

Improved wheelchair design utilizing linear rotary motion with enhanced efficiency and reduced injury and pain for users

Market and Background

According to BCC Research, in 2014 the market for home assistive devices was estimated at \$2.26 billion and is expected to reach \$2.7 billion by 2020. Of this, the wheelchair and scooter market represent roughly 70% of the total market share with light/ultra-light wheelchairs (including sports wheelchairs) and standard wheelchairs making up 40% of this segment. While the wheelchair manufacturing industry has experienced a decline over the past 5-7 years, factors leading to its anticipated recovery include demographic trends, government and private spending on health, as well as advances in medical technology and healthcare regulations, amongst others. In particular, the aging population is anticipated to have a significant effect on this industry with the number of US residents aged 65 and over estimated to be 55.6 million by 2022.

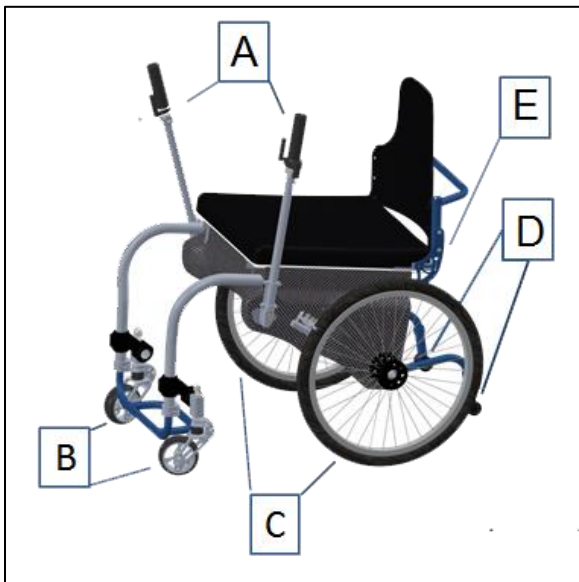
In the US alone, it is estimated that around 3 million people use a manual push rim wheelchair for daily mobility. Unfortunately, a significant percentage of manual wheelchair users will suffer pain and injury in their shoulders, wrists, and hands as a result. While research has shown that lever propulsion systems could go toward reducing such injuries and pain, the industry has not successfully adopted a complete system capable of providing a solution that addresses the full needs of the user. As such, there is a clear and unmet need for the development of an improved wheel-chair design capable of providing better quality of life for wheelchair users.

Research and Development Status

An alumnus from the University of Wisconsin-Parkside has developed an alternative to the rim-driven manual wheelchair offering a new and improved mobility device for the physically disabled. T120022 uses lever inputs connected to a patented linear rotary motion (LRM) conversion mechanism providing highly efficient manual power to the wheels without the need of much force. The underlying LRM device is capable of converting a range of linear motion inputs into rotary motion in the chosen direction and efficiently transferring 90% of human biomechanical power to the driven wheels. In addition, the technology is mounted on the base on the wheelchair rather than the wheels, making it more versatile than other lever-drive systems.

A [pre-production prototype chair](#) has been manufactured and tested by users at veteran's facilities throughout the Midwest.

As shown in Figure 1 below, this new and improved wheelchair design with LRM technology possesses a number of beneficial features.



Key Benefits:

A – Left and right hand input levers

- Providing total control through the LRMs, summing all motion into rotation in the direction selected
- Right and left inputs work independently allowing for zero radius turns
- Brakes activated through each input lever

B – Suspension casters with shock absorbing suspension

C – Reduced wheel size

- Enabling better maneuverability and surface transfer
- Takes up less space
- Quick disconnect hubs to aid in transport

D – Anti-tip mechanism for enhanced stability

E – Folding back for ease of transport

Figure 1. Schematic of pre-production prototype wheelchair

Competitive Advantage

- Utilizes an innovative mechanism that efficiently converts bi-directional linear motion to continuous one-way rotary motion at a constant torque to power manual wheelchairs;
- Provides for enhanced propulsion and increased efficiency with independent right and left lever force inputs from the user;
- Eliminates painful repetitive stress injuries that rim-driven wheelchair users often face;
- More hygienic as compared to traditional push-rim wheelchairs as hands never come into contact with wheels;
- Smaller footprint, lightweight (e.g. <35lbs) and portable.

Intellectual Property & Partnering Opportunity

A U.S. Patent ([US 9,139,251](#)) has issued for this technology which is available for exclusive licensing. WiSys is seeking a strategic partner in the Durable Medical Equipment industry interested in gaining a competitive edge in the marketplace.

T120022 is the first application developed using the patented LRM platform technology. Additional fields of use are available for development and licensing.

For more information, please contact Jennifer Cook at jennifer@wisys.org or by phone at 608-316-4131.