3200 Psi in 1923

THIRTY YEARS AGO, in the spring of 1923, POWER received a phone call from a stranger named Mark Benson. He had just landed in New York from England and was encamped at the Commodore Hotel. He wanted to see an editor. I was then an assistant editor, and was sent over to see what it was all about.

Benson pulled out a big sheaf of diagrams, tables and calculations—all relating to his radical proposal to generate steam at the critical pressure of 3200 psi in a once-through boiler.

With his permission I photostated all the papers and sweated out the two long articles published in POWER, May 22 and 29, 1923. These excited much interest all around the world. Digests appeared in the leading engineering journals of England, Germany and Russia.

With the cooperation of the English Electric Co, Benson was aiming primarily to provide 1500-psi steam for turbine operation without paying the price of the heavy boiler drum required for that pressure. He reasoned that feedwater pumped through boiler tubes at pressures slightly above 3200 psi would turn quietly into steam at the point where the fluid reached the critical temperature of 706 F. There would be no boiling—no steam bubbles to disengage, so no drum would be needed.

The 3200-psi steam would be throttled to 1500 psi and superheated before going to the high-pressure turbine.

Presumably, the very moderate steam temperatures then permissible, and the very small capacity of the proposed pilot plant (1000 kw) made it uneconomical to operate the turbine at 3200 psi, despite the obvious power waste in pumping feedwater at more than 3200 psi to produce turbine throttle steam at 1500 psi.

Here are some of Benson's proposed conditions: boiler outlet 3200 psi (plus) and 730 F; throttling to 1500 psi and superheating to 788 F; expansion to 200 psi in a tiny one-stage impulse turbine running at 20,000 to 25,000 rpm; reheating to 662 F; final expansion to 0.5 psi in a 7000-rpm gear-connected turbine. These were paper plans, not operating results. All pressures are absolute.

Now let's move on 13 years to March 12, 1936. I was in Berlin interviewing Dr Gleichman, chief engineer of the big Siemens-Schuckertwerke. Dr Gleichman kidded me about his bald head—said it was my fault. It seems that Siemens first heard of the Benson boiler through the POWER articles. Later, they bought the world patent rights from the English Electric Co. Gleichman said it took him years to get the unit working properly. As a result he lost a lot of sleep and tore out a lot of hair. Hence the bald head—which was my fault.

After 1929, however, Dr Gleichman continued, it was a different story. He got the unit under control, but operating well below the critical pressure—anywhere from 1200 psi to 2500 psi, depending on the load. Further details may be found on page 246 of May, 1936 POWER if anybody is interested.

In time, the Benson boiler came into wide use in Germany—also in Russia under the name Ramsin. We don't know that it was ever commercially operated at critical pressure, but it did operate without a drum, which made it attractive to steel-poor Germany just before the second World War. At that time about 170 units were running on land and sea.

It's worth noting again that Benson's announced purpose was merely to eliminate the costly high-pressure boiler drum. Under the technical limitations of his time it does not appear that he planned to operate turbines at the critical pressure or higher. It is a far cry from his ingenious pioneer proposal to present plans for an ultra-high efficiency plant with a throttle pressure of 4500 psi.—PWS