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*Feats of Railway Engineering. North and South American and Canadian Railway Brid [John. Bogart] on www.enganchecubano.com \*FREE\* shipping on qualifying offers.*

The railroads of the United States, now aggregating a hundred and fifty thousand miles and having several hundred different managements, are frequently spoken of comprehensively as the railroad system of the country, as though they constituted a unity in fact, and might be regarded and dealt with as an entirety, by their patrons and by the public authorities, whenever the conveniences they are expected to supply, or the conduct of managers and agents, come in question. So far, however, is this from being the case, that it would be impossible to name any other industrial interest where the diversities are so obvious and the want of unity so conspicuous and so important. The diversities date from the very origin of the roads; they have not come into existence under the same laws nor subject to the same control. It was accepted as an undoubted truth in constitutional law from the first that the authority for the construction of railroads within a State must come from the State itself, which alone could empower the promoters to appropriate lands by adversary proceedings for the purpose. The grant of corporate power must also come from [xxii] the State, or, at least, have State recognition and sanction; and where the proposed road was to cross a State boundary, the necessary corporate authority must be given by every State through or into which the road was to run. It was conceded that the delegated powers of the General Government did not comprehend the granting of charters for the construction of these roads within the States, and even in the Territories charters were granted by the local legislatures. The case of the transcontinental roads was clearly exceptional; they were to be constructed in large part over the public domain, and subsidies were to be granted by Congress for the purpose. They were also, in part at least, to be constructed for governmental reasons as national agencies; and invoking State authority for the purpose seemed to be as inconsistent as it would be inadequate. But, though these were exceptional cases, the magnitude and importance of the Pacific roads are so immense that the agency of the General Government in making provision for this method of transportation must always have prominence in railroad history and railroad statistics. Not only have the roads been diverse in origin, but the corporations which have constructed them have differed very greatly in respect to their powers and rights, and also to the obligations imposed by law upon them. The early grants of power were charter-contracts, freely given, with very liberal provisions; the public being more anxious that they be accepted and acted upon than distrustful of their abuse afterward. Many of them were not subject to alteration or repeal, except with the consent of the corporators; and some of them contained provisions intended to exclude [xxiii] or limit competition, so that, within a limited territory, something in the nature of a monopoly in transportation would be created. The later grants give evidence of popular apprehension of corporate abuses; the legislature reserves a control over them, and the right to multiply railroads indefinitely is made as free as possible, under the supposition that in this multiplication is to be found the best protection against any one of them abusing its powers. In very many cases the motive to the building of a new road has been antagonism to one already in existence, and municipalities have voted subsidies to the one in the hope that, when constructed, it would draw business away from the other. The anomaly has thus been witnessed of distrust of corporate power being the motive for increasing it; and the multiplication of roads has gone on, without any general supervision or any previous determination by competent public authority that they were needed, until the increase has quite outrun in some sections any proper demand for their facilities. Roads thus brought into existence, without system and under diverse managements, it was soon seen were capable of being so operated that the antagonism of managers, instead of finding expression in legitimate competition, would be given to the sort of strife that can only be properly characterized by calling it, as it commonly is called, a war. From such a war the public inevitably suffers. The best service upon the roads is only performed when they are operated as if they constituted in fact parts of one harmonious system; the rates being made by agreement, and traffic exchanged with as little disturbance as possible, and without abrupt break at the terminals. But when every [xxiv] management might act independently, it sometimes happened that a company made its method of doing business an impediment

instead of a help to the business done over other roads, recognizing no public duty which should preclude its doing so, provided a gain to itself, however indirect or illegitimate, was probable. Many consolidations of roads have had for their motive the getting rid of this power to do mischief on the part of roads absorbed. In nothing is the want of unity so distinctly and mischievously obvious as in the power of each corporation to make rates independently. It may not only make its own local rates at discretion, but it may join or refuse to join with others in making through rates; so that an inconsiderable and otherwise insignificant road may be capable of being so used as to throw rates for a large section of the country into confusion, and to render the making of profit by other roads impossible. It is frequently said in railroad circles that roads are sometimes constructed for no other reason than because, through this power of mischief, it will be possible to levy contributions upon others, or to compel others, in self-protection, to buy them up at extravagant prices. Cases are named in which this sort of scheming is supposed to have succeeded, and others in which it is now being tried. Evils springing from the diversities mentioned have been cured, or greatly mitigated, by such devices as the formation of fast-freight lines to operate over many roads; by allowing express companies to come upon the roads with semi-independence in the transportation of articles, where, for special reasons, the public is content to pay an [xxv] extra price for extra care or speed; and by arrangements with sleeping-car companies for special accommodations in luxurious cars to those desiring them. These collateral arrangements, however, have not been wholly beneficial; and had all the roads been constructed as parts of one system and under one management, some of them would neither have been necessary nor defensible. They exist now, however, with more or less reason for their existence; and they tend to increase the diversities in railroad work. The want of unity which has been pointed out tended to breed abuses specially injurious to the public, and governmental regulation was entered upon for their correction. Naturally the first attempts in this direction were made by separate States, each undertaking to regulate for itself the transportation within its own limits. Such regulation would have been perfectly logical, and perhaps effectual, had the roads within each State formed a system by themselves; but when State boundaries had very little importance, either to the roads themselves or to the traffic done over them, unless made important by restrictive and obstructive legislation, the regulation by any State must necessarily be fragmentary and imperfect, and diverse regulation in different States might be harmful rather than beneficial. It must be said for State regulation that it has in general been exercised in a prudent and conservative way, but it is liable to be influenced by a sensitive and excitable public opinion; and as nothing is more common than to find gross abuses in the matter of railroad transportation selfishly defended in localities, and even in consid [xxvi] erable sections, which are supposed to receive benefits from them, it would not be strange if the like selfishness should sometimes succeed in influencing the exercise of power by one State in a manner that a neighboring State would regard as unfriendly and injurious. The Federal Government recently undertook the work of regulation, and in doing so accepted the view upon which the States had acted, and so worded its statute that the transportation which does not cross State lines is supposed to be excluded. The United States thus undertakes to regulate interstate commerce by rail, and the States regulate, or may regulate, that which is not interstate. It was perhaps overlooked at first that, inasmuch as Government control may embrace the making of classifications, prescribing safety and other appliances, and naming rates, any considerable regulation of State traffic and interstate traffic separately must necessarily to some extent cause interference. The two classes of traffic flow on together over the same lines in the same vehicles under the management of the same agencies, with little or no distinction based on State lines; the rates and the management influenced by considerations which necessarily are of general force, so that separate regulation may without much extravagance be compared to an attempt in the case of one of our great rivers to regulate the flow of the waters in general, but without, in doing so, interfering with an independent regulation of such portion thereof as may have come from the springs and streams of some particular section. This is one of many reasons for looking upon all existing legislation as merely tentative. There are those who think this may, sufficiently for practical purposes, be accomplished by the legalization of some scheme of pooling; but this is a crude device, against which there is an existing prejudice not easily to be removed. Others look for unity through gradual consolidations, the tendency to which is manifest, or through something in the nature of a trust, or by means of more comprehensive and stringent national control. Beyond all these is not infrequently

suggested a Government ownership. Of the theories that might be advanced in this direction, or the arguments in their support, nothing further will be said here; the immediate purpose being accomplished when it is shown how misleading may be the term system, when applied to the railroads of the country as an aggregate, as now owned, managed, and controlled. Every man in the land is interested daily and constantly in railroads and the transportation of persons and property over them. The price of whatever he eats, or wears, or uses, the cost and comfort of travel, the speed and convenience with which he shall receive his mail and the current intelligence of the day, and even the intimacy and extent of his social relations, are all largely affected thereby. The business employs great numbers of persons, and the wages paid them affect largely the wages paid in other lines of occupation. The management of the business in some of its departments is attended by serious dangers, and thousands annually lose their lives in the service. The ingenuity which has been expended in devices to make the transportation rapid, cheap, and safe may well be characterized as marvellous, and some feats in railroad engineering are the wonder of the world. He was successful in securing a series of papers of high value, the appearance of which has been welcomed from month to month, beginning with June, , with constant and increasing interest. These papers have a permanent value; and, in obedience to a demand for their separate publication in convenient form for frequent reference, the publishers now reproduce them with expansions and additions. A reference to the several titles will convince anyone at all familiar with the general subject that the particular topic is treated in every instance by an expert, entitled as such to speak with authority. Railways have been known since the days of the Romans. Their tracks were made of two lines of cut stones. Iron rails took their place about one hundred and fifty years ago, when the use of that metal became extended. These roads were called tram-roads, and were used to carry coal from the mines to the places of shipment. They were few in number and attracted little attention. The modern railway was created by the Stephensions in , when they built the locomotive "Rocket. Civil engineering has done much, but mechanical engineering has done more. The invention of the steam-engine by James Watt, in , attracted the attention of advanced thinkers to a possible steam [2] locomotive. Erasmus Darwin, in a poem published in , made this remarkable prediction: The first locomotive of which we have any certain record was invented, and put in operation on a model circular railway in London, in , by Richard Trevithick, an erratic genius, who invented many things but perfected few. His locomotive could not make steam, and therefore could neither go fast nor draw a heavy load. This was the fault of all its successors, until the competitive trial of locomotives on the Liverpool and Manchester Railway, in The Stephensions, father and son, had invented the steam blast, which, by constantly blowing the fire, enabled the "Rocket," with its tubular boiler, to make steam enough to draw ten passenger cars, at the rate of thirty-five miles an hour. Then was born the modern giant, and so recent is the date of his birth that one of the unsuccessful competitors at that memorable trial, Captain John Ericsson, was until the present year living and actively working in New York. Another engineer, Horatio Allen, who drove the first locomotive on the first trip ever made in the United States, in , still lives, a hale and hearty old man, near New York. The earlier locomotives of this country, modelled after the "Rocket," weighed five or six tons, and could draw, on a level, about 40 tons. After the American improvements, which we shall describe, were made, our engines weighed 25 tons, and could draw, on a level, some sixty loaded freight cars, weighing 1, tons. This was a wonderful advance, but now we have the "Consolidation" locomotive, weighing 50 tons, and able to draw, on a level, a little over 2, tons. And this is not the end. Still heavier and more powerful engines are being designed and built, but the limit of the strength [3] of the track, according to its present forms, has nearly been reached. It is very certain we have not reached the limit of the size and power of engines, or the strength of the track that can be devised. After the success of the "Rocket," and of the Liverpool and Manchester Railway, the authority of George Stephenson and his son Robert became absolute and unquestioned upon all subjects of railway engineering. Their locomotives had very little side play to their wheels, and could not go around sharp curves. They accordingly preferred to make their lines as straight as possible, and were willing to spend vast sums to get easy grades. Their lines were taken as models and imitated by other engineers. All lines in England were made with easy grades and gentle curves. Monumental bridges, lofty stone viaducts, and deep cuts or tunnels at every hill marked this stage of railway construction in England, which was imitated on the European lines. As it was with the railway, so it was with the locomotive.

The Stephenson type, once fixed, has remained unchanged in Europe, except in detail, to the present day. When we come to the United States we find an entirely different state of things. The key to the evolution of the American railway is the contempt for authority displayed by our engineers, and the untrammelled way in which they invented and applied [4] whatever they thought would answer the best purpose, regardless of precedent. When we began to build our railways, in , we followed English patterns for a short time. Our engineers soon saw that unless vital changes were made our money would not hold out, and our railway system would be very short. Necessity truly became the mother of invention. The first, and most far-reaching, invention was that of the swivelling truck, which, placed under the front end of an engine, enables it to run around curves of almost any radius. This enabled us to build much less expensive lines than those of England, for we could now curve around and avoid hills and other obstacles at will. The illustration opposite shows a railroad curving around a mountain and supported by a retaining wall, instead of piercing through the mountain with a tunnel, as would have been necessary but for the swivelling truck. The swivelling truck was first suggested by Horatio Allen, for the South Carolina Railway, in ; but the first practical use of it was made on the Mohawk and Hudson Railroad, in the same year. It is said to have been invented by John B. Jervis, Chief Engineer of that road. The next improvement was the invention of the equalizing beams or levers, by which the weight of the engine is always borne by three out of four or more driving-wheels. They act like a three-legged stool, which can always be set level on any irregular spot. The original imported English locomotives could not be kept on the rails of rough tracks. The same experience obtained in Canada when the Grand Trunk Railway was opened, in 1825. The locomotives of English pattern constantly ran off the track; those of American pattern hardly ever did so. Finally, all their locomotives were changed by having swivelling trucks put under their forward ends, and no more trouble occurred. The equalizing levers were patented in 1825, by Joseph Harrison, Jr. Avoidance of a Tunnel. These two improvements, which are absolutely essential to the success of railways in new countries, and have been adopted in Canada, Australia, Mexico, and South America, [1] to the exclusion [7] of English patterns, are also of great value on the smoothest and best possible tracks. The flexibility of the American machine increases its adhesion and enables it to draw greater loads than its English rival. The same flexibility equalizes its pressure on the track, prevents shocks and blows, and enables it to keep out of the hospital and run more miles in a year than an English locomotive.

## 2: The American railway : its construction, development, management, and appliances / - CORE

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## 4: Index: Stories, Listed by Title

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## 5: The American railway | Open Library

*Scribner's Magazine (contents): Building of a Railway. Thomas Curtis Clarke, III(6), p. , June, ; Feats of Railway Engineering. John Bogart, IV(1), p. 3, July.*

## 6: American Railway, The Its Construction, Development, Management Appliances | eBay

## FEATS OF RAILWAY ENGINEERING JOHN BOGART pdf

*The John Bogart Letters: Forty-two letters written to John Bogart of Queen's college, now Rutgers college, and five letters written by him, notes (Rutgers college publications. 2d ser) 1 Feats of Railway Engineering.*

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### 8: Full text of "The American railway; its construction, development, management, and appliances"

*Introduction, by T. M. Cooley. The building of a railway, by T.C. Clarke. [June ] Feats of railway engineering, by J. Bogart. [July ] American locomotives and.*

### 9: Full text of "Scribner's Magazine"

*FEATS OF RAILWAY ENGINEERING: By JOHN BOGART, State Engineer of New York. Development of the Railâ€”Problems for the FEATS OF RAILWAY ENGINEERING. By JOHN BOGART.*

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