I became convinced that it was the right thing. However, although I have no practical experience with the working of the thing myself, there are a great many men who send in accounts of their grievances to me—trainmen, & I find that there is about an equal division among trainmen againt the ton-rating of locomotives & the system of pooling locomotives. Neither of them seems to have many friends among trainmen, & I think the reason of that has been that the tendency of the new system has been to overload locomotives. There is a very important individual connected with terminals who is called the yardmaster. That man wants to get as many cars out of his yard as possible, & he is very often not very particular about the loading he puts on to a locomotive. A general superintendent of the railway who is opposed to this system said to me one day that the difficulty with the great mass of men is that they cannot add figures. A yardmaster can put whatever he likes on to a train, & there are few of them who would take the trouble of adding up the figures to see whether it is the right load or not, & that has certainly brought a good deal of onus upon the system among the trainmen, & has made them prejudiced against it. I think that the system which the C.P.R. has worked out & which we have just heard described by Mr. Tait, is the fairest of any that has been tried. It seems to meet all the objections as far as possible. You cannot establish any form of engine rating without having injustice or inequalities, & that seems to even it up as fairly as any that I have read about. There is no doubt that the tonnage system has increased the number of tons that locomotives have hauled, & I think that the railroads have been very much benefited thereby. I have a paper in my hand here describing a system on the Southern Pacific Ry., & in three years under the tonnage system their loads were increased 33%. That, of course, will induce all railway companies to go into some system of the kind sooner or later. I think that this system will become popular when railway men generally become acquainted with it, because it seems to be founded on justice. Most of the systems make no provision for difficult conditions, for bad wind-storm days, slippery track, from cold weather, & so on, & the consequence has been that the engines were overloaded & a great deal of delay consequently occurred. I noticed in that Southern Pacific system the loads have increased 33%, & it seems to me that the delays had increased in about the same proportion. I think the tendency is to overload locomotives without reasoning on what the effect of it is. There are two problems to be considered in that regard. It is quick movement & heavy loads. Quick movement does not agree with putting the last ton upon a locomotive. If a locomotive can only make 10 miles an hour, & another, more lightly loaded, can make 20 miles an hour, the chances are that the one making 20 miles an hour is earning more for the company than the one that is making 10 miles an hour. I think that has not been sufficiently considered by railroad companies, & where traffic is congested it very often happens, through the persistent efforts of yardmasters & others, their locomotives are loaded away beyond their capacity.

F. F. GAINES—I would like to ask Mr. West if I understood him to say that he doubted the economy of the large capacity cars.

G. W. WEST—No, I did not say that. I asked Mr. Tait whether they had experience enough with the heavy capacity cars to know whether the conditions that he referred to were actual or imaginary. On some tests that were recently made we were not able to haul a great deal more tonnage than the heavy capacity cars—in fact, not so much. But the prime cause was that the heavy capacity cars got down on the side bearings & it was a question with me whether the results were not due to car construction more than to the increased tonnage that he was able to get in the less number of cars. I can understand how 1,000 tons can be hauled in 10 cars if the cars are in proper condition, a good deal easier than in 20 cars. But that is due to the heavy capacity cars being of new & modern creation. When those cars get old, as some of our 40,000 or 50,000 lbs. capacity cars are, whether we will get the same conditions that we get now from the new cars is a question.

F. F. GAINES—I think that there is no question, if a car is properly designed, with stiff body bolsters and stiff truck bolsters as cars are designed to-day, there is no doubt that they will stay up as long as the cars last. I referred once before to figures I had here. In a test of 100,000 lbs. cars against 60,000 lbs. cars the actual increase in tonnage with the same engine was 20%. That is not imaginary, these are actual facts, after the cars had been in service for a year or a year and a half.

G. W. WEST—I do not think there is any one here who knows of any old 80,000 lbs. capacity cars. I know these cars were two years old.

F. F. GAINES—I would like to say that we have a lot of 80,000 lbs. cars. There is a little difference in favor of the 100,000 lbs. but not over 10 or 12%.

G. W. WEST—There are several Erie men here, & I know they have a system of loading by M's that I think includes light & loaded cars & is quite successful.

MR. MITCHELL—The system on the Erie R. R. of loading cars on the tonnage basis is to consider unit 1,000 lbs., or an M. Now, in taking the light weight of a car we take the number of thousand pounds. If the light or tare weight of the car is 23,700 lbs., we call it 24 M's. If the weight is 23,400, we call it 23 M's. We add the M's in the train together & to that add the tonnage carried in each car, & obtain the total M's behind the engine; dividing that by 2 will give us the tons. We have not gone into dynamometer tests as Mr. Tait has. We have a committee at the present time who are working on these lines with a dynamometer car. But where the dynamometer car has been used by us on certain divisions we have fully demonstrated that the pressure on side bearings controls in a great measure the pulling of the train. We took one train on the Buffalo division loaded with grain, in box cars, with metal trucks & metal body bolsters (about 97% of it, I think, was metal body bolsters), & also a train of grain with all diamond trucks & wooden body bolsters, & we found a vast difference in the pulling of the latter train, showing at once that the car of modern construction pulls easier than the old-style car. I am very glad to see our neighbor in the North has gone into the use of the dynamometer car so thoroughly. It is the way of demonstrating what we can do. The percentage of train we should haul, based on tare & load, was left in the hands of each division superintendent to do the best he could on his division, & I think whenever we have made use of the dynamometer car we have demonstrated that our engines are very well loaded. We are still working on the problem; the transportation department has it in charge & they will develop something before they get through.

E. CHAMBERLAIN—I was very much interested in the remarks of Mr. Gaines with regard to modern car construction as compared with that of a few years ago. There can be no question that the improvement made in recent years by the substitution of metal for wood parts, the elimination of factors that were a hindrance to starting & moving of cars, the positive center instead of side bearings on your car, the perfect tram of your trucks, & many more things of a like character, place you in a position to start & move greater tonnage with the same motive power than it did before such motive changes were incorporated. I cite, for instance, the cars built, I believe, by the Pittsburgh, Bessemer & Lake Erie R.R., I think, of a carrying capacity of 100,000 lbs., all of metal & improved construction. It is just possible that you would find—if it were possible to obtain figures, showing tonnage hauled in these cars with the same type of engines—that it would be quite a revelation & also show quite an attractive figure in mills per ton per mile. Mr. Mitchell very clearly pointed out the difficulties which existed in hauling trains with cars having bodies riding constantly on the side bearings. It is possible that the genius of the American mechanic will undoubtedly further improve & perfect the vehicles for freight carriage, possibly to that extent—let us hope - that one engine regardless of size of cylinder will haul a string of cars so great in extent that it will be a joy to the management & result in something tangible to the stockholder.

T. TAIT—Something has been said here about the large trains which the Pittsburgh, Bessemer & Lake Erie are hauling. I think that is one of the very best arguments in favor of large capacity cars, fully loaded (small percentage of tare), that has been advanced; that large capacity cars fully loaded will increase the tonnage which a given engine can take over a given grade will not, I am sure, be controverted.

Mr. Daly has pointed out that the class of commodity has much to do with the average size of train. True, coal, iron, etc., can be loaded to the full capacity of a car, again demonstrating the truth of the proposition that the percentage of tare should always be taken into consideration.

I agree with Mr. West that car construction has much to do with resistance of trains, but I submit that the side bearings can be taken care of on a 40-ton car as well as on a 20-ton car.

Before proceeding to deal with the second part of the paper, I would like to make a few remarks on the value of "equivalent" tonnage for purposes of comparison. When a comparison is made between engines & between men in fuel performance, & an engineman is called to account for a poor record, he may say, if actual ton miles per ton of coal is the basis of comparison, "I ran merchandise trains very often during the month, with many light loaded cars," or "I hauled a great many empties during the month." "I did not have as favorable conditions as the other men to make a good record." He would not perhaps have been required to explain at all, or if he was, such an explanation would not have been in order if "equivalent" tonnage had been the basis of comparison, for he then would have received credit for everything he had done. Under the "equivalent" tonnage method, every man & every engine receives credit for the resistance overcome according to the percentage of tare in trains handled by them, & an intelligent & fair comparison can be made.

I would now like to show you with the aid of the blackboard & of two of the tables accompanying the paper how we not only supervise the full loading, but check the overloading of engines. As a rule on our line, & I think on most lines, the tonnage preponderates on each section in one direction. Your power & your men must return in the other direction without full loads. That being the case, on any such section as that, what we want to watch is that engines are fully loaded over the controlling or limiting grades in the direction of the balance of tonnage. If we do that, if we see that our engines haul full loads over the controlling grades in that direction, we have done all we can. Now, supposing this profile A to H (referring to blackboard) represents a section or engine run of