Candidate's answer

Description

The present invention relates to an air pump assembly comprising a bicycle frame.

It is know to attach an air pump to a bicycle by clips. The air pump can be used inflate bicycle tyres.

However, such air pumps sometimes fall off, and are easy to steal.

A first solution to these problems is provided by D1, upon which the preamble of each of the appended independent claims is based.

D1 discloses a bicycle with a built in compressed air reservoir, in which the bicycle frame comprises a hollow seat tube. A compressed air reservoir is built into the seat tube. A hermetic plug and an electric rotary air pump 16 are fixed in the seat tube. The air reservoir is a closed cylinder comprising the portion of the seat tube 3 between the plug and pump. A one-way valve, through which air can enter but not leave the reservoir, is located in the portion of the seat tube. An air outlet comprises a lateral through-hole in the portion of the seat tube. The through-hole extends to the exterior of the bicycle frame. The air outlet also comprises a manually operable tap for controlling the flow of air out of the reservoir through the through-hole.

When it is connected to a mains electricity supply the electric pump can fill the reservoir. The pump pumps air from the exterior of the bicycle frame, via the seat post, into the reservoir. When mains electricity is not available, the reservoir can be filled with air by connecting a compressed air source to the one-way valve. Compressed air then passes from the compressed air source into the reservoir via the one-way valve. When it is completely filled, the reservoir contains enough air to inflate two bicycle tyres.

To inflate a bicycle tyre the tyre is connected to the air outlet 14 via the hose 9. When the tap 17 is opened, compressed air passes from the compressed air reservoir 18 into the tyre.

The compressed air reservoir is manufactured in the following steps.

In a first step a hermetic plug is glued into a seat tube. In a second step a first through-hole is formed in the seat tube 3 above the plug. In a third step, a second through-hole is formed in the seat tube above the plug and a one-way valve is mounted in the second through-hole. In a final step a manually operable tap is mounted in the first through-hole and the cylinder is hermetically closed with an electric air pump, which is glued into the seat tube.

If the seat tube is hermetically sealed by another part of the bicycle frame, the first step may be omitted.

Another solution to the problem of lost pumps is to provide a miniaturised air pump in the seat tube of the bicycle frame, and also to provide a plug in the seat tube for retaining the miniaturised air pump in the seat tube.

However, these solutions have disadvantages.

The D1 solution suffers from the problem that it can only store enough air for inflating two tyres (as already mentioned). This is inconvenient (as the compressed air needs to be regularly topped up) and potentially problematic if a lot of air is needed (i.e. if multiple punctures are suffered) in a single trip with no opportunity to refill the compressed air.

Therefore there is an outstanding problem of how to provide a pump which is not easily lost which can also provide unlimited pumping.

The problem of a miniaturised pump is that such pumps are not very robust and so is liable to break.

The invention is defined in the appended claims. In particular, claim 1 defines an air pump assembly comprising a bicycle frame, and claim 16 defines a method of manufacturing an air pump assembly.

Claim 1 is novel over D1 because it defines a piston and actuator provided within a tube of a bicycle frame. In contrast D1 has no piston or actuator because it uses an electric pump.

The provision of the piston and actuator in the frame of the bicycle itself solves the problem of limited air availability, because it provides a manual pump. As a result as much air as is required can be pumped.

The air pump assembly of claim 1 is also robust (because it is built into the bicycle frame) thereby overcoming the problem with the miniaturised pumps. It is novel over such miniaturised pumps because it uses the tube of a bicycle frame for the pump cylinder.

The method of claim 16 is also novel over D1, because it requires mounting an actuator and piston, which are not mentioned in D1 (and which are therefore not mounted in the manufacturing process of D1).

The method of claim 16 solves the same problem as claim 1, as it provides a method for manufacturing the manual air pump assembly of claim 1.

The method is also novel over any method implicitly derivable in the manufacture of a miniaturised pump, as it requires the presence of a bicycle tube to form the pump cylinder.

The claims are also novel over D2. D2 does not relate to air pumps, but to a suspension system for a bike seat post. It uses a piston and spring arrangement in the seat post to cushion the motion of the seat.

Claim 1 is novel over D2 because D2 does not provide for an air outlet as define
claim. Although the opening to the top tube in D2 could be considered an 'air outlet'
not positioned such that air is forced out of it when the piston is moved towards the se
(8) (D2 specifically says that reciprocation occurs below this through hole).

Claims

1. An air pump assembly comprising a bicycle frame (1), the air pump assembly comprising:
a cylinder comprising a portion (3b) of a tube (3) of the bicycle frame (1), a hermetic seal (8) at one end of the cylinder and an air outlet (14) for allowing air to exit the cylinder;
characterised in that the air pump assembly further comprises:
a piston (11) reciprocable in the cylinder; and
a piston actuator (4,5; 12, 13) for reciprocating the piston (11) in the cylinder;
wherein the air outlet is positioned in the cylinder such that, during reciprocation of the piston, when the piston is moved towards the hermetic seal (8) air is pumped out of the cylinder via the air outlet.

2. An air pump assembly according to claim 1, wherein the tube (3) of the bicycle frame (1) is a seat tube.

3. An air pump assembly according to claim 1 or 2 wherein the actuator (12,13) comprises a rod and handle.

4. An air pump assembly according to claim 1or 2 wherein the actuator (4,5) comprises a seat post and seat.

5. An air pump assembly according to claim 4, wherein the seta post (4) is attached to the piston (11) at one end and is open at the other end.

6. An air pump assembly according to any one of claims 1-3 or 5 wherein the piston (11) further comprises a one-way valve (15) configured to open and draw air into the cylinder when the piston (11) is moved away from the hermetic seal (8).

7. An air pump assembly according to any one of claims 1-5, wherein the cylinder further comprises a one-way valve (15) configured to open and draw air into the cylinder when the piston (11) is moved away from the hermetic seal (8).

8. An air pump assembly according to any one of the preceding claims, wherein the hermetic seal (8) is formed by a hermetic plug arranged in the tube (3).

9. An air pump assembly according to any one of claims 1-7, wherein the hermetic seal (8) is formed by a metal wall that is part of the bicycle frame (1).

10. An air pump assembly according to any one of the preceding claims wherein the piston (11) is made of rubber.

11. An air pump assembly according to any one of the preceding clams, wherein the air outlet (14) comprises a lateral through-hole (14a) in the cylinder.

12. An air pump assembly according to claim 11 wherein the through-hole (14a) is threaded.

13. An air pump assembly according to claim 11wherein the air outlet (14) comprises a ring (14b) fixed to the exterior of the tube (3) and being conce with the through-hole (14a).

14. An air pump assembly according to claim 13 wherein the ring (14b) is threaded on the outside or the inside of the ring (14b).

15. A bicycle comprising an air pump assembly according to any one of the preceding claims.

16. A method of manufacturing an air pump assembly comprising a bicycle frame, the method comprising a bicycle frame, the method comprising:
forming a hermetic seal (8) in a tube (3) in the bicycle frame to form a cylinder comprising a portion (3b) of the tube (3) with a hermetic seal (8) at one end of the cylinder, the other end of the cylinder being open;
forming a through-hole (14) in the portion (3b) of the cylinder;
characterised in that the method further comprises attaching a piston (11) to an actuator (4,5; 12,13); and
mounting the piston (11) and actuator (4,5; 12,13) in the cylinder such that air is expelled through the through-hole (14) when the piston (11) is moved in towards the hermetic seal (8).

Note to the Examiner

I have chosen D1 as the closest prior art because it relates to the same purpos (providing a pump integrated with a bicycle frame) as the invention.

D2 has a piston and actuator (and so more structural features in common with the invention) but is directed to a different purpose – providing suspension. As a result of the different field of D2, I have not mentioned it in the description until after considering the claims.

EXAMINATION COMMITTEE I

Candidate No.

Paper A (Electricity/Mechanics) 2010 - Marking Sheet

Category	Maximum possible	Marks awarded	
		Marker	Marker
Independent claim	50	50	50
Dependent claims	35	25	28
Description	15	15	15
Total	**100**	**90**	**93**

Examination Committee I agrees on 92 marks and recommends the following grade to the Examination Board:

☒ PASS (50-100) ☐ COMPENSABLE FAIL (45-49) ☐ FAIL (0-44)

02 July 2010

Chairman of Examination Committee I