A COMPARATIVE HISTORY OF CERTAIN PHASES OF EARLY RAILWAY
CONSTRUCTION, FINANCING, AND ADMINISTRATION IN
ENGLAND, FRANCE, GERMANY, AND THE
UNITED STATES

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FOREWORD

One of the most bewildering problems of the nineteenth century was that of rapid transit. Men, beginning to feel a need for getting about more rapidly and with more comfort and efficiency, began to look about them for means of effecting the thing that they dreamed of -- transporting themselves and their goods from one place to another in a more efficient manner. A long struggle stretched out ahead before the goal was attained, but so surely was it reached ultimately that H. G. Wells, writing in his Anticipations, declares that "when the nineteenth century takes its place with the other centuries in the chronological charts of the future, it will, if it need a symbol, almost inevitably have as that symbol, a steam-engine running upon a railway."

Other experiments had been tried out before the steam locomotive was thought of, but the railroad, powered with steam, proved to be the most satisfactory method for the rapid transportation of persons and goods from place to place, for neither roads nor canals had been adequate. The railroad as we know it was simply the application of Watt's steam engine so as to perform the functions of locomotion and transportation.
The story of the development of the railroad to the point where it was found to be more efficient than any other modes of transportation then in use forms a romance of human ingenuity. In the main, this study sets out to trace the history of railroads in England, France, Germany, and the United States from their inception about 1830 to about 1870, when, in Europe, the main networks of railways in the three countries mentioned had been completed, and the United States had built the first transcontinental railroad. It is the object of the writer to trace certain phases of early railway construction, financing, and administration, and to point out comparisons and distinctions found in the four countries.

Specifically, the outstanding subjects to be developed are as follows: modes of transportation before the coming of the railway; experiments with the steam locomotive; the first steam railways in the four countries; the public attitude toward railways; the results of the coming of railways; the economic and political aspects of railway construction and control; and the growth of mileage and of primary networks up to about 1870.

Whereas in the instances of England and the United States the writer found an overabundance of relevant material, for France and Germany a dearth of information placed limitations upon the study in that adequate comparisons could not, in every
case, be made.

England, France, Germany, and the United States were selected for study because of distinct variations in their railroad policies. These differences are to be pointed out within the study for the purpose of showing their influence upon the development of railroads.
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CHAPTER I

THE PRELUDE TO STEAM RAILWAYS

Transportation Prior to the Railway

Persons living in the twentieth-century world are likely to look about them and behold the wonders of modern science and industry with an air of nonchalance and disinterest that is the product of the all-too-common attitude of taking things for granted. In the crowded schedules of daily life few people pause to consider how things came to be, but hasten to utilize them to further their own interests without conscious knowledge of the struggles and romance and hardships out of which evolved the conveniences of modern life that enhance its pleasures and enjoyments. The story of the development of the modern science of railway transportation is one that is replete with romance, obstacles, opposition, genius, courage, and ultimate triumph. Over a century of determined endeavors was necessary to make the first puny little railroad train grow into the massive, powerful monsters that now hurtle themselves through space over twin rails of steel.

The first railway was a product of man's ingenuity, and
represented a giant's stride in progress and a mammoth leap ahead of any previously existing means of transportation. Crude and unreliable though it was, it foretold a century of advancement that put the world on wheels and sent it journeying over gleaming rails.

Transportation may be defined as "the carriage of persons and goods from places where they are less useful to places where they are more useful. In the case of commodities the latter place is often that where they are consumed or altered by some manufacturing process. With persons it is the place where personal services can be put to maximum advantage, or where pleasure may be most easily obtained."\(^1\)

Before the advent of the railway, transportation by land could in no way compete successfully with transportation by water. Roads, where any existed, were, for the most part, in a deplorable state that discouraged their use except in instances of extreme necessity; hence rivers and the sea provided the most accessible and economical channels for the carriage of commerce.\(^2\)

In those days almost no one thought of attempting to conserve time, for it was the most plentiful possession of man. Life was not easy, but it was simple and leisurely.

\(^1\)C. E. R. Sherrington, The Economics of Rail Transport in Great Britain, I, 1.

Therefore,

Economy of time was a virtue but little practised by our ancestors. The innovator who proposed to effect a saving of it was regarded as either a fool or a revolutionary. To a race which lived in the constant prospect of eternity this life at best was but a "fleeting show," and any attempt to multiply its moments was properly frowned upon as vanity. 3

When coaches were introduced into England about the middle of the seventeenth century, the belief was widespread among the populace that they would surely ruin the country. One inspired chronicler penned a eulogy of the old cumbersome wagons of other days, "which did not jog along the highway at a speed of four miles an hour, but traveled easily, 'without jolting men's bodies or hurrying them along.'" 4 So, even then, men sighed for the simplicities of the "good old days," and longed for their return. Human nature is one of the few things that are not perceptibly altered by the passage of time.

England inaugurated the era of modern road-building. There, after 1750, "metalled" roads were constructed with considerable enthusiasm, and canals were coming into use by 1760; but all improvements were piecemeal and patchwork in nature. Enterprising landowners improved a stretch of road through their property and charged a toll for its use by the public; farther on, the adjoining property owner might not have been

3 Beckles Willson, The Story of Rapid Transit, p. 11.
4 Ibid.
so public-spirited, and the road might be full of dangerous ruts and treacherous sloughs and bogs -- utterly unimproved.

In France, "when improved road-making was undertaken, it was undertaken on a more or less comprehensive plan by the central government." In the latter half of the eighteenth century, a great movement, designed to connect Paris to the principal towns of the kingdom by means of good roads with "made" surfaces, found favor. Labor was provided by means of corvees, which required the inhabitants of country districts to devote thirty days each year to road-making and maintenance. Naturally, this requirement was an onerous tax on the peasants, who performed the work unsatisfactorily because of their sullen disapproval of the system. In 1787 the corvees were suppressed and French roads fell into a state of utter disrepair that lasted until the days of Napoleon. The corvees, however, had given France the best system of roads in Europe; by 1788, the country boasted 12,000 leagues of "made" roads. After the abolition of this compulsory system of road-maintenance, most roads degenerated into impassable quagmires in the winter. Rivers were not improved during the eighteenth century, and water navigation was difficult and dangerous. Between 1784 and 1787 thirty-seven boats were wrecked on the Loire alone. The Crown planned a giant system of inland navigation, with canals uniting all rivers, but little had been done by the outbreak of the Revolution. Here and there were a few
private canals, but they were dry in summer and frozen over in winter.⁵

After the bloody debacle of the Revolution, Napoleon became the head of the French nation. Next to his reforms in the field of administration, law, and finance, his greatest work was the improvement of facilities for communication. The Revolutionists had made all roads toll-roads, but Napoleon abolished the tolls and made the roads free for the use of the entire populace. He employed skilled engineers to survey and construct paved roads from Paris into Italy and Switzerland, from Paris to Hamburg, from Paris to Amsterdam, and from Paris to Madrid. His carefully surveyed and planned arteries of commerce, designed for the greatest safety and speed, were long the best-made roads in Europe. Napoleon's engineers were the greatest road-builders since the Romans. He carried out the network of canals and navigable rivers planned by the Crown before the Revolution, and the ease of communication over the new routes was responsible for the economic unity of France during this era.⁶

Across the Rhine, Prussia, by the close of the eighteenth century, had the best system of waterways in the world at that time. Rivers had been improved and made navigable, and canals linked the rivers into a gigantic spider's web of water com-


⁶Ibid., p. 211.
merce which would have been very efficient but for the vexa-
tious system of customs and tolls everywhere. Sixteen customs
barriers existed between Dresden and Magdeburg; and if one
journeyed or shipped goods from Hamburg to Austria or from
Berlin to Switzerland, he passed through ten states, each
of which had its own tolls and customs. Princes, nobles, ec-
clesiastics, corporations, and private persons, all had the
right to fix tolls and customs on canals passing through their
property. So numerous and prohibitive were the tolls on the
Rhine that most goods were shipped overland until 1804, when
the French made the river free to commerce. Few roads had
been built in Germany, and those that existed served mainly
military purposes. That they were poor excuses as arteries
of travel the following quotation shows:

A humorous German writer of the late eighteenth
century recommended a journey over the north German
roads as the best means, next to marriage, by which
a man might learn patience. But not only patience
was required by the traveller of that time. Courage,
good health and physical strength were necessary as
well. It was not for nothing that men made their
wills before setting out on a lengthy journey. To
the perils of highwaymen were added those of accident
by the road. Upsets and breakdowns were common inci-
dents in a journey of those days. The great noble-
man's lumbering carriage was accompanied by a crowd
of running footmen armed with poles to prop it up at
the rough parts of the road, and to set it upright
again if overset. Even if no accident occurred,
travelling by coach was insufferably tedious. ... So little were the roads adapted for wheeled traffic
that most travellers found it safer and more expe-
ditious to travel on horseback.

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7Ibid., pp. 216-217.  
8Birnie, p. 35.
Similar conditions were prevalent in England at the same time, and it was not sheer eccentricity that caused John Wesley, the popular evangelist, to travel over 8,000 miles each year on horseback.

In the United States, when Washington became President, men were getting about in much the same manner as they had always transported themselves since the first settlers had come to the shores of the New World. They were walking, riding horses, or bouncing about in crude wagons. They were paddling canoes or poling unwieldy barges. Only by the use of sails could men travel with ease, and sails were of almost no value in the interior of this vast land. Westward-bound settlers led pack trains, while their families trudged on foot beside the creaking wagons. On the rivers, men steered keelboats. The East had a few established stagecoach lines and a few coastwise sailing boats. Through the countryside galloped post-riders with bulging saddle-bags crammed with mail. All in all, the transportation system was but little better than the Romans had known two thousand years earlier. "Then, all in a hundred years, man found new, swift, and tireless ways of getting around... In the space of a single long lifetime, man improved his means of transportation more than he had in all the years since the dawn of history." 9

But progress was slow and fitful. As late as 1820, the only transportation facilities available were a few turnpikes, or toll-roads, and poorly built local roads. Travel by wagon was slow and costly. Wheels had to turn for a whole week before they could cover the distance from Boston to New York, while for the journey from New York to Charleston, three weeks were required. Passenger travel was unsafe and decidedly uncomfortable. Long-distance haulage of freight was practically unknown and impracticable. In 1793 the introduction of a turnpike in Pennsylvania had demonstrated the possibility of a well-built road for through traffic, and by 1820 a number of these roads had been constructed by private companies in New York and New England, in Pennsylvania and Kentucky, sometimes with the aid of state subsidies.10

As in England, France, and Germany, an extensive system of canals was constructed in the eastern part of the United States. In all, over 4,000 miles were completed, nearly all of which was built during the first half of the nineteenth century. Generally speaking, the era of canal building was ushered in with the completion of the Erie Canal in 1825 and came to a close with the financial crisis of 1837. Private enterprise constructed a number of early canals in Pennsylvania to unite anthracite coal fields with tide-water, but most of the canals built were financed by state enterprise

10P. Harvey Middleton, Railways of Thirty Nations, p. 2.
with funds from the state treasuries.\textsuperscript{11}

The Erie Canal opened up the grain regions around the Great Lakes and reduced freight charges between Buffalo and New York City from one hundred to fifteen dollars a ton, and the time of haulage from twenty days to eight. This canal was the economic link between the East and the West, and represented the earliest great diversion of traffic from its natural courses -- rivers and valleys -- to man-made artificial routes.\textsuperscript{12}

Hardly had people become established in the eastern portion of the United States when they began to look over the mountains into the wide expanses of the West. And they no sooner looked than many of them packed up their few belongings, sold what they could do without, hitched their horses to their wagons, and started west through mountain valleys and out into the vast reaches of the central plain. The tide of migration was not great, however, until arteries of communication had linked the wilderness to civilization. Migration and communication were inter-acting, the one producing and stimulating the other.

The westward flow of settlement in America necessitated means of communication. Before migration could assume large dimensions there had to be a market for the purposes of the settlers, and the existence of a market depended on good communications.\textsuperscript{13}

\textsuperscript{11} D. Philip Locklin, \textit{Economics of Transportation}, p. 24.

\textsuperscript{12} Knowles, p. 230.

\textsuperscript{13} Ibid., p. 229.
When gold was discovered in 1848, people in their excitement almost forgot the existence of an untracked wilderness between the Mississippi and the Pacific, and hurried westward by land and sea. Certain enterprising individuals established stagecoach lines across the plains and through the mountain passes. "The West, too, had its bouncing Concord coaches, its cumbersome freight wagons, its inns and relay stations where travelers rested and ate, and where fresh horses replaced tired ones." Regular stage routes sprang up soon after the discovery of gold and continued in operation until the distance was traversed by the more efficient railway. In the East, substantial frame or stone inns and hostleries were provided for the convenience of travelers, but the West offered only log cabins and adobe huts at long intervals. Stage lines in the East had stableyards, those in the West had pole corrals. Eastern stagecoaches traveled over roads, while those in the West bounced and rumbled over barely perceptible trails. In the East, travelers were occasionally robbed by masked bandits, but in the West hostile Indians were vigilantly on the lookout for scalps and lives. In the East, patrons of the stagecoaches usually slept in comfortable bedrooms in the inns, but in the West, because of the scarcity of makeshift inns, they often slept on the ground under the stars, with guards posted to keep watch.\(^{14}\)

For a decade stagecoaches had been making regular trips to the West Coast before another forward step was taken in 1858 when John Butterfield founded the famous Overland Mail, operating on a government contract to provide twice-a-week service between San Francisco in the West and St. Louis and Memphis in the East; the government was to pay $600,000 annually for the carriage of mail by stagecoaches that were pulled by horses. Along the route were erected one hundred sixty stations where horses could be changed and meals served. Numerous bridges were built and repair shops were established at regular intervals along the way. Seven hundred fifty drivers, stablemen, inn-keepers, and mechanics were employed. The fare for the westward trip, exclusive of lodgings and meals, was $200.00, with permission to carry as much as forty pounds of luggage. The charge for the eastward journey was $100.00 at first, when very few people were traveling east, but it was later increased to $150.00 when disappointed gold-seekers began to make their way homeward. If a traveler was in a hurry, he could go from St. Louis to San Francisco in twenty-five days on Butterfield's line, but to do this he had to travel night and day, sleeping on the seat of a swaying, rocking coach, usually crowded between other passengers. Rather than go through such an ordeal, he usually stopped off along the way for a day or two at a time to rest.\textsuperscript{15}

\textsuperscript{15}\textit{Ibid.}, pp. 135-137.
In the meantime, telegraph lines were being built from San Francisco to the eastern boundary of California, and westward across Nebraska. Between the two lines that were building toward one another were long stretches of plains and mountains. The firm of Russell, Majors, and Waddell conceived the idea of providing communication between New York and San Francisco in nine days! This meant, actually, the bridging of the distance between the telegraph terminals in eastern California and western Nebraska in nine days. To accomplish this, they bought wiry ponies, employed sturdy young riders, and established a chain of relay stations across the plains. With horses and riders galloping day and night over the Rockies and through Indian country, the Pony Express operated for eighteen months until the telegraph communication was completed across the continent. Riders were allowed only two minutes at relay stations to throw their saddle-bags, stuffed with mail, onto fresh horses and be off. At first, letters were carried for five dollars each, and later the rate was lowered to one dollar as business increased and the distances of the rides were shortened. Service was provided twice a week.\(^\text{16}\)

In the 1860's, Russell, Majors, and Waddell established a wagon freighting system in the West. Wagons were drawn by

\(^{16}\text{Ibid.}, \text{pp. 138-139.}\)
six pairs of mules or six yokes of oxen, and could carry 5,000 pounds. They wound their way across the plains in convoys two miles or more in length. When night came on the prairie, the wagons were placed in a great circle with men and stock inside for protection against raiding Indians. Many campfires were built, and armed sentries patrolled the camp outside the circle of wagons.

These freightingers provided the growing ranches and mining communities of the West with groceries, clothing, tools, and other items. The long overland trip, of course, was costly, and the ordinary staples of life were high-priced to the first settlers of the West. Potatoes frequently sold for twenty-five cents a pound, a sack of flour for twenty-five dollars, and a box of matches for seventy-five cents -- all because of the difficulties and slowness of transportation.17

Of the four countries, England, France, Germany, and the United States, only the last had broad distances to cover, immense tracts that were still uninhabited, and an impelling urge that drove people westward.

All four of the countries were waiting for the railroad, which was sorely needed everywhere, but particularly so in the vast empire of the New World.

17Ibid., p. 138.
Tramways: The Birth of the Railroad Idea

The origin of the railway is as uncertain as that of the wheel. We know that, even before the Christian era, some form of railed track had been designed to expedite haulage and to make it easier than on ordinary roads. Possibly the earliest example of this type of effort was the ship railway across the isthmus of Corinth, constructed about 600 B. C. for the purpose of conveying small boats over land from sea to sea. The method of construction of the Egyptian pyramids is still a secret, but it seems likely that some similar aid to transportation may have been employed to facilitate the handling of the weighty materials needed in their erection.

The real history of railways, however, begins in the sixteenth century, although some trace of primitive undertakings has been discovered for earlier times. It is definitely known that mine railways were in use in the Tyrol as early as 1530, for descriptions of the track and rolling stock are still extant: the track was of wood, but strips of iron were placed on curves to reduce wear; the wagons were about four feet long, two and one-half feet wide, and two and one-half feet deep, and must have required a gauge of about two feet. There is also a record that wagons and wooden rails were used in Italy in the sixteenth century for the construction of fortifications, but the evidence is fragmentary and
the details are unknown.18

There seems no doubt that the railway came into use as an adjunct to mining operations. Sebastien Munster's Cosmographie Universelle, published in 1550, illustrates a narrow-gauge railway in use in Alsace at the Leberthal mines. Six years later Georg Bauer's De Re Metallica presented an illustrated description of wagons designed to run on rails; and among the exhibits at the Berlin Transport and Building Museum is the sixteenth century wagon equipped with flanged wooden wheels, together with a section of track, which was commonly used at the Transylvania gold mines of Siebenburgen.19

Although primitive railways were known in Germany in the fifteenth century, they were not introduced into England until some two hundred years later. The early German roads consisted of parallel rows of heavy square timbers, designed for more efficiency and for overcoming obstacles presented by the miserable roads common to the country. The function of the timbers was to keep the conveyance from sinking into the mud.

When the railway idea was transplanted into England, it was utilized principally for the transportation of heavy materials from quarries and mines. Until the close of the eighteenth century timbers were still used as tracks, sometimes re-enforced with strips of iron to prevent excessive

18Vernon Sommerfield, English Railways, Their Beginnings, Development, and Personalities, pp. 3-4.

19Ibid., p. 4.
wear. Numerous public tramways, in addition to private ones built by miners, manufacturers, and merchants, were finally built and were open to all upon the payment of a toll or fee. Carts and coaches were drawn by oxen, mules, or horses. 20

A young Leicestershire citizen, Huntington Beaumont, whose family seems to have been financially interested in the mining of coal, and who is thought to have visited Bohemia and Tyrol, is usually given credit for the introduction of rails and trucks into England. It is true that he may not have been the first in that country to employ the railway idea, but there is definite evidence of his pioneer work. A manuscript of about 1597 mentions his name in connection with the transportation of coal from the pits at Wollaton Hall to the Trent River. In 1602, the date generally accepted for the laying of the first wooden railway in Newcastle, Beaumont was associated with a syndicate that obtained a Crown lease of the Cowpen and Bedside Collieries, near Bedlington in Northumberland. The fact that the pits were near the port of Blyth suggested the desirability of a colliery railroad in an age when the cost and slowness of transportation by land made it necessary that coal for London and southern England be borne by sea. 21

In addition to the railway, Beaumont introduced into

20 Harry Elmer Barnes, An Economic History of the Western World, p. 333.
21 Sommerfield, p. 5.
Northumberland "many rare engines, not known then in these parts, as the art to boore with iron rodds to try the deepness and thicknesse of the cole; rare engines to draw water out of the pits; and wagons with one horse to carry down coles from the pits to the staithes on the river." The employment of horses suggests that the wagons used by Beaumont were probably larger and heavier than those utilized earlier in the Tyrol, which, because of their smallness, likely were operated by man-power. Another factor indicating larger carts in England is the fact that evidence seems to show a gauge of about four feet, thus approaching the later colliery standard gauge of approximately four feet eight inches.

Roger North, writing in 1676, described the method of transporting coal by rail on a primitive tramway in the neighborhood of Newcastle-on-Tyne:

Another thing that is remarkable is their way-leaves; for when men have pieces of ground between the colliery and the river, they sell leave to lead coals over their ground, and so dear that the owner of a rood of ground will expect twenty pounds per annum for this leave. The manner of the carriage is by laying rails of timber from the colliery down to the river exactly straight and parallel; and bulky carts are made with four rowlets fitting these rails; whereby the carriage is so easy that one horse will draw down four or five chaldrons of coal and is an immense benefit to the coal merchants.  

Previously, coal was usually conveyed from the mine to the town or port by large wicker baskets transported by pack-

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22 Ibid., pp. 5-6.

horse. The imperative need of finding a better method of transit led to the laying of a rough sort of tramroad in the mining districts. "A track of wooden logs placed parallel to one another from mine to shipping point enabled horses to draw a primitive wagon thereon, with the result that the load was more than doubled." At first, the mines were usually opened near the sea or river to reduce haulage costs, but exhaustion of these pits made it necessary to open new mines farther inland, which necessitated the "wayleave" system described by Roger North in the preceding quotation. In many instances, landowners received substantial incomes by granting permission to colliery proprietors to transport coal over their estates by constructing tramways between the pit and the river or port.  

But wooden rails wear out rapidly in carrying loads of coal, hence were replaced by flat iron bars as early as 1767. A quarter of a century later, Mr. Outram, an Englishman, conceived the idea of the edge or plate rail, which prevented both wheel and rail from clogging with dirt -- a serious handicap with the use of flat rails. Thereafter the railroads were called "Outram-ways" after the name of the inventor, but this term gradually became shortened to "tramways."  

The first cast-iron rails were used at the Durham col-

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lieries in 1794; they were in three-foot lengths. A horse could carry ten to twelve tons on a level road, over a distance of about twenty-four miles per day. The line was called a plate-way because of the plate-like structure of the rails. Both the early wooden and the later cast-iron railways were fitted with flanges on the outer edge, designed to prevent the wheels from slipping off of the rails. This flange was soon transferred from the rail to the inner side of the wheels. Plate rails were constructed in an L-shaped design in which two flat plates came together to form a right angle. Since one of these plates was fastened to sleepers level with the ground, the other plate projected upward vertically on the inner side, and as the wheels of the cart traveled over the horizontal plate, the vertical projection of the other served as a guide to prevent the wheels from running off the rails.26

In 1776 the first iron railway was laid down in the neighborhood of Sheffield. This date was noteworthy, since in the same year the Trent and Mersey Canal was sanctioned, and its charter was the first to authorize canal proprietors to construct a railway. However, in 1758, Parliament had sanctioned a previous railway project, when the Middleton Tramway of Leeds received its charter -- the first to be authorized by statutory enactment.27


27 Sommerfield, pp. 8-9.
Mine cars were sometimes drawn by men or women instead of by horses and mules, and the use of human beings as beasts of burden led to much suffering and unrest on the part of the workers.

Although for the first two centuries of its existence the English railroad was a crude affair "built to handle the products of the collieries in the northeast corner of the country, to bring the coal down to the docks," Dr. James Anderson, late in the eighteenth century, recommended the construction of railways to carry agricultural products from one part of a farm to another. Later he proposed the use of railways or tramroads throughout the kingdom for getting the products of field and mine to market or shipping point. He recommended the employment of four-wheeled wagons with a ton capacity, to be drawn by horses. He conceived an ingenious scheme of cranes that would lift the wagon-bed off of its truck axles and convey it, still loaded, to other truck axles equipped with wheels for street use. When the load had been distributed, the empty wagon was returned to the tramline and replaced on the truck that was equipped for operation over the rails.

The first suggestion made in public for the construction of railways as a means of general transportation came from

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30 Willson, p. 31.
William Thomas, Denton, Northumberland, who, on February 11, 1800, read a paper on the subject to the Literary and Philosophical Society of Newcastle. In November, 1800, Dr. James Anderson published a magazine article on "cast iron railways," which he described as "a mode of forwarding weighty articles that has long been in use under certain local peculiarities, but which has not yet been introduced into general practice."

These papers by Thomas and Anderson indicated an unmistakable realization of the latent possibilities inherent in a new mode of conveyance. In 1812 another striking forecast was made in the form of Medhurst's pamphlet, *Calculations and Remarks, Tending to Prove the Practicability of a Plan for the Rapid Conveyance of Goods and Passengers upon an Iron Road through a Tube of 30 ft. in Area, by the Power and Velocity of the Air*. The first tube railway was the subway under the Thames, opened in 1869, which for a time carried passengers by cable car, and which was discontinued after the opening of the Tower Bridge in 1894.\(^{31}\)

In 1801 the Grand Surrey Iron Railway Company obtained the first of all public railway bills to be presented to and sanctioned by the legislature of any country. But the Surrey was not a public railway in the modern sense -- it carried no passengers, "and at no time used or appears to have contemplated locomotive power." But it was a public railway inasmuch as its

\(^{31}\)Sommerfield, pp. 9-10.
promoters undertook to carry merchandise upon the payment of fees for all who desired to avail themselves of the facility, and the project needed Parliamentary sanction for the acquisition of the necessary land. The road was opened to traffic on July 26, 1803, and its success led to extensions and to the construction of other similar lines. The Surrey was nine and one-half miles long, extending from the Thames at Wandsworth to Croyden, via Mitcham, with a one and one-half miles branch to Carshalton. The whole track disappeared long ago, and almost nothing is known concerning its construction and physical equipment. 32

Shortly after the opening of the nineteenth century, James Gray of Nottingham visited a tramway connecting the mouth of a colliery with a shipping wharf. Becoming enthusiastic over the transportation system in use there, he asked of the engineer: "Why are not these tramroads laid down all over England, so as to supersede our common roads and steam-engines employed to convey goods and passengers along them, so as to supersede horse-power?" The workman, staring at him in amazement as though beholding a mad-man, exclaimed: "Just propose that to the nation, sir, and see what you will get by it! Why, sir -- you will be worried to death for your pains." Nevertheless, Gray began at once to advocate tramroads, locomotives, steam engines, and the superseding of horse-power,

32 Ibid., pp. 10-11.
and by his dreams became the first, perhaps, to visualize the transportation of goods and people by steam engine. "It was his thought by day; it was his dream by night. He talked of it till his friends voted him an intolerable bore. He wrote of it till the reviewers deemed him mad." 33

His idea, however, found lodging, and the plate-rail track, developed for use in the mines and between the mines and the port, was copied elsewhere, and "iron railways" became fairly common in England and on the continent. In 1819 it was claimed for the Munich wagonway that a woman or child could easily draw a cart laden with three-fourths of a ton, and that one horse could do the work of twenty-two horses. 34 Gray's idea of substituting steam for horse-power did not so readily find advocates, however.

His original plan was to convey both goods and passengers over tramroads whose networks should cover the kingdom, but even after tramlines were in common use, only freight was transported, and almost no one thought of using tram-cars as a substitute for stagecoaches until about the time the locomotive made its appearance. 35

In France, in the coal-fields of St. Etienne, occurred similar developments, where a large number of horse-worked

33Willson, pp. 32-33.
34Herbert Heaton, Economic History of Europe, p. 543.
35Willson, p. 32.
railway lines had been constructed. The developments in France were several years later, however. In February, 1823, a royal ordinance empowered the construction of fifteen miles of railway line from St. Etienne to Andrezieux on the upper Loire. Three years later, in the same way, St. Etienne was linked to Lyons and the Rhone. In 1832, as a by-product of the widespread excitement over the success of the Liverpool and Manchester Railroad in England, came the first locomotive in France, hauling passengers as well as goods between Lyons and St. Etienne. Parliament became interested, set aside £20,000 for a systematic study of the railway question, and decided that no railway concessions could thereafter be granted by royal authority alone, but reserved this privilege and power to itself.36

France's first railway, that from St. Etienne to Andrezieux, was opened in 1827, designed mainly for the haulage of coal. It was a single-track affair which used horse traction and did not carry passengers until 1832. The line from St. Etienne to Lyons, opened in 1830, used steam locomotion from its beginning.37 There are records of other early railroads in France, used in connection with mining operations, but of them all the two mentioned are typical.

Probably the first railway in America was an inclined


37Encyclopedia Britannica, XVIII, 917.
plane built in Boston about 1795. A brick kiln stood on a high elevation called Beacon Hill, and an inclined plane about two feet wide and equipped with wooden rails was used in lowering the finished products of the kiln to the street below. Loaded cars ran down the track and, when emptied, were hauled up by cable. Twelve years later, in 1807, Silas Whitney built a short railway in Boston near the location of the old inclined plane. Here the gradient was not so pronounced, and horse-drawn wagons were used. In 1809 Thomas Leiper laid some wooden rails at his stone quarry in Delaware County, Pennsylvania, and two years later a similar but longer track was laid at Falling's Creek, ten miles from Richmond, Virginia, for the purpose of moving the products of a powder mill. Later a number of other similar railways were constructed in various sections of the East, one of the most famous being the Quincy Railroad, about four miles in length, built in 1826-1827 from the granite quarries at Quincy, Massachusetts, to tidewater on the Neponset River. The granite used in the construction of the Bunker Hill Monument was transported over this tramway, which is sometimes referred to as the first railway in the United States, although this is not strictly true, as has been shown. Its wooden rails were laid on granite sills, with a strap-rail of rolled iron. In 1827 a railroad was built from the nearby coal mines to the Lehigh River at Maunch Chunk, Pennsylvania, a distance of nine miles. Loaded cars traveled
down inclined planes by gravity, and when emptied were drawn up by mules. The rails were of timber, covered with strips of iron. In 1828 the Delaware and Hudson Canal Company built a sixteen-mile railway from its coal mines to Honesdale, the termination of the canal, to transport anthracite to tidewater. These initial efforts at railway construction were followed in rapid order by more ambitious projects -- the Baltimore and Ohio, the Mohawk and Hudson, the South Carolina, the Camden and Amboy, the Ithaca and Oswego, and the Lexington and Ohio -- which, by the close of 1830, had ninety-two miles in operation and 463 miles projected or under construction. Except for the Delaware and Hudson, all of these roads were built for horse-power, and originally employed it on their lines. 38 Although these early efforts are usually referred to as railroads, an interesting observation is made in the following quotation regarding the Quincy Railroad: "It was operated by gravity and horse power and never rose to the dignity of a railroad until it was purchased by the Old Colony Company in 1872, when it was relaid with T-rails and the steam whistle re-echoed among the boulders on its ancient right of way." 39

Despite this opinion as the "dignity of a railroad," in various parts of the four countries under consideration rails were being utilized for purposes of transportation, and

38 Seymour Dunbar, A History of Travel in America, pp. 876-879; Locklin, pp. 38-39; Willson, pp. 86-87; Slason Thompson, A Short History of American Railways, pp. 67-68.

39 Thompson, pp. 67-68.
before the first quarter of the nineteenth century had expired, were being brought into common usage with the aid of horse-power. Unquestionably, their utility was vastly enhanced when steam was made the motive power that hauled loads over them from terminal to terminal.

Early Experiments with Steam Locomotives

When the short horse railroad was opened in 1803 from Wandsworth to Croyden in the suburbs of London, and was made available for public use on the toll system, a few ingenious persons began to conceive of the idea of using steam as the motive power on such lines. In 1814, when the discovery was made that cars could be propelled by the adhesion of smooth wheels to smooth rails, an important step had been taken that led directly to the application of steam power. But a way had to be found to generate the necessary power in a manner that would make it usable; to do this, two important things were essential -- there had to be a sufficient draft to maintain a hot fire, and there must be a large heating surface on a small area on which to apply the fire. When these two essentials were successfully combined, the steam locomotive resulted.\(^{40}\)

The first extensive and successful use of steam as a motive power for land vehicles occurred in England, where

\(^{40}\)Arthur Twining Hadley, *Railroad Transportation, Its History and Its Laws*, pp. 9-10; Ogg, p. 239.
the industrial revolution had its genesis. In various places stationary engines pulled strings of dwarf cars over wooden planks. Trouble occurred when cars slid off and sometimes were overturned, so sideboards were attached to the planks to prevent mishap. The first really significant improvement occurred when the idea was born that an engine might be placed on one of the cars in such a way as to bring the motive power in contact with the wheels and thus move the whole train. In 1814 George Stephenson constructed a primitive locomotive that could draw thirty tons of coal at four miles per hour. Until 1829 the locomotive remained in the experimental stage, but in that year Stephenson's Rocket proved that a locomotive could move a train of cars faster and with more efficiency than a horse could pull a carriage.41

A Dr. Robison was the first Englishman to have a practical idea for the employment of steam power to the propulsion of wheeled carriages. He told James Watt of his idea, and the latter made a model of a high-pressure locomotive described in the patent of 1784 (Watt's fourth patent) as "a portable steam-engine and machinery for moving wheel-carriages." In 1787 Watt's friend, Murdoch, made an engine with which he pulled a small car around a room in his house. Richard Trevithick, who had been Murdoch's assistant and had seen his machine, patented a similar device in 1802 which, when put in

41 Robert Edgar Riegel, The Story of the Western Railroads, p. 2; Ogg, p. 239.
operation on the Merthyr tramway, drew a load of ten tons at five miles an hour. But an accident occurred which produced widespread apprehension toward the use of such machines -- it blew up. As early as 1787 Symington had exhibited a locomotive in Edinburgh, and eight years later was using a steam engine on a line of turnpike road in Manarkshire and the adjoining county.  

Whereas Watt, in his Birmingham workshop, had employed steam as a source of power, Trevithick was the first Englishman to use steam to propel vehicles upon wheels. At the beginning of the nineteenth century he turned his engineering genius to the construction of high-pressure steam engines for use in coal mining in his native county, Cornwall. By 1801 he was using an engine to pull a few trucks on rails around the mine where he worked, and on December 24 of the same year his "common road locomotive" made history by carrying the first passengers ever conveyed by steam -- in fact, by any form of mechanical power. On February 13, 1804, his locomotive hauled for nine and one-half miles, the length of the line, the first load of merchandise ever transported by steam power on a railroad track. The performance was said to have been made on a wager that it could not be done. "A net load of fifteen tons in five wagons, which would have made the total about twenty tons, was conveyed over the whole line at

42 Willson, p. 34.
a speed of about five miles an hour on a coal consumption of twenty-five pounds a mile." As was often the case in the days of the early locomotive, the engine had to be withdrawn from service because of the constant breakage of the light rails. Trevithick's first locomotive had flywheels, and steam power was applied to all four wheels. In 1804, he built a locomotive at Pen-y-darren, near Merthyr Tydvil, of which he wrote: "We put it on the tram-road. It worked very well, and ran up hill and down with great ease and was very manageable. We had plenty of steam power." This engine made several trips, once hauling five wagons loaded with ten tons of iron and seventy passengers, for a distance of nine miles at nearly five miles an hour. This historic experiment was made at Trevithick's own expense, for he was convinced that his locomotive would work with success as soon as it was perfected - success such as would recommend it for general use. But the tramway could not long endure the added strain imposed by the locomotive, and Trevithick had to take his machine off the line when the mine owners declined to incur the expense of keeping the tramway in good condition. Trevithick designed a locomotive tried out by the Wylam colliery in Northumberland, but for some reason it was never employed regularly, and was soon put in use as a stationary engine in an iron foundry at Newcastle. In 1808 Trevithick exhibited a locomotive nicknamed "Catch-me-who-can" on a circular railway in London. Although the experiment was received enthusiastically, nothing
came of it, for the engine soon ran off the track and he had no money for its repair. This accident was the last straw that permanently discouraged him from pursuing his work as a builder of locomotives, and while he was in Peru to install engines for the draining of mines, Stephenson, taking advantage of Trevithick’s earlier experiments, became the successful pioneer of railway locomotion.43

As for Trevithick, he now gave up locomotive work and turned his attention to other branches of engineering. We find him endeavouring to tunnel beneath the Thames, working on the idea of the double expansion and triple expansion engine, making the first steam threshing-machine, and designing the first propeller for steamships. A window in Westminster Abbey commemorates this remarkable man, who has been described as one of the greatest geniuses who ever lived.44

John Blenkinsop in 1811 patented a design for a rack railway, a toothed wheel on his locomotive working into a toothed rail. This system proved successful in Blenkinsop’s Middleton colliery at Leeds, and from it developed the modern cog railroad used on steep gradients in mountain regions.45

Blenkinsop’s engine with a cogged wheel that acted on a rack rail solved the imaginary difficulty of making a smooth wheel “bite” upon a smooth rail. The weakness of the engines had been the chief source of trouble rather than the smoothness of the traction. One ingenious inventor even devised an

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43 Sommerfield, pp. 16-17; Sherrington, I, 166; Heaton, p. 543; Hawks, pp. 172-173.
attachment for the engine which helped it along by imitating the action of the hind legs of a horse! But by 1814 Stephenson’s experiments had substantiated what Trevithick had believed years before -- that a locomotive with smooth wheels could draw heavy loads with no assistance other than the force of friction between wheel and rail.46

Despite other claims to the distinction, Matthew Murray is sometimes credited with being "the maker of the first successful locomotives," although lively controversies always arise when such a claim is advanced. In 1799 he obtained a patent in which the suggestion of the horizontal cylinder for steam engines appears for the first time, and likewise the method of automatically regulating the draught so as to secure a steady pressure. That Murray's firm, soon after the locomotive had been employed by a few railways, began to rival Watt's company in the commercial manufacture of steam engines, is definitely known. Murray's first locomotive had five wheels -- four carriers that rolled on the rails, and one cogged wheel engaged with a rack rail on one side of the track. Motion was imparted by two vertical cylinders. The following is a contemporary account of the trial run, June 24, 1812:

This highly interesting experiment was made with a machine constructed ... for the purpose of substituting the agency of steam for the use of horses in the conveyance of coals, on the Iron-rail-way, from the mines of J. C. Brandling, Esq., of Middleton, to Leeds.

46Fay, p. 190.
This machine is, in fact, a steam engine of four horses' power, which with the assistance of cranks turning a cog-wheel, and iron cogs placed at one side of the railway, is capable of moving, when lightly loaded, at the speed of ten miles an hour. . . . The experiment, which was witnessed by thousands of spectators, was crowned with complete success; and when it is considered that this invention is applicable to all rail-roads, and that upon the works of Mr. Brandling alone the use of 50 horses will be dispensed with, . . . we cannot forbear to hail the invention as of vast public utility, and to rank the inventor amongst the benefactors of his country.47

This reference to economy resulting from the replacement of horses is one of the first on record to draw attention to the potential economies of mechanical traction. Just at this time it was a particularly important item because of the great increase in the cost of horse fodder occasioned by Napoleon's Continental wars.48

As a result of the success with which Fulton and others had applied steam power to the propulsion of ships, George Stephenson, originally a smith in a mine, conceived the idea of using steam to propel trucks on land. He installed in his mine some steam trucks of his own design and manufacture. When various inventors began experimenting with the problem of steam locomotion for railways, Stephenson kept his eyes open and, at his Killingworth mine, worked arduously at verifying the experiments that others had undertaken and at perfecting some of his own. In 1814 his locomotive, the Blucher, pulled thirty tons of ore up a steep hill at the rate of four

47 Quoted in Sommerfield, p. 18. 48 Ibid., pp. 18-19.
miles per hour, a feat which prompted Parliament to name him engineer for the Stockton and Darlington Railroad, then being projected. In 1816 he built an engine which would travel ten miles an hour without a load. In 1825, he built the first railway in the world on which steam locomotives were run, the Stockton and Darlington, whose main purpose was to carry coal from the Durham coal fields. To accomplish his task, Stephenson had to fight against enormous opposition, against petty private interests, and even against contempt and ridicule. In 1823 the promoters of the road, acting upon Stephenson's advice, had obtained official Parliamentary sanction "to attempt the experiment of using steam-power." In September, 1825, Stephenson opened the Stockton and Darlington line by driving an engine, preceded by a signalman on horseback and hauling thirty-four little cars, between the two terminals at the rate of ten to twelve miles an hour. With his Rocket of 1829, however, he attained his greatest success, chiefly because his engine utilized two principles incorporated into almost all subsequent steam locomotives -- the rapid generation of steam and the direct application of power to the driving wheels. 49

Stephenson was born in 1781 near Newcastle. His parents were so poor that as a lad he was unable to obtain the school-

49 Walter W. Jennings, A History of the Economic and Social Progress of European Peoples, p. 545; Corti, p. 83; Willson, p. 34; Ogg, p. 239.
ing necessary for learning to read and write. The family of eight lived in one small room of a humble cottage. Despite the handicaps of his early life, he "lived not only to realize great wealth himself, but to see the face of England so much changed by the invention which his own industry had the chief share in developing, that it was actually cheaper -- to use his own words -- for the poor man to go by steam than to walk." Because "it is probably true that to him more than to any other man do we owe its development in the early stages during the first half of the nineteenth century," Stephenson has been called the "father" of the railway system.  

In October of 1829 the directors of the Liverpool and Manchester Railroad, being in doubt as to the type of traction to employ on their new line, decided to offer a prize of £500 for the best locomotive submitted that would meet certain requirements: (1) the engine must consume its own smoke; (2) if it weighed six tons, it must be able to draw a train weighing twenty tons at a speed of ten miles an hour on a level road, working at a pressure of not over fifty pounds to the square inch; (3) the engine must have two safety valves -- one beyond the control of the engine-driver; (4) the height of the engine, including the chimney, must not be over fifteen feet; and (5) the cost of the engine must not exceed £550, the cost of the locomotive which Stephenson had built for the Stockton

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50 H. D. Traill, editor, Social England, VI, 199.
51 Lewin, Early British Railways, p. 1.
Five competitors entered their engines in the contest, but by the time when the trial runs were to be held, one had withdrawn his entry, leaving only four locomotives to take part in the competition. On the official day of the contest, the Novelty, one of the entries, sometimes attained twenty-four miles an hour, but the bellows that pumped air into the fire-box gave out and the engine had to limp out of the race for repairs. As to the other three entries, the Sanspareil's boiler needed mending, and the Perseverance could make only six miles an hour. Stephenson's Rocket attained a speed of thirty miles an hour, with an average of fourteen miles, and was declared the winner of the contest. But the judges postponed the awarding of the prize for a time, hoping that the other locomotives would soon be put in running order for a second trial. The Rocket was ready every day and created a sensation by pulling a coach containing thirty people at a speed of thirty miles an hour. On another occasion it hauled a thirteen-ton load in wagons of somewhat crude construction at an average speed of thirty-five miles an hour. At length the judges decided that there was no point to continuing the contest, and awarded the prize to Stephenson. The Rocket was the only engine entered in the contest that met, and even surpassed, all stipulations, for the others either developed defects that eliminated them from the competition or else fell short in meeting certain of the requirements. The victory of
the *Rocket* "settled the supremacy of the steam locomotive as the main source of power on the world's railways for a hundred years."\(^{52}\)

A new era in rapid transit was inaugurated. No one in Europe had ever before traveled thirty miles an hour except in a balloon. Stephenson was immediately selected to build all engines to be used on the Liverpool and Manchester Railroad, and until his death was in charge of the engineering department of what grew into the great London and Northwestern Railway.\(^{53}\)

In popular estimation, which here, as in so many other matters, is not always in accordance with historical truth, the greatest name associated with both the locomotive and the railway is that of George Stephenson. We must certainly accord to him the twin distinctions of being the father of the locomotive and the first of the great railway builders, while the credit of inducing the hesitant directors of the Liverpool and Manchester to work their line with locomotives throughout, instead of employing stationary engines on gradients, is also his. But he was not, and never claimed to be, a great inventor or innovator; he was an untaught engineer of native genius who improved on the work of his precursors; maintained and proved, despite the weight of contemporary opinion to the contrary, that a smooth-wheeled locomotive running on a smooth track could develop adequate power and adhesion; and had the foresight to realise that railways would become the grand highways of the nation.\(^{54}\)

About the time that Stephenson perfected his first locomotive (1814), Nicholas Wood, an early "railway expert," voiced his own skepticism and the general attitude of the populace regarding the practicability of the railway locomotive:

\(^{53}\)Jillson, p. 38.

\(^{54}\)Sommerfield, pp. 19-20.
I should not dream of telling everyone that the ridiculous expectation, or rather prophecies, of the enthusiastic speculators could possibly be realized, and that we shall see steam-coaches travelling at a speed of twelve, sixteen, eighteen, or twenty miles an hour. Nobody could do more harm to the prospects of building or generally improving such coaches than by spreading abroad this kind of nonsense.  

Not only because of the public attitude, but also because of essential defects within itself, "the locomotive engine did not win an easy victory; nor, in its early form, did it altogether deserve one."  

For many years the weakness of the early engines in pulling heavy loads uphill led to the general use of a combination of locomotive engines, inclined planes operating on the principle of gravity, stationary engines, and horses for uphill hauls. Even as late as 1850 "dandy carts" were to be seen in the hilly regions of England. "The dandy cart was a crate in which the horse travelled when going down an incline. Arriving at the bottom, he obligingly trotted out and helped to haul the train uphill." But the main lines out of London, built in the 1830's, had only locomotive power in view, and by 1840 the locomotive engine was unquestionably supreme on English railways. It was to have no rival for half a century.

While locomotives were yet in their experimental stage, traction on English railways was a strange diversification of

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55 Corti, p. 84.


57 Fay, p. 190.
efforts at efficiency. Horses were still used by the more conservative railways, and most lines used horses or stationary steam engines and cables to help the puffing little locomotives to ascend hills and steep gradients. In the mines human beings were still employed in some places to push the little carts of coal or ore from the pit to the mouth of the mine. But one of the strangest methods of traction was that of atmospheric pressure. The South Devon Railway, fifty-two miles in length, opened on December 30, 1846, was the most important of the railroads operating on this principle, though it was by no means the only one. Power was derived from atmospheric pressure contained in a large tube placed between the rails for the length of the line. A vacuum was created in the tube immediately ahead of the train by means of pumping engines located about every three miles along the route. Fitted into the tube was an air-tight piston to which was joined a rod that passed through an opening in the pipe and was attached to the engineless train. The great difficulty of this plan was to seal effectively the opening in the pipe after the passage of the train so that the vacuum ahead could be complete. With this method heavy gradients were overcome at a fair speed, although the system was never particularly successful. Having operated at a loss throughout the year 1848, the South Devon reverted to the steam locomotive in 1849. Other lines here and there throughout the kingdom continued to use at-
mospheric pressure, but the plan was increasingly unsuccessful as haulage requirements mounted and heavier rolling stock was installed.\textsuperscript{58}

The experiments with atmospheric pressure represented only another chapter in proving the worth of steam locomotives and demonstrating their superiority over any other form of traction known at the time. By 1831 English locomotives were attaining speeds of twenty-five to thirty miles an hour, and by 1850 it was not uncommon for them to travel at fifty miles an hour.\textsuperscript{59} These were speeds of which no one had dreamed until they were actually attained.

Strange as it now seems, locomotives have not always run on rails. The first efforts at harnessing steam for purposes of transportation over land were aimed toward the designing of steam coaches that would run on roads as do motor-buses today, but opposition on the part of road authorities suppressed this idea almost before it attained realization. It was soon apparent that steam vehicles must operate on tracks.

So far as the records show, the first steam locomotive engine which actually carried passengers on common roads was constructed in 1769 by an ingenious French mechanic, Nicholas Joseph Cugnot, who, following his retirement from illustrious service as a military engineer, was enabled, at public expense, to build a steam-propelled carriage to run on common roads.

\textsuperscript{58}Sherrington, I, 52-53. \textsuperscript{59}Fay, p. 193.
In the presence of a number of French notables, the inventor gave his strange vehicle a trial test. It had three wheels, the front one being driven by an engine whose two pistons acted upon it alternately. On its first run, Cugnot's machine carried four passengers, traveling at the rate of 2.25 miles an hour. Because of the smallness of the boiler, the vehicle had to come to a stop about every fifteen minutes to raise more steam. In 1770 Cugnot built another and larger locomotive from which great things were expected. However, after several highly successful trials in the streets of Paris, the machine got out of control, damaged a wall in a collision, and overturned at a street corner, whereupon the police appropriated both the invention and its inventor and put them safely under lock and key. Cugnot was soon released and, although his engine was regarded as a public nuisance and was never permitted to run again, the inventor was given a liberal pension by the government in recognition of his labors as a pioneer in a new field. Gradually he and his ideas faded out of the picture and were forgotten. But England witnessed similar efforts, which may or may not have been outgrowths of Cugnot's experiments, and by 1830 steam buses were operating on some British highways.60

Experimentation with the steam locomotive began in France before the locomotive had become an assured success in England,

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60 Willson, pp. 33-34; Sommerfield, p. 8; Heaton, p. 543; Birnie, p. 42; Stuart Daggett, Principles of Inland Transportation, p. 64.
and steam traction was employed to some extent on the coal lines around St. Etienne even prior to 1830. A significant demonstration was given in 1832, but not until 1835 was the first steam railroad projected. In that year the line from Paris to Le Havre was chartered by the government, but was to be controlled by private corporations assisted by the state.61

The idea of steam locomotion in the United States seems to have had its genesis in 1786, when Oliver Evans, an inventor, presented a petition to the Pennsylvania Legislature requesting the sole right to do two extraordinary and unheard-of things: to use wagons propelled by steam on the highways of Pennsylvania, and to build and operate steam flour mills. The legislators listened with tolerance and some interest while the inventor explained the principles of his mill, but when he began to describe a vehicle that would travel over a road or street under its own power, their patience was exhausted and they believed that Evans' mind was seriously deranged. Soon thereafter the Legislature of Maryland granted him the privileges he had asked of Pennsylvania, "on the ground that such action on their part could harm nobody."62

Nothing seems to have come from Evans' first plans, but in 1800 he was once more attempting to arouse public interest in steam locomotion. Unable to find any one who had faith in

61 Witt Bowden, Michael Karpovich, and Abbott Payson Usher, An Economic History of Europe Since 1750, p. 527.
62 Dunbar, p. 874.
his idea, he set to work, four years later, to construct a steam engine of five horsepower which he placed in a large scow that had been mounted on four wheels. He drove this boat-like steam Juggernaut, which propelled itself over the road by its own power, through the streets of Philadelphia, to the amazement and consternation of the populace. Later he converted his machine into a versatile amphibian by attaching a windmill-like paddle-wheel to its stern and gearing it to the engine. He traveled over land to the Schuylkill River, launched it upon the water, and propelled it down-stream to the junction of the Schuylkill and the Delaware. He attracted much attention with his machine that could move over land or in water. But so crude was Evans' idea that Latrobe, one of the first American engineers, commented upon it unfavorably when, in 1808, he made his report on transportation to Albert Gallatin, Secretary of the Treasury. A contemporary of Evans, John Stevens, throughout the next decade attracted some interest in Congress by his experiments with steam locomotion, but nothing was done.63

"American development of the locomotive was in large part independent and parallel to that of England."64 In 1812, two years before Stephenson in England built his first locomotive, Oliver Evans in America, still undaunted by his failure to interest his countrymen in his ideas, declared: "I do verily

63Daggett, p. 64; Riegel, p. 2.  
64Riegel, p. 2.
believe that the time will come when carriages propelled by
steam will be in general use, as well for the transportation
of passengers as goods, traveling at the rate of fifteen
miles an hour, or 300 miles per day." A year later Evans'
enthusiasm was still more dynamic: "The time will come when
people will travel in stages moved by steam engines, from one
city to another, almost as fast as birds fly, fifteen or twenty
miles an hour." Needless to say, many who had laughed at
him lived to marvel at the astounding accuracy of his prophecy.

John Stevens of Hoboken, New Jersey, builder and operator
of steamboats and originator of the Hoboken-to-New-York ferry,
the first steam ferry in the world, was one of the earliest
and most enthusiastic champions of steam railways in the United
States. As early as 1812 he proposed a steam railway to the
skeptical populace, describing his plan as follows: "Let a
railway of timber be formed between Lake Erie and Albany. The
angle of elevation in no part to exceed one degree. . . . The
carriage wheels of cast-iron, the rims flat with projecting
flanges to fit the surface of the railways. The moving power
to be a steam engine, nearly similar to the one on board the
Juliana, a ferry boat plying between this city (New York) and
Hoboken." He proposed three essentials of a modern railroad --
tracks, flanged wheels, and steam locomotives -- but men could
not comprehend his idea and dismissed it as utterly imprac-

65 Dunbar, pp. 887-888.
ticable. Not until seventeen years after Stevens' vigorous proposal did the United States begin to take railroads seriously. But Stevens continued his efforts to obtain backing from capitalists and from state governments and the national Congress to enable him to carry out his experiments. By 1820 he had grown tired of being laughed at and decided to construct, at his own expense, a railway that would turn widespread skepticism into amazed belief. On his estate at Hoboken he built a narrow-gauge railway and perfected a small steam locomotive of his own design and handiwork. Placing the engine and cars on the track, he operated the train repeatedly with himself as engineer, fireman, and passenger, amazing those who witnessed the demonstration. "As far as is now known that was the first steam railway locomotive to be built or to be run on a track in America." Stevens' experiments at length had widespread results, winning for him in 1823 a charter to construct a railroad from Philadelphia to Columbia which, however, was not accomplished until years later.66

In the second decade of the nineteenth century the Delaware and Hudson Canal Company had constructed a canal one hundred miles long to help in getting coal from their collieries in northeast Pennsylvania to the point of shipment; but the canal could not be extended all the way to tidewater because of elevations in the topography. In an effort to solve their

66 Reck, p. 77; Dunbar, pp. 889-890.
problem, the directors of the company sent Horatio Allen, one of the canal engineers, to England to investigate the rumors that were reaching this country of what England was doing with railroads. Allen's assignment also included the purchase of iron rails for the canal company's railroad, which was to be operated with horse-power if locomotives proved impracticable. Allen purchased four English locomotives for importation into the United States. What happened to three of them is a mystery, but the other, the Stourbridge Lion, was the first locomotive to be operated publicly on a commercial basis in this country. On August 8, 1829, Allen operated the engine over six miles of the road, maintaining a "good speed" amid the cheers of the still incredulous spectators. The engine carried no load, for it was feared that the rails could not support additional weight, but this was the first trip ever made on an American railway by a locomotive engine. The Stourbridge Lion resembled a giant grasshopper because of its varied assortment of exterior valves and joints. The iron rails bought in England had not yet been installed, and the crude wooden track was constructed of heavy hemlock timbers to which bars of iron with dimensions of 2.25" x 1.5" were spiked to serve as rails. The engine weighed seven tons, instead of the anticipated three. No one accepted when Allen called for passengers for his initial trip, because it was commonly known that the track was slightly warped where it crossed the Lackawaxen Creek on a sway-backed trestle. Allen ran the engine
up and down the coal dock for a few minutes, and when still
no one volunteered to ride, he waved good-bye, opened the
throttle wide, and "dashed away from the village around the
abrupt curve and over the trembling trestle at a rate of ten
miles an hour." The spectators, expecting to see the engine
derailed, broke into a frenzy of applause. The Lion, however,
actually proved too heavy for the company’s tracks and was
soon removed from service on the line. An additional obstacle
was that the Lion’s four wheels were rigidly mounted so that
they would run only on straight track or on very gradual curves,
which arrangement was satisfactory in England’s level country-
side but not for a line built in the hills. Hence the Lion
was a failure in the United States, but it did arouse popular
interest in steam locomotion.67

When the Baltimore and Ohio Railroad laid the first sec-
tors of its tracks, horse traction was used until Peter Cooper,
a New York inventor and business man with property interests in
Baltimore, volunteered to build an experimental engine for the
railroad. When he brought his locomotive to Baltimore, it was
a tiny affair with a fourteen-inch stroke and a boiler about
the size of an average water-heating boiler in a modern home.
Cooper had connected the boiler, which was mounted upright on
a small truck, with the engine and had contrived a system of
wheels, pulleys, and levers to turn the wheels on the rails.

67 Hungerford, pp. 5-8; Willson, pp. 87-88; Reck, pp. 80-81.
So miniature was the whole arrangement that it was dubbed the Tom Thumb. In the summer of 1830 the engine made a speed of eighteen miles an hour over the track to Ellicott's Mills -- a performance that could not be ignored. On one of its trips occurred an unscheduled but memorable race with a horse. The track between Baltimore and Ellicott's Mills was double, and halfway between the two cities was the Relay House where the cars stopped for fresh horses. At the Relay House the Tom Thumb met a horse-drawn coach on the parallel track, the driver of which invited Cooper to race him to Baltimore. Cooper accepted the challenge and at first, while the locomotive was getting up steam, the horse drew ahead, but as steam pressure increased, the Tom Thumb passed the horse and chugged noisily down the track, smoke billowing from its stack. "Just as Cooper was congratulating himself that the race was won, the belt which operated the blower flew off its drum, and without the blower to force a draft through the furnace, steam pressure began to drop. Cooper tried to replace the belt while the car was in motion and lacerated his hand. The pressure dropped further, and as the engine slowed down the horse came from behind to win the race."68

The Tom Thumb's performance convinced the Baltimore and Ohio engineers that steam power was the best type of traction that could be used, and in January, 1831, the railroad adver-
tised for locomotives, offering $4,000 for the best one and $3,500 for the next best, specifying that the engine must burn coke or coal, must weigh not more than three and one-half tons, must be able to draw fifteen tons of weight at fifteen miles per hour, and the flanges of the wheels must run on the inside of the rails. The York, built by Phineas Davis, a watchmaker of York, Pennsylvania, won the prize. It came within the weight limit, was mounted on a flatcar, and had a vertical boiler that permitted the fire to come up through the hollow center. The York drew 150 people at fifteen miles an hour, hauling a train of five cars. Those seeing the train pull out of Baltimore for the first time in the summer of 1831 called it one of the "grandest, most inspiring sights ever to greet the eyes of man."69

The "first commercially adequate American-built locomotives," however, were not put in use on the Baltimore and Ohio line, but on the Charleston and Hamburg Railroad, later called the South Carolina Railroad. This road was built inland to reach the cotton plantations of interior Georgia. Hitherto the cotton had been floated down the Savannah River, and the business men of Charleston, nearby to the north, were not getting much of the trade. In order to "cash in on" the lucrative commerce in cotton, they decided to build a railroad westward across the state to the town of Hamburg on the Savannah River.

69 Reck, p. 82.
The line was chartered in January, 1828, nearly a year after the authorization of the Baltimore and Ohio. Horatio Allen, who had piloted the Stourbridge Lion, was put in charge of construction operations. He was convinced that steam power was preferable to horses if the right kind of locomotive could be built. In the fall of 1830 the West Point Foundry of New York City attained the honor of building the first successful locomotive in this country, the Best Friend of Charleston, put in service on the Charleston and Hamburg line. On its trial run it attained a speed of thirty miles an hour alone and pulled four cars containing forty to fifty people at a speed of twenty-one miles an hour. In January, 1831, it was put in regular service and operated satisfactorily until June 17, when a Negro fireman, tired of hearing the hiss of escaping steam, either sat on or tied down the safety valve. When the pressure became too great, the boiler exploded, hurling the surprised Negro and its own fragments a distance of twenty-five feet. The fireman received a broken hip and two other employees were painfully injured, and the engine was completely destroyed. But by this time the line's second engine, the West Point, was in operation, and service was continued without interruption. The Charleston and Hamburg has the distinction of being the first American railroad with regular passenger service.⁷⁰

⁷⁰Hungerford, p. 8; Reck, pp. 82-85; Thompson, pp. 51-52.
Thus, from very crude beginnings, the steam locomotive had, by 1830, evolved into a practical and commercially successful adjunct to the transportation of goods and people.
CHAPTER II

THE FIRST STEAM RAILWAYS

The railway as it is known to the world today was definitely the handiwork of mine superintendents and their engineers who were attempting to find speedier and more economical ways of placing their coal and ores upon the market. The locomotive was invented to handle the transportation problem that was placing great pressure upon the facilities of lines operated by horse-drawn wagons.¹

The railroad was not an invention. It was merely a putting-together of ideas already in existence. A railroad, after all, is merely a track on which some kind of mechanical power is used to draw cars. Both tracks and steam power were well-developed inventions before the dawn of the railroad era. They simply had not yet been put together.²

"England, unlike Germany and the United States, passed through a revolution of great importance before the introduction of the railway."³ This revolution was mostly social and economic in nature: the dissolution of the old manorial village, the transformation of the textile industry from homosex to manufacture, the resultant growth of industrial

¹Bowden, p. 393. ²Reck, p. 75.
towns, and the concentration of capital and power in the industries connected with iron, steel, and coal.

England

As was to be expected, the perfecting of commercially adequate locomotives tended to encourage the construction of railroads on which these engines could be put in operation. In the establishment of the world's railways, England led the way and was the pioneer nation, although much of the experimental work undertaken there was transplanted to other countries, and the practices employed in the infancy of English railways served as guide-posts to other nations as they, too, interested themselves in building up a railway system.4

Eleven years after Stephenson had built his first locomotive, the first public steam railway in the world was opened for traffic. It began as a resolution at a public dinner in the Town Hall of Stockton on September 18, 1810, calling for a committee to "inquire into the practicability and advantage of a railway or canal from Stockton, by way of Darlington and Winston, for the more easy and expeditious carriage of coals, lead, etc." Two years later, when the committee reported in favor of a canal, bitter quarrels broke out between the canal and railway advocates. Finally, in 1818, differences were partially settled and Stockton petitioned Parliament for

authority to construct a railway designed for the transporta-
tion to parts of Durham and Yorkshire Counties of "coals, and
for the general conveyance of merchandise." Local opinion
was optimistic and enthusiastic, and the sum of £25,000 was
subscribed within a week. The first bill, presented in 1819,
was rejected by a small majority, however, "largely because
of the opposition of a noble lord, who objected to the line
passing through his estates, and objected with particular fury
when he learned that it would pass through a fox covert." A
new survey was made in order to avoid this holy place, and the
new bill was passed in 1821. It said nothing of using loco-
motives or of transporting passengers, but on May 23, 1823,
a year after the first rails were laid, a bill was passed
which called for the use of locomotives "for the Purpose of
facilitating the Transport, Conveyance, and Carriage of Goods,
Merchandise, and other Articles and Things upon and along the
same Roads, and for the Conveyance of Passengers upon and along
the same roads."

The charter of 1821 had merely provided for the hauling
of wagons and other carriages upon the line "with men or horses
or otherwise," and the word "otherwise" gave Stephenson his op-
portunity, for it was through his efforts that locomotives were
adopted even after horses had been used on the first sectors
of the line. Stephenson had a locomotive engine in operation
at a nearby colliery and gave a demonstration before the di-
rectors of the Stockton and Darlington that convinced them
that the steam locomotive was reliable, powerful, and cheap. As a result of the demonstration, Stephenson was employed as engineer for the road at a salary of £660 per year. On September 27, 1825, the Stockton and Darlington Railroad was publicly opened. It had a single track thirty-eight miles long, with passing places every quarter of a mile. Stephenson's new locomotive, built especially for use on the line, attained a speed of fifteen miles an hour while hauling a load of merchandise, coal, and passengers weighing about ninety tons; the average speed, however, was only four to eight miles an hour. The train, a spectacular sight, was composed of the following units: the Locomotion, driven by George Stephenson; tender with water and coal; six wagons, loaded with coals, passengers riding on top of them; one wagon loaded with sacks of flour, passengers among them; one wagon containing the surveyors and engineers; coach occupied by the directors and proprietors; six wagons filled with strangers; and fourteen wagons packed with workmen and others.

The engine weighed about seven tons, and at all speeds its chimney was red-hot; but it succeeded in performing the work of forty teams of horses, and the price of coal in Stockton soon fell by one-half. With the opening of the Stockton and Darlington Railroad, the locomotive and the public railway passed out of the stage of experimentation, Englishmen became railway-minded, and only a financial panic late in 1825 curbed
the first enthusiastic epidemic of railway promotion.⁵

But not every one was enthusiastic over the prospects of steam locomotion, even after it had been proved successful. At the time the directors of the Stockton and Darlington decided to employ locomotives on their line, they were roundly ridiculed for their decision. Lord Eldon publicly declared: "I am sorry to find the intelligent people of the North country gone mad on the subject of railways." Another noble skeptic promised to endeavor to "eat all the coals that your railroad will carry." Farmers were assured that they would be ruined, since there would be no further demand for their horses.⁶ But the road was built despite opposition.

Soon after the opening of the Stockton and Darlington, Stephenson had six of his locomotives in operation over the road, each of which averaged twelve miles per hour, and occasionally fourteen. They hauled only freight, for horses were still used to carry passenger cars and some freight cars as well. Even with the steam trains, horses had to be used, for a time, to help the puffing little locomotives climb slopes. The speed of the trains was affected still further by the fact that a law had been enacted which required a man to ride fifty yards in front of the locomotive, on horseback, to warn people of the "approaching monster."⁷

⁵Thompson, p. 23; Sommerfield, pp. 23-25, 34; Heaton, p. 543; Traill, VI, 200-201; Daggett, p. 66; Encyclopedia Britannica, XVIII, 916; Willson, p. 36.

⁶Willson, p. 36.

⁷Rugg, p. 74; Corti, p. 84.
Although the conveyance of passengers had in no way been considered in the original plans of the road, hundreds of persons made the excursion on the opening day, and soon the railway was beset by insistent demands on the part of the public that passengers be conveyed regularly. It was necessary to provide carriages suitable for passenger accommodation, and thus unintentionally began the story of the railway passenger traffic of the world.\(^8\) Although at first passengers were conveyed by horse-power only, locomotive service was soon extended to the passenger traffic, and the Stockton and Darlington became the world's "first line to combine steam locomotive haulage with the definite booking of passengers." Because of this fact, the railway centenary celebrations were held in Darlington in July, 1925, of which one feature was a procession of locomotives and rolling stock showing a century of progress and development in designs and efficiency.\(^9\)

The quiet cathedral town of Canterbury, in the heart of England's agricultural region, became the scene of the opening of the second British public railway. The reason for the construction of the Canterbury and Whitstable Railway, joining Canterbury to the coast, was the silting up of the River Stour, which caused losses in the Canterbury shipping trade which consisted largely of imported coal. The six-mile line, which opened for service on May 3, 1830, had the world's first rail-

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\(^8\) Willson, pp. 36-37. 
\(^9\) Sherrington, I, 11.
way tunnel, one-half mile in length.\textsuperscript{10}

After the Stockton and Darlington, several short lines were opened, but not until the Liverpool and Manchester was inaugurated in 1830 was the English mind "given its first irresistible impression that a revolution in modes of transportation and travel was impending." This line was thirty miles in length, and was the first railroad in the world to be definitely designed at its inception for the carriage of passengers. This road was noteworthy because from the first it adopted locomotive power as the sole form of traction, as a result of Stephenson's successful operation of the \textit{Rocket}. Double track was laid throughout its entire length, and ample facilities were provided for passengers as well as for goods and minerals. Although the Liverpool and Manchester was the first great railway to employ locomotive engines, "the triumphant success of the experiment led directly to the construction of far more extensive lines."\textsuperscript{11}

Despite the carriage of passengers, the promoters of the Liverpool and Manchester relied chiefly upon the haulage of heavy merchandise for their revenues. Stephenson, in charge of the engineering department of the line, foresaw the future possibilities of passenger traffic and expressed a desire to live to see the day "when it would be cheaper for a poor man to travel by railway than to walk." Officials of the railroad

\textsuperscript{10}\textit{Ibid.}, p. 12.

\textsuperscript{11}Ogg, p. 239; \textit{Encyclopedia Britannica}, XVIII, 916; Wilson, p. 38; \textit{The Historians' History of the World}, XXI, 550.
had expected to receive some £10,000 from the passenger traffic during the first year of the road's operation, and were amazed when passenger receipts exceeded £100,000. During the first twenty-two months of its existence the road conveyed 669,211 passengers, an average of 1,200 per day. Before the railway was opened, about twenty-two regular stagecoaches ran between Liverpool and Manchester, with about six additional ones in summer, which carried some 450 passengers daily. By the middle 1830's, the railway was transporting 500,000 passengers per year.\textsuperscript{12}

London, Liverpool, Birmingham, and Manchester were the four principal cities on the London and Northwestern Railway, and the four primary reasons for its existence. The system was planned originally for the purpose of welding into one network the short lines that had been built between these four cities and between them and smaller towns, all of which had been built independently and without consideration of any of the other short branches and lines. It was appropriate that the Liverpool and Manchester should be the first segment of the great London and Northwestern network, for by the beginning of the eighteenth century Liverpool had become the third port in the kingdom, whose importance was vastly increased in the first quarter of the nineteenth century by the shipment of Lancashire textiles to India and importing from that country the raw materials necessary for the textile industry. Man-

\textsuperscript{12} Sherrington, I, 14.
chester, too, had grown enormously during the early industrial era. From 1780 to 1824 the population had increased from 22,000 to 160,000, while that of Liverpool in the same period grew from 26,000 to 125,000. Canals, river navigation, and highly developed pack-horse service provided transportation facilities between the two cities, but were wholly inadequate. The Liverpool and Manchester Railroad Company was formed in 1825, with a capital of £510,000. Stephenson was chosen as engineer for the line at a salary of £1,000 a year.\textsuperscript{13}

The bill authorizing the Great Western Railroad had some difficulty in getting through Parliament, but it was finally approved and received royal assent on August 31, 1835. The Great Western was unique in railway history for several reasons. It was the only system in any country to be designed and constructed on the principle of a seven-foot gauge. It was the first to demonstrate the possibilities of speed, and the first line in Great Britain to make use of large and powerful locomotives, eight-wheeled express engines of considerable dimensions being employed at a time when other roads were still contenting themselves with little six-wheelers. This was also the first line to use the telegraph regularly. It is often called the first of the great railways. "Save for the American Transcontinentals, no railway in the world was in its beginnings planned and completed to so great a scale." The

\textsuperscript{13}Sommerfield, pp. 97-100.
first prospectus was issued in August of 1833, inviting subscriptions of £3,000,000 in 100 shares, the customary denomination at that time. The cost of the main line, 120 miles long, was estimated at £2,805,330, and the yearly revenue in the first years averaged £747,752.14

Boards of directors of English railways long clung to the theory that the scale of fares should be regulated according to the cost of construction of the line rather than by what the traveling public could be induced to pay for railway accommodations. Many roads, disappointed at passenger receipts, raised their fares and thereby drastically diminished the receipts still more.15 Even as late as 1841, passenger carriage was often retarded by the high fares charged, especially for local journeys, so that coaches and omnibuses retained a considerable proportion of traffic which might otherwise have gone by railway. However, passenger traffic increased steadily because of the great increase in mileage and the arousal of "railroad consciousness" on the part of the public. There was no fixed scale of rates; the authorization acts said nothing about fares, and each line at first was given a free hand in the matter, each one, through experimentation, discovering how much it could profitably charge for the conveyance of passengers and freight.16

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14 Ibid., pp. 29-30, 32, 38, 42.
15 Lewin, British Railways, p. 117. 16 Ibid., pp. 97-98.
France

The legitimate French kings who followed in the wake of Napoleon saw that it was to their advantage and to that of their kingdom to keep Napoleon's roads in a state of good repair.

By the 'thirties France had one of the finest road systems in the world, just when railways were coming to the fore. Indeed, both roads and canals were so well managed by the State that they may be said to have retarded the development of mechanical land transport, since people did not feel, as England did in the 'thirties, the urgent need for greater facilities.17

When steam locomotives first made their appearance in England and the United States, France was not particularly interested in the new invention nor enthusiastic about adopting it; in fact, large sectors of the population bitterly opposed it. So France hesitated while England and the United States were enjoying early successes with railways. In 1830, when an enterprising Parisian sought a concession to build a railway from Paris to Marseilles, there was such a furious outcry from hostlers, horse breeders, stagecoach owners, canal bargemen, peasants, and even from merchants along the route, that the proposal had to be abandoned. In 1833, the French Parliament voted 500,000 francs to be used by the Ministry of Public Works in a study of technical and commercial aspects involved in the construction and operation of rail-

17Knowles, p. 211.
roads, and Michael Chevalier was sent to England and the United States to study the railroad situation in those countries. Four years later he made a report advancing the idea of a definite plan for a national system of railways, but nothing came of it for some time.\(^\text{18}\)

Speaking of French roads, stagecoaches, and railways, a writer observed in 1844: "France has allowed herself to be outstripped by her neighbors, not only by England, but also by Belgium, Prussia, and Austria, in these means of extending national resources and civilization, which the country more especially stands in need of." Then he proceeded to excuse France's neglect of communication and transportation facilities by stating that the country had expended all its surplus money on the construction of fortifications. A still more serious handicap to the development of transportation facilities lay, this writer asserted, "in the want of confidence between man and man, and in the absence of the spirit of association, by means of which all great public works are executed in England by private enterprise, but which does not exist in France." However, he found a word of commendation for the fact that all great French rivers were traversed by steamers.\(^\text{19}\)

Railway progress in France was certainly slow. The first tramroad dated from 1783, but not until 1835 was the first modern steam railway begun by authorization of the Paris-St.

\(^{18}\text{Middleton, p. 183.}\)

\(^{19}\text{Willson, p. 65.}\)
Germain line, completed two years later. In 1838 the Orleans line was undertaken, and a railroad from Paris to Rouen was opened in May, 1843, and was soon extended to Le Havre. Ultimately the French government began to consider comprehensive measures relating to railway planning. Roads were to be constructed from the capital to all the frontiers of France, serving the principal towns and cities en route. By 1865 the plan was, in the main, fulfilled, and between eight and nine thousand miles were open for traffic.\(^{20}\)

Except for the chartering of a few horse-railroads between 1826 and 1832, France's first step was the appropriation of money to pay the government engineers for laying out a general system of railway lines. As to the question of ownership and management, only after years of investigation and discussion was a comprehensive plan drawn up by Thiers, ultimately adopted in 1842, calling for the construction of nine trunk-lines radiating from Paris to the borders of France and uniting the Mediterranean with the Rhine and with the Atlantic.\(^{21}\)

The scheme called for the following main lines:

1. Paris to the Belgian frontier via Lille and Valenciennes.
2. Paris to the English Channel.
3. Paris to the German frontier via Nancy and Strasbourg.
4. Paris to the Mediterranean via Lyon, Marseilles, and Cette.
5. Paris to the Spanish frontier via Tours and Bordeaux.
6. Paris to the Atlantic via Tours and Nantes.
7. Paris to the center of France via Bourges.

\(^{20}\textit{Ibid.}, \text{ pp. 65-66.}\)  
\(^{21}\textit{Ogg}, \text{ p. 245.}\)
8. Mediterranean to the Rhine via Lyon, Dijon, and Mulhouse.
9. Atlantic Ocean to the Mediterranean via Bordeaux, Toulouse, and Marseilles.\textsuperscript{22}

The thoroughness with which French railroads were planned before being constructed justifies the delay in actual railroad work. Methods of network formation, of construction, and of administration were thought out beforehand, for while other countries were "acting and experimenting, France was reasoning," and debates continued in the Parliament through the years from 1837 to 1842. When, in the latter year, it was decided that a definite network should be laid out as outlined above, the state obligated itself to prepare and own the railroad bed and build the bridges and stations, at an average cost of about £10,000 per mile, while private enterprise was to be encouraged to lay the track and provide rolling stock. Control of transportation was regarded as part of the duty of the state, therefore it was expected that companies would appeal to the state for assistance and equally certain that they would receive it. Though railways were to cost much money, they were regarded as absolutely indispensable to the nation both from a military and a commercial viewpoint.\textsuperscript{23} In addition to the national plan, concessions were granted to private companies for branch lines or transverse lines, and sometimes these corporations met with such difficulty in obtaining funds that

\textsuperscript{22}Daggett, p. 70. \textsuperscript{23}Knowles, p. 212.
they came repeatedly to Parliament with requests for subsidies and guarantees of interest. 24

Immediately upon the passage of the national plan idea, the government set about to acquire the necessary land for the rights-of-way, for which local authorities supplied about two-thirds of the cost. After the road-beds were completed by the government, companies were readily found to lay the track and put the railway in operation over some of the lines, but with others the government had difficulty in finding companies that would proceed with the necessary work. In this event, the government usually inaugurated actual construction operations in the hope of finding, ultimately, a company which would lease the line and carry the work to completion. 25

All of the proposed lines followed the established routes of travel and conformed to the national ambition to look to Paris as the commercial as well as the political capital. So the railways were designed to form, roughly, the spokes of a great wheel of which Paris was the hub. 26

By the law of 1842 that inaugurated the national plan of railroad building, "the state was brought into close association with private enterprise. It was hoped that the railways would be taken over by the government and operated directly by the state, but the pressure of circumstances led toward a

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26 Middleton, p. 184.
larger measure of private initiative with government regulation."

Thirty-three different railway companies began operations to carry out the government's proposed network; excessive speculation broke out; then came the crisis of 1847 and the revolution of 1848. The companies, brought to a halt because they could raise no more money, appealed to the government, which had already invested heavily in the preliminary work undertaken on the road-beds. But the state, in an effort to attract additional capital, agreed to guarantee interest on investments; and even further concessions were necessary for adequate stimulation. The agreement whereby all lines and equipment were to revert to the government in forty years was amended in 1851 and the time was extended to ninety years. In return, the companies undertook to make numerous branch-line extensions, in which the state was not to acquire and prepare and turn the road over to them as in previous arrangements. Before 1857 the companies had spent about £80,000,000 on these lines; then, unable to borrow any more money, they appealed to the government once more, and obtained an agreement whereby the state was to guarantee interest on new lines up to 4.65 per cent.  

In 1847 the new National Assembly proposed to revert to the policy of Lamartine, close certain insolvent railroad

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27 Bowden, Karpovich, and Usher, pp. 527-528.

28 Knowles, pp. 212-213.
companies which could not fulfill their contracts, buy out the others, and start a complete state system. But the government was too weak, politically and financially, even to make a beginning. Between 1848 and 1852 the only railway legislation was the concession to a company for a line from Paris to Rennes, the state giving the corporation a guarantee of interest, coming to be recognized by that time as the most useful form of state assistance.  

German

When France at last opened her great trunk-lines under the Second Empire of Napoleon III, Germany had had her main lines in operation for a decade. Despite the absence of a central government and the utter lack of great reserves of capital, in railway development Germany outstripped all continental nations except Belgium.

At an early date some German business men, statesmen, and thinkers had occupied themselves with consideration of the possibilities of railway transportation. Fritz Harkort, a Westphalian manufacturer, began in 1825 to press railway projects on "an incredulous and generally hostile public," and continued to do so for many years. In 1828, Motz, creator of the Zollverein, advocated a line from the Rhine to the Weser, to avoid Dutch Rhine tolls. King Ludwig of Bavaria was enthusiastically interested in railroad possibilities, and sent

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engineers to England, France, and Belgium in the early 1830's to study railroading in those countries. He gave no heed when the Bavarian College of Physicians tried to dissuade him from engaging in railroad building by asserting that railway travel would give horrible headaches to both travelers and spectators. But in December, 1835, King Ludwig had the satisfaction of knowing that the first German railroad had been opened in his kingdom -- the five-mile suburban line from Nuremberg to Furth. The distance was covered in fifteen minutes by steam and twenty-five by horse traction. 30 Having inaugurated the railway era in Germany, the line from Nuremberg to Furth was followed in 1838 by the opening of a line between Leipsic and Dresden. 31 At least as early as 1816, experiments had begun in Germany with the steam locomotive, and the first two railroads in the country, the Nuremberg-Furth and the Leipsic-Dresden, were designed primarily as passenger carriers to be operated by steam locomotive engines. "The length of the Leipzig-Dresden Railroad, 115 kilometers, the importance of the cities which it connected, the volume of the business which it secured, and the publicity which accompanied its promotion made it even more significant than its predecessor." 32

In Germany there was no comprehensive national plan such as had existed in France to guide the pattern of railway con-

30 Clapham, Economic Development of France and Germany, pp. 150-151.
31 Ogg, p. 249.
32 Daggett, p. 70.
struction, and each German state was left free to build as it liked, and hence the first German roads were designed purely to serve local interests. In 1833 Friedrich List, just returned from America, conceived and began to advocate with restless energy the idea of a German railway system. He published a pamphlet in which he advanced schemes for almost all of the main lines that were later built. At this time, however, the independent status of the various German states prevented the materialization of his systematic plan, for each state constructed its own lines as it pleased without any thought of joining lines in neighboring states. The uniformity of gauges on German railroads resulted from the importation of locomotives and rolling stock from England. 33

The railway from Leipsic to Dresden was the direct result of List's enthusiasm. Although helping the project in many ways, the Saxon government took no real part in the undertaking. Within six years, by April of 1839, the line was in operation, and in the first year carried 412,000 passengers, including ladies who kept needles between their lips to discourage masculine familiarity while going through the tunnel. 34

Having founded a railway journal to spread his views, List went to Magdeburg to interest the people there in an extension of the Saxon line, which he visualized as a sector of a future trunk-line from Prague to Hamburg. Interested,

33 Encyclopedia Brittanica, XVIII, 918; Clapham, Economic Development of France and Germany, p. 151; Ogg, p. 249.

34 Clapham, Economic Development of France and Germany, p. 151.
the Magdeburgers approached the Prussian government, only to find the officials suspicious and hesitant. There were very few dirt roads in Prussia, and the authorities believed that there would not be sufficient trade to justify railway lines; the leading general of engineers objected because, he said, railways would be of no use in war. The king believed that rapid travel should be reserved for gentlemen. As a result of these widespread attitudes, the first Prussian railway law, enacted in 1838, rather dampened the ardor of railroad advocates by its lack of sympathy to private enterprise and its discouragement of immediate state action. Cool indifference characterized the measure, which impassively permitted the Magdeburg project to go forward without either encouragement or discouragement. By August, 1840, the Magdeburg-Leipsic line was open to traffic, and a number of other companies had been formed to construct lines in various sectors of the country. 35

The first state railway in Germany was a short stretch of line opened in Brunswick in 1838. In 1842, Hanover decided to take part in the general development of German railroads, lest her trade should be diverted, and before 1848 this state had in operation some 150 miles of railways. Every line in Hanover was built by the state until its annexation to Prussia in 1866. Bavaria began with private lines, but by 1844 little

35Ibid., pp. 151-152.
progress had been made and the state stepped in and did all of the work itself for the next twelve years, when an era of speculation gave rise to a number of private companies. Wurtemberg, after long delays, decided in favor of state action in 1845, but the first line was not opened until 1850. Baden also adopted the state system, opened the first segment of the Rhine Valley line (Heidelberg-Karlsruhe) in 1843, and in the next three years extended it southward to the Swiss frontier.  

Topographical and economic obstacles to be overcome in Germany were few. Land was cheap, and the configuration of the great plain of central Germany simplified the engineering and technical problems of railway construction, so that work, when once launched, could proceed with rapidity and efficiency.  

The United States

In the 1820's, the general American public had little conception of the nature of railways. In 1823, when John Stevens was granted a charter by the State of Pennsylvania for the construction of a railroad from Philadelphia to Columbia, and reference was made to the fact in newspapers, one inquisitive reader wrote to his editor, asking: "What is a railroad?" The disturbed editor, not quite sure of himself, evaded the issue by suggesting, "Perhaps some other correspondent can

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36 Ibid., p. 153.  
37 Birnie, p. 47.
tell." Because so little was known about railways, a society was formed in Philadelphia in 1824 for the purpose of finding out more about them. This society sent William Strickland to England to investigate British railways, and from time to time he sent back reports of his investigations and findings.38

The Baltimore and Ohio is given credit for being the first railroad in the United States constructed for general transportation purposes. It was chartered by the State of Maryland in 1827, construction work began in 1828, and a portion of the line was opened to traffic in 1830, which year therefore marks the beginning of the railroad era in the United States. England had preceded this country in the construction of railways, for the Stockton and Darlington had been opened in 1825, and the Liverpool and Manchester in 1830, the same year that saw the opening of the Baltimore and Ohio on this side of the Atlantic.39

The Baltimore and Ohio was the first railroad in the United States to provide public rides. It had been built to compete with the Erie Canal. Baltimore merchants had reaped rich profits from the western trade coming to them over the old National Road, but now much of this trade was being routed along the Erie Canal, and Baltimore was alarmed over the situation. Because of the necessity of crossing the Alleghenies,

38Locklin, p. 39. 39Ibid.
Baltimore decided on a railroad instead of a canal. The line was to be built to the mountains, carry the cars over the divide by means of inclined planes, and reach the Ohio River at Wheeling. 40

On July 4, 1828, Charles Carroll, aged ninety-one, the last surviving signer of the Declaration of Independence, laid the first rail of the Baltimore and Ohio, saying as he did so: "I consider this among the most important acts of my life, second only to my signing the Declaration of Independence, if even it be second to that." President Hadley of Yale University, commenting upon Carroll's participation in the ceremonies that launched the railroad, said: "One man's life formed the connecting link between the political revolution of the last century and the industrial revolution of the present." 41

By January 1, 1830, the track had been completed to Ellicott's Mills, thirteen miles from Baltimore, and a horse drew a car containing twenty-four people at a speed of fifteen miles per hour. Later on the same day another horse drew three cars containing eighty people at about ten miles per hour. All winter the railway in its primitive state was an attraction to prominent Baltimoreans and members of Congress who, for the novelty of it, paid nine cents for the thirteen-
mile ride. This was the first public use of a railroad in the United States. In the first month of its operation the road made about one thousand dollars a week. Freight service was inaugurated, and soon farm produce was coming into Baltimore regular by horse-car. 42

When the tracks of the Baltimore and Ohio were laid down, wooden rails hewn from oak were mounted upon stone sleepers set in a rock ballast. Money and energy expended in laying such track were obviously wasted because, before long, with increased traffic, all such superficial construction had to be torn out and replaced by iron rails and wooden sleepers. Construction proceeded with little thought of the permanent motive power. Horses were soon found to be unsatisfactory for the transportation of passengers and freight for any considerable distance. The Baltimore and Ohio gravely experimented with a car that was carried before the wind by means of a sail fixed to a sturdy mast — a veritable boat on wheels that would sail over land instead of the sea. In addition to horse traction pure and simple, a horse was put inside of a car on a treadmill that, when the horse went through the motions of walking, turned the axles of the car and caused it to move down the track. Both of these plans were ingenious but unsuccessful. And when Cooper had produced the Tom Thumb, steam traction superseded all other forms on the road. 43

42 Reck, pp. 79-80.

43 Hungerford, p. 17; Riegel, p. 3; Hadley, p. 33.
Two years after the beginning of work on the Baltimore and Ohio, "brigades" of horse-cars were in regular service over the thirteen miles of track between Baltimore and Elliscott's Mills; by December 1, 1831, steam-drawn trains were running into Frederick, Maryland; five months later they were entering Point of Rocks on the Potomac, seventy miles out from Baltimore. Here the work was brought to a standstill by opposition from the powerful Chesapeake and Ohio Canal, and no additional accomplishments were made until two years later, when the railroad was able to purchase a compromise (the courts had sustained the canal's claim of transportation monopoly of the Potomac Valley by right of priority). 44

As to the details of the construction of such a railroad as the Baltimore and Ohio, the following account, taken from an official report of 1832, is informative:

A line of road is first graded, free from short curves and as nearly level as possible. A small trench is then formed for each track, which is filled with rubble stone, on which are laid blocks of granite or other suitable stone, about one foot square and of as great length as can be obtained. The upper and inner surfaces of each track are dressed perfectly even, as well as the ends of the blocks at their joinings. Bars on plates of wrought iron, near an inch in thickness, are then laid on these blocks or rails, in line with the inner surfaces, and fastened to the stone with bolts or rivets, entering about four inches in holes fitted to receive them, at a distance of about eighteen inches. The distance between the two tracks, for the wheels, should be about five feet. 45

The cost of such a road, not including rolling stock, stations,

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44 Hungerford, p. 18.  
45 Thompson, pp. 57-58.
and other equipment, was calculated at $28,173 per mile.\textsuperscript{46}

In point of performance, the Charleston and Hamburg Railroad is entitled to precedence in the list of railways in the United States operated by steam. The road, chartered in 1827, was, by January 1, 1830, ready for a trial run by the first practical locomotive built in the United States, the Best Friend of Charleston, which was shipped by packet to Charleston, and promptly ran off the track during its trial trip over the six miles of road that had been completed.\textsuperscript{47}

The Charleston and Hamburg road was a community enterprise promoted and financed by the citizens of Charleston. "It was proposed to rectify the freak of despiteful Nature that emptied the waters and water-borne cotton of the Savannah River at Savannah instead of Charleston."

The project was financed almost wholly by private subscription, although the city made a small loan of $20,000. On this road, too, "the experiment of the tractive power of sails was tried with anything but satisfactory results." As a result, the railroad was steam-operated from the beginning, not even employing horses as did most of the early roads. In September, 1833, when it was completed to Hamburg, its 136 miles of track composed the world's longest line of railroad at that time, "and its operation was considered marvelous . . ." Because of the weakness of the early locomotives, the company hauled only

\textsuperscript{46}Ibid., p. 58. \textsuperscript{47}Ibid., pp. 50-51.
cotton downward to the coast, and only light merchandise upward into the interior. For a while livestock, lumber, and other articles which would pay only low rates were declined, but were later accepted for shipment. Passenger rates as fixed by the Legislature were so low "that a poor man could not afford to walk."\textsuperscript{48}

In the several years immediately following 1830, the American people had considerable fun with the railroad, alternately praising and ridiculing it, while the builders and operators struggled along, running into difficulties and surmounting them as best they could.\textsuperscript{49}

While the Erie Railroad was in process of construction, one of the promoters was laughed to scorn by his associates when he expressed a belief that the road would eventually earn, by freight alone, $200,000 a year. But the ridicule turned to amazement when, in the first six months of the operation of the line, receipts were $1,755,285 -- mostly from freight.\textsuperscript{50}

To illustrate the nature of early steam travel in the United States, one writer takes his readers on an imaginary ride in an open coach drawn by the DeWitt Clinton, one of the most famous of the early locomotives, on its trial trip on the Mohawk and Hudson line in the summer of 1831:

\textsuperscript{48}Ibid., pp. 52-53; Reck, p. 84; Hadley, pp. 34-35.  
\textsuperscript{49}Reck, p. 90.  
\textsuperscript{50}Hungerford, p. 25.
The entire train, consisting of engine, wood-and-water car, three coaches, and several flatcars, was not much longer than a present-day locomotive. The engine was ten to twelve feet long with a horizontal boiler and a high stack in front. It was built by the same company that had provided the South Carolina road with its first two engines -- the West Point Foundry. The car behind the engine contained a barrel of water and a stack of wood for fuel.

The three passenger coaches were merely modified stage coaches with flanged wheels to fit the rails. The flatcars behind were fitted with benches to accommodate overflow passengers who were eager to make history. Each car was coupled to the other by a three-link chain nearly three feet long.

The engine started forward, and as it took up the slack in the chain couplings, the cars started with a jerk that threw passengers off their seats toward the rear. When the train was properly lengthened out it rolled smoothly enough, but as the fire became hotter, sparks and burning embers began showering the unprotected passengers. For a few miles the privileged riders were busy beating out their burning clothes and putting up umbrellas to protect themselves.

When the train stopped to take on water, the cars came together with a series of bumps that piled passengers in the forward ends. To prevent these jolts on the return trip, the riders tore down a rail fence, cut bolts of wood, and wedged them between the cars.

Travel, in the dawn of the railroad era, was hardly a pleasant jaunt. Pioneer builders were forced to learn their railroading by the trial and error method.51

The Boston and Albany, whose line was completed in its entirety by 1842, has the distinction of being the first road operated in this country as an important through route and not supported merely by local traffic. However, it was not the only instance of continuous railroad connection, for already an almost continuous line from New York to North Carolina was in operation, and rail connections from Albany to Buffalo were nearly completed; but each of these was made up of a series of

51 Reck, pp. 88-89.
local lines managed for local interests, while the Boston and Albany was built "with some conscious idea, though an imperfect one, of the work that it was to do in the future."  

In 1823 the Pennsylvania Legislature granted a charter to John Stevens to construct a railroad from Philadelphia to Columbia, but it was later abrogated before actual work had begun. In 1829 the state itself began work on the project — "the first railway work undertaken and prosecuted by a State government in America." In 1832, twenty miles at the east end of the line were opened for traffic, and two years later the entire double-tracked road was completed. At first, the line was operated entirely by horses and mules, private individuals or companies owning passenger and freight cars and paying a toll to the state for the use of the tracks. At Columbia the rail ride ended and the traveler took a canal packet up the Susquehanna and Juniata rivers to Hollidaysburg, where cars again ran the four miles to the foot of the Alleghenies. At this point the railroad became the first line to surmount the Alleghenies, although later its elaborate system of inclined planes disappeared as a result of the development of the locomotive — just as elsewhere where they had been used. The line enjoyed great prosperity from 1834 to 1854. It was solidly constructed, its rails resting upon massive stone sleepers which can still be seen along the

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52 Hadley, p. 35.  
53 Thompson, pp. 54-55.
abandoned route. This road had the most elaborate system of inclined planes ever constructed in the United States. Charles Dickens, in his *American Notes*, describes his experience in 1842 when he rode in a train that took him over the Alleghenies:

On Sunday morning we arrived at the foot of the mountain, which is crossed by railroad. There are ten inclined planes, five ascending and five descending; the carriages are dragged up the former and slowly let down the latter by means of stationary engines, the comparatively level spaces between being traversed sometimes by horse and sometimes by engine, power, as the case demands. . . . The journey is very carefully made, however, only two carriages travelling together; and while proper precaution is taken, is not to be dreaded for its dangers. . . .

Occasionally the rails are laid upon the extreme verge of a giddy precipice; and looking from the carriage window, the traveller gazes sheer down, without a stone or scrap of fence between, into the mountain depths below. . . . [He then tells how they] rattled down a steep pass, having no other moving power than the weight of the carriages themselves and saw the engine released long after us come buzzing down alone, like a great insect, its back of green and gold shining in the sun, that if it had spread a pair of wings and soared away, no one would have had occasion, as I fancied, for the least surprise. But it stopped short of us in a very business-like manner when we reached the canal; and before we left the wharf, went panting up the hill again, with the passengers who had waited our arrival for the means of traversing the road by which we had come.54

Early American railways, like those in Europe, were similar to modern street railroads in construction. Instead of having transverse sleepers, they were laid upon heavy wooden beams or sills, placed lengthwise. These beams were the real supports; the rail was simply a flat strip of iron

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54Hungerford, pp. 11-12; Thompson, pp. 55-56.
to protect the underlying wood from wear. The first locomotives, imported from England, were too heavy to use on this type of road. 55

At first, railroads in America were not "unquestionably an improvement over other forms of transportation. Considering cost, speed, convenience, and safety, the canals were able to wage a vigorous struggle for supremacy." And turnpikes, because of greater speed, were sometimes awarded mail contracts in preference to railroads. An average of fifteen miles an hour was considered very fast, and very few early trains were able to attain that speed. Not until 1838 were all American railroads made post-roads. 56

The railway was gaining in popular esteem, however, and the two decades from 1840 to 1860 marked the final conquest of the railroad over the canal. While railway mileage grew from 2,818 to 30,600, canal mileage increased only from 3,300 to 3,700. "The canal, which could not be used in winter, which frequently broke its banks, or lacked water during seasons of drouth, could not compete with the all-year-round swift-moving railroad." 57

The Communal Use of Railroads

It is interesting to observe that originally it was supposed that railway transportation could be managed upon the principles long familiar in the operation of turnpikes and canals; that is to say, the idea

55 Hadley, p. 33. 56 Riegel, p. 4. 57 Reck, p. 118.
was that, under authority conferred by statute, a company should construct tracks and should admit to the use of these tracks any persons who were willing to pay the toll charged, such persons using their own locomotives and cars and competing one with another in the transport of goods and passengers as did the coaches that plied for hire on the highways. Not much experience was required to demonstrate, however, that considerations of safety and expeditiousness made it imperative that the traffic on a railway line should be administered by a single directing agency. In an epoch of laissez faire, the normal disposition was to permit the fullest competition; but it was found that competition could operate only between different lines, not between users of the same line. The technique of the railroad led inevitably to the monopolistic form of management which has ever since been characteristic of it. 58

Early English railways were at first operated in a very simple manner that was modelled after the principle of the turnpikes and tramways -- they were rented to any person who wished to pay the required tolls. This confusing procedure soon proved utterly paralyzing and impossible of execution, and quickly gave way to a centralized, regulating agency -- the railroad company. 59

It had been the original Parliamentary conception that the English railway company should provide the road but must allow all comers to use it provided they paid for its use. All early railroad acts called for scales of tolls to be charged to outside users, but no provisions were inserted compelling the company to supply water, stations, sheds, and other equipment for outsiders; hence private individuals could not operate over the line unless the trustees or directors of

58Ogg, p. 240.

59Harry Elmer Barnes, An Economic History of the Western World, p. 334.
the company allowed these privileges, for which they might name their own figure. Because of widespread confusion and delay resulting from the intrusion of outside agents, and especially on the grounds of safety to the traveling public, Parliament soon amended its ideas and recognized the fact that, for all practical purposes, a company must be given the right to exercise a monopoly over its own lines. In actual practice, the safeguard to the public intended by Parliament in the form of competition of various carriers over the same line did not function efficiently and was discarded as an impracticable venture. 60

The Stockton and Darlington Railroad differed from most of the colliery roads of England in that it was designed to serve many shippers as a common carrier, and not simply to handle the business of a single mine. The proprietors encouraged the running of privately owned coaches drawn by horses under special arrangements. These private cars began to do an increasing passenger business on the line, which caused the company, about two weeks after the railway opened, to apply for license to run passenger coaches on the line. When the railroad had received official sanction, the company had not asked for authority to use coaches. 61

The Stockton and Darlington was only a single-track

60 Lewin, Early British Railways, pp. 62-63.
61 Daggett, p. 66; Hawks, p. 186.
road, with four passing places per mile. Locomotives were employed for coal haulage, but single-horse "coaches" continued in use for passenger service for some time, the company, after receiving its license to operate passenger coaches, at first owning only one of the vehicles. Because of the mixture of traffic, rules were in use regarding precedence at passing places, but sometimes trouble occurred between drivers, as most meetings naturally took place between the loops and one or the other vehicle had to return to the siding it had last left. Coaches were sometimes bodily removed from the track by passengers and replaced after the passage had been effected.  

Privately owned coaches continued to run on the Stockton and Darlington line until 1833, when the company bought them out. In the following year the company announced its intention of operating locomotive-drawn coaches and carriages. Only horses had been used up to this time. On April 7, 1834, the company advertised to the effect that it had begun operating locomotive-drawn coaches and carriages for the conveyance of passengers and goods six times daily.  

In the United States, when railroads were new, it was commonly supposed, as in England, that they would be operated in the manner of toll-roads and that any person would be free to haul his goods over the road by paying a toll and using his

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63 Hawks, pp. 187-188.
own carrier. Early charters permitted this practice, and some lines erected gates and toll houses. For a time, certain lines operated as toll-roads, but the special type of equipment required and the difficulty of meeting and passing other users of the railway rendered this system of operation impracticable. The coming of steam locomotion imposed still other difficulties, and it was soon apparent that a railroad company must have a monopoly of transportation over its road, unlike the canal and the highway. 64

All early builders of American railroads assumed that the company should have its own equipment and offer regular schedules of trips, but they saw no reason why private carriages should not also make use of the tracks. Should two carriages meet on the track, one could back up to the nearest side-track and let the other pass. "Railroading, they believed, would be as simple as that. The original concept of railroading was almost as crude as the equipment." 65

Strange-looking cars operated on the railway lines of the early days as a result of the use of the tracks by private individuals who paid the required fees. Sometimes the cars resembled boats and occasionally were propelled with sails or even with "oars" -- prod-poles long enough to reach the ground by means of which the car was shoved along by its occupants. 66

Although the communal use of railroads did not endure

64 Locklin, pp. 43-44. 65 Reck, p. 89. 66 Riegel, p. 3.
for very long, there were some notable exceptions, among which was the Philadelphia and Columbia road. For ten years after the line was opened in 1834, "the horse-teams of private freight haulers alternated upon the tracks between steam locomotives hauling trains. A team of worn-out horses hauling a four-wheeled car, loaded with farm produce could, and frequently did keep a passenger train hauled by a steam locomotive fretting along for hours behind it." 67

But, like all other impracticable features, this interesting communal use of the early railroads disappeared in time.

67 Hungerford, p. 12.
CHAPTER III

THE PUBLIC ATTITUDE TOWARD RAILWAYS

Early Opposition to Railways

When railroads were first catching the public eye, it seemed that well-nigh every one, at one time or other, voiced some degree of opposition and hostility toward the new-fangled mode of transportation that was causing old men to see visions and young men to dream dreams. Sometimes even government was unfavorable to the railways, fearing the result of their widespread use and declaring that "improved transportation would increase the mobility of the people and encourage the spread of ideas." No one doubts that the diffusion of ideas can become a menace to some -- but a blessing to others.

Right and left, people raised their eyebrows quizzically as they contemplated the new method of conveyance. Some believed it to be "an engine of the devil to lead immortal souls to hell fire." Almost every one believed that to travel faster than four miles an hour was dangerous, while to leap through space at the rate of fifteen miles an hour was suicidal.

In England the Quarterly Review looked with intense dis-

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1Daggett, p. 72.  
2Jennings, p. 545.
favor upon the idea of railways and urged Parliament, in sanctioning the construction of new roads, to "limit the speed to eight or nine miles an hour, which is as great as can be ventured upon with safety." In 1825 an impassioned reviewer, writing in a periodical on the proposed line to Woolwich, on which the speed of conveyance would be twice that of stagecoaches, stated:

The gross exaggeration of the powers of the locomotive steam engine . . . may delude for a time, but must end in the mortification of those concerned. . . . We would as soon expect the people of Woolwich to suffer themselves to be fired off upon one of Congreve's ricochet rockets, as trust themselves to the mercy of such a machine, going at such a rate. We would back old Father Thames against the Woolwich Railway for any sum.

But soon the railway would supersede even "old Father Thames," not, however, without a struggle against odds and opposition.

Laws were actually passed in England, on the first introduction of steam on railways, limiting the pressure in the engine-boilers to thirty pounds per square inch. The first railroad charter contained a clause limiting the speed of trains to twelve miles an hour, and when thirty miles an hour was suggested, it was ridiculed as an idea simply insane. "Such a fearful velocity would, without doubt, have the most disastrous effects upon the circulation of the blood and the vital organs."

At the time of the construction of the Great Western Railroad in England, eminent men of science in France, including Arago, outdid each other in making the flesh of the public creep, even though the terrible menace was safely removed from them and located across the English Channel. These learned

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3 Willson, p. 28. 4 Traill, VI, 201-202. 5 Willson, p. 68.
gentlemen were apprehensive as to the results of "an excessively rapid transition from one place to another on the respiratory organs," and insisted that

the abrupt change of diet, the alternation from districts where butter is used to those in which it is replaced by oil or other fatty substances, would give birth to dyspeptic conditions or dysentery that would necessitate prompt repatriation. The motion . . . must generate nervous affections, such as St. Vitus's dance, hysteria, and epilepsy, while the succession of fleeting images would instantaneously generate inflammation of the retina. The dust and smoke would give rise to bronchitis. . . . It was also impossible that there would not be persons who, owing to the impossibility of relieving themselves, would find their organs undergo an abnormal, painful, and dangerous tension . . . The gynaecologists . . . asserted that in the case of a pregnant woman any railway journey would infallibly result in a miscarriage, with all its puerperal consequences.

But the risks were not to be confined to the unfortunate passengers. Railway employees, predicted the learned doctors, must incur the same dangers as the passengers, with this added aggravation, that -- the causes being repeated, persistent, and permanent -- special morbid conditions would result . . . so that these employees would constantly be in hospital, and their lives would be of only brief duration.6

Peculiarly, opposition to railroads did not readily diminish with time, for even ten years after the passage of the bill for the Liverpool and Manchester, learned English counsel advanced, in an effort to defeat the proposed Great Western, arguments similar to those that had come from France. In addition, the railway would cause the Thames to be choked up with weeds because of lack of traffic to keep the river clear; the drainage of the country would be utterly destroyed;

6 Sommerfield, pp. 40-41.
and Windsor Castle would be deprived of a water supply. Eton College, argued the counsel, would be absolutely and entirely ruined, for the inhabitants of London would pour forth by railways and pollute the minds of scholars. Even if this did not happen, the boys themselves would take advantage of the speedy means of travel and would be able to run up to town and mix with all the undesirables of London life, returning before their absence was discovered.\(^7\)

Railways passing through the country would prevent cows from grazing and hens from laying, and the poisoned air from the locomotives would kill all the birds that flew overhead. The railroad would destroy pheasants and foxes. Householders were warned that their homes would be burned by the fire that was discharged from the engine chimneys, while the air for miles around would be polluted for a long while after the train had passed by the clouds of smoke that it had left in its wake. The introduction of locomotives would destroy the need for horses, the species would become extinct, and hence oats and hay would become commodities for which no market existed. Travel by rail would be highly hazardous -- the boilers would explode at any minute and blow the passengers to bits. Inns in the country would be ruined, for travelers could pass through the rural sections so quickly that there would be no necessity for their staying in inns along the way. The weight of the locomotives would be so great as to prevent their moving along the rails, hence railways could never be worked suc-
cessfully by steam power.  

Unemployment, too, was regarded as a grave evil resulting from the railroad, due chiefly to the displacement of horses by locomotives. An English writer voiced the fears of the agriculturists of his country when he wrote:

Nearly a hundred million pounds a year are to be saved by the disuse of horses and drivers. Said horses require as much land for their support as would maintain fourteen million persons. A great revolution in the value of horse-flesh is surely at hand, and scores of thousands of persons who have subsisted by their labor in various ways, such as supplying their food and taking care of them, will be thrown out of employment.

The Great Western seems to have had hurled upon it more than its share of the hostility to railways that was "partly due to innate distrust of novelty, but was more owing to a combination of opposition by vested interests, and of legalised highway robbery and blackmail on the part of wealthy and aristocratic landowners." The Commons, before they were to consider the bill for the railway, were solemnly assured that the project would "poison the air, interfere with drainage, spoil the landscape, and choke the Thames, after inflicting on the river the preliminary injury of ruining its traffic."

There were material and esthetic objections, also. Eton College authorities, headed by the celebrated Dr. John Keate, famed chiefly for his fondness for flogging, pointed out the moral dangers of the new-fangled means of conveyance. Keate addressed a letter to Gladstone requesting that he use his

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8Ibid., pp. 188-189.
9Locklin, p. 45.
personal influence to prevent the building of any railway that would serve Windsor, since the inevitable result of such a project would be that of "interfering with the discipline of the school, the studies and amusements of the boys, affecting the healthiness of the place, from the increase of floods, and endangering even the lives of boys." Gladstone's answer is not known, but it was probably unfavorable to the request, since he was never opposed to railway development.\textsuperscript{10}

The Eton masters, however, were not long in recognizing the advantages of the railway, and within a month of their defeat in Parliament over the railway matter, and while their appeal to enforce an injunction preventing any trains from stopping within three miles of the college without the consent of Eton authorities was still pending, they requested the company to provide a special train to take the boys to London for the royal coronation. The request was granted and the injunction was repealed in the following year.\textsuperscript{11} Despite apparently amicable reconciliation to the coming of the railroad, the Eton authorities and even those of Oxford were ill at ease over the results, and they succeeded in obtaining legal authority to compel policemen to patrol the railroad to prevent the access of Eton boys, and giving the officers of Oxford access to the railway at all times for the purpose of detecting any students who might be loitering there or riding on the trains without permission. In like manner,

\textsuperscript{10}Sommerfield, pp. 39-40. \hspace{1cm} \textsuperscript{11}Ibid., pp. 51-52.
another act forbade trains to run to Cambridge during certain hours on Sundays.\textsuperscript{12}

The trading interests of the English towns launched all of the early large railway schemes, opposition coming largely from the agricultural interests represented by landowners and farmers, the two chief items in the opposition being the fright caused to livestock when they saw the steam and smoke emitted by the engine and heard the noise of the train, and damage to the game preserves. Opposition of the canal interests to the railways was natural and easy to explain, although it was not extensive. But it is difficult to understand why country folk were so slow to realize the value of railway service.\textsuperscript{13}

Strong opposition to railways existed among the coaching interests because of the strong competition that railroads would offer.\textsuperscript{14} Even before they had secured their right-of-way, the early railway companies had to fight the vested interests of the old order or rival projectors of the new. Canal stockholders, turnpike trusts, inn-keepers, coach owners, horse breeders, and fodder merchants saw that they would be injured by "this smoky substitute for canals," and tried to stop its progress, while two or more companies might fight each other to obtain the right to build a potentially profitable line.\textsuperscript{15}

In the eighteenth century the rich traveled in the family coach or hired a post-chaise; those of moderate means used the stagecoach; and the poor walked or begged a lift from a carter.

\textsuperscript{12} Traill, VI, 203.

\textsuperscript{13} Sherrington, I, 21.

\textsuperscript{14} Lewin, British Railways, p. 61.

\textsuperscript{15} Heaton, p. 544.
At first, the nobility despised the common railway carriages, even those of the first class, and attached their private coaches to the rear ends of trains, paying handsome fees for this privilege. But on one occasion the coach of a certain noble lord caught fire in a tunnel from the sparks of the engine, and the occupants were rescued at the other end in a state of suffocation. Thereafter the practice was discontinued and the nobility began to ride in first-class carriages. A great impetus was given to the position of railroads in the public esteem when even the queen, in 1842, consented to risk a ride on a train.

As confidence in the new means of transport grew, the attitude of landowners, broadly speaking, began to change from that of open hostility to one of support for a line passing through their district, and this frequently took the form of a substantial subscription to the capital required. . . . sufficient time had elapsed to show that the successful operation of railways would be a permanent factor in the life of the nation.

In France, when the locomotive began to invade that country, a group of "experts" declared that "the fire from the engine would set forests and crops on fire. The noise of the trains would make the neighbouring country houses and properties uninhabitable, and drive mad the cattle pasturing in the vicinity of the railway." The famous French physicist and astronomer, Arago, addressed the Chamber of Deputies in op-

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16 Fay, p. 199.  
17 Rugg, p. 76.  
18 Lewin, Early British Railways, p. 155.
position to the railway, stating, among other things, that passengers going through a tunnel a few meters long would be suffocated. 19

When the promoters of the Nuremberg-Furth Railway in Germany were seeking the necessary concession, the Upper College of Medicine of Bavaria, the highest medical authority in the country, gravely warned the government that the operation of such an enterprise by steam would undoubtedly result in serious cerebral injury to travelers and public -- a sort of "delirium furiosum" -- and urged that the populace, "as innocent victims of the modern craze," be safeguarded from the disease by the erection of high wooden fences on both sides of the tracks. Later, when the line was being planned from Berlin to Potsdam, the Postmaster-General of Prussia ridiculed it as a waste of effort and money, commenting: "Here am I, sending several diligences to Potsdam every day, and nobody uses them, yet they are going to build a railway in addition! It is a stupid business!" 20

In 1835, when the Rothschilds were trying to win a concession that would permit them to form a company to construct a railway from Bochnia to Vienna, public opinion in Vienna was opposed to railways. Newspapers published opinions by a host of "experts" who showed the madness of such an undertak-

19 Corti, pp. 112-113.

20 William Harbutt Dawson, The Evolution of Modern Germany, pp. 211-212; Daggett, p. 72.
ing. They proved -- on paper -- that the human respiratory system could not stand a speed of fifteen miles an hour; it was the maddest recklessness to venture upon a railway journey; nobody in possession of even half of his senses would expose himself to the great risks; travelers would have to take their doctors with them. Passengers would "spurt blood from nose, mouth, and ears, . . . they would be suffocated in passing through a tunnel more than sixty metres long, and . . . not merely were the passengers in danger themselves, but . . . the spectators might go mad through the terrific speed of the passing train."\textsuperscript{21}

On the whole, the early railways in the United States were subjected to less opposition than in England and in the rest of Europe, probably because the canal and stagecoach interests were less powerful in America, and large landowners were less influential with the legislatures. Railroads, of course, had to demonstrate their practicability, as was quite proper, but seldom was there any deliberate effort to handicap them in the interest of some other mode of travel.\textsuperscript{22}

Most American opposition to railways had an economic basis. Thousands earned their livelihoods by transporting persons or property over routes or operating tolls on canals, turnpikes, and plank-roads; other thousands kept inns and taverns along the routes. Taxpayers were worried over large state debts for canals and believed taxation would be increased

\textsuperscript{21}Corti, p. 91. \textsuperscript{22}Daggett, pp. 87-88.
if canal revenues were reduced. Farmers feared the loss of markets for horses, hay, grain. The wagoners of Pennsylvania, who had earned their living by driving six-horse Conestoga freighters, voiced their complaint against railroads in a song, a portion of which follows:

Come, all ye bold Wagoners, turn out man by man,
That's opposed to the railroad or any such a plan;
'Tis once I made money by driving my team,
But the goods are now hauled on the railroad by steam.

May the devil get the fellow that invented the plan,
For it'll ruin us poor wagoners and every other man.
It spoils our plantations, wherever it crosses,
And it ruins our markets, we can't sell our horses.

It ruins our landlords, it makes business worse,
And upon every other nation it has been a curse.
It ruins wheelwrights, blacksmiths, and every other trade:
"Damned" all the railroads that ever was made! 23

At the time the railway made its appearance on the scene in America, it found that the most profitable trade routes were already being utilized by well-established canals and turnpikes, and naturally all those persons who had made investments in these older forms of transportation were not happy over the introduction of the locomotive. 24

The owners of the Middlesex Canal, operating between Boston and Lowell, presented protests to the Legislature to the effect that their charter gave them a monopoly of carrying privileges between the two cities, and were thus able to delay the construction of the Boston and Lowell Railroad for over two years. In the same manner the Baltimore and Ohio,
struggling desperately to tap the West, was halted for almost the same length of time by the Chesapeake and Ohio Canal, which tried to hold its trade monopoly of the Potomac Valley region. 25

At many large American towns and villages and cities, especially in the State of New York, the continuity of the rails was broken — sometimes in actual opposition to having a railway within the city limits, and sometimes to protect the interests of local draymen and wagoners. Utica sent a committee of eminent draymen, bus-drivers, and inn-keepers to Albany to prevent two of the early lines from making rail connections in the vicinity of the city. At Rochester for years, both passengers and freight had to be transported by horses across the city from the railroad leading to the east to that going toward the west, or vice versa. The carrying of passengers across a city between railroad terminals served as a stimulus to local pride. As late as the 1850's, Erie, Pennsylvania, waged a bitter war to prevent the Lake Shore Railroad from laying a road of uniform gauge through the city and thus abolishing a time-honored transfer of passengers and freight. 26 All profiteers from the re-shipment — draymen, freight handlers, hotel and restaurant owners — were in the fight and protested vehemently. Open warfare and rioting even occurred before the New York Central finally accomplished its

purpose and obtained a through line.\textsuperscript{27}

Typical of American opposition, outside of that arising from business competitors of the railroad, is a portion of the speech of a Massachusetts legislator who spoke in the House of Representatives in 1827 against the proposed railroad from Boston to the Hudson River. Declaring that the railroad at that time was still a premature undertaking, he declared that it would cost an enormous sum of money, and would be worth little or nothing. He begged the House to pause, to have mercy on the people, to have some compassion. In the winter the snow would be in some places 10 feet deep, and so make the railroad useless. . . . How would turkeys, butter and eggs look after coming over a railroad thirty miles an hour? How would pigs and passengers travel over it together in the same car? There was nothing else to bring. He called upon the House to wait before they began the work, till they saw a reasonable chance of getting their money's worth. If they must have a magnificent project, he would go the whole length, and would try to bring Heaven down to Earth, or Earth to Heaven.\textsuperscript{28}

Reasons for the Construction of Railways

Historically, the railway was merely a development of the tramway, distinguished by the general use of iron rails, and eventually of steam-power. The successful operation of the tramways in connection with mines, the congestion of heavy traffic on the canals, the tendency of the canal companies to combine and to increase the toll rates, and the expensiveness of travel by stagecoach combined to suggest to reflective persons the possibility of constructing railways for the conveyance of general merchandise and of passengers over long distances.\textsuperscript{29}

Thus, in spite of difficulties, inconveniences, and discomforts connected with travel up to the end of the eighteenth century, the railway was not introduced primarily for the pur-

\textsuperscript{27} Riegel, p. 7. \textsuperscript{28} Daggett, p. 87. \textsuperscript{29} Ogg, pp. 238-239.
pose of facilitating travel from one part of the country to another. The original function was to facilitate the mining of coal in England. At first, the coal had been taken from the mine-pits to the place of shipment in sacks or large wicker baskets carried on the backs of pack-horses, mules, or donkeys. Later, two-wheeled carts carried larger quantities, averaging a ton for each horse and cart, transported ten miles per day. Still later, the carts were enlarged and made into four-wheeled vehicles carrying two tons drawn by one horse. To facilitate haulage, a form of wooden rail was introduced, laid parallel on timber sleepers or imbedded in the ruts cut by the carts in the ground. Although these wooden tramroads reduced the cost of haulage materially, it was still high; one mine on the Tyne River in England kept over 350 horses for conveying coal from the pit to the river.30

Why should the first railway act in England have involved communication between two such small and relatively unimportant places as Wandsworth and Croyden?

The answer is to be found in the conditions of the time. The pioneer railways, in this and other countries, were short, primarily of local interest and importance, and designed to deal with purely local transport needs. In a number of instances they were also promoted either as alternatives to canal schemes -- as was the case with the Surrey Iron -- or originated in the deficiencies of water carriage. . . .

But since even the smallest railway undertaking absorbed a relatively considerable capital, and the days of the great limited company had yet to come, it was

30 Hawks, p. 171.
natural that the railway should be regarded as an improved highway to meet the specific requirements of a particular district, rather than a means of long-distance communication. The English system, as that of most other countries, thus originated for the greater part in such local lines, which subsequently linked up and amalgamated with each other. . . . 31

Specific needs animating the promotion of the early little railways were actually of considerable, although localized, importance. The Wandle River in England, for instance, now only a minor tributary, was at the beginning of the last century said to be the busiest river of its size in Europe. Nearly forty miles of factories, wharves, and mills lined its bustling banks, representing varied industries employing about three thousand persons. The river having become inadequate as a commerce carrier, a canal project was considered but was later abandoned as impracticable. Then came the Surrey Iron Railway, "whose traffic consisted of such commodities as coal and manure from London, and agricultural produce, lime, and chalk in the reverse direction." 32

Early railroads were built, in the main, with the idea that passenger patronage would be more or less inconsiderable and was regarded only as a by-product of the real business of hauling freight. But the Liverpool and Manchester segment of the London and Northwestern Railway had to apologize for having only a few engines for the carriage of merchandise, since most of their locomotives were in use to meet the de-

mands of passenger traffic. On this line alone the passenger receipts for 1831 amounted to the remarkable sum of nearly half a million pounds. And the Grand Junction segment between Birmingham and Liverpool had so many passengers that goods traffic was not carried at all until a year after the opening, when the number of locomotives had been increased to accommodate the volume of business. 33

Americans believed at first that railways would only supplement waterways. The first railways were detached enterprises planned to serve purely local needs, designed to connect waterways or cities and to enlarge the trade territory of a given city or locality. Massachusetts, New York, and Pennsylvania were the leading industrial and commercial states, and by 1830 they had the best turnpikes and canals in the country. These states then took the lead in railroad building; by 1840, there were 2,800 miles of railways in this country, one-half being located in these three states. 34

Whereas the railroad era in England was inaugurated by the pressing need for better communication facilities between Liverpool and Manchester, in the United States the decisive motivating influence was the desire to provide facilities whereby the Atlantic coast cities might be united with the expanding markets of the Mississippi Valley region. This influence definitely fostered the Erie Canal, the Pennsylvania State

33 Ibid., pp. 102-102. 34 Splawn, p. 340.
Works, the National Road, and led to the Baltimore and Ohio Railroad. 35

The English railroads were mainly built to accommodate and extend existing business. As the facilities were increased, the business grew enormously; but for the most part, on lines which already existed before railroads were thought of. On the other hand, the American railroads have been mainly built with a view to the development of new lines of traffic, new establishments, or even new cities. The Englishman built for the present and future both; the American chiefly, and sometimes entirely, for the future.

This hope of future gains, out of all proportion to present traffic, of necessity gave railroad business in America a more speculative character than in England. 36

English railway lines were originally built to meet the demands of communities which already enjoyed good roads and canals and insisted on having good and secure railroad service. Capital, being abundant, was spent freely and often lavishly. Double track was habitually laid, grade crossings were avoided wherever possible, and every effort was made to construct the roads according to the highest standards of engineering art. Hence the original lines required only insignificant changes with the passing of years and the increase of traffic. Many improvements were put into effect, of course, but almost no actual reconstruction was necessary to meet new demands.

American railroads, on the other hand, were often built where existing business and existing means of communication amounted to little or nothing; capital was scarce; and speedy and economical construction was more to be desired than

35 Daggett, pp. 78-79. 
36 Hadley, p. 147.
solidity or safety or permanence. To avoid the expense of cuttings and embankments, railroad lines were adapted as far as possible to the natural contour of the ground. As a result, heavy grades and sharp curves were numerous. Station accommodations were inadequate to provide even protection from the weather. As traffic grew, many changes had to be made, involving, not improvements, as in England, but usually total reconstruction, the cost of which was often enormous. The easiest way to provide money was to issue bonds, and often the bondholders' investments totaled more than the stockholders'. From this abuse of the borrowing power of corporations and from the worst forms of stock-watering, England has been free.\textsuperscript{37}

Stability is the outstanding feature of the English railway system, and has been from its beginning, just as stability is a leading trait of the English character. This quality represents the fundamental difference between the English and the American railroad. It is shown in construction, management, and legal relations. In England the traveler observes this stability in massive stone bridges, tunnels, and viaducts, in station accommodations, and in a thousand details of other kinds which combine to produce an impression of solidity and endurance usually lacking in the majority of American railroads. The quality is shown, too, in the cost of construction

\textsuperscript{37}Ibid., pp. 148-149.
per mile -- a little over $60,000 in the United States, and over $200,000 in England. 38

In 1831 President Pierce, in his message to Congress, stated:

In the construction of railways, and the application of steam power, we have a reasonable prospect that the extreme parts of our country will be so much approximated, and those most isolated by the obstacles of nature rendered so accessible, as to remove the apprehension sometimes entertained that the great extent of the union would endanger its permanent existence. 39

Thus he expressed his opinion that the railroad would prove to be a powerful force for union, and a great web of common interest that would mold the American people together.

In 1838 Congress demonstrated its belief in the importance and efficiency of railroads by enacting a law that made every railway in the nation a post route. Almost without exception, the early Congressional committees, in their reports dealing with aid to railways, recognized the social benefits which railroads would confer upon the nation. 40

The story of American railroads is the story of a long struggle that stretched out from the East toward and into the vast West. Forty years elapsed between the operation of the Stourbridge Lion and the spanning of the continent with iron rails.

The war with Mexico, the discovery of gold in the far West, and the settlement of boundary questions in the Southwest

38 Ibid., p. 146. 39 Middleton, p. 10. 40 Ibid.
and West, all occurring near the middle of the last century, made Americans conscious of the region beyond the Mississippi. People began to migrate into the Pacific regions, and the need for better transportation facilities began to be felt.\textsuperscript{41}

Gold provided the greatest single impetus to westward migration and to the growth of the idea of a transcontinental railroad. According to an estimate, at least 35,000 persons went to California in 1849 by the overland route, and probably as many more went by ship around Cape Horn. In 1850 California was admitted into the Union as a state with almost 100,000 population. Comparatively few of the many who went to California were fortunate enough to find gold. "The rest discovered fertile, exciting, beautiful country, and many stayed to become merchants, farmers, and laborers."\textsuperscript{42}

\textbf{Early Improvements in Railway Service, Equipment, and Safety}

Early English railways began by catering to the business men of the middle class, and only slowly awoke to the importance of third-class traffic. At first only two classes were provided. First-class passengers rode in covered carriages, while those of second class rode in open ones, corresponding, respectively, to the inside and the outside of a stagecoach. By 1850, second-class passengers were usually conveyed in closed carriages with glass windows and open seats,

\textsuperscript{41}Reck, p. 132. \textsuperscript{42}Ibid., pp. 131-132.
"but the third class long endured the torments of hell in open boxes exposed to wind and rain." Some roads inaugurated third-class service only for the purpose of preventing peasants and workmen from riding on coal trucks or walking on the tracks. In 1844 Parliament decreed that every railway company should operate at least one third-class per day at a charge of one penny per mile, traveling at a speed of at least twelve miles an hour. Thereafter, competition between lines brought about rapid improvement in third-class accommodations. Even two years after Parliament had acted, however, improvements had not yet become so startling, for Punch in 1846 published some "Rules for Railways," which included the following: "No 3rd class carriage is to contain more than a foot deep of water in wet weather; but, to prevent accidents, corks and swimming belts should always be kept in open carriages."43

By 1850, two-thirds of the revenues of English railroad companies was from passenger service, for which three types of accommodations were offered: (1) the first-class carriage resembled three stagecoach bodies mounted upon a chassis; (2) second-class carriages were cheerless, but had seats and a roof and sometimes glass windows; (3) "third-class passengers stood in open trucks on trains that started at inconvenient hours, dawdled along, and reached their destination at no fixed hour." Rapid improvements soon led to the abandonment of

43Fay, pp. 199-200; Jennings, p. 545.
second-class service, and by 1900 only rich men and honeymoon couples traveled first-class.\textsuperscript{44}

A crude form of signalling came into use on the world's first public railway, the Stockton and Darlington. The earliest definite fixed signals were lamps attached to posts, for night use only, as traffic was run "by sight" during the day. Later, flags were used in the daytime and lamps at night, both operated by attendants at stations. These eventually were superseded by triangular, round, or square boards fixed to revolving masts along the track at certain intervals and at strategic or dangerous points, the signal board facing the engineer when "danger" was ahead and placed at right angles when all was "clear." As early as 1845 the electric telegraph was in use for single-line roads in some parts of England, and semaphore signals were gradually replacing the boards. The first semaphores were composed of arms that were sometimes equipped with lamps and that remained at "danger" for five minutes after a train had passed, then lowered to "caution" for another five minutes, and then the arm dropped out of sight inside the semaphore tower to indicate "all clear."\textsuperscript{45}

The "battle of the gauges" occurred in England as a result of the fact that short lines, local in nature and purpose, when attempting to unite with other such lines to form a through route, were prevented from doing so in many instances because

\textsuperscript{44}Heaton, pp. 545-546.

\textsuperscript{45}British Railways, 1825-1925, p. 116.
of varying widths of track. In 1846 a Parliamentary commission was appointed to study the question. In its report, the commission indicated that it had found no significant points favoring either broad or narrow gauge lines in regard to safety, accommodation for passengers, or possibilities for speed, but it had made the discovery that narrow-gauge construction would materially decrease dead-weight haulage. Also, tradesmen and industrialists favored narrow gauge, for it was more convenient for use in their private sidings. The commission therefore pronounced its decision in favor of narrow-gauge construction, although its favorable aspects were by no means overwhelming. The commission agreed that broad-gauge lines should not be converted to narrow-gauge at public expense, and to call upon the companies which had obtained Parliamentary authorization to construct broad-gauge lines, to bear the cost of conversion was thought to be "manifestly unfair." Hence the commission only recommended a general conversion to narrow-gauge lines for those roads already in existence, but stipulated that any future roads should be constructed on the narrow-gauge basis. The companies, of their own volition, began gradually to change their lines to the narrow-gauge pattern. It was to their advantage to do so in order to build up an adequate railway network.

After the locomotive came into use, the earliest rails in

47 Ibid., p. 127.
all countries having railroads at that time were made of wood or stone surfaced with strap iron to protect the wood or stone from wear. In 1830, Col. Robert L. Stevens, son of John Stevens, sailed to England to buy strap iron for the rails of the proposed Camden and Amboy Railroad. While on the ship he began to wonder whether strap iron was the right idea for rails, and conceived the plan of substituting a rail strong enough to bridge the space between the supporting cross-ties placed at right angles to the rail. This seemed an advantage over the old method of supporting the relatively flimsy strap rail along its entire length with wood or stone sills. To pass his time, Stevens whittled his idea of a rail from a piece of wood, and the design as he finally perfected it was soon adopted as the T-shaped rail that has since been used as the standard.48

Schedules were not considered important for early railroads, which were merely short lines forming connections with stagecoaches and canals, and the train always patiently waited for the arrival of the stagecoach or canal packet before starting out. Because of the indefinite starting schedules and frequent mishaps along the way, no one knew when a train would arrive at its destination. There was no telegraph to announce the progress of the train along the line. When it left one town for another, it was as completely lost as a ship at sea.

48 Reck, pp. 93-94.
Some stations erected high lookout towers from which a sentry could sight a train several miles down the track, and in this manner the station-master and patrons were given a short time to prepare for its arrival.\textsuperscript{49}

Some early locomotives had wooden-block brakes operated against the driving wheels by means of a foot pedal, but many trains had no brakes at all. When a brakeless train came into a station, a crew of men ran out, grabbed it wherever a handhold was available, and pulled it to a stop. Such practices, together with serious accidents resulting from inadequate brakes, gave George Westinghouse an idea that, in time, evolved into the modern automatic electric air-brake that sets the braking units instantaneously throughout the length of the train.

Most improvements in railroading were made as a result of experience. The \textit{DeWitt Clinton}'s initial trip, for instance, proved that links of chain were unsatisfactory as couplings between cars. A rigid bar was substituted, and finally the coupler and pin, allowing a little play between cars, but not too much.\textsuperscript{50}

Most early locomotives burned wood, carried on a small flatcar immediately behind the engine. Frequently, on the run, the supply of fuel would be exhausted, and the engineer took axes and went into the woods to cut more fuel while the

\textsuperscript{49}Ibid., pp. 90-91. \textsuperscript{50}Ibid., p. 91.
passengers waited in the coaches or strolled about nearby.

As trains did not run at night, headlights were not necessary at first. The first makeshift headlight is credited to lines in both Pennsylvania and South Carolina, but it is probable that a number of roads used the same principle almost simultaneously. A flatcar was attached to the front of the engine, a layer of white sand was thrown over the floor, and a bonfire of pine knots was erected and ignited. A tin reflector behind the bonfire caused the track to be well-lighted for a short distance ahead of the engine. This crude arrangement was soon replaced by oil lamps and reflectors.\(^{51}\)

The sandbox, so indispensable to modern locomotives, resulted from the handicap of slippery tracks caused by a plague of grasshoppers in Pennsylvania. At first, men were employed to sweep off the tracks ahead of the advancing locomotives, but at length some one conceived the idea of attaching boxes of sand to the engine in such a manner as to permit a fine trickle of sand to run continuously onto the track in front of the wheels. The friction produced by the grit of the sand was sufficient to neutralize the slipperiness of the rails.\(^{52}\)

The cowcatcher was invented by Isaac Drips of the Camden and Amboy line. After having slaughtered several cows, unintentionally, with his locomotive, he installed on the front

\(^{51}\)Ibid., p. 93. \(^{52}\)Ibid.
of his engine a little truck bearing two iron bars thrust forward like spears, but slanting down toward the track. This arrangement served to protect the engine, but it sometimes impaled the cows, so Drips substituted a crosswise bar similar to the bumper of a present-day automobile. Eventually the V-shaped cowcatcher was adopted.\(^{53}\)

As in England, there was no standard gauge in America during the early years of the railway era. In 1863, Congress chose 4'8.5" as the gauge for the proposed Union Pacific Railroad, and eventually all roads in this country built track to conform to this pattern, which has an interesting history. Originally it was the span of an English cart, and Stephenson, when he began constructing locomotives in England, used the same span. Certain American engineers of the Baltimore and Ohio and other lines adopted the English gauge. In this way the uniform railroad gauge of today came from the English peasant's cart.\(^{54}\)

Early passenger cars in the United States evolved from the stagecoach, just as in England. They were hardly more than open wagons with a roof and leather curtains to give some protection in case of wind or rain. One of the first "luxury" passenger cars on the Baltimore and Ohio was a glorified stagecoach which could carry twelve passengers inside, six on the outside seat at the front, six more at the rear, and twelve on the double sofa on the roof. Persons riding on the

\(^{53}\)Ibid., pp. 91, 93. \(^{54}\)Ibid., p. 94.
roof were protected by an awning supported by iron rods.

The design of the railway passenger car soon deviated from the original stagecoach style and became a box about forty feet in length, with an aisle down the center and unupholstered seats on each side. In winter, heat was provided by a coal stove in one end. 55

In 1838 one of the first sleeping cars came into use between Baltimore and Philadelphia. As in the canal packets, three tiers of bunks were set up on each side of the car; also like the packet, these bunks were hardly more than narrow wooden shelves overlaid with a thin straw mattress. But this car, crude though it was, was heartily welcomed by the people who had occasion to use it. One newspaper even commented that one could sleep as comfortably in the train as at home, and that the only thing needed to complete the luxury of train travel was a dining car. 56 This, too, would come eventually.

"The telegraph for railroad operation, the land grant to aid in construction, the Pullman for passenger comfort, end-to-end combinations" (amalgamations and consolidations), were the four outstanding railway developments during the two decades from 1840 to 1860. 57 But a number of other important things happened to the railroads in the United States during this period. The hastily laid and unsubstantial tracks were improved and strengthened, curves were widened, stone and iron

55 Ibid., p. 95. 56 Ibid. 57 Ibid., p. 128.
bridges replaced flimsy wooden trestles, heavy T-rails everywhere took the place of strap iron. Where inclined planes had made it possible to get the railroad cars over the mountains by means of cables and stationary engines, tunnels were now excavated through the hills. In the 1850's, when Bessemer succeeded in reducing the time required for making steel from eight hours to twelve minutes, steel became cheap and soon replaced cast-iron rails that had been in use on all the earlier lines in this country. The first steel rails lasted fifteen times as long as the old cast-iron ones.

The Erie Railroad, in 1851, was the first to utilize the telegraph, invented seven years previously. A crude telegraph line for commercial purposes had been erected along the eastern end of the road, and messages were transmitted in the form of letters, beginning with "Dear Sir" and ending with "Yours Truly." The railroads, whose trains by this time were operated by "hard and fast" railroad rules, scorned the use of the telegraph. Then, as now, north- and east-bound trains held the right-of-way over those that were south- and west-bound, and meeting places on single-track lines were carefully indicated on the time schedules. Should a train be waiting for another at a place of passing, and an hour elapsed before the second train appeared, the first train could go forward "under flag" -- that is, a man with a flag in his hand walked ahead of the train to "protect" it. Necessarily,

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58 Ibid., p. 118.  
59 Ibid., p. 167.
progress was made at a snail's pace.

On one occasion Charles Minot, superintendent of the Erie, took a trip over the east end of his line. After his train had waited nearly an hour for an approaching train, he was seized with an inspiration. He sent a telegraphic message to a station fourteen miles away to hold the west-bound train until he should arrive there. The train crew refused to proceed, and the engineer refused to violate the time-card rules, even under the superintendent's orders. Minot finally took over the engine himself while the engineer seated himself in the last seat of the last car to await the worst -- which never came. By the same method Minot advanced to two other stations before he met the delayed train, and saved three hours of time by the use of the telegraph. As a result of this experience, the telegraphic operation of trains soon became established usage on the Erie and other lines. 60

The railway sleeper of the early '50s had not advanced far from the makeshifts of the '30s and '40s. Their builders apparently took canal bunks or shelves for their models. Sometimes narrow mattresses, hardened into something resembling granite from frequent usage, were provided; more seldom an unaired blanket or unlaUNDERED sheet was thrown in and the sleeper used his old-fashioned carpetbag for a pillow. When he was about to retire his eye fell on the necessary warning, "Passengers will please remove their boots before getting into the berths." No curtains shut out the fierce publicity that beat upon the occupants ... 61

George M. Pullman, having undergone such discomforts of

60 Hungerford, pp. 24-25. 61 Thompson, pp. 138-139.
railway travel, had an idea for improvement of the situation. Pullman had made $6,000 as a contractor for moving buildings in Albion, New York, when the Erie Canal was being widened. Later he had increased his personal fortune to $20,000 by moving buildings and raising foundations in Chicago where a portion of the city was being built on swampy ground.

By 1858 there was considerable night travel on railroads, and the sleepers were highly unsatisfactory. Pullman obtained permission from the Chicago and Alton road to experiment with two of their day coaches in an effort to convert them into better sleeping cars than any then in existence. In each of the cars, which were forty-four feet long, Pullman built ten sleeping-car sections, two washrooms, and a linen locker. A stove was installed at one end, and candles furnished light. Lower berths were made by readjusting the backs of the seats. Mattresses and blankets were provided, but sheets were regarded as an unnecessary refinement. The upper berths were shelves secured to the top of the car by catches when not in use, and could be lowered with pulleys to a point midway between the ceiling and the floor of the car. The washrooms were so small as to accommodate only one person at a time. A tin wash basin was filled from a water tank. The roofs were so low that a tall man would bump his head on the ceiling. Though the whole arrangement, judged by today's standards, was crude, it was a great improvement over other sleepers. 62

In 1864 Pullman went to work on a new sleeper, the famous Pioneer, which was fifty-four feet long and ten feet wide. It had more head room than the older cars, was finished in handsome woods and luxurious upholstery, and had larger washrooms and every comfort including sheets and towels. It cost $20,000 to build and equip. Railroad men said that the car was too wide to enter station platforms and too high to go under bridges, and Pullman suggested that platforms and bridges be altered to accommodate larger cars. Nothing was done, and the car might have rusted in the yards but for the assassination of President Lincoln. The Pioneer was commandeered for the funeral train between Chicago and Springfield, and platforms and bridges that could not be altered for an over-sized sleeping car were readily and rapidly enlarged to accommodate the cortege of a martyred President. Later, President Grant used the Pioneer between Chicago and his home in Galena. The fame of the new coach spread, and the Pullman Palace Car Company was organized in 1867 and grew into one of the big industries of America. Pullman cars have never belonged to the railroads, but to the Pullman Company, and the charge for Pullman accommodation is separate from railroad fare.63

Early in the 1870's a great advance was made by the substitution of steel for iron rails, a step which permitted an indefinite increase in the train load so far as the track is concerned, while the iron rail would bear but a limited burden.

63 Ibid., pp. 126-128.
Increased loads mean a vast saving in the cost of transportation, since they decrease the relative proportion of dead weight. Marked declines in the freight rates were perceptible at once after the introduction of steel rails, and this lowering of rates meant that the American farmer could raise grain for Europe. In 1867, 8.3 per cent of the American wheat crop was exported; in 1870, 20 per cent; in 1880, 40 per cent; in other words, the value of agricultural exports increased from $361,188,483 in 1870 to $685,961,091 in 1880.

Following the completion of the Union Pacific Railroad in 1869, the great cattle traffic of the West was favored with low freight charges. Refrigerator cars, introduced in 1878, were the next great improvement, and opened new European markets for American meat and stimulated the cattle interests of the far West and in the corn-growing and cattle and hog raising sections of the central West.64

Results of the Advent of Railways

The improved river, the canal, the good road and the larger sailing ship enable men to move greater quantities of cheap, bulky, heavy, or fragile commodities more quickly over long distances at lower cost. Then steam and the internal combustion engine increase further the size of the load, give certainty to movement, defy climatic obstacles, add greatly to speed and flexibility of movement, reduce costs still more, and give power to penetrate areas inaccessible by river or canal.65

The great advantage of rail transport over water transport is its greater speed, and it was "this advantage which

64 Knowles, p. 233. 65 Heaton, p. 538.
rapidly obtained for the early railways the perishable traffic which had previously gone by canal or coasting vessel." Although transportation by rail was costlier in many instances, greater speed of shipment abrogated the increased cost and enlarged the area over which it paid to transport goods. 66

The application of the steam engine to navigation in 1807 and to land transportation through the locomotive in 1829 ushered in the era of cheap transportation. Although the steamboat greatly reduced the cost of water transportation, the steam locomotive was decidedly revolutionary in its effects upon transportation by land. The cheap transportation made possible by the steam railroad is "one of the basic facts on which the economic life of the nineteenth and twentieth centuries has been built." The railroad possesses two great advantages which are almost equally significant -- cheapness and rapidity of transportation. The obvious outcome of improved transportation is to make available to a community the goods which must necessarily be produced elsewhere. Communities without cheap transportation must be largely self-sufficing. Cheap transportation permits other goods to be brought in, so that the products of other regions may become as commonplace as the articles produced at home. 67

The coming of the railways during the thirties and forties of the last century was probably the most upsetting and stimulating single economic phenomenon that society in this country [England] has ever experienced.

66 Sherrington, II, 4-5.  
67 Locklin, p. 1.
It is impossible for us to do more than faintly imagine the awe with which the advance of the "iron road" through the heart of the old-world countryside was regarded in the early days of Queen Victoria; or the tremendous revolution in ways of living which even a single new branch line caused in the district which it served. Romance, beauty, and poetry were perceived in steam engines, railway stations, viaducts, cuttings, and tunnels. The magic of speed took hold of men's imaginations for the first time, making them dream of new amusement, new education, new health, and new morals, as well as of new material comforts.68

In 1820, when James Gray published his Observations on a Railroad for the Whole of Europe, he commented on the possibilities inherent in railroads, although they were still in a nebulous state of experimentation, in the following manner:

Here is the mainspring of the civilization of the world; all distances shall disappear; people will come here from all parts of the continent without danger and without fatigue; distances will be reduced one-half; companies will be formed; immense capital paid and invested; the system shall extend over all countries; emperors, kings and governors, will be its defenders; and this discovery will be put on a par with that of printing.69

In England the railroads created new business, made more employment, aided the growth of cities and towns, opened up provincial areas and made their minerals and products accessible, and in turn brought to their doors products of other regions. In addition to bringing about greater economy of transportation, the railroad regularized the course of commerce: it "did for distribution what standardized machinery

69Willson, p. 35.
did for production. Being able to rely on regular and speedy delivery, merchants carried smaller stocks. Their turnover was accelerated, and they needed less credit to finance it. Business was brought closer to a cash basis." The mobility of people and goods was increased immensely, and the railway contributed to the enjoyments and health of the populace by enabling them to take week-end excursions into the country or to the seaside.\textsuperscript{70}

But the change most directly encouraged by the railroad in England was the development of engineering, or the use of machines to make machines. In Germany, likewise, railways turned the country into an industrial empire by solving more effectively than canals the problems of internal transport.\textsuperscript{71}

After 1850 in England freight grew steadily more important than passengers, but even today British railroads derive a third of their revenues from ticket sales, as compared to one-sixth in the United States. In the 1830's the carriage of mail was undertaken, and when the penny post was inaugurated in 1840, postal service was made both cheap and rapid. The railway ended the long-distance driving of livestock along English highways: one of the earliest extant pictures of a freight train (1833) shows trucks of sheep, a wagon crowded with cattle, and two trucks in which green-coated Irishmen were trying to keep pigs in order. Milk and other

\textsuperscript{70}Fay, pp. 196-200. \textsuperscript{71}Hammond and Hammond, pp. 79-80.
perishable farm produce could be marketed rapidly, and fresh fish could be distributed far inland. Railroads soon built up rapid and efficient service for handling small consignments of produce and merchandise, and rates were proportionately the same for small shipments as for carloads. 72

Englishmen were thrilled by the successes of the railway in their country, and when Lancashire passenger trains on the Liverpool and Manchester road were traveling twenty miles an hour, people declared that this amazing speed went "far to strike space and time out of the calculations of the traveller." 73

In France, in accordance with the national plan of construction, the railways were extended until by 1860 they totaled 5,907 miles. "The net result was that they had provided new arteries for traffic all over France and were beginning to revolutionize the transport of persons and goods." 74 Railways were among the greatest French achievements of the mid-nineteenth century. They created national rather than local prices, especially for agricultural products, and did much toward the equalization of all prices. As in every country where the railway network was linked into a connected system, the railroads hastened the evolution of industrialization. Perhaps France is the outstanding example of the parcelling out of territory for the purpose of railway building

72Heaton, p. 546. 73Ibid., p. 544. 74Knowles, p. 213.
and administration. Each of the nine main roads has a virtual monopoly on all transportation within its given territory, and as a result there is, even today, little communication between the different industrial sections of France. In the main, the traffic goes to Paris and is redistributed from there by way of the system operating in the region whither the shipment is bound. Hence the individual district is largely self-sufficing with respect to subsidiary industries.\textsuperscript{75}

By the end of the 1840's it was certainly true that the railway had changed the whole face of Germany. In a country where most of the towns were small and half-rural, and whose road system was still new, inadequate, and almost primitive, the revolutionary influence of the railroad was far more conspicuous than in older, more thoroughly developed, and more highly urbanized lands. "There was something American about it, just as there was a technical likeness between German and American railway methods. Like America, Germany had got her railways quickly and cheap. Land was cheap in the first place."\textsuperscript{76}

Railroads did more, in the United States, than attract some of the trade that had formerly gone to the stage lines. They actually increased the amount of travel. When the Balti-

\textsuperscript{75}Ibid., pp. 213-214.

\textsuperscript{76}Clapham, Economic Development of France and Germany, pp. 155-156.
more and Ohio was opened to Frederick, Maryland, a distance of sixty-one miles from Baltimore, passenger traffic between the two cities increased from twenty to 120 per day. People who had been reluctant to journey by stagecoach from one city to the other were eager to travel by the swift and novel railroad. Homebound persons began to venture abroad to visit acquaintances and relatives in other places, to make new friends, and to transact business.

The railway also altered trade habits. Before the coming of railroads, eastern cities had made use of rivers and canals to provide themselves with Pennsylvania anthracite coal; when the Baltimore and Ohio was opened to the Ohio River, however, West Virginia coal began to find its way eastward over the line. Rich deposits of ore and minerals which hitherto could not be utilized because there had been no way to transport them from the mine to the place of consumption, were now opened up and made available to the nation. Besides being more efficient and speedier, the railroad was also more economical than stage lines. In 1834 the Arabian, doing the work of 113 horses, was being operated at a cost of $13.25 per day.77

Railways in America did not, as in Europe, merely provide better trade arteries; they also were instrumental in the creation of new productive districts and commercial centers.

In the latter nineteenth century the principal prairie districts west of the Mississippi, the pasture region of the mountains, and the fruitful fields of the Pacific area were opened up by railroads.

Solidity and safety were not characteristic of these early railways, nor was their financial position of the best. If there was a prospect of good traffic two or three parallel lines competed for it and there would be bitter rate wars. The history of American railways alternates between periods of feverish over-speculation and heavy depression, since good trade stimulated railroad building and then cut-throat competition followed. The railways, economically speaking, conquered the land, united it politically for ever, and in half a century made the Union one of the most powerful empires of the earth.78

However ruthless may have been the methods employed by some of the early American railroad builders, it is also true that the men who built our early railways "forged an instrument for expanding the nation beyond its early boundaries, and that they welded an immense area into a compact political and economic entity, united in industrial and commercial interest and in sympathetic understanding."79

American railroads linked the West to the East and not to the South. Whereas traffic in the Middle West had been north and south in direction, since it had followed the natural transportation routes of the Mississippi region, the railroads diverted it to east and west. "It was the railroads that enabled the great distances to be bridged and the settlers to be taken away from rivers. They made settlement

beyond the Mississippi possible. The railways opened up fresh lands and the pioneers followed them. Between 1831 and 1853 the lines were chiefly built in the Eastern States. After that they appeared West of the mountains, and soon the wheat of the Dakotas, the cattle of Texas and Wyoming, and the gold, copper, silver, and lead of the western mountain region had a new and better way to reach the markets. As new farms were settled and new mines opened, new towns sprang up along the railroads, and "hamlets and sleepy cow towns grew into bustling cities." In 1870 there were seven million people west of the Mississippi, but twenty years later there were seventeen million.\textsuperscript{81} New states were admitted into the Union in swift procession: Nevada, 1864, with the Central Pacific approaching its western border; Nebraska, 1867, with the Union Pacific bisecting it; Colorado, 1876; North Dakota, South Dakota, Montana, and Washington, 1889; Idaho and Wyoming, 1890. After 1890, only four states remained to be admitted -- Utah, Arizona, New Mexico, and Oklahoma. "The country was settled to the whistle and smoke of railroad locomotives."\textsuperscript{82} "Railroad fever" in the United States mounted high during the 1850's.

\textsuperscript{80} Knowles, p. 231. \textsuperscript{81} Reck, pp. 151-152. \textsuperscript{82} Ibid., p. 152.
else that people needed. The railroads were another name for prosperity. So, when visionaries suggested a transcontinental railroad, nobody laughed. Why not? Suppose it did cost a lot of money! It would pay for itself. Towns held railroad conventions. Congress considered the matter. The idea of a railroad to the Pacific Coast grew.83

The value of railways to the countryside through which they ran was tremendous. Persons who were qualified to know the subject, claimed that the construction of the first five hundred miles of the Northern Pacific added, in two years, $100,000,000 to the cash value of the property along the completed line. It was also stated that the construction of any new railroad added five times its cost to the aggregate value of the property in its immediate vicinity.84

Westerners were right in their feeling that the future depended on railroads. Hundreds of towns were killed by their failure to secure railroad connections, while a corresponding number grew from small villages to large commercial centers under the powerful impetus of the railroad. It was largely due to the initiative of the early settlers that particular towns secured adequate transportation and became important.85

83Ibid., p. 132. 84Middleton, pp. 19-20. 85Riegel, p. 62.
CHAPTER IV

THE ECONOMIC AND POLITICAL ASPECTS OF RAILWAY CONSTRUCTION AND CONTROL

The Economics of Railway Construction

From the very beginning of railway construction in England, lines have been owned and operated by private companies which have received almost no public aid.\(^1\) Private enterprises which have constructed and administered canals and railroads have raised their own capital, made their own profits, or sustained and absorbed their own losses.\(^2\)

Despite severe opposition from canal interests, the construction of railroads progressed rapidly in the second quarter of the nineteenth century, until by 1850 the mileage in the United Kingdom was 6,635. The canal companies, by squeezing their patrons too hard, turned public opinion in favor of the railways, and such was the enthusiasm for railroads that, "except in Ireland, no occasion for encouragement by state subsidies ever arose." In fact, some persons believed that the populace needed to be discouraged rather than encouraged in the matter of railway building. "Not only were no direct

\(^1\)Spawn, p. 191.  \(^2\)Heaton, p. 538.
subsidies granted; the state made no guarantees of profits or of interest returns, and was never asked to do so.3

The railway in England, as everywhere else, was "a great new sponge for capital" that, in the last century throughout the world has absorbed perhaps $100,000,000,000. By 1853, £273,000,000 had been invested in British lines, and in the next sixty years the total capitalization rose to nearly £1,300,000,000, of which amount bonds and guaranteed stock absorbed less than three-eighths, as compared with three-fifths in the United States.4

When the financial depression of the early 1840's was over, the English Stock Exchange for the first time became seriously interested in railways as a medium for active speculation; and the public, too, became interested in the possibilities of railways for the investment of money that was once more becoming plentiful. The older companies were suddenly roused from their position of security by finding themselves threatened on all sides by schemes calling for the construction of additional railways in their vicinity. They soon found that if they would protect their own interests, their only course lay in supporting such proposals as would likely become feeders for their own established lines, and "in promoting rival schemes in the hope of defeating those whose effect was sure to be contrary to their own interests."5

4Heaton, p. 547.  
5Lewin, The Railway Mania and Its Aftermath, p. 4.
In an effort to cope with excessive speculation, the Railway Department of the English Board of Trade, which had to sanction every new railway project before it could be authorized by Parliament, announced that November 30, 1845, would be the last day on which plans for new railroad lines could be filed. Extraordinary activity immediately broke out in an effort to meet the deadline. Engineers, surveyors, and draftsmen were employed at fabulous fees -- $50 a day in some cases -- to complete their work on record time. Special trains were run night and day to expedite the work of the surveyors, who worked at night with the aid of lanterns. As November 30 drew near, every form of conveyance from the provinces into London was at a premium. Dozens of special trains were engaged to transport promoters and their plans. When one railway refused to carry a party known to have plans for a competing line, the rival promoter's lawyer staged a mock funeral, with mourners and every appearance of grief, and the precious plans were sealed in the coffin and carried on the railway.

By November 30, over eight hundred plans for new lines had been drawn up. They continued to come in all through the last day, and by midnight the scene outside the Board of Trade was a bedlam. Applicants with bundles of documents fought and scrambled to get through the doors before they were locked. Many were unable to arrive in time or to effect an entrance, but during that remarkable day over six hundred schemes had been entered and the Parliamentary deposits and expenses in
connection with them amounted to about $300,000,000. Although the projects for new lines, including the six hundred entered on November 30, numbered 1,263, calling for an investment of over $2,500,000,000, only 120 of them were passed through Parliament. 6

During the latter years of the Second French Empire, constant complaints were heard that the great railway companies were reluctant to develop out-of-the-way districts by constructing lines which were not likely to be remunerative. Therefore the government subsidized a number of small new companies, especially in the south and southwest provinces. Sometimes, when companies could not be found for the particular projects which were considered to be "of public utility," the state itself began operations, as it had in similar instances during the early days of railroads in France. 7

France used a system of government subsidy which was not found at all in England and by no means universally in Germany -- that of a guarantee of interest on the capital of railroad companies. The advantage of this plan was that it rendered assistance in accordance with the actual need of the company. But at least two serious disadvantages should be mentioned: it removed the incentive to economical operation, and it involved the government in losses growing out of conditions over

6 Middleton, pp. 40-41.

which the government had had no control.\textsuperscript{8}

In most sections of the continent, capital was not so abundant as in England, the tradition of state enterprise was strong, the prospect of profit was not sufficiently alluring to induce capitalists to risk their funds, and military authorities needed railway facilities for the movement of troops and supplies with greater rapidity and efficiency. Hence the state, in most instances, in addition to having undertaken work on rivers, canals, and roads, either built and operated railroads or supplied private enterprise with substantial subsidies.\textsuperscript{9}

The first German railway, that from Nuremberg to Furth, was a private enterprise, except that the Bavarian government had taken two shares of stock for which it had paid two hundred florins. The lines from Berlin to Potsdam (1838) and from Leipsic to Dresden (1839) were likewise constructed as private enterprises. A small railway, however, had been built by the state in Brunswick in 1838.\textsuperscript{10}

The German states subsidized the construction of some lines, and subscribed to the stock or guaranteed the interest upon securities of other railroad companies.\textsuperscript{11} At first the Prussian government was hesitant to do much about the construction of railroads, and looked rather passively upon the

\textsuperscript{8}Daggett, p. 88. \\
\textsuperscript{9}Heaton, p. 538. \\
\textsuperscript{10}Dawson, p. 211. \\
\textsuperscript{11}Daggett, p. 72.
idea of building such roads, financed either publicly or priv-
ately. But,

After 1840 the suspicions of the government were
allayed, and the work of concession-granting went on
rapidly. The Prussian state even began to give some di-
rect assistance to railway building. It took shares in
or guaranteed interest on the Berlin-Kothen and the Ber-
lin-Stettin. After 1842 it became bolder and, finding
the exchequer full, planned over a thousand miles of
necessary line, to expedite the construction of which it
was not prepared to offer a guarantee of interest to the
constructing companies, whenever the prospects of any
given railway were not good enough to attract capital
without guarantee.12

The results of this change of policy by the Prussian govern-
ment were rapidly reflected in the growth of mileage: in 1844,
there were about 500 miles of lines in the country; in 1848,
about 1,500 miles; and by 1860 there were 3,500 miles.13

In America, land and wood were cheap, and it only remained
for the railroad companies to select such courses as would in-
volve the outlay of the least amount of money for grading, cut-
ting, and bridges. This done, sleepers were laid down upon
the ground itself, the cheapest rails were laid, and every-
body trusted to the future for more solid construction. In
Europe, on the other hand, the question of railroad construc-
tion was made the subject of serious scientific study.14

Since the state and federal governments in America had
constructed or aided liberally in the construction of highways,
and had improved the rivers and built canals, it was only

12Clapham, *Economic Development of France and Germany*, p. 152
natural and in keeping with previous policy that these governments should contribute liberally to the funds which brought some of the American railroads into existence.\textsuperscript{15}

The earliest form of federal aid to railways was granted under an act of Congress in 1824 empowering the President to authorize government surveys of roads and canals. Before 1838, when the act was repealed because it had led to log-rolling and other abuses, about sixty railroads had been surveyed by government engineers, although railroads had not been specifically mentioned in the act itself. Another form of aid was the remission of duties on railroad iron. Rails at first were imported from England, and the high tariff placed upon such importation for the purpose of protecting our own iron industry was a hard burden for the railroad companies. In 1832 an act was passed providing for the remission of duties if the iron was laid within three years after importation. This law was in effect until 1843, and during the eleven years of its enforcement remissions totaled nearly $6,000,000, estimated to equal about $2,000 for every mile of road constructed during the period. The third type of government aid consisted of grants of one-hundred-foot rights-of-way through the public domain, together with sites for depots and terminals, and the right to use timber, stone, and other materials from the adjacent public lands. The first such grant was to the Talla-

\textsuperscript{15}Emory R. Johnson, \textit{Government Regulation of Transportation}, p. 4.
hassee Railroad Company of Florida in 1835, and in 1852 this plan was extended so as to apply to all railroad, plank-road, and turnpike companies then chartered or to be chartered within the next decade. In 1828 the Congress passed a resolution declaring itself opposed to the government's owning stock in railroad or canal companies; however, when the Baltimore and Ohio appealed for aid in 1834, the Senate recommended the payment by the government of $320,000 to the railroad, in return for which mail was to be carried free forever over the line. It was fortunate for the railroad that the House killed the bill. In 1864 Congress departed from its previous policy of not making loans to railroads and authorized loans to various companies that had projected routes to the Pacific Coast. The Union Pacific, the Central Pacific, the Kansas Pacific, the Western Pacific, the Central Branch of the Union Pacific, and the Sioux City and Pacific were to receive United States bonds amounting to $16,000 to $48,000 per mile of line constructed. Over $64,000,000 in bonds was issued to these companies, with second mortgages on the railways as security. By 1900 complete settlement had been made.16

In the United States,

The flatness of the country facilitated the construction of railways. In this respect the United States is in the same category with Russia. The land was cheap; the road system was undeveloped and the canals inadequate. In winter many of the waterways froze. The need for railways was so great that they were built in America without any State interference. The States and

16Locklin, pp. 62-63.
the lesser public authorities supported the new undertakings with loans and guarantees of interest. They never troubled how the rails should be laid and there was no State regulation as to rates, building, or safety. Under these circumstances railway companies multiplied. The Federal Government began to make enormous gifts of public lands to the companies. Through these land grants the interest of the railway companies was bound up in the most intimate manner with the colonization of the district, since the hope of the companies lay in settling their districts and attracting population. Some of the railways were run through an absolutely barren country. The companies gave cheap tickets to land-seekers, and cheap rates for seed for farmers. They sold the land under an easy repayment system and in order to facilitate traffic created great grain elevators. They found their reward in the increased goods traffic. The general rate tariff was high so long as there was no competing line. 17

The early railroad legislation in the United States was devised for the object of securing railroad construction. The only fear was that railroads would not be built as fast as they were needed. Obstacles to railroad enterprise were removed as fast as possible. General railroad laws were passed which did away with the necessity of securing any special act of the Legislature and made it possible for persons with the requisite capital -- or even without it -- to build railroads wherever they chose. This negative encouragement was not all. Most communities were only too ready to give positive encouragement in the form of subsidies. 18

Since capital in the United States was comparatively scarce, it was natural that much European capital should be invested in American railways. State securities and stocks and bonds of private companies were sold abroad in large quantities. Some American railroads were controlled by European interests; in 1876, 86 per cent of the stock of the Illinois Central was held abroad; in 1890-1896, foreign stockholders held 75 per cent of the Louisville and Nashville. 19 In the industrial East, however, capital was more plentiful and hence

foreign ownership was almost non-existent. Here the first lines were built with the proceeds of capital stock issues. In the South, the states aided railroad construction by direct stock subscriptions, thus adding local aid to that advanced by the national government to help the railways to carry on during their construction period and until they became self-supporting through the development of traffic. Early railway promoters appealed to public bodies for as much assistance as they thought public sentiment would countenance, and legislatures and city councils contributed whatever they could -- often more than they should have -- and voted such privileges as they thought might prove of value.  

Subsidies were freely given; they [the railroads] got land grants and exemptions from taxation; the Government subscribed to their shares and guaranteed their bonds. There was much speculation and a good deal of chicanery. To get railways was the one thing that interested the public. How they got them and on what terms and what sort of a railroad it was, so long as there were two rails on which a locomotive could run, they cared not. As a result railroads spread out over the West at the rate of thousands of miles per annum.  

The load of debt shouldered by local governments in aid to the railroads was often burdensome. In 1853, the per capita debts for railroads of certain cities were estimated as follows: Wheeling, $55; Baltimore, $43; Pittsburgh, $34; St. Louis, $30; Louisville, $25; New Orleans, $23; Philadelphia, $20. Sometime later Watertown, Wisconsin, had a debt amounting to almost $100 per capita. Instances were not un-

\[20\text{Middleton, p. 8.}\] \[21\text{Knowles, p. 234.}\]
common of municipalities and counties that incurred debts to aid railroads which exceeded the assessed value of all taxable property within the political subdivision.

The explanation of such extravagance is to be found in the dire need of transportation facilities. The people knew very well that the economic future of their communities depended upon transportation facilities and they were willing to pay almost any price for them. Railroad promoters were expert in working up the enthusiasm of the people along the lines of the proposed railroad with extravagant claims of prosperity that would come with the railroads. In addition to the improvement in the economic condition of a community that the railroads were expected to bring, hope was held out of generous dividends on railroad stocks.22

The general enthusiasm for railroad connections was shown in the offers sometimes made to the companies for the purpose of inducing them to provide their facilities to the locality concerned. In 1880, when the Northern Pacific promised to extend its line to Superior, Wisconsin, if the city would give it a right-of-way and one-third of all land, premises, and real estate in the city, the offer was accepted. Seattle offered the Northern Pacific 7,500 town lots, 3,500 acres of land, $50,000 in money, $200,000 in bonds, and the use of much valuable waterfront for terminal purposes if the railroad would make Seattle its western terminal. The consequences of the policy of local subsidy proved so disastrous that constitutional provisions were enacted in many states, prohibiting or severely restricting aid to railroad corporations by local units of government. "Disillusionment over the benefits which had

22Locklin, p. 55.
been anticipated, resentment at the burdens of taxation imposed, and anger for having been tricked into a policy which lined the pockets of railroad promoters at the expense of the taxpayers," incited many attempts to repudiate the debts thus incurred. Judge Cooley of the Supreme Court of Michigan stated that it was almost "exceptional" for municipalities, when called upon to meet their obligations to railroads, "could do so with a feeling of having received the expected consideration."23

From 1830 to 1837 the track mileage in the United States increased from twenty-three to 1,497. In every then-existing state, railways were being chartered or else were already in operation. In many towns throughout the nation promoters were selling stock and promising prosperity to the citizens: "Just wait until you get your railroad! Then watch the town grow!" Inevitably, this enthusiasm resulted in trouble. Construction and stock-selling progressed too rapidly, and too much money was invested in railroads from which no return could be expected soon. People were also over-investing in lands. Speculators and syndicates were buying up vast tracts of government land at a minimum of $1.25 an acre, thus tying up money needed for carrying on the regular business operations of the nation. Also, many canals were being built, some of which could not possibly be financial successes.

23Ibid., pp. 56-57.
But the time comes in any speculative venture when people come to earth and wonder how wise they have been. Here was a triple venture in railroads, land, and canals. The money was going out but it was not coming back in. Builders of roads and canals, trying to get money with which to finish their projects, discovered that funds were no longer available. Building stopped and men were thrown out of work. The panic of 1837 resulted, and for several years the construction of our transportation system was forced to wait until the country caught up, and people regained their confidence.24

It was an all-too-common practice for the directors of railroad companies to form construction companies and award to the latter the contract to build their road. The same men controlled both corporations. "As railroad directors, they gave the construction company the job of building the road at prices that would guarantee the construction company a substantial profit. As directors of the construction company, they built the road and declared themselves handsome dividends. Thus the borrowed money went through the railroad and the construction company into the pockets of the controlling directors." This policy was not good for the railroads because it resulted in excessively high costs of construction, but it was very good for the directors, many of whom amassed great fortunes.25

Land grants represent the most important federal aid to railroads. Although the land-grant movement is usually dated from 1850, two early grants to Ohio and Illinois were modified by Congress in 1830 and 1833, respectively, to permit their

25Ibid., p. 142.
use to aid railroads. Stephen A. Douglas and Illinois are responsible for the inauguration of the land-grant era, and even of the policy itself. Since 1836 Illinois had been trying to complete a railway line from Cairo at the south to Galena at the north, with a branch to Chicago. There was not enough money to go ahead, and by 1850 the Illinois Central was still little more than a surveyed route. The railroad was badly needed; there were 850,000 people in Illinois, most of whom were farmers. Of these, only those living near the Mississippi, the Illinois River, or Lake Michigan could profitably send their crops to market. Highways were bogs of mud. If cattle and grain had to be moved more than twenty miles, the cost of transportation was so high as to consume all the profit. Douglas asked Congress to help the state build the road, which he advocated extending to Mobile, Alabama, so as to enlist the co-operation of Southern Senators. His plan was to ask Congress to turn over the public land to the state, which in turn would give it to the railroad for sale to raise the necessary money. Douglas asked for alternate sections of land on each side of the railroad, six miles deep. In return, the railroad was to give seven per cent of the gross revenues to the state, and transport United States troops and government property free of charge. It was an unusual proposal, but Douglas avowed that every one would benefit from it. The government did not need the land (it owned one-third of the state's total area),
but Illinois sorely needed the railroad. The value of the land would rise. Crops could reach the markets, and the total wealth would be increased. The law passed on September 20, 1850, giving the Illinois Central six sections of land for each mile of road -- a total of 2,595,133 acres, which ultimately sold for some $20,000,000. From the moment the railroad was completed in 1855, Illinois prospered.²⁶

In the next twenty-two years the government was to give away between 150,000,000 and 160,000,000 acres of public land to railroads, thus making possible the building of railways to the Pacific Coast long before the population in western areas was dense enough to support or even to justify a railroad. Some of the lines received as much as ten, twenty, and even forty sections of land for every mile of road constructed. In terms of areas, one-ninth of Louisiana, one-eighth of California, one-seventh of Nebraska, one-fifth of Wisconsin, Iowa, Kansas, North Dakota, and Montana, and one-fourth of Minnesota were given to railroads. The total area thus granted represents an expanse of land equal in size to Michigan, Wisconsin, Illinois, Indiana, and nearly half of Ohio.²⁷

Early advocates of a transcontinental railroad had succeeded in implanting firmly in the minds of most people the belief that the government should render financial assistance

²⁶ Ibid., pp. 123-124.
²⁷ Ibid., p. 125; Locklin, pp. 63-64.
to encourage the first such undertaking. Hence, as a result, Congress was persuaded to give direct monetary aid to the Union Pacific and the Central Pacific, to take the form of a loan of $16,000 per mile for mileage built on level ground, $32,000 per mile for more difficult construction, and $48,000 per mile for mountainous sections. Both companies were also deeded twenty sections of public land for each mile of line built. From the direct loan the companies eventually received some $20,735,000, and from the sale of land through the following years they realized about $10,000,000. In addition, states and cities which would receive benefit from the road were liberal with monetary aid.28

Some of the lands granted to railroads were disposed of as soon as possible and the proceeds were used for the construction of the roads; other tracts were sold years later after land values had increased. The grants were of great value to some roads, while others received much less from their sale than had been expected. The government's price for public land was often $1.25 to $2.50 per acre, and these figures limited the price the railroads could ask for their lands unless they waited until the major portion of the government land had been sold. The price per acre received from the sale of land grants varied from $11.70 for the Illinois Central to $1.75 for the Santa Fe. Probably the average was

28Riegel, p. 44; Reck, pp. 141-142.
about $5.00 per acre. The total sum received by American railroads from the sale of land grants has been variously estimated at from $500,000,000 to $648,000,000. Today these figures do not seem excessively large, but at the time the grants were made the money would have been sufficient to build three lines like the Union Pacific-Central Pacific from Omaha to San Francisco. However, much of the land was worthless at the time it was granted, and only with construction of railroads did its value mount. If all of the land-grant roads could have waited even fifty years to dispose of their lands, they would have amassed great wealth, but they had to sell as rapidly as possible so that construction work could proceed.  

At first the West was jubilant over the land grants, but the panic of 1857 slowed down construction work considerably. Also, it was soon evident that the land was not valuable until settlers appeared, and settlers would not go into remote sections of the West until the railroads were constructed. Hence the railroads were necessary to make the land grants valuable, but the railroads could not be built without revenues derived from the sale of the land grants. Because of this vicious circle of circumstance, many of the companies had to look elsewhere for much of their initial capital.  

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29 Riegel, p. 42; Locklin, pp. 64-65.

30 Riegel, p. 39.
State Ownership and Control of Railways

In the early years of railway history in England, state control was expressed chiefly by means of a careful scrutiny of each proposed railway project. Standing committees of Parliament studied the projected routes in all their details and heard complaints from any parties who felt that their interests would suffer from the construction of the line. Every project was considered strictly on its own merits. All railroad companies, from the very beginning of the era of construction, were required to build their roads in accordance with standards set up by the government. These standards, of course, were altered from time to time in the interest of improvements in service, efficiency, and safety. The English railway policy was chiefly dominated by the liberal philosophy that competition should be maintained among private enterprises subject to regulation by the state. In regions which promised only a modest volume of traffic and hence would likely yield only small profits, railway construction was restricted by Parliament to lines with an assured prospect of profitable operation. Over-building was never permitted, as it was in the United States. In this manner, by declining to approve the charters of certain lines, the English government saw to it that needless or unprofitable competition was kept at a

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31 Bowden, Karpovich, Usher, p. 522. 32 Johnson, p. 47.
minimum -- also in contrast with the United States. In England the authority of the state was vigorously asserted from the beginning, and determined efforts were made to protect the interests of the public. 33

National policy in railroad construction has, through the years, been determined by practical rather than by theoretical considerations. Where private capital was abundant, as in England and Prussia, private corporations were permitted to construct and administer railways; but where private capital was inadequate, as in southern Germany and, to some extent, in France, the governments themselves undertook the task of railroad building. 34

Although in England acts of incorporation for railroads specified maximum tolls for the use of the line and the maximum total rates for complete service, 35

. . . in Great Britain alone, among European countries, no penny of Government money had been contributed to railway enterprise, and therefore there was no justification for claiming the control exercised abroad. 36

This fact is one explanation of the comparative absence of government control over English railways. Even the powers of the Board of Trade were, until 1889, limited to framing measures designed to insure the safety of the public, and the Board itself could only exert its influence before the lines were opened.

33 Bowden, Karpovich, and Usher, pp. 521-522.
34 Daggett, p. 74. 35 Fay, p. 204. 36 Traill, VI, 206.
As a matter of fact, the English government, in contrast particularly to that of France and Germany, was hesitant to assume any real authority over railroads, and only the force of public opinion, voiced by tradesmen and merchants in 1839, induced Parliament to recognize that some form of control, in addition to the restrictive provisions in the charters and enabling acts of individual companies, would be necessary for the purpose of curbing the exercise of excessively autocratic power on the part of the railways. Lord Seymour's Act of 1840 concerned itself mainly with questions of public safety and minimized the problems of administration and operation. In 1844, however, Gladstone began seriously to cope with the railway problem, and his famous act of that year dealing with possible terms of purchase by the government "is perhaps the most important milepost in the railway history of the last century."37 This law is still in effect, but nothing has been done by the government toward purchasing the railroads of the country, as authorized in the act. Perhaps Englishmen still feel as did a Parliamentary committee when, in 1840, after having made a thorough study of the railway question, it concluded that "an enlightened view of their own interests would always compel managers of railroads to have due regard to the general advantage of the public."38

37 Lewin, The Railway Mania and Its Aftermath, p. 3.
38 Splawn, p. 191.
Broadly speaking, in the first two decades of the railway era, the English Parliament had left the matter of beginning and fostering the growth of a railway system entirely to private enterprise, and had made no effort whatever to lay out plans to promote the creation and development of railways in such a manner as to contribute to the national interest. In other words, the government took no hand in railway matters beyond the consideration of each individual proposal for railway promotion on the sole basis of its own inherent and particular merits. This was the nature of Parliamentary interest until 1840, when it was too late to do anything about establishing a systematic national plan of railway lines -- too late because the private companies had already done so much on their own initiative and without any thought or obligation of conformity to any plan broader than their own immediate interests. After Gladstone's Act of 1844, however,

... railway questions were to claim a fair share of Parliamentary attention, pronouncements were to be made on the subjects of gauges, rates, amalgamations between companies, and many other matters of first-rate importance to the industry; but despite a tendency to greater control of the railways by the State, the actual question of State purchase never came within the range of practical politics.

In the three decades, 1830 to 1860, British success with steam locomotion inspired the building of railroads in most nations of continental Europe. English capital, equipment,

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40 Ibid., p. 3.
and laborers played important roles in the work. The continent used almost everything that England had found to be practicable -- everything but the English system of private ownership. 41

In France, as in England at first, widespread skepticism prevailed regarding locomotive transport; and in 1835, when public opinion and the pertinacity of a group of promoters extorted from the French Parliament a concession for a line from Paris to St. Germain, Thiers and others looked upon the project with deep misgivings. Thiers even remarked that the railway was a "toy" which must be given to the people of Paris to quiet their clamors, but it would never prove to be practical. The next year, despite opposition, a line to Versailles was authorized, and Parliament now "settled down to discussions of immense length and great interest" on what was later to be called the question of nationalization. Various ambitious projects were rejected because of legislative disagreements over technicalities and principles of operation. For example, in 1835 the government rejected a scheme calling for a railroad from Paris to Rouen and Le Havre, according to which private companies were to do the work, but the state was to assist the project by buying shares of stock. Two years later a great discussion of government policy occurred over the proposal to construct a railway from Paris to Le Havre,

41 Heaton, p. 550.
another from Paris to the Belgian frontier beyond Valenciennes, another from Paris to Tours, and still another from Lyons to Marseilles. In the course of the deliberations,

Lamartine, the most eloquent advocate of construction by the state, spoke of the dangers, political, economic, and strategic, of placing in private hands control over the unknown powers of the new age. . . . He denounced the new feudalism and the railway barons who would impudently levy toll on the trade of France. . . . Against him were the professed economists, advocating private enterprise and laissez faire, and suspicious of the delays and political dangers of state construction, under a Parliament not too pure. And with them were the promoters and men of affairs.42

Despite the opposition of various groups to Lamartine's policy of state construction, it was generally agreed in France that unless the state assumed a considerable measure of control over railways and granted some financial assistance, the country could not hope to build up a railway system adequate for her economic and political requirements. At length the legislature narrowed its discussions down to the form of state assistance and the amount that should be proffered. The government could not carry the financial responsibility for a complete state system, although some of the proposals called for state construction of main lines.43

Not until 1842 was an agreement reached on the nature and extent of state participation in the French railroad program. While the issue was under discussion, from 1837 to 1842, various concessions were given for short lines of obvious local

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42 Clapham, Economic Development of France and Germany, p. 144.
43 Ibid., p. 145.
utility, the state assisting in numerous ways: in 1837 it made a loan to the company authorized to build a line from Alais to Beaucaire; in 1840 it guaranteed interest to the Paris-Orleans line; when young or weak companies got into difficulties, the government was ready to lend assistance; the state undertook the construction of the road from the Belgian frontier to Valenciennes, when it became apparent that Valenciennes, for commercial reasons, should be connected with the new Belgian railways at the border. The result of all these projects was that by 1841 over 250 miles of railways of various sorts were open in France. 44 Although the government guaranteed assistance to railway promoters, it exacted from them in return a measure of state control that took the form of extensive regulation of rates, of safety of passengers, and of the geographical distribution of the railway system. 45

In the principle of state ownership and operation, Germany has led all of Europe. "The movement was most successful in the smaller German states, in the early years of railway building." Hanover in 1842, Baden in 1843, Bavaria in 1844, and Wurttemberg in 1845 adopted the principle of state ownership. 46 In most sections of the country, particularly in the southern states, railroad building was regarded as exclusively a public function, and most of the roads constructed

44Ibid., p. 145.
45Ibid., p. 146; Birnie, pp. 45-46.
46Bowden, Karpovich, and Usher, p. 533.
were, from the beginning, owned and operated by the state. Only in Prussia were the earliest lines built by private capitalists, and about 1842 the French policy of granting state aid in the form of guarantees of interest became general. The first exclusively state-built and state-operated road in Prussia was one from Berlin toward the Russian frontier, begun in 1848. "Throughout the ensuing decade the way for the fuller installation of state ownership was prepared not only by state construction of a few other lines but by state purchase of railroad stock from the proceeds of a special railroad stock."47

Whereas the railroad system of France was systematically planned, that of Germany, and even of the constituent States, grew up without any plan whatever. This led to as great a confusion of rates and rivalry as the system of customs and tolls before the Zollverein, and again the lead for unity came from Prussia. Most of the South German States built their own railways, but Prussia, at first, left railway building to private capital. As the railway system did not develop, the State guaranteed interest on the capital invested, with a proviso that it might after a time undertake the running of the road itself. There were many lines, however, which no company would undertake, and so the State was forced to construct some of the railways itself. The roads that the State built itself were first of all built on military grounds without much regard to business considerations, for example, the line from Berlin to the Russian frontier. Then after a time they had to take over the management of others. Between 1862 and 1866 Bismarck wanted money, and so he granted concessions to railway companies on especially favourable terms. He absolved them from the condition by which the State could take over their lines. Accordingly there was a real chaos of state-built lines, State-subsidized lines, State-managed lines, and private lines. By 1866 there were 5,896

47 Ogg, pp. 249-250.
miles of road, of which the State had constructed 1,890 miles and was managing 1,000, while the remaining 3,006 were in the hands of private companies. A good deal of railway building was undertaken between 1866 and 1874, partly on account of the expansion of trade and partly of the military exigencies of the Austrian and French wars. Then, as Prussia annexed Hanover and Hesse, it owned their State lines also. 48

Most of the South German states believed that railroads were such an important undertaking that to entrust them to private hands would tend to jeopardize the welfare of the state itself. At the beginning of the railroad era, the smaller German states were regarded as the personal property of their respective sovereigns, and naturally, the princes built or thought of building railways to enhance the value and further the development of their estates. At first, private capital usually built the lines in important commercial regions, while the state set about to construct railways in the more backward agricultural districts. Following the Franco-Prussian War of 1870-1871, Bismarck, as an empire-builder, saw more clearly than before that railways were an important adjunct of the state government, so he began to lay plans for the acquisition of all lines by the government of the new German Empire. He was pleased when he contemplated the contribution to the state treasury that would be made by state railways, and conceived of military and political considerations as determining factors in the management of railroads. His decision brought about a pronounced change

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in railway policy throughout the German states. 49

In the beginning, Prussia had followed the English precedent of leaving railway construction to private enterprise, at the same time reserving wide powers of control to the state. The Prussian government, however, demanded the right to purchase any line in the country after it had been in operation for thirty years. When the government recognized that railroads had come to stay and that their possibilities were unlimited, it began to regret its original policy of leaving construction wholly to private enterprise. After 1840 the prejudice against state participation in railroad construction gradually subsided, leaving the government free to enter the field as it wished. 50

Between 1850 and 1866, although the density of the railway network increased rapidly throughout Germany and especially in Prussia,

There were no important changes in the principles of railway policy. Prussia exercised a close supervision over all projects, so as to avoid wasteful competition and provide adequately for economic and strategic necessities. Under Moltke, her War Staff thoroughly understood what use the army could make of a properly controlled railway system. Encouragement of essential lines was carried out, as before, by guarantees of interest or other financial devices. But the Prussian government continued to rely mainly on private enterprise to raise the capital and carry on the business management of the railways. Prussia's chief western and southern neighbours relied mainly on the national exchequer as before. Not until Hanover and Hesse-Cassel were annexed in 1866 did the Prussian state own much railway line.

49 Barnes, p. 337; Splawn, p. 65. 50 Dawson, p. 212.
Those annexations, followed by that of Alsace-Lorraine in 1871, form the prelude to the railway history of the German Empire; for in no sphere do economics and politics blend more completely than in that of railway policy.\textsuperscript{51}

In the eight stormy years between 1862 and 1870, in which occurred a war with Austria, a war with France, and serious internal conflicts in Prussia, Bismarck realized the enormous importance of control of railways if he were to bring about his dream of the unification of all German states into an Empire. He created a commission which in 1873 reported that a universal state system of railways would be the ultimate aim of the newly created Empire.\textsuperscript{52} At the time of the creation of the Empire in 1871, the railroad situation in Germany was extremely complicated. As a rule, the small states owned the railway lines within their borders, and even Prussia owned about one-third of those within her territorial limits, having constructed some lines, having acquired others through business operations, and having taken over others when the state in which they were located had been annexed to Prussia.\textsuperscript{53}

After three or four years of definite planning, during which time some of his plans had been broken up by the Reichstag of the Empire, Bismarck, in 1876, was successful in obtaining the adoption of legislation which would control and unify the railway system of the Empire by encouraging the individual states to hand over their railroads to the central

\textsuperscript{51}Clapham, \textit{Economic Development of France and Germany}, p. 155

\textsuperscript{52}Middleton, pp. 130-131.

\textsuperscript{53}Ogg, p. 250.
authority; and he was willing to begin with Prussia. The other states, however, declined to surrender their railroads and would not accept the gift of Prussia's roads for the Empire. They were afraid of strengthening Prussia and wanted to retain their prized state autonomy in matters of regulation, supervision, and appointments. Afraid that Bismarck would buy up their private railways behind their backs, several of the German states began to purchase the few private lines that existed within their boundaries. All that Bismarck's plan accomplished at the time was to serve as an impetus for the transformation of railways into state property owned by the individual states and not by the Empire, as he had hoped would be the case. Many years were to go by, and Bismarck himself was long dead, before his plan of an imperial railroad system was to be realized.

The opinion was widely current, even in Prussia, that though nationalization of railroads was good, imperialization would be dangerous. Bismarck, being approached with this argument on one occasion, retorted that he was sure that German liberty and unity would "not travel away with the first Imperial locomotive." When his plans for the complete imperialization of German

54Knowles, p. 219.
55The Historians' History of the World, XV, 536.
56Dawson, p. 213.
railways went awry, Bismarck, disappointed and thwarted, set about to do the next best thing -- enlarging and improving the Prussian railway system and consolidating the state's control over it. Soon the Prussian railroads were the best-managed and most efficient in the Empire, and state ownership was rapidly extended, so that Prussia has long been recognized as the world's principal laboratory for the study of the problems and methods connected with railway nationalization.  

Whether the railroads should be built by the government or by private enterprise was an important question in most countries when railroads were new, and the question was answered differently in different nations. Railroads in the United States have, for the most part, been constructed as private enterprises. Though a number of the earlier roads were built by the states, the states withdrew from such activities before the era of rapid expansion. Despite the fact that the Federal Government had built the Cumberland Road, a turnpike extending from Cumberland, Maryland, to Vandalia, Illinois, and had made appropriations for other internal improvements, the feeling had grown up that federal participation in internal improvements was an infringement upon the rights of the individual states. With the triumph of "Jacksonian Democracy" in 1828, "states' rights" advocates had their way and, as a result, when the railroads appeared about 1830, the development of internal improvements was considered an affair for the states

57Ogg, p. 251.
and not for the Federal Government to deal with.

When the question of a transcontinental railroad was brought up for consideration in the 'forties and 'fifties, there was some sentiment in favor of authorizing the Federal Government to build such a road. But later a compromise was effected, whereby the line was built by private enterprise with the aid of heavy government subsidies. Again, in 1874, a Congressional committee reported in favor of the government's constructing and owning one or more good-sized railroads in this country as a means of regulating the rates of privately owned railroads and preventing monopolistic charges. With three minor exceptions, however, the Federal Government has never built or owned railroads. These exceptions are the Alaska Railroad, 470 miles long, built about 1916; the Panama Railroad, the capital stock of which is owned by the United States Government; and the Hoboken Manufacturers' Railway, the stock of which was acquired by the government during the World War for military reasons. The government relinquished control of this line in 1927.\textsuperscript{58}

Congress has habitually rejected all proposals calling for government ownership of railroads in this country, and long ago decided that it would be the wiser course and a better bargain for the government to encourage private capital to take the responsibility for railway construction and operation, and to grant to such private interests, in some cases, a portion

\textsuperscript{58}Locklin, pp. 47-48.
of the land that railway transportation would make accessible and salable. President Pierce opposed any attempt by the government itself to construct railways, and reminded Congress that it should deal with the disposal of the public domain only as a prudent and far-seeing proprietor. The government's attitude toward railroads is clearly defined in the fact that, in 1845, when it was first proposed that the government construct, own, and operate the projected railroad to the West Coast, a majority of the Senators violently opposed and defeated the measure, declaring that if the government should become involved in the project, the result would be inefficiency and corruption, there would be a lack of responsibility, and the whole undertaking would be a "political monstrosity." 59

More than eight years later, in 1853, President Pierce voiced the same attitude toward government ownership of railroads when he asserted that "it is held to be of doubtful power and more than doubtful propriety . . . for the general government to undertake to administer the affairs of a railroad, and that therefore its connection with a work of this character should be incidental rather than primary." 60

Before the outbreak of the Civil War, it had been definitely decided that American railroads should be owned and operated by private corporations. After 1850, private capital was available in sufficient amounts to make state ownership unnecessary. By this time the fact had been satisfactorily

59 Middleton, pp. 11-14. 60 Ibid., p. 13.
demonstrated that railroads could be privately operated with the greatest efficiency and with a profit to the owners. The states ceased their earlier custom of including a clause in railroad charters which would enable them ultimately to acquire the railroad properties within their boundaries. Gradually the states withdrew from the railroad business, and by 1857 it was true that all states except Georgia and Virginia had disposed of their railroads to private interests. 61

Today the ownership of railways by the states seems strange, but earlier in the railroad history of the United States, when it was considered outside the sphere of the Federal Government to aid internal improvements, the states were the logical government units to engage in railroad building unless it be left entirely to private enterprise. The states did, in a number of instances, engage in railroad building; some state lines were never completed because of financial difficulties or litigation; others were taken over by private corporations while still under construction; and still others, though projected, were never built at all. In addition to actual state construction of lines, others came into state hands through failure of corporations which had built roads with the aid of state subsidies secured with mortgages. The results of state construction were quite disappointing. Construction and ownership almost invariably involved the states in financial or legal difficulties -- often both -- and the

61 Splawn, pp. 349-350.
states were soon eager to withdraw from the railroad business and to dispose of their roads, even at a loss, as was often the case. Only North Carolina and Georgia still own railroad stock, but neither state operates the roads.\textsuperscript{62}

In return for assistance to the railroads in the form of land grants, Congress made certain stipulations as to the management and construction of the land-grant roads. In each case of Congressional subsidy the bond issue was limited, the price of the stock was fixed, and the fixing of fair and reasonable rates was made compulsory. In some instances the rates were to be directly under the control of Congress, while in others Congress allowed the companies to establish their own rate schedules in conformity with certain specific limitations. The Texas and Pacific was prohibited from any kind of rate discrimination. The use of American iron and steel was made mandatory for all land grant railroads.\textsuperscript{63}

When Massachusetts and Illinois, in 1869 and 1870, respectively, enacted the first laws for the government regulation of carriers by rail, inland waterways were carrying only a small portion of the traffic consigned to long-distance movement, and dirt roads and horse-drawn vehicles provided only local service. The railroad had already risen to prominence as the country's main transportation facility. Railroad mileage was rapidly increasing and rival companies, unhampered

\textsuperscript{62}Locklin, pp. 48-49. \textsuperscript{63}Riegel, p. 43.
by government authority, were engaging in competitive warfare that led to serious discriminations in rates among persons, places, and commodities that were injurious to the public, costly to the investors in railways, and harmful to the railroad program as a whole.  

In respect to the way in which people in general look upon government interference with railroads or with any other public interest, England and America are alike, but unlike France, Germany, and other European nations. "The English and American maxim is that whatever can be done without government, should be thus done. The continental principle is that whatever can be done by government, should be."  

Although an Act to Regulate Commerce was passed in 1887, there was no comprehensive or really effective regulation of American railways until the Hepburn Act of 1906. At about the same time, individual states were passing similar regulatory measures, so that problems of conflicting jurisdiction rapidly developed and caused serious difficulties. "Because of its interlocking relation to all business affairs and to social life in general, transportation was the first business any part of which was thoroughly regulated by the Government."

Until about 1870 the states, and until 1887 the nation, left transportation facilities and agencies virtually unregulated.  

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64 Johnson, p. 6.  
65 Hadley, p. 187.  
66 Middleton, p. 28.  
67 Johnson, pp. 3-4.
According to Bowden, Karpovich, and Usher,

We cannot reach any positive conclusion as to the relative merits of state ownership or of private ownership. Careful analysis of rate structures and of policies leads, on the whole, to the opinion that the form of ownership is less important than unity of administration and sound concepts of public interest.  

The policies adopted with reference to rates, service, and continuing investment determine the actual relations between the railroads and the public. While state-controlled systems sometimes reveal errors of policy and sometimes deliberately sacrifice or neglect significant public interests, privately owned systems are not by any means fault-free. "Both types of management can achieve high degrees of efficiency; each type represents opportunities for the realization of the best interests of the social group."  

68 Bowden, Karpovich, and Usher, pp. 534-535.

69 Ibid., p. 535.
CHAPTER V

THE GROWTH OF MILEAGE AND OF PRIMARY NETWORKS

England

In the railway history of England, the first quarter century, from 1825 to 1850, was the most significant period of development, for in those twenty-five years the main framework of the present-day English railway system was set up. The fifty years from 1850 to 1900 constituted a period of gradual development; the Great Northern, the Midland, and the Great Central entered London and extended their lines elsewhere; and broad-gauge roads completely disappeared.¹

The year 1835 brought to a close the experimental stage of English railroads, since "by this time it was generally recognized that as a form of transport for any considerable distance overland railway transit was proving itself superior to any other known form of locomotion." As a result, a great boom in railway construction began in 1836, and did not subside to any appreciable extent until all the principal towns of England were linked with one another by railroads. In the year 1836 alone, over one thousand miles of new lines were promoted,

¹Sommerfield, p. xix.
giving a proposed new mileage exceeding in length the total of all of the various lines already in existence.²

The year 1837, which witnessed the coronation of Queen Victoria, was the first in which new railway mileage brought into operation in England exceeded one hundred miles; the total in this year was 137 miles, and by the end of the year 540.25 miles of line in all were in regular operation throughout the country -- a remarkable record of progress. The London and Northwestern was opened all the way to Birmingham on September 17, 1838, a total of 112.25 miles. It was the first main line to enter London and at the time was the longest railway system in existence anywhere in the world.³ From the beginning of its operation, trains maintained a speed of twenty miles an hour over the line.⁴

Within a period of four or five years were laid, by Parliamentary authorization, the foundations of most of the English trunk-lines of the present day, although some of them were not actually constructed until years later. As early as 1840, however, the railway map of England was beginning to show much of the nucleus of the present-day main system. Lines were operating from London to Brighton and Southampton, and between London and Lancaster, with branches to Liverpool, Manchester, and Fleetwood; the Great Western was in operation at both the

²Lewin, Early British Railways, pp. 34, 41.
³Sommerfield, pp. 104-105.
⁴Ogg, pp. 239-240.
London and Bristol ends, but the gap between the two sections was yet to be bridged. Communication by rail was also established between Newcastle and Carlisle, Stockton and Darlington, Leeds, York and Selby, Durham and Sunderland, and even between towns of such relative unimportance as Whitby and Pickering and Canterbury and Whitstable. Short lines radiated from Birmingham and Derby and other provincial cities and towns, and later would be united to form the extensive Midland system.5

By the close of 1843, approximately 2,700 miles of railway had been authorized by Parliament, of which some 2,050 miles (seventy-five per cent) had been constructed and opened. Of the remaining 650 miles, composed mostly of local lines, only about one-half was in the process of construction or about to be built, the other half having been abandoned because of failure on the part of the various companies concerned to obtain "pecuniary support" for their various projects.6

In 1843 seventy-one separate lines were in operation in England, averaging about thirty miles in length. From 1844 to 1847, 637 new companies were chartered, over half of which ultimately faded out of the picture without having done anything. Soon symptoms of extensive consolidation were being felt, and during the decade 1860-1870 the public knew considerable anxiety over the amalgamation of many competing companies.

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5Ibid.; Sommerfield, p. 142.

6Lewin, Early British Railways, p. 139.
By 1872 railway mileage had grown to 13,000, but the number of companies operating these lines had been reduced to twelve. In that year a Parliamentary committee reported, after an extensive investigation, that the widespread amalgamation had not produced the anticipated evils, and that Parliament, though it might hinder and thwart, could not prevent amalgamation, and that it was equally powerless to lay down any general rules defining its limits and character. For a time the railroad corporations were left to grow unhampered, although an efficient set-up for regulation was gradually evolved during the last decades of the nineteenth century.\(^7\)

In all countries, the first railroad charters for the construction of lines were for short independent roads with only local significance. In England, the earliest lines averaged about fifteen miles in length. By 1847 there were about 5,000 miles of lines in operation, owned by several hundred different companies. Twenty-five years later the 13,000 miles of railroads was in the hands of twelve companies. France, too, witnessed consolidation of its railway interests, for the number of independent companies and systems was reduced from thirty-three in 1847 to eleven in 1852, and to six in 1859. The same tendency was illustrated in the early American lines. For example, the New York Central line between the Hudson and Lake Erie represents a union of sixteen original companies. Everywhere the public regarded railroad consolidation with

\(^7\)Splawn, pp. 191-192.
vague fears and apprehensions, which were present not so much when the union of short lines made a through route as when competing lines consolidated, for in the latter case the advantages to the public were less obvious, the dangers were thought to be greater, and the opposition was louder and often more effective.⁸

By 1844 a few English railways were already mounting head and shoulders above the others for at least three reasons: their indispensability to the traveling public, their relation to important industrial and commercial centers, and the resultant financial prosperity coming to these roads. Certain lines, being first in the field, had obtained the best, and not infrequently the only practicable, route between the centers they served. Their roads were well-constructed, and no expense had been spared to provide favorable gradients suitable to the moderate powers of the locomotives of that early period. The position of these roads was relatively impregnable. Since they possessed a virtual monopoly of traffic in their respective districts, they were not especially eager to extend their field of operations and thus perhaps incur stringent competition.⁹

By the end of 1844, eleven companies were operating 1,134.5 miles of railroads, or slightly over half of the total mileage in England, while 1,000.5 miles were in the hands of ninety-two other companies, each operating an insignificant

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average of 11.9 miles. At this time, the different railways were scattered haphazard all over the kingdom, their sole reason for existence being the hope of substantial profits to their promoters and proprietors. Hence, great tracts of country with few industries and scanty population were left without railway facilities, while the more favorable localities had substantial and adequate railway developments.

Between certain places even more than one route by railway was available, but the promotion of competing routes had hitherto found little favour, and it was thought that new railways whose traffic case was dependent in any material degree on traffic to be abstracted from the older established lines would have little chance of getting their Bills through Parliament. The few cases in which active, and more or less unforeseen, competition had actually arisen had been settled by an amalgamation of interests.

In England at the close of the year 1844, 2,235 miles of railways were in actual operation, and 855 additional miles were authorized by Parliament, on which construction had already begun or was about to begin. The authorized total of 3,090 miles represented the endeavors of 104 different companies then in existence, excluding a few whose lines had been absorbed by or leased to larger corporations in previous years.

The year 1845 was a momentous one in the history of English railways, and ushered in a new epoch of development, since at least 2,816 miles of new lines were sanctioned by Parliament in that year. This mileage was approximately equivalent to

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10 Ibid., p. 4. 11 Ibid., p. 2. 12 Ibid., pp. 1-2.
all the mileage approved in the twenty-two years from 1821 (when the Stockton and Darlington obtained its first act) to 1843, and more than two and one-half times the mileage sanctioned in the previous all-time boom year, 1836. By 1846 the major portion of the new mileage sanctioned in 1844 had begun operation. The 605.75 miles opened in 1846 represented a mileage greater than that which had been put in operation in any previous single year, even exceeding by seventy-eight miles the total for 1840, when the maximum figure resulting from the first railway boom had been obtained. By the end of 1846, through communication by rail was being provided regularly between London and Carlisle, practically on the Scottish border, a distance of just under 300 miles. This road remained the longest trunk-line under a single ownership until the Great Western, in 1876, absorbed the various independent undertakings linking Bristol and Penzance.

The year 1848 was the year of maximum accomplishment in English railway building, for 1,253 miles were opened to traffic during that year. No other year, before or since, has witnessed so large an addition to the total lines in operation.

In 1855, twenty-five years after the opening of the Liverpool and Manchester, there were 8,053 miles of railway in operation in the United Kingdom, mostly in England, and in the

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13 Ibid., p. 1.  
14 Ibid., p. 243.  
15 Sommerfield, p. 117.  
next two decades this mileage was doubled, \(^\text{17}\) and England was rapidly and securely being knit together from north to south and east to west by a growing network of rails that contributed much to social, industrial, commercial, and economic life.

The system of British railways, whether considered in point of utility or in respect of the gigantic character and extent of the works involved in their construction, must be regarded as the most magnificent public enterprise yet accomplished in this country -- far surpassing all that has been achieved by any Government, or by the combined efforts of society in any former age. \(^\text{18}\)

**France**

France had over 2,000 miles of railways open by 1852; for lack of willing companies, 360 miles of this total were being worked by the state. The whole set-up and status of the railroads were confused and far from satisfactory. Companies having the roads in charge were too numerous for efficiency. The great trunk-line systems proposed a decade earlier were far from complete. \(^\text{19}\)

The situation was vastly improved during the Second Empire, when the great national plan of a French railway network was completed. The first decisive step in the realization of this comprehensive project was the amalgamation of companies that controlled successive sections of the main routes. In 1852 and 1853 amalgamations were progressing rapidly, with the

\(^{17}\) Ogg, p. 240.


\(^{19}\) Clapham, *Economic and Industrial Development of France and Germany*, p. 146.
approval and encouragement of the state, which was now anxious to have its railroad system in the hands of strong companies, for it wished to enter into contracts with them whereby they would construct subsidiary lines in return for the concessions of the trunk routes and any government assistance which might go with these concessions. In 1857, the process of concentration was completed and the state no longer had any lines. All trunk-lines throughout France were controlled by six great companies, each with a recognized area of operation, inside of which there was no competition with other companies or lines.  

Between 1852 and 1860, during the Second Empire, the 1842 program of trunk-lines in France was completed almost as originally planned, except for a number of subsidiary lines. By 1870, modernization and expansion had occurred to the point where the French railway map exhibited most of the features appearing on the railway map of the twentieth century. A number of minor lines had been authorized outside the control of the six large companies, usually receiving assistance from the state, but no guarantees of interest on their capital. Their purpose was to furnish transportation facilities to communities where the large corporations could not profitably operate.  

The disadvantage of the system of monopoly which was inherent in the French plan of apportioning the country to the six major railroad corporations was that these corporations

20 Ibid., p. 147.
21 Ibid., p. 149.
felt no necessity for making an effort to secure traffic either by cheap rates or good facilities. Since no competitors were present, they had no fear of lack of patronage. These big lines did not develop local traffic where it was likely to be unimportant, and the state actually built and operated some branch lines itself in order to bring the railroad into certain areas.²²

Many Frenchmen believed that the war with Prussia (1870-1871) had been lost because of the slowness and inefficiency of the French railways in comparison with the German lines. Hence a feverish era of railroad building and improvement began immediately after the war, and in twenty years the mileage had doubled. The government built some lines and, under guarantee arrangements, had to take up the deficits of some companies, thus coming to own some of the lines. It came to be a question whether the state would not do well to own all railway lines, but the state was apprehensive over the gigantic financial transaction that would be involved should the government take over the railroads. In 1883, a new agreement was arranged whereby the companies and the state were to share the profits, if any were made, and the railways were to revert to the state between 1950 and 1980. For many years after this agreement, deficits were far more plentiful than profits, because of the prevalence of short hauls, the rigidity of rail-

²²Knowles, p. 213.
road rates, and the general lack of adaptability. Only one of the main systems, the Western, was, through financial difficulties, taken over by the government (1908-1909); hence, the French railway system remains mainly private to the present time.  

Germany

In 1849 and 1850, about 3,000 miles of railway line were in operation in what, in 1914, was the territory of the German Empire, exclusive of Alsace-Lorraine; and there were 1,000 additional miles in Austrian territory. At about the same time, perhaps a year or two later, there were only approximately 2,000 miles of railway lines in France. In addition to having more mileage than France, Germany had witnessed, up to that time, much more rapid progress in the development of through routes than had France.  

United States

By the early 1840's, steam railroads were assured of predominance in the field of transportation in the United States. Construction was gradually attaining momentum, and the twin rails were reaching farther westward. In 1853 a line was completed from New York to Chicago, and in 1858, one from Philadelphia to Chicago. During this period the eastern rail-

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23Ibid., p. 214.

way network was assuming its permanent form as to main lines, and railroads were beginning, one by one, to arrive at the east banks of the Mississippi -- the first in 1854 and seven others in the next eight years.25

In 1830 there were not more than twenty-two miles of railroads in use in the United States, but during the next hundred years the mileage was to increase to over 245,703 miles. For the two years between 1838 and 1840 railway mileage in this country increased forty-seven per cent, foreshadowing the mighty revolution in transportation that was to occur in the near future and was, even then, already in the making.26

By the close of 1835, the Baltimore and Ohio line, with its Washington branch, had attained a length of 115 miles. Pennsylvania had about 200 miles of railways, or one-fourth of the total American mileage at that time. South Carolina had 137 miles open to traffic. Massachusetts, New York, and New Jersey had almost 100 miles each, and Virginia had about an equal mileage. Railroad construction was not seriously checked by the crisis of 1837; in fact, it was even benefited, for proposals for new canals were, in the main, given up and the necessity for more railroads was made more apparent.27

As a result, by 1840, 2,755 miles had been completed, and by 1850 the mileage had reached 8,571. When the Civil War broke

25Riegel, p. 4.
26Thompson, p. 74; Locklin, p. 40.
27Hadley, p. 33.
out, 28,919 miles of railroads were in regular operation in the United States.28

In 1840 a traveler could go by steam from near Portsmouth, New Hampshire, to Wilmington, North Carolina, except for a few short stage journeys between railroad terminals. A line ran inland from Charleston, South Carolina, almost to Atlanta, and another from Savannah nearly to Macon. In New York, railroads were reaching westward from the Hudson halfway across the state. In Pennsylvania, engineers were busy at work preparing roadbeds into the Alleghenies. The new state of Michigan was extending its lines westward into the Lake Michigan vicinity, and Ohio was building its first line southward from Lake Erie. Kentucky, Indian, and Illinois each had short lines. On these pioneer roads passengers traveled at twelve to twenty miles per hour in cars resembling stagecoaches or rude boxes drawn by dwarf engines.29

At the end of the decade 1840-1850, the railway mileage of the United States had more than trebled in ten years, and was distributed among twenty-five states instead of nineteen, as was the case in 1840. There were 9,021 miles in 1840 and 30,635 in 1860.30

In 1850 New England, which had never had canals, had a comprehensive network of railroad lines reaching from Canada

30Thompson, pp. 97, 119.
to Long Island Sound. In New York, Albany and Buffalo were connected by rail, and the Erie was approaching Dunkirk on Lake Erie. In Pennsylvania, Philadelphia and Pittsburgh were nearly united. A railroad ran across Ohio from north to south, and one west across Michigan from Detroit to Lake Michigan. Chattanooga, Tennessee, was connected with the Atlantic both at Charleston and at Savannah. Chicago was building the first line westward toward Galena, Illinois, but had no through connection with the East. One could go from Chicago to New York City in six days by a combination of railroad and lake steamer. Although 9,000 miles of railroads were not to be disparaged, the national set-up was far from complete, and the nation's passenger and freight traffic was still conveyed principally by canal, river boat, and coastwise steamer, with railroads serving as connecting links between waterways. A thousand steamboats were busy on the navigable rivers of the country, and canals were numerous in Indiana, Ohio, and the eastern states, and carried an enormous traffic. In taking a long trip, one invariably had to use a combination of all forms of travel, from horseback to stagecoach, from railroad to canal packet. 31

In the decade from 1850 to 1860, railroads were built in the United States to the extent of 22,000 miles, costing about $850,000,000. These figures brought the total railway mileage of the country to over 30,600, and the total railway investment

to about $1,100,000,000. In this decade great progress was made in combining local lines into through systems. The states of Illinois, Ohio, and Indiana accounted for about one-third of the total new construction. 32

By 1860 the railroad's conquest of the region east of the Mississippi River was nearing completion. One could travel entirely by rail from Chicago to New Orleans, and from Bangor, Maine, to Savannah, Georgia. There was a well-rounded network of lines from the Great Lakes to the Gulf of Mexico and from the Mississippi to the Atlantic. West of the Mississippi, several lines were forging forward into Iowa, Missouri, and Louisiana. Passengers journeyed in gaudily painted wooden coaches with flat roofs. The interiors were lighted with candles or lamps, and small stoves at each end of the coach provided some heat when the weather was cold. The platforms were open. Engines were beginning to look modern, and had enclosed cabs. The burning of coal instead of wood was beginning to eliminate the bell-shaped smokestack and its spark arrester. 33

American railway mileage had, by 1870, reached 52,922, enough to go twice around the world. In view of the fact that in 1850 there had been only 9,000 miles in existence, this figure represents a commendable record of growth. But this development was only the beginning of the building program

that was to distinguish the next two decades. By 1880, in spite of a six-year depression that was the worst the country had ever known, mileage had increased to 93,262. In the next decade the United States had such an unprecedented "railroad fever" that 70,000 miles of new lines were constructed, bringing the total mileage up to 163,597 by 1890. Most of the building after 1869 was in the West and Middle West, and had a large share in the miracle that was rapidly transforming the West from a wild frontier into a settled country. Railroads everywhere opened up new sources of wealth.\textsuperscript{34}

The most significant item of railroad construction in the middle nineteenth century was that of the building of the first transcontinental railroad. The signing of important commercial treaties with the Far East and the resulting interest in that part of the world had, for several years, made Americans feel the need of a better method of carrying on trade relations with their neighbors across the Pacific, but nothing had been done to improve the old system of sailing around Cape Horn or of going by portage across the isthmus of Panama. But the discovery of gold in California in 1848 altered the situation. If the lure of rich commerce with the East could not fire Americans with the determination to establish better trade channels, the luster of yellow metal could perform the task.\textsuperscript{35} And gold more than commerce gave birth

\textsuperscript{34}\textit{Ibid.}, pp. 149-150. \textsuperscript{35}\textit{Riegel}, pp. 10-11, 13.
to a railroad that spanned the continent.

Immediately following the discovery of gold on the West coast, considerable enthusiasm for the construction of a transcontinental railway sprang up in the United States. This first surge of interest in the matter had a dual importance: it led to the gathering of information that later made possible the actual construction of such a transcontinental railroad, and it advanced construction work on local lines that had begun to extend westward from the Mississippi. Almost every one of these small trans-Mississippi railroads begun in the 'fifties dreamed of some day stretching out to the waters of the Pacific and linking the West to the East.\textsuperscript{36} The first railroad west of the Mississippi had been opened on December 23, 1852, when the first train on the Pacific Railroad of Missouri steamed proudly from St. Louis to Cheltenham -- for the great distance of five miles! It was a time of triumph and exaltation for Missourians; flags waved, bands played, and orators foretold "the flowering of the West under the beneficent influence of the steam locomotive." Twenty-five years earlier, the whistle of the locomotive had never been heard in the United States, and twenty-five years later steel rails had, for eight years, been spanning the continent to unite San Francisco to New York. The railroad conquest of the United States was completed in less than half a century.\textsuperscript{37}

\textsuperscript{36}Ibid., p. 16.  
\textsuperscript{37}Ibid., p. 1.
Texas had the honor of having the first trans-Mississippi railroad to be put in operation after the memorable opening of the Pacific Railroad of Missouri. As early as 1840, the Harrisburg and Brazos Railroad began construction work in Texas' most populous area, the Galveston Bay area. After many interruptions and transfers of ownership, the property became known as the Buffalo Bayou, Brazos, and Colorado Railroad, and under this name became the first Texas railroad to be put in operation. The first rails were laid in 1852, several months before work was begun on the Missouri road, but the opening of the first stretch of twenty miles to traffic did not occur until 1853. Progress thereafter was slow but steady. "Thirty years later this road, then known as the Galveston, Houston, and San Antonio, had the poetic justice of being the first southern road to make transcontinental connections."  

Most of the other Texas lines built before the panic of 1857 also centered in the Galveston-Houston area. The total construction by that time was even less than that in Missouri. The population of Texas was small, and state aid was granted conservatively. It was actually surprising that any railroads at all were built. Perhaps the answer lies in the concentration of the population and in the character of the early pioneers who settled Texas and wrested it from Mexico.  

No one anticipated that the arrival in California in 1854

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38 Ibid., pp. 24-25.  
39 Ibid., p. 25.
of a young man named Theodore D. Judah would ever mark the real starting-point in the story of the first transcontinental railroad. Judah had worked on several eastern railroads, and was one of the young engineers called West by California to direct the building of railroads in that state. While at work on the short Sacramento Valley line, Judah began dreaming of a long railroad to the East. In pursuit of his idea, he explored the Sierra Nevada range in eastern California until he had found a pass through which he was sure a railroad could be constructed. In 1859 he went to Washington at his own expense to solicit government aid for his project. Having received encouragement, he returned to the West to form a company and to raise capital.

Upon meeting with indifference upon the part of the San Francisco capitalists, Judah went inland to Sacramento and ultimately succeeded in winning the enthusiasm and the support of four men, Collis P. Huntington, Mark Hopkins, Charles Crocker, and Leland Stanford (elected governor of California in 1861). These four formed the Central Pacific Railroad, with a California charter dated June 28, 1861. Then they elected officers and paid in enough money to give the company legal status, and appointed Judah as chief engineer for the project. He immediately set out for Washington once more to inform the government that the railroad company was now duly organized, and to solicit federal aid for the tremendous un-
As has already been pointed out in another section of this study, the government was interested in Judah's idea to the extent of making generous land grants and liberal cash loans to supplement the funds that could be raised by the four Sacramento business men.

The physical problems of building the Central Pacific were staggering. Rails, spikes, tie-plates, and tools had to come by ship from the East, lighter materials across the isthmus of Panama, and heavier equipment such as rolling stock, by Cape Horn. Rails costing $91.70 per ton in the East increased to $143.67 when shipped by way of Panama. The labor problem, too, was serious. "Few men wished to work on a railroad when the opportunities for wealth in mining, farming, and storekeeping seemed so rosy." In 1864, the Central Pacific could find only 1,200 men willing to work for the company. Finally the directors solved the difficulty by bringing in Chinese workmen who would work for $35.00 a month and board themselves; white laborers received $35.00 and were boarded by the railroad. By 1867, 14,500 white laborers and Chinese coolies were working for the line, and work was advancing rapidly.

From the East, the Union Pacific was stretching out across the plains to meet the Central Pacific. Chartered by Congress on July 1, 1862, about a year after the chartering of the Central Pacific, it received the same aid as did the Central

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40 Reck, pp. 140-141.  
41 Ibid., p. 144.
Pacific. "By the same construction company device, government bonds were made available for building -- and for enriching the promoters." This line used the same gauge as did the Central Pacific -- 4'8.5" -- which was soon to become the standard all over the country, so that eventually the cars of one road could use the tracks of all roads.

In December, 1863, the Union Pacific started west from Omaha. Materials were almost as difficult of access as they had been for the Central Pacific. Most supplies were carried by boat up the Missouri River and hauled out to the line on wagons. Workers were scarce, because most of the country's able-bodied men were engaged in fighting the Civil War. Because the Union Pacific did not import Chinese labor, and because of the scarcity of white workmen, only forty miles of track were laid in 1864-1865.  

When the end of the war released men and made them available for work, the laying of track proceeded much more rapidly. "The line stretched out into Indian country and men worked with armed troops guarding them or with rifles stacked handy, so that they could drop their shovels and pick up guns in case raiding parties swept down on them. In spite of all protection, Indians stole horses, burned camps, tore up tracks, and captured and killed workmen." By July, 1866, the road was completed to Kearney, Nebraska, 305 miles west of Omaha, and

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42Ibid., pp. 144-145.
the line was opened for business to that point with a passenger fare of ten cents per mile.

In the winter of 1867-1868 the Union Pacific reached Cheyenne and began racing the Central Pacific to see which road could build farthest and receive the most aid from the government. Congress had not specified a meeting-place, having only guaranteed loans of from $16,000 to $48,000 per mile completed. Each line meant to obtain as much government money as it could, hence both companies began a feverish activity that was not to abate until their tracks had merged.43

Construction on the Union Pacific line was carried on in hundred-mile segments, fleets of wagons hauling the necessary supplies and materials to the place where they were to be used. The whole stretch was graded and the bridge work was completed before any rails were laid. This procedure necessitated that the grading crews should work considerably in advance of the construction gangs.

Ties were taken from the adjacent country where possible, but over much of the route the wood had to be hauled over long distances across treeless plains, and to do this the cost was excessive. If hard-wood was not available, cottonwood was used for the ties after having been treated with a zinc chloride solution. After the ties were in place the placing and spiking of the rails could proceed rapidly, and then the track was ready for use.44
In the construction of the Union Pacific, a special technique was developed for the laying of the rails. A light car running upon the rails and drawn by a single horse carried a load of rails to the end of the track where they would be needed. Two men grabbed a rail at the end and pulled it forward, others, in twos, grasping it at regular intervals as it was pulled off the vehicle. When the rail was clear of the cart, the men carried it forward at a run. At a word of command, the rail was dropped in place, with the right side up with care. With the same procedure going on at the other side of the car, the men could lay four rails in a minute's time, ready to be spiked by gangs of men with sledges. When the car had been emptied of its burden of rails, it was tipped over on the side of the track to permit the next loaded car to pass, then it was set upright on the tracks once more and went flying back for another load of rails, drawn by a galloping horse.\(^{45}\)

The Indians of the West believed the railroad to be a last threat to their very existence when it began bisecting the heart of their country. Naturally they fought back. Fortunately they never gave much trouble by destroying the rails or the road-bed, but they frequently made surprise attacks on the workers, stole equipment, and killed and abducted workmen. Much of the Union Pacific construction work went forward under the protection of armed guards, frequently United States troops.

\(^{45}\text{Thompson, pp. 176-177.}\)
Sometimes half of a construction crew would stand guard while the other half worked, and the men often worked with their arms stacked and close at hand for immediate use. Isolated workers were in constant fear of Indian raids, and often their fears were justified. The entire project for a while had the aspect of an Indian war.\textsuperscript{46}

In 1868, when the Central Pacific and the Union Pacific were each about 530 miles from the Great Salt Lake, west and east, respectively, such a construction campaign began as has never been approached in the history of railroad building. Twenty-five thousand men and 6,000 teams, together with whole brigades of locomotives and work-trains, engaged in a desperate struggle to bridge the gap and weld the rails into a continuous track across the nation. In a single day ten miles of track -- a world record. Leland Stanford, who had been ridiculed when he had turned the first earth for the Central Pacific at Sacramento six years before, drove the last spike when, in May of 1869, the two roads met.\textsuperscript{47} The union of the rails was the result of a furious struggle carried on by the construction crews of both lines who were determined to carry the gigantic project to fruition at the earliest possible moment. The last months of the work took on the aspect of a race, which has been graphically described as follows:

They whipped themselves into racing speed, and their road building became heroic for its feverish pace if not for its excellence. Observers marveled at

\textsuperscript{46}Riegel, p. 83. \textsuperscript{47}Hungerford, pp. 31-32.
the way in which track was laid.

First went the graders working with scrapers, pick and shovel, cutting through hills and filling in hollows, laying a smooth, narrow bed of earth and gravel.

Then came the ties, cut by gangs in the forests of the Black Hills and on the slopes of the Rockies and hauled by team to the roadbed, where they were swiftly set in place.

After that the rails, and this part amazed all watchers. Back at the supply depot the rails were loaded on horse-drawn trucks, the wheels of which were flanged to fit the track. These truckloads of rails, with tie-plates and spikes, were drawn at a gallop down the road to the end of the track.

There gangs pulled the rails off the wagons, carried them forward, and at a signal lowered them to the track. Rail after rail was carried forward and put in place until the truck was unloaded.

The empty truck was then dumped over on its side, off the track, to allow the next loaded truck to pass it at a gallop, on down the new sections of track already bolted in place. When the loaded truck had passed, the empty one was lifted onto the rails again and driven back to the supply depot.48

By employing these methods, the Union Pacific laid four to seven miles of track a day, and occasionally ten miles. Both companies worked at breakneck speed through the winter of 1868-1869, without calling a halt for the cold weather.

By spring of 1869, both companies were working in western Utah, "Chinese coolies laying track eastward on the C. P., Irish laborers and ex-soldiers sweating westward on the U. P." Slowly their lines of steel grew closer together, until the two groups of workers were within hailing distance. Then, "on parallel road-beds, within a stone's throw, they began passing each other, the C. P. blithely laying track eastward and the U. P. as unconcernedly laying track toward the West." In their

48 Reck, p. 146.
eagerness to receive money from the government, both roads, despite the fact that they had been chartered expressly for the purpose of uniting into one line, seemed determined to continue separate construction until stopped by the oceans. Congress stepped in, however, and designated Promontory Point, Utah, as the meeting place, where, on May 10, 1869, the two roads ceremoniously united to complete the first transcontinental railroad. To effect the union, the Central Pacific had laid 689 miles of track eastward from Sacramento, over the Sierra Nevadas; and the Union Pacific had traversed Indian country and the Rockies with 1,086 miles of track laid westward from Omaha.49

The telegraph had kept pace with the progress of the railroads, and on the historic day of their union the wires carried to the waiting world the story of the placing of the last tie and the driving of the last few spikes. The last tie-piece was made of laurel wood from California. It was placed on the road-bed and the last two rails were laid down. Seventeen spikes were needed to secure the rails in place, ten for one of the rails and seven for the other. Three of the seventeen spikes were unusual -- Nevada had furnished a silver spike; Arizona, one of iron, silver, and gold; and California, one of pure gold.

Over the telegraph keys the message sped to cities and villages throughout the nation, where citizens had gathered in

49 Ibid., pp. 146-148.
public squares in honor of the event: "Almost ready. . . .
Hats off. . . . Prayer is being offered." While, at the spot,
coolies, Mexicans, Indians, Irish laborers, and silk-hatted
officials formed a colorful band, masses of citizens from
coast to coast bowed their heads.

Again came the dot-dash: "The spike is about to be
presented." Then: "All is ready now."

When at length the gold and silver spikes were driven
home, the telegraph operator signaled each sledge blow, and
these same blows were recorded in almost every city by the
ringing of a bell. People marveled as they heard the bells
and listened to the telegraphic report of the "welding of
the last link in America's most daring, romantic epoch of rail-
road building."50

In less than half a century the railroad had crossed the
continent, spanning the vast open spaces of the interior and
winding up through the defiles of the mountain ranges, until
at last it wedded the West to the East and knitted the nation
together with twin threads of steel.

50Ibid., p. 148.
BIBLIOGRAPHY
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