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**WO 2024/009123 A2**

(54) Title: TWO-PISTON SMART VALVE WITH ADJUSTABLE TIRE INFLATION

(57) Abstract:

## Description

### Title of Invention: Two-piston smart valve with adjustable tire inflation

[0001] smart valve with adjustable tire inflation which consists of the following parts: 1. Air outlet and air inlet 2. Adjustable button with air outlet capability 3. Air inlet ducts 4. Air adjustment piston inside the tire. the adjustment of car tire pressure in this design is done automatically and manually. the designed piston is essentially a two-way piston, but because we use the manual valve mode, we can activate the piston with a mechanical side and in the automatic mode, the smart valve adjusts to the appropriate proportion according to the weight and pressure of the tire, so that the car air is always adjusted.

#### Technical Field

[0002] F16K37/00; G01K1/02; G05D7/06; G08B21/18

#### Background Art

[0003] Smart Valve and Related Control Method

[0004] United States Patent Application 20150176718

[0005] A smart valve and the related control method to solve the problem of energy waste in current heating and air-conditioning systems due to the inconvenience of valve adjustment. The smart valve is constructed with the valve body, the valve stem, and the internal valve spool located inside the body of the valve. The specialty of the smart valve is its inclusion of a controller, pressure differential transducer, display monitor, and a keypad that can enter certain flow rates and operating information to the controller. The illustrated Actuator, pressure differential transducer, display monitor, and keypad are all connected to the controller. The controller is able to receive the parameter settings entered by the keypad and the pressure differential detected by the pressure differential transducer and will process and send certain movement instructions to the actuator to drive the movements of the valve stem.

[0006] Air shock absorber with a smart suspension system with height adjustment without losing comfort and safety

[0007] The United States Patent 919324

[0008] The smart suspension is a compilation of air coils (air cylinder and air piston) as well as a smart hydraulic shock absorber that in respect their roles are making comfort and improving vehicles balance. Regardless of the vehicle, the height adjustment system being used in smart suspension adjusts the height and has the ability to drive at any desirable heights without losing a bit of comfort and safety (lowest to the highest elevations). There are two manual and automatic height adjustment systems, the

automatic system is being activated by disembarking passengers and the manual system is set using the electronic key. These changes can range from 1 mm to 20 cm in both conditions there would be no change in safety or any uncomfortable feeling.

[0009] Smart valve maintenance alert device

[0010] The United States Patent, 11060632

[0011] A smart valve maintenance alert device includes a connection unit, which is connectable to a valve stem of a smart valve. The connection unit includes a detectable element that is movable in unison with the valve stem. A control unit includes a detecting element arranged to correspond to the detectable element. A drive unit is connected to the connection unit, and the drive unit drives the connection unit to allow the valve stem to be driven by the connection unit to rotate, and the valve stem drives the smart valve to rotate. The detecting element and the detectable element collaboratively generate a detection signal in response to the rotation of the valve stem, such that the control unit generates data of the operation state according to the detection signal.

[0012] Mass Flow Controller Driven by Smart Material Actuator with Mechanical Amplification

[0013] United States Patent Application 20140109995

[0014] An improved mass flow controller with a body having an inlet and an outlet; a sensor adapted to sense the flow of material out of the outlet; a controller adapted to receive a signal from the sensor; a proportional valve operatively connected between the inlet and the outlet; and a mechanically-amplified smart material actuator electrically connected to the controller and operatively connected to the proportional valve. The mechanically-amplified actuator comprises a smart material device, a compensator, a movable supporting member, at least two mechanical webs, at least two actuating arms, and a second stage assembly.

[0015] SMART ACTIVE TIRE PRESSURE OPTIMISING SYSTEM

[0016] United States Patent Application 20150005982

[0017] Smart Active Tire Pressure Optimizing System [TPOS] 102 is a highly time sensitive design and technique that acts instantaneously in sensing and controlling the tire pressure particularly in imminent and inevitable critical driving situations to reduce emergency & high speed braking distance, mitigate—loss of traction, hydroplaning, roll over, loss of stability, over & under steering, break failure, loss of control due to puncture by smartly sensing, perform context aware computing and directing the Tire Pressure Control Units [TPCU] 104 to instantaneously control the tire pressure in right time with right pressure on right tires thereby actively controlling the footprint and sidewall deformation rate to enhance traction & stability simultaneously sustaining drivability or steer ability ultimately to avoid or reduce the impact of collusion and

overcome or mitigate critical situations for protecting the vehicles, occupants, pedestrians and other objects around or on the way; also according to design, configurations and scenarios the system instantaneously optimizes the tire pressure on all tires for further safe driving till next restoration else restores the pressure to optimum preset value utilizing inbuilt reservoir or other external restoration systems immediately after the vehicle overcomes the critical situation to continue with safe and comfortable driving. In critical situations, TPOS performs sensing, pre-computing, and current computing for controlling the tire pressure during a critical situation, post computing to optimize tire pressure after overcoming accordingly. TPOS 102 utilizes a smart and adaptive closed-loop processing algorithm with a predetermined and tested lookup table to instantaneously check and compare the effects between predetermined and tested real-world scenarios to the actual real-world scenarios for actively sensing, computing, and controlling the tire pressure accordingly to mitigate the critical situations. The controlling of tire pressure is computed mainly based on parameters comprising of sensor system, vehicle safety and stability systems, nature of braking & brake force distribution, tires upper & lower cut-off pressure values, sensing reservoirs and tires internal & external pressure, temperature, moisture, humidity, wheel & tire specifications, vehicle & wheel speed, acceleration & deceleration, vehicle orientation & axial rotation, transverse motion & lateral acceleration, tires position or angle of attack, load & torque distribution, tire traction, steering position, cornering effects, change in Centre of gravity, over & under steering, hydroplaning, sensing road conditions, etc and to further enhance the efficiency, the system interoperates with vehicles existing safety and stability systems like ABS, EBD, ESC, TCS, Rollover mitigation systems, ECU, BA, Precrash systems, suspension & vertical dynamics, radar assisted auto braking, cruise control system, aerodynamics & airbrakes etc. Other aspects of the present invention are controlling the tire temperature according to environmental temperature, moisture, and humidity thereby enhancing traction and varying tire pressure according to changes in the center of gravity & load, driving modes—comfort, standard, and sports modes.

[0018] Smart active tire pressure optimizing system

[0019] The United States Patent 9296263

[0020] Smart Active Tire Pressure Optimizing System is a highly time-sensitive design and technique that acts instantaneously to sense and control the tire pressure particularly during imminent/inevitable critical driving situations to reduce emergency and high-speed braking distance, mitigate the loss of traction, hydroplaning, roll-over, loss of stability, over and understeering, brake-failure, loss of control due to puncture through real-time sensing, perform context-aware computing and directing Tire Pressure Control Units to actively control the tire pressure in the right time with right pressure

on right tires thereby instantly controlling footprint and sidewall deformation rate to enhance, traction and stability simultaneously sustaining drivability/steer-ability and restore/optimize to pre-set tire pressure value immediately after overcoming critical situation for further safe and comfortable driving. Other aspects are controlling tire temperature according to environmental temperature, moisture, and humidity to enhance traction and vary tire pressure according to driving modes like comfort, standard, sports etcetera.

- [0021] Tire tread depth and tire condition determination
- [0022] The United States Patent 10907959
- [0023] A method for assessing tire tread depth and/or tire condition by taking analyzing a camera image or images of a tire using portable instrumentation.
- [0024] VEHICLE WHEEL MONITORING SYSTEM
- [0025] United States Patent Application 20210300130
- [0026] A mobile electronic device (102, 300), and a method, for obtaining a tire pressure reading from a tire pressure sensor module (700) fitted to a valve of a pneumatic tire (106), a tire pressure sensor module, a locating feature (304, 400) and a tire pressure gauge system comprising the above. The mobile electronic device comprises a transmitter (202) and a receiver (200) to transmit and receive telecommunications signals over a distance of up to 4 cm to obtain the tire pressure reading, and a locating feature to indicate when the transmitter and/or receiver are located within 4 cm or less of the tire pressure sensor module. The tire pressure sensor module comprises an antenna to detect a telecommunications signal from a mobile electronic device over a distance of up to 4 cm, a transmitter (902), a receiver (904), and a pressure sensor (916) to measure tire pressure.
- [0027] Tire monitoring device and method
- [0028] United States Patent 10828943
- [0029] A tire monitoring device configured to be mounted on a wheel is described. The device includes a pressure sensor for sensing an inflation pressure of a tire on the wheel; a wireless communication interface configured to receive data indicative of a command to indicate tire pressure; storage storing a predetermined pressure value; an indicator configured to provide a first indication and a second indication, wherein the first indication is different from the second indication; and a processing system configured to operate the indicator to provide the first indication or the second indication responsive to receipt of the command to indicate tire pressure, and based at least in part on the inflation pressure and the predetermined pressure value.
- [0030] Valve with the smart handle
- [0031] United States Patent Application 20040045608
- [0032] A valve with a smart handle including a memory module to log relevant data. A

sensor on the handle determines when the valve is open, and this triggers the start of timers and recording of the “open” event in a log in the memory module. When the valve is closed, the sensor triggers the stopping of the timers and the recording of the “closed” event in the log. The timer information is used to calculate the duration of the time “open” event, and this, together with the actual date and time of the opening and closing of the valve, are recorded in the log. Other relevant information, such as cylinder fill date, cylinder I.D. number, batch number, and patient name or account number may also be logged in the memory module. The log of the events and the corresponding dates and times may be used to prepare invoices for billing gas treatments, for inventory control, and for other record-keeping and control functions.

### **Summary of Invention**

[0033] A valve stem is a self-contained valve that opens to admit gas to a chamber (such as air to inflate a tire) and is then automatically closed and kept sealed by the pressure in the chamber, or a spring, or both, to prevent the gas from escaping. They are most commonly used on automobiles, motorcycles, and bicycle tires, but also for many other applications. The designed part is the smart tire valve of the car, which consists of two main metal and plastic parts that are placed inside each other and a one-way four-hole piston is designed between this part and air enters from the valve bullet and exits at the end of the part. The valve is designed in two ways: Manual adjustment 2. Automatic adjustment. In manual mode, a button is designed on the valve that empties the tire if necessary by pressing the extra air button. In principle, the piston used is a two-way piston, but it is activated one way due to manual wind adjustment. The car air enters the car tire automatically in proportion to the smart valve. This manual or automatic mode causes the car tire pressure to always be adjusted

### **Technical Problem**

[0034] A valve stem is a self-contained valve that opens to admit gas to a chamber (such as air to inflate a tire) and is then automatically closed and kept sealed by the pressure in the chamber, or a spring, or both, to prevent the gas from escaping. They are most commonly used on automobiles, motorcycles, and bicycle tires, but also for many other applications.

[0035] Humans have always been looking for the right tire since the invention of the automobile. The first was Weber tires. Later, pneumatic tires made a dramatic change, and punctures are very simple if the car is punctured, it can continue to move up to 200 km. The only problem with this type of tire is its air pressure, which is usually irregular.

[0036] "If the tire is low, the fuel consumption will increase." Millions of dollars are spent annually in the world due to low tire pressure. Adjusting the tire pressure is constantly

tedious and requires literature, so few people have the patience to do this.

[0037] Proper wind pressure increases tire strength against gravity and various driving conditions such as braking, acceleration, etc. The best tire condition is provided by proper wind pressure. Therefore, wind pressure should be adjusted at least once every two weeks

1. Increased fuel consumption due to increased road contact
2. If the front wheels are low, the steering wheel is stiff or pulled to one side
3. Abrasion faster and more on the outside of the treads
4. Separation of layers increases, which poses many risks
5. Ripple and heat rise at high speeds
6. Crush the tube between the rim and the inner ring of the tire

[0038] In previous designs, due to the increase or decrease in air pressure in the wheels, factors such as increased fuel consumption and wear and tear, and the loss of tires. Therefore, the design of the smart valve, which is a two-piston valve with additional air discharge capability, automatically adjusts the wind for each vehicle with a unique design. It prevents wear and tear of the lining and tires and prevents increased fuel consumption.

### **Solution of problem**

[0039] A valve is a plastic or metal tube used in both tubular and tubeless tires. Most people who work with a car do not have a string head valve, but we should know that this small device is very valuable and also practical. Most of us park our car when we are done and go to the car tomorrow to see that our tires are low. Sometimes there is even no air in the tires. The first thought that comes to mind is the puncture of the tire by others, but most of the time we think wrong.

[0040] The valve, like anything else that has a long service life, has a limited lifespan and it is recommended that the valves be replaced when replacing the tire, as the valve is attached directly to the rim or is an integral part of the inner tube. Valve tires may break down suddenly, and in tubeless tires, replacing the valve at regular intervals or changing the tire greatly reduces the possibility of damage.

[0041] The designed part is the smart tire valve of the car, which consists of two main metal and plastic parts that are placed inside each other and a one-way four-hole piston is designed between this part and air enters from the valve bullet and exits at the end of the part.

[0042] The valve is designed in two ways: Manual adjustment 2. Automatic adjustment

[0043] In manual mode, a button is designed on the valve that empties the tire if necessary by pressing the extra air button. In principle, the piston used is a two-way piston, but it is activated one way due to manual wind adjustment. The car air enters the car tire automatically in proportion to the smart valve. This manual or automatic mode causes the

car tire pressure to always be adjusted

### **Advantage effects of invention**

- [0044] One of the most important benefits of a valve is that it prevents dust and moisture from entering the tire.
- [0045] Wind pressure is always standard
- [0046] No equipment is added to the car
- [0047] It does not increase fuel consumption in any way
- [0048] Very simple production
- [0049] Ability to run on all types of tires

### **Brief Description of Drawings**

- [0050] [Fig.1]: Overview of Two-piston smart valve with adjustable tire inflation

### **Description of Embodiments**

- [0051] [Fig.1]: 1. Air outlet and air inlet 2. Adjustable button with air outlet capability 3. Air inlet ducts 4. Air adjustment piston inside the tire

### **Examples**

- [0052] The designed part is the smart tire valve of the car, which consists of two main metal and plastic parts that are placed inside each other and a one-way four-hole piston is designed between this part and air enters from the valve bullet and exits at the end of the part.
- [0053] The valve is designed in two ways: Manual adjustment 2. Automatic adjustment
- [0054] In manual mode, a button is designed on the valve that empties the tire if necessary by pressing the extra air button. In principle, the piston used is a two-way piston, but it is activated one way due to manual wind adjustment. The car air enters the car tire automatically in proportion to the smart valve. This manual or automatic mode causes the car tire pressure to always be adjusted

### **Industrial Applicability**

- [0055] Ability to run on all types of tires

## Claims

- [Claim 1] smart valve with adjustable tire inflation which consists of the following parts: 1. Air outlet and air inlet 2. Adjustable button with air outlet capability 3. Air inlet ducts 4. Air adjustment piston inside the tire.
- [Claim 2] According to claim 1, the adjustment of car tire pressure in this design is done automatically and manually.
- [Claim 3] According to claim 2, the designed piston is essentially a two-way piston, but because we use the manual valve mode, we can activate the piston with a mechanical side.
- [Claim 4] According to claim 2, in the automatic mode, the smart valve adjusts to the appropriate proportion according to the weight and pressure of the tire, so that the car air is always adjusted.

[Fig. 1]

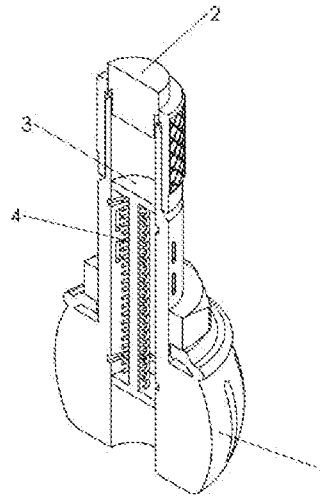


FIG 01

**PATENT COOPERATION TREATY**

**PCT**

**DECLARATION OF NON-ESTABLISHMENT OF INTERNATIONAL SEARCH REPORT**

(PCT Article 17(2)(a), Rules 13ter.1(c) and (d) and 39)

Applicant's or agent's file reference 1401031301	<b>IMPORTANT DECLARATION</b>
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International Patent Classification (IPC) or both national classification and IPC B60C23/00,F16K37/00 Version=2022.01	
Applicant TABAEI KHALEDI, SEYED ALI	

This International Searching Authority hereby declares, according to Article 17(2)(a), that **no international search report will be established** on the international application for the reasons indicated below.

1.  The subject matter of the international application relates to:
- a.  scientific theories
  - b.  mathematical theories
  - c.  plant varieties
  - d.  animal varieties
  - e.  essentially biological processes for the production of plants and animals, other than microbiological processes and the products of such processes
  - f.  schemes, rules or methods of doing business
  - g.  schemes, rules or methods of performing purely mental acts
  - h.  schemes, rules or methods of playing games
  - i.  methods for treatment of the human body by surgery or therapy
  - j.  methods for treatment of the animal body by surgery or therapy
  - k.  diagnostic methods practised on the human or animal body
  - l.  mere presentations of information
  - m.  computer programs for which this International Searching Authority is not equipped to search prior art

2.  The failure of the following parts of the international application to comply with prescribed requirements prevents a meaningful search from being carried out:
- the description                       the claims                       the drawings

3.  A meaningful search could not be carried out without the sequence listing; the applicant did not, within the prescribed time limit:
- furnish a sequence listing complying with WIPO Standard ST.26, and such listing was not available to the International Searching Authority in a form, language and manner acceptable to it.
  - pay the required late furnishing fee for the furnishing of a sequence listing in response to an invitation under Rule 13ter.1(a).

4. Further comments:  
  
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INTERNATIONAL SEARCH REPORT

The applicant has described the invention in the description as a valve consisting of two main metal and plastic parts that are placed inside each other but don't mention whether the metal part is inside the plastic part or the plastic part is inside the metal part. It further mentions a one-way four-hole piston is designed between this part but the piston marked with reference numeral 4 in the drawing doesn't show the four holes mentioned in the description. It further mentions air enters from the valve bullet but the term 'valve bullet' is not a proper technical term indicating the position. Also, the automatic adjustment of the valve is also not described properly. It also mentions the piston as a 'two-way piston' but doesn't explain or provide an indication in the drawings.

A person skilled in the art needs the above information to perform the invention on its own. Due to the lack of such information, the application suffers from insufficiency of disclosure as per Article 5 of PCT.

Hence, a meaningful search cannot be performed for the application.