# U.S. Patents

*From Hunter's Award-Winning Team of Engineers*

## Wheel Alignment

<table>
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<tr>
<td>6,370,455</td>
<td>Method and Apparatus for Networked Wheel Alignment Communications and Service</td>
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<td>6,427,346</td>
<td>Method and Apparatus for Calibration of No-Comp Universal Adapters</td>
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<tr>
<td>6,442,460</td>
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<td>6,556,904</td>
<td>Method and Apparatus for Update and Acquisition of Automotive Vehicle Specifications in Automotive Diagnostic Equipment</td>
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<td>6,581,463</td>
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<td>6,684,516</td>
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<td>6,754,562</td>
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<td>6,799,376</td>
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<td>6,822,582</td>
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<td>6,917,417</td>
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<tr>
<td>6,982,653</td>
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<td>7,040,029</td>
<td>Method for Detection of Vehicle Movement During Wheel Alignment Measurement</td>
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<td>7,328,124</td>
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## Wheel Alignment Sensors

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<td>Angular Position Transducer Apparatus</td>
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<td>Sensors for Vehicle Alignment System and Apparatus Using Same</td>
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<td>5,489,983</td>
<td>Sensors for Vehicle Alignment System and Apparatus Using Same</td>
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<td>5,528,836</td>
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<td>5,724,128</td>
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<td>6,134,792</td>
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<td>Rolling Runout Compensation Apparatus and Method</td>
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<td>6,509,962</td>
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<td>6,744,497</td>
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<td>6,798,936</td>
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- 6,894,771 Wheel Alignment Apparatus and Method Utilizing CMOS Three-Dimensional Imager
- 7,000,326 Apparatus and Method for Maintaining Wheel Alignment Sensor Runout Compensation
- 7,164,472 Common Reference Target Machine Vision Wheel Alignment System
- 7,295,297 Image Sensing Wheel Alignment System
- 7,302,093 Color Vision Vehicle Wheel Alignment System
- 7,336,350 Wheel Alignment Apparatus and Method Utilizing CMOS Three-Dimensional Imager
- 7,355,687 Method and Apparatus for Vehicle Service System with Imaging Components
- 7,359,775 Method and Apparatus for Information Transfer in Vehicle Service Systems
- 7,382,913 Method and Apparatus for Guiding Placement of Vehicle Service Fixtures
- 7,444,752 Method and Apparatus for Vehicle Service System Optical Target Assembly
- 7,454,841 Method and Apparatus for Wheel Alignment System Target Project and Illumination
- 7,518,714 Vehicle Service System with Variable-Lens Imaging Sensors
- 7,538,664 Vehicle Wheel Alignment System Scanning Laser-Based Camera Sensor
- 7,583,372 Machine Vision Vehicle Wheel Alignment Image Processing Methods
- 7,703,212 Method and Apparatus for Vehicle Service System Optical Target Assembly

Wheel Balancers

- 2,341,443 Wheel Balancing Apparatus
- 2,341,444 Wheel Balancing Apparatus
- 2,682,396 Wheel Balancing Device
- 2,680,974 Wheel Balancing Device
- 2,723,555 Dynamic Balancer for Rotary Bodies
- 2,964,278 Wheel Mounting for Balancing Apparatus
- 3,772,919 Balancing Apparatus for Rotating Bodies and Method of Producing Frequency Stable Phase Delay
- 4,193,305 Vehicle Wheel and Tire Balance Testing Machine
- 5,156,049 Manual Input System for Automotive Test Equipment
- 5,355,729 Split Weight Wheel Balancing
- 5,356,786 Wheel Balancing Apparatus and Method
- 5,396,436 Wheel Balancing Apparatus and Method with Improved Calibration and Improved Imbalance Determination
- 5,473,941 Caliper for Use With Wheel Balancers
- 5,542,294 Wheel Balancer Quick Calibration Check
- 5,915,274 Method of Correcting Imbalance on a Motor Vehicle Wheel
- 6,293,147 Wheel Balancer with Pressure Adjustment
- 6,324,908 Wheel Balancer With Control of Current to Motor
- 6,336,364 Wheel Balancer with Wheel Rim Runout Measurement
- 6,386,301 Wheel Balancer with Speed Setting
- 6,389,695 Wheel Balancer for Controlling the Application of Power to the Motor and Rotation of the Wheel/Tire Assembly
- 6,393,911 Wheel Balancer with Control Circuit and Rim Runout Measurement
- 6,397,675 Wheel Balancer Using Wheel Rim Runout and Loaded Wheel/Tire Assembly Measurements
- 6,405,591 Wheel Balancer Using Controlled Load Roller Force Variation
- 6,422,074 Wheel Balancer with Load Roller for Applying Substantial Force to Wheel/Tire Assembly
- 6,435,027 Wheel Balancer with Lateral Force Variation Measurement
- 6,439,049 Wheel Balancer with Control Circuit for Controlling the Application of Power to the Motor to Facilitate Mounting
- 6,481,281 Wheel Mount Chuck and Wheel Mount Method for Vehicle Wheel Balancers
- 6,481,282 Wheel Balancer System with Centering Check
- 6,484,574 Wheel Balancer Apparatus with Improved Imbalance Correction Weight Positioning
- 6,523,408 Wheel Balancer System with Improved Matching Capabilities
- 6,546,635 Vehicle Service Equipment Utilizing Wheel Lateral Force Measurements
- 6,595,053 Balance Correction System with On-Car Runout Device
- 6,609,424 Wheel Balancer with a Mounting Mode of Operation
- 6,715,351 Wheel Balancer Data Acquisition Arm

- 6,799,460 Wheel Balancer Using Tire Stiffness and Loaded Wheel / Tire Measurements
- 6,854,329 Wheel Balancer with Variation Measurement
- 6,952,964 Vehicle Wheel Balancer System
- 7,191,651 Vehicle Wheel Balancer System with Projection Display
- 7,221,441 Method for Measuring Optically Reflective Vehicle Wheel Surfaces
- 7,359,248 Method and Apparatus for Determining Imbalance Correction Weights for a Rotating Body
- 7,328,614 Improved Vehicle Wheel Balancer System
- 7,353,610 Wheel Component Centering System for Vehicle Service Devices
- 7,574,913 Vehicle Wheel Balancer System and Display Method
- 7,594,436 Method for Determining an Imbalance Condition of a Rotating Body
- 7,617,726 Method and Apparatus for Vehicle Wheel Imbalance Correction Weight Type Selection
- 7,658,108 Method and Apparatus for Selection of Balancer Static Imbalance Correction Mode
- 7,684,027 Method and Systems for Wheel Balancer Weight Placement Aid
- 7,686,483 Method and Systems for Balancing Spoked Wheels Using Weight Behind a Single Spike

Brake Lathes

- 5,785,457 Brake Lathe with Display
- 7,059,056 Wheel Centering System for Vehicle Service Devices
- 7,334,510 Vehicle Brake Lathe with Variable Speed Motor
- 7,536,936 Vehicle Brake Lathe with Variable Speed Motor
- 7,640,832 Method and Apparatus for Resurfacing Brake Rotors
- 7,681,478 Method and Apparatus for Resurfacing Brake Rotors

Inspection Lane

- 3,855,841 Method of Testing Vehicle Shock Absorbers and Apparatus Therefor
- 5,083,456 Plate Brake Tester Apparatus and Method
- 5,129,149 Stand-Alone Sideslip Meter
- 5,230,242 Plate Brake Tester Apparatus and Method
- 5,305,636 Plate Brake Tester and Method
- 5,369,974 Suspension Tester and Method
- 5,379,636 Plate Brake Tester Apparatus and Method
- 5,386,639 Multi-Axe Vehicle Sideslip Tester
- 5,979,230 Brake in Motion Plate Brake Tester and Method

Lifts/Racks/Jacks

- 3,216,530 Vehicle Service Rack
- 4,050,545 Vehicle Lifting Jack Assembly
- 4,238,003 Vehicle Lift Rack
- 4,319,666 Vehicle Service Jack
- 4,804,068 Vehicle Elevating Apparatus and Method of Assembly
- 5,012,898 Control System for Vehicle Lift Racks
- 5,299,658 Automatic Hydraulic Lift Circuit
- 5,189,432 Automotive Lift Hydraulic Fluid Control Circuit
- 5,738,971 Turn Plate and Slip Plate Centering and Looking Mechanism
- 7,702,126 Vehicle Lift Measurement System

Miscellaneous

- 2,565,233 Wheel Spinner for Automobile Wheels
- 2,831,298 Vehicle Tire Turning Apparatus
- 3,572,106 Radial Tire Force Indicator Apparatus
- 3,575,047 Radial Tire Force Determining Apparatus
- 3,895,545 Steering Wheel Turning Device
- 3,951,112 Rotary Internal Combustion Engine with Rotating Circular Piston
- 3,953,159 Internal Combustion Engine
- 3,964,442 Internal Combustion Engine
- 4,029,369 Turn Plate Dirt Seal
- 4,134,580 Vehicle Headlight Testing Apparatus
- 5,870,835 Automotive Measuring Gauge
- 7,484,427 Vehicle Tire Changer with Integrated Detector for Tire Pressure Sensors