

Rail Transportation

FALL 2006

CHAIRMAN'S COMMENT



Leadership is a key to success for any volunteer organization, which is true for the ASME Rail Transportation Division (RTD) as well. While I assume the duties of Division Chairman, I am but one person on the Division leadership team. I follow in a long line of outstanding Division Chairmen who continue to be active in guiding our Divisional efforts. It is impractical for me to mention names here, but you can see the list of those on the Executive Committee who form the current leadership team. The General Committee is also critically important to our success as a Division.

What is RTD success? Fundamentally, it is serving the needs of our members – you and other ASME members. We do that primarily through the technical conferences we organize and sponsor. The number and quality of technical papers offered to these conferences is a measure of our success. Through this means, authors are able to inform the industry on breakthrough studies which in turn help the industry advance. The number of attendees at these conferences is also a measure of our success.

We trust you are finding the paper quality and quantity to your liking at these conferences and will attend the IMECE in Chicago in November. It promises to live up to our high standards for such events.

Finally, I need to tell you that ASME, as an organization, is re-inventing itself. While your Divisional leadership is participating in these lively discussions at the Society level, we are not letting those activities dissuade us from the missions of the RTD. I would like to hear from you with any ideas you have for improvements – within RTD or at the Society level.

I look forward to seeing you in Chicago in November.

Roger D. Sims, P.E.

FUTURE MEETINGS

Chairman

2006 IMECE Chicago, IL -
November 6-8, 2006

2007 JRC Pueblo - March 13-
16, 2007

2007 IMECE Seattle -
November 11-16, 2007

2008 JRC Wilmington, DE -
March-April 2008

2006 IMECE – RAIL TRANSPORTATION TECHNICAL SESSIONS

2006 IMECE RTD SCHEDULE

CHICAGO HILTON & TOWERS HOTEL
NOV 6-8, 2006

**“Technology for the Rail Industry
through Mechanical Engineering”**

Mon, Nov 6:

2:00 pm – 4:00 pm Executive & Advisory
Committee

4:15 pm – 6:00 pm General Committee

Tue, Nov 7:

6:45 am – 7:30 am Authors' Breakfast

7:45 am – 9:15 am RTD Session 1

9:30 am – 11:00 am RTD Session 2

11:15 am – 12:00 pm RTD Session 3

PANEL

12:10 pm – 1:45 pm RTD RECEPTION &
LUNCHEON

2:00 pm – 3:30 pm RTD Session 4

3:45 pm – 5:15 pm RTD Session 5

Wed, Nov 8:

6:45 am – 7:30 am Authors' Breakfast

7:45 am – 9:15 am RTD Session 6

9:30 am – 11:00 am RTD Session 7

11:15 am – 12:45 pm RTD Session 8

2:00 pm – 3:30 pm RTD Transportation
Track Session

Luncheon Speaker

The RTD luncheon speaker will be Mr.

RTD-4 Crashworthiness of Railway Equipment

Session Organizer: Allen Bieber,
abieber@velocity.net

- Train-to-Train Impact Test of Crash-Energy Management Passenger Rail Equipment: Structural Results
Eloy Martinez, martinez@fra.gov
- Crush Analyses of Multi-Level Equipment
Eloy Martinez, martinez@fra.gov
- Train-to-Train Impact Test of Crash-Energy Management Passenger Rail Equipment: Occupant Experiments
Kristine Severson, severson@volpe.dot.gov
- A Collision Dynamics Model of a Multi-level Train
Michelle Priante, priante@volpe.dot.gov

RTD-5 Car Dynamics and Steering Issues

Session Organizer: Dennis R. Weed, Dennis.Weed@crdx.com

- Investigation Into The Effects Of Geometric Tolerances On Freight Car Dynamics
John Tunna, john_tunna@aar.com

Andrew F. Reardon, President and CEO, TTX Co. Mr. Reardon will discuss The TTX View of Engineering in Today's Marketplace.

Technical Sessions

RTD-1 Engineering for Noise Control

Session Organizer: Michael Iden, meiden@up.com

- An Experimental Investigation of Brake Squeal Suppression of Air Brake Systems for Electric Passenger Trains Using Oil Damper
Adachi Kazuhiko, Adachikazuhiko@mech.kobe-u.ac.jp
- Investigation of Multi-Degree of Freedom Damped Dynamic Vibration Absorber Applied to Wheel Noise Control
Zhaobo Chen, chenzb@hit.edu.cn
- Progress in Railroad Freight Car Engineering
John Punwani, john.punwani@dot.gov

RTD-2 Wheel Properties and Analysis

Session Organizer: Stuart F. Trout, stu_trout@ttx.com

- Fatigue Testing of Microalloyed AAR Class C Wheel Steel
Cameron Lonsdale, clonsdale@standardsteel.com
- Residual Stresses in Passenger Car Wheels
Shuangqin Liu, shuangqin.liu@tufts.edu
- Development of a Standard for New Passenger Wheel
Brandon Talamini, talamini@volpe.dot.gov

RTD-3 Panel Discussion - Passenger and Freight Railroad Cooperation

- 8-axle Railcar Carbody Roll Performance: CG and Track Wavelengths Effects
William Shust, shust@comcast.net
- Rail Geometry and Euler Angles
Cheta Rathod, cratho2@uic.edu

RTD-6 Passenger and High-Speed Rail Issues

Session Organizer: Anthony Giammarise, anthony.giammarise@trans.ge.com

- Passenger Equipment Suspension Performance
Brian Marquis, Brian.Marquis@volpe.dot.gov
- Status of Positive Train Control Development in North America
Terry Tse, Terry.Tse@dot.gov
- On the crosswind stability of high speed railway vehicles
Christian Wetzel, wetzel@itm.uni-karlsruhe.de
- Optimal Suspension Systems for High-Speed Trains Traveling over Corrugated Rails
Ebrahim Esmailzadeh, ezadeh@uoit.ca

RTD-7 Freight Car Safety and Service Performance

Session Organizer: Dennis Buda, budad@dteenergy.com

- Engineering Analyses for Railroad Tank Car Puncture Resistance
David Jeong, jeong@volpe.dot.gov
- Bulkhead Flat Car Impact Analysis using NUCARS
Roger Sims, rds@simspe.com
- Tracking the Performance of Heavy Axle Load Vehicles in Revenue Service
Harold Harrison, h_sqd@salientsystems.com
- Wayside Defect Detection to Improve

Session Organizer: Roger Sims,
rds@simspe.com

Train Safety
Scott Keegan, lskeegan@nscorp.com

- Passenger and Freight RR Cooperation - CREATE Perspective
Chuck Allen, challen@nscorp.com
- Passenger and Freight Railroad Cooperation - Amtrak Perspective
Mike Franke, fran3624@amtrak.com
- Passenger and Freight Railroad Cooperation - Union Pacific Perspective
Tom Mulligan, tmulligan@up.com

RTD-8 Engineering For Improved Railway Safety

Session Organizer: Claire Orth, claire.orth@dot.gov

- Performance of Spent Fuel Transportation Casks in Severe Tunnel Fires
Robert Lewis, rxl1@nrc.gov
- Dynamic Simulation of Train Derailments
Chris Paetsch, chris.paetsch@gmail.com
- Fire-Life Safety Provisions in Non-Revenue Rail Tunnels
Mark Colino, colino@pbworld.com

2007 JOINT RAIL CONFERENCE CALL FOR PAPERS

The **Annual Joint Rail Conference** (JRC) will be held March 14-16, 2007, in Pueblo, Colorado at the Marriott Hotel/Pueblo Convention Center. This premier railroad technical conference is a multi-disciplinary engineering event sponsored in partnership by the ASME Rail Transportation Division, the Land Transportation Division of the IEEE Vehicular Technology Society, the ASME Internal Combustion Engine Division and the American Society of Civil Engineers. This 2007 JRC will be held immediately following the 12th Annual Association of American Railroads Research Review in Pueblo, Colorado which will be held on March 13-14, offering the single-trip economy of attending both conferences, thereby broadening your experience and gaining new contacts and new technical perspectives. Each event requires a separate registration.

The theme of the 2007 JRC is **"Railroad Advancements through Civil, Electrical and Mechanical Engineering."** Featured will be over 100 technical papers detailing advances in design, analysis, testing and performance equipment serving the rail industry. The conference will begin with a technical tour of the Transportation Technology Center, Inc. (TTCI is a wholly owned subsidiary of the AAR).

This annual conference provides a forum for international technical information exchange among professionals from equipment and component manufacturers, rail maintenance and operations personnel, government agencies, university and research

organizations and others involved in the business of passenger and freight rail transportation.

Plan now to join leaders in research, development and application of engineering advancements at the 2007 Joint Rail Conference in Pueblo!

CALL FOR PAPERS:

You are invited to submit papers for presentation and discussion at the Conference. Papers are solicited from members of the supply industry, rail transportation corporations and rail transit agencies, governmental agencies, consulting/engineering firms, academia, technical organizations, and others. Papers should cover topics of current interest. Topics may include:

- Communications Based Train Control
- Substation design
- Signal improvements
- Locomotive performance enhancement
- Improvements in fuel economy and emissions
- New electrical/electronic concepts for heavy rail/commuter rail/light rail performance and safety improvements
- Freight car plans for heavier or higher-speed equipment
- Evolution in electrical/electronic rail products for more reliable service life or safety improvements
- Vehicle performance including ride quality and crash worthiness
- Wheel/rail interaction dynamics
- New or improved mechanical components

Advanced Conference Registration is required for lead authors, before final acceptance of a paper for publication.

PUBLICATION SCHEDULE:

This is the overall publication schedule for JRC 2007. For specific details and questions regarding submission of papers, please contact Cameron Lonsdale at clonsdale@standardsteel.com

PUBLICATION SCHEDULE
Submission of Abstracts-November 1, 2006
Author Notification of Abstract Acceptance - November 5, 2006

Submission of Full-Length Draft Paper for
Review - December 1, 2006

Author Paper Review Complete and/or
Acceptance Notification - January 2, 2007

Submission of Final Paper and Required Forms
for Publication - February 1, 2007

EXHIBITS/SPONSORS

Exhibit Opportunity - Table-Top Display: What better way to promote your company name and products or services to the Railroad Community than to sponsor a table-top exhibit at the 2007 Joint Rail Conference. The cost for the display space is \$100 per foot of table space requested. For more information contact, Nick Darien at ndarien@ctlgroup.com

Luncheon Sponsors: Sponsorship opportunities are also available for the conference reception and luncheon. Donations of \$150 are requested, and each company contributing will be acknowledged at the luncheon and in the ASME RTD Newsletter. For more information contact, Monique Stewart at monique.stewart@fra.dot.gov

Program Advertisements: Business card size advertisements are being accepted for inclusion in the conference printed program at \$100 each. For more information contact, Nick Darien at ndarien@ctlgroup.com

ASME RAIL TRANSPORTATION DIVISION : RR-1 EXECUTIVE COMMITTEE
JULY 1, 2006 - JUNE 30, 2007

CHAIR

Roger D. Sims (year 5)
Sims Professional Engineers
2645 Ridge Road
Highland, IN 46322-1663
Phone: (219) 838-0011
Fax: (219) 838-0033
Email: rds@simspe.com

SECRETARY-TREASURER

Nicholas J. Darien (year 4)
Sr. Principal/Project Manager
CTL Group
Construction Technology
Laboratories, Inc.
5400 Old Orchard Road
Skokie, IL 60077-1030
Phone: [main] (847) 965-
7500, X3224
[direct] (847) 972-3224
Cell: (708) 334-9340
Fax: (847) 965-8997
Email: ndarien@ctlgroup.com

**TECHNICAL PROGRAM
CHAIR**

Cameron P. Lonsdale (year
3)
Vice President - Technical
Standard Steel
500 North Walnut Street
Burnham, PA 17009-1644
Phone: (717) 242-4698
Cell: (814) 574-5141
Fax: (717) 242-4680
Email:
clonsdale@standardsteel.com

**ASST. TECHNICAL
PROGRAM CHAIR**

David Tyrell (year 1)
Senior Engineer
USDOT / Volpe Center
55 Broadway
Cambridge, MA 02142
Phone: (617) 494-2687
Fax: (617) 494-3616
Email: tyrell@volpe.dot.gov

**PUBLICITY &
LUNCHEON CHAIR**

Monique Stewart (year
2)
Program Manager
Office of Research and
Development
Federal Railroad
Administration
U.S. Department of
Transportation
1120 Vermont Ave., NW,
Mail Stop 20
Washington, DC 20590-
0001
Phone: (202) 493-6358
Fax: (202) 493-6333
Email: monique.stewart@fra.dot.gov

**MANAGER OF
DIVISIONAL AFFAIRS**

Samuel R. Williams
5759 Scotia Court
Dublin, OH 43016-3256
Phone: (614) 766-6970
(614)-799-1870
Cell: (614) 570-9197
Fax: (614) 766-6970
Email:
srwilliams@columbus.rr.com

ASME STAFF

Elio A. Manes (support person)
Senior Program Manager
Knowledge & Community Sector
Mail Stop 23S1
ASME
Three Park Avenue
New York, NY 10016-5990
Phone: (212) 591-7797
Fax: (212) 591-7671
Email: manese@asme.org

2006 ASME/IEEE JOINT RAIL CONFERENCE: A Successful Meeting

87 engineers representing IEEE and ASME attended the 2006 JRC held in the Sheraton Atlanta Hotel, Atlanta, GA, April 4-6, 2006. The conference kicked-off with a tour of the Metropolitan Atlanta Rapid Transit Authority (MARTA) new Armour Yard maintenance facilities.



Technical papers (36) were presented on various subjects relating to freight and passenger car performance and safety, wheels, substations and catenaries, network management and reliability.



The Keynote Speaker at the IEEE/ASME luncheon was **Mr. Calvin L. Cox**, Assistant Vice President-Mechanical, Norfolk Southern Corporation. He addressed "Technological Challenges Facing the Railroad Industry."

RTD thanks the following companies for sponsoring the luncheon at the conference:

- Amsted Rail
- CTL Group, Construction Technology Labs
- Hadady Corporation
- Lea & Elliot, Inc
- LTK Engineering
- Miner Enterprises
- National RR Construction and Maintenance Assoc.



- Parsons Brinkerhoff
- Railway Research, Inc.
- Rail Sciences
- Standard Car Truck Company
- STV Incorporated
- A. Stucki Company
- STV Incorporated
- The Timken Company
- TTX Company
- ZTR Control Systems-Rail Business Unit

The conference was also enhanced by the support exhibitors who provided attendees with information and demonstrations on their products and services. Exhibitors were Rail Sciences, Whiting Corporation and Ensco Inc.

HISTORY of the RTD - ALEXANDER LYMAN HOLLEY 'An Engineer of Many Disciplines'

While **Alexander Lyman Holley** is honored with a bronze bust in Washington Square, New York City, few of the thousands who pass it each day recognize his name, or his importance to the engineering profession. Its supporting column is inscribed "To Alexander Lyman Holley, foremost among those whose genius and energy established in America and improved throughout the World the manufacture of Bessemer Steel, this memorial is erected by engineers of two hemispheres." It was erected in 1890 by the Holley Memorial Joint Committee of the ASCCE, AIME and ASME.

A "**scion of true American intellectual and moral worth**", Holley was born into a happy and virtuous New England home, on July 20, 1832, in Lakeville, Conn. Following a few years in the District School, he attended the best New England academies, giving him an excellent preparation for Yale University, where his brother John was educated.

But, young Holley had no love for classical studies and didn't want to go to Yale since it offered no course that would satisfy his keen interest in mechanisms. He evidenced a hard-to-control restiveness and indications of a versatile genius. Although his father preferred Yale, when he learned that a course in Natural Philosophy had been established at Brown University by Professor Alexis Caswell, he decided to send his son to Brown in October 1850.

Young Holley had a natural talent for drawing, and a keen command of visual imagery. He was especially interested in locomotives, one of the fields of engineering in which he became famous. During his freshman year he made a fine tinted drawing of the "Whistler" locomotive which ran on the New York, Providence and Boston Railroad.

Holley graduated in September 1853 as a Ph.D. His oration was on The Natural Motors. He then accepted a job as a draftsman in the Corliss, Nightingale & Co. steam engine and boiler works. At that time Mr. Corliss was developing plans to use a "detachable

variable cutoff" on the engine of a locomotive he named the Advance, but which was known euphoniouly as "The Old Jigger". In view of Holley's ingenious mind, good judgment, and common sense, he was chosen to operate the Advance on trial runs between Providence and Stonington, Conn. Although indicator cards showed superiority over the "link motion" locomotive, the "detachable cutoff" was too delicate to endure the jars caused by the rough roadbeds of that era of American railroads. Despite all attempts to solve the problem, it was found to be impracticable.

In a speech given at Hartford on the subject, "The Pursuit of Science, and later published in Volume IV (1883) of the ASME Transactions, Mr. Holley recounted:

"The idea began to obtain that science should be pursued not in books, but in things; and I commenced the pursuit of science in and on and under one of the awfulest things this world ever saw. It was Corliss's original locomotive, euphoniouly called 'The Old Jigger'. This locomotive was of a certain inborn cussedness which could hardly be the attribute of a mere machine -her spiritual nature was a sort of Mephistophelian cross with a Colorado mule; and as to her physical constitution and membership, a cotton factory 'mule' was simple in comparison. The Old Jigger had, as nearly as I can remember, 365 valves, one to break down every day of the year. And as to valve motion, well, nobody ever counted the number of its pieces. They were as the sands of the seashore. Most of them used to jar off the first few trips of the week, after which all the men in the shop could comparatively keep track of the rest of them. "I will say for the Old Jigger that she made the best indicator card I ever saw from a locomotive; clean cut-off, almost a theoretical expansion curve, and an exhaust as if she had hocked out a cylinder head. Once in a while, after she had been jackassing over the road about four hours behind time, and we had pinch-barred her into the roundhouse, we used to pull out those indicator cards of hers, and talk them over right before her, and we would look at her and ask one another why in thunder an engine that could make a card like that would act as if the very old-chief engineer was in her. And next morning she would rouse up and pull the biggest train that had ever been over the road - ahead of time. "But she was an inconstant old girl - and lazy too - used to prefer to work with one side, and always made some plausible excuse for breaking down the other. I remember, one March morning, when nobody was looking, she kicked off about two dozen pieces of her starboard valve gear, and brought up all standing, over a culvert about ten feet wide and full of ice-water. As I was standing in this culvert up to my middle, disconnecting her eccentric straps, a college professor came along, and rammed his umbrella into me, and asked me to explain to him the difference between this locomotive and any other locomotive! I then delivered my first scientific lecture: and I am now of the opinion that its diction would have been modified by a divinity student ..."

After this experience Corliss decided not to build locomotives, and since Holley's interest was obviously in that branch of engineering, he left the works with a letter of recommendation stressing his qualifications as an accomplished draftsman, with exceptional knowledge of locomotives. It ended with: "Mr. Holley leaves us, and carries with him our best wishes for his successes".

In the weeks that followed Holley wandered about the country, haunting every

locomotive shop without success. Hope diminished and doubt tormented his soul. But despite the loss of most of his money, and some of his pride, he was still determined to succeed. Finally, he found a job in the New York Locomotive Works in Jersey City, N.J., where the management soon became aware of his exceptional ability as a designer. He also had enough energy left to contribute to *The Railroad Advocate*, edited by Zerah Colburn, a former superintendent of the Locomotive Works. Holley entered into partnership with Colburn and became an editor, and later, as full owner he changed the name to *Holley's Railroad Advocate*. However, the business panic of 1857 forced him to give up this enterprise, but Holley's name had become well known to American railroad men and his reputation had spread to England and the Continent. Late in 1858 - he was only 25 then - he submitted his first article to the *New York Times* and wrote on all phases of engineering practice for the *Times* until 1875. Keenly aware of the superiority of British railroad practice, Holley and Colburn convinced a group of American railroad executives that a study of European methods would be of great value, and offered to undertake a study if their expenses would be covered. Assured of financial backing, they went to England in 1857 and on their return they published *The Permanent Way and Coal Burning Locomotive Boilers of European Railways*. In preparation, much time had been spent in traveling, inspecting, and interviewing by day; and analyzing and drawing, by night. The report, published late in 1858, revealed documented engineering data, and evidence of European ideas and equipment, far in advance of American thinking. Although somewhat disturbing to American railroad men, it was a justifiable tribute to English and European engineering. This comprehensive report was dedicated to their principal backer, Samuel M. Felton, president of the Philadelphia, Wilmington & Baltimore Railroad.

In 1862, Holley was sent to Europe by Edwin Stevens of the famous Stevens family to make an intensive study of the adaptability of armor plate to naval craft, and obtain useful information for the construction of the Stevens Battery. From a mass of accumulated data not otherwise available, he published in 1864, a widely accepted standard textbook, *Ordnance and Armaments*.

In the Fall of 1863, Holley went to Europe again for the purpose of buying the American rights to the Bessemer steel process. The process had failed to meet Sir Henry Bessemer's expectations, due largely to the lack of knowledge of the chemical reactions involved, but Holley studied the operations, analyzing the weak points with remarkable accuracy.

A year later, 1865, Holley designed and built the first American steel works in Troy, N. Y., capable of producing high grade Bessemer steel. How he did it was a remarkable demonstration of his ability to correct the faults and to accordingly redesign the massive machinery required. He abandoned the idea of a deep pit, and raised the vessels to the ground floor to provide working space under them. Top-supported hydraulic cranes, designed for greater crane power, replaced the expensive English counterweights. Cranes and vessels were worked from a single point. Cupolas replaced reverberatory furnaces, and an accumulating ladle which could be weighed before pouring into the converter, was an innovation. Each change was a radical departure from existing practice, and Holley reported them in Volume I of the *ASME Transactions*.

Following Holley's demonstration of the efficiency of the Troy plant, American investors, no longer distrustful, made large sums of money available to Holley for designing and building new plants. The American steel industry began to boom as steel plants were built in Pittsburgh, Chicago, Bethlehem, and elsewhere, from Holley's plans and under his supervision. Spurred by his leadership, American steel production soon surpassed that of Great Britain, and blossomed into the greatest basic industry of the United States. Holley was so devoted to the industry that his friends, deeply concerned about his health, "cautioned him not to burn the candle at both ends. But Holley never knew how to be idle". How does basic steel relate to rail transportation? In those years railroads were the steel industry's biggest customer, and the steel industry generated an enormous volume of freight traffic.

Holley's life span covered the era during which the engineering profession in America emerged as a separate entity. He became a member of the AIME in its first year, and later served as its president. He was also a member of ASCE. Aware of need of an organization for Mechanical Engineers, Holley took the initiative and arranged a preliminary organization meeting which was held February 16, 1880, in the New York office of The American Machinist. He served as its chairman, and in a prepared address he stressed the importance of recognizing the Field of Mechanical Engineering, and outlined the advantages of three ways the mechanical engineer might communicate with his colleagues:

1. The most obvious advantage is the collection and diffusion of definite and much needed information by means of papers and discussion.
2. A less obvious but ... a more important advantage of organization is the general, personal acquaintance thus promoted.
3. The habit of writing and discussing technical papers is of very great importance.

He also pointed out "the advantages of the association of businessmen with engineers", and the importance of "bringing professional knowledge, capital, and business talent together under the most favorable circumstances". These, and other wise precepts proposed by Mr. Holley are reflected in the subsequent history of ASME.

The first Annual Meeting of the Society was held in the New York Union League Theatre, November 4 and 5, 1880. Professor Robert H. Thurston of the Stevens Institute was elected president, and Mr. Holley, vice president. The ASME cherishes the memory of Alexander Lyman Holley as its proponent and one of its honored founders. His personality, charm, world-wide prestige as an engineer, and his phenomenal energy, were vital factors in the establishment of its lasting foundation.

Holley had many human virtues that marked him a paragon of man and engineer. He was youthful, dashing, and well-proportioned physically. He had a brilliant creative mind, a generous sincere open heart, and a personality that was a combination of engineering sense, artistic talent, and poetic insight. With a philosophic understanding of men, he had the will and energy to direct the power of his personality toward a good end. He won the loyalty and affection of his friends and was well-known all over the

world. Mechanics loved him as a brother. Basically he was a practical, exceptionally gifted American engineer, who always aimed to simplify, economize, and save labor. Mr. Holley was married in 1856 to 16-year-old Mary Slade. It was an elopement in the romantic tradition of that era, and the marriage was a very happy one. They had four children: three girls and one boy. His son and one daughter died in infancy.

Mr. Holley died in Brooklyn, N.Y. on January 22, 1882. Still a young man - he was only 49 - his heart and mind were absorbed in engineering. Conscious of his impending death, he said to friends around his bed, "I should like to live 10 or 15 years longer to aid in realizing the possibilities of the open-hearth process ... but I am satisfied. The Holley Medal, endowed by George I. Rockwood in 1923, perpetuates the memory of Alexander Lyman Holley.

Charles M. Smith

References:

Brown University Engineer, "Who Was This Man Holley?", Professor Samuel J. Berard, July 1964.

The Permanent Way and Coal-Burning Locomotive Boilers of European Railways, Colburn and Holley, 1958
