



Cautionary Tale: Springs in the Leisure Industry

A spring is a device that is deformed under an applied load; the energy so stored is given back when the applied load is removed, often working at better than 99% efficiency. This is precisely the action a spring does when it is used in a trampoline or in gymnastic apparatus. When I heard the theme of this magazine I was reminded of a recent “You Tube” clip in which a gymnast was launched into the audience due to a malfunctioning spring. There are obvious leisure industry springs that must be reliable, but there are many others not so easily recognised. One such are the under-wires in a sports bra, and before readers’ imaginations get too carried away with these springs, the cycling that causes the risk of fatigue occurs in the washing machine, *not* on the athlete. Talking of athletes, should there be springs in runner’s shoes? Is this cheating? Should they be permitted in prostheses for disabled athletes? These springs are causing much debate today, but I emphasise; a spring is only up to 99% efficient – it cannot be 110% efficient.

Springs have many applications in sports equipment. Perhaps the earliest spring used by man was the archer’s bow originally used to hunt for food. The most dramatic example of a spring in sports may be the pole used for vaulting. The Motor Sport also uses many special springs for the suspension, brakes, gear box etc.... Some motor racing protocols insist on the use of springs for the valves, which is definitely more fuel efficient than the F1 system of closing valves pneumatically. In case you think that the F1 accident in which Filipe Massa was hit on the head by a spring was due to a spring problem; that titanium suspension spring was intact when it hit and seriously injured him. The important feature of all spring applications described so far is that the springs must be reliable, and assembled so that they cannot become airborne.

This theme can be continued into the children’s playground – the author’s granddaughter, Sky, loves bouncing up and down on the spring mounted camel in our local park. This spring may have been designed correctly; unfortunately, *IST* have seen some of these springs after they have failed in use, so I am selective in the equipment that I allow Sky to use. *IST* suspect some failures are due to use by “over large” children, but the springs should be designed to be reliable even in the face of this type of abuse.

Talking of babies, do baby bouncer springs, or the reclining seats used before babies can walk, count as part of the leisure industry? Whether or not they do, they also must be reliable, and this is the moral of this cautionary tale.

Designers and suppliers of equipment for the leisure industry have an obligation to ensure safety. *IST* strongly advocates rigorous testing to provide proof that the product is “fit for purpose”. This testing may be load testing to ensure the correct load / deflection characteristics, or, more importantly, fatigue testing. Visitors to *IST*’s laboratory seldom realise that the springs they see being tested are parts of under-wires, but that may be because most of our visitors are men. All of the springs mentioned in this article, apart from the bow and pole, have been tested by *IST*, using equipment designed specifically for this purpose, as per the large fatigue tester illustrated. Such testing is strongly recommended since it supplies a reassurance to the supply chain that the design of the product is rigorous.

Having completed this article I need a little leisure time. Maybe the springs in my sofa or bed will provide the comfort and relaxation that I need, so long as the springs have not relaxed of course!



PICTURE OF AN *IST* FATIGUE TEST MACHINE

Mark Hayes is Technical Adviser at the Institute of Spring Technology (IST) in Sheffield, England. He guides IST's spring failure analysis service and provides metallurgical advice to our customers; he also delivers spring training courses that the Institute offers globally.

Readers are encouraged to contact IST with comments about this cautionary tale, and with subjects that they would like to be addressed in future tales, by e-mail ist@ist.org.uk.

