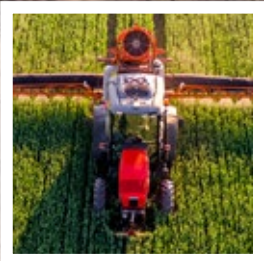




# INDUSTRIAL PRODUCT OVERVIEW



**Firestone**



PRACTICED

— and —

PERFECTED





Henry Ford, Thomas Edison and Harvey Firestone on one of their many cross-country camping trips. These excursions introduced the public to a new age of travel—and fostered friendships among leaders of the day.

Today, the number-one air spring in the world is the Airide™ Spring from Firestone Industrial Products Company, LLC. Originally patented in 1938 by Firestone Tire Company, out of which we grew, it was as innovative then as it is now. It's a solution that began changing the way machines functioned nearly as soon as it was created.

From the beginning, the Firestone® name has been synonymous with revolutionizing the way the world works, right along with giants like Ford and Edison. Today, ingenuity that redefines how industries operate remains part of who we are.



# EXPERIENCE

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is

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# EVERYTHING

While our company is most associated with transportation, sophisticated rubber and fabric products provide solutions for a broad range of industrial and non-vehicular applications—from agriculture and packaging to construction and mining. Our air springs help these industries, and more, by increasing efficiency, reducing vibrations and improving operations.

Air springs are rubber and fabric bellows inflated with compressed air that provide force, motion, stability and protection. Constructed to be an incredibly durable option in the market, they contain no moving parts, are friction-free and function in harsh environments to greatly reduce vibrations.

**INNOVATION** has been a hallmark of the company and is still a hallmark, and very front and center.





## AGRICULTURE

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As agriculture faces ever-growing demands to produce food cost-effectively while keeping up with population growth worldwide, we're supplying the answers to help. Since land surfaces are often uneven and soil density can change frequently in the same field, an air spring is an ideal alternative technology. Because being off by even

an inch in planting is critical, our Airstroke™ actuator aids in sowing seeds at the correct depth. And since the air springs are enclosed, they won't succumb to harsh farming environments—from pervasive dirt and dust, to prolonged moisture.

## COMMERCIAL LAUNDRY

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In the commercial laundry industry, saving time, conserving energy and combating wear-and-tear is everything. Our air springs help washing machines run more efficiently by consolidating washing processes. A single air spring efficiently handles two functions: it acts as an actuator, tilting

the machine to simplify the loading and unloading process; and as a vibration isolator, resulting in better water spinout. No other single product in the market can do both of those jobs.

## CONSTRUCTION AND MINING

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The construction and mining industries present some of the most daunting conditions of all. Dirty, dusty and wet operations plague equipment with rust and corrosion that lead to broken parts. Products like Marsh Mellow™ springs are perfectly suited to these kinds of extreme challenges and

have been utilized in equipment such as vibrating screens. In addition to being a sealed unit closed off to dirt and debris, a Marsh Mellow spring is a variable-rate spring that can handle differences in load while delivering vibration isolation.

## FORESTRY

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Our background in forestry demonstrates the true versatility of air spring technology. Before application to forestry itself, air springs provided a better alternative to hydraulic systems in paper mills, that were prone to poor performance and frequent oil leaks. Eventually, this knowledge transferred

from one area to the next. Air springs now work in the forest products industry in a number of ways, including handling and conveying logs, which can vary greatly by weight and size.

## MATERIAL HANDLING

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Air springs are invaluable in the material handling industry thanks to their seemingly limitless applications. They've been an essential part of conveyors for years due to their strength and resiliency. Ideal for applications needing a compact but mighty solution, air springs are engineered with small dimensions and can fit into spaces no larger than two inches. They're also the ideal augmentation for floor-mounted conveyor systems, as other types of springs

may require expensive modifications to flooring. Air springs can also be used in scissor lifts, vibratory packers, bag flatteners, roller friction brakes on conveyors and countless other ways.

# INNOVATION

— that enables —

# PRODUCTIVITY

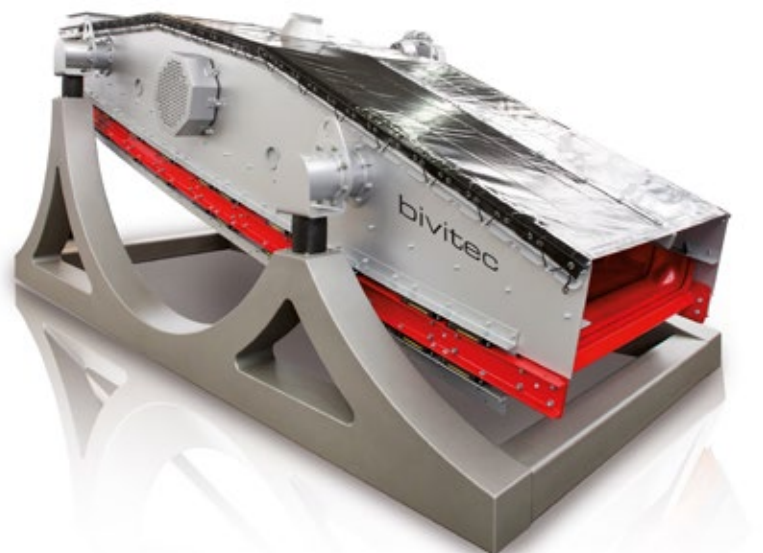
Firestone® air springs improve countless industries by enabling technology to work more efficiently. We test our products rigorously for durability, high pressure, extreme temperature and more, in order to foresee issues and exceed expectations for performance. That's why our air springs can withstand every challenging environment imagined—from the hot and cold, to pothole-filled roads in deep, dust-filled mines.





WE CONSIDER INNOVATION A REQUIREMENT in the solution-driven products we manufacture. We develop our innovations not for innovation's sake, but to make a true difference in a variety of applications. Put one of our industry-leading products to the test.

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**MARSH  
MELLOW  
SPRINGS**  
by Firestone  
PAT. No. 3892398

2-23-18 5092







# FIRESTONE

— technological —

# SOLUTIONS

The following pages highlight how our products are a technological solution for countless challenges across a range of applications.



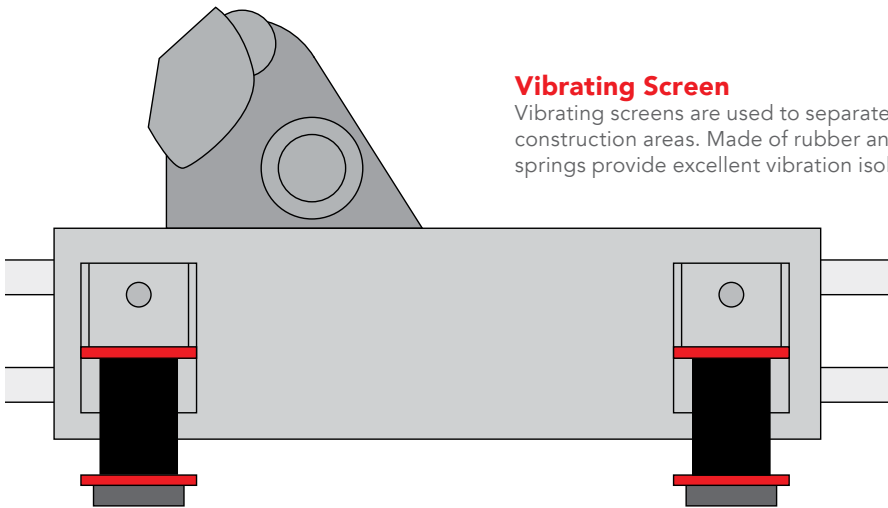
# MARSH MELLOW™

SPRINGS



APPLICATION	FEATURES	BENEFITS	EXAMPLES
<p><b>Vibrating Equipment Isolation</b> Machines that use vibration to do work</p> <p><b>Alternate Technology:</b> Air springs, metal or rubber springs</p>	<ul style="list-style-type: none"> <li>• Low natural frequency</li> <li>• Variable spring rate</li> <li>• Rubber and fabric construction</li> <li>• Good isolation in all degrees of freedom</li> </ul>	<ul style="list-style-type: none"> <li>• Good isolation over a wide load range</li> <li>• Resistant to corrosion</li> <li>• Can be taller than all-rubber part, which gives lower spring rate</li> <li>• Reduced vibratory energy input into supporting structure</li> <li>• Does not require available air pressure</li> </ul>	<ul style="list-style-type: none"> <li>• Vibrating screens</li> <li>• Vibrating hoppers</li> <li>• Vibrating conveyors</li> </ul>
<p><b>Protecting the Surroundings from Normal Machine Vibrations</b> Machines that produce vibrations as a side effect of their function</p> <p><b>Alternate Technology:</b> Air springs, metal springs or rubber pads</p>	<ul style="list-style-type: none"> <li>• Low natural frequency</li> <li>• Variable spring rate</li> <li>• Rubber and fabric construction</li> <li>• Good isolation in all degrees of freedom</li> </ul>	<ul style="list-style-type: none"> <li>• Keeps high-energy vibrations from disturbing the surrounding area</li> <li>• Good isolation over a wide load range</li> <li>• Resistant to corrosion</li> <li>• Can be taller than all-rubber part, which gives lower spring rate</li> <li>• Reduced vibratory energy input into supporting structure</li> <li>• Does not require available air pressure</li> </ul>	<ul style="list-style-type: none"> <li>• HVAC equipment</li> <li>• Pumps and motors</li> <li>• Centrifuges</li> </ul>
<p><b>Protecting Equipment from Shock Impact</b> Machines that generate shock as part of their performance</p> <p><b>Alternate Technology:</b> Industrial dampers, rubber pads and springs</p>	<ul style="list-style-type: none"> <li>• Fabric-reinforced rubber construction</li> <li>• High-damping elastomer</li> </ul>	<ul style="list-style-type: none"> <li>• Fabric allows the rubber part to be longer and still stable for lower spring rate</li> <li>• High-damping elastomer reduces "bounce back"</li> </ul>	<ul style="list-style-type: none"> <li>• Crain bumpers</li> <li>• Machine motion end stops</li> </ul>



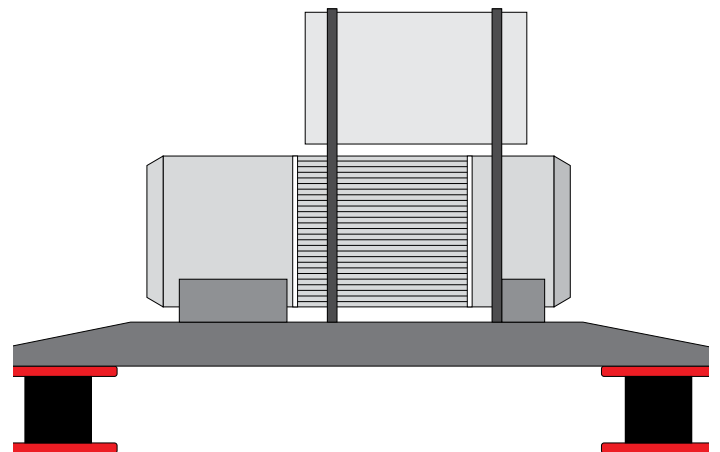
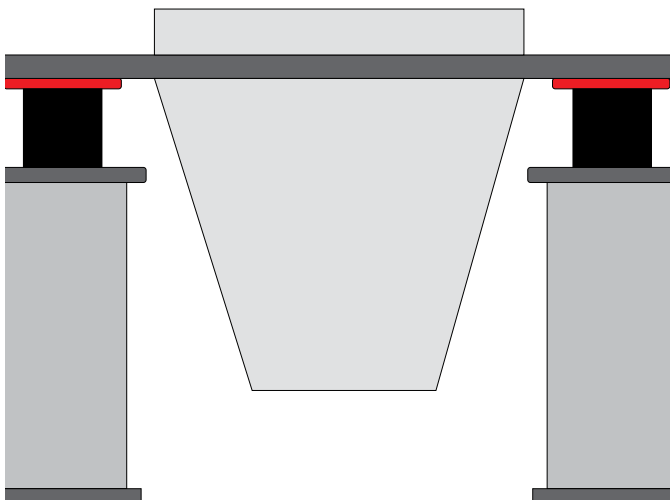


### Vibrating Screen

Vibrating screens are used to separate different sizes of minerals in mining and construction areas. Made of rubber and fabric, the Firestone® Marsh Mellow™ springs provide excellent vibration isolation and great resistance to corrosion.

### Vibrating Bin Hopper

Firestone Marsh Mellow springs have a very wide effective load range. They provide excellent vibration isolation when the hopper is both loaded and empty.



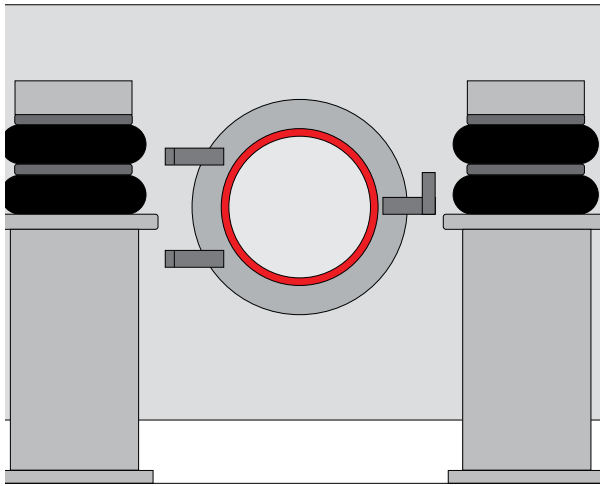
### Compressor

Firestone Marsh Mellow springs are also very quiet. On startup and shutdown, a coil spring can bottom out and create a lot of spring clatter noise. Marsh Mellow springs are quiet as a mouse.



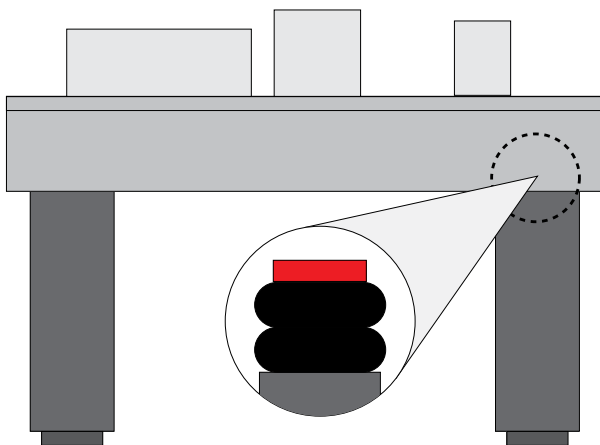
APPLICATION	FEATURES	BENEFITS	EXAMPLES
<p><b>Delicate Equipment Isolation</b> Equipment that must remain stable to do work</p> <p><b>Alternate Technology:</b> Coil springs, rubber pads, active precision isolation systems</p>	<ul style="list-style-type: none"> <li>• Low natural frequency</li> <li>• Adjustable pressure</li> <li>• Passive isolation</li> <li>• Flexible sidewalls</li> </ul>	<ul style="list-style-type: none"> <li>• Protects delicate equipment from vibrations coming from the surrounding environment</li> <li>• Very high degree of vibration isolation</li> <li>• Wide load range for excellent isolation</li> <li>• No need for energy input or active control system</li> <li>• Isolates seismic inputs from all directions</li> </ul>	<ul style="list-style-type: none"> <li>• Optical tables</li> <li>• CMM/precision testing equipment</li> <li>• Laser holography</li> <li>• Electron microscope</li> <li>• Microchip inspection</li> </ul>
<p><b>Vibrating Equipment Isolation</b> Machines that use vibration to do work</p> <p><b>Alternate Technology:</b> Metal coil or rubber springs</p>	<ul style="list-style-type: none"> <li>• Low natural frequency</li> <li>• Adjustable pressure</li> <li>• Flexible sidewalls</li> </ul>	<ul style="list-style-type: none"> <li>• Keeps high-energy vibrations from disturbing the surrounding area</li> <li>• Wide load range for excellent isolation</li> <li>• Excellent isolation in all degrees of freedom</li> <li>• Allows movement in all directions</li> </ul>	<ul style="list-style-type: none"> <li>• Vibrating conveyors and hoppers</li> <li>• Dynamic shakers</li> <li>• Vibratory packers</li> </ul>
<p><b>Protecting the Surroundings from Normal Machine Vibrations</b> Machines that produce vibrations as a side effect of their function</p> <p><b>Alternate Technology:</b> Coil springs or rubber pads</p>	<ul style="list-style-type: none"> <li>• Low natural frequency</li> <li>• Adjustable pressure</li> <li>• Flexible sidewalls</li> </ul>	<ul style="list-style-type: none"> <li>• Keeps high-energy vibrations from disturbing the surrounding area</li> <li>• Wide load range for excellent isolation</li> </ul>	<ul style="list-style-type: none"> <li>• Commercial laundry machines</li> <li>• HVAC equipment</li> <li>• Pumps and motors</li> <li>• Centrifuges</li> <li>• Looms</li> </ul>





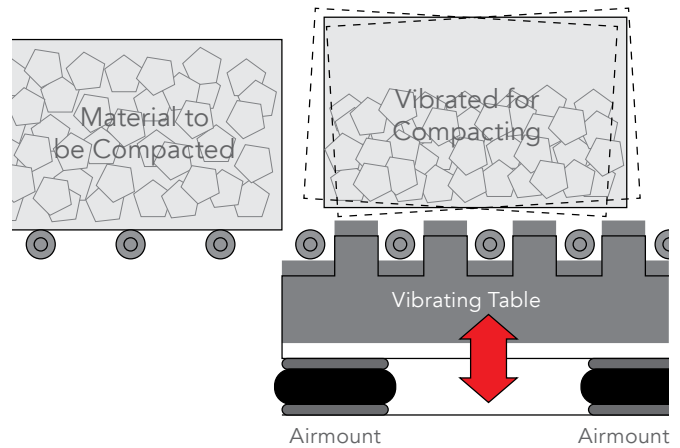
### Commercial Laundry Machine

Airmount™ isolators are sealed and primarily made of rubber which gives the parts a great life in a difficult environment. Also the parts will do double-duty as actuators to tip the machine and isolators to prevent the transmission of vibration.



### Shake, Rattle & Roll Mounts

Here, a casting flask rolling down the line stops over a vibrator. It is lifted for tamping, then lowered for further conveying. Airmount isolators lift the vibrator and also isolate its vibrations.



### Optical Table

These tables are used for laser holography, electron microscopes, microchip inspection equipment, etc. In this case, you are trying to reduce the energy of floor vibrations from disturbing the equipment mounted on the table. Air springs are the lowest frequency passive isolators available and, therefore, reduce the transmitted vibration energy of lower frequency structural vibrations better than other passive devices.



# AIRSTROKE™

ACTUATORS



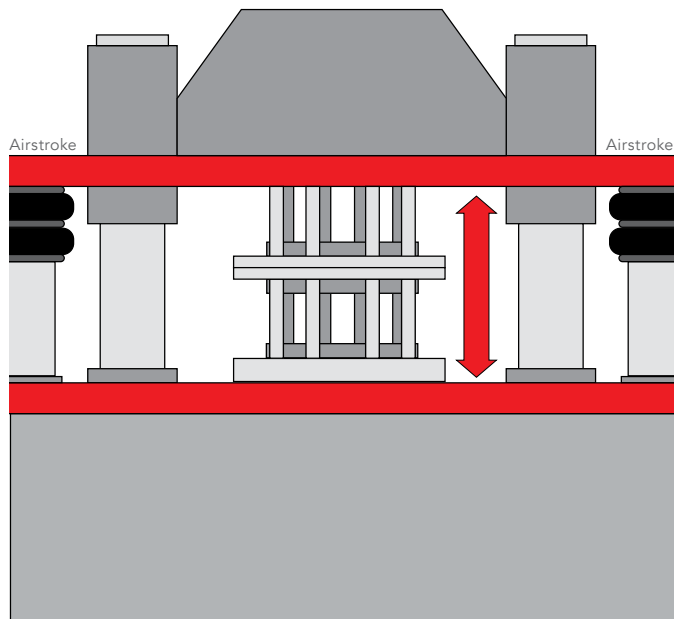
APPLICATION	FEATURES	BENEFITS	EXAMPLES
<p><b>Air Springs</b> Used to provide force or motion</p> <p><b>Alternate Technology:</b> Air or hydraulic cylinders</p>	<ul style="list-style-type: none"> <li>• Flexible sidewalls</li> <li>• Low starting height compared to stroke length</li> <li>• No sliding seals</li> <li>• Optional end closures and materials</li> </ul>	<ul style="list-style-type: none"> <li>• Able to move through angles</li> <li>• Able to accept side-loads</li> <li>• Facilitates use in tighter vertical spaces</li> <li>• Friction-free operation</li> <li>• Immediate response time</li> <li>• Resistant to elements</li> </ul>	<ul style="list-style-type: none"> <li>• Scissor lift</li> <li>• Conveyor transfer actuator</li> <li>• Conveyor gravity gate</li> <li>• Airstroke™ actuated roller stop</li> <li>• Doctor blade actuator</li> <li>• Roller friction brake</li> <li>• Vertical actuated drive table</li> <li>• Felt guide actuators</li> <li>• Web tensioning</li> </ul>
<p><b>Air Springs</b> Used as springs to support and balance a load</p> <p><b>Alternate Technology:</b> Air cylinders or springs</p>	<ul style="list-style-type: none"> <li>• Low spring rate</li> </ul>	<ul style="list-style-type: none"> <li>• Balances load with very low force variation</li> </ul>	<ul style="list-style-type: none"> <li>• Press counterbalance</li> <li>• Press die cushion</li> <li>• Assembly fixture</li> <li>• Modal vibration testing</li> <li>• Bag flattener</li> <li>• Log debarker actuator</li> </ul>





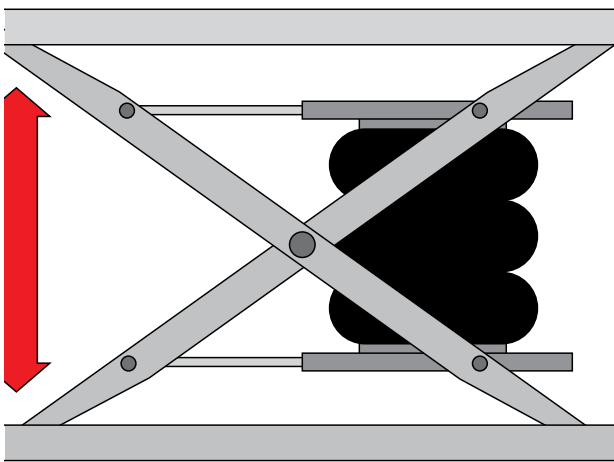
### Can Making Machinery

The air springs here provide the counterbalance force to support the upper platen so that the mechanical drive only needs to do the work of forming the metal—not lifting the platen. The low spring rate of the air springs means greater energy-efficiency.



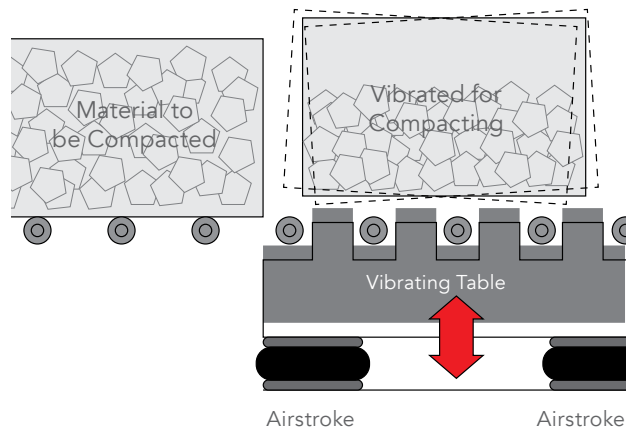
### Scissor Lift Table

Although the air spring itself only has about 12 inches of stroke, the use of a scissors linkage allows the manufacturer to offer much longer travel. The high force and lateral/angular compliance allow great flexibility in design.



### Shake, Rattle & Roll Mounts

Here, a casting flask rolling down the line stops over a vibrator. It is lifted for tamping, then lowered for further conveying. Airstroke actuators lift the vibrator and also isolate its vibrations.



GLOBAL LEADER

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LOCAL PARTNER



**Firestone**

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