

Basic functionality that hides a myriad of engineering expertise

From their precision use in the most exquisite antique pocket watch all the way up to brutal off highway earth-mover suspension systems, springs are often the unsung heroes of many applications. But do they deserve a little more airplay and engineering recognition? **William Hughes** comments



When you see the thought and engineering that goes into their creation, we definitely take springs for granted. The materials science and physics behind a spring's make-up and method of operation are well-documented, but these two are just part of what is a much bigger array of considerations when it comes to springs being fit for purpose in their target applications.

In-depth design knowledge, broad application experience and precision manufacturing arguably take up the lion's share of the skills behind spring design, development and deployment. This is why 'commodity' is such a harsh word to use when describing the results of what are often heavily involved development, design and manufacturing processes.

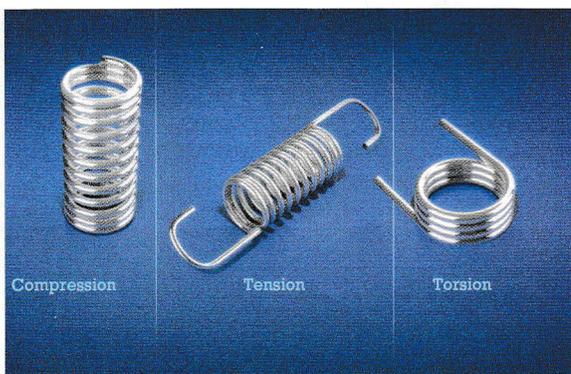
According to Emma Burgon, engineering director at William Hughes, a specialist in the design and manufacture of custom-made springs, wire forms and assemblies: "The function of a spring is surprisingly important in most mechanisms. In a valve, if a spring is too weak fluid will force its way through; too strong, the valve will stick."

And there is certainly a commodity mindset. "Quite often the spring is the last thing that is thought about in the design process," Burgon adds. "The hole that it fits into or the shaft that it fits over will often already be defined, so engineers have to come up with a functional spring that will fit in a predefined space.

"Luckily our spring designers have lots of tricks that can be put into play. There is no limit to the wire diameter or the material choice – they all result in different outputs. You can also change the number of coils

but keep the internal diameter the same. Once again this delivers a completely different result. Add processes such as shot peening or pre-stressing into the mix and the results are different again. However, in a perfect world, the earlier that the spring designer can get involved the better, as small changes in the envelope can result in more stable and more cost-effective springs."

the last few hundred years, the machines upon which they are manufactured have seen development and advances commensurate with the broader application and design variation of springs. Most of the parts that William Hughes manufactures are handled by CNC machines, with built in measurement equipment linked to a Statistical Process Control system, but traditional methodologies still apply.



SPRING MANUFACTURE

William Hughes caters for a wide range of functional demands, developing both large-batch stock items and bespoke wire forms for specialist applications. "We manufacture compression, tension and torsion springs as well as torsion bars, typically from high-carbon round wire that varies in diameter from 0.1 to 7.5mm," Burgon explains. "Our springs are mostly cold coiled on CNC coiling machines – even the low-volume orders – as we believe CNC coiling provides excellent consistency, delivering the quality we promise to our customers.

"Indeed, quality is a vital metric for us and our customers. In addition to our customer's unique and often very bespoke quality regimens, we are also accredited to the highest level for both Automotive (IATF 16949:2016) and Aerospace (AS9100 D & NADCAP), seeing audits at least once per year."

Although the design of basic springs has changed very little in

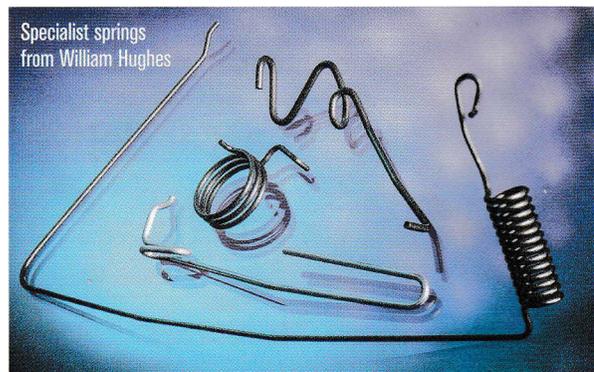
"We have been in business since 1790 and, over the centuries, we have seen a huge variety of products go through our books," Burgon, an eighth generation descendent of the founder, explains. "In the past everything was made by hand with mechanical equipment. In fact, we still do some manufacturing today using the same techniques that would have been used 100 years ago.

"Before the first world war we were making piano strings, which are made by coiling copper wire around a piece of high-tensile wire using something that looks like a lathe. Then, during the war we used the same technology to make springs. Between the wars we went back to making piano strings but returned to spring making during World War 2 and never stopped spring making after that.

"Over the last 50 years there have been lots of changes of spring applications in the UK. When I was a child, the factory was full of machines making springs for typewriters and BIC biro's, now it is automotive products and parts for the breathing apparatus of fighter pilots," Burgon concludes.

So, from WW1 biplanes to modern fighter jets, springs may not have changed much over the last hundred years, but the science, design philosophies and technology behind them certainly have. Are they really commodity products? In some cases... yes, but in others, they are an intrinsic high tech example of engineering evolution, critical to the application they serve.

William Hughes
www.wmhughes.co.uk



Specialist springs from William Hughes