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(54) Training exerciser to be applied to a bicycle

(57) An adjustable braking device (1; 51) for cyclist training, to be mounted on a movable bicycle (30), comprises a roller (11) which engages a wheel (25) of the bicycle (30), a hydraulic pump (13) connected to said roller (11) and having the outlet connected to a tank (21) containing a viscous fluid, and regulations and control means. The regulation and control means comprises an adjustable maximum pressure valve (20) for allowing the passage of the fluid from the pump to the tank when the fluid pressure reaches a predetermined value, a relief valve (22) to reduce the fluid pressure in the hydraulic circuit, and a flow control valve (23), positioned between said pump (13) and said pressure regulating valve (20).

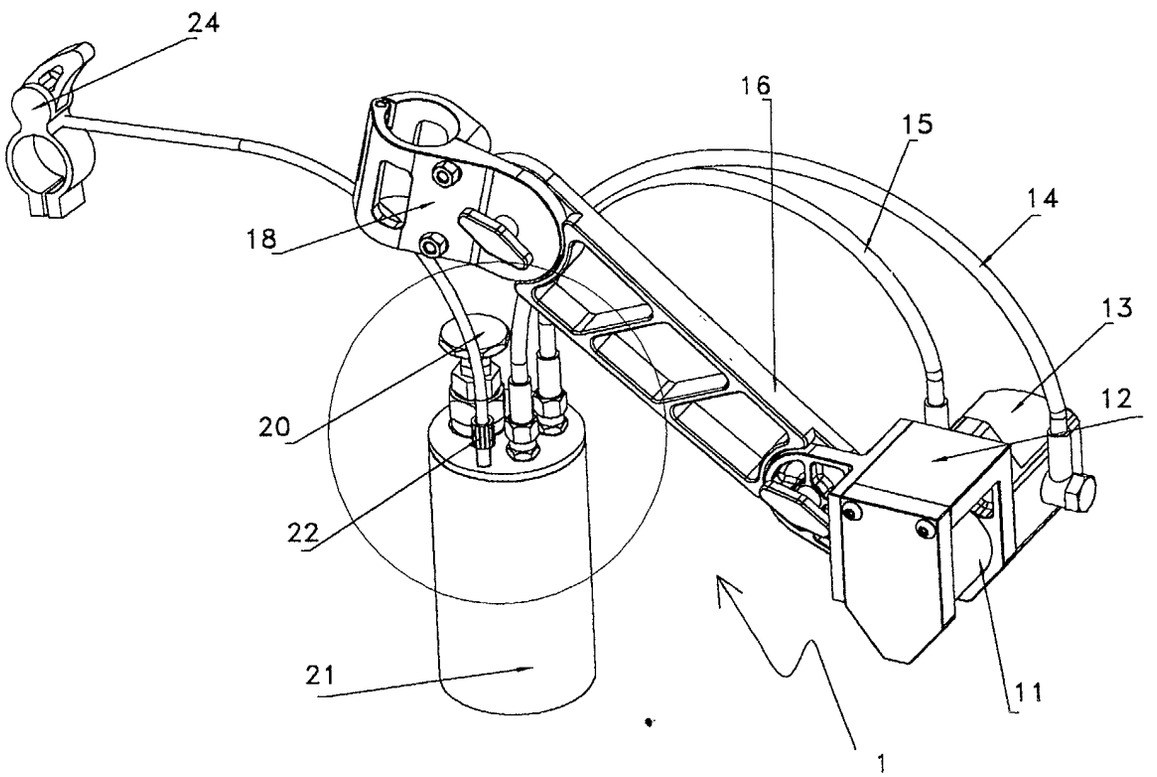

Fig.2

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Description

[0001] The present invention relates to an exerciser to be applied to a bicycle for cycling training, particularly to a movable bicycle, which can generate a variable resistance to the bicycle advancement.

[0002] More precisely, the device according to the present invention allows to apply a desired braking force to a wheel of a bicycle, in order to simulate - when travelling along a preferably flat or downhill route - any desired road slope.

[0003] Modern cycling, both competitive and amateur cycling, requires profiles of periodical training which cannot depend on the meteorological conditions or the geographical situation of the area in which training is being carried out.

[0004] There are known several stationary devices, in case comprising a bicycle or a part thereof mounted on rollers to allow a training which simulates several different racing conditions.

[0005] For example, US-A-5 792 030 discloses a device to be applied to a bicycle mounted on a fixed supporting structure and having a wheel in contact with a roller that is braked by a rotor that moves in a medium viscosity oil within a chamber, in order to obtain a braking force which increases linearly with the rotation speed, thus simulating the increase of the advancing resistance in actual cycling.

[0006] US-A-4 206 914 and US-A-4 364 557 disclose braking devices to be applied to a bicycle where the rolling resistance of a wheel is changed by rotating a knob that varies the pressure of the roller against the wheel.

[0007] These known devices are stationary and therefore do not meet the requirements of those athletes who, for example, must practise in flat country or in during winter season (usually in seaside resorts) that should otherwise recur to long and expensive roving for a realistic training.

[0008] WO0124885 discloses a device to be applied to a complete bicycle which can also run on the road, such device including a brake assembly comprising a belt movable around a pair of rollers and engaging the bicycle rear wheel, which belt is braked by a magnetic brake. Although this device allows for a much more realistic training, it cannot simulate various types of road slope at any speed of the bicycle. In order to generate all the torques required for a proper training, the device would become quite large, with associated problems of size and weight.

[0009] It is therefore an object of the present invention to overcome the above mentioned drawbacks and limitations of the prior art devices, and more particularly to provide a new and improved braking device for training on a bicycle.

[0010] The invention achieves the above objects through a braking device according to claim 1. Further advantageous features are recited in the dependent claims.

[0011] In the device according to the invention, a hydraulic circuit is used to generate a resistance against the advancement of the vehicle. When a fluid in the hydraulic circuit is pushed by a pump towards a tank or reservoir, either directly or through a pipe, its pressure has to rise to overcome the resistance of an adjustable pressure control valve before the fluid is admitted into a fluid tank. The hydraulic power absorbed by the pump is given by the product of the pump delivery and the circuit pressure. Therefore, the hydraulic power absorbed by the pump, for a given circuit pressure, is proportional. to the pump rotation speed, i.e to the bicycle speed, and therefore - other things being equal-the braking force is directly proportional to the bicycle speed.

[0012] The present invention will now be disclosed with particular reference to the attached drawings, supplied by way of non limiting examples, in which:

Fig. 1 illustrates a bicycle to which a device according to the invention has been applied;
Fig. 2 is a perspective view of the device of Fig. 1;
Fig. 3 illustrates the hydraulic circuit of the braking device according to the invention;
Fig. 4 is a perspective view which illustrates another embodiment of the device according to the invention; and
Fig. 5 illustrates a bicycle incorporating the embodiment of the invention shown in Fig.4.

[0013] Throughout all the Figures, equal or substantially equivalent parts have been designated by the same references.

[0014] With reference to the Figures, a braking device according to the present invention is preferably secured to the frame of a bicycle 30 and comprises three main parts, i.e. a roller-pump assembly interacting with a wheel of the bicycle, a tank for a viscous fluid, and regulating and control means to selectively varying the fluid introduction pressure into the tank.

[0015] With particular reference now to Figures 1 and 2 which illustrate an embodiment of the invention, the roller-pump assembly 1 comprises a roller 11 which is fitted to a bicycle 30 through a bracket 6 so as to directly press against the tire 25 of the bicycle wheel. The roller 11, or rather its shaft, is connected to a hydraulic pump 13 which when rotating compresses a viscous fluid, by increasing its pressure before transferring it to a tank 21. The fluid is typically an oil with a proper viscosity.

[0016] More precisely, the axle of the roller 11 is rotatably mounted on a support 12 which carries the pump 13 and can be fastened to the bicycle frame so that the roller presses against a bicycle wheel, preferably the rear wheel of the bicycle. In the embodiment illustrated in Figures 1 and 2, the support 12 is anchored to the bicycle pillar by means of a collar 18 and a bracket 16. On the contrary, the tank 21 is preferably located on the bicycle inclined tube, e.g. in a water-bottle-holder or similar device. The delivery outlet of the pump is con-

nected to the tank 21 through a small hose 15 and a pressure regulator 20, while the return outlet is connected to the tank 21 through a small hose 14.

[0017] As shown in the hydraulic diagram of Fig. 3, the regulation and control means of the device according to the invention comprises a maximum pressure valve 20 which has the function of opening a connection between the pump pressure duct and the tank when the fluid pressure in the pump reaches a given value (predetermined at will by the user). A helical spring acting against the movable valve element is used for providing an opposing force, as schematically illustrated in Fig. 3.

[0018] The valve 20 ensures a pressure regulation in a given range or interval of values, by simply varying the pre-loading force of the helical spring, nevertheless this regulation range-extending from a minimum value, different from zero, up to a maximum value - is depending on the spring type. Thus, when using a spring of a given stiffness, it might be difficult to obtain a desired wide range of resisting torques at the wheel. In other words one could achieve either minimum torques that are adequate to the racer's performance, but associated with too strong maximum torques, or vice versa and this might limit the possible use of the device.

[0019] According to the invention, a flow control valve 23 is additionally provided between the pump 13 and the pressure regulating valve 20, which valve 23 allows to obtain a constant resistant torque when the bicycle speed changes.

[0020] This flow control valve 23 could be regarded as a pressure reducing valve. While the maximum pressure valve 20 causes a pressure drop almost independent from the pump delivery, the flow control valve 23 generates a pressure drop varying (increasing) in a non linear manner. As a consequence, at delivery values (i. e. speeds) near zero, the pressure in the pipe is almost null and increases proportionally with the delivery.

[0021] When a device according to the invention is equipped with both the maximum pressure valve 20 and the flow control valve 23, it is possible to obtain a diagram of the pressure in the hydraulic circuit with a first section where only the flow control valve is operating, and a second section (having a reduced slope) where also the maximum pressure valve is operating. Of course a given value of the intervention point can be selected by properly choosing the components and calibrating the device.

[0022] In the first section of the diagram, the pressure gradually varies with the speed, from a minimum value near zero up to an intermediate pressure value, while in the second section (where the maximum pressure valve intervenes) the resistant torque is increased in proportion to the speed, while the pressure remains constant and is only determined by the adjustment of the maximum pressure valve 20.

[0023] Through proper combinations of the valves 20, 23 it is possible to obtain infinite curves of the above indicated type, and therefore infinite values of resistant torques at the wheel.

[0024] As previously said, the tank 21 is further equipped with a relief valve 22, remotely actuated through a lever 24 placed on the handle-bar and belonging to the regulation and control means. The relief valve 22 is designed to discharge the pressure in the hydraulic circuit and make null the resistant torque at the end of operation.

[0025] According to another embodiment of the device of the invention, shown in Fig. 3 and indicated by numerical reference 51, the tank 21 is mounted on the support 12 instead of the inclined tube, thus eliminating hoses 14, 15 and making the device more compact. The hydraulic layout of the braking device, also in this case, is the one shown in Fig. 4.

[0026] Fig. 3 further illustrates a general layout of the automatic control arrangement according to the invention, comprising one or more actuators 25 to actuate the valves 20, 22 and 23, an electronic programmable circuit 26, typically incorporating a microprocessor, and a setting device 27, comprising, for example, a small display and some pushbuttons.

[0027] The pump 13 can be of various type, such as gear pump (either with inner meshing also called lobe pump, or with outer meshing), a vane pump, a screw pump, a piston pump, and so on, while the pressure regulating valve 20 can be either manually actuated by acting on it, or remotely actuated through a knob on the handle-bar, or even remotely actuated through an electronic programmable circuit controlling both the time and the resistance in accordance with the training needs.

[0028] According to a further embodiment, not illustrated in the drawings, the hydraulic pump 13 and/or the tank 21 can be incorporated in the support 12, the system providing in this case a single assembly comprising the support, the pump and the tank. In this embodiment, on one side of the support 12 (the side for the pump application) there are provided recesses to lodge the gears and the oil pipes, whereas the tank containing the viscous fluid is located on the top side. In this configuration, the system results extremely compact and has quite reduced overall dimensions.

[0029] Although the invention has been illustrated with reference to preferred embodiments thereof, it is generally subjected to other applications and modifications which fall within the scope of the invention, as it will be evident to the skilled of the art.

Claims

1. An adjustable braking device (1; 51) to be mounted on a movable bicycle (30) for training a cyclist, said device comprising braking means mounted on said bicycle in engagement with a wheel (25), **characterised by** comprising in combination: a roller (11) engaging a wheel (25) of said bicycle (30); a hydraulic pump (13) connected to said roller (11) and

having the outlet connected to a hydraulic circuit connected to a tank (21) containing a viscous fluid; and regulating and control means.

2. A device as claimed in claim 1, **characterised in that** said regulation and control means allows to selectively varying the fluid introduction pressure into said hydraulic circuit, and comprises an adjustable maximum pressure valve (20) for allowing the fluid passage from the pump (13) into said tank (21) when the pump pressure reaches a predetermined value, and a relief valve (22) to reduce the pressure of the fluid in the hydraulic circuit.

3. A device as claimed in claim 2, **characterised in that** said regulation and control means further comprises a flow control valve (23), located between said pump (13) and said pressure regulation valve (20).

4. A device as claimed in the preceding claims, **characterised in that** it is mounted on the pillar tube of said bicycle (30) through a bracket (6).

5. A device as claimed in the preceding claims, **characterised in that** said hydraulic pump (13) is connected to said tank (21) by two hose sections (14, 15), with said adjustable pressure regulation valve (20) being inserted in one of said hose sections, and that said tank (21) is fitted to the inclined tube of said bicycle (30) in a support such as a water-bottle-holder.

6. A device as claimed in claims from 1 to 4, **characterised in that** said tank (21) is mounted on said support (12).

7. A device as claimed in the preceding claims, **characterised in that** said regulation and control means further comprises a lever (24) placed on the handlebar which actuates said relief valve (22).

8. A device as claimed in the preceding claims, **characterised in that** said regulation and control means comprises a programmable electronic circuit (26), at least an actuator (25) to actuate said valves (20, 22, 23), and a setting device (27).

9. A device as claimed in the preceding claims, **characterised in that** said viscous fluid is an oil.

10. A device as claimed in the preceding claims, **characterised in that** said hydraulic pump (13) and/or said tank (21) are integrated into said support 12,

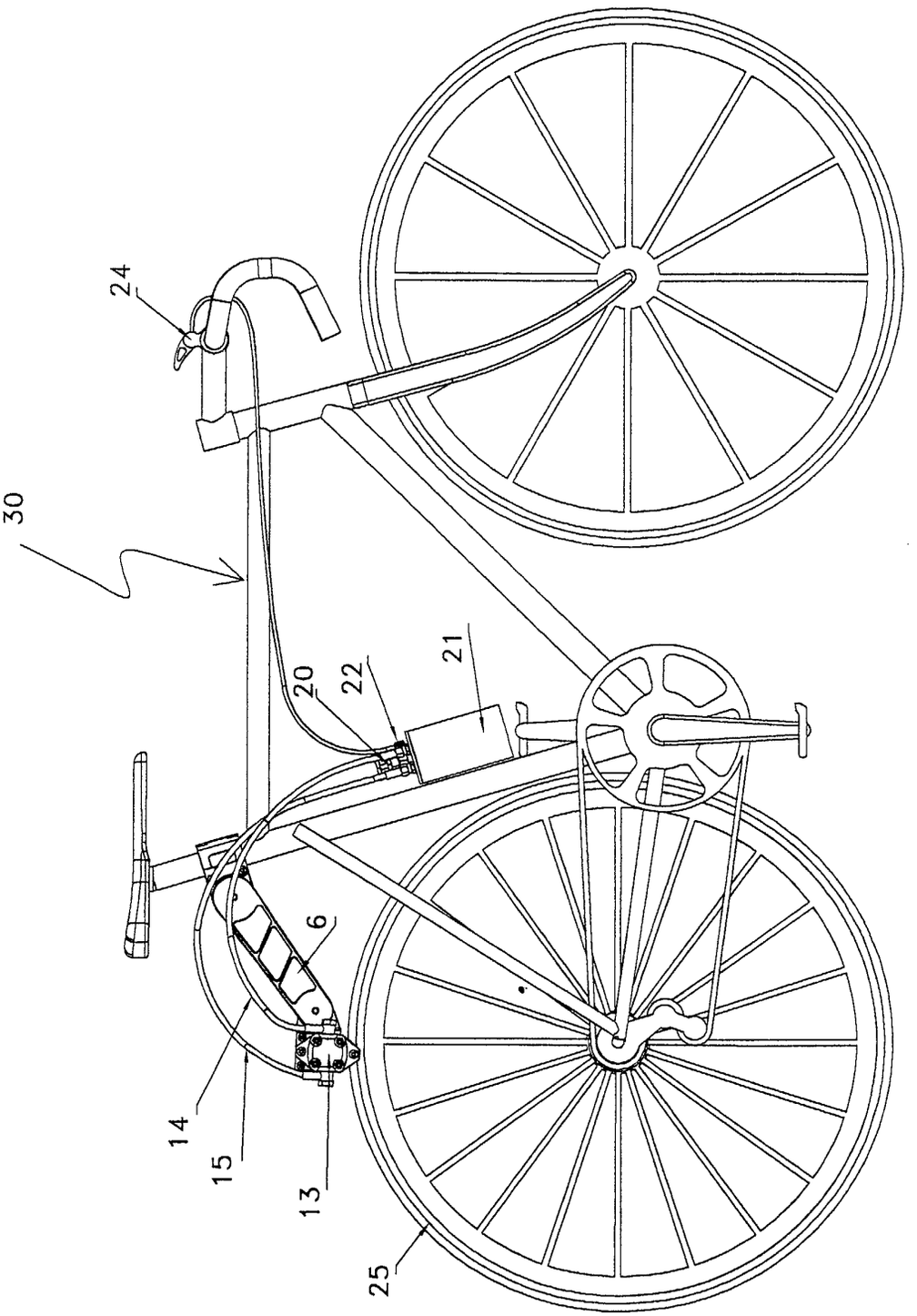

Fig. 1

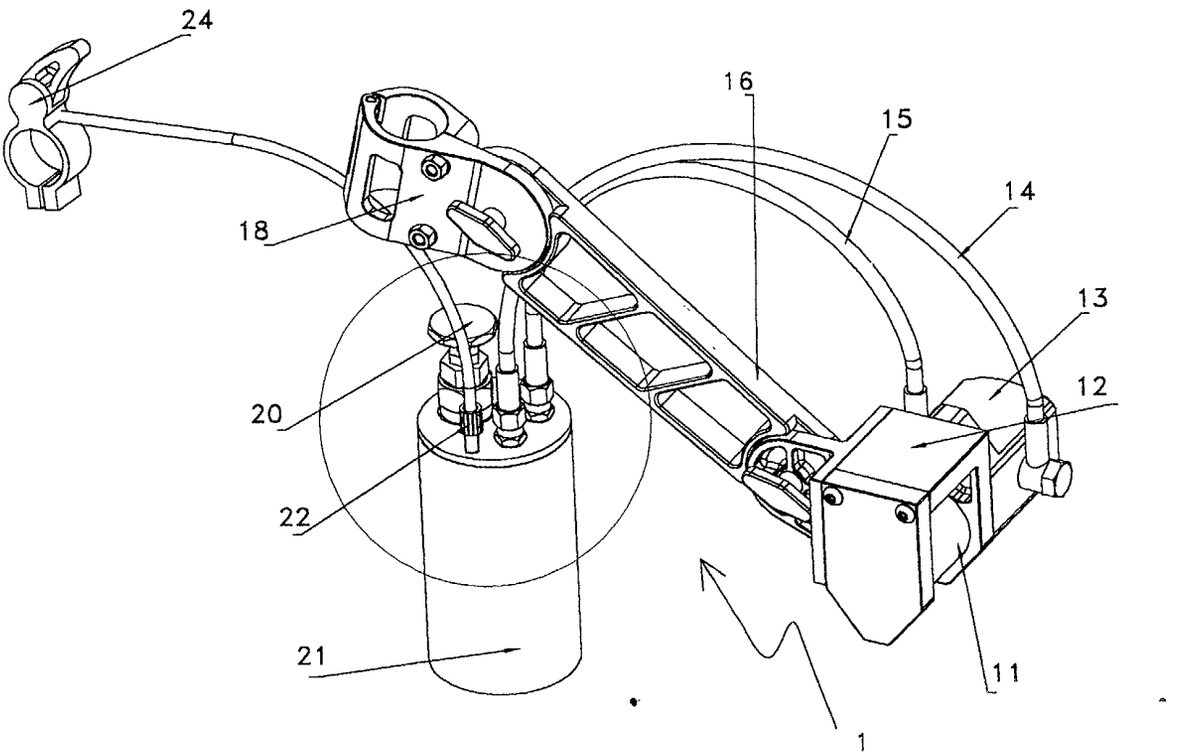

Fig.2

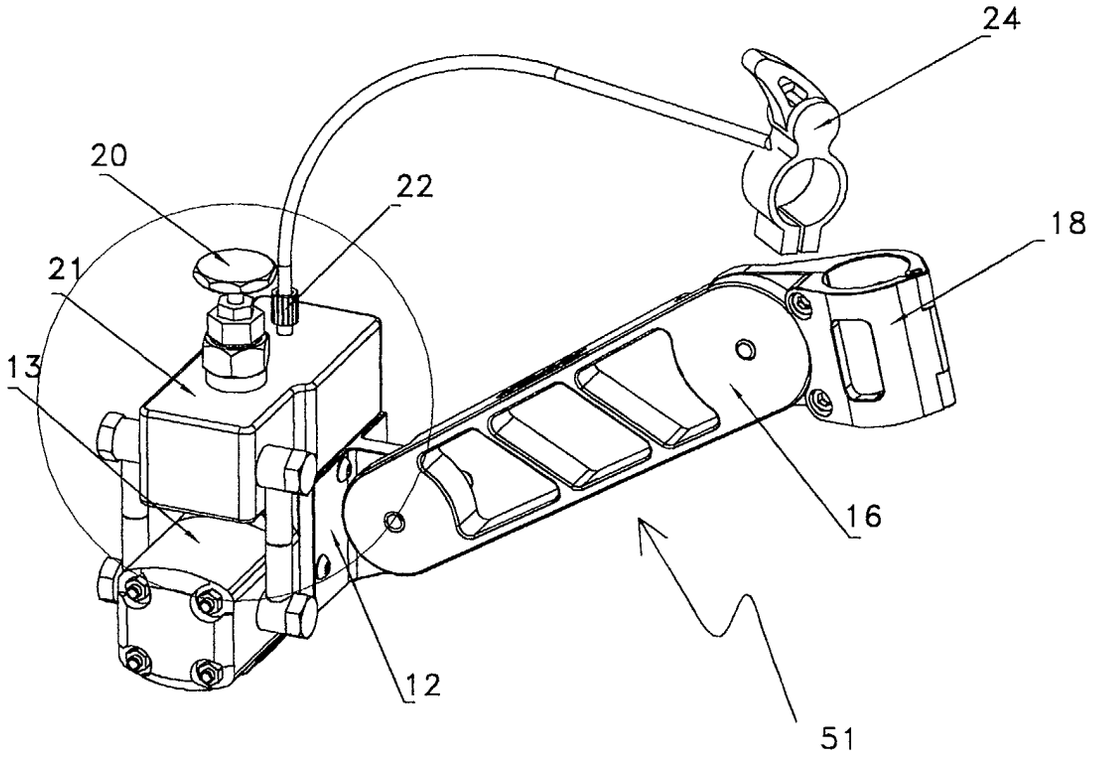

Fig.4

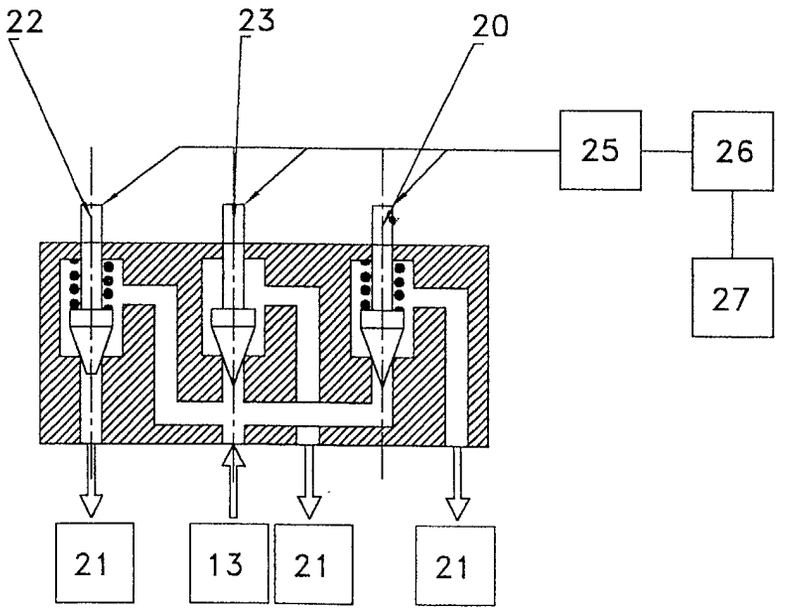

Fig.3

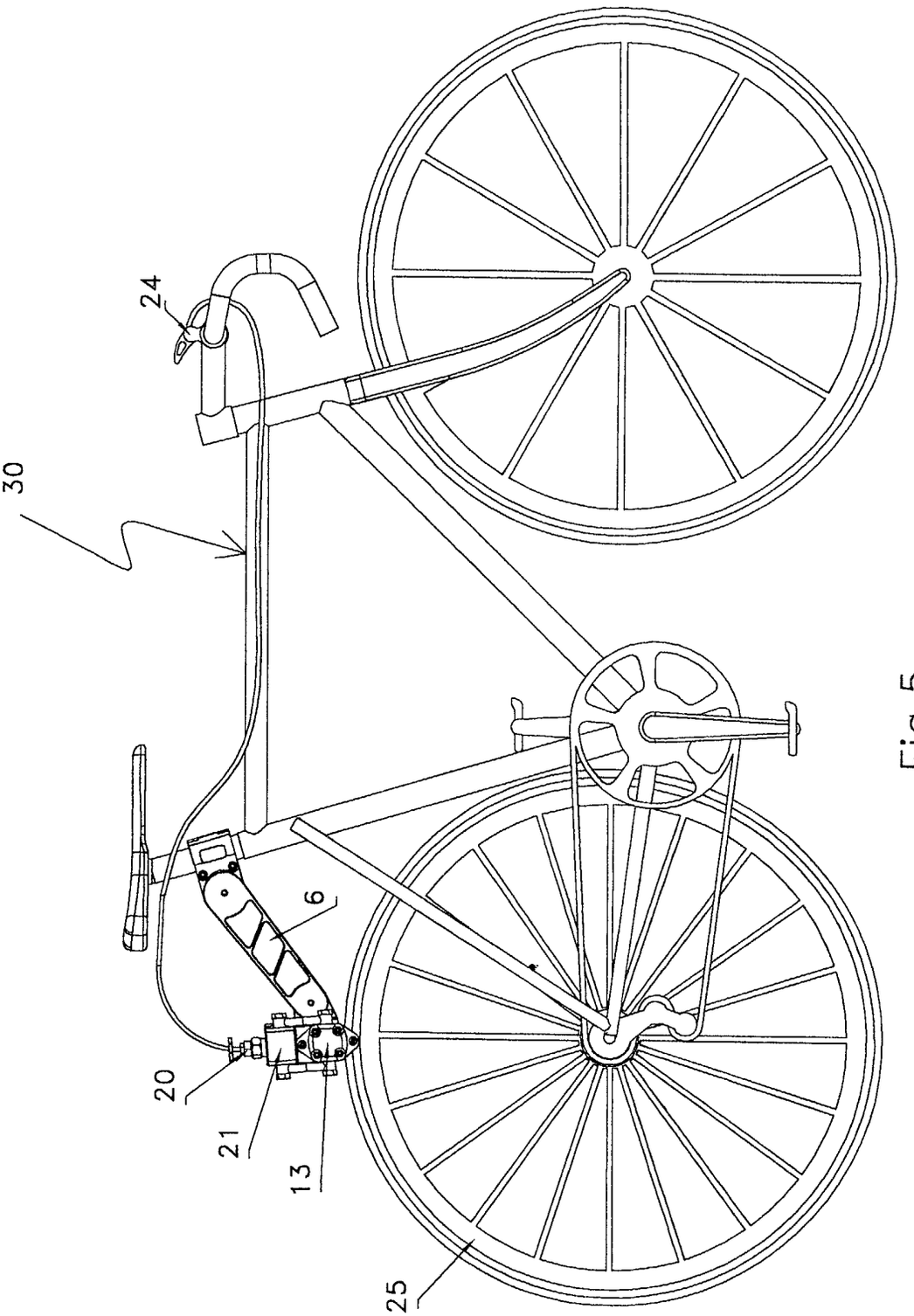

Fig.5

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EUROPEAN SEARCH REPORT

Application Number
EP 02 42 5227

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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A	* page 2, line 32 - page 5, line 34; figures 1-3 *	5,9	B62L1/04
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27 September 2002	Oelschläger, H

CATEGORY OF CITED DOCUMENTS

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