Cautionary Tale XXXVIII The Lessons of History

Unusual for this column, the moral of the tale comes first. The lesson is this: we can learn from the important developments in the spring industry of the past because they are likely to point the way forward in the 21st century.

When I attended the Japan Society of Spring Engineers (JSSE) conference in Nagoya last year, I was asked to write a few words about the most important stepping stones in the evolution of the spring industry worldwide. The Japanese who were at JSSE urged me to prepare a cautionary tale on this subject. They reminded me of this when I saw them again at Wire 2008 in Düsseldorf, and so I will not delay any longer. It is the Japanese view that a disproportionately large number of the historical developments originated from the UK, and that is my view too.

I guess the history of springs began with horse drawn cart suspensions and bows for firing arrows. Such springs were made from wood and/or gut strings. The first mechanical contrivances that required a better spring than could be made from wood were locks and guns. The availability of brass and steel, to use as springs materials for locks and guns, was very limited. This made these items expensive, but it wasn't everyone who needed them.

The first mechanical device that required springs in larger quantities was clocks. After the invention of the pendulum clock by Christian Huygens in the Netherlands in 1656, the invention of the hairspring for table clocks appears to have occurred contemporaneously and coincidentally by Huygens and Robert Hooke. Hooke, an English physicist, discovered his law that is fundamental to all springs in about 1660 and wrote it down in terms that scholars could understand in 1680. His first obscure definition was motivated by the need to keep the commercial implications of his invention for his own benefit. It said that the load applied to a piece of wire caused it to deflect and that load and deflection were proportional to each other. He also recognized that the area under the straight line of the load – deflection diagram was a measure of the energy stored and a spring is "a device for storing mechanical energy in the form of elastic strain."

The next significant development was a process for making high quality steel. Benjamin Huntsman, a clockmaker in Doncaster, England, found that the availability of steel for springs was the major obstacle to making a good living. He set his mind to develop a process for making steel which lead to the invention of the crucible process in Sheffield. In this process steel became molten, slag floated out and really high quality spring steel resulted. Unfortunately, Huntsman soon realized he could make more money by producing steel for knives and arms than he could out of spring steel. Was this the start of the spring industry becoming the poor relation compared with other steel products?

The next development was high quality spring wire. That became available following the granting of the patent taken out by James Horsfall in 1854. The Webster Company had already been making steel wire for over 90 years out of crucible steel. It became Webster and Horsfall in about 1850 when James Horsfall's heat treatment processes enable higher strength wires. Patented wire has a pearlitic microstructure that becomes strong enough for springs during the wire drawing process. Today hard drawn wire of this type is called music wire in some countries and piano wire in others. However, the term piano wire pre-dates the patent as it was used in the making of a piano that the Broadwood Company in London gave to Beethoven in 1818, and doubtless for many years before that.

The development of automatic machines for making springs started in the late 19th century and that would require a whole book to describe. The next material development of significance was the invention of stainless steel. Charged with the task of trying to find an

alloy addition to steel to improve the wear resistance of gun barrels, a Sheffield metallurgist named Harry Brearley noticed that some pieces of discarded steel (with high chromium content) in the yard didn't corrode like all the others. This is the story, often told in Sheffield, and reported in the New York Times and was the basis of the development of 400 series martensitic stainless steel, but history now tells us that one year earlier, Krupp metallurgists in Germany were independently investigating the effects of adding nickel and chromium to steel. These inventions laid the foundation for the development of the "300" series of austenitic stainless steels.

In summary, it can be said that spring manufacturing in all countries today was enabled by these inventions, which all arose out of the need for developing better products. Watch this column for details of the invention that will make my fortune and be important in the spring industry in the 21st century!

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Readers are encouraged to contact him with comments about this cautionary tale, and with subjects that they would like to be addressed in future tales, by telephone at (011) 44 114 252 7984, fax (011) 44 114 2527997 or e-mail m.hayes@ist.org.uk. or in person at Springworld 15th –17th October 2008.