



HURON CYCLING

Patent Information

Huron Cycling is offering two patent families (consisting 3 US and 6 Non-US patents) for license and/or sale in the area of crankset assembly. They can be widely used for drivetrain applications in pedal driven vehicles like bicycles and E-bikes. **The Global Bicycle Market size is expected to be worth around USD 67.4 Billion in 2023, and reach USD 130.1 Billion by 2033, growing at a CAGR of 6.80% during the forecast period from 2024 to 2033.**

Below is the list of patents which are being offered for sale/license:

S. No.	Representative US Patent	Title	Other US Family Members	Other Non-US Family Members	Priority Date
1	US9403576B2	Power Smoothing Crank Arm	US9809275B2	-	August 13, 2012
2	US11142281B2	Cycle Crank Assembly	-	CN110386217B EP3556645B1 ES2904801T3 JP7266450B2 PT3556645T TWI778253B	April 17, 2018

Within the purchase/license deal, Huron Cycling is optionally offering:

- Huron Cycling’s low cost torque sensor reference design which has a bill of materials less than \$20. It can be used as a left/right power meter and also to control the motor assist in Pedelects. Ebikes with torque sensors are generally preferred. However, they are typically a few hundred dollars more expensive than E-bikes with a cadence sensor. This is related to the high cost of torque sensors currently on the market.
- In case of sale of patents, Huron Cycling is able to provide one year support for technology transfer.

The patent portfolio covers two areas of invention:

- **Improvement in cycling efficiency:** The patented invention covers a crankset in which the crank arm has a pivot point which allows part or all of the crank arm to rotate by up to a few degrees relative to the crank axle under load at the pedals. This rotation is counteracted by springs on or in the crank arm and is proportional to the torque applied at the pedals. The crank set improves cycling efficiency based on testing by multiple organizations.
- **A unique power meter not based on strain gauges:** The patented invention covers rotary sensor systems which measure the rotation of the crank arm relative to the crank axle. The resulting value for torque can be combined with the angular velocity of the crank arms to obtain power applied to the left and right pedals.

The first claims of each of the three US patents illustrate the breadth of coverage of the crank set and the sensor for the power meter:

Claim 1 of US Patent [US9403576B2](#)

1. A crank arm for a pedal-driven vehicle, comprising: a first member that pivots about a crank axis of the pedal-driven vehicle; a second member rotationally coupled to the first member, pivoting about the first member via a member pivot point, and configured to receive a pedal at a pedal interface; and a spring assembly configured to bias the second member towards a neutral rotation configuration relative to the first member and to resist rotation of the second member away from the neutral rotation configuration in either rotation direction, a linear distance between the crank axis and the pedal interface is greater than a linear distance between the crank axis and the member pivot point for all crank angles.

Claim 1 of US Patent [US9809275B2](#)

1. A crank assembly for a pedal-driven vehicle, comprising: a first member that rotates about a crank axis of the pedal-driven vehicle; a second member rotationally coupled to the first member and configured to pivot clockwise and counterclockwise about the first member via a member pivot, the second member configured to receive a pedal at a pedal interface; a spring to bias the second member toward a default orientation relative to the first member when the second member pivots clockwise relative to the first member and to bias the second member toward the default orientation relative to the first member when the second member pivots counterclockwise relative to the first member; and a rotary sensor coupled to the first member, the rotary sensor configured to measure rotation of the second member relative to the first member.

Claim 1 of US Patent [US11142281B2](#)

1. A cycle crank assembly, comprising: a crank spindle; a drivetrain connector configured to translate rotation of the crank spindle into rotation of a wheel; a crank arm including a pedal interface configured to receive a pedal spindle of a cycle pedal; a slip connection configured to allow the crank arm to rotate about the crank spindle; and a resiliently deformable member connected to the crank spindle and to the crank arm proximate to the pedal interface, wherein the resiliently deformable member translates rotation of the crank arm into rotation of the crank spindle, and wherein the resiliently deformable member deforms under load to store pedal energy provided by a rider to the cycle pedal, and returns at least a portion of the pedal energy when not under load in a direction of the rotation.

Huron Cycling LLC is a privately funded technology startup founded by cycling enthusiasts. It **operates from Brighton, Michigan, USA and Utrecht, The Netherlands**. Huron Cycling is looking to partner with component or bicycle manufacturers in order to bring their technology to the market.

Huron Cycling has been founded by people with a background in innovation and startups. One of the founders, Willem Den Boer, is an LCD expert with more than 30 years of experience in advanced display technology and manufacturing. Apart from the novel IMPACT crankset, he is also the inventor/co-inventor on more than 150 patents related to display, sensor, touch panel, solar and glass coating technologies. Some of them were implemented by companies like Apple within their products. **Pieter Den Boer is a Concept & Business Developer who works on the motto 'Innovation through Combination'.** He has been founder or co-founder of several successful startups.



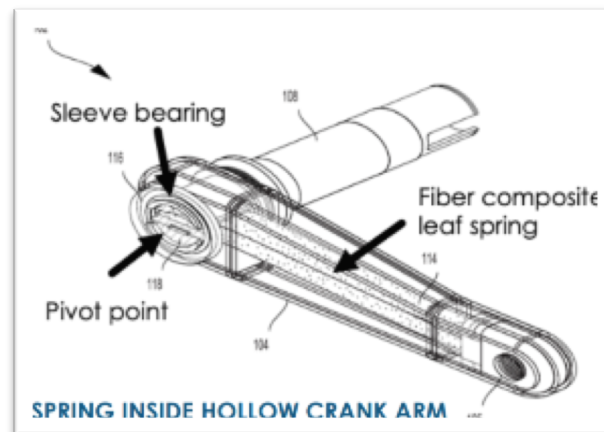
[Willem Den Boer](#)



[Pieter Den Boer](#)

Huron Cycling has developed a novel bicycle drivetrain called **IMPACT drivetrain** which increases the speed/power ratio of cyclists by up to 4%. In conventional drivetrains applied torque is much greater during the down stroke than in the dead spot of the pedal stroke. With the IMPACT crankset the variation is reduced. **This is achieved by fiber composite leaf springs inside each hollow crank arm.** They allow the cyclist to maintain cadence using a chainring with one or more extra teeth without spending more energy. **The end result is up to 4% more effective power*** when it is most needed: Going uphill, sprinting or accelerating.

[source](#)



Lightweight Carbon based IMPACT Drivetrain
Crankset Prototype

*Performance improvement of the drivetrain has been scientifically tested and confirmed at Eastern Michigan University by an academic team led by professor McGregor, an expert in power measurements and their interpretation.

Eastern Michigan University performed a set of scientific tests on the Huron Cycling IMPACT drivetrain. The IMPACT drivetrain includes a novel type of spring crank set with improved efficiency. The results of the scientific research were submitted for presentation at the American College of Sports Medicine Annual Meeting in 2019. The test results were obtained on an Aluminum proof of concept only crank set by McGregor's team. Huron Cycling has also developed a lightweight carbon based prototype targeted for commercialization.




"We have extensively tested the Huron Cycling IMPACT drivetrain with 16 trained athletes using power meters and metabolic test equipment. Our conclusion is that the IMPACT drivetrain increases effective power by several percent for a range of cadence and power levels" - [Source](#)

Professor Stephen McGregor

Stephen McGregor is Director of the Applied Physiology Laboratory at Eastern Michigan University and coauthor of the standard book on [cycling power measurements](#). He is also a Level 1 USA Cycling coach and has coached numerous athletes including Olympians.

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LEADING THE WAY

Novel Crank with Elastomer Spring Improves
Effective Power in Trained Cyclists and Triathletes

3434 Board #122 June 1 8:00 AM - 9:30 AM

Bestianelli, Brandon M.; Workman, Andrea; McGregor, Stephen

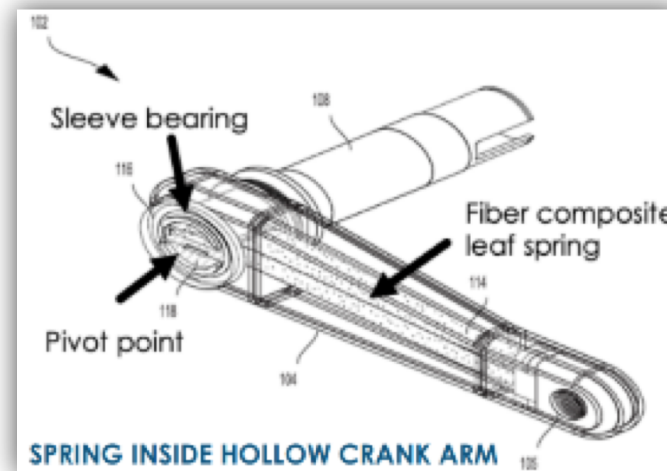
[Source:](#) Results of Scientific Research



[Source:](#) Aluminum proof of concept crank set in action



[Source:](#) Scientific Testing of Proof of Concept Prototype at Eastern Michigan University

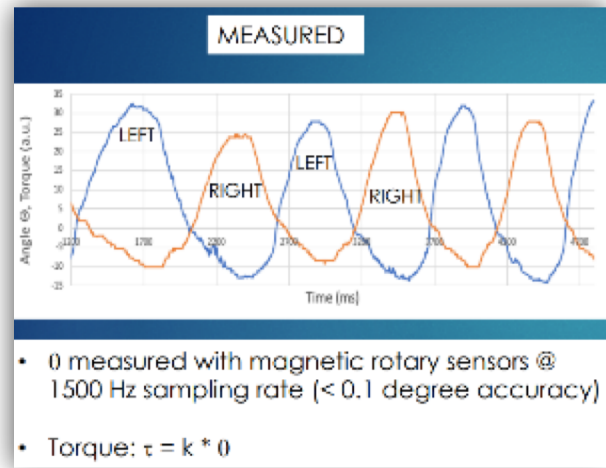


Huron Cycling has developed Bluetooth and ANT+ enabled power meters with resistive and magnetic rotary sensors. Huron Cycling’s IMPACT crank sets have a pivot point, either on the crank or on the spindle. The two parts that come together at the pivot point, **can rotate with respect to each other over a small angular range, up to about 5 degrees, when a load is applied at the pedal.** The unique feature of the IMPACT power meters is their use of inexpensive rotary sensors rather than strain gauges that measure left and right torque independently at sampling rates up to 1500 Hz. Torque profile, power and much more can be displayed in real time on GPS cycling computers or smart phones. The IMPACT cranks are spring-loaded, which forces the angle at the pivot point back to zero in rest position, when no load is applied. The excursion angle is proportional to torque applied to the crank. The rotary sensor system measures this angle with an accuracy better than 0.1 degree.

Source: *Whitepaper on Test Results of IMPACT Power Meter (Aug 2019)*



Source: Location of magnetic rotary sensor between crank arm and spindle



Source: Measurement of left and right torque acquired at 1500 Hz

The patent portfolio can be utilized for various different applications in vehicles such as –



Conventional Bicycle

Global Market Size – \$50.4 Bn

Major Players



E-Bike

Global Market Size – \$17 Bn

Major Players –



Other pedal driven vehicles and stationary bikes

Global Market Size – \$? Bn

Major Players



Market Validation – IMPACT Drivetrain Technology by Huron Cycling



Multiple other companies working on related technology that enhance the riding efficiency or comfort. Hence, Huron’s technology focuses on an important problem in the industry. FREE POWER has products on the market with an other type of elastic drivetrain. However, these solutions are different from Huron Cycling’s patented IMPACT crankset in terms of operating principle, design and sub-components.



FREE POWER

Free Power provides a system which includes specially synthesized silicone placed inside the gear. It reduces energy loss and improves speed and effective power.



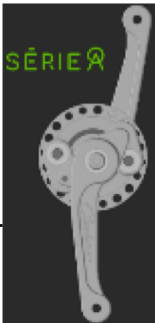
OCHAIN

OCHAIN active spider can remove or reduce pedal kickback, isolating transmission effects from rear suspension when needed.

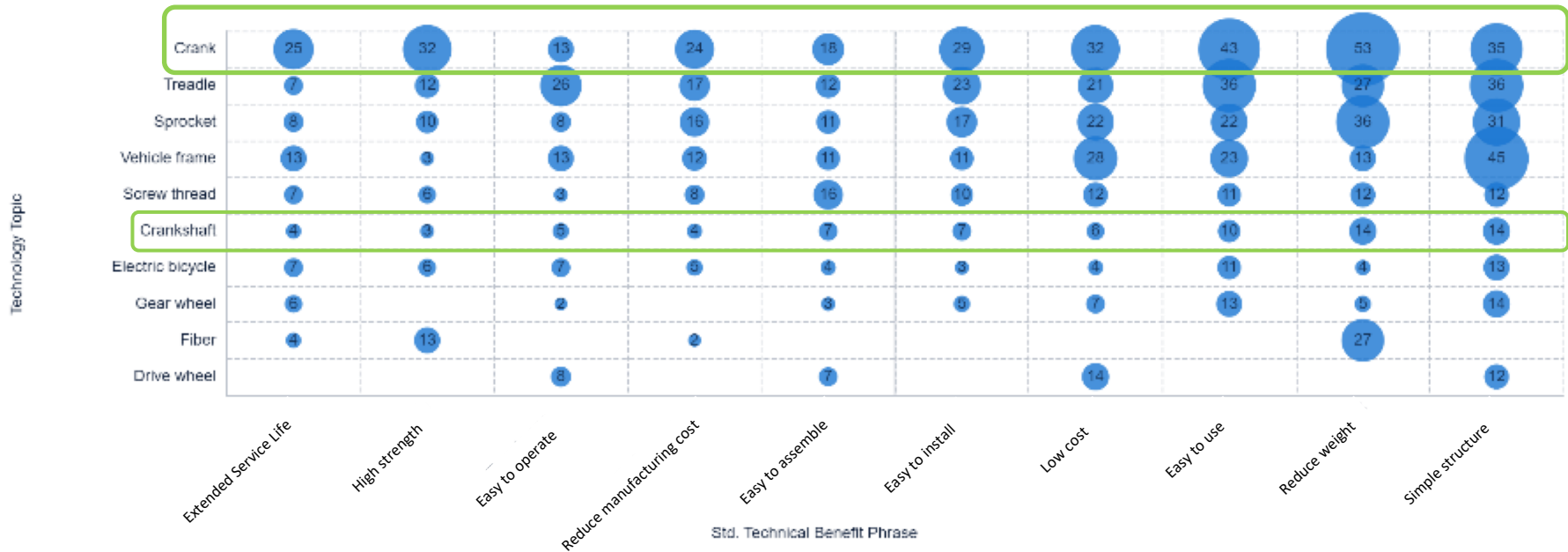


LE PEDALIER CERDAN

The Cerdan A Series Crankset is a 100% mechanically assisted crankset, based on the principle of shifting the cranks to eliminate top dead center.



The image below illustrates the various different issues that are being addressed by patent applications getting filed in this domain. It can be observed that the majority of problems being addressed are crank/crankshaft related. **Therefore, Huron Cycling's patents, which are related to crank assemblies, contribute to resolving problems prominent in the drivetrain technology domain.**



Source: Paid Patent Database

Bicycle / E-Bike / Pedelec Drivetrain Crankset

- **The Global Bicycle Market size is expected to be worth around USD 67.4 Billion in 2023, and reach USD 130.1 Billion by 2033, growing at a CAGR of 6.80% during the forecast period from 2024 to 2033.** – [Source](#)
- **The Bicycle Crankset Market size is expected to develop revenue and exponential market growth at a remarkable CAGR during the forecast period from 2023–2030. The growth of the market can be attributed to the increasing demand for Bicycle Crankset owing to the Road Bike, Mountain Bike, others applications across the global level.** – [Source](#)
- **In 2023, the conventional segment was responsible for over 74.8% of the total revenue and will continue to dominate the market over the forecast period...Electric bicycles will be the fastest-growing segment, with a CAGR of 10.2% during the forecast period.** They are simple to use. The electric bicycle can travel faster than their traditional counterparts. – [Source](#)
- **The global Pedelec market size was valued at USD 13479.27 Million in 2022 and will reach USD 43178.81 Million in 2028, with a CAGR of 21.41% during 2022-2028.** – [Source](#)



[Source](#)

Cycling Power Meter

- **The global cycling power meter market** is anticipated at US\$ 390.6 million in 2022. The sector is gaining pace as companies provide technologically improved cycling power meters with various integrated technologies. **Thereby, garnering US\$ 647.4 million in 2033, recording a CAGR of 4.7% from 2023 to 2033. The market is likely to secure US\$ 410.5 million in 2023.** – [Source](#)
- **Crank Arm-Based Segment Generated High Revenue:** Based on mounting type, the **crank arm-based segment is expected to dominate the market** in the forecast period. The segment is projected to exhibit a CAGR of 5.2% during the forecast period. – [Source](#)

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