(c) Respiratory problems in the blast pipe restricting the exhaust (contributory)

Had this issue been resolved greater power, greater economy may well have resulted.

"Review of Testing and Evaluation of an Improved Steam Engine" by Roy A Renner (Courtesy "The Steam Automobile VOL 25 No 2 1983")

This forward thinking team took Steam Car engine efficiency to very creditable 24% and appear to have reached similar conclusions and I quote "Another design improvement has been proposed to reduce throttling losses at the first stage inlet (poppet valve). As steam chest can be installed upstream of the inlet (poppet) valve, storing enough steam to allow filling the cylinder with a minimum pressure drop in the steam line. Of course the steam chest would be heavily insulated."

The Single Headed Poppet Valve Advantages

* Capable of handling vast quantities of superheated Steam.
* Comfortably able to handle steam temperatures in excess of 1,500oF
* Little potential for leakage
* No rubbing contact with sealing surfaces, minimum friction
* Separate steam admission and steam exhaust valve
* Very short cut-offs indeed can be achieved
* Variable exhaust and inlet timing, able to be optimised for best performance
* Minimum clearance volume can be achieved
* Can be made self opening in the event of water compression
* Does away with upper cylinder lubrication, as only the valve guide requires lubrication. Modern seals will prevent oil ingress into the cylinder head.
* A self-opening admission valve could nullify the effect of clearance volume and increase steam temperature by compression and improve efficiency (doubtful).

Disadvantages

(a) Unacceptable high forces involved in opening the steam admission valve

(b) Once open it will refuse to close until the piston is well on its descent until a pressure differential exists

(c) When it does close it closes with an almighty crash driven on to its seat by the inertia of the steam Valves usually close after the contoured ramp on the cam has long gone (valve bounce)

(d) Uncontrolled closing affects engine efficiency

(e) Exhaust valve very reluctant to close, valuable exhaust compression lost through the valve

Possible Solutions

(a) We all know that, say a 1,000psi inlet pressure is likely to subject the valve opening mechanism to as great as 500lbs/F. Did Roy A Renner, Dutch Industries and the rest of the team miss this? On page 30 sub heading "Motoring Tests" This is further illustrated in graph FIGURE 5.2 Page 29. We may question that the valve train was not under load when the friction tests were undertaken. Use of a Stepper Motor with engine in steam at 1000psi + may have told a different tale.

(b) Hit the valve stem with a 14lb hammer that will do the trick.

(c) Next best thing is to use the deliciously named "Bash Valve" which is no more than a projection screwed on top of the piston that impacts the valve off its seat on the last 1/8" of travel.

On the credit side the "Bash Valve" gives the valve a very desirable opening and in theory an almost ideal cut-off at approx 3%. Unfortunately the valve becomes very obstinate like a small child and will only close when it wants to.

(d) This problem was picked up by Peter Barrett in his article * "The Steam Automobile" Vol 26 No 4 1985 Appendix P14, where he has calculated that the kinetic energy of the valve is 64 times greater when it crashes in to land as against staying with the lift pin.

(e) Peter went on to have his Bash Valve redesigned by Jay Carter SR with spring assist to close. Spring poundage at fully open was 18lbs/F. We may question that a relatively small additional spring pressure would influence the valve to follow the lift pin on its descent and cure problem (see P11 to 13)*

The answer may lie in Bash Valves losing favour, but they may well have a role to play in the future.