

Smokebox Demonstration
by Dick Thomas

The following article was extracted from the November 2002 issue of the CallBoy – Pat Young Librarian.

Technical Program Summary for October 11, 2002 Meeting

Dick Thomas, who was originally scheduled to talk, was ill so his presentation was made instead by Steve Vitkovits.

SMOKEBOX DEMONSTRATION

In August, Dick explained the function of the major components in the smokebox and closed by listing their functional relationships. The purpose of this second talk was to demonstrate those relationships via a smokebox mock-up. The mock-up was constructed of wood and roughly proportioned for 1 ½ inch scale. The stack was a piece of kitchen sink plumbing. It was a thin walled tube 1 ½ inch in diameter with a flare at one end. This "found" component became the defining start to the whole demo. The stack was fitted so it could be adjusted in the X, Y, and Z directions. Also, a movable choke with a one inch throat, 10° entry slope, 5° exit slope, and about three inches long was made for the stack. The exhaust stand was a piece of ¼ inch pipe. Nozzles of 0.094, 0.078, and 0.063 diameter were fitted into tubing fittings that screwed onto the top of the pipe. A manometer was installed on the side of the smoke box to indicate the vacuum level. A small, low pressure compressor was used to provide the "exhaust". The demonstration consisted of a series of experiments in which the effect various adjustments was shown.

These were the observations made:

1. The stack and nozzle must be coaxial. Unlike the mock-up, a locomotive stack and exhaust stand will be fixed relative to the smokebox; therefore, the builder must accurately position them during fabrication. However, the exhaust stand should be made vertically movable so the nozzle-to-choke height can be adjusted for maximum performance.
2. Decreasing the nozzle diameter increases the vacuum, but if carried too far engine performance will suffer from high back pressure.
3. A flare on the petticoat pipe increased the vacuum.
4. The addition of a choke increased the vacuum dramatically. It was the most important modification to a straight bore stack.
5. Since a steady supply of air pressure was used with rather small nozzle diameters, the mock-up resembled a blower more than it did main vacuum producing components. Remember, with the custom of running with late cut-offs, the exhaust will be a series of pressure pulses with peaks as high as ½ times the inlet pressure.

Conclusions:

1. Keep in mind that the mock-up was used only to observe changes in performance for various adjustments and that one should not attempt to "scale" any of the components to an actual engine. Further, while a higher vacuum usually leads to better steaming, the absolute vacuum is not a fixed number that one should strive to obtain. The

correct vacuum level is the one that produces the desired steaming performance. Comparing vacuum levels between two engines, even similar ones, regarding steaming performance is meaningless because of variations in firing technique and coal properties.

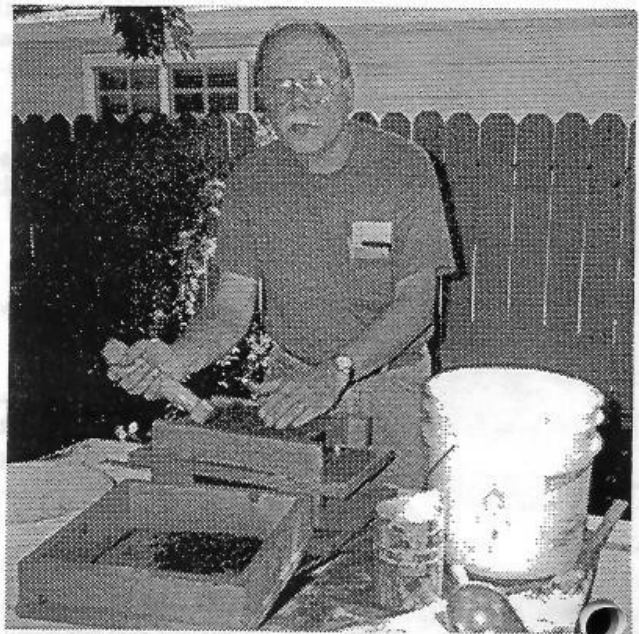
2. If an engine boiler is being built to a proven design, stick to the prints, but at least make the nozzle height and nozzle diameter easily changed or adjusted.
3. If you are experiencing steaming difficulties with an existing boiler and suspect the front end make a manometer and record a baseline reading. Then experiment along the lines described above noting the resultant vacuum for each change. Do this both for the engine on blocks and while actually running on the line. Make a fixture to hold the manometer on the pilot and either connect it to the smokebox via a small connector or use a piece of small diameter copper tubing and simply push it down the stack.
4. When designing a new boiler, use the rules of thumb described in August 2002 as a guide. Strive to make a stack with a flare, a choke and a bore with a tapered exit.
5. For further experimentation, consider nozzles with multiple orifices, and nozzles with divergent exit bores.

Thanks to Dick Thomas for preparing the outline for this talk.

DEDICATION PLAQUE

The Following names will be attached to the trestle structure at the track. We do not wish to omit any of our past "Life Members" who are no longer with us, if you know of anyone's name that is not listed, or listed incorrectly, please advise a board member.

Ken Brenneman
Bob Cherry
Albert DeFreitas
Barney Embrson
Boynton Green
Ralph M Heintz
Clyde Johnson
Louis Lawrence
Ed Lisherness
Ralph McChesney
Victor Shattock
Henry Steimle
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TELL ME AGAIN, "WHAT'S A COPE?"