The River Steam Boat: A Ticking Time Bomb

Out of the experience of the early years of the river steam boat, there emerged two architectures of steam-engine design and building. The first and for some years the predominant one was that provided by Boulton and Watt, with their low-pressure condensing steam engine. This was the architecture followed by Robert Fulton with his early success on the Hudson estuary. However, it was less than a decade after Fulton’s successful trip up the Hudson that steam engines based on designs using high pressure steam began to evolve. The result was largely to reshape the pattern of steamboat design and virtually eliminate the earlier low-pressure practices of Fulton, Boulton and Watt.

The development of the high-pressure steam engine with its attendant steam boiler was governed almost entirely by practical considerations. The advantages of the simple, compact, low-cost high pressure engine over the low-pressure engine with its complicated condensing apparatus, greater size and weight, and heavy requirements of condensing water were clearly apparent and appropriate to American conditions. These conditions were (1) scarcity of capital and skilled labor, (2) scarcity of repair facilities and (3) limited scale of operation. All of these conditions, at one time or another, contributed to the fateful disasters that followed.

Although explosions were by no means confined to boilers generating steam at high pressure, it was with this class of boiler that this type of operating hazard appeared in its most destructive and spectacular form. Every high-pressure boiler was in operation a storehouse of concentrated energy in the form of water and steam at high temperature confined under pressures ranging from 30 to 150 psi [i.e., pounds per square inch] and upward. It has been calculated that a pound of steam at 60 psi yielded about one-third of the energy of a pound of gunpowder.

When some part of a boiler gave way under the straining pressure of the steam, the boiler, could explode with a thunderous blast that often could be heard for miles. The boiler shell could be ripped apart and hurled through space for hundreds of yards, causing death and destruction along its path.

No class of boiler – stationary, steamboat, or locomotive – was exempt, but it was above all the high-pressure western river steamboat that give the boiler and steam power its vilest name. The urgencies of navigation of swift and winding rivers – with irregularities of loading and handling impacting the level of the boilers at riverbanks without dockage and silt-laden feedwater – aggravated the ordinary problems of boiler attendance and care. With an average rating in 1838 of 70 horsepower per boat, and with multiple boilers carrying typical steam pressures of 100 psi and more, the steamboat’s power plant possessed a correspondingly high potential for disaster. The placement of the boilers near populated areas such as staterooms and promenades magnified the potential for lethal destruction, which might include fire and drowning. While the western waterways commanded the largest proportion of steamboat boiler disasters, eastern steamboat accidents also recorded their share of death and destruction.

Boiler Explosion on River Steamboat
The potential risks associated with developing a high pressure marine power plant was further complicated in the United States by encouraging racing between rival steamboats. This phenomenon was a socially acceptable pastime on the inland waterways, even though it presented situations yielding high probabilities for disaster. In many documented circumstances it was found that riverboat captains would “disengage” the safety valve so higher boiler pressures could increase the speed of the boat – purely for the satisfaction of obtaining “bragging rights” on the river.

Despite public outcries from certain segments of the population, racing continued until mid-century. Racing was a tremendous boost for increasing profits for the owners of steamboat companies. Results of races were published in the local papers and schedules of future “match ups” provided for a heightened excitement along the riverfront. If a race between competing boats did not end in a disastrous boiler explosion, lives and property were often lost due to collisions with other vessels or the rocky shoreline. Visibility problems were often the cause of accidents of races that were conducted at night or during poor weather conditions such as those involving fog and rain.

Very little was done during the first part of the 19th century to promote safety for those traveling on these river steamers. Racing trumped safety, as the steamboat entrepreneurs and government bureaucrats sat idly by as benign neglect and laissez faire attitudes carried the day.

Two initiatives were developed in response to the increasing problem with river steamboat accidents and boiler explosions. The position of the boilers on some vessels was changed to place their location on the “guards” of the vessel. The guards of a steamboat were located at the perimeter of the vessel and were intended to protect the paddle wheels from being rammed by other vessels. By positioning the boilers closer to the exterior of the boat, it was felt that the exposure to passengers in the event of an explosion would be minimized. Very little is written about this structural change, and it is expected that efforts to adopt a satisfactory solution was never fully realized.

The other innovation was known as the safety barge. A safety barge was “essentially a fancy scow which was hitched on behind a steamboat as a passenger annex.” The steamboat would pull this safety barge behind it by cable at a distance sufficient so that it would be undamaged if a boiler blew. This innovation, however, could only be implemented with side-wheelers. A moveable gangway with handrails connected the barge with the steamboat, across which regular passenger services, including meals, were extended. The one handicap that the safety barge had was the drag it had on the speeds necessary to make the steamboat competitive with other vessels making for the same destinations. One source commented that, “Once the novelty wore off and the panic died down, most passengers preferred living dangerously to wasting all that time [being pulled from the stern of the steamboat].”
The demand for government intervention began (in some circles) with the first major steamboat explosion (c 1820). Some thirty years of inquiry, argument, hesitation, and, poorly composed legislation (c 1838) passed by before the enactment of the first effective federal Steamboat Inspection Law of 1852. This legislation established the foundation for what became an increasingly effective control of steamboat equipment and personnel bearing upon safety. Applicable only to steam vessels, carrying passengers, it was concerned with the prevention of fires and collisions as well as the boiler explosions accounting for some 50% of the fatalities in earlier steamboat accidents.

Succeeding years brought improvement both in the requirements of the law and in arrangements for its administration. In the generation following the enactment of the 1852 law, the ratio of steamboat explosions and fatalities to steamboat tonnage markedly declined.

Some of the more noted 19th century riverboat boiler explosions on the Hudson estuary were: Aetna (1824), Jersey (1824), Constitution (1825), Chief Justice Marshall (1830), Reindeer (1852), Isaac Newton (1863), St. John (1865) and the Riverdale (1883).

Sources:
Hunter, Louis C., Steamboats on the Western Rivers, 1949

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