INCREASE IN MOTIVE POWER

One Great Factor in Problem of Modern Railroad Management.

LOCOMOTIVES ARE GIANTS IN THESE DAYS

Hauling Power Limited Only by Strength of Couplings Which Bind Freight Cars Into Trains.

Annual statistics giving the total increase by American railroads of the supply of motive power and rolling stock, or, collectively speaking, of the freight hauling facilities, offer complete details as to the exact number of engines and cars that have been added to the working capacity, but they contain absolutely no reference to what is by far the most wonderful feature of this advance.

This is the great increase in the abilities of the units themselves, as regards cars, in their carrying capacities, with engines, in their hauling power. While this same marvelous doubling and trebling of the numerical amount of the equipment has been progressing steadily year after year, improvements just as constant and of results far more startling have been accomplished in its individual components.

Blunt figures, while giving no fine details or suggestions as to the means and methods employed in this advance, probably indicate with the most startling convincingness its actual extent. A statement follows, in which the inferences to be deducted from the comparisons submitted are most palpable. Today any one of the hundreds of recent model freight engines are capable of hauling up a grade of thirty-five feet to the mile a weight of 1,800 tons. Fifteen years ago the best locomotives built could handle but 700 tons up a similar grade.

Basis of Comparison.

These figures do not include the weight of the engines themselves, referring exclusively to that behind them, so they do not represent the actual hauling powers of the two styles of locomotives. The engines used for this calculation are neither of them compound. The one of fifteen years ago had four pairs of driving wheels, which were sixty-two inches in diameter. It carried a weight of 62,000 pounds on these drivers, and weighed 99,000 pounds over all. It was of the American type and bore the well-known diamond smokestack, which has not yet entirely disappeared from railroad equipment of this sort. The locomotive of today is a consolidation engine, with the same number of drivers, which are exactly the same size as those of the other monster, but it weighs 165,000 pounds on its drivers and 200,000 pounds over all. So this type is in reality pulling 1,900 tons up that hill instead of 1,800.

Simple, but absolute and accurate formulas, are used by the mechanical engineers of railroads to determine what weights their engines will handle. This weight is computed by dividing the tractive power of the locomotive by the resistance per ton of the train. To ascertain the former factor there is but one inviolable formula, tractive power being the same under all conditions. But with resistances grades must be taken into consideration, so there are two processes.

Computing Effective Force.

The resistance per ton of trains on level ground is universally attained by D. K. Clark's formula, which divides the velocity squared by a constant, 191.5, and adds another constant, 7.2. The result is the resistance. On grades the co-efficient of resistance is added to the natural sine of the angle of inclination of the grade and this sum is multiplied by 2,000 to give the power required to haul that number of pounds.

Of the four numerical factors which are used in computing the tractive powers of engines the locomotive of today differs from that of fifteen years ago in just two.

The cylinder diameter squared multiplied by the mean effective boiler pressure in pounds, multiplied by the stroke of the piston in inches and divided by the diameter of the driving wheels in inches, gives this tractive power. The stroke and the diameter of the driver in the new engine are the same as in the old, but the cylinder diameter and the boiler pressure have been increased. With them also has of necessity increased the weight of the engine, in order to prevent its slipping under the enormous addition to the load. This adhesive power is an essential to hauling power and must increase with it. Nowadays from a quarter to a fifth of the entire weight on the drivers is calculated to be utilized for adhesion, the exact amount varying with different conditions of track and rolling stock.

Today it is entirely the severity of the grades to be encountered upon a run that determine the weight of a train that can be hauled over it by a given engine. Were there only level tracks to consider the power would be almost unlimited, for these new engines can, in sober truth, pull anything you can put behind them that will stay together. As long as couplings and trucking will stand the strain the engine can haul the load. Cars may be added at will, and the coupling will give way before the locomotive is stalled. A train cannot be built strong enough to be too heavy for an engine to pull over level trackage.

Some Sample Trains.

Proofs of this statement may be found in the fact that engines of the type which can haul 1,800 tons on a thirty-five-foot grade can and do pull 5,000 tons on the level. It is a fact that on prairie divisions of many railroads today trains of that enormous weight are being run. In Nebraska no longer than two weeks ago a train of eighty-five loaded cars was pulled from South Omaha to Grand Island by one of these engines. That train was 3,400 feet in length, which is two-thirds of a mile, and it weighed at a conservative estimate 3,500 tons. A few days since that time 100 empty freight cars were similarly handled by another of these new model locomotives. This comprised a string of cars which was not quite a mile in length, but the only reason more were not added was that there were no others on hand just then to go out. The engine could have hauled fifty more with ease, and 100 more if the couplings would have stood the strain. Trains a mile in length are not an impossibility, but an impracticability.

Speed a Great Factor.

It must be remembered, however, that this enormous hauling capacity of 1,800 tons is calculated upon a slow rate of speed. This item of velocity is one of the greatest importance in matters of motive power, as being a vital factor in the resistance of a train. The fact that the velocity is squared in the formula for ascertaining resistance makes even a slight increase in it of great importance and bearing on the hauling force of the engine, as the change in the resistance is correspondingly many times greater. So it is easier to haul one train at thirty miles an hour than another only half as heavy at forty miles.

In short, it is impossible to pull these enormous freight trains at high speed, and that point brings in issue one of the interesting features of the progress in railroading. This is the fact that the speed of freight trains has not been materially increased in the last fifteen years. Improvement in that department has been left to the passenger traffic. The great expense involved has been the item that has militated chiefly against any general adoption of fast freight service. It costs much more per ton mile to run them fast than slow, and each additional unit of speed costs more than the last. Finally, there are but two classes of freight that require fast runs, so the rest of it is taken at the gait that is best for the railroads. Livestock and perishable goods, which the cold or heat will affect, however, are run fast, and that is the reason why one never sees a very large train of either class of freight. In order to make that speed the weight must be cut down. This makes the freighting very expensive, comparatively, and though the rates are higher, shipping this class of property is less remunerative than handling that which can be taken slowly and therefore in larger trainloads.

Weight and Proportions.

Though the freight engines have more than doubled in weight in the last fifteen years, their increase in proportions has not been correspondingly large. Contrary to the public belief, the huge driving wheel is not a recent affair. Forty years ago many eastern railroads had engines equipped with drivers as large as seventy-two inches in diameter, and that is still large today, being ten inches bigger than the size in general use on freight locomotives. In passenger engines, it is true, the type has undergone a considerable increase in dimensions, but this is for speed only.

It is freight cars that have really experienced the greatest development in actual size as well as carrying capacity. Fifteen years ago, when a yardmaster was calculating how long a train he could run onto a certain siding, he allowed twenty-eight feet for each car. Today he allows forty feet. That car of 1887 would, if it was unusually large, have been capable of accommodating twenty tons of lading. Now fifty-ton cars are common, while a large proportion of the new ones being put out are sixty-ton capacity.

Capacity of Freight Cars.

So marked is this increase in the carrying capacity of cars that it has attracted considerable attention from railroad authorities, and a strong sentiment is arising questioning the advisability of making this feature so important. With a large proportion of the freight traffic this capacity can never be utilized to the full. Grain, coal, stone, sand, ores and similar lading, it is true, can be loaded to the limit, but not so with fruit, furniture, shoes and hundreds of other articles, to put even twenty tons of which in the cars there is not room. Such lading could be carried as well in cars of fifteen tons capacity as of fifty. It is not yet practicable to increase the size of box cars, so with all these commodities that occupy much room for little weight the cubic capacity of the car will continue to be the limit of lading, not the capacity in tons. On the whole, however, constant changes of lading would seem to argue the advisability of having all cars large enough to carry a full load of anything rather than so small that they could not accommodate forty or sixty tons of solid lading when desired.

Evolution in Construction.

The construction of freight cars has suffered great changes. Fifteen years ago they were all wood, box, trucking, everything save the very wheels and axles. Now they are practically all steel. On a box car only the box is wood, on a flat car only the floor. The underpinning is all steel. Coal cars are now steel throughout. It was found necessary to wire boards to the sides of these new cars in order to have a place on which to tack signs and destination cards.

A discussion of passenger equipment has been omitted, and purposely so. Although great strides have been made in this department of the traffic as well, they have been chiefly toward speed and not with a view to increasing to any great extent the motive power. The passenger engines are the biggest and strongest built today, some of the recent ones weighing 300,000 pounds over all and having drivers eighty-four inches and a fraction in diameter. Yet the immense power resulting is devoted to velocity.

Weight of Passenger Engines.

Not a passenger engine on the road today has ever been taxed to its hauling power while in that branch of the service. There are very few instances during a year in which a passenger train of 1,000 tons weight is hauled behind a single engine. The average even in these days of massive coaches and long trains is about 600 tons. The cars themselves are heavy enough. The new sleeping cars weigh 110,000 pounds and the coaches and mail and baggage cars grade down to make the average on a train about 85,000 pounds. But just as with their engines, these cars are never taxed to their capacity. All passenger cars are built superlatively strong. If they ever got into them within a tenth of the weight they could stand it is unusual. Seventy people is a coach load, and that is a mere fly on the Ferris wheel to a modern passenger car.

But passenger speed has certainly increased greatly. Round-house gossip of short clips at a ninety-mile gait cover certain good bits of road are now common, and in fifteen years' time schedules between the east and west have been altered beyond recognition. Save time! That is the one cry, and as soon as there is any danger of a monster engine getting half a load behind it another is added to it, and all for time's sake.

PRATTLE OF THE YOUNGSTERS.

Mamma—Teacher tells me you were very naughty in school yesterday. Why did you not tell me yourself?

Tommy—Why—er—you always told me not to tell tales out of school.

Bessie—Mamma's hands are so soft; they are velvet.

Billy—Well, when she caught us in the pantry this morning Tommy can tell you that her hands were felt.

Little Elsie—Papa, where have you been?

Papa—To the barber shop, my dear.

Little Elsie—Oh, I know! You went to get the splinters pulled out of your face, didn't you, papa?

"Are you going to marry when you grow up?" asked a visitor of 5-year-old Bessie.

"No," was the reply, "I'm going to be a widow, because they always have such pretty black clothes and look so happy."

"Come out of there, Johnny," said his mother, coaxingly, "and I'll give you a nice piece of angel cake."

"Don't want any angel cake," came in a muffled voice from under the lounge. "It hain't got any goo on it."

There is a man who fancies he is the head of the house. This particular man has several small children, and it pleases him to discourse a great deal on the training of the young.

A few days ago he had friends visiting him. His two little sons began to play about noisily. It is one of his theories that children should obey implicitly, and he wanted his friends to see how he carried it out in the training of his own family.

"Johnny," he said, sternly, "stop that noise instantly."

Johnny looked up in surprise, then grinned a little.

"Oh, Freddy," he said to his brother as they went on with the noisy romp, "just listen to papa trying to talk like mamma."

Mamma—Willie! What's the baby crying for?

Willie—Oh, he's ungrateful; that's what he is.

Mamma—Ungrateful?

Willie—Yes'm. I jest showed him how to eat his cake and he don't 'preciate it.

"Did your sister say how she liked the amateur minstrels last night?" asked DeJones of his best girl's small brother.

"Oh, she thought your part was good, all right enough," replied the youngster.

"Did she really?" queried the delighted DeJones. "What did she say?"

"I heard her tell mamma," replied the young hopeful, "that you made a holy show of yourself."

LABOR AND INDUSTRY.

Cincinnati is organizing a $150,000 cooperative wagon factory.

Ohio has 26,920 working women. Their average weekly wages are $4.83 and savings 14 cents.

The Broom Makers' union issues a round million of labels each month for union made brooms.

Denver's Housemaids' union will establish a training school for housemaids. Working girls will be trained, with literary and social features as an adjunct.

A bill to be presented in the Belgian chamber, proposed by the labor councils, makes Sunday labor optional and a matter of free contract between parties employing and employed.

The Texas penitentiary board has decided to buy a 25,000-acre plantation and place all of the state convicts at work raising beet sugar. This will remove all convict labor from any contract employment.

The announcement that a pension system will be established by the American Steel and Wire company for its workmen who by age or otherwise are incapacitated from earning a living is an interesting phase of the corporate era.

John A. Brashear, who has just been elected chancellor of the University of Western Pennsylvania, was a rolling mill man in Pittsburg twenty-five years ago and today is the greatest of landscape lens makes and a prominent scientist.

At the suggestion of Alfred Moseley of London and Lord Reay, president of University college, London, a special commission will be sent from England to this country to inquire into labor matters and the relations between masters and labor unions.

The Mexican government has ordered that all railway employes coming into contact with the public must be able to speak the Spanish language well enough to deal directly with the passengers. Pullman car employes will be principally affected.

The state railroad commissioners of Iowa will meet in Sioux City January 28 for the purpose of condemning such property in the Floyd valley as is desired by the Omaha road for the proposed shops and terminal grounds, which the company has been unable to secure by other methods. It is the desire of the company to secure possession of the property and have the houses removed by March 1, when the work of making the improvements will begin.

David Ross, secretary of the Bureau of Labor Statistics of Illinois, has compiled the reports on the output of coal mines for the year 1901. The report shows a marked increase of nearly 2,000,000 tons over the previous year, when the output was 26,635,319 tons. There has been a notable increase in the value of the product. The report shows that the average value of all grades of coal per ton at the mines last year was $0.9543, while the year before it was $0.8949. The average price paid per gross ton for hand mining last year was $0.564, as against $0.4931 in the preceding year. The average price paid per gross ton for machine mining last year was $0.4125, as against $0.3578 the year before. This increase in tonnage gave employment to 1,500 more miners and has increased the membership of the Illinois branch of the United Mine Workers by that number.