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Paper A(E/M)

Electricity / Mechanics

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Client's Letter

Dear Mr Schütz,

[001] My company manufactures and sells bicycles. Fig. 1a shows a bicycle frame 1 of one of our bicycles. The bicycle is shown in Fig. 1b. The bicycle frame 1 of Fig. 1a is made of hollow tubes that are welded together. The tube 2 is called a top tube 2. The tube 3 is called a seat tube 3, it has an axial opening 3a at its upper end.

[002] The bicycle shown in Fig. 1b comprises a hollow tube 4 called a seat post 4. A bicycle seat 5 is mounted on the seat post 4. The lower end of the seat post 4 is located inside the seat tube 3. The seat post 4 is clamped in a desired position within the seat tube 3 by means of a clamp 7. When the clamp 7 is open, the seat post 4 can move within the seat tube 3 and can be removed from the seat tube 3 through the axial opening 3a. An air pump 6 is attached to the seat tube 3 by clips. The air pump 6 can be used to inflate bicycle tyres.

[003] Some years ago, our customers complained that the air pump 6 sometimes falls off the bicycle. Furthermore the pump 6 is easy to steal. Our main competitor solved these problems by making bicycles having a built-in compressed air reservoir. They published an article about this, D1. A copy of D1 is attached to this letter.

[004] We solved these problems by equipping the bicycles we sold with miniaturised air pumps. Fig. 2 schematically shows a detail of one of these bicycles equipped with a miniaturised air pump. The bicycle has a bicycle frame 1, a seat post 4, a seat 5 mounted on the seat post 4, a miniaturised air pump 6 and a plug 8 in the seat tube 3. The pump 6 has a very small diameter so that it fits inside the seat tube 3. The plug 8 prevents the pump 6 from descending too far down in the seat tube 3.

[005] We were granted a patent claiming: “Bicycle comprising a bicycle frame having a seat tube, the bicycle further comprising a plug in the seat tube for retaining a miniaturised air pump”. Unfortunately, some of our competitors managed to avoid directly infringing our patent by selling bicycle frames fitted with a plug in the seat tube. Their customers then assembled bicycles from these bicycle frames at home.

[006] We will now describe in detail the three forms of known miniaturised air pumps we have used to equip our bicycles.

[007] Fig. 3a schematically shows the first form of miniaturised air pump 6 and a hose 9. The pump 6 comprises a cylinder 10, a piston 11, a rod 12 and a handle 13. The cylinder 10 comprises an air outlet 14. The air outlet 14 has a lateral through-hole 14a in the cylinder 10 and a ring 14b. The ring 14b is concentric with the through-hole 14a and has an external thread. The piston 11 has a one-way valve 15 and can reciprocate in the cylinder 10. The rod 12 and the handle 13 make up the piston actuator. The piston 11 is fixed to a first end of the rod 12, the handle 13 is fixed to the second end of the rod 12.

[008] When the handle 13 is alternately moved in the directions of the arrows A and B in Fig. 3a, the piston 11 reciprocates in the cylinder 10. When the handle 13 is moved in the direction of the arrow A, the one-way valve 15 opens and air is drawn into the cylinder 10 via the one-way valve 15. When the handle 13 is moved in the direction of the arrow B, the one-way valve 15 shuts and air is pumped out of the cylinder 10 via the air outlet 14.

[009] The hose 9 has a first end that can be screwed to the ring 14b and a second end that can be attached to the inlet valve of a bicycle tyre (not shown). The air pumped out of the cylinder 10 can then be used to inflate the bicycle tyre.

[010] Fig. 3b schematically shows the second form of miniaturised air pump 6 and hose 9. The pump 6 of Fig. 3b differs from the pump shown in Fig. 3a only in that in Fig. 3b the piston 11 has no one-way valve, and the cylinder 10 comprises a one-way valve 15. When the handle 13 is moved in the direction of the arrow A, the one-way valve 15 opens and air is drawn into the cylinder 10 via the one-way valve 15. When the handle 13 is moved in the direction of the arrow B, the one-way valve 15 shuts and air is pumped out of the cylinder 10 via the air outlet 14.

[011] The third form of miniaturised air pump we have used is not shown. It differs from the pump shown in Fig. 3b only in that it has no one-way valve. With this pump it is necessary to use a special hose. The special hose has its own one-way valve that enables air to be drawn into the cylinder of the pump when the handle is moved away from the cylinder.

[012] Because a miniaturised air pump has a small diameter, it is not very robust and its pumping volume is limited. When reading an article about a bicycle seat suspension in an issue of the magazine “Mad about bikes” (D2), one of our bright engineers, Ms. B. C. Klette came up with an idea to solve these problems. A copy of D2 is attached to this letter. We have developed her idea into our invention by making a bicycle having an air pump assembly.

[013] Fig. 4 schematically shows a detail of a first example of our new bicycle, and a hose 9. The bicycle frame is part of the air pump assembly. The bicycle frame has a seat tube 3 in which a seat post 4 is mounted. A seat 5 is mounted on the seat post 4. A hermetic plug 8 is located in the seat tube 3.

[014] The air pump assembly comprises a cylinder, a piston 11 and a piston actuator. The piston 11 can reciprocate in the cylinder.

[015] The cylinder comprises the hermetic plug 8 and a portion 3b of the seat tube. The portion 3b starts at the axial opening 3a and ends at the hermetic plug 8. The cylinder also has an air outlet 14 positioned close to the plug 8 for allowing air to exit the cylinder. The air outlet 14 has a lateral through-hole 14a in the portion 3b. The air outlet 14 also comprises a ring 14b which is fixed to the exterior of the seat tube 3 and which is concentric with the through-hole 14a.

[016] The piston 11 is made of rubber. It has a one-way valve 15 for allowing air to enter the cylinder. The piston actuator consists of the seat post 4 and the seat 5. The piston 11 is glued to the lower end of the seat post 4. The upper end of the seat post 4 is open.

[017] To use the bicycle to inflate a tyre, the seat post 4 is first unclamped by opening the clamp 7. The tyre is connected to the air outlet 14 via the hose 9. When the seat 5 is alternately moved upwards and downwards, the piston 11 reciprocates in the cylinder. When the seat 5 is moved in the direction of the arrow A, the one-way valve 15 opens and air is drawn through the upper end of the seat post 4 and the one-way valve 15 into the cylinder. When the seat 5 is moved in the direction of the arrow B, the one-way valve 15 shuts and air is pumped out of the cylinder via the air outlet 14. The air pumped out inflates the tyre.

[018] To connect the hose 9 to the air outlet 14, the hose 9 can be clamped to the ring 14b. Alternatively, the air outlet can have a threaded ring to which a hose can be screwed. The thread can be on the inside or outside of the ring.

[019] However, the air outlet does not need to have a ring. For example, the air outlet can be a threaded through-hole in the seat tube, into which a hose can be screwed. The through-hole does not need to be threaded if a hose having a suitable clamp is used. Such hoses are known.

[020] Fig. 5 schematically shows a detail of a second example of our new bicycle, and a hose 9. This example differs from the example shown in Fig. 4 only in that in Fig. 5, the piston 11 has no valve, and the cylinder comprises a one-way valve 15 in the portion 3b of the seat tube 3, close to the plug 8. When the seat 5 is moved in the direction of the arrow A, the one-way valve 15 opens and air is drawn into the cylinder via the one-way valve 15. When the seat 5 is moved in the direction of the arrow B, the one-way valve 15 shuts and air is pumped out of the cylinder via the air outlet 14.

[021] In Fig. 5, the upper end of the seat post 4 is open. A seat post with a closed upper end could alternatively be used for this example of our new bicycle.

[022] Fig. 6 shows a detail of a third example of our new bicycle, and a hose 9. This example differs from the example shown in Fig. 4 only in that in Fig. 6, the piston actuator consists of a rod 12 and a handle 13. The piston 11 is glued to a first end of the rod 12 and the handle 13 is fixed to a second end of the rod 12. The piston actuator is dimensioned so that it fits inside the seat post 4.

[023] To use the bicycle of Fig. 6 to inflate a tyre, the seat post 4 is first unclamped by opening the clamp 7. The seat post 4 is then removed from the seat tube 3 to allow access to the handle 13. When the handle 13 is alternately moved upwards and downwards, the piston 11 reciprocates in the cylinder. Before the bicycle can be ridden, the seat post 4 is returned to its original position and then secured by closing the clamp 7.

[024] It would be possible to modify the bicycle of Fig. 5 by using the rod 12 and the handle 13 of Fig. 6 as a piston actuator instead of the seat post 4 and seat 5 of Fig. 5. When a rod and a handle are used as a piston actuator, it would also be possible to perform our invention using other tubes of a bicycle frame than the seat tube, for example the top tube.

[025] In all the air pump assemblies described above, the cylinder comprises a hermetic plug that is not part of the bicycle frame. However a cylinder for our invention can alternatively comprise a tube portion that is closed at one end by a metal wall that is part of the bicycle frame.

[026] The invention could also be performed using the special hose described above in paragraph 11.

[027] Please file a patent application for us that covers all aspects of our invention. Please note that for financial reasons we will not pay any claim fees for this patent application.

Best regards,

B. Ciclo

Client's Drawings

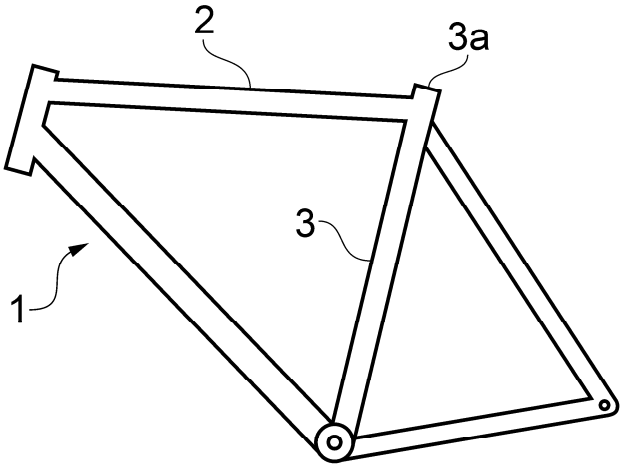

FIG. 1a

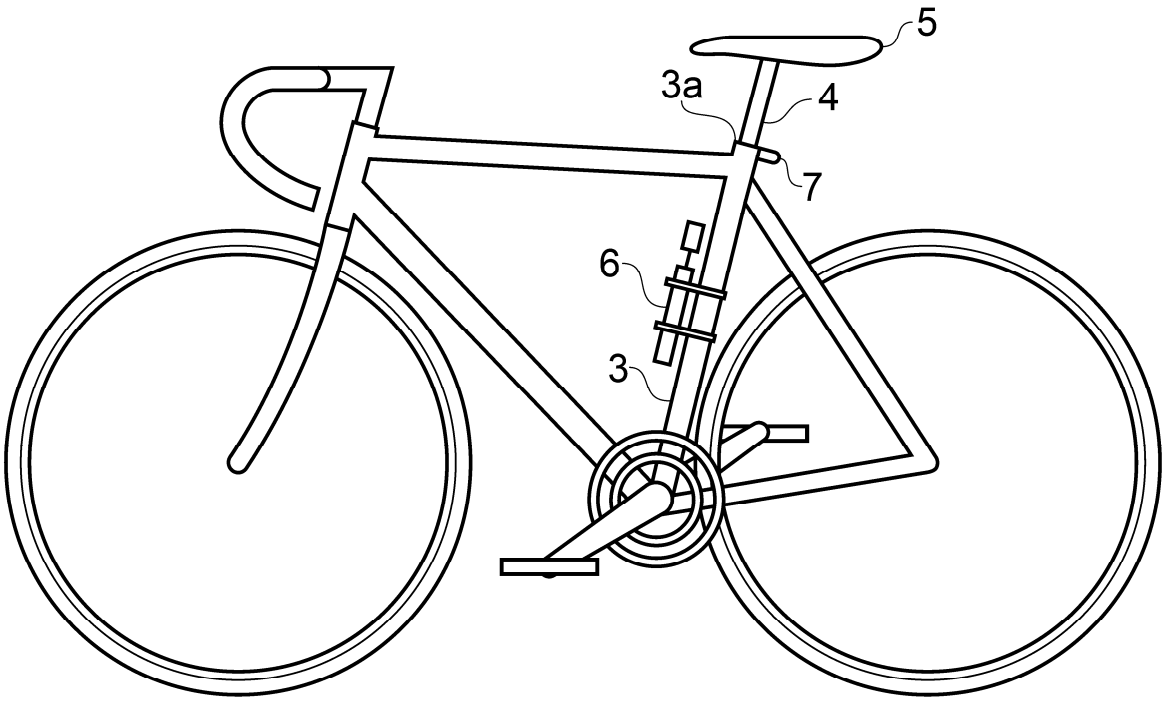

FIG. 1b

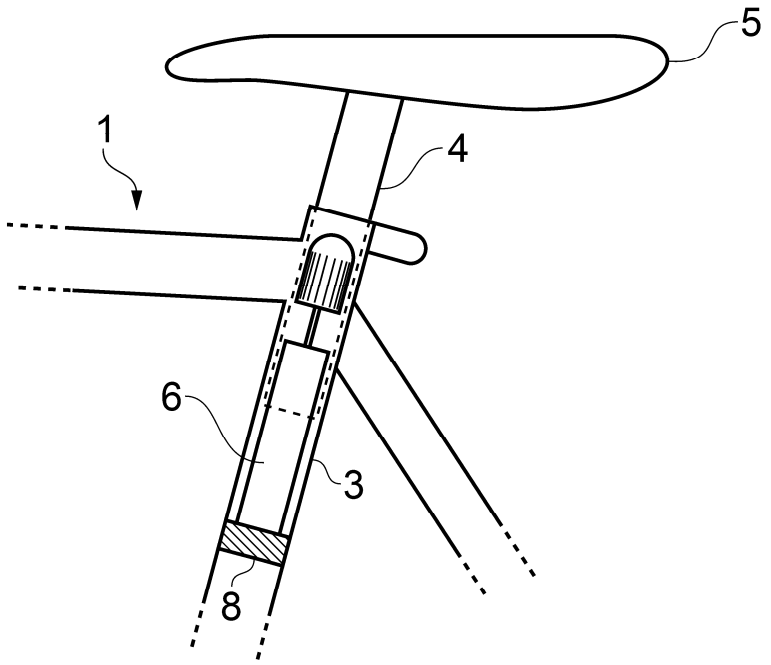

FIG. 2

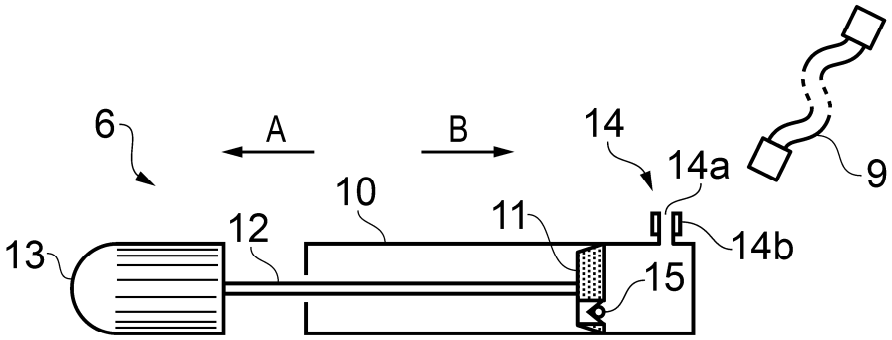

FIG. 3a

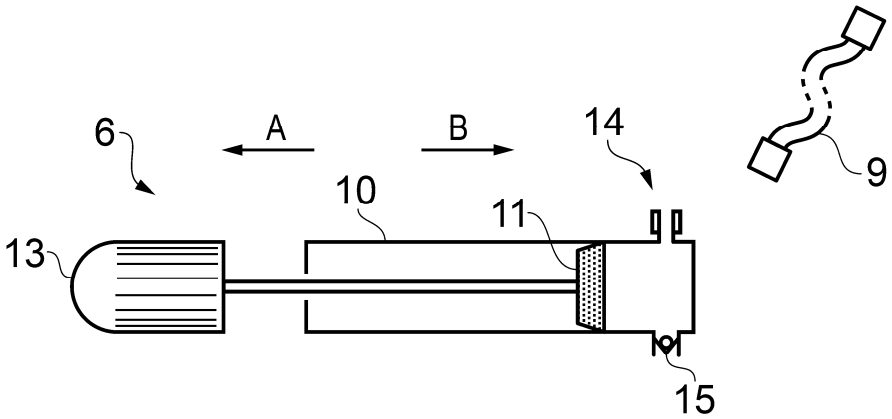

FIG. 3b

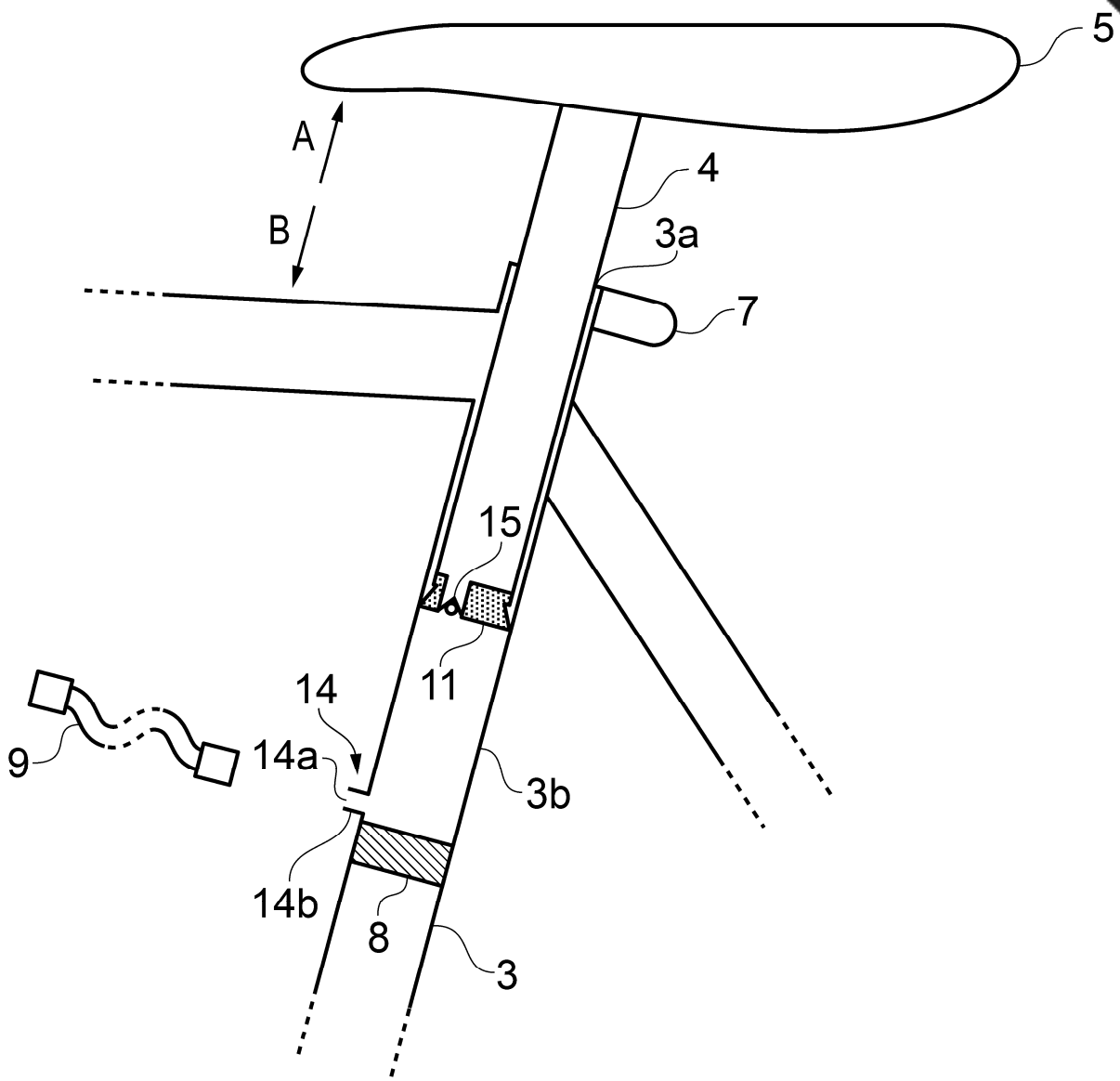

FIG. 4

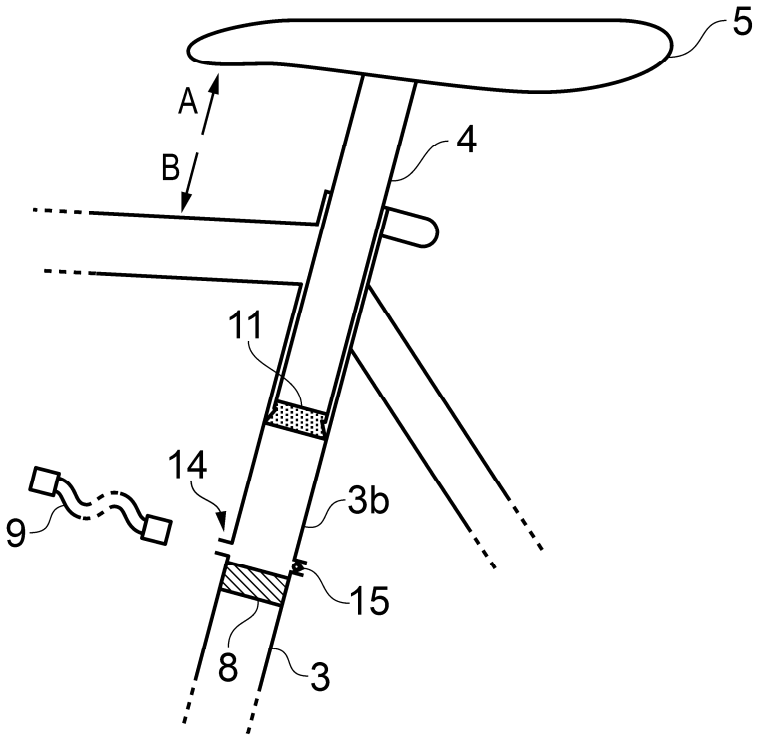

FIG. 5

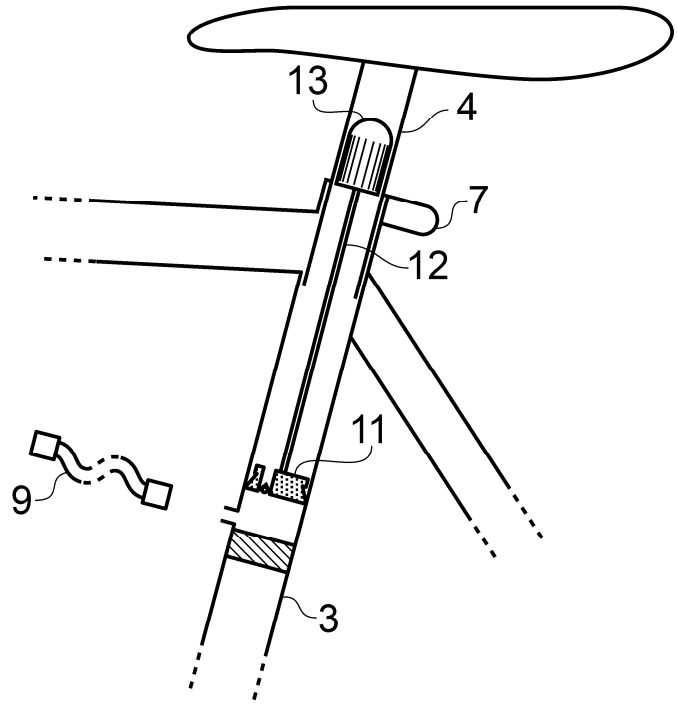

FIG. 6

Document D1

A bicycle with a built-in compressed air reservoir

[001] Our new bicycle enables you to inflate your tyres quickly and easily.

[002] Fig. 1 shows a detail of our bicycle with a compressed air reservoir and a hose 9. The bicycle frame comprises a hollow seat tube 3. A compressed air reservoir 18 is built into the seat tube 3. A hermetic plug 8 and an electric rotary air pump 16 are fixed in the seat tube 3. The air reservoir 18 is a closed cylinder comprising the portion of the seat tube 3 between the plug 8 and the pump 16. A one-way valve 15, through which air can enter but not leave the reservoir 18, is located in the portion of the seat tube 3. An air outlet 14 comprises a lateral through-hole 14a in the portion of the seat tube 3. The through-hole 14a extends to the exterior of the bicycle frame. The air outlet 14 also comprises a manually operable tap 17 for controlling the flow of air out of the reservoir 18 through the through-hole 14a.

[003] When it is connected to a mains electricity supply (the connections are not shown), the electric pump 16 can fill the reservoir 18. The pump 16 pumps air from the exterior of the bicycle frame, via the seat post, into the reservoir 18. When mains electricity is not available, the reservoir 18 can be filled with air by connecting a compressed air source (not shown) to the one-way valve 15. Compressed air then passes from the compressed air source into the reservoir 18 via the one-way valve 15. When it is completely filled, the reservoir 18 contains enough air to inflate two bicycle tyres.

[004] To inflate a bicycle tyre (not shown), 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.

[005] Figs. 2a and 2b show the compressed air reservoir at two stages of its manufacture. We manufacture the compressed air reservoir in the following steps.

[006] In a first step a hermetic plug 8 is glued into a seat tube 3. In a second step a first through-hole 14a is formed in the seat tube 3 above the plug 8. The resulting open cylinder is shown in Fig. 2a. In a third step, a second through-hole is formed in the seat tube 3 above the plug 8 and a one-way valve 15 is mounted in the second through-hole. The resulting open cylinder is shown in Fig. 2b. In a final step a manually operable tap 17 is mounted in the first through-hole 14a and the cylinder is hermetically closed with an electric air pump 16, which is glued into the seat tube 3. This results in the compressed air reservoir 18 shown in Fig. 1.

[007] Some bicycle frames comprise hollow tubes that are welded together in such a way that the bottom end of the seat tube is hermetically closed by a metal wall that is part of the bicycle frame. In such bicycles, a compressed air reservoir can be made as described above in conjunction with Figs. 2a and 2b, except that the first step does not need to be performed.

Drawings Document D1

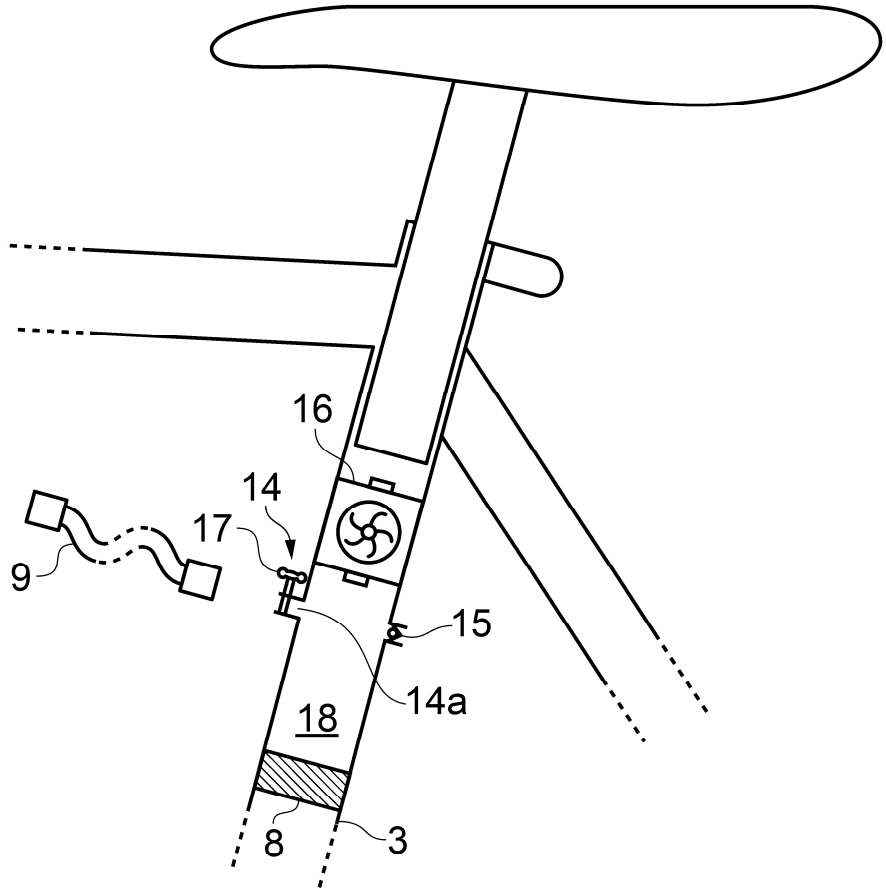

FIG. 1

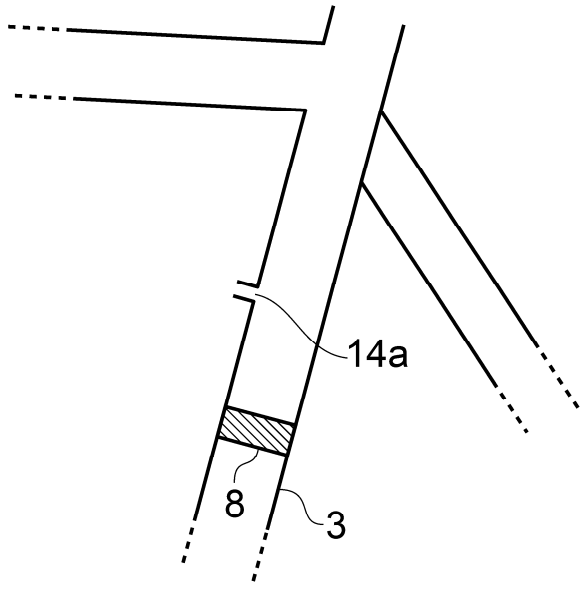

FIG. 2a

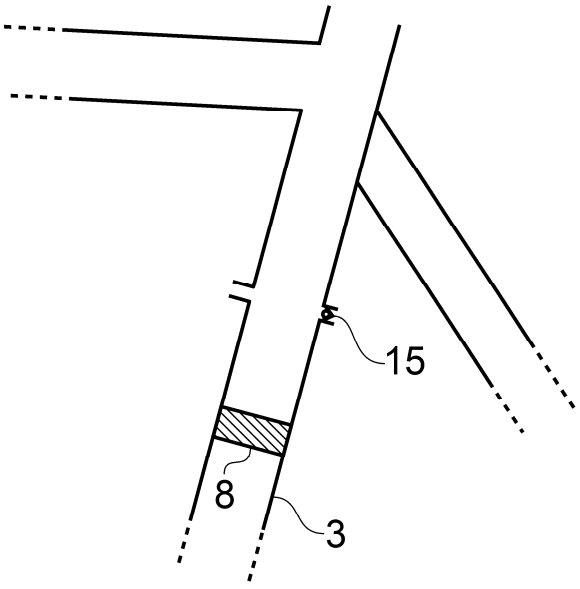

FIG. 2b

Document D2

Mad About Bikes: Air Suspension for a Seat Post

[001] In this article we present a great new bicycle with an air suspension device for a seat post. Riding the bicycle along a bumpy road is very comfortable. The air suspension comprises an air pump and an air chamber. The air pump has a cylinder, a piston and a piston actuator. The piston reciprocates in the cylinder.

[002] Fig. 1 schematically shows a detail of our new bicycle. The bicycle has a seat post 4 and a bicycle frame having a seat tube 3. The seat post 4 can be clamped in a desired position within the seat tube 3 by means of a clamp 7.

[003] The cylinder of the pump comprises a portion 3b of the seat tube 3 and a hermetic plug 8 located in the seat tube 3. The portion 3b starts at the axial opening 3a at the upper end of the seat tube 3 and ends at the plug 8. A spring 19 is located in the cylinder.

[004] The piston 11 of the pump is made of rubber and is glued to the seat post 4. The seat post 4 and the seat 5 make up the piston actuator. The piston 11 comprises a first one-way valve 15a for allowing air to pass into the cylinder and a second one-way valve 15b for allowing air to pass out of the cylinder. The movement of air through each of the one-way valves is prevented in one direction and restricted in the other direction.

[005] A metal wall 20 hermetically seals the seat post 4 near its upper end. The air chamber 21 is defined by the piston 11, the metal wall 20 and by the portion of the seat post 4 between the piston 11 and the metal wall 20.

[006] When a person rides the bicycle on a bumpy road they must first open the clamp 7. The piston 11 then reciprocates in the cylinder. When the piston 11 moves upwards (arrow A), the spring 19 extends and air is drawn from the air chamber 21, through the first one-way valve 15a, into the cylinder of the pump. When the piston 11 moves downwards (arrow B), the spring 19 compresses and air is pumped out of the cylinder, through the second one-way valve 15b, into the air chamber 21. This dampens the movement of the seat post 4 in the seat tube 3.

[007] The movement of air through the one-way valves 15a and 15b is restricted by different amounts. Consequently the damping effect as the seat 5 goes down is different from the damping effect as the seat 5 goes up.

[008] A guide (not shown), mounted on the exterior of the seat tube 3, prevents the seat post 4 from rotating relative to the seat tube 3. The guide also limits the axial movement of the seat post 4 in the seat tube 3. The guide may additionally comprise a spring which replaces the spring 19 of Fig. 1.

[009] The bicycle frame partly shown in Fig. 1 has a top tube 2. A lateral through-hole 3c in the portion 3b of the seat tube 3 extends into the top tube 2. For this reason the suspension is arranged so that the piston 11 reciprocates below the lateral through-hole 3c. Other bicycles have no top tube. In these bicycles the piston can reciprocate within the whole portion of the seat tube.

[010] Figs. 2a-2c show intermediate products obtained during the manufacture of the suspension device of the bicycle shown in Fig. 1. We manufacture the suspension device in the following steps.

[011] In a first step we glue a piston 11 to the bottom end of a seat post 4. Fig. 2a the intermediate product resulting from the first step. In a second step we form a first through-hole in the piston 11, and mount a first one-way valve 15a in the first through-hole. Fig. 2b shows the intermediate product resulting from the second step. In a third step we form a second through-hole in the piston 11, and mount a second one-way valve 15b in the second through-hole. Fig. 2c shows the intermediate product resulting from the third step. In a fourth step we weld a metal wall 20 near to the upper end of the seat post 4 and mount a seat 5 on the seat post 4. In a fifth step we mount a plug 8 and a spring 19 in the seat tube 3. In a sixth step we mount the seat post 4 in the seat tube 3. In a final step we mount the guide which is described above.

[012] If the guide comprises a spring, the suspension device is manufactured according to the steps described above except that in the fifth step no spring is mounted in the seat tube.

Drawings Document D2

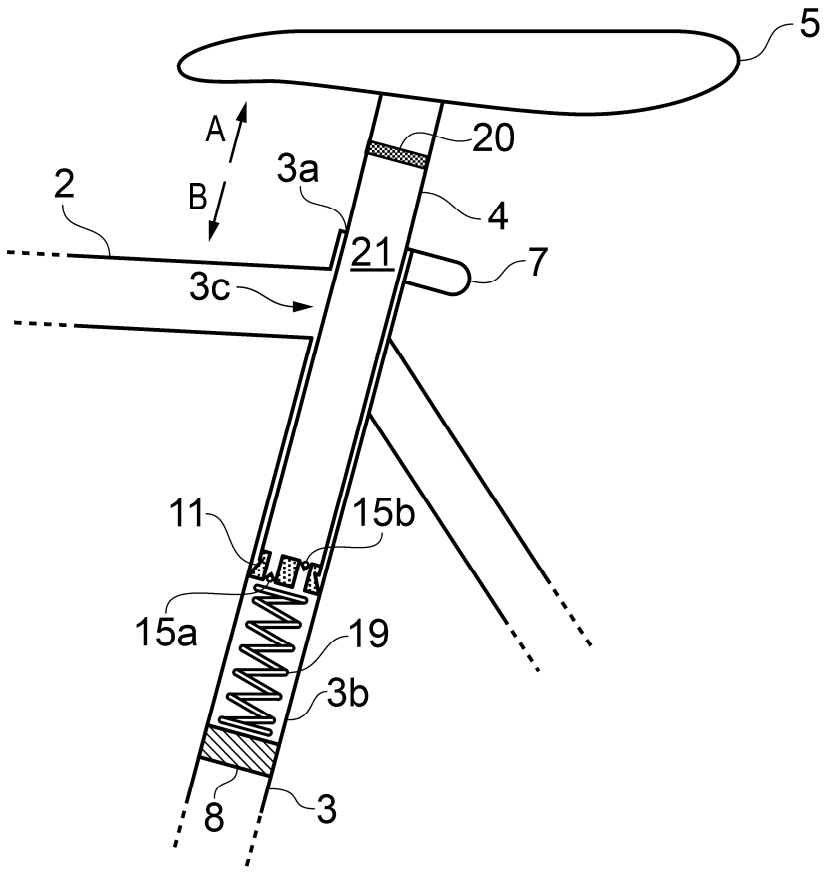

FIG. 1

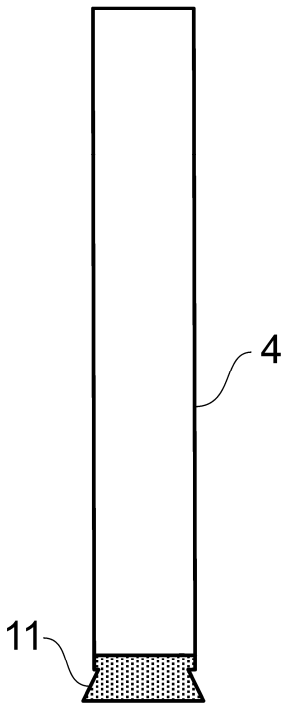

FIG. 2a

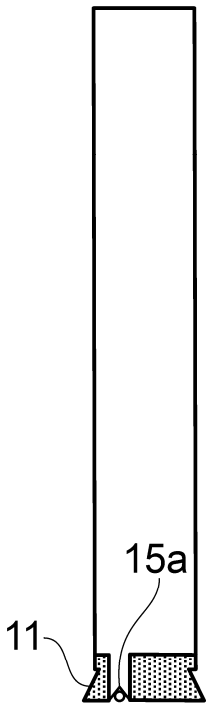

FIG. 2b

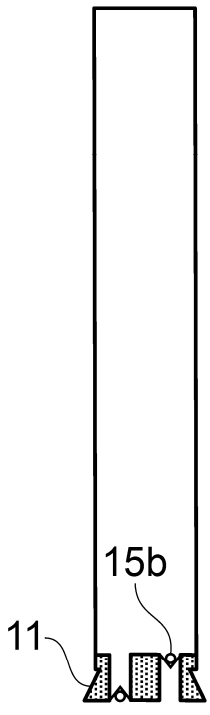

FIG. 2c