to show how far they would have to go to complete the 70 revolutions. The car was then run in the reverse direction. Table I gives the results of these measurements; in column 2, actual distance traversed by each wheel in making 70 revolutions is recorded; in column 3, 70 times the circumference taped in the field close to the flange. It should be noted here, however, that only the wheels on the one side of the car were taped. It was taken for granted that they would be properly mated, as they showed no flange wear that would indicate they were not. Column 4 gives the difference, or apparent skidding distance of each wheel, if the wheels had been running on the diameter as measured. After the test was made, the car was sent to the shop, the wheels taken out and officially taped. In column 5, is shown 70 times the circumference of this official taping, and in column 6 the difference between 70 times the circumference and the actual difference travelled on the rail. We started out with the idea that there would be very little or no skidding of the outside leading wheels of any truck. If one will note, however, the outer wheel's axle, nos. 1 and 3, column 4 and 6, the car going north, and also the outside wheel on axles 2 and 4 in column 4 and 6, when the car was going south, one would be apt to say that these were the wheels that did the skidding. As a matter of fact, however, from experiments made with a very soft fine wire, the writer is convinced that the outer leading wheels on a truck take the position indicated in figs. 2, 3, 4 and 5, plate II, and that there is absolutely **no backward skidding of the inner leading wheels of any railway truck in rounding a curve. Any skidding that may take place in the wheels of the leading axle is equal and in a forward direction**, taking the very small amount of indicated backward slip of the inner wheel axles 1 and 3 going north, and 2 and 4 going south, column 4, where we know the taping was this forward skidding of both wheels of leading axle is quite natural.

It should be noted here that 5 or 6 rails were taken from the inside of the car, and placed on the outside, in an attempt to balance the vertical pressure on the two rails of the curve, on account of 2 in. being too much elevation for a speed of 4 miles an hour. However, there were not enough rails moved to entirely overcome the effect of the 2 in. elevation.

If the reader will again look at figs. 2, 3, 4 and 5, he will see how easy it is to get a wheel to ride ⅛ of an inch or more high; that is, increase the diameter on which the wheel rotates by ¼ of an inch and that is all it requires to account for the extra 4,862 ft.

Now, making a study of all the outer rear wheels of the trucks, it is very plain to the writer, as observation and experiments proved, that these wheels press

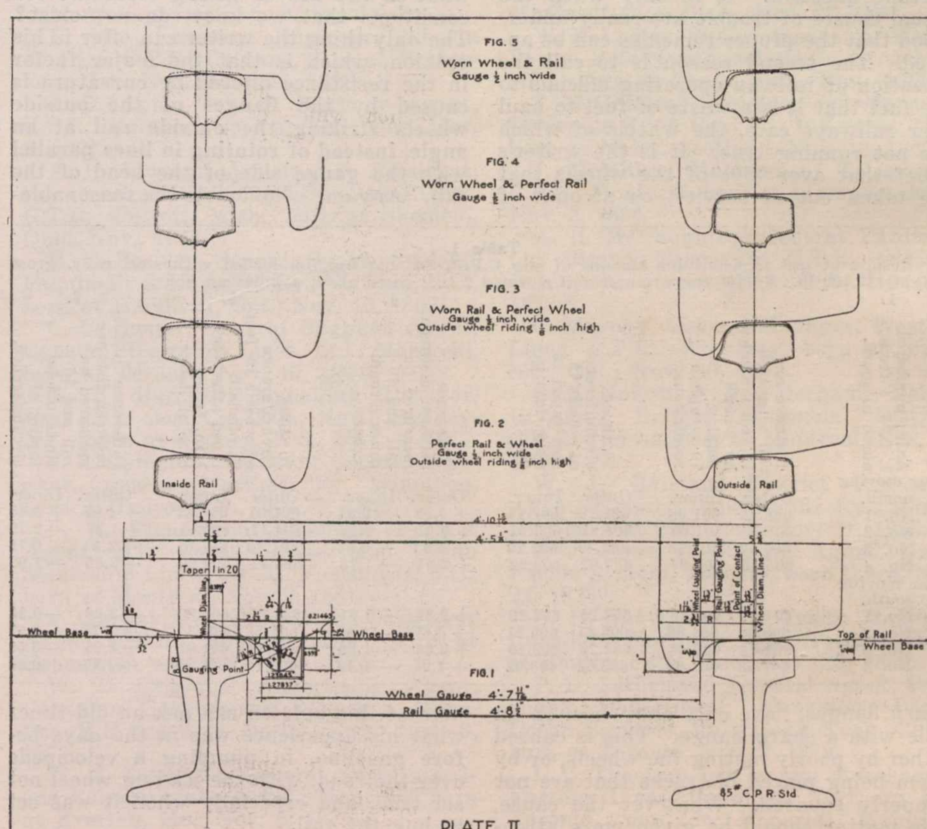

PLATE II
SHOWING POSITION OF CAR WHEELS ON TRACK UNDER VARIOUS CONDITIONS
C.P.R. Winnipeg, June 19th 1918

taken on a larger diameter than the one the wheels were rotating on, and taking the figures in column 6 for the inner wheels of the leading axles of the trucks, which indicate a positive forward slip of the inner wheel, when we know that the diameter on which the wheels were rotating could not have been larger than the diameter on which measurements were made, would indicate that the outer wheel was pressed so hard against the outer rail that the resistance against free rotation was so great that the result is that both wheels were actually skidded a short distance forward. It is well known that a speedometer attached to the rear wheel of an automobile will register a greater amount of miles than one attached to the front wheel of the same diameter. If we reversed this situation, and there were obstructions placed in the way of a wheel, equal to the force exerted in driving the car, we would expect this wheel to show a loss in distance equal to the gain in distance shown by speedometer on the rear wheel. It appears to the writer that against the outer rail and ride on a larger diameter than the official taping indicates, but not sufficient to overcome skidding entirely; that is, there is some skidding of the inner wheel of the rear axle of a truck, although the amount is rather small. This conclusion is directly opposite to that stated in paragraph 302, page 285, The Economic Theory of Railway Location, by Wellington. On a test with C.P.R. flat car 311,074, with the special wheels, on about 600 ft. of straight track, measurements were made for only the leading truck, and it was found that there was about 3 in. slip on the larger wheel of the leading axle and about 10 in. on the larger wheel of the rear axle. These amounts were reversed when the car was run in the reverse direction, and as the difference in the diameter of wheels, the **treads being turned flat**, amounts to about 4.2 ft., in going a distance of 603 ft., the writer was convinced that the small amounts of slip mentioned, 3 in. and 10 in. respectively, were accounted for by the fact that the wheels of smaller diameter,