



The
PLS GAZETTE

P.O. Box 26202
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The PLS GAZETTE

A newsletter of the Pennsylvania Live Steamers, Inc.

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FIRST CLASS



Green Signals Ahead

This is my first Gazette editorial as the new president of PLS. Let me introduce myself; I have been a member of PLS for the past 15 years and previously served 4 years on the Board of Directors. I grew up in Ossining, NY the home of the New York Central, no boo's please, and for as often as I crossed the third rails on the multi-track Harmon line I feel lucky to be writing this message today.

I would like to thank Lee Nonnemacher for his service as President for the past year and for his previous years as Secretary, and as President in the early 90's.

April is the start of a new running year at PLS and I would like to welcome all members to join us for spring clean up and help get the club out of its winter mothballs and prepare the facility so trains can once again come to life on the mainline. There is always a lot of work to do to get the facility up and running. If you have any questions please do not hesitate to ask me or one of the officers or directors for

where you can help out.

At the March Membership meeting the budget was approved along with three major projects. The new car storage building for 1 inch scale 4 ¼ gauge cars was approved along with an addition of a roof extension to the 1 ½ station that will cover the 4 benches on the west side of the main station building. The third approved project is the building of a shed roof on the west side of Engine Storage Building #3 for the storage of the tractor/backhoe and our cement mixer. The new car storage building required that we submit a request for a zoning variance for set



Allen Underkofler

The PLS membership gathered at the clubhouse on March 16th to elect a new president and three board members. Outgoing president Lee Nonnemacher (checkered shirt with papers in hand) presides over the meeting.

Election Results

Elections were held at the regular membership meeting on March 16, 2013. Frank Webb, Bob Blackson and Walt Mensch, running unopposed, were confirmed as president, secretary, and treasurer, respectively. There were eight names on the ballot for the board of directors, for which three were to be elected. Those elected were Sharon Connelly, Ron Henderson and Bruce Saylor. Rounding out the board with one year remaining on their two-year terms are John Bortz, Jr., Bob Freer and Jim Salmons.



Clockwise from Near Right: Frank Webb, Ron Henderson and Bruce Saylor are the club's newly-elected officers.

Green Signals Ahead

(Continued from page 1)

back from the front of our property, current zoning requires 75 feet, we have requested a variance to 20 feet. Hopefully a decision will be made at the Perkiomen Township meeting on April 24th, Walt Mensch and I will attend.

However, before we begin working on any of these new projects we have several existing jobs that need to be completed. Over the winter good progress was made on 7 ¼ inch “East Rahns” passing siding located at the east end of the lower tunnel. Both switches were constructed and are now in the mainline. The siding track will be put in place over the next several weeks, weather permitting. The siding still requires an electric switch, selection pushbuttons, wiring, signal head and supporting electronics. Another project that must be completed before the April run day is the new centering plate for the turntable located in the lower steaming bays, this project has been delayed by the wet and cold weather. Ron Shupard has been leading the effort to upgrade the 1 inch track in front of the 1 inch station, as of this writing work is coming along nicely. The signal and switch team lead by Ron Henderson has been working to complete the addition of several new signals on the 1 inch track just before the walkway as you approach the mainline/station/yard switches. Another project that needs our attention is the repair and replacement of rotting wood on the multi-gauge bridge that crosses the 7 ¼ mainline tracks just

2013 PLS Calendar of Events

Saturday, April 20	Board of Directors Meeting - 9:30 AM Membership Meeting - 12:30 PM Spring Clean Up Afternoon/Evening Run
Saturday, April 28	Run Day - Members & Guests Boiler Testing
Sunday, May 5	Run Day Rain Date
Saturday, May 18	Board of Directors Meeting - 9:30 AM Membership Meeting - 12:30 PM
Friday, May 24	Spring Meet – Members & Guests
Saturday, May 25	Spring Meet – Members & Guests
Sunday, May 26	Spring Meet – Members & Guests

east of the 1 ½ station. Needless to say there is always something for to fill the Wednesday and Saturday work days all year long. Members are always welcome to come out and lend a hand.

See you on the Mainline,

Frank Webb - President

Membership Gauge

As of March 31, PLS has:

- 106 Regular Members**
- 207 Associate Members**
- 7 Honorary Members**

Donation Acknowledgements

PLS wishes to thank the following members for donations received during February and March: Edward Kabak, David Taylor, Bill Lambert, Judith Taylor, John Bortz Jr, Carl Bruhns, Rich Falzone, Michael McDevitt, Harry Quirk, Jared Schoenly, Tom McInerney, Robert Smith, Virginia Kulak, Robert Goepel, Jeff Stahl, Buddy Borders, Sue Borders, Stephen Roadcap, Jim Connelly, Sharon Connelly, Sean Skelonis, Carl Skelonis, Faith Skelonis, Eric Peffel, Brittany Grimm, Don Maleta, Joseph Rohanna, and Roy Nelson.

Pennsylvania Live Steamers, Inc.

President	Frank Webb	77 Roundwood Circle, Collegeville, PA 19426	president@palivesteamers.org
Secretary	Robert Blackson	303 North Tulpehocken Road, Reading, PA 19601	PennsylvaniaLiveSteamer@comcast.net
Treasurer	Walter Mensch	1348 Sheep Hill Rd., Pottstown, PA 19465	
Gazette Editor	Allen Underkofler	Box 609, Kimberton, PA 19442-0609	pls@apunderkofler.com

Board of Directors: John Bortz Jr., jonyx@netzero.net; Sharon Connelly, connellywood@verizon.net; Bob Freer, W3YLT@Juno.com; Ron Henderson, ronjhenderson@verizon.net; Jim Salmons, jshay6@verizon.net; Bruce Saylor, bgsberk@comcast.net.

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Passing Siding Nearing Completion

Work has resumed on the 7¼-inch passing siding after a much-needed break in the weather. The first photo shows the completed double-curved turnout installed at the approach to Mercer Bridge. The second photo is of the work crew on Saturday, April 6 in the process of leveling the new track and tamping the ballast to provide a firm roadbed. That operation was completed by noon that day up to and including the turnout in the first photo. The signal crew was also out there making necessary connections to restore the mainline signaling that was interrupted by the turnout installations.



a peak cylinder pressure somewhat lower than boiler pressure. The area of that card measured with the author's K&E Amsler planimeter (Figure 3), is 28.4 sq. cm. Dividing that area by the 11.7 cm. length of the expansion cycle yields an MEP of 37.8 psi when the boiler pressure is 100 psi. Now suppose the card was obtained from a 1.5" scale NYC J3 Hudson running at 8 mph (64 scale mph). The Indicated horsepower is calculated from:

$$\text{IHP} = 4 \text{ PLAN} / 33,000$$

Where:

- P** is the MEP in psi
- L** is length of stroke in feet
- A** is piston area in sq. in.
- N** is number of revolution per minute

Constant 33,000 converts foot-pounds per second to HP

Notes: The factor 4 represents four power strokes per revolution. For strict accuracy piston rod cross section area should be deducted from piston area for two strokes, but that is ignored here. N, number of revolutions per minute, is calculated from locomotive speed and driver diameter.

At 8 mph (pretty fast) a 79" driver turns at 272 rpm, which is N in the equation. The MEP is 37.8 psi, as determined with the planimeter, and all other quantities in the equation are

directly scaled from the prototype. The engine is working really hard, to say the least, as it develops 2.33 IHP, or about 2.1 Drawbar-HP when friction losses are deducted. That is some power output; it will produce 98 pounds of force at the drawbar! Sometime when one of you fellows is hauling a long freight drag with a J3, throttle wide open and linked-up at 25% cutoff (never happen), it would be interesting to know what the drawbar pull is while highballing at 8 mph, if possible, to see how close it is to the calculation.

It isn't possible to use a conventional indicator on our small locomotives because the volume of steam they use is too large compared to cylinder displacement. To circumvent that limitation, British model engineer Brian Lee, devised an electronic system over forty years ago to display cylinder conditions of a 3/4" scale 0-6-0 *Juliet* on an oscilloscope screen. He used a solid state pressure transducer to generate a voltage proportional to cylinder pressure for vertical deflection of the 'scope. A potentiometer linked to the crosshead provided a d-c voltage corresponding to stroke for horizontal deflection. The locomotive was restrained while its drivers were loaded by a board pressed against its drivers. Oscilloscope waveforms were photographed for later analysis. Brian discovered from his early "electronic cards" that the valve was not fully

uncovering an admission port, a defect he was able to correct and verify with subsequent tests.

Brian's work was carried to an even higher level in 1992 by Bill Hall, another Brit, who built a steam plant with a highly instrumented boiler and temperature sensors embedded in the walls of a stationary engine's cylinder. He found when using saturated steam there was a significant drop of cylinder pressure caused by condensation of steam on cylinder walls. The walls had been cooled during the previous cycle by contact with low temperature steam before it was exhausted. When Dr. Hall used 100 degrees of superheat the steam was too hot to condense and his engine developed the same power output as it had with saturated steam *but with 39% less steam consumption!* His measurements prove that even in miniature engines when steam temperature is raised high enough above saturated temperature a superheater performs a far loftier function than a "steam dryer" – it vastly improves the engine's performance.

Indicators of old and their comparable modern electronic equivalents tell us a lot about the performance of steam engines, large and small. In our hobby it is up to individual engineman to decide to take heed or ignore what is revealed. The PRR certainly used the information they had to great advantage! 🍷

For Sale – 1" Scale Train and Parts

- 1 Aluminum cast 4' gondola
- 1 Home-built 5" gondola with 2 seats
- 1 Caboose specially made for carrying personal property.
- 1 GG-1 Locomotive 4-6-6-4 Powered by 12-24v 3.5 amp motors (geared 2 per axle).
- 1 Battery car (box car) included with engine



Main Control with R/C remote feature intended for train riding in one of the cars in the train and a spare bare-bones set for use in case main unit needs fixing. An instruction book included with a schematic drawing of wiring and electronics shown. For the first ninety days I will have it fixed (on me) if the control is returned to me. I cannot promise how long such a repair might take as I would have to send it to Marietta, Ga where my son lives. He built the control

about seven years ago, and is an expert in electronics.

Inventory of parts is not yet completed, but will be posted at clubhouse at Rahns.

Suggested price for cars: \$750 each. For the locomotive, give me your offer and I will consider the best offer.

George Lord (610) 356-5713.

2013 Spring Meet Information

The Spring Meet will be held on May 25th and 26th this year. As usual, running may start on Friday afternoon, May 24th. Volunteers are needed for gate duty, station duty, and kitchen duty. Please sign up for a time slot when you arrive at the meet. Your donation of baked goods is always appreciated.

Please note: during the meet, the clubhouse refrigerators are used for food and drinks sold by PLS throughout the weekend. Should you need refrigeration for either personal use or items brought for the pot luck dinner, please use your own cooler if at all possible. Thank you.

Membership Renewals are Past Due

All membership renewals were due by March 1. If you have not renewed and wish to remain a member, please do so at this time. Dues must be accompanied with the completed renew-

al form which you received in early January. If you need another form, please e-mail secretary@palivesteam.org. This will be the last notice.

For Sale

NEW! Little Engines 2-6-0 finished and tested 11/2012. Pulled my 6 car passenger train with ease. Contact Bruce Saylor for information. Asking \$14,750. E-mail bgsberk@comcast.net



Club Membership News

PLS welcomes new Associate members Chris Haas, Dolores Stahl, Tom Cavella, Gita Talmage, Ray Gross, William Krayger, Faith Skelonis, Jack Barr, Richard Hunter, Ronald Drenth.

Storage Track Payments are Due

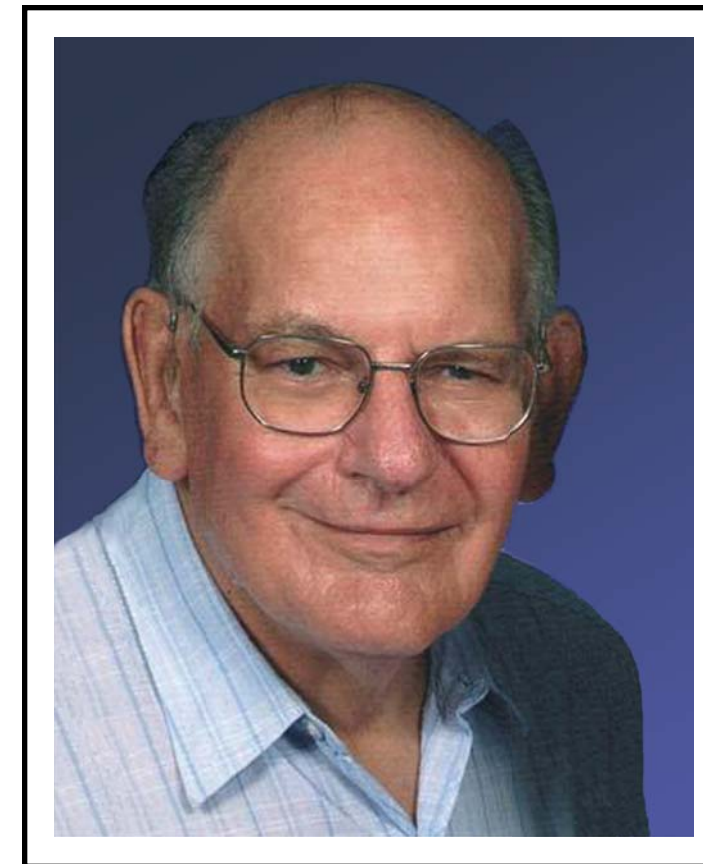
To regular members who have storage tracks at PLS: your annual fees are due as of April 1. Please see Walt Mensch with your payment or send it to PLS c/o the Treasurer.

In Memoriam

John Bixler

PLS honorary member John Bixler passed away on Tuesday, March 12, 2013 at his home in Hilltown Township, Pennsylvania. He was 90 years old. John served in the Army Air Corps in WWII and worked for SPS Technologies in Jenkintown for 42 years prior to his retirement in 1984. Following retirement, John joined PLS where he was a regular participant with our Wednesday work crews for many years. John became a regular member after completing a small switching locomotive and riding cars, which he operated at our run days. Unfortunately, John's health began to fail him several years ago and became unable to participate in club functions. It was then that he was awarded honorary membership in PLS. Our condolences go to his wife, Rita.

Contributions may be made in John's memory to the American Parkinson Disease Association, Inc., 135 Parkinson Avenue, Staten Island, NY 10305 or to Crossroads Hospice, 523 Plymouth Rd., Suite 225, Plymouth Meeting, PA 19462.



Testing Steam Locomotives

Indicators and How They Are Used

By Bob Thomas

Railroads had good reason to operate their locomotives at maximum efficiency: cost of fuel and delays from replenishing water directly affected profit. Engine performance was reflected in time tables and ultimately on the balance sheet. The Pennsylvania Railroad was in the forefront of locomotive development in 1905 when their Altoona test stand went into operation. It consisted of a massive foundation with wheelsets that could be moved directly under the locomotive's drivers. Test stand wheels were coupled to hydraulic pumps that applied adjustable restraint to the drivers to simulate train resistance. Tests were made with the locomotive operated in place at various loads, speeds, and throttle and cutoff settings. Measurements of water and coal consumption were made along with recordings of time, drawbar force, equivalent locomotive speed, steam quality, smokebox vacuum and various temperatures. At the same time graphs of cylinder pressure vs. stroke were periodically recorded by an ingenious mechanical instrument called an *indicator*, which will be described in detail later. Measurements of indicator graph recordings, known as "cards," revealed power developed by steam acting on a piston in the cylinders, from which engine efficiency could be calculated. Overall efficiency was determined by the ratio of heat input (coal consumption) to power developed by the drivers. Indicator cards revealed the effects of steam chest pressure, valve timing, back pressure and superheat.

Lesser railroads had to resort to on-track testing of their locomotives coupled to an actual train through a dynamometer car. Instruments in the

dynamometer car recorded drawbar force, distance traveled, and time, from which locomotive power output was plotted on a moving chart for various operating conditions along the route. The indicator was mounted right on the cylinder itself so someone had to attend to it while huddled inside a "doghouse" temporarily erected over the cylinder near the front end of the locomotive. The late Harold Crouch of Finger Lake Live Steamers conducted numerous such road tests of New York Central power inside a dark, cramped doghouse deftly actuating the indicator, changing cards and making notes, all within inches of the smokebox while a blasting, bucking, swaying Niagara or Hudson pounded along at 60-plus. No wonder Harold was profoundly deaf in his later years!

Figure 1 – Photograph of the author's vintage indicator.



An indicator is the crux of reciprocating heat engine performance measurement – including I.C. engines and compressors. James Watt originated the basic concept two hundred years ago and by the mid-1800s they were being manufactured by several instrument makers. Figure 1 is a photograph of the author's Robertson-Thompson indicator made around the turn of the century.

Refer to the cross section of a typical indicator in Figure 2 for the following explanation of its operation. The indicator is connected to a port in one end of an engine's cylinder through a tapered fitting tightened by hand with two short handles, bottom left. Steam pressure from the cylinder forces a piston against an accurately calibrated spring that compresses in

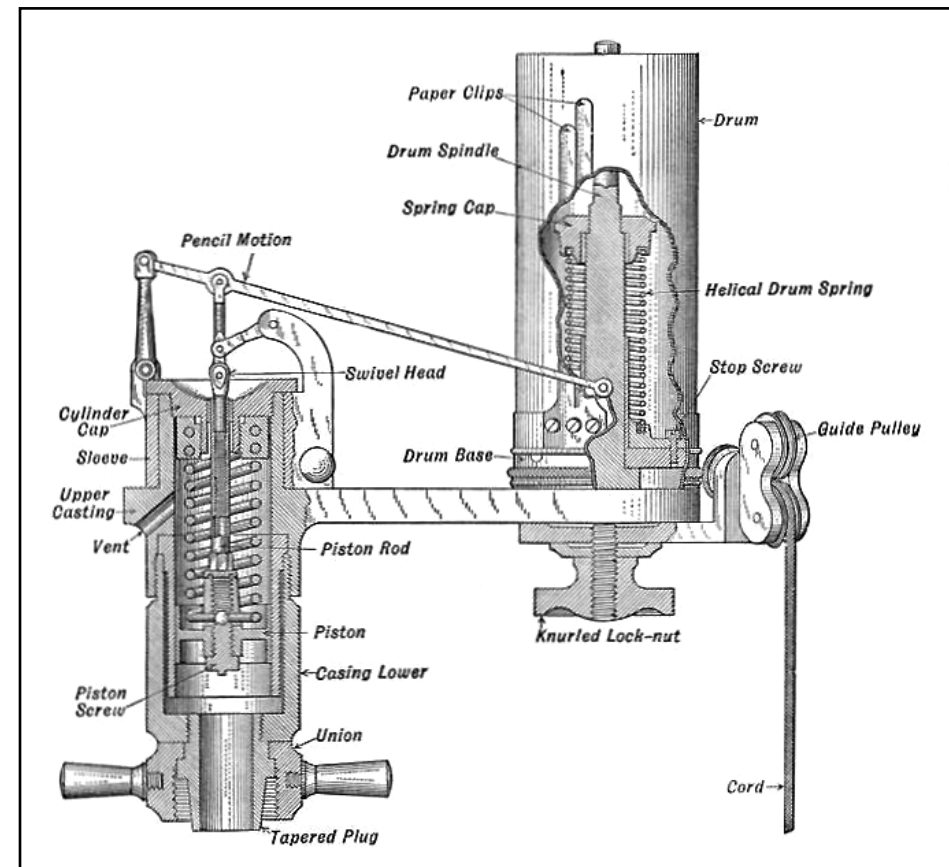


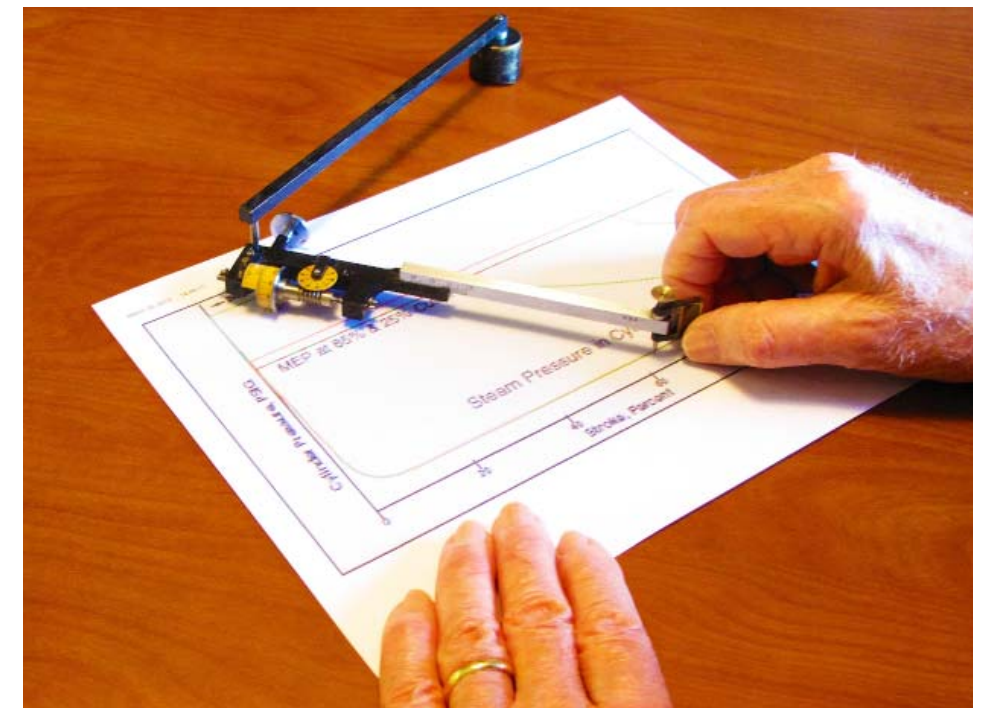
Figure 2 – The cross section of a typical indicator

proportion to cylinder pressure. A vertical connecting rod from the piston drives three levers of a Watt's Linkage to move a pencil point vertically on a blank paper "card" wrapped around the rotating drum at right. A flexible cord wound around the bottom of the drum passes through guide pulleys to the engine's crosshead through a reduction lever system to rotate drum in proportion to the engine's stroke. Constant tension is applied to the cord by a helical spring inside the drum. Combined actions of the pencil's vertical motion (cylinder pressure) and drum rotation (stroke) produce a graph from which engine performance can be deduced. A short hand-lever, plainly visible in the photo, is attached to the stylus drive mechanism to move the pencil in contact with the card to record only one cycle of piston movement. Four cards are generally made to record conditions at each end of both cylinders for a complete locomotive performance analysis.

After cards are recorded they are examined for any deviations from ideal operating conditions caused by

errors in valve setting, piston or valve blow-by, leaking glands, or excessive back pressure. Then they are physically measured to determine "indicated horsepower." A comparison of indicat-

Figure 3 – Using a planimeter to measure the area of cylinder card.



ed HP and drawbar HP reveals friction losses in driver and rod journals and valve gear.

Calculation of indicated horsepower requires knowledge of the Mean Effective Pressure (MEP). As explained in the earlier article, "Steam Cutoff – Part 2," March/April 2011 *PLS Gazette*, MEP is a fictitious constant pressure that produces the same work in the cylinder as the actual pressure that varies with piston position. The MEP shown in the article was determined by a graphical method but the most accurate method is to measure the area enclosed by the expansion curve and divide that by the stroke distance on the graph. The result is the average height of the expansion curve which is the MEP. Irregular areas are most accurately measured with an instrument called a *planimeter*. These clever devices have two hinged levers, one with a fixed pivot point and the other carrying a pointed stylus used to trace the curve being measured. Two friction wheels at right angles roll on the diagram to record stylus motion on dials as illustrated in Figure 3.

To explain how an indicator card is used to determine horsepower we will measure the one from the earlier *Gazette* article. That card is typical of an engine running at 25% cutoff with