this delay must be taken into account. The law has been stated above.

The delay occasioned to trains at other stations than the terminals, and the two stations between which the longest interval occurs, is as we found above, twice the difference between this longest interval and the other passing track intervals. In our example this delay would occur at Giroux

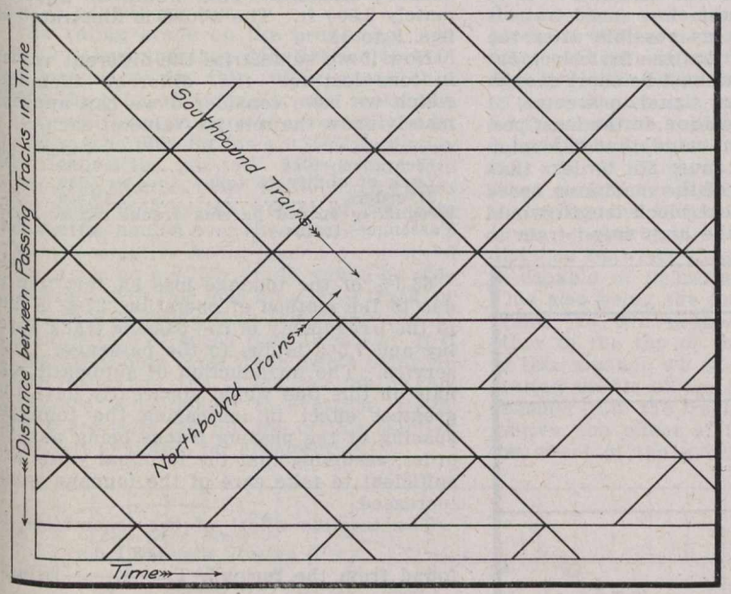

Fig. 6.—Train Schedule with One Unevenly Spaced Passing Track.

and would be 8.42 minutes for every westbound train. That is $8.42 \times 54 = 454.68$ tons per train affected. The number of trains would be $\frac{67,808}{1,200+227} = 48$ trains, and the total loss of tonnage would be $24 \times 454.6 = 10,896$ tons, giving the capacity now of 67,808—10,896=56,912 tons.

The effect of the delay due to the delivery of 31 orders is an element which, with a line so short as the one we are considering, could be neglected, as the orders will be delivered at St. Anne and Bedford, therefore not affecting the running time in this section. However for illustration, assuming that the eastbound trains are given their meet orders at Giroux, the time taken in stopping, delivering and starting, will consume not less than 10 mins., or $10 \times 54 = 540$ tons per train. The number of trains then would be reduced to 19 each way, and the maximum tonnage would be 56,912—10,260=46,652 tons.

There is one other element which we can value, that is the delay on slow trains by fast ones running in the same direction. It will be seen that in the above the passenger trains reduce the tonnage due to tying up the line between passing tracks for following movements until the fast train reaches the next station in advance, or a clearance of 10 mins. is allowed. Assuming that the 10 mins. rule is in force, the delay at such passing track for one passenger train each way will be 10 mins. at St. Anne, 10—8.42=1.58 min at Giroux, 10 mins. at Labroquerie, 10 mins. at Marchand in the one direction, and 10 mins. at Bedford, 10 mins. at Marchand, 10 mins. at Labroquerie, and 10 mins. at Giroux, or a total of 71.58 mins., being equal to 7,730 tons lost in capacity for two passenger trains each way, leaving a maximum now of 46,652—7,730=38,922. tons per 24 hours.

While it is quite possible that the maximum tonnage may never be realized, yet it is quite evident that this is the maximum tonnage possible, and that the nearer this is approximated the more efficient is the operation.

We have now considered all of the elements tending to reduce traffic mentioned above, except the question of insufficient terminal facilities. It is self evident that the tonnage capacity of the line requires that at the two terminals there must be, at least,

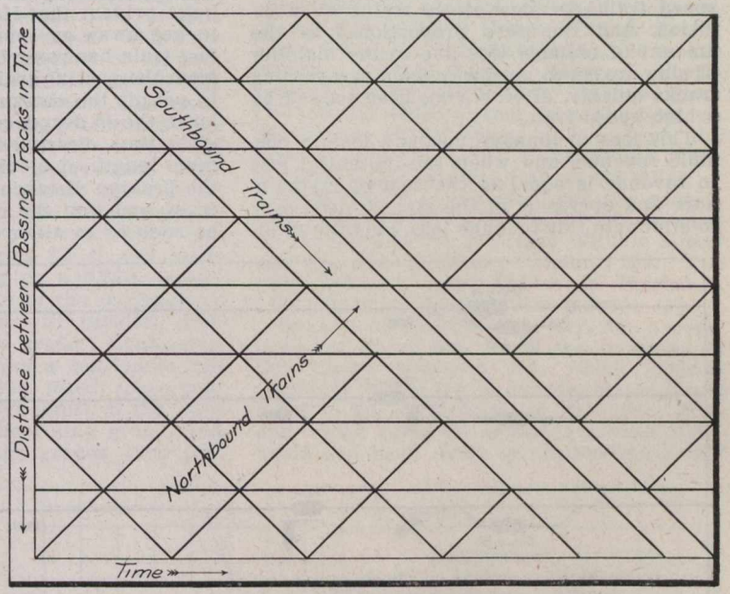

Fig. 7.—Effect of Attempting to Run More than the Number of Trains Determined by the Passing Track Intervals.

capacity in the yards to handle the tonnage which can be handled over the line. As however the capacity of a yard is determined by the number of cars handled, rather than the tonnage, the unit which we have used must be translated into number of cars.

The average capacity of cars in service in Canada in 1910 was 28 tons per car. The ratio of empty car mileage to loaded car

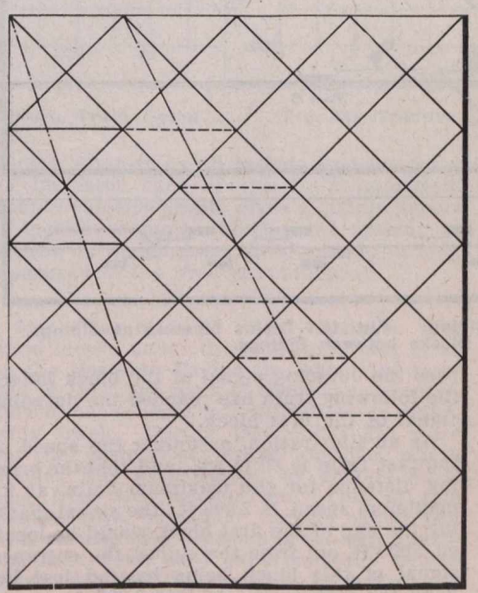

Fig. 8.—Effect of Introducing Trains of Different Speeds into Schedule.

mileage was 30%. Assuming the tare as a third of the total car weight, then the average car would weigh 28+9=37 tons. This divided into half the total tonnage, and multiplied by 130% would equal the number of cars,—i.e. $\frac{38,922 \times 130}{2 \times 37} = 683$ cars. Therefore the yard at each end must in this case be capable of taking care of 683 cars in 24 hours.

The usefulness of such a calculation as the above, consists in being able to determine what are the elements in the operation of a division which needs improvement, and their relative importance. If under existing conditions it appears that double track is necessary, a calculation as above gives a means of determining whether all the facilities of the single track have been worked out to their maximum, or if some improvement, costing less than double tracking, can be undertaken in lieu of the second main track, thus indefinitely delaying the capital outlay, and increase in fixed charges.

Moreover such a calculation gives for a division the ratio of efficiency, by dividing the tonnage actually hauled, by the calculating maximum, thus as between different divisions, giving efficiency ratios, which are comparable. By such a means the operating forces on different divisions may be compared.

Further with respect to the dispatching method. It is seen from the above, that in order to obtain the maximum, every minute of lost time must be eliminated. The time sacrificed on account of delivering 31 orders, the clearance rules, flagging rules, etc., must be reduced to a minimum. The only method that will do this safely is a proper designed block system, one on which the block for head on movement is the distance between the passing tracks, but which will permit of the movement of trains in the same direction closer than the passing track interval, as with trains of different speeds considerable delay is introduced if the slow trains being passed are compelled to wait until the train passing has reached the next passing track in advance. I do not believe that fleeting trains, or running certain trains closer together than the schedule based on the passing train intervals, will tend toward maximum traffic, on account of the effect of these fleeted trains on the opposing trains, but it is absolutely necessary to allow permissive movements in the same direction, between passing tracks, to take care of the variation in speeds of different trains, and the greater the number of speed trains, the greater the necessity for such permissive movement.

The possibility of permitting two trains to approach each other head on, even if the possibility of collision is prevented by inter-