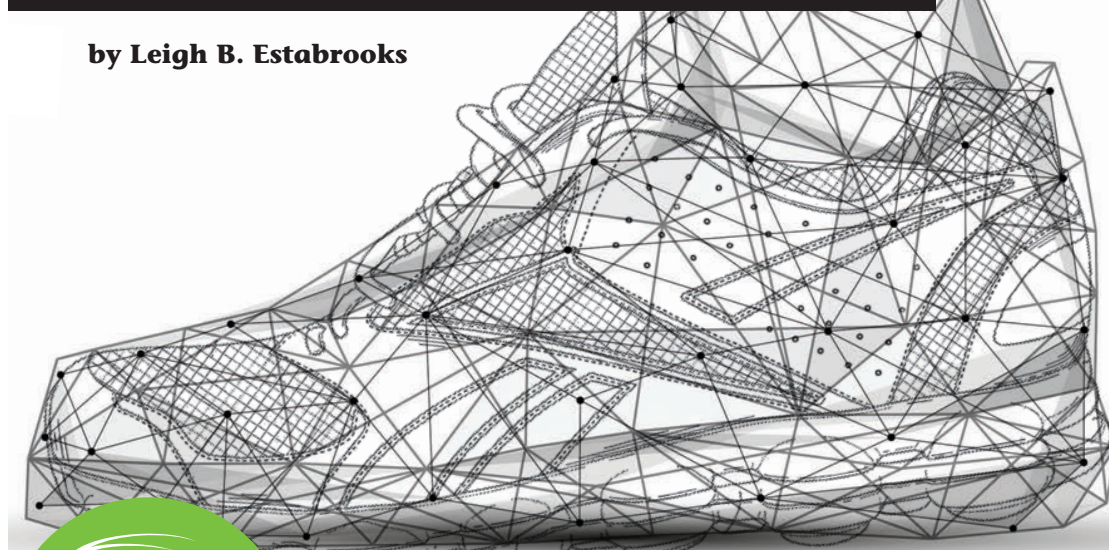


# A CLOSER LOOK

by Leigh B. Estabrooks





**On July 31, 2018, Reebok International Limited was assigned U.S. patent 10,034,517 for a sole and article of footwear having a pod assembly. Did you know that patents are numbered?**

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IT researchers and material scientists Michael Tarkanian and Dorothy Hosler have analyzed the records to detail one process the ancient Mesoamericans

used to make rubber (see also pages 25–27). It included mixing the milky sap or latex tapped from rubber trees with juice from morning glory vines. What attracted their attention, in particular, were the solid, bouncy, elastic balls the Mesoamericans used for play in games. They found that these balls had been tailored in such a way as to produce the characteristics Mesoamericans wanted in their balls. It is this type of research that is the focus of materials science.

Today, the materials science of rubber includes many types of processing and machinery. Working in this field are scientists, engineers, and inventors who, like the ancient Mesoamericans, aim to modify the characteristics of rubber. In the 18th-century, explorers brought latex sap extracted from rubber trees in the rainforests of South America and other tropical areas of the world to England. Thomas Hancock and Charles Macintosh were two British inventors and manufacturers who worked with this raw rubber. Hancock manufactured rubber-based elastic fabrics, called artificial leather, during the early 1800s. He also invented a hand-cranked machine that could shred waste raw rubber so it could be reused.

## TEAM SPORT

Inventing is considered a team sport. So it was with Hancock. He teamed with Macintosh who invented waterproof, sandwiched fabric that was used to make raincoats. Hancock's rubber technology — commonly known as vulcanization — solved the problem of the fabric's stickiness in warmer weather and stiffness in colder weather. This method of transforming raw rubber was patented in the United States by Charles Goodyear and in England by



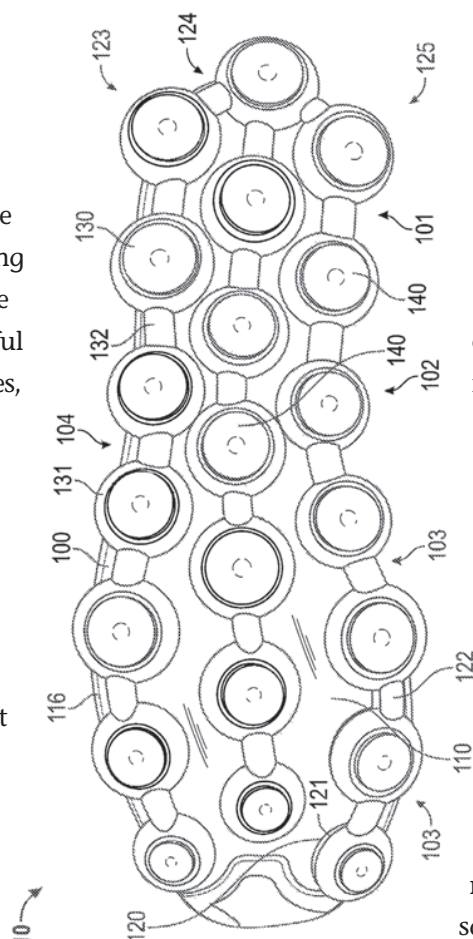


## RUBBER

Thomas Hancock around the same time. It was this process of removing the stickiness that ultimately made way for the manufacturing of useful and unique molded tires, shoe soles, and many other items (see also pages 25–27).

### RUBBER EVERYWHERE

You may be thinking that the Goodyear Tire and Rubber Company was started by Charles Goodyear. Not so! Goodyear was a tenacious inventor, but not a good businessman. Records show that Goodyear died in debt in 1860. Almost 40 years later, Frank Seiberling established the company and named it after the inventor. Today, man-made or synthetic rubber is produced from petroleum, and more synthetic rubber is used than natural rubber. The uses of rubber — natural and synthetic — continue to increase and go well beyond the transportation industry. Go on a scavenger hunt in your home. Look for objects made with rubber. Examine some of the physical properties



**Reebok was assigned a U.S. patent for this sole in 2018. The side view of this shoe is pictured on page 36 and on page 37.**

are illustrations of a recent U.S. patent assigned to Reebok International Limited for a sole with air or fluid “pods” assembled on it.

of items that you think are made with rubber. These properties include being elastic and stretchy, water- and chemical-resistant, able to rebound to shape after being compressed, hard to tear, and resistant to abrasion. You will not have to go very far to make a list. Did you look at your shoe soles?

### SHOE ‘TIRES’

The footwear industry uses natural and synthetic rubber, too. After all, shoes are “tires” for our feet! Many of the reasons for using rubber are the same. We want our shoe soles to be long wearing. We also want them to be water resistant. When we step on rocks, we want them to rebound to shape after being compressed. In some cases, we even want airy, cushioned comfort from our soles! Above and on pages 36–37

### Natural or Synthetic?

Natural rubber is preferred in some athletic shoe soles because it is more elastic and stickier than synthetic rubber. Synthetic rubber, however, can be made to have greater resistance to abrasion, wear, and water, for example. Inventors of shoe soles want a material that can be formed and molded into specific shapes and sizes. Inventors must balance the technical and performance needs with the source and blends of rubber — natural and synthetic. To explore aspects of inventing through making shoe soles, check out the JV InvenTeams™ Shoe Sole activity: <http://lemelson.mit.edu/resources/jv-inventeams-shoe-soles>

