

# VECTR

U.S. Pat. No. 9,316,282

## Kinetic Energy Converting Shock Absorption System

### 1.0 CONFRONTING THE REALITY OF AN EPIDEMIC

Concussions are a very serious and quickly growing epidemic among high school, college and professional football players with long term and debilitating effects that are just now beginning to be fully understood. With the advancements in sports science and nutrition, football players are larger, stronger, faster, and hit with more force, however current protective gear, especially helmets, have remained virtually unchanged. Concussions have risen 200 percent among teens ages 14 to 19 in the last decade and CDC reports show that the amount of reported concussions has doubled in the last 10 years. CDC estimates reveal that 1.6 million to 3.8 million concussions occur each year with football as the most common sport with concussion risk for males (75% chance for concussion).

College football players reported having six suspected concussions for every one diagnosed concussion, and a study conducted by the NCAA's Injury Surveillance Program found that there are now about 4,000 concussion cases a year throughout all levels of college football. Over the past two seasons, 306 professional players have suffered a combined 323 concussions according to team injury reports. When left undetected, concussions can result in long-term brain damage and may even prove fatal.

#### Beyond the Gridiron

The issue of head protection is not isolated to football ... Recent independent studies performed by Virginia Polytech Institute and State University have exposed that most hockey helmets under-performed in safety ratings with many helmets designated as unsafe.

This urgent concern extends outside the sports arena as the U.S. military seeks to protect its operatives with better equipment to replace outdated padding with more effective helmet suspension systems.

**47%** of all reported sports concussions occur during high school football .

**1 in 5** high school athletes will sustain a concussion during the season.



### 2.0 A SOLUTION INSPIRED BY NATURE

Of all the animals that engage in head-butting in the wild, the Musk Ox does it with the smallest horns but with the greatest speed and force without sustaining concussions or any damage to their brains. Weighing up to 1,500 lbs, a musk ox will back up 50 to 100 yards opposite another male ox and charge at speeds up to 35 mph and butt heads with tremendous force with neither animal sustaining any brain damage. Musk oxen may engage in this behavior for up to eight hours. Upon studying the craniums of Musk Oxen, it was observed that there is a gap between the brain and the skull that prevents the brain from crashing into the inside of the skull when musk ox butt heads, and the dura encasing the animal's brain provides enough elasticity to compensate for the brain's forward momentum from the impact.

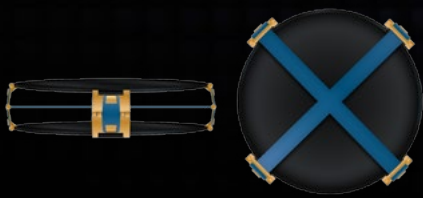
### 3.0 TECHNOLOGICAL SOLUTION

Angel 7 Industries is directly addressing the concussion problem with VECTR™, a lightweight, energy conversion and management system that is robust and is impervious to heat, cold, and moisture. VECTR™ counters the dynamic forces inherent in concussions by preventing the direct conduction of the kinetic energy/impact force from the helmet to the head while simultaneously slowing the head down to minimize rapid brain movement within the skull.

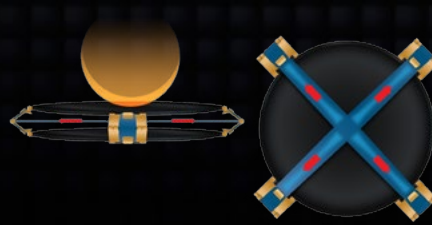
In other words, VECTR™ prevents the head from crashing into the inside of the helmet thus preventing the brain from rapidly smashing against the inside of the skull as forcefully as it would with a dense foam or rigid plastic. The law of Conservation of Energy states that energy can neither be created nor destroyed, but can be changed from one form to another.

Each VECTR™ cell works independently and converts kinetic energy and the associated momentum into potential energy during an impact, and stores that potential in four directions that are perpendicular to the direction of the impact while simultaneously slowing the head's momentum and preventing the head from crashing into the inside of the helmet. Once the initial forces of the impact have dissipated, the potential stored within the VECTR™ cells is released and used to rapidly reset the cells.

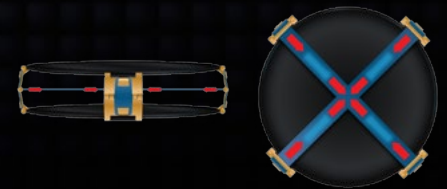
VECTR AT READY



VECTR REACTS, redirecting the impact and storing incoming kinetic energy.



VECTR uses the stored energy to reset itself.

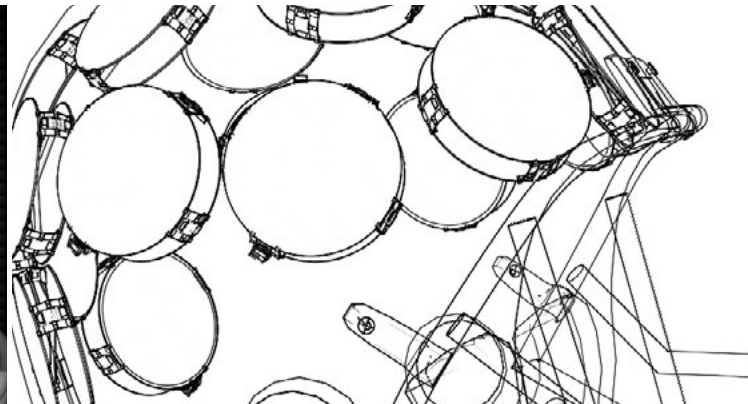
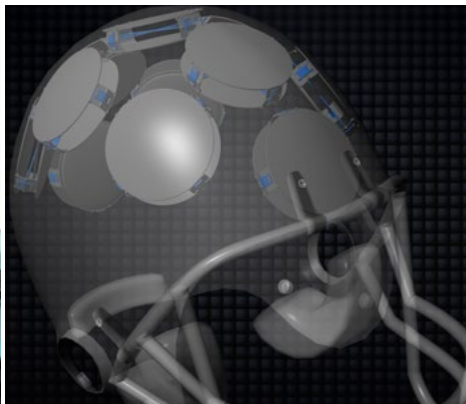


### 4.0 REAL-WORLD APPLICATION OF VECTR™

Multiple VECTR™ cells comprise a complete system with each cell functioning independently. The cells are made from a lightweight yet very strong military-grade composite material that, unlike vinyl based foams and urethane based foams, is impervious to temperature changes and moisture. Furthermore, the system is inherently redundant meaning that if one of the VECTR™ cells fail, an athlete will still be fully protected because an impact on any one area of the helmet engages multiple VECTR™ cells simultaneously. Impacts can also be simultaneously managed in different areas of the helmet if an athlete sustains blows from different directions at the same time. Another added feature of the design is that, since VECTR™ cells are open, they allow excellent airflow into the helmet and allow heat from the head to easily escape.

The flexibility and versatility of the VECTR™ cell can be adapted and customized to any protective headgear for any sport that is currently lacking in adequate protection, and the head is not the only part of the body that can be protected. If a piece of equipment uses traditional padding, VECTR™ can increase its utility.

PROTOTYPE MODEL



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