

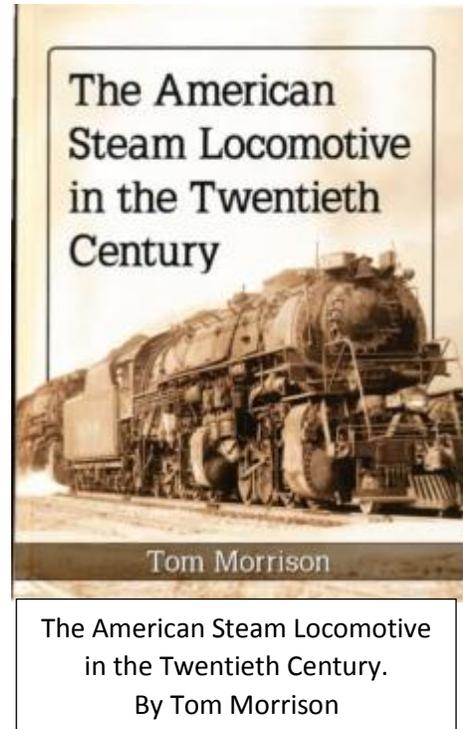
## **American Steam Locomotive-Morrison**

The American Steam Locomotive in the Twentieth Century

By Tom Morrison. McFarland Books, 636 pages, Hardcover, US \$99.00. ISBN 978-1-4766-6582-5

Reviewed by Eric Hiser

I received *The American Steam Locomotive in the Twentieth Century* unexpectedly in the mail. I confess to some initial skepticism. The topic of American steam locomotives is wide and varied. The author, Tom Morrison, grew up in England and worked as a mining engineer in Canada and has written technical histories on mining and aviation topics. He disclaimed the ability to review the “vast” complex of railroad holdings. Instead, he focused exclusively on articles in the *Railroad Gazette* (1856-1908), *Railroad Age Gazette* (1980-1918) and *Railway Age* (1909 to present). How could a comprehensive history of American steam locomotive power development be produced in this fashion? Mr. Morrison’s response to this concern is apt: these “are the original writings, comments and opinions by the most eminent engineers and executives of the American steam locomotive industry, with abundant graphs, drawing, and statistics.” Out of this material Mr. Morrison draws out “their struggles and triumphs, and often [] their frustration and bafflement” with the steam locomotive. As a result, this book captures not only the changes in American steam locomotive development, but also the why that it happened. And that makes it worth reading.



The book begins with a brief “Introduction” that quickly brings the reader up to speed from the initial development of the steam locomotive in England to the start of the Twentieth Century. In Part One, he lays an important, and necessary, background of the political and economic conditions in early and middle Twentieth Century America: increased transportation demand juxtaposed against a political and regulatory environment that restricted rates, and hence revenues, for the railroads. In this context, the railroads began a search for efficiency in delivery of transportation service. In America, that desire for efficiency led to a demand for high locomotive tractive effort to start long, heavy trains, fuel efficiency to hold down costs, and enough horsepower to minimize double-heading, with its ruinous effect on cost per ton mile. In addition, American locomotive developers had to contend with severe weather, long runs, bad water and heavy grades not seen in many other areas of the world. Against this challenging backdrop, the steam locomotive also had to contend with increased competition from other forms of transportation and the threat posed by electric, gas-

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mechanical, gas-electric and eventually diesel-electric locomotives. Finally, the steam locomotive had to contend with its overall low thermal efficiency.

Part Two begins the technical history. Each Part presents a chapter on general steam locomotive development during the period (usually about 15 to 20 years), then a chapter that delves into the details. Sections on “Fuels, Firing and Fuel Economy” detail efforts to improve these aspects of steam locomotive performance and focus on fuel developments and stokers. “Fireboxes and Combustion” discusses trends in firebox construction and design, grates, arches, combustion boxes. “Boilers and Steam Generation” focus on the boiler, injectors, instrumentation, feed water heating and superheating. “Smokeboxes and Drafting” discusses front end developments, an area where even at the end of locomotive development little was known for certain and small adjustments would substantially change locomotive performance. “Cylinder Arrangements and Compounding” traces the evolution of different schema of cylinders, the search for the best way to fully exhaust the “expansive” properties of steam. “Valves and valve gear” looks at developments in this important area, while “Frames and Running Gear” looks at how the locomotive was set up to minimize the effect of track curvature and defects and the continual effort to avoid track damage from weight and dynamic augment through counterbalancing. The final section, “Performance Testing and Design” recounts the often-trailing effort of manufacturer, railroad and academic engineers to understand and consistently test locomotives to advance the science of locomotive design. The next chapter in each Part then addresses the types of locomotives built during the period and how they reflected the changes discussed in the preceding chapter. The final chapter of each part then discusses developments in other forms of tractive power, such as electric and internal combustion. The final chapter looms larger in each successive Part.

The strength of this book lies in the slow buildup of this detail, the explanation by contemporary actors for why different approaches were desired, tried, and then generally adopted or abandoned. Certain factors stand out, such as the very practical approach to steam locomotive construction at the beginning of the century, which was slowly replaced by a more scientific and engineering-based approach after the construction of locomotive test plants, most notably at Purdue University and the Pennsylvania Railroad Altoona shops. Individual railroad personalities also appear. The Pennsylvania, with its detailed and statistically-driven approach and major shop and manufacturing abilities was an early leader and prominent player, but ultimately headed down an idiosyncratic path. The Appalachian coal haulers fought a never-ending battle to build locomotives that could master steep grades and haul more coal at lower cost, leading to massive locomotives. The Santa Fe and its aggressive approach to locomotive innovation. The New York Central System with its search for fast passenger power and the Union Pacific and its search for fast freight power. Out of these details a picture of the industry, the locomotive, and their co-development emerges. This is the great contribution of the book—it presents the overall context of locomotive development that neatly complements the work of the many company-based locomotive development histories.

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A few additional facts. As befits a technical history, an appendix provide guidance on how technical information was gathered and presented and define terms used throughout the book. A separate appendix lists each *Railroad Gazette/Railroad Age Gazette/Railway Age* article cited in support by railroad company, type, article name, issue date and page. A final appendix provides a reprint of the Cole ratios, which were fundamental design principles. The book has extensive end notes, a bibliography and index. Physically, the book is hardbound, 624 pages of good quality paper in what appears to be 9- or 10-point type. It is liberally illustrated, averaging a photo or drawing on every two-page spread, with some pages having just text or some presenting multiple images. The drawings, charts and similar materials are well chosen to illustrate principles discussed in the text and substantially advanced this reviewer's understanding of the various technical advances in steam locomotive design and operation. Photographic reproduction is generally good, but lacks the crispness and contrast associated with some locomotive photography books. The only complaint about the physical book is that in humid weather it tends to swell slightly.

In sum, I was initially skeptical, but have been won over completely. *The American Steam Locomotive in the Twentieth Century* attains what it set out to do: present a comprehensive history of the development of the American steam locomotive. What it achieves beyond that, however, is placing those developments in the wider context and explaining why the development occurred the way it did and why it ultimately failed. And that makes this book well worth the price of admission.

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