DEVELOPMENT OF TRANSPORTATION IN THE UNITED STATES.

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MECHANICAL AND BUSINESS PROBLEMS.

Lord Bacon truly says that there are three things which make a nation great and prosperous—a fertile soil, busy workshops, and easy conveyance of men and commodities from place to place. The history of the world has proved Bacon's words to be true, but there have been nations blessed with a fertile country and busy workshops which have tried to get along without easy means of transportation, because of sectional differences concerning the defraying of the expense of constructing artificial arteries of intercommunication. The regions served by water transport were opposed to building roads for the convenience of localities remote from sea, lake, or river, and thus conflicting interests retarded the progress of some countries for the time being and left great spaces of fertile regions undeveloped.

In the course of two-thirds of a century a vast wilderness on the American Continent has been changed from gloomy, untrodden forests, dismal swamps, and pathless prairies into the abode of a high civilization. Prosperous States, teeming with populous towns, fertile farms, blooming gardens, and comfortable homes have arisen from regions where formerly savage men and wild animals were the sole tenants. A powerful factor in effecting this beneficent change has been the building of railroads.

EARLY PRESSURE OF PRODUCTION UPON TRANSPORTATION.

Projects for providing facilities of transportation by rail originated almost simultaneously in the British Isles and the United States. Both countries were badly supplied with highways on which wheeled vehicles could convey heavy loads; both had tried canals and found them unsatisfactory in some respects. The increase of production of commodities faster than the means of moving them led enterprising men in both countries to look in the same direction for relief.

The conditions of urgent necessity which led to the inventing of the steam engine were repeated as the volume of produce and merchandise to be carried went beyond the capacity of water carriage and inferior roads. The steam engine came when great properties were

deteriorating because horse power was incompetent to concentrate great effort in limited space. It was a foregone conclusion that the steam engine would be applied to locomotive purposes as soon as the horse proved unequal to the work of supplying the motive power for roads and canals.

The application of steam to water transportation delayed for a time the advent of the locomotive, but thoughtful men had glimpses of what the steam engine might do in moving loads on land almost as early as attempts were made to use steam in propelling boats.

THE RAILROAD TRACK.

The railroad structure provided a way for the wheels of a vehicle to run upon a smooth, hard surface, where obstacles to progress, such as sinking of the wheels into soft places and mounting over stones or other projecting obstructions, would not be encountered. Such roads were to be found in various localities hundreds of years before the steam engine was invented. There are many traces of what were really stone railroads to be found in parts of Asia and Africa, where an advanced civilization flourished thousands of years ago. The rows of huge stone blocks, worn with myriads of wheels, are in many places the most substantial traces of an enterprising people long passed away. The writer has seen in the streets of Italian cities stone blocks laid down parallel, with a depression to keep the wheels of vehicles in place, and these make as smooth a roadbed as the inside surface of car-track rails provide for the truckmen of our large cities.

For hundreds of years stone ways were used in Germany and other countries in connection with quarries and coal pits. They were introduced into Great Britain in the eighteenth century. This kind of crude railroad was known by the name of "tramway," and Englishmen say it originated from the name of Outram, a noted individual, who took some interest in pushing these friction-reducing roads. As the word "tram" is German and has been used by all northern nations for a thousand years, the claim of Outram to the word is not acceptable. His name probably originated from the word, which was given to the man who drove the oxen outside of the trams of the plow. Outram was the outside man.

Burns, who wrote before Outram's time, in his "Inventory," says:

> An auld wheelbarrow more for token
> Ae tram and baith the legs are broken.

In the days anterior to railways the intercommunication between the people of different districts in Great Britain was not at all intimate, but those with the same interests seemed to find out what the others were doing. The British Isles are inflicted with rain, and rain is not good for dirt-made roads. It is, then, easy to imagine how well the invention of some coal miner was regarded who introduced

tram rails to carry the wagons from the mine to the staith, or wharf, where the coal was dumped into ships.

One could not tell the coal-mining world of Great Britain at the beginning of this century much that was new about trams. The tramway began with long blocks of stone, that gave place to parallel wooden stringers for the wheels to run upon. The hand of progress covered the stringers with iron strips. Then some one found out that a cast-iron rail simplified matters, and a flange was put upon the wheels to prevent them from jumping the track. This was the condition of the world's "permanent way" when people of advanced ideas proposed to use it for steam-driven locomotives.

NEED OF THE LOCOMOTIVE.

The nineteenth century had not advanced many years when people in the United States began to realize that something better than canals was necessary as a means of intercommunication if a great part of the nation's territory were to be opened up to settlement and civilization. There are numerous navigable rivers and long-reaching lakes on this continent, but geographically they are far apart, and there is no means of reaching vast regions except by land transportation. To the ordinary thinker a system of substantial macadam roads would have solved the difficulty as far as draft animals could have aided, but these roads were not tried to any extent.

The pinch of necessity wonderfully quickens the inventive faculties. Long before a mile of tramway was built in the United States in connection with coal mines, engineers and farseeing public men were discussing the possibilities of the steam engine as a means of accelerating land travel, and projects began to be agitated in different States to construct railways, or tramways, on which the steam engine could do the work of hauling the cars.

Those who looked favorably upon steam engines as motive power on railroads were a small minority, and they were considered by the majority as cranks and visionaries. Those regarded as sensible, progressive men, a little ahead of their time, favored horses for motive power.

The problem that public men were interested in was, How are we going to move our merchandise, and coal, and ore to the nearest point of water navigation? The transportation of passengers received little consideration from the early railroad schemers.

It might here be mentioned that had James Watt never lived, the use of the steam engine for transportation purposes would have been given to the American people just as soon as it was. Oliver Evans, a native of Delaware, invented the high-pressure, high-speed engine as an improvement on the Newcomen atmospheric engine when Watt was working out his ponderous slow-moving improvement on the

same engine. The United States has been the land of high-speed, high-pressure engines, the type most suitable for locomotive purposes, and Oliver Evans was the originator.

The need for the locomotive was much more urgent in the United States than it was in any other country. There were long stretches between Western rivers and Eastern estuaries that needed to be connected. There were no well-constructed roads of any consequence, and such roads, had they existed, could not have offered rapid transportation, so the railway was the chief hope of connecting the remote territory with markets and the seaboard.

FIRST AMERICAN LOCOMOTIVE.

The first locomotive that was tried on the American Continent to run on rails was imported from England by the Delaware and Hudson Canal Company. It was selected and brought here by Horatio Allen, a pioneer engineer, who was interested in railroad enterprises. The engine was taken to Honesdale, Pa., and tried there in August, 1829. Mr. Allen reported that it was too heavy for the railroad structure, and its use was given up. The engine weighed only 7 tons, and there was some diversity of opinion about its being too heavy for the railroad, but Mr. Allen's decision was final. Several engines of the same type worked for years successfully on English railways. From what is known about the structure of the road, engineers now agree that it was sufficiently strong to support twice the weight of Allen's engine, known as the "Stourbridge Lion."

The first thirty years of the nineteenth century were for Americans the period of speculation about the probable success of railroad building and the utility of the locomotive. Then the people set to work to build railroads, and within ten years (1840) the country had 2,755 miles of railroads and tramways.[1] For a few years there was decided uncertainty that the locomotive would be a practical form of motive power, and Allen's fiasco with the "Stourbridge Lion" helped to make the capitalists who were investing their money in railroad building timid about ordering locomotives while they could operate their cars with horses.

EARLY RAILROADS AND LOCOMOTIVE BUILDING.

The South Carolina Railroad Company was one of the earliest in the world to decide that its railroad should be operated by locomotives, and the operation began in 1827, very soon after the beginning in England.

People of Baltimore, who have always shown much zeal in supporting enterprises likely to bring trade and commerce to the city, obtained in 1827 a charter from the legislature of Maryland to construct

[1] Report on Transportation by Land, Eleventh Census, by Henry C. Adams, special agent, p. 6.

a railroad from Baltimore to a point on the Ohio River. The building of the Baltimore and Ohio Railroad was begun without loss of time with imposing ceremonies. In the early part of 1830 the road had been finished from Baltimore to Ellicott Mills, a distance of 13 miles, and the company began operating that part by horses. There were several sharp curves on the route, and a belief was general that a railroad having curves could not be operated by locomotives. Peter Cooper, whose fame as a philanthropist is well known, was a resident of Baltimore at that time, and he did not share the popular belief that locomotives would not be capable of working around curves, so, to demonstrate the faith that was in him, he built a small locomotive in the Mount Clare shops, Baltimore, and tried it on the road. It was a very tiny affair of about 1½ horsepower, but it proved that a locomotive could haul a load on a curved road.

Cooper's experiment increased public confidence in the efficiency of locomotives, and the demand for this kind of engine increased as steadily as pieces of railroad were finished.

Machine shops capable of building locomotives were not very numerous, but a few shops undertook the work and succeeded very well under the circumstances. The first practical engine intended for everyday work was built by the West Point foundry, New York, for the South Carolina Railroad. It was a small engine, with a vertical boiler, but it worked as satisfactorily as the English locomotives built at the same time (1830). The West Point foundry continued to build locomotives for a time, and improved on the design and capacity of the first engine. Among their most celebrated productions was the "De Witt Clinton," built for the Mohawk and Hudson Railroad.

Shortly after the experiment with Peter Cooper's model locomotive on the Baltimore and Ohio the management of the company advertised for locomotives of American manufacture, offering to pay liberally for them. In due time this brought five engines, all built at different places, all different in design, and none of them imitating English models. The preference was given to an engine built by Davis & Gartner, of York, Pa. This engine had a vertical boiler and was for a time the type of locomotive used by the Baltimore and Ohio Railroad.

After this there were locomotive-building shops to be found in several towns. Mathias Baldwin had entered the business the year previous, and his "Ironsides," the second locomotive built in the United States, was running on the Germantown road, where it was doing good work, although the company published a standing notice that the locomotive would start daily with a train of passenger cars if the weather was fair, but that on rainy days horses would pull the train.

By 1840 there were about two hundred and seventy locomotives working on fifty-six railroads that were partly finished; but the greater

part of the mileage was still operated by horses. It may seem surprising that so many locomotives should be employed on such a short mileage when horses were doing most of the work, but a locomotive during the first railroad decade was very little larger than the fire engine of to-day, and great care was taken to prevent it from working hard. The weight of the first Baltimore and Ohio regular locomotive was 3½ tons.

EARLY FREIGHT RATES.

The greater parts of early railroads were projected to join two or three towns by easy communication or to provide the means of carrying freight from the interior to harbor towns that were not well provided with water transport. Complaints were made in the interior, where farm products were raised, that the cost of transportation to a market often exceeded the value of the shipment. When we examine the railroad rates charged in 1840, we are not surprised at the complaints made by agricultural communities. A good many of the railroads were chartered as turnpikes, and any person could haul cars over them on paying the legal toll charges. This plan, which caused great confusion, did not have the effect of cheapening transportation. For years after steam motive power was generally introduced private cars were hauled, both freight and passenger, payment being exacted on a tonnage basis.

In 1840 Mr. W. H. Wilson, engineer of the Columbia and Philadelphia Railroad, reported that the rates of toll for the use of the road varied from 6 mills to 4 cents per ton-mile. There were twelve different rates, the average being 2 cents per ton-mile. It was said that in the first nine months of the operation of the Baltimore and Ohio the cost per ton-mile was 6 cents. In 1837 the charges for carrying freight on a few leading railroads were as follows, in cents, per ton-mile: Baltimore and Ohio, 4½; Baltimore and Washington, 4; Winchester and Potomac, 7; Portsmouth and Roanoke, 8; Boston and Providence, 10; Boston and Lowell, 7; Mohawk and Hudson, 8. At that time passengers were charged between 2 and 3 cents per mile on the roads that carried them.

Although the rates were high from our present standpoint, the railroads did not obtain much profit from the work done. This arose from a variety of causes. The railroads had nearly all been built in an inferior fashion, with material that was too light for trains, although engines and cars were also very light and poorly built. On most of the lines the business offered was very small, but the trains had to be run, no matter what the extra expense was.

As late as 1873 Gen. Herman Haupt, general manager of the Atlanta and Richmond Railroad, testified to a Senate committee that local rates were 3½ to 4 cents per ton-mile, and that local passengers were charged from 4 to 5 cents per mile. These rates, he acknowledged, were about twice as high as those charged on Northern

railroads. He justified the high charges on the ground that business was small. He was dealing with conditions that existed on nearly all railroads up to 1860.

The men in charge of the operating and of the machinery of railroads had to learn their business by hard and often expensive experience. But they made steady progress, and every succeeding year, up to a certain point, saw the railway transportation done at reduced expense.

RAILS AND ROADBED.

It was soon found out that strap rails and other forms of weak permanent way, laid on a soft, yielding roadbed, made the worst kind of a foundation upon which to build up a prosperous business. Railroad operators were not long in finding out that locomotives weighing under 10 tons were too weak for hauling paying loads, and that the small cars used had too much dead weight for the paying load. From 1840 to 1860 the improving of the weak points named occupied the attention of the most progressive railroad officials.

When there are good prospects for obtaining plenty of goods to transport by railway the most important preparation for doing the work at low cost is to have a good roadbed and a substantial track properly laid upon it. The engineers who supervised the building of early railroads believed that the first requirement of a good track was to have it as unyielding as possible. The first part built by the Baltimore and Ohio served for several years as a model for other railroad builders. A roadbed was first graded as nearly level as possible. A small trench was then made for each track and filled with rubblestone. On this were laid blocks of granite or other rock, about a foot square and as long as possible. The upper face and inner surface of these blocks were dressed perfectly smooth. Bars of iron, about an inch thick, were then laid on them close to the inner edge and fastened there.

In some sections granite or other rock blocks were laid at intervals with wooden stringers, to which the iron rails were fastened.

As late as 1841, in the building of the Erie Railroad, one of the presidents had piles driven for 100 miles on dry land, to make a substantial support for the stringers that were to carry the rails.

A few years' experience proved that the unyielding support to the rails turned the structure into a long anvil, on which the rolling stock was hammered to destruction. All who could afford the expense lost no time in putting in cross-ties to support the track.

Great varieties of rail sections were tried during the first twenty years of railroad building. First there was the plain strap noted for its "snakeheads," which was a form the rail sometimes took at a loose joint. Frequently those snakeheads forced their way up through the car floor. Contemporaneous with the strap was the fish-bellied rail, which was deeper in the middle than at the ends. This rail had to

be kept in position by cast-iron chairs, secured to the stringers or cross-ties. Next came the U, or bridge, rail, laid with the flanges spiked to the supports. Eventually the T-rail came and gradually sent the others to scrap dealers.

IMPROVEMENTS IN THE ENGINE.

The first direction that the improvement of rolling stock took was the extension of the wheel base of the engine so that the weight should be distributed over as much rail length as practicable with the lightest possible weight on any one spot. This movement was really begun in the United States, when, in 1831, John B. Jervis, chief engineer of the Mohawk and Hudson Railroad, put a four-wheel truck under the front end of an engine that was built under his supervision. This worked so well on weak, uneven track that it was gradually adopted by nearly all American railroads.

The coal railroads of Pennsylvania, Maryland, and New York, which frequently had more business than their motive power could handle, began using engines about the middle of the century which were extraordinarily heavy and powerful for that time. The companies using those engines could afford to build and maintain very substantial permanent way, which was not the case with the average railroad company. At the same time the engine for ordinary train service was working into an established form. By 1860 engines weighing about 20 tons were becoming common, and most of them were carried on two pairs of coupled driving wheels and a four-wheel truck in front. That form came to be known as the "American" engine, and it held almost exclusive control of the motive-power field with regular enlargements until about 1880. These engines were suitable for any service, passenger or freight, when used on fairly level roads, and are to-day the most popular motor ever put in front of a train.

The locomotive of 1900 is an example of steady evolution, and its leading features are survivals of the fittest. Vast improvements have been made in quality and finish of material. Certain important changes have been effected, among which these may be mentioned: The putting of iron and steel into frames and driving wheels that formerly were partly of wood; counterbalancing the driving wheels; making the fire box suitable for burning coal instead of wood; using equalizing levers between the wheels; placing the cylinders horizontally instead of vertically or inclined; using steel tires instead of iron; using steel for boilers instead of iron and for fire boxes instead of iron or copper; using iron or steel for tubes instead of brass. All these improvements have helped to increase the durability of the engine, to make it more efficient, and therefore to enable it to reduce the cost of hauling mile-tons of freight or passengers. Other changes made in the interests of economy are extremely high boiler pressure, increase in size, and using the steam on the compound system.

STEEL RAILS.

Steel rails began to be introduced about 1867, and they steadily forced iron rails out of use, except for places where the traffic was very light. Engineers who have made the subject a special study say that a steel rail is from 8 to 15 times more durable than iron and is much less liable to breakage throughout the whole of its use. The invention of cheap methods of making steel rails has had a stupendous effect upon transportation. It brought the cereals of regions west of the Missouri River and of the remote Northwest into competition with the grain-raising districts of the Eastern States and of Europe and Asia; it caused a semirevolution in farming business in the British Isles, and strongly affected the condition and fortunes of millions of people. While inflicting injury on the interests of the few, the invention exercised a distinct beneficent influence on the many.

The iron rail and the 25-ton locomotive had pushed settlement and civilization far beyond the limits possible when the mule-hauled wagon formed the means of transport to waterways. Steel rails and huge locomotives make the railroad a close competitor with waterways in the cost of transportation; these have also made the capacity for reaching remote places almost unlimited.

It was only after the introduction of steel rails that railroad men began to grasp the conditions necessary to move a unit of passengers or freight at the least possible expense. The principal conditions are powerful locomotives, loaded to their utmost capacity with large cars carrying heavy loads and run over a fairly straight and level road. For the last ten years all competent railroad managers have been working in this direction.

Improvement in permanent way and in motive power greatly reduced the cost of transportation, but a great change in the methods of railroad operating and management preceded the physical improvements referred to.

CONSOLIDATION AND EXTENSION OF RAILROADS.

It has already been mentioned that most of the early railroads were built to connect towns or waterways. They were mostly short roads that did not attempt to cooperate with one another in moving freight or passengers beyond their own limits. This led to very annoying delays and extra handling of freight. The line, for instance, between Albany and Niagara was in the hands of many separate companies that seldom worked in harmony, and nearly all other lines that were links in through routes were managed in a similar manner. By 1850 the people had become tired enough of the unnecessary discomforts endured on long journeys, and they began to demand radical reform. This gave personages who became known as "railroad kings" their opportunity.

ECONOMICS OF THE GAUGE.

In connecting disjointed lines the consolidators lost an opportunity which may cause much inconvenience in coming years. They found a great variety of track gauges and chose the narrowest, 4 feet 8½ inches, now known as the standard. That gauge is too narrow for admitting of a properly designed boiler upon a large locomotive. Many locomotives are already at work that have reached the limit of their capacity, because the limited gauge prevents the boiler from being made larger. To obtain a large boiler it has been raised as high as bridges and tunnels will admit, and it can not be made any longer with economy, so that the question has been raised whether this country has not already nearly reached its limit of cheapness in railroad transportation. If the gauge had been made 6 feet, the Erie standard, or 5 feet 6 inches, which was the gauge of many Southern roads and that of Canada, the possibilities of making railroads compete successfully with water carriage would have been greatly increased. When all the leading railroads use locomotives of the greatest possible capacity for the gauge, and cars are made to carry the maximum load that can be safely conveyed on two four-wheel trucks, the cost of transportation will be reduced, but not to a radical extent. It is believed in some quarters that the bottom cost has nearly been reached unless some revolutionary change is made in the track and motive power.

One of the most curious facts met with in railroad history is the influences by which certain track gauges were established. The settling of the gauge likely to prove most convenient for the business to be done is an engineering problem which ought to have received careful study and profound calculation. Instead of that, the gauge was generally decided by some whim. In 1840 there were thirty-three separate railway companies in Great Britain, with 1,552 miles of track, and they had five different gauges, ranging from 4 feet 8½ inches to 7 feet—the narrowest gauge having more mileage than all the others. The former was George Stephenson's gauge, and it was established in a curious way. The gate openings of the first tramroad Stephenson was connected with were just sufficiently wide to permit wheels extending 5 feet to pass. At that time the flange of the wheel was on the outside. When the Stockton and Darlington Railway was built Stephenson put the wheel flanges inside. The width of the rail head was about 2 inches, so the inside gauge was 4 feet 8 inches. When the Liverpool and Manchester Railway was under construction the engineers concluded that it was better to give the wheels plenty of side play to make fast running easy, and they widened the gauge one-half inch, making it 4 feet 8½ inches.

The success of the Liverpool and Manchester Railway made George Stephenson a great man, and others were ready to imitate what he had done, so his gauge was adopted by most of the British railways.

He had locomotive building works that supplied many of our early railroads with engines, and the track gauge was generally established to fit the wheels of the engine. The South Carolina track was laid to 5-foot gauge, and the tendency in the South was to follow that width, but toward the Ohio River and some other Southern districts 5 feet 6 inches was the favorite gauge.

There was more confusion in the North. The roads that began with Stephenson engines had mostly 4 feet 8½ inches gauge; but there were to be found gauges of 4 feet 9 inches, 4 feet 10 inches, 4 feet 11 inches, and 5 feet. Canada had 5 feet 6 inches, and the Erie road 6 feet. The wide gauge was adopted for the Erie because the chief engineer said that the grades would be so heavy that enormously large locomotives would be needed to haul the trains and that the narrow gauge could not accommodate the size of engines necessary. The president favored the wide gauge because he did not wish the road to have facilities for interchange with other roads that might be the means of carrying trade away from New York City.

RATES IN RECENT YEARS.

For the last thirty years the rates for the transportation of freight have been steadily reduced. In 1854 a leading trunk line with terminal in New York received an average 2.58 cents per ton per mile; in 1899 the rate had fallen to 0.517 of a cent. In 1870 twelve leading railroads received an average of 2 cents per ton-mile for freight, and in 1898 it had fallen to 7.53 mills. The average rate for passengers in the latter year was 1.973 cents per mile.

The rates for carrying passengers have not decreased in proportion to freight charges, but it is doubtful if the railroad companies earn more in proportion, for the cost of hauling trains has been greatly enhanced by the introduction of heavy, luxurious cars and accelerated speed.

EXPANSION AND PROGRESS.

In the foregoing pages much space has been devoted to a consideration of the mechanical difficulties that were encountered by railroad engineers and constructors in the extension of the railway system of this country, for the reason that these difficulties were of a fundamental character and needed to be overcome before distant agricultural regions could be placed in practical and economical communication with their markets. In previous treatments of this subject, the dependence of agriculture upon these technical and fundamental features of transportation has not received due importance; hence, the present attempt to explain the indebtedness that agriculture and its extension in the United States owe to the mechanic, the engineer, the railroad constructor, the inventor, and the railroad manager. In the remainder of this paper attention will be given to industrial and economic features.

ROADS AND CANALS.

When the nineteenth century began the inhabitants of the States forming the Union were settled within easy reach of navigable streams or estuaries of the ocean, which provided indifferent means of transportation. The most fertile land was often to be found farther from the waterways, but the expense of carrying produce to the market was in such cases greater than the value of the goods.

A glance at the map of the United States will show how bountifully nature has provided the Atlantic coast with inland waterways that extend far into the interior of the country. By the aid of these the nucleus of a great nation was established with practically no aid from artificial means of transportation. During the colonial period there was not enough State or national feeling to induce the people to join their energies in pushing enterprises, such as roads and improved waterways, for the public good. The long struggle of the Revolutionary conflict impoverished the people, never rich in the world's goods, and the close of the eighteenth century found the Government too poor to undertake the execution of public works greatly needed to aid the country in a progressive career.

Sentiment in favor of making better means of inland transit was, however, kindled, and it gradually but surely warmed up public opinion to engage in united efforts to carry out public works for the good of the country at large. The first useful manifestation of this sentiment was the building of good roads between important trade centers. Then came agitation in favor of the construction of canals. That the making of roads and canals did not achieve much progress in the early years of this century was due more to the poverty of the people than to their want of inclination.

The war of 1812 delayed to a great extent the construction of roads and canals, but peace was scarcely established when these public improvements were pushed with renewed vigor. By this time the invention of the steamboat was imprinting its mark upon the country and opening up prospects of extended inland commerce which never had been dreamed of when the century began.

IMMIGRATION.

The nineteenth century has seen a mighty emigration, more stupendous than anything that happened in ancient times, and it has gone on so quietly that few people realize its vast proportions. This has been the emigration of people from Europe to the United States. The principal part of this immigration, which in itself has been sufficient to form a great nation, has happened since the beginning of the railroad era, and the extending of new railroads has constantly opened new worlds, where industry and thrift made possible conquests of wealth and comfort, such as no other movement of the human race has brought to the enterprising seekers after fortune.

THE STREAM OF TOILERS FROM EUROPE.

With road building, canal construction, and the sending of steamboats farther and farther inland, the United States was becoming the greatest center of commercial activity and enterprise in the whole world. The fame of this land of liberty extended beyond the Atlantic, and thousands of people, destitute of land or starving in forced idleness, looked to the United States as a land of promise, where industry would reap the reward of food, raiment, and comfort.

That started a stream of emigration which rose like a rippling brook, and increased as it advanced until it became a mighty river.

It is estimated that in the years from 1789 and 1820 about 250,000 immigrants came to the United States, a large proportion of them having arrived in the latest decade. Although the disturbance of the war of 1812 had prostrated enterprise, the last few years of the second decade of the century witnessed the inauguration of industrial activity, and were the beginning of the nation's irresistible march on the crusade of peaceful triumphs.

In the decennial period from 1821 to 1830 the immigrants numbered 143,439, and this brought the country to the beginning of the railroad-building period. The flood of immigrants then increased very rapidly, for the people in Europe found out that thousands of hands would be needed in the construction of railroad works, while others learned that the railroads were opening up new territory for settlement, where land could be bought cheaply, while a market would be open for the produce raised. In the decade 1831 to 1840 the Government records show that 599,125 immigrants arrived.

The stream of emigration was now becoming a flood. From 1841 to 1850 the population was increased by 1,713,251 people who came from beyond the seas. It went on increasing from this source till, in the decade from 1881 to 1890, it reached the immense proportions of 5,246,613. That was the high tide. From 1821 to 1899 immigrants to the number of 18,823,668 came to find homes in the United States. In the year 1882, which was the flood of the tide, the country received almost 800,000 immigrants.

The world never before saw anything comparable with this tremendous movement of people in so short a space of time. The population that Europe has thus lost in a hundred years is about equal to two-thirds of the population of Great Britain and Ireland in 1861, and is a little less than this fraction of the number of inhabitants in the United States in the same year. It represents five-sixths as many people as Great Britain and Ireland gained in population in the first ninety years of this century. If the ships on which these emigrants embarked carried, on an average, 500 passengers, more than 38,000 round trips have been made in ferrying them to their new homes.

No probability can be discerned that any later century will see the equal of this migration. The fairest parts of the world that were

wildernesses in 1800 now teem with industry and population. There are no more virgin lands in abundance to occupy in this country; no more such enticements to draw millions from the homes of their fathers.

Much of this vast concourse of people rested not in towns upon their arrival, but marched out bravely to lands that had never felt the plow and to forests unmarked by the ax, and there by patient toil proceeded to enrich themselves and the nation under whose industrial flag they had enlisted.

INCREASE OF POPULATION, AGRICULTURE, AND RAILROAD MILEAGE.

The means of railroad transportation advanced steadily with the growth of population. Although early in the century a movement had been started for the construction of good roads, the work done scarcely made a mark on the map of the United States, and the people who settled more than a day's journey from navigable water or canals depended on railroads as almost their sole means of transporting their produce to markets. To them the railroad was looked upon to perform the functions done by turnpikes in other countries. On this account the people have given extraordinary encouragement to the building of railroads.

In 1840 the population of the country was 17,069,453, and there were 2,755[1] miles of railroads in operation, or 0.16 of 1 mile, about one-sixth of a mile for every 1,000 people. In the census year 1840 Ohio, Pennsylvania, New York, Virginia, and Kentucky raised 57 million bushels of wheat. During the same year Tennessee, Kentucky, Virginia, Ohio, and Indiana raised 181 million bushels of corn. The total volume of agricultural exports that year was worth $92,548,067.

The next decade, ending in 1850, found the population increased to 23,191,876 people, and the railroad mileage to 8,571,[1] or 0.37 of 1 mile for every 1,000 of the population. Pennsylvania, Ohio, New York, Virginia, and Illinois in 1850 raised 63½ million bushels of wheat, and Ohio, Kentucky, Illinois, Indiana, and Tennessee raised 281 million bushels of corn; Alabama, Georgia, Mississippi, South Carolina, and Tennessee raised 2.04 million bales of cotton; New York, Ohio, Pennsylvania, Virginia, and Tennessee had $222,900,000 worth of farm live stock on hand. The exports amounted to $108,605,713 in agricultural produce.

In 1860 there were 31,443,321 people, and 28,920[1] miles of railroad, or 0.92 of 1 mile to every 1,000 of the people. During 1860 Illinois, Indiana, Wisconsin, Ohio, and Virginia raised 84½ million bushels of wheat, while Illinois, Ohio, Missouri, Indiana, and Kentucky raised 397 million bushels of corn; Mississippi, Alabama, Louisiana, Georgia, and Texas raised 4.1 million bales of cotton; and the farms of New

[1] Report on Transportation by Land, Eleventh Census, by Henry C. Adams, special agent, p. 6.

York, Ohio, Illinois, Pennsylvania, and Kentucky had on hand 388 million dollars' worth of live stock. The value of agricultural exports was $256,560,972.

In 1870 the population had risen to 38,558,371, and the railroad mileage was 49,168,[1] or 1.28 miles to each 1,000 of the population. During that year Illinois, Iowa, Ohio, Indiana, and Wisconsin raised 141 million bushels of wheat; Illinois, Iowa, Ohio, Missouri, and Indiana raised 383½ million bushels of corn; Mississippi, Georgia, Alabama, Louisiana, and Texas raised 2.17 million bales of cotton; New York, Illinois, Ohio, Pennsylvania, and Missouri had on their farms 646 millions of dollars' worth of live stock. The export of agricultural produce was worth $361,188,483.

During the decade ended in 1880 the population increased to 50,155,783, and there were 87,724[1] miles of railroad, or 1.75 miles for each 1,000 inhabitants. Illinois, Indiana, Ohio, Michigan, and Minnesota raised 214½ million bushels of wheat in 1880, while Illinois, Iowa, Missouri, Indiana, and Ohio raised 1,030½ million bushels of corn, Mississippi, Georgia, Texas, Alabama, and Arkansas raised 3.89 million bales of cotton, and Illinois, Iowa, New York, Ohio, and Missouri had 574½ million dollars' worth of live stock. The value of agricultural produce exported that year was $685,961,091.

In the 1890 decade the population was 62,622,250; there were 163,597[2] miles of railroads, 2.61 miles for every 1,000 of the population. Minnesota, California, Illinois, Indiana, and Ohio in 1890 raised 203½ million bushels of wheat; Iowa, Illinois, Kansas, Missouri, and Ohio raised 1,173 million bushels of corn; Texas, Georgia, Mississippi, Alabama, and South Carolina raised 5.48 million bales of cotton, while the farmers in Iowa, Illinois, Missouri, Kansas, and New York had on hand 778 million dollars' worth of live stock. The export of agricultural products aggregated $629,820,808.

In 1900 the estimated population is 75,000,000; the miles of railroad, 190,000,[3] or 2.53 miles per 1,000 of population.

In 1899 Minnesota, North Dakota, Ohio, South Dakota, and Kansas produced 234 million bushels of wheat; Illinois, Iowa, Kansas, Nebraska, and Missouri raised 1,114 million bushels of corn; Texas, Georgia, Mississippi, Alabama, and South Carolina raised 8.2 million bales of cotton, and the farms in Iowa, Texas, Illinois, Kansas, and New York contained about 621 million dollars' worth of live stock.[4] The value of agricultural products exported was about $784,999,009.[5]

[1] Report on Transportation by Land, Eleventh Census, by Henry C. Adams, special agent, p. 6.

[2] Report of Statistician of Interstate Commerce Commission, 1898.

[3] Estimates of the Department of Agriculture, based on reports of the Statistician of the Interstate Commerce Commission.

[4] In 1900, without swine, $784,989,087.

[5] Bureau of Statistics, Treasury Department (subject to revision).

LONG-DISTANCE TRANSPORTATION.

While the United States for many years continued to be almost exclusively an agricultural country, the center of population has remained near the middle of the settled portion. A century ago there were very few settlers west of the Appalachian Mountains except in Kentucky, Pennsylvania, and Ohio. The people were mostly settled on a strip about 1,600 miles long, extending along the coast from Maine to Alabama, the width depending upon the number and character of the rivers that provided means of transportation into the interior. Up to 1840 the center of population moved within a radius of 200 miles from Washington, D. C.; then it moved slowly westward. In 1850 it was near Parkersburg, W. Va.; in 1860 it was near Chillicothe, Ohio; in 1870 it was 48 miles east by north of Cincinnati, Ohio; in 1880 it was 8 miles west by south of Cincinnati and in 1890 it was 20 miles east of Columbus, Ind.

The center of population after 1840 began to be more and more influenced by the increasing population of the manufacturing and mining districts, and the greater part of the agricultural products came to be raised in States that were a long distance away from the center of population. It will be noticed that in 1840 and 1850 New York, Pennsylvania, and Virginia were among the best wheat-raising States, but after that the raising of cereals moved gradually to the Western States. This movement became very rapid after the introduction of steel rails enabled railroad companies to make material reduction in freight charges.

After railway construction began a part of the westward movement of population was surging in advance of railroad building, the enterprising people being contented to go forward and wait for the railroads that would give them easy communication with the commercial world by the time they had produce to sell and were ready to purchase the commodities that the outer world would supply. They went by rail, by boats on lakes and other waterways, and then by prairie schooner found their way to the more fertile regions open for settlement.

It was not safe, however, to settle far from a point of shipment by rail or water, because produce could be carried by wagons but a short distance before the cost of transportation would equal the value of the load.

The desired reduction of freight rates has not yet been accomplished; but the movement toward cheapness has been so pronounced that it is safe to predict that when railroads are using locomotives and cars of maximum power and capacity, a day's wages of a common laborer in New York may be sufficient to pay the charges on a year's food sent from St. Paul, Omaha, or Kansas City to New York. In 1887 the average charge for transporting a bushel of wheat from Chicago to New York by rail was 15.75 cents; in 1899 the charge was 11.6 cents. During

the year 1887 the average rate per 100 pounds of meat from Cincinnati to New York by rail was 27.12 cents; during 1899 it was 24.83 cents.

Anterior to the steel-rail period, when wood-burning locomotives hauled cars loaded with from 500 to 600 bushels of wheat or from 15,000 to 20,000 pounds of other products, the rail freight charges for long distances were practically prohibitory. In 1858 the rate per bushel of wheat from Chicago to New York was 38.61 cents, and there was a very small margin of profit for the carriers. The introduction of more powerful locomotives and cars of greater capacity, together with water competition, pushed the all-rail rate downward till in 1870 it was 26.11 cents. At this time the lake and rail rate was 19.58 cents per bushel of wheat.

DEVELOPMENT WEST AND SOUTHWEST.

There were now prospects that land in districts remote from water carriage would be cultivated with profit to the farmer, and the tide of immigration flowed rapidly into States that previously had a meager population. In the decade from 1860 to 1870 twelve States and Territories in the West, Northwest, and Southwest added the following approximate increase of population:

Increase of population from 1860 to 1870.

State or Territory.	Increase of population from 1860 to 1870.	State or Territory.	Increase of population from 1860 to 1870.
Dakota	9,000	Minnesota	268,000
Illinois	728,000	Missouri	539,000
Indiana	330,000	Nebraska	94,000
Iowa	519,000	Texas	214,000
Kansas	257,000	Wisconsin	279,000
Kentucky	165,000		
Michigan	435,000	Total	3,837,000

This movement of immigration must have been greatly obstructed by the civil war, which covered nearly half of the decade. After peace and order were restored, the stream of immigration increased rapidly.

The increase of agricultural products was closely related to the increase of population. Cheap railroad rates enabled the more remote farmers to compete with farmers raising farm produce on the seacoast, and their dressed meat and grain were sent to consumers thousands of miles away. The subject of ocean transportation as relating to the distribution of the agricultural products in this country and the creation of a world market for them has been treated of fully in another publication issued by the Department.[1] The subject

[1] Statistics of Freight Charges for Ocean Transportation of the Products of Agriculture, October 1, 1895, to October 1, 1896, prepared by Mr. H. T. Newcomb, formerly chief of the section of freight rates, Division of Statistics, Department of Agriculture, now chief of the division of agriculture, Twelfth Census.

of canal transportation is a large one, and will only be mentioned in this paper, especially since the subject has been exhaustively treated of in other publications.[1]

FREIGHT AND PASSENGER RATES.

FREIGHT RATES.[2]

The following table shows the freight rates, in cents, per bushel for wheat and corn from Chicago to New York:

Rates, in cents, per bushel for wheat and corn from Chicago to New York, 1870, 1880, 1890, and 1899.

Year.	Wheat.		Corn.	
	By rail.	By rail and water.	By rail.	By rail and water.
	Cents.	*Cents.*	*Cents.*	*Cents.*
1870	26.11	19.58	24.37	19.32
1880	19.8	15.8	17.48	14.43
1890	14.3	8.52	11.36	7.32
1899	11.6	6.63	10.08	5.83

The tendency of rates for live stock and dressed meat has been steadily downward, but not in the same proportion as the rates for cereals.

The following are the rates, in cents, per 100 pounds of live stock from Chicago to New York by rail:

Rates, in cents, per 100 pounds of live stock from Chicago to New York by rail, 1872, 1880, 1890, 1895, and 1899.

Year.	Cattle.	Hogs.	Sheep.	Horses and mules.	Dressed beef.	Dressed hogs.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1872	.....	.....	.....	.....	81	.....
1880	55	43	65	60	88	.....
1890	23	28	30	60	39	39
1895	28	30	30	60	45	45
1899	25	25	25	60	40	40

The distance from St. Louis to New Orleans by rail is about 754 miles. By water it is considerably greater. The river rates, however, compare favorably with the charges by rail. In 1866 corn and rye per bushel cost 9.05 cents during high water and 10.93 during low water. In 1877 these rates were 7.63 and 8.59 cents, respectively, and

[1] See Publications of the American Economic Association, Vol. V, 1890, Nos. 3 and 4, two papers on the canal question, by Edmund J. James, Ph. D., and by Lewis M. Haupt, C. E.; also Quarterly Journal of Economics, February, 1900, "The New York canals," by John A. Fairlie.

[2] All rates are expressed in gold.

grain in sacks of 100 pounds cost 20.04 cents for freight, while wheat in bulk was charged only 8.11 cents per bushel. In 1899 these latter rates had dropped to 10 and 4.50 cents, respectively. The rates for corn and rye were quoted in 1892 as 5 cents per bushel for high water and 7 cents for low water.

The distance from Cincinnati to New York is about 200 miles shorter than the distance from Chicago, but the rates for dressed meats are not materially lower. In 1868 the average rate per 100 pounds was 48.8 cents. In 1880 the rate was 33.41 cents; in 1890 it was 23.89 cents, and in 1899 it was 24.83 cents.

For bulky, fragile, and perishable articles higher rates are charged by railroad companies than for those heavy articles with which a car can be loaded to its full carrying capacity as measured by weight, and which are not likely to sustain damage in transit. The following table shows the rates, in cents, for 100 pounds of a variety of merchandise from New York to Chicago:

Rates, in cents, per 100 pounds of merchandise from New York to Chicago by rail, 1867, 1870, 1880, 1890, and 1899.

Year.	Less than car load.			Regardless of quantity.				
	Agricultural implements.	Lead.	Sugar.	Dry goods.	Cotton piece goods.	Boots and shoes.	Tea.	Drugs.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1867	137	60	60	137	137	137	135	137
1870	113	61	.....	113	113	113	113	113
1880	.....	40	40	75	75	75	65	75
1890	50	35	35	75	50	75	75	75
1899	50	35	35	75	50	75	75	75

Car loads naturally come cheaper than small quantities, but it was only the later generations of railroad officials who recognized this distinction. They have also treated shippers of different classes of freight more equitably than their predecessors. The following are the rates, in cents, per 100 pounds of a variety of commodities from New York to Chicago by rail, in car loads:

Rates, in cents, per 100 pounds of articles from New York to Chicago by rail, 1867, 1870, 1880, 1890, and 1899.

Year.	Furniture.	Agricultural implements.	Crockery and earthenware.	Coffee.	Starch.	Molasses.	Soap.	
							Castile.	Common.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1867	137	137	117	117	117	60	117	93
1870	113	113	.....	.....	78	.....	98	60
1880	75	40	40	40	40	40	60	40
1890	65	30	30	25	25	30	65	30
1899	65	30	30	25	25	30	25	25

The following are the average freight rates, in cents, per ton per mile charged by different railroad companies:

Average rates, in cents, per ton per mile by different railroads, 1867, 1870, 1880, 1890, and 1898.

Year.	Boston and Albany.	New York Central.	Erie.	Lake Shore and Michigan Southern.	Pennsylvania.	Chesapeake and Ohio.	Chicago, Rock Island and Pacific.	Illinois Central.	Union Pacific.	All in United States.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1867..	2.201	1.98	1.465	1.745	1.497	3.753	2.185	2.085	.....	1.925
1870..	1.851	1.590	1.125	1.269	1.268	4.101	2.316	1.953	3.596	1.889
1880..	1.207	.879	.836	.750	.918	.866	1.209	1.543	.....	1.232
1890..	1.105	.730	.665	.644	.661	.561	.995	.942	1.138	.941
1898..	.839	.606	.575	.530	.521	.369	.966	.695	.95	.753

PASSENGER RATES.

The following table shows the average rates, in cents, per passenger-mile charged by different railroad companies:

Average rates, in cents, per passenger-mile, 1867, 1870, 1880, 1890, and 1898.

Year.	Boston and Albany.	New York Central.	Erie.	Lake Shore and Michigan Southern.	Pennsylvania.	Chesapeake and Ohio.	Chicago, Rock Island and Pacific.	Illinois Central.	Union Pacific.	All in United States.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1867..	1.955	.....	1.641	.....	2.074	.....	3.132	2.798	.....	1.994
1870..	2.342	1.77	2.47	2.204	2.167	3.979	3.426	3.29	4.301	2.392
1880..	2.096	1.999	2.041	2.135	2.222	2.959	2.806	2.514	.....	3.442
1890..	1.858	1.91	1.584	2.253	2.094	2.056	2.149	2.022	2.045	2.167
1898..	1.75	1.806	1.548	2.032	1.953	1.943	2.092	1.938	1.945	1.973

It will be seen from the above figures that the downward trend of passenger rates has not been conspicuous. Indeed, the above table shows that passenger rates were about as high in 1898 as they were in 1867. There is so much suburban business, which is carried at reduced rates, mixed up with the figures quoted that the real rates for through travel are higher than the table shows. As the rates on American passenger trains for first-class cars have been for forty years as low as were to be found in any country, it is not surprising that they have undergone little reduction.[1]

[1] For a detailed statement of railway transportation rates, see Bulletin No. 15, miscellaneous series, Division of Statistics, U. S. Department of Agriculture, Changes in the Rates of Charge for Railway and other Transportation Services, prepared under the direction of Mr. John Hyde, Statistician, by Mr. H. T. Newcomb, formerly chief of the section of freight rates.

The Midland Railway of England, which may be taken as a representative road, some years ago abolished second-class passenger rates, and now runs only first-class and third-class carriages. The rate for first class is $3\frac{1}{6}$ cents per mile, and for third class 2 cents per mile. Other railways charge from $4\frac{1}{2}$ cents to 5 cents per mile for first class, 3 to $3\frac{1}{2}$ cents for second class, and 2 cents per mile for third class, the latter rate being regulated by law.

Mr. George H. Daniels, general passenger agent of the New York Central Railroad, a high authority on railroad matters, in an address delivered before the Utica Chamber of Commerce on February 19, 1900, said :

It is beyond question that American railroads to-day furnish the best service in the world, at the lowest rates of fare, at the same time paying their employees very much higher wages than are paid for similar service in any other country on the globe.

In the United States the first-class passenger fares last year averaged 1.98 cents per mile, although on some large railways the average was several mills less than 2 cents per mile; in England the first-class fare is 4 cents per mile; third-class fare, for vastly inferior service, is 2 cents per mile, but only on certain parliamentary trains.

In Prussia the first-class fare is 3 cents per mile; in Austria 3.05 cents per mile; in France 3.36 cents per mile.

Our passenger cars excel those of foreign countries in all that goes to make up the comfort and convenience of a journey.

Our sleeping and parlor car system is vastly superior to theirs; our baggage system is infinitely better than theirs, and arranged upon a much more liberal basis. American railroads carry 150 pounds of baggage free, while the German roads carry only 55 pounds free.

The lighting of our trains is superb, while the lighting of trains on most foreign lines is wretched.

The annual reports of British railway companies do not show the charges of freight per mile, but Mr. E. G. Dorsey, a well-known civil engineer, investigated the subject several years ago, and his conclusion was that the rates averaged $2\frac{1}{2}$ cents per ton per mile. That is nearly three times the average rate charged by American railroads. Mr. J. S. Jeans, secretary of the Iron and Steel Institute of Great Britain, estimates the average rate for mineral to be 1.5 cents per ton per mile. The rates on railways on the Continent of Europe are a little higher than those of England for both freight and passengers.