

Handlebar Bi-Directional Portable Pump on Vehicle

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Abstract. The design is to change the ordinary one-directional push-type pump into bi-directional pull-type pump. At the same time, it also integrates bi-directional pull-type pump and bike handle faucet, which integrates the pump and bike together successfully. Therefore, this design fundamentally improves the portability of the pump to avoid the clumsiness type caused by carrying pump. Besides, it reduces the burden of carrying the pump, increases doubly the efficiency of work and avoids the body up and down movement when uses pump.

Background and Significance of This Design

As now advocates green travel concept, bike was given new meaning in the new era. With the rapid development of the times, the environmental problems are becoming more and more serious and the traffic is becoming increasingly crowded. The bike as an important travel tool in both major and small cities, it can meet the different needs of urban travelers with the ground and underground bus and subway system, which is useful to make the city's public transport traffic rate reach a higher level.

We should realize that because of the existing technology on the market of portable pump are basically one-directional push-type pump, there are many issues, such as low efficiency, more effort needed and inconvenient to carry. The design is to change the ordinary one-directional push-type pump into bi-directional pull-type pump to improve the efficiency and to avoid the original body up and down movement when uses pump, which can prevent the waist muscles and knee muscle damage. Besides, this design can save time and effort. It also integrates bi-directional pull-type pump and bike handle faucet, which integrates the pump and bike together successfully. It fundamentally solves the inconvenience and clumsiness caused by carrying pump.

In the era of economic sharing, sharing bicycles appear. At the same time, phenomenon of tire leakage and puncture is increasing when riding. The existing problems will be fixed to carry a pump on the bike or the bike to be fixed on the maintenance location. However, carrying a pump will affect the aesthetics and waste time and effort to fix it at maintenance location. By placing and using the design on sharing bicycles, the rider can consciously pump if bicycles appear tire leakage and puncture. Then it can greatly reduce the number of fault repair and reduce the work pressure of the relevant staff in the global scale. And gradually increases the national moral quality and their own literacy.

Design of Pump Structure

The design is to change the ordinary one-directional push-type pump into bi-directional pull-type pump to improve the efficiency and to avoid the original body up and down movement when uses pump, which can prevent the waist muscles and knee muscle damage. Besides, it also integrates bi-directional pull-type pump and bike handle faucet, which integrates the pump and bike together successfully. This design realizes the convenience, reduces the clumsiness and improves the aesthetics of bike.

To achieve the above objectives, this paper will use the following technical program. This product is made by pump frame(bike handlebar), pump air intake(bike handlebar), pump air outtake(bike handlebar core), pump piston, the threaded hole of handle center, leather tube (removable, normally hidden under the bike seat), the handlebar center connection and other major structures. Just need to connect pump air outtake and hose, put hands on the bike handlebar near the

middle of the bike faucet and then make pull-push movement at the same time when pump for the bike. The air comes into handlebar storage tube and through the leather tube into the bicycle tire, and then remove the leather tube and put it under the bike seat. All the process to pump a bike is completed.

Through the main aspects of this design involved, it solves many issues of traditional pump, such as the inconvenience to carry, waste time to pump, aesthetics is not strong. This design is scientific and reasonable and has accurate positioning and simple structure, so it is easy to realize as industrial manufacturing difficulty coefficient is not high and cost is low.

Design of Bi - Directional Pull - Push Pump



Figure 1. Schematic of Bi-Directional Pull-Push Pump

Fig.1, bi-directional pull-push pump is made by pump air intake(1) and pump air outtake(2), pump outlet (3) leather tube(4) (removable, normally hidden under the bike seat) (Fig. 1 does not draw) three parts.

When using the air pump, it is necessary to connect its air intake to the valve of the bicycle tire. When the pump air intake (1) is stretched to the left and right sides, the air is into the cylinder from the small hole between pump air intake (1) and pump air outtake(2). Hold the pump air intake (1) both ends near the center of the pump, air will be placed in the pump air outtake (2) through one-way valve at both ends of the pump air outtake (2). And then air will into the tire valve along with the pump air outtake(3).

Handlebar Integration Design of Pump

This section mainly marks and describes the various components of handlebar bi-directional portable pump. As shown in Fig. 2 below.

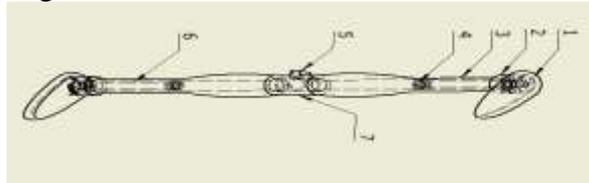


Figure 2. Schematic of Bike Faucet

This part consists of pump (bicycle faucet) handrail (1), pump (bike faucet) inlet (2), pump intake(bike faucet) (3), pump piston (4), the threaded hole of handle center(5), pump outtake(bicycle faucet inner core) (6), handlebar center connector (7), leather tube (8) (removable, normally hidden under the bike seat) (Fig.2 does not draw).



Figure 3. Physical Effect Picture of Bike Handlebar (normal state)



Figure 4. Physical Effect Picture of Bike Handlebar (pump state)

The design that integrates bi-directional pull-push pump(hereinafter referred to as bi-directional pump) and bike handle faucet together needs to change bi-directional pump intake into bicycles' left and right handlebar. Put bi-directional pump outtake into the bike handlebar cavity and bi-directional pump air outlet in the connection of bike handlebar and seat.

If the tire occurs leakage or punctured by sharp objects during the ride, firstly, we should immediately slow down and find a place where you can stop the bike and check the tires. And then takes out the leather tube(8) which is placed under the bicycle seat and connects the threaded end of the hose (8) to the center hole (5) of the handlebar. At the same time, connects the other end of the leather tube with the valve of failure of the tire(be sure to keep the connection tightly). Thirdly, rotates and separates both left and right pump intake (bike faucet)(3) and handlebar center connector (7) as they are threaded connection. At the same time, please always make sure the connection of pump outtake(bicycle faucet inner core) (6) and handlebar center connector (7) as they are integral connection. Afterwards, put hands on the bike handlebar near the middle of handlebar center connector (7) and then makes pull-push movement at the same time to pump for the bike(This invention is a bi-directional pump. It can ensure the length of the pump and save effort at the same time according to the principle of force and reaction, thus ensuring the work efficiency). Removes leather tube (8) from both tire and threaded hole of handle center and put it under the seat again. At the same time, tightens left and right pump intake (bike faucet)(3) and handlebar center connector (7). These are all the processes of once pumping.

Handrail Design of Handlebar Bi-Directional Portable Pump

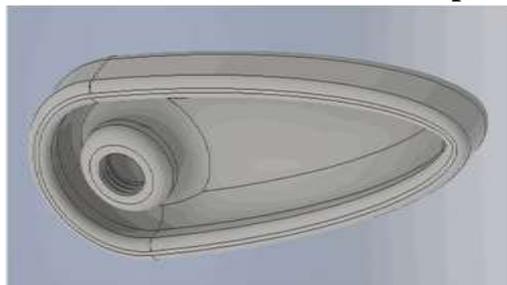


Figure 5. Physical Effect Picture of Bicycle Handlebar Handrail

The main role of handrail showed in Fig.5 is to decorate bike handle and enhances the bike aesthetics. It can be designed based on the bike business LOGO or consumer willingness.

Market and Theoretical Analysis of Pump

Market Analysis of Pump. Bicycles are essential vehicles for every household. Sometimes, the tires will leak or be punctured on the way. This pump is designed to minimize or even avoid the phenomenon of people leaving the road due to the absence of tires. Therefore, this design has a wide range of market demand. Besides, this design fundamentally solves the inconvenience and clumsiness caused by carrying pump and it can also save time and effort with high work efficiency. Meanwhile, this design has the advantages of simple structure and scientific design. It is easy to realize as industrial manufacturing difficulty coefficient is not high and cost is low, which makes this design has broad market prospects.

It adapts to the new shared bicycle industry under the sharing economic system. As the cost of market economy is not high and the mass production process is not complicated, high-volume and rapid production can be carried out. This design can meet the features of shared bicycle vehicles,

such as large quantity, a wide range of maintenance and many consumer. Therefore, most of the shared bicycles can use this design.

It adapts to a number of two-wheelers (including bicycles, electric cars, etc.) factories mass production in global. This design not only takes into account the traditional push-push pump shortcomings, how to increase the aesthetics of the bike when change the shortcomings is also considered comprehensively. This pump (bike handlebar) handrail is a great consideration for the aesthetics, which can be made based on the business brand. According to the working principle of this design, electric car-mounted bi-directional portable pump can also be designed and put this product into the electric car or even tricycle handlebar, which will broaden the market prospects.

It adapts to the consumer's personal DIY design. There are many persons from teenager to elder in China. Cycling organizations and personal teams are huge. Consumers can design pump (bike handlebar) handrails based on their own needs, which greatly meets the consumer psychological and stimulates more consumers to spend.

Material Analysis of Pump. Parts size, material and shape of this design are as follows. The material of pump (bicycle faucets) handrails and pump (bicycle faucet) intake is lightweight plastic. The design of handrail for aesthetic considerations can be made into any shapes. The material of pump air outtake(bike handlebar inner core) is PUT and the material of bicycle faucet is aluminum alloy. Pump piston material is high quality rubber. There is leather tube outside(removable, normally hidden under the bike seat). The diameter of hexagonal nut matching with threaded hole of handle center (5)and inner diameter of bike faucet is 15 mm. The diameter of pump air outtake(bicycle faucet inner core) (6) is less than the diameter of the inner cavity of the bicycle faucet. The stretchable length of pump(bicycle faucets) handrails (1) is 130-270mm.

Air Volume Analysis of Pump. The diameter of the inner cavity of pump intake (bike faucet)is $\phi 32\text{mm}$ and the stroke is 140mm, so the compressible gas is $2 \times 1.6 \times 3.14 \times 14 \approx 141 \text{ (cm}^3\text{)}$.

The distance of both hands to the end of handlebar are 135mm when pumping. When the two hands make a force F to the middle of compressed gas, each hand can save $1/2 F$ according to the principle of force and reaction force. It was learned that when pumping, as long as make 10N on bike handle, the force acting on piston to compress gas is 20 N. If there is 50N on handrail, the unit pressure is $P = 1 / 2F \div (3.14 \times 1.6) \approx 5\text{Pa}$.

By calculating the air intake capacity of the vehicle-mounted bi-directional portable air pump and analyzing the force, we can know that this design improves the working efficiency with two times of the portable pump by comparing with the conventional one-directional push-push pump.

Beneficial Effect of This Pump

The integrated design of the pump and bike faucet fundamentally solves the inconvenience of carrying a pump and can play a role when the consumer needs it.

The design is to change the ordinary one-directional push-type pump into bi-directional pull-type pump to improve the efficiency and to avoid the original body up and down movement when uses pump, which can prevent the waist muscles and knee muscle damage.

The customized feature of bicycle handrail makes the bicycle look more beautiful. It can meet the brand needs of the bike manufacturers and stimulate the majority of consumers to spend.

Conclusion

The biggest reason to delay time is that pump is inconvenient to carry so as to make riders can not pump timely when appears tire leakage and punctured by sharp objects. However, the invention and advent of this pump with its own design features is a very good solution to this big problem. Of course, this invention also has some shortcomings. There are also a lot of research directions of adding the electric mode on handlebar bi-directional portable pump in future.

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