

While Einstein was busy extolling the credibility of his theory of relativity, another inventor in Switzerland was exploring the first recorded use of springs in footwear. This is not really too surprising, as springs became a necessity in the production of the famed Swiss timepieces and firearms from the fourteenth century onward.

Spring has sprung

Mechanix Illustrated magazine featured spring-heeled shoes in one of its 1939 editions, claiming them to be the latest aid for “prolonging shoe life and eliminating all jars to the various organs of the body experienced by wearers of ordinary shoes”. The shoes shown in 1939 were coil springs attached to a rubber heel-plate, invented by a Swiss shoemaker, but there have been several other ‘spring’ formations placed in shoes leading up to today’s latest entries into the marketplace.

Springs are flexible elastic objects used to store mechanical energy, not all of which adhere to Hooke’s law, which states that the force with which the spring pushes back is linearly proportional to the distance from its equilibrium length. Springs come in numerous shapes and configurations from helical (coil) to tension, leaf to catapult, compression (volute) to V, spiral to cantilever, Belleville to torsion, air to wave and gas to rubber band. Materials can vary greatly too. Although one usually associates springs with their metal form(s) just about any material that stores potential energy can act as some form of spring.

Take Nike’s compressed ‘Air’ bag as a point in question. Undoubtedly, the most successful shoe feature in the history of footwear, Nike’s adoption of the M. Frank Rudy innovative air bag patent in 1978 is, by definition, a form of compression spring.

Shock absorbers for shoes

More recently there has been a renewed interest in the insertion of springs of all types into modern day footwear—both for casual and performance uses. Why then such an interest in adding springs to footwear when so many other materials offer better shock absorption? The answer is in the other reaction to a soft cushioned landing for the feet and body, namely energy return.

New Balance had a great advertisement for its running shoes years ago illustrating this point. They showed a runner wearing two pillows strapped to his feet and stating, “What could be more comfortable than this?” Without an adequate return or rebound of energy, once the



Kenyan athlete David Cheruiyot takes first place in the 2007 Ottawa Marathon at the end of May. Wearing controversial Stinger shoes from Spira, he achieved a course record time, and personal best, of 2:10:35.

📷 ING Ottawa Marathon



Al Gallegos, founder of Z-Coil 'Pain Relief' Footwear, believes his products can help alleviate pain in the heel, joints or lower back.

 Z-Coil

shoe has reached maximum compression, the shoe would only aid the foot when landing. Springs are the most efficient form of stored energy return. Of course, the balance between shock absorption and energy return determines the ultimate success of the mechanism placed in the shoe. Let's look, then, at the latest spring-enhanced footwear and their claims.

The most successful use of a 'spring' device in footwear to date has been Nike's compression air bag. Now out of patent in its original form, the idea has been emulated by many companies, using helium, nitrogen and even butane gases.

Air suspension has a dampening effect upon landing in a shoe but any energy return is derived from the encapsulated bag or bladder containing the gas. The pressure contained in the encapsulated underfoot device is expressed in PSI (pounds per square inch) and may be divided into separate chambers, thus enabling the stability and cushioning to be controlled according to the amount of pressure in each chamber. An undoubted advantage of air or gas shock absorption in footwear is its weightlessness. Air or gas shock absorbers cannot take a compression set (or bottom out) unless the container loses pressure.

Pain relief

The most exaggerated commercial form of spring footwear to date belongs to Z-Coil. Founded by Al Gallegos in New Mexico in 1995, Gallegos and his son Andrés have established Z-Coil footwear and its trade marked

slogan 'Pain Relief Footwear', despite the radical appearance of the product. They have spent many challenging years refining the shoes to stabilise the three-inch wide conical steel coil spring in the heel. The whole emphasis of the shoe is on impact reduction at heel-strike with the mission to bring relief to every person who suffers from foot, leg and back pain.

Initially, Z-Coil wearers experienced some instability when running in the radically plantar-flexed shoe, but with the inclusion of a rigid, built-in polypropylene cradle, called a Z-Orthotic, instability has been reduced. In the same way that a car's steel frame supports its shock absorbers, this anatomically shaped platform inside the shoe—in combination with increased thickness and cushioning in the forefoot—has reduced the angle of plantar flexion and provided better support for the foot. The spring coil is adjustable with a simple screw mechanism in the heel.

The establishment of Z-Coil's radical heel-spring shoe would not have been possible without Al Gallegos' relentless belief in the concept. He is not easily discouraged, and a fortunate business relationship with South Korean shoe manufacturer Yong Oh Lee developed. After making shoes for Nike and Reebok for many years, Mr. Lee offered to construct a shoe of any design for \$50. Needless to say, he was taken aback by the Z-Coil concept but accepted the challenge and the rest is shoe history.

In 2005, Z-Coil launched its retail franchise opportunity, named Pain Relief Footwear stores.

the only one

adv - plus d sensor

light™ the only one

innovation fabrics for the future

light™ as only one	light™ nature	light™ sea	light™ TECHNO STRUCTURE	light™ dry-state polymer mesh
light™ sport power	light™ sport comfort	light™ sport coolmax	light™ sport coolmax	light™ sport coolmax

CERTITEX CISO LYCRA

mr™ MAGLIFICIO RIPA

www.maglificioripa.it
email: info@maglificioripa.it

According to studies conducted at Los Alamos National Laboratory, Z-Coil's concept showed a 50% decrease in impact and between 40% and 50% improvement in energy return as compared to running shoes with elastomer midsoles. An interesting side note is that Z-Coil requires wearers to be custom fit in their own stores by a trained Z-Coil representative; the company will not sell through other retail shoe outlets.

'Ban me if you can catch me'

Engendering much publicity from the media with its 'Ban me if you can catch me' campaign and favourable reports from orthopaedic physicians, footwear company Spira has made an impact (albeit with less impact) with its WaveSpring Technology. WaveSpring is mechanical and will not break down or lose its extraordinary feel over time. In fact, the springs will most likely outlast the shoe.

Created and patented in El Paso, Texas, WaveSpring technology is laterally stable, lightweight and compact as opposed to more traditional coil or conical springs. According to Ray Fredericksen of Sports Biomechanics Inc. at Michigan State University, who directs laboratory testing for Runner's World magazine, Spira's springs (tested separately) have the highest energy return of any shoe technology tested to date. The patented steel design uses 87–96% of the potential energy that can be used during propulsion to optimise performance.

Spira has several configurations of WaveSpring engineered both for running and walking shoes; single heel, dual heel and forefoot, and TriSpring with one spring in the heel and two in the forefoot. In addition to an energy return of up to 96%, WaveSpring reduces peak impact forces by 20% to allow runners and walkers to participate in activities for longer periods with less stress on the body.

Controversy

Spira has gained excellent support and positive testimonials from many orthopaedic surgeons who have recommended the shoes to patients recovering from knee surgery, or to reduce stress on the joints of the ankles, knees, hips and back. On the other foot, Spira created considerable publicity with its campaign to offer \$1 million as prize money to any winner of the Boston Marathon wearing Spira running shoes.

This is in the face of an Amateur Athletic Federation (IAAF) and USA Track and Field Association (USTA) ruling that states that "no spring... may be incorporated in the shoes". This year's Boston Marathon saw Spira team up with Foot Solutions, the largest comfort footwear chain in the USA, to sponsor an elite team of Kenyan runners.

Although none of the Kenyan athletes won, they did lead for half the race and scored a moral victory (as WSA goes to press, news reaches us of a victory for one of the Kenyan athletes, David Cheruiyot at the 2007 Ottawa Marathon). Andy Krafur, president and founder of Spira loves the controversy—and the publicity. First, he's a lawyer and has entered a \$10 million lawsuit against the two governing bodies on the grounds of "restraint of competition". Second, Krafur argues that the IAAF and USTA have always embraced innovation—citing fibreglass vaulting poles and rubberised track surfaces as examples—so why not springs in shoes? After all, is compressed air not a form of spring? Better yet, is Nike's Shox system not a series of foam columns encased in plastic springs?



Elche-based J. Rubio has made more than two million pairs of sandals and clogs with in-built spring technology.

 J. Rubio

Force of gravity

Springs in footwear seem to attract attention, especially if they are advertised widely. There is, for example, a direct sales advertising campaign launched nationally in the USA by Gravity Defyer in airline magazines and catalogue publications. The company is owned and operated by Alexander Innovation Wizard (The AROA Marketing Company) with offices in Hong Kong and California and supported by a 200-strong group of manufacturers in China.

Gravity Defyer makes a quality range of men's leather dress and casual shoes with industrial-grade metal coil springs embedded in a high grade polymer unit sole. Gravity Defyer does it all: makes you taller, helps you lose weight (based on the assumption you will walk further and spend more time on your feet, thus using more energy exercising), eases joint pain and pressure on the spine; allows you to jump higher and walk faster and of course, at the same time defy gravity. Just to make sure nothing is left out, it includes a magnetic disc valve in the heel to increase blood circulation. Now, who was it that said that shoe people were not progressive?

On a lower scale, two other companies are trying their luck with mechanical springs. One is J. Rubio, a manufacturer in Elche, Spain, which has introduced springs into sandals and clogs. The visible spring is located between the upper and midsole or outsole unit and comprises a shock absorbing steel coil spring in the heel. J. Rubio specialises in women's shoes that are worn in hospitals throughout Europe claiming to benefit the wearer's feet, back and knees; it has already manufactured more than two million pairs. The other, Monster Spring Shoes, markets its products under the name of former American football star Dick Butkus and offers a limited range of work, casual, walking and golf shoes with a patented titanium coil spring system using ten springs in the heel and forefoot to absorb shock at foot-strike with mechanical integrity for better energy recoil. Monster Spring Shoes claims its footwear provides maximum comfort, support and shock absorption for the wearer, helping to alleviate foot fatigue, aching arches and associated lower leg pain. The company claims that wearing its shoes is most often described as 'walking on air'. 

KEEPING THE BODY TEMPERATURE

Material	Value
Dryarn®	10
WOOL	9,4
POLYESTER	8,5
NYLON	6,6
COTTON	3,6

THE FEEL GOOD MICROFIBRE
Dryarn®
 BY AQUAFIL

www.dryarn.com
 Dryarn is produced exclusively by Aquafil