



Hydraulic Stance Control Knee Mechanism (VA Reference No. 12-090)

Novel hydraulic stance control knee mechanism to fully support the knee against flexion during stance and allow uninhibited motion during swing

Technology

Hydraulic stance control knee mechanism to support knee against flexion during stance

Inventors

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Key Features

- Hydraulic approach to stance control which delays fatigue for patients
- Allows uninhibited motion during swing and eliminates the need for muscle activity during static load supporting tasks
- Reduced power consumption, size, and weight of the device

Stage of Development

Reduced to practice with prototypes developed

Keywords

Stance control knee mechanism
Gait assistance
Spinal cord injury
Stroke
Neuromuscular stimulation
Hybrid neuroprosthesis

Patent Status

Patent pending

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Technology

The Department of Veterans Affairs (VA) has developed a hydraulic stance control knee mechanism (SCKM) to fully support the knee against flexion during stance and allow uninhibited motion during swing for individuals with paraplegia using functional neuromuscular stimulation for gait assistance. The developed SCKM eliminates the need for muscle activity during static load supporting tasks and reduces the duty cycle of electrical stimulation to the knee extensor muscles in a hybrid neuroprosthesis system. This will delay the onset of fatigue for patients by prolonging the rest periods between successive contractions and, therefore, extend operating times and walking distances. In addition, the SCKM was specified to have high mechanical impedance during stance to prevent falling from knee collapse or buckling resulting in insufficient foot-to-floor clearance of the contralateral leg during swing.

Opportunity

The feasibility and viability of the developed hydraulic SCKM has been demonstrated in a clinical setting with individuals with paraplegia. The device has been demonstrated to support the body and maintain knee extension during stance without the stimulation of the knee extensor muscles and adversely affecting gait. The technology could provide significant benefits to individuals with stroke and spinal cord injuries and fulfill a need for a long-term reliable solution that will facilitate walking. The potential opportunity for the technology is substantial with an estimated 260,000 existing patients with spinal cord injuries and 12,000 new patients per year who could benefit from the developed technology. In addition, there are approximately 6.5 million Americans living that have suffered a stroke in their lifetime and most likely are living with debilitating effects from the occurrence of stroke.

Competitive Advantage

The novel hydraulic SCKM offers a number of competitive advantages when compared to other SCKMs. Commercially available SCKMs do not provide sufficient control for individuals with paraplegia because these individuals require consistent full extension or a preset orientation of the thigh to operate. Other devices only lock at discrete angles, which may result in a minimal degree of unsupported knee flexion after locking and thus complicate the contralateral swing leg clearance. The developed system provides different control possibilities for the knee mechanism. Shock absorption at initial contact may be controlled by varying the angle at which the mechanism is locked while the knee is extended during late swing. Furthermore, the hydraulic approach to the system enables reduced power consumption, response time, size, and weight of the device.

Status

The Department of Veterans Affairs is looking for a partner for further development and commercialization of this technology through a license and the VA inventors are available to collaborate with interested companies through a Cooperative Research and Development Agreement (CRADA).